# ANEJO Nº 6. ESTRUCTURAS

# *4.3 Pasos superiores*

## *4.3.1 Paso superior E-1500.4*

# INDICE

1º DEFINICION GEOMETRICA

2º CALCULO DEL TABLERO

3º CALCULO DE PILAS

4º CALCULO DE ESTRIBOS

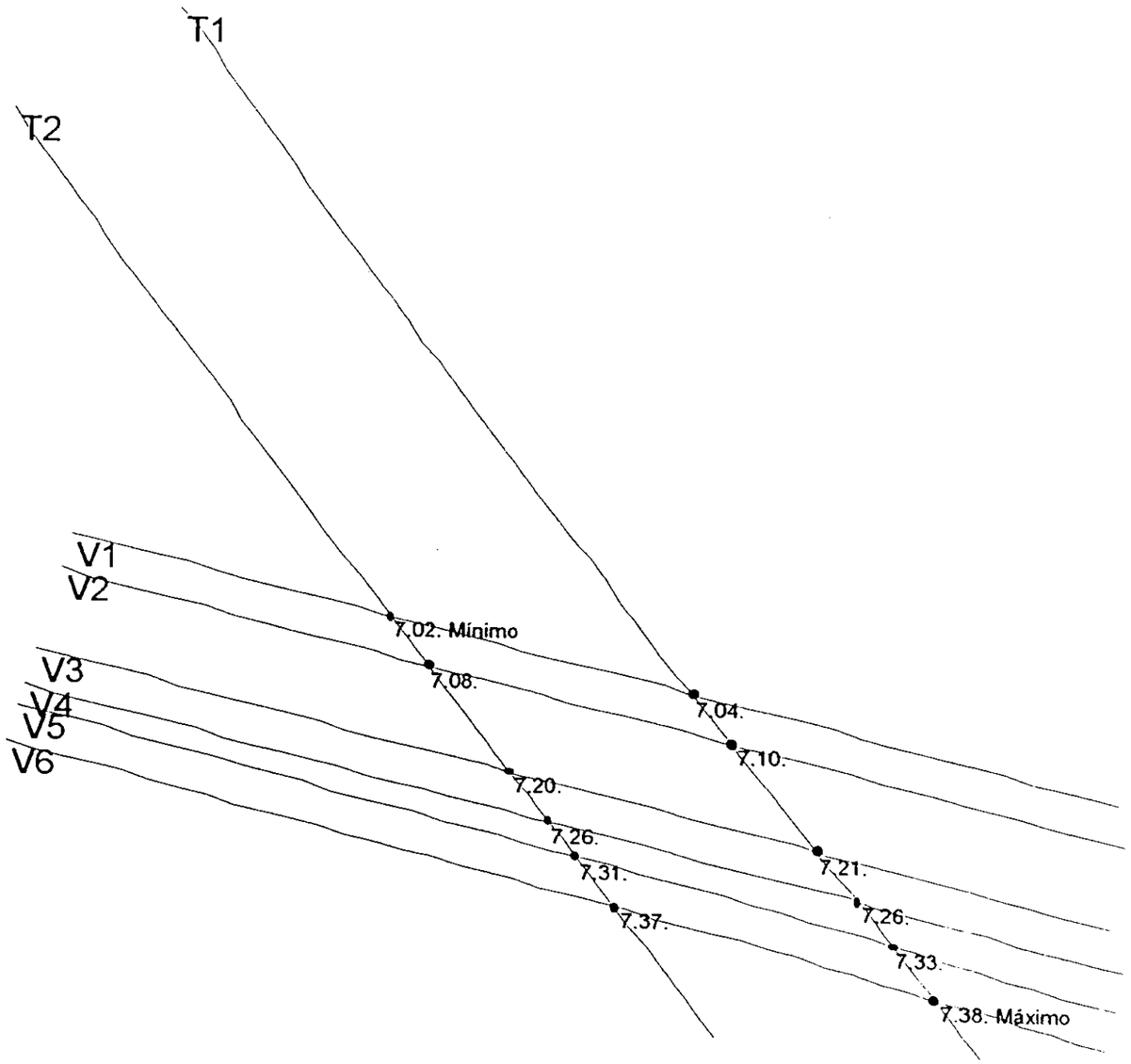
**5º PROYECTO DE PRUEBA DE CARGA**

PASO SUPERIOR E-1500.4

1º DEFINICION GEOMETRICA

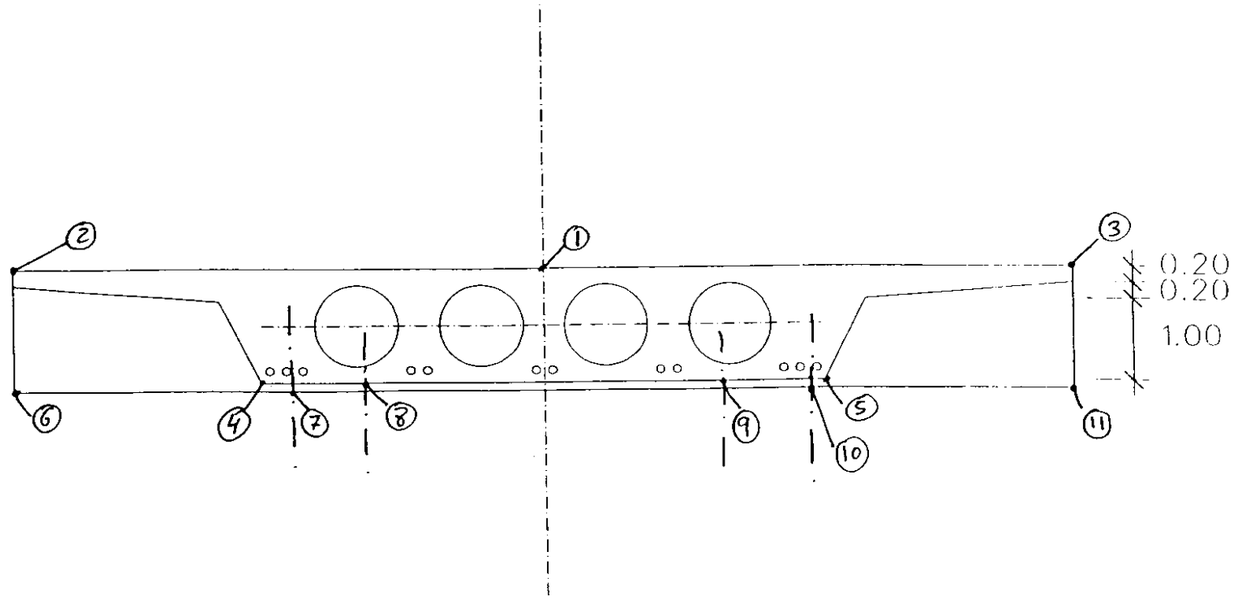
| | |
|---|---|
| Proyecto : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| Nombre obra : | Estructura E-1500.4 |

| GALIBOS | | | | | | SITUACION PUNTO | | |
|---|---|---|---|---|---|---|---|---|
| Punto Nº | X | Y | Z inf. tablero | Z vial inf. | Gálibo (m) | Nº polig.tab. | Nº polig.vial | Dcha.o Izda. |
| 1 | 664545.708 | 4611277.983 | 305.359 | 298.321 | 7.038 | 1 | 1 | --- |
| 2 | 664535.317 | 4611280.740 | 305.447 | 298.426 | 7.021 Mínimo | 2 | 1 | --- |
| 3 | 664547.060 | 4611276.138 | 305.398 | 298.302 | 7.096 | 1 | 2 | --- |
| 4 | 664536.639 | 4611278.904 | 305.490 | 298.409 | 7.081 | 2 | 2 | --- |
| 5 | 664549.978 | 4611272.188 | 305.475 | 298.265 | 7.210 | 1 | 3 | --- |
| 6 | 664539.493 | 4611274.971 | 305.576 | 298.372 | 7.204 | 2 | 3 | --- |
| 7 | 664551.354 | 4611270.338 | 305.509 | 298.247 | 7.262 | 1 | 4 | --- |
| 8 | 664540.840 | 4611273.127 | 305.615 | 298.354 | 7.260 | 2 | 4 | --- |
| 9 | 664552.541 | 4611268.750 | 305.537 | 298.208 | 7.329 | 1 | 5 | --- |
| 10 | 664541.775 | 4611271.855 | 305.641 | 298.330 | 7.310 | 2 | 5 | --- |
| 11 | 664553.995 | 4611266.813 | 305.570 | 298.185 | 7.384 Máximo | 1 | 6 | --- |
| 12 | 664543.157 | 4611269.979 | 305.678 | 298.310 | 7.367 | 2 | 6 | --- |



```
NOMBRE del EJE : t00500-4
TRAMO donde se situa la estructura: 10
CASO en que se encuentra la estructura(0-1-2)
0   ....  La seccion de la carretera tiene calzada unica
1   ....  La estructura se situa en la calzada DERECHA
2   ....  La estructura se situa en la calzada IZQUIERDA
CASO=  0
NUMERO de VANOS del tablero:  3
PK Estribo nº1 :          408.044
PK Pila  nº  1 :          428.044
PK Pila  nº  2 :          460.044
PK Estribo nº2 :          480.044
Distancia eje REP.PLANTA al de la ESTRUCTURA:              .000
ESPESOR del pavimento (en metros):              .060
NUMERO puntos DE REPLANTEO: 11
PUNTO nº..  1 X=              .000 Y=              .000
PUNTO nº..  2 X=            -6.400 Y=              .000
PUNTO nº..  3 X=             6.400 Y=              .000
PUNTO nº..  4 X=            -3.400 Y=             1.400
PUNTO nº..  5 X=             3.400 Y=             1.400
PUNTO nº..  6 X=            -6.400 Y=             1.500
PUNTO nº..  7 X=            -3.200 Y=             1.500
PUNTO nº..  8 X=            -2.150 Y=             1.400
PUNTO nº..  9 X=             2.150 Y=             1.400
PUNTO nº.. 10 X=             3.200 Y=             1.500
PUNTO nº.. 11 X=             6.400 Y=             1.500
NUMERO de puntos que acompañan a los bordes:  0
VANO nº..   1 NUMERO de secciones NORMALES: 21
VANO nº..   2 NUMERO de secciones NORMALES: 21
VANO nº..   3 NUMERO de secciones NORMALES: 21
NUMERO de secciones ESVIADAS a calcular:  4
SECCION Nº..  1  PK=          408.044   AZIMUT(g)=116.617
SECCION Nº..  2  PK=          428.044   AZIMUT(g)=115.344
SECCION Nº..  3  PK=          460.044   AZIMUT(g)=113.307
SECCION Nº..  4  PK=          480.044   AZIMUT(g)=112.034
TIPO de tablero (1-2-3-4):  1
VANO..  1 PUNTO..  1  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  2  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  3  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  4  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  5  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  6  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  7  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  8  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  9  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO.. 10  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO.. 11  Variacion VERTICAL tipo:  1
VANO..  1 PUNTO..  1  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  2  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  3  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  4  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  5  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  6  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  7  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  8  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO..  9  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO.. 10  Variac. HORIZONTAL tipo:  1
VANO..  1 PUNTO.. 11  Variac. HORIZONTAL tipo:  1
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VANO..  3 PUNTO..  7  Variacion VERTICAL tipo:  1
VANO..  3 PUNTO..  8  Variacion VERTICAL tipo:  1
VANO..  3 PUNTO..  9  Variacion VERTICAL tipo:  1
VANO..  3 PUNTO.. 10  Variacion VERTICAL tipo:  1
VANO..  3 PUNTO.. 11  Variacion VERTICAL tipo:  1
VANO..  3 PUNTO..  1  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  2  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  3  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  4  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  5  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  6  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  7  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  8  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO..  9  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO.. 10  Variac. HORIZONTAL tipo:  1
VANO..  3 PUNTO.. 11  Variac. HORIZONTAL tipo:  1
```

| Sec.Pto. | PK | AZsec(g) | X | Y | Z |
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| 1 2 | 415.540 | 116.617 | 664533.398 | 4611300.535 | 306.130 |
| 1 3 | 400.703 | 116.617 | 664514.473 | 4611305.589 | 306.194 |
| 1 4 | 411.946 | 116.617 | 664528.860 | 4611301.748 | 304.749 |
| 1 5 | 404.067 | 116.617 | 664518.806 | 4611304.433 | 304.782 |
| 1 6 | 415.477 | 116.617 | 664533.320 | 4611300.556 | 304.630 |
| 1 7 | 411.709 | 116.617 | 664528.558 | 4611301.828 | 304.650 |
| 1 8 | 410.484 | 116.617 | 664527.005 | 4611302.244 | 304.756 |
| 1 9 | 405.501 | 116.617 | 664520.647 | 4611303.942 | 304.777 |
| 1 10 | 404.293 | 116.617 | 664519.096 | 4611304.355 | 304.682 |
| 1 11 | 400.643 | 116.617 | 664514.395 | 4611305.611 | 304.693 |
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| 2 3 | 420.702 | 115.344 | 664525.851 | 4611288.988 | 306.698 |
| 2 4 | 431.947 | 115.344 | 664540.313 | 4611285.434 | 305.192 |
| 2 5 | 424.068 | 115.344 | 664530.208 | 4611287.917 | 305.268 |
| 2 6 | 435.476 | 115.344 | 664544.795 | 4611284.333 | 305.054 |
| 2 7 | 431.709 | 115.344 | 664540.010 | 4611285.508 | 305.094 |
| 2 8 | 430.485 | 115.344 | 664538.449 | 4611285.892 | 305.207 |
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| 3 2 | 467.541 | 113.307 | 664563.906 | 4611258.841 | 307.007 |
| 3 3 | 452.703 | 113.307 | 664544.742 | 4611262.907 | 307.279 |
| 3 4 | 463.948 | 113.307 | 664559.311 | 4611259.816 | 305.675 |
| 3 5 | 456.067 | 113.307 | 664549.130 | 4611261.977 | 305.820 |
| 3 6 | 467.477 | 113.307 | 664563.826 | 4611258.860 | 305.507 |
| 3 7 | 463.710 | 113.307 | 664559.005 | 4611259.881 | 305.580 |
| 3 8 | 462.486 | 113.307 | 664557.432 | 4611260.215 | 305.703 |
| 3 9 | 457.503 | 113.307 | 664550.995 | 4611261.581 | 305.794 |
| 3 10 | 456.292 | 113.307 | 664549.423 | 4611261.914 | 305.716 |
| 3 11 | 452.642 | 113.307 | 664544.664 | 4611262.924 | 305.779 |
| 4 1 | 480.041 | 112.034 | 664566.547 | 4611245.087 | 307.332 |
| 4 2 | 487.540 | 112.034 | 664576.209 | 4611243.238 | 307.149 |
| 4 3 | 472.701 | 112.034 | 664556.968 | 4611246.920 | 307.501 |
| 4 4 | 483.949 | 112.034 | 664571.596 | 4611244.120 | 305.837 |
| 4 5 | 476.067 | 112.034 | 664561.375 | 4611246.076 | 306.024 |
| 4 6 | 487.477 | 112.034 | 664576.130 | 4611243.253 | 305.650 |
| 4 7 | 483.709 | 112.034 | 664571.288 | 4611244.179 | 305.743 |
| 4 8 | 482.486 | 112.034 | 664569.711 | 4611244.481 | 305.873 |
| 4 9 | 477.503 | 112.034 | 664563.247 | 4611245.717 | 305.991 |
| 4 10 | 476.291 | 112.034 | 664561.668 | 4611246.021 | 305.919 |
| 4 11 | 472.641 | 112.034 | 664556.889 | 4611246.935 | 306.002 |



| Van.Sec.Pto. | P.K. | AZsec(g) | X | Y | Z |
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| 1 1 2 | 408.044 | 261.917 | 664529.181 | 4611306.674 | 305.944 |
| 1 1 3 | 408.044 | 261.917 | 664518.610 | 4611299.469 | 306.392 |
| 1 1 4 | 408.044 | 261.917 | 664526.663 | 4611304.958 | 304.650 |
| 1 1 5 | 408.044 | 261.917 | 664521.048 | 4611301.130 | 304.888 |
| 1 1 6 | 408.044 | 261.917 | 664529.138 | 4611306.644 | 304.445 |
| 1 1 7 | 408.044 | 261.917 | 664526.495 | 4611304.843 | 304.557 |
| 1 1 8 | 408.044 | 261.917 | 664525.631 | 4611304.254 | 304.693 |
| 1 1 9 | 408.044 | 261.917 | 664522.080 | 4611301.834 | 304.844 |
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| 1 2 3 | 409.044 | 261.854 | 664519.178 | 4611298.638 | 306.417 |
| 1 2 4 | 409.044 | 261.854 | 664527.225 | 4611304.134 | 304.675 |
| 1 2 5 | 409.044 | 261.854 | 664521.613 | 4611300.301 | 304.913 |
| 1 2 6 | 409.044 | 261.854 | 664529.698 | 4611305.823 | 304.471 |
| 1 2 7 | 409.044 | 261.854 | 664527.057 | 4611304.020 | 304.583 |
| 1 2 8 | 409.044 | 261.854 | 664526.193 | 4611303.430 | 304.719 |
| 1 2 9 | 409.044 | 261.854 | 664522.645 | 4611301.006 | 304.870 |
| 1 2 10 | 409.044 | 261.854 | 664521.775 | 4611300.412 | 304.806 |
| 1 2 11 | 409.044 | 261.854 | 664519.134 | 4611298.609 | 304.918 |
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| 1 3 2 | 410.044 | 261.790 | 664530.302 | 4611305.033 | 305.995 |
| 1 3 3 | 410.044 | 261.790 | 664519.746 | 4611297.807 | 306.443 |
| 1 3 4 | 410.044 | 261.790 | 664527.787 | 4611303.312 | 304.701 |
| 1 3 5 | 410.044 | 261.790 | 664522.179 | 4611299.473 | 304.939 |
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| 1 3 7 | 410.044 | 261.790 | 664527.620 | 4611303.197 | 304.608 |
| 1 3 8 | 410.044 | 261.790 | 664526.757 | 4611302.606 | 304.745 |
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| 1 3 10 | 410.044 | 261.790 | 664522.341 | 4611299.584 | 304.832 |
| 1 3 11 | 410.044 | 261.790 | 664519.702 | 4611297.778 | 304.944 |
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| 1 4 2 | 411.044 | 261.726 | 664530.864 | 4611304.213 | 306.020 |
| 1 4 3 | 411.044 | 261.726 | 664520.314 | 4611296.977 | 306.468 |
| 1 4 4 | 411.044 | 261.726 | 664528.351 | 4611302.489 | 304.726 |
| 1 4 5 | 411.044 | 261.726 | 664522.746 | 4611298.645 | 304.964 |
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| 1 4 7 | 411.044 | 261.726 | 664528.183 | 4611302.374 | 304.633 |
| 1 4 8 | 411.044 | 261.726 | 664527.321 | 4611301.783 | 304.770 |
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| 1 4 10 | 411.044 | 261.726 | 664522.908 | 4611298.756 | 304.857 |
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| 1 5 2 | 412.044 | 261.663 | 664531.426 | 4611303.394 | 306.045 |
| 1 5 3 | 412.044 | 261.663 | 664520.884 | 4611296.148 | 306.493 |
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| 1 5 5 | 412.044 | 261.663 | 664523.314 | 4611297.818 | 304.989 |
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| 1 5 8 | 412.044 | 261.663 | 664527.885 | 4611300.960 | 304.795 |
| 1 5 9 | 412.044 | 261.663 | 664524.344 | 4611298.526 | 304.945 |
| 1 5 10 | 412.044 | 261.663 | 664523.476 | 4611297.929 | 304.882 |
| 1 5 11 | 412.044 | 261.663 | 664520.841 | 4611296.118 | 304.994 |
| 1 6 1 | 413.044 | 261.599 | 664526.722 | 4611298.947 | 306.294 |
| 1 6 2 | 413.044 | 261.599 | 664531.989 | 4611302.575 | 306.070 |
| 1 6 3 | 413.044 | 261.599 | 664521.455 | 4611295.319 | 306.518 |
| 1 6 4 | 413.044 | 261.599 | 664529.480 | 4611300.847 | 304.776 |
| 1 6 5 | 413.044 | 261.599 | 664523.883 | 4611296.992 | 305.014 |
| 1 6 6 | 413.044 | 261.599 | 664531.946 | 4611302.546 | 304.571 |
| 1 6 7 | 413.044 | 261.599 | 664529.312 | 4611300.731 | 304.683 |
| 1 6 8 | 413.044 | 261.599 | 664528.451 | 4611300.138 | 304.820 |
| 1 6 9 | 413.044 | 261.599 | 664524.912 | 4611297.700 | 304.970 |
| 1 6 10 | 413.044 | 261.599 | 664524.045 | 4611297.103 | 304.907 |
| 1 6 11 | 413.044 | 261.599 | 664521.411 | 4611295.289 | 305.019 |
| 1 7 1 | 414.044 | 261.535 | 664527.289 | 4611298.124 | 306.318 |
| 1 7 2 | 414.044 | 261.535 | 664532.553 | 4611301.757 | 306.094 |
| 1 7 3 | 414.044 | 261.535 | 664522.026 | 4611294.490 | 306.542 |
| 1 7 4 | 414.044 | 261.535 | 664530.046 | 4611300.026 | 304.800 |
| 1 7 5 | 414.044 | 261.535 | 664524.453 | 4611296.166 | 305.038 |
| 1 7 6 | 414.044 | 261.535 | 664532.510 | 4611301.728 | 304.595 |
| 1 7 7 | 414.044 | 261.535 | 664529.878 | 4611299.911 | 304.707 |
| 1 7 8 | 414.044 | 261.535 | 664529.017 | 4611299.317 | 304.844 |
| 1 7 9 | 414.044 | 261.535 | 664525.481 | 4611296.875 | 304.994 |
| 1 7 10 | 414.044 | 261.535 | 664524.614 | 4611296.277 | 304.931 |
| 1 7 11 | 414.044 | 261.535 | 664521.983 | 4611294.460 | 305.043 |
| 1 8 1 | 415.044 | 261.472 | 664527.858 | 4611297.301 | 306.342 |
| 1 8 2 | 415.044 | 261.472 | 664533.118 | 4611300.940 | 306.119 |
| 1 8 3 | 415.044 | 261.472 | 664522.598 | 4611293.662 | 306.566 |
| 1 8 4 | 415.044 | 261.472 | 664530.612 | 4611299.206 | 304.824 |
| 1 8 5 | 415.044 | 261.472 | 664525.023 | 4611295.340 | 305.062 |
| 1 8 6 | 415.044 | 261.472 | 664533.075 | 4611300.910 | 304.620 |
| 1 8 7 | 415.044 | 261.472 | 664530.445 | 4611299.091 | 304.731 |
| 1 8 8 | 415.044 | 261.472 | 664529.585 | 4611298.496 | 304.868 |
| 1 8 9 | 415.044 | 261.472 | 664526.051 | 4611296.051 | 305.018 |
| 1 8 10 | 415.044 | 261.472 | 664525.185 | 4611295.452 | 304.955 |
| 1 8 11 | 415.044 | 261.472 | 664522.555 | 4611293.632 | 305.067 |
| 1 9 1 | 416.044 | 261.408 | 664528.427 | 4611296.479 | 306.366 |
| 1 9 2 | 416.044 | 261.408 | 664533.684 | 4611300.123 | 306.142 |
| 1 9 3 | 416.044 | 261.408 | 664523.171 | 4611292.835 | 306.590 |
| 1 9 4 | 416.044 | 261.408 | 664531.180 | 4611298.387 | 304.848 |
| 1 9 5 | 416.044 | 261.408 | 664525.595 | 4611294.515 | 305.086 |
| 1 9 6 | 416.044 | 261.408 | 664533.641 | 4611300.093 | 304.643 |
| 1 9 7 | 416.044 | 261.408 | 664531.012 | 4611298.271 | 304.755 |
| 1 9 8 | 416.044 | 261.408 | 664530.153 | 4611297.675 | 304.892 |
| 1 9 9 | 416.044 | 261.408 | 664526.621 | 4611295.227 | 305.042 |
| 1 9 10 | 416.044 | 261.408 | 664525.756 | 4611294.627 | 304.979 |
| 1 9 11 | 416.044 | 261.408 | 664523.128 | 4611292.805 | 305.091 |
| 1 10 1 | 417.044 | 261.344 | 664528.997 | 4611295.657 | 306.390 |
| 1 10 2 | 417.044 | 261.344 | 664534.250 | 4611299.307 | 306.166 |
| 1 10 3 | 417.044 | 261.344 | 664523.745 | 4611292.008 | 306.614 |
| 1 10 4 | 417.044 | 261.344 | 664531.748 | 4611297.568 | 304.872 |
| 1 10 5 | 417.044 | 261.344 | 664526.167 | 4611293.691 | 305.110 |
| 1 10 6 | 417.044 | 261.344 | 664534.207 | 4611299.277 | 304.667 |
| 1 10 7 | 417.044 | 261.344 | 664531.581 | 4611297.452 | 304.779 |
| 1 10 8 | 417.044 | 261.344 | 664530.722 | 4611296.856 | 304.916 |
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| Van.Sec.Pto. | P.K. | AZsec(g) | X | Y | Z |
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| 2 12 11 | 445.644 | 259.524 | 664540.461 | 4611268.577 | 305.675 |
| 2 13 1 | 447.244 | 259.422 | 664546.601 | 4611271.119 | 306.975 |
| 2 13 2 | 447.244 | 259.422 | 664551.741 | 4611274.926 | 306.752 |
| 2 13 3 | 447.244 | 259.422 | 664541.460 | 4611267.313 | 307.199 |
| 2 13 4 | 447.244 | 259.422 | 664549.292 | 4611273.112 | 305.457 |
| 2 13 5 | 447.244 | 259.422 | 664543.831 | 4611269.068 | 305.695 |
| 2 13 6 | 447.244 | 259.422 | 664551.699 | 4611274.895 | 305.252 |
| 2 13 7 | 447.244 | 259.422 | 664549.129 | 4611272.991 | 305.364 |
| 2 13 8 | 447.244 | 259.422 | 664548.288 | 4611272.369 | 305.501 |
| 2 13 9 | 447.244 | 259.422 | 664544.834 | 4611269.812 | 305.651 |
| 2 13 10 | 447.244 | 259.422 | 664543.988 | 4611269.185 | 305.588 |
| 2 13 11 | 447.244 | 259.422 | 664541.418 | 4611267.282 | 305.700 |
| 2 14 1 | 448.844 | 259.320 | 664547.554 | 4611269.834 | 307.000 |
| 2 14 2 | 448.844 | 259.320 | 664552.688 | 4611273.649 | 306.776 |
| 2 14 3 | 448.844 | 259.320 | 664542.420 | 4611266.020 | 307.223 |
| 2 14 4 | 448.844 | 259.320 | 664550.242 | 4611271.831 | 305.481 |
| 2 14 5 | 448.844 | 259.320 | 664544.787 | 4611267.778 | 305.719 |
| 2 14 6 | 448.844 | 259.320 | 664552.646 | 4611273.617 | 305.277 |
| 2 14 7 | 448.844 | 259.320 | 664550.079 | 4611271.710 | 305.389 |
| 2 14 8 | 448.844 | 259.320 | 664549.239 | 4611271.086 | 305.525 |
| 2 14 9 | 448.844 | 259.320 | 664545.790 | 4611268.523 | 305.676 |
| 2 14 10 | 448.844 | 259.320 | 664544.945 | 4611267.896 | 305.612 |
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| 2 15 1 | 450.444 | 259.218 | 664548.509 | 4611268.551 | 307.023 |
| 2 15 2 | 450.444 | 259.218 | 664553.637 | 4611272.374 | 306.799 |
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| 2 15 4 | 450.444 | 259.218 | 664551.194 | 4611270.553 | 305.505 |
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| 2 15 6 | 450.444 | 259.218 | 664553.595 | 4611272.342 | 305.300 |
| 2 15 7 | 450.444 | 259.218 | 664551.031 | 4611270.431 | 305.412 |
| 2 15 8 | 450.444 | 259.218 | 664550.192 | 4611269.806 | 305.549 |
| 2 15 9 | 450.444 | 259.218 | 664546.747 | 4611267.237 | 305.699 |
| 2 15 10 | 450.444 | 259.218 | 664545.903 | 4611266.608 | 305.636 |
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| 2 16 1 | 452.044 | 259.116 | 664549.466 | 4611267.269 | 307.046 |
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| 2 16 4 | 452.044 | 259.116 | 664552.148 | 4611269.275 | 305.528 |
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| 2 18 10 | 455.244 | 258.913 | 664548.791 | 4611262.754 | 305.702 |
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| 2 20 9 | 458.444 | 258.709 | 664551.565 | 4611260.828 | 305.806 |
| 2 20 10 | 458.444 | 258.709 | 664550.726 | 4611260.192 | 305.743 |
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| 2 21 1 | 460.044 | 258.607 | 664554.284 | 4611260.882 | 307.149 |
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| 3 1 7 | 460.044 | 258.607 | 664556.787 | 4611262.786 | 305.538 |
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| 3 3 1 | 462.044 | 258.480 | 664555.496 | 4611259.291 | 307.172 |
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| 3 10 4 | 469.044 | 258.034 | 664562.411 | 4611255.794 | 305.727 |
| 3 10 5 | 469.044 | 258.034 | 664557.039 | 4611251.632 | 305.965 |
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| 3 10 10 | 469.044 | 258.034 | 664557.194 | 4611251.752 | 305.858 |
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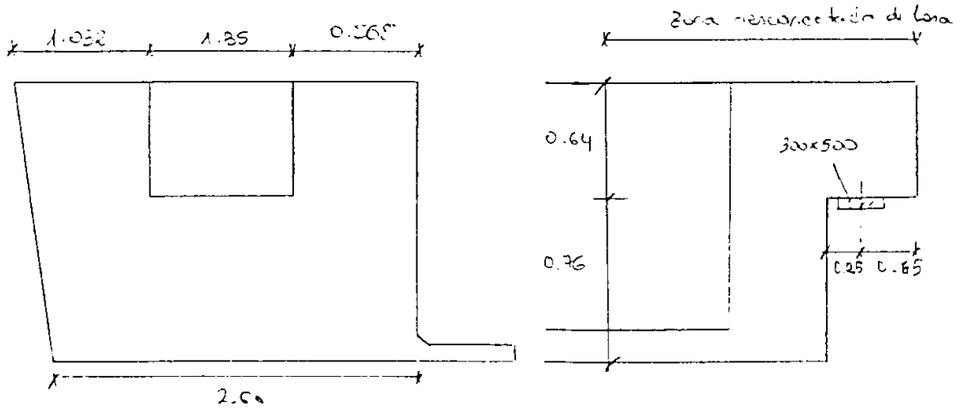
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| 3 14 3 | 473.044 | 257.779 | 664557.180 | 4611246.648 | 307.504 |
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| 3 14 5 | 473.044 | 257.779 | 664559.504 | 4611248.463 | 306.000 |
| 3 14 6 | 473.044 | 257.779 | 664567.219 | 4611254.491 | 305.557 |
| 3 14 7 | 473.044 | 257.779 | 664564.699 | 4611252.522 | 305.669 |
| 3 14 8 | 473.044 | 257.779 | 664563.875 | 4611251.878 | 305.806 |
| 3 14 9 | 473.044 | 257.779 | 664560.488 | 4611249.232 | 305.956 |
| 3 14 10 | 473.044 | 257.779 | 664559.659 | 4611248.584 | 305.893 |
| 3 14 11 | 473.044 | 257.779 | 664557.139 | 4611246.615 | 306.005 |
| 3 15 1 | 474.044 | 257.716 | 664562.836 | 4611249.798 | 307.289 |
| 3 15 2 | 474.044 | 257.716 | 664567.873 | 4611253.740 | 307.065 |
| 3 15 3 | 474.044 | 257.716 | 664557.800 | 4611245.855 | 307.512 |
| 3 15 4 | 474.044 | 257.716 | 664565.473 | 4611251.862 | 305.770 |
| 3 15 5 | 474.044 | 257.716 | 664560.122 | 4611247.673 | 306.008 |
| 3 15 6 | 474.044 | 257.716 | 664567.831 | 4611253.708 | 305.566 |
| 3 15 7 | 474.044 | 257.716 | 664565.313 | 4611251.737 | 305.678 |
| 3 15 8 | 474.044 | 257.716 | 664564.490 | 4611251.092 | 305.814 |
| 3 15 9 | 474.044 | 257.716 | 664561.106 | 4611248.443 | 305.965 |
| 3 15 10 | 474.044 | 257.716 | 664560.277 | 4611247.794 | 305.901 |
| 3 15 11 | 474.044 | 257.716 | 664557.759 | 4611245.823 | 306.013 |
| 3 16 1 | 475.044 | 257.652 | 664563.453 | 4611249.011 | 307.296 |
| 3 16 2 | 475.044 | 257.652 | 664568.485 | 4611252.958 | 307.073 |
| 3 16 3 | 475.044 | 257.652 | 664558.421 | 4611245.063 | 307.520 |
| 3 16 4 | 475.044 | 257.652 | 664566.088 | 4611251.078 | 305.778 |
| 3 16 5 | 475.044 | 257.652 | 664560.741 | 4611246.883 | 306.016 |
| 3 16 6 | 475.044 | 257.652 | 664568.444 | 4611252.926 | 305.574 |
| 3 16 7 | 475.044 | 257.652 | 664565.928 | 4611250.952 | 305.685 |
| 3 16 8 | 475.044 | 257.652 | 664565.105 | 4611250.307 | 305.822 |
| 3 16 9 | 475.044 | 257.652 | 664561.724 | 4611247.654 | 305.973 |
| 3 16 10 | 475.044 | 257.652 | 664560.896 | 4611247.004 | 305.909 |
| 3 16 11 | 475.044 | 257.652 | 664558.379 | 4611245.030 | 306.021 |
| 3 17 1 | 476.044 | 257.588 | 664564.071 | 4611248.224 | 307.304 |
| 3 17 2 | 476.044 | 257.588 | 664569.099 | 4611252.177 | 307.080 |
| 3 17 3 | 476.044 | 257.588 | 664559.042 | 4611244.271 | 307.528 |
| 3 17 4 | 476.044 | 257.588 | 664566.703 | 4611250.294 | 305.786 |
| 3 17 5 | 476.044 | 257.588 | 664561.361 | 4611246.094 | 306.024 |
| 3 17 6 | 476.044 | 257.588 | 664569.058 | 4611252.145 | 305.581 |
| 3 17 7 | 476.044 | 257.588 | 664566.544 | 4611250.168 | 305.693 |
| 3 17 8 | 476.044 | 257.588 | 664565.721 | 4611249.522 | 305.830 |
| 3 17 9 | 476.044 | 257.588 | 664562.343 | 4611246.866 | 305.980 |
| 3 17 10 | 476.044 | 257.588 | 664561.515 | 4611246.215 | 305.917 |
| 3 17 11 | 476.044 | 257.588 | 664559.001 | 4611244.239 | 306.029 |
| 3 18 1 | 477.044 | 257.525 | 664564.689 | 4611247.438 | 307.311 |
| 3 18 2 | 477.044 | 257.525 | 664569.713 | 4611251.396 | 307.088 |
| 3 18 3 | 477.044 | 257.525 | 664559.664 | 4611243.480 | 307.535 |
| 3 18 4 | 477.044 | 257.525 | 664567.320 | 4611249.511 | 305.793 |
| 3 18 5 | 477.044 | 257.525 | 664561.981 | 4611245.305 | 306.031 |
| 3 18 6 | 477.044 | 257.525 | 664569.672 | 4611251.364 | 305.589 |
| 3 18 7 | 477.044 | 257.525 | 664567.160 | 4611249.385 | 305.700 |
| 3 18 8 | 477.044 | 257.525 | 664566.338 | 4611248.738 | 305.837 |
| 3 18 9 | 477.044 | 257.525 | 664562.963 | 4611246.078 | 305.988 |
| 3 18 10 | 477.044 | 257.525 | 664562.136 | 4611245.427 | 305.924 |
| 3 18 11 | 477.044 | 257.525 | 664559.623 | 4611243.448 | 306.036 |
| 3 19 1 | 478.044 | 257.461 | 664565.308 | 4611246.653 | 307.319 |
| 3 19 2 | 478.044 | 257.461 | 664570.329 | 4611250.616 | 307.095 |
| 3 19 3 | 478.044 | 257.461 | 664560.288 | 4611242.690 | 307.542 |
| 3 19 4 | 478.044 | 257.461 | 664567.937 | 4611248.728 | 305.801 |
| 3 19 5 | 478.044 | 257.461 | 664562.603 | 4611244.518 | 306.038 |
| 3 19 6 | 478.044 | 257.461 | 664570.287 | 4611250.583 | 305.596 |
| 3 19 7 | 478.044 | 257.461 | 664567.777 | 4611248.602 | 305.708 |
| 3 19 8 | 478.044 | 257.461 | 664566.956 | 4611247.954 | 305.844 |
| 3 19 9 | 478.044 | 257.461 | 664563.583 | 4611245.292 | 305.995 |
| 3 19 10 | 478.044 | 257.461 | 664562.757 | 4611244.639 | 305.931 |
| 3 19 11 | 478.044 | 257.461 | 664560.246 | 4611242.658 | 306.043 |
| 3 20 1 | 479.044 | 257.397 | 664565.928 | 4611245.869 | 307.325 |
| 3 20 2 | 479.044 | 257.397 | 664570.945 | 4611249.836 | 307.102 |
| 3 20 3 | 479.044 | 257.397 | 664560.911 | 4611241.901 | 307.549 |
| 3 20 4 | 479.044 | 257.397 | 664568.555 | 4611247.946 | 305.807 |
| 3 20 5 | 479.044 | 257.397 | 664563.225 | 4611243.730 | 306.045 |
| 3 20 6 | 479.044 | 257.397 | 664570.903 | 4611249.804 | 305.603 |
| 3 20 7 | 479.044 | 257.397 | 664568.395 | 4611247.820 | 305.714 |
| 3 20 8 | 479.044 | 257.397 | 664567.575 | 4611247.171 | 305.851 |
| 3 20 9 | 479.044 | 257.397 | 664564.204 | 4611244.505 | 306.002 |
| 3 20 10 | 479.044 | 257.397 | 664563.379 | 4611243.852 | 305.938 |
| 3 20 11 | 479.044 | 257.397 | 664560.870 | 4611241.868 | 306.050 |
| 3 21 1 | 480.044 | 257.334 | 664566.549 | 4611245.085 | 307.332 |
| 3 21 2 | 480.044 | 257.334 | 664571.561 | 4611249.057 | 307.108 |
| 3 21 3 | 480.044 | 257.334 | 664561.536 | 4611241.112 | 307.556 |
| 3 21 4 | 480.044 | 257.334 | 664569.173 | 4611247.165 | 305.814 |
| 3 21 5 | 480.044 | 257.334 | 664563.847 | 4611242.944 | 306.052 |
| 3 21 6 | 480.044 | 257.334 | 664571.520 | 4611249.025 | 305.609 |
| 3 21 7 | 480.044 | 257.334 | 664569.014 | 4611247.038 | 305.721 |
| 3 21 8 | 480.044 | 257.334 | 664568.194 | 4611246.389 | 305.858 |
| 3 21 9 | 480.044 | 257.334 | 664564.826 | 4611243.719 | 306.008 |
| 3 21 10 | 480.044 | 257.334 | 664564.001 | 4611243.065 | 305.945 |
| 3 21 11 | 480.044 | 257.334 | 664561.495 | 4611241.079 | 306.057 |

| Van.Sec.Pto. | P.K. | AZsec(g) | X | Y | Z |
|---|---|---|---|---|---|

## PASO SUPERIOR E-1500.4

## 2º CALCULO DEL TABLERO

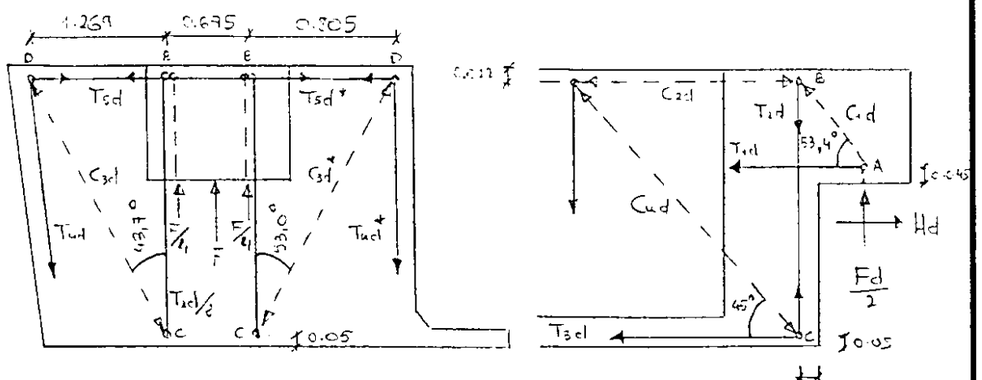
# 1. CALCULO DE MENSULAS MADERAS




* Mecanismos de suspensión y arriostramiento a disponer:

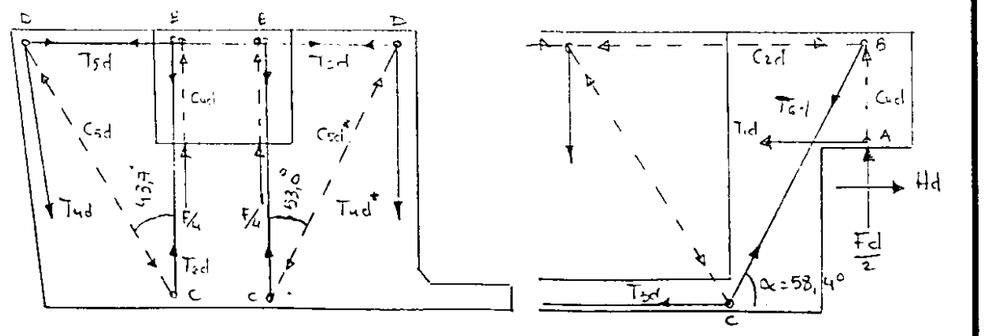
1 Tras corte de cuerdas dejar la rueda contra las almas:

a/



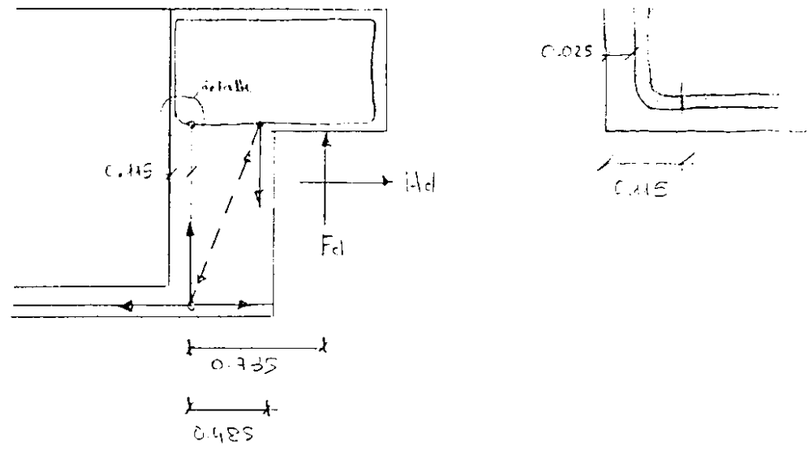

NOTA: Tud se dimensiona para Fd + Hd.
Tsd y Tsd' " " Fd.

b/





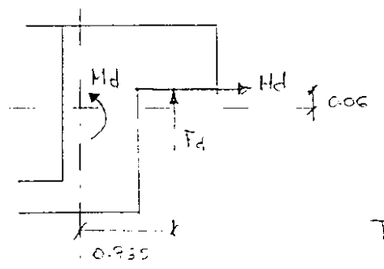

# 2. Comprobación a flexión de la viga. Armadura a cortante ver esfuerzo a distancia.




Fuerza axilada de las tensores:

$$F_{bpd} = 1.20 \times \left[ 13,2 \times 0.01524 \times \left( \frac{14.268}{0.50 \times 450} \right)^{1/3} \right]^{-} = 1.519 \text{ m}$$

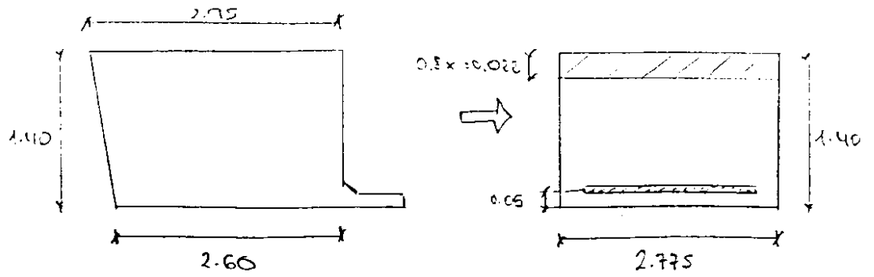
$$F_t = 29 \times 15,545^{T/cm^2} \times \frac{0.485^{m}}{1.519^{m}} \times 1.40^{cm^2} = 201,51 \text{ T}$$




$$M_d = F_{vd} \times 0.735 - H_d \times 0.06 = 316,415 \times 0.735 = 232,29 \text{ mT} \approx$$

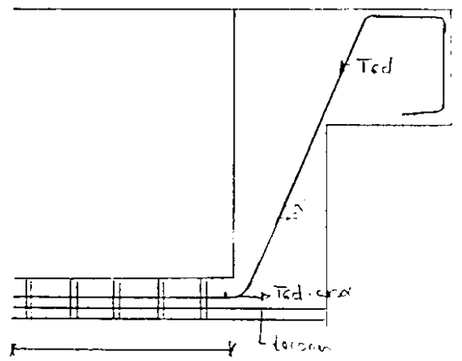
$$z = (1.40 - 0.05) \times 0.90 = 1.215$$

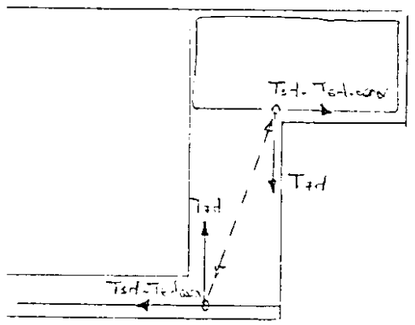
$$T_{sd} = \frac{M_d}{z} = \frac{232,29}{1.215} = 191,18 \text{ T} < 201,51 \text{ T} \checkmark$$

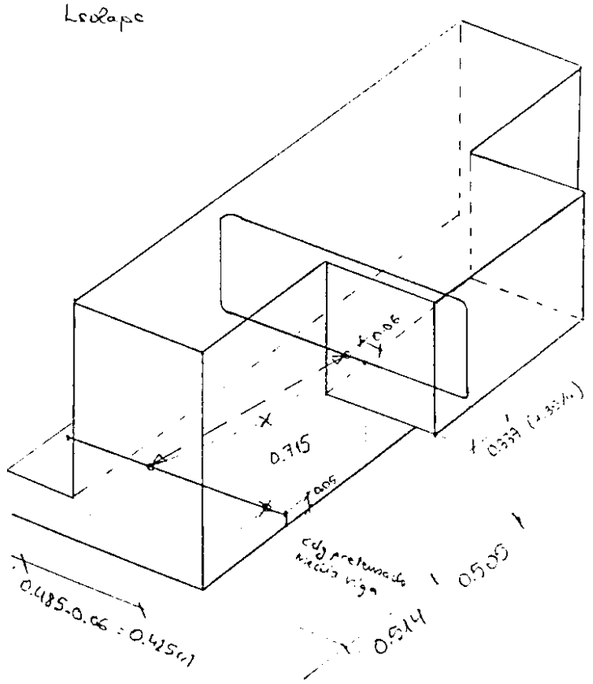


Armadura de solape a distancia :

Se anulará $T_{sd} - T_{sd\,cos}$ suponiendo que este último término se anula directamente en la losa (1) en su cara y se solapa con los tramos con la armadura inferior de losa.




$tg\,\alpha = \frac{0.715}{0.425} = 1.682$

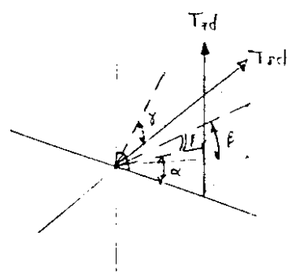
$tg\,\beta = \frac{0.715}{0.505} = 1.415$

$\alpha = 59,26°$

$\beta = 54,75°$

$tg\,\varepsilon = \frac{0.505}{0.425} = 1.187$

$\varepsilon = 49,91$






a/ $F_{sd} = 1,35 \times (50,951 + 31,641) + 1,50 \times (41,375 + 23,179) = 146,045$ T

$4_d = 15$ T

$F_{sd/2} = 128,0$ T

$C_{1d} = 158 / \tan 53,4° = 196,84$ T

$T_{1sd} = 2 \times 196,84 \times \cos 53,4° + 15 = 241,92$ T

$T_{2sd} = 158$ T

$C_{3d} = T_{3d} = 191,13$ T

$C_{2d} = 158 / \cos 53,7° \times \frac{1}{2} = 109,27$ T

$C_{3d}^* = 158 / \cos 53° \times \frac{1}{2} = 131,27$ T

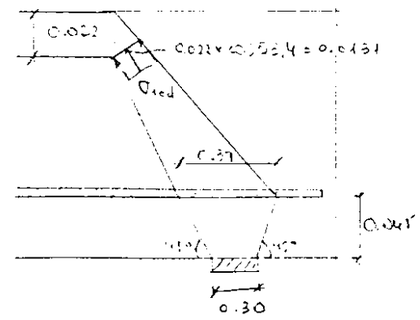
$T_{sd} = T_{sd}^* \sim T_{2d}/2 = 79,00$ T

$T_{sd} = 131,27 \times \sin 53,7° = 79,69$ T (se toma el mismo valor que en apt. (1))

$T_{sd}^* = 131,27 \times \cos 53° = 104,93$ T

Esfuerzo apoyo : $216,076 / 0,3 \times 0,425 = 2166,16 \frac{T}{m^2} < f_{cd} = 2214,28 \frac{T}{m^2}$

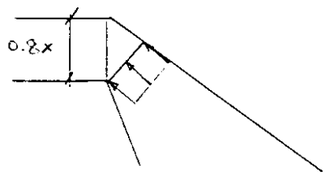
Ured :



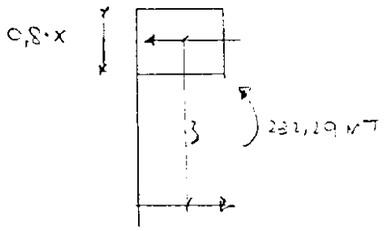

$T_{red} = \frac{196,84}{0.0191 \times (1.35 + 0.175 \times 2)} =$

$= 2529,8$ T/m² >>

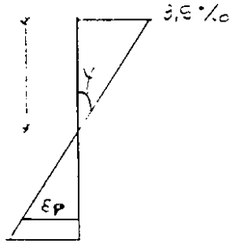
>> $0.70 \times \frac{4500}{1.40} = 2250$




$0.8 \cdot x \geq \frac{1}{2250} \times 196{,}84 \Big/ (1.834 \cdot 0.192 \, m) = 0.0515$




$z = 1.40 - 0.05 - 0.0515/2 = 1.324 \, m$




$x = 0.0035 / 0.0544 = 0.0544 \, m^{-1}$

$\varepsilon_p = 0.0544 \times 1.255 = 0.0679$

$\varepsilon_{pt} = f_{pt}/E_p = 191000/1,1 \Big/ 1{,}9 \times 10^6 = 0.0092$

$\varepsilon_p > \varepsilon_{yp} \rightarrow$ Armadura trabajando a $f_{pd}$.

$T_{sd} = C_{cd} = 232{,}29 / 1.324 = 175{,}44 \, T < 201{,}91$ ✓

$T_{sd}$: compresión automáticamente en cuantía $C_{cd}$

Dimensionamiento de la armadura

$A_{s1} = 249{,}73 \times 1{,}15/5{,}10 = 53{,}86 \, cm^2 \rightarrow$ 11 ϕ 25

$A_{s2} = 158/4{,}2 = 37{,}62 \, cm^2 \rightarrow$ 11 x 2 cϕ16

$A_{s4} = 79/4{,}2 = 18{,}80 \, cm^2$ se suman a los $cm^2$ del apt. b)



b/ $C_{cd} = 158 \, T$ $\quad T_{sd} = 90{,}69 \, T$

$T_{sd} = 158 / \text{sen } 58{,}4° = 185{,}51 \, T$

$T_{sd} = T_{sd}^* = 79 \, T$

Comprobación de la cuantía según artículo

Comprobación en apt. a/

Dimensionamiento de la armadura

$A_{s6} = 155{,}51 \times 1{,}1/5{,}1 = 40{,}01 \, cm^2 \rightarrow$ 7 ϕ 20

$A_{s4} = 79/4{,}2 = 18{,}80 \, cm^2$

a+b : $A_{s4} = 18{,}80 + 18{,}80 = 37{,}61 \, cm^2$

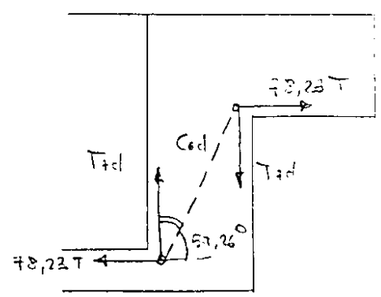
Llevamos $y/2 = d/2 = 12{,}5$ en 60 cm → $30{,}14 \, cm^2$

Se necesitan $37{,}61 - 30{,}14 = 7{,}46 \, cm^2$

Se dispondrán $d/2 = 12{,}5 = 38{,}59 \, cm^2$ en los extremos

60 cm . $A_{s5} = 90{,}69 \times 2 \times 1{,}1/5{,}1 = 39{,}12 \, cm^2 \rightarrow$ 8 ϕ 25

Armadura de alzado a distancia

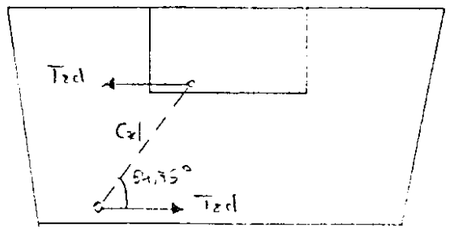



$T_{sd} - T_{sd} \cdot \text{sen}\alpha = 179{,}44 - 204{,}46 \times \text{sen } 58{,}4° = 53{,}30 \, T$

$C_{cd} = 139{,}03 \, T$

$T_{sd} = 114{,}25 \, T$

$A_{s6} = 114{,}25/4{,}2 = 27{,}24 \, cm^2 \rightarrow$ 7 cϕ16




$Crd = \frac{Crd}{\cos\xi} \times \cos\xi = 133,63 \times 1,127 = 150,72\ T$

$Trd = 150,75 \times \cos 34,25° = 91,620\ T$

$As = \frac{91,620 \times 1,1}{5,1} = 19,76\ cm^2 \Rightarrow$ 4 cΦ25

Armadura de zunchado de la biela Crd :

6 cΦ10 — 5cΦ10 (armadura de espera para el empalme de armaduras)

5 cΦ10 — 3cΦ10 en toda la altura de la ménsula — 3cΦ10



Armadura de anclaje de la biela de arranque Crd

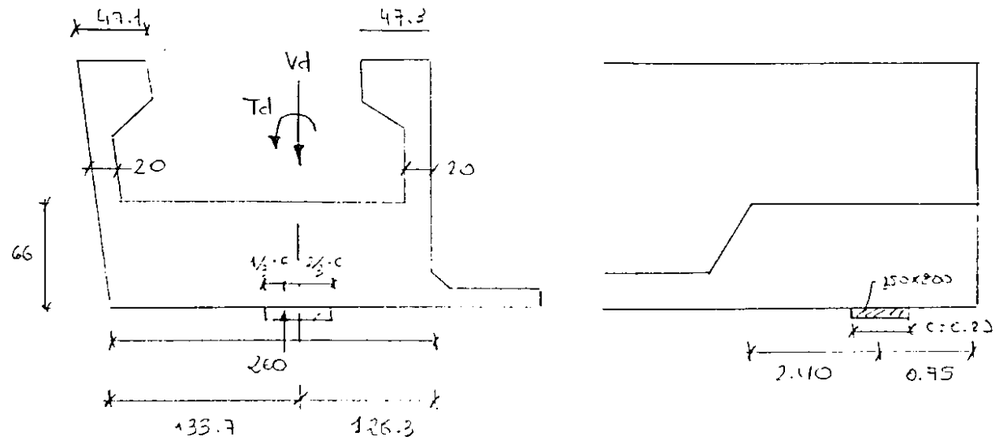
$\Delta T = \frac{Crd}{2} = \frac{Fd}{4} = 79\ T$

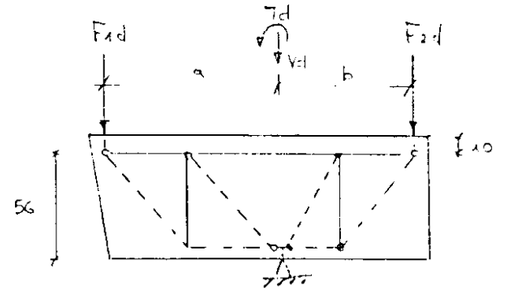
Fuerza resistente de los tensores = 0

⇒ 4 cΦ25 anclados en patilla — 50 — 1,0

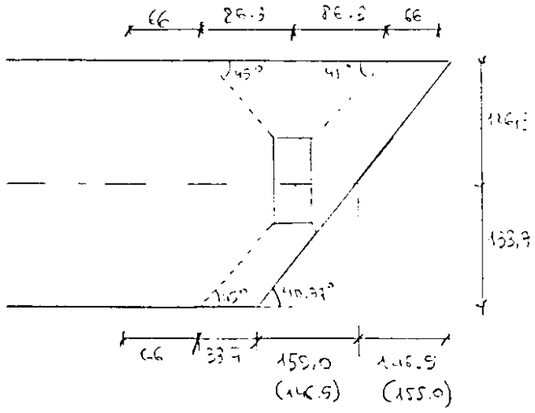
bajo losa superior

## CALCULO DE MACIZADO DE VIGA: V-2




La viga la vamos a considerar como viga a flexión y cortante




biselado min $\left(66+86.3+86.3\cdot\frac{1}{6}\right)$ = 3

$\left(\frac{\quad}{\quad}=33.7\right) \approx 100$

$a = \left(133.7+\frac{66}{4}-10\right)_{/\text{pendiente}=1} - \frac{80}{3} = 15$

$b = \left(126.3+\frac{66}{4}-10\right)_{/\text{pendiente}=1} - \frac{80}{3} = 20$



Se mejora el hormigón a $f_{ck}$ = 250 kp/cm²

Vd = 402,13 T

Td = 77,724 x 1,50 = 116,59 mT

$F_{1d} = \frac{Vd}{2} + \frac{Td}{a+b}$ = 239,58 T

$F_{2d} = \frac{Vd}{2} - \frac{Td}{a+b}$ = 162,65 T

Md = max (F1d x a ; F2d x b) = max (3342,1 ; 3410,69) = 3342,1

z = 0.3 d

Dimensionamiento a flexión

d = 0.66 - 0.10 = 0.56

Uc = fcd · bx · z = 2100 T

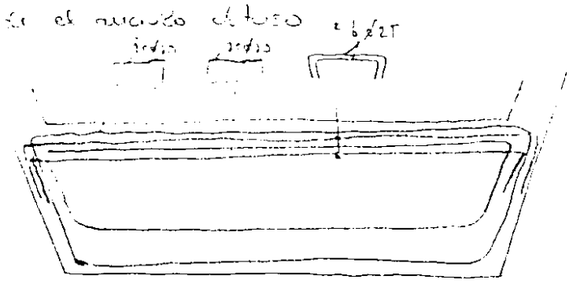
Mlim = z · Uc · d = 373,96 mT

Md < Mlim

$x = 1.25 \times d \times \left(1-\left(1-2.125\times Md/(Uc\times d)\right)^{1/2}\right)$ = 0.45 (N x Lim)

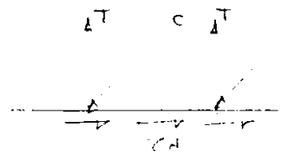
Us = 0.85 x fcd x bx x = 221,17 T

As = 190,13 cm² → 6 (2ø25 + 2ø20 + 2b/25) a cada 10 cm hacia el macizado del tubo + 1 b/27




En el resto del macizado se colocarán cø20 + cø20 + 2b/16

Dimensionamiento a cortante:



$F_{1d}$ = 235,58 T

$z_d = F_{1d} / (b \times d)$ = 235,58 / (1,00 × 0,55) = 428,69 T/m²

Biela de compresión:

$\bar{\sigma}_{cd} \leq 0,60 \cdot f_{cd}$ = 1425 T/m² ✓

Armadura necesaria:

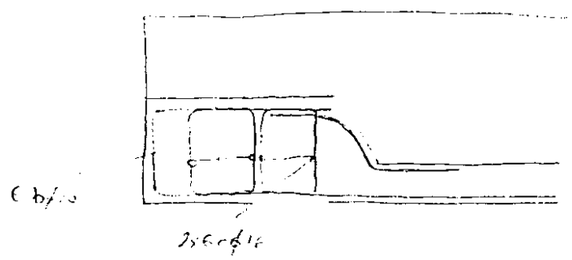
$V_{cu} = 5 \cdot \sqrt{f_{cd}} \times b \times d$ = 211,12 T

$A_{sx} \geq (V_d - V_{cu}) \times b / f_{yd}$ = 43,19 cm² ⇒ Asmin

$A_{smin} \geq 0,04 \times \frac{f_{cd}}{f_{yd}} \times b$ = 23,85 cm²/m

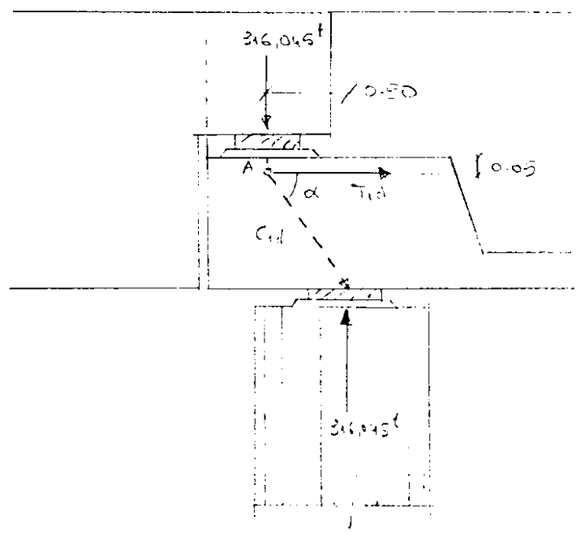
→ cada 100 cm cercos de 1 tramo de 53,93 cm²

→ 6 bf/10 + 2xEstd/16 a cada 2 cercos más 2 = 8






Efecto de la tensión tangencial




$tg\alpha = \frac{0,66 - 0,05}{0,50}$ = 1,22

α = 50,68°

$C_{1d}$ = 316,045 / (sen 50,68°) = 405,64 T

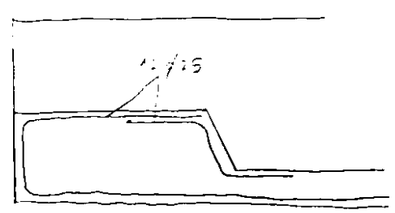
$T_{1d}$ = 259,05 T

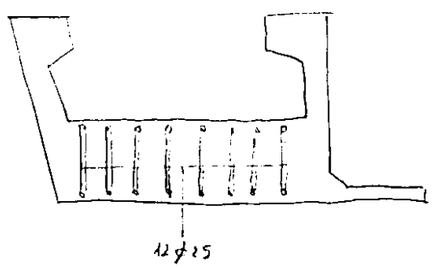
Comprobación de tensiones en bielas: (nudo A)

$\sigma_{1cd}$ = 405,64 / [(0,50+0,10) × (0,50+0,10)] = 1702,66 ≤ 0,7 fcd = 2625 T/m² ✓

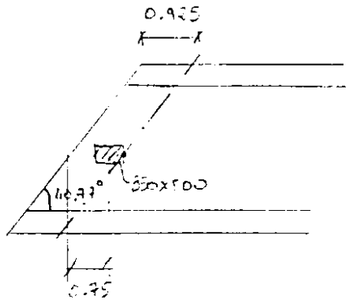
Armadura:

$A_{s1}$ = 259,05 × 1,1 / 5,1 = 55,89 cm² ⇒ 12 ϕ 25



Anclaje de la biela de compresión




Vd = 403,13 T

ΔT = Vd/2 = 201,56 T

$l_{bpt}$ = 1,2 x ( 15,7 x 0,0125 x $P_{E}$ 2400 / $\sqrt{f_{ck}}$ ) = 1,482 m

$F_{tr}$ = 65 x 19,545 x 1,4 x 0,715 / 1,187 = 382,82 T ✓

Sobra el anclaje y por precaución dispondremos 2Ø12 bajo alzado anclados en cada lado.



CALCULO DE MACIZADOS V'SAC 1-2 y 1-3

Dimensiones 350 x 900

biela = 1.60

Vd = 316,045 T

Td = 56,333 mT

$F_{1d}$ = 316,045/2 + 56,333/0,60 = 158,022 + 93,888 = 251,91 T

$F_{2d}$ = 316,045/2 − 56,333/0,60 = 158,022 − 93,888 = 64,134 T

Md = max ( 173,67 x 1,50 ; 112,24 x 2,00 ) = ( 260,51 ; 224,48 ) = 260,51 mT

Dimensionamiento a flexión :

β = 0,312 ; d = 0,56 m

$U_c$ = 2100 T

$M_{lim}$ = 373,96 mT > Md

x = 1,25 x 0,56 x ( 1 − ( 1 − 2,1333 x 260,51 / 2100 x 0,56 )$^{1/4}$ ) = 0,2114 m

$U_c$ = 0,68 x 5250/1,40 x 0,2114 x 1 = 607,99 T

$A_s$ = 134,13 cm² → 6Ø16 + 2Ø16 + 5Ø12 + 5Ø12 = 6,10 cm cada 10cm desde el anclaje alzado.

En el resto del macizado 4 diametros 4Ø16 + 2Ø16 + 2Ø16.

Armadura a cortante

$A_{sw} \geq \frac{(173.67 - 54.22) \times 1}{4.2} = 28,44 \text{ cm}^2/\text{m}$

Área > 21,35 cm²/m → 2 x 2 c/12

Armadura mínima de cortante

1 b/20 por alma.

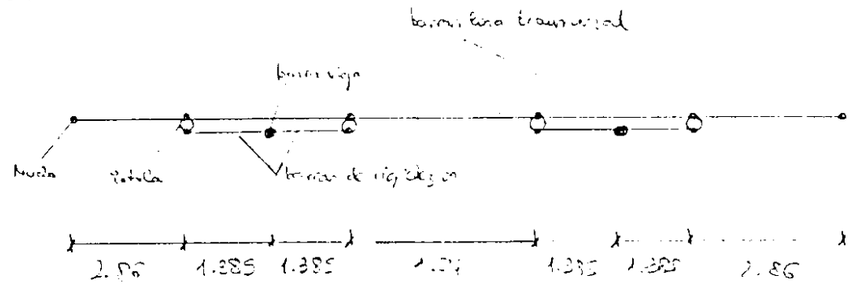


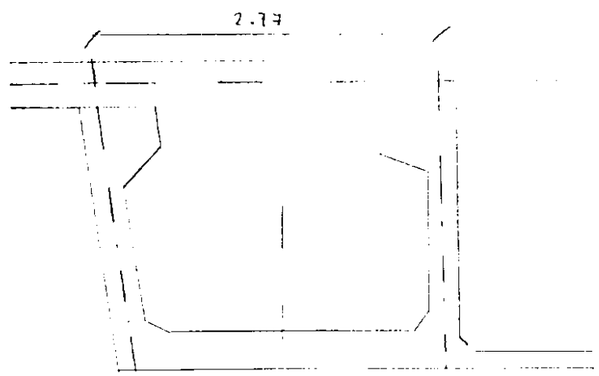
# 2. CALCULO DE LA LOSA

## 1. Modelo de calculo

Se modeliza el tablero mediante un emparrillado de barras con el programa "SAP90".

Se calculan las inercias de la losa y las vigas del tablero



6.1.2.CARACTERISTICAS MECANICAS DE LAS BARRAS

**E-1500.4 / SUB XV AVE**

**E:24785**

BARRAS LOSA

| BARRA | Bizq(m) | Bdrcha(m) | B(m) | H(m) | A(m2) | I(m4) | J(m4) | NM |
|---|---|---|---|---|---|---|---|---|
| 1 | 3,38 | 1,84 | 2,61 | 0,25 | 0,65 | 0,0034 | 0,0068 | 1 |
| 2 | 0,85 | 1,84 | 1,35 | 0,25 | 0,34 | 0,0018 | 0,0035 | 2 |
| 3 | 1,84 | 3,30 | 2,57 | 0,25 | 0,64 | 0,0033 | 0,0067 | 1 |
| 4 | 1,84 | 3,30 | 2,57 | 0,25 | 0,64 | 0,0033 | 0,0067 | 1 |
| 5 | 0,12 | 3,30 | 1,71 | 0,25 | 0,43 | 0,0022 | 0,0045 | 3 |
| 6 | 3,30 | 3,35 | 3,33 | 0,25 | 0,83 | 0,0043 | 0,0087 | 5 |
| 7 | 3,30 | 3,35 | 3,33 | 0,25 | 0,83 | 0,0043 | 0,0087 | 5 |
| 8 | 3,30 | 3,35 | 3,33 | 0,25 | 0,83 | 0,0043 | 0,0087 | 5 |
| 9 | 0,85 | 3,35 | 2,10 | 0,25 | 0,53 | 0,0027 | 0,0055 | 6 |
| 10 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 11 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 12 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 13 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 14 | 1,67 | 3,35 | 2,51 | 0,25 | 0,63 | 0,0033 | 0,0065 | 1 |
| 15 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 16 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 17 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 18 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 19 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 20 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 21 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 22 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 23 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 24 | 3,35 | 3,35 | 3,35 | 0,25 | 0,84 | 0,0044 | 0,0087 | 5 |
| 25 | 3,35 | 1,50 | 2,43 | 0,2 | 0,49 | 0,0016 | 0,0032 | 7 |
| 26 | 3,35 | 1,50 | 2,43 | 0,25 | 0,61 | 0,0032 | 0,0063 | 8 |
| 27 | 3,35 | 1,50 | 2,43 | 0,25 | 0,61 | 0,0032 | 0,0063 | 8 |
| 28 | 3,35 | 1,50 | 2,43 | 0,25 | 0,61 | 0,0032 | 0,0063 | 8 |
| 29 | 3,35 | 1,50 | 2,43 | 0,25 | 0,61 | 0,0032 | 0,0063 | 8 |
| 30 | 1,50 | 1,62 | 1,56 | 0,25 | 0,39 | 0,0020 | 0,0041 | 9 |
| 31 | 1,50 | 1,62 | 1,56 | 0,2 | 0,31 | 0,0010 | 0,0021 | 10 |
| 32 | 1,50 | 1,62 | 1,56 | 0,2 | 0,31 | 0,0010 | 0,0021 | 10 |
| 33 | 1,50 | 1,62 | 1,56 | 0,25 | 0,39 | 0,0020 | 0,0041 | 9 |
| 34 | 1,50 | 1,62 | 1,56 | 0,25 | 0,39 | 0,0020 | 0,0041 | 9 |
| 35 | 1,62 | 1,50 | 1,56 | 0,25 | 0,39 | 0,0020 | 0,0041 | 9 |
| 36 | 1,62 | 1,50 | 1,56 | 0,25 | 0,39 | 0,0020 | 0,0041 | 9 |
| 37 | 1,62 | 1,50 | 1,56 | 0,2 | 0,31 | 0,0010 | 0,0021 | 10 |
| 38 | 1,62 | 1,50 | 1,56 | 0,2 | 0,31 | 0,0010 | 0,0021 | 10 |
| 39 | 1,62 | 1,50 | 1,56 | 0,25 | 0,39 | 0,0020 | 0,0041 | 9 |
| 40 | 1,50 | 4,29 | 2,90 | 0,25 | 0,72 | 0,0038 | 0,0075 | 11 |
| 41 | 1,50 | 4,29 | 2,90 | 0,25 | 0,72 | 0,0038 | 0,0075 | 11 |
| 42 | 1,50 | 4,29 | 2,90 | 0,25 | 0,72 | 0,0038 | 0,0075 | 11 |
| 43 | 1,50 | 4,29 | 2,90 | 0,2 | 0,58 | 0,0019 | 0,0039 | 8 |
| 44 | 1,50 | 4,29 | 2,90 | 0,2 | 0,58 | 0,0019 | 0,0039 | 8 |
| 45 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 46 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 47 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 48 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 49 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 50 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 51 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 52 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |

BARRAS LOSA

| BARRA | Bizq(m) | Bdrcha(m) | B(m) | H(m) | A(m2) | I(m4) | J(m4) | NM |
|---|---|---|---|---|---|---|---|---|
| 53 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 54 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 55 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 56 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 57 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 58 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 59 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 60 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 61 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 62 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 63 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 64 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 65 | 4,29 | 3,01 | 3,65 | 0,25 | 0,91 | 0,0048 | 0,0095 | 13 |
| 66 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 67 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 68 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 69 | 4,29 | 4,29 | 4,29 | 0,25 | 1,07 | 0,0056 | 0,0112 | 12 |
| 70 | 4,29 | 0,85 | 2,57 | 0,25 | 0,64 | 0,0033 | 0,0067 | 1 |
| 71 | 4,29 | 3,30 | 3,80 | 0,25 | 0,95 | 0,0049 | 0,0099 | 13 |
| 72 | 4,29 | 3,30 | 3,80 | 0,25 | 0,95 | 0,0049 | 0,0099 | 13 |
| 73 | 4,29 | 3,30 | 3,80 | 0,25 | 0,95 | 0,0049 | 0,0099 | 13 |
| 74 | 3,30 | 0,12 | 1,71 | 0,25 | 0,43 | 0,0022 | 0,0045 | 3 |
| 75 | 3,30 | 1,84 | 2,57 | 0,25 | 0,64 | 0,0033 | 0,0067 | 1 |
| 76 | 3,30 | 1,84 | 2,57 | 0,25 | 0,64 | 0,0033 | 0,0067 | 1 |
| 77 | 1,84 | 0,85 | 1,35 | 0,25 | 0,34 | 0,0018 | 0,0035 | 2 |
| 78 | 1,84 | 3,38 | 2,61 | 0,25 | 0,65 | 0,0034 | 0,0068 | 1 |
| 101 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 102 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 103 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 104 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 105 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 106 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 107 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 108 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 109 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |
| 110 | 0,80 | 0,80 | 0,80 | 0,25 | 0,20 | 0,0010 | 0,0021 | 14 |

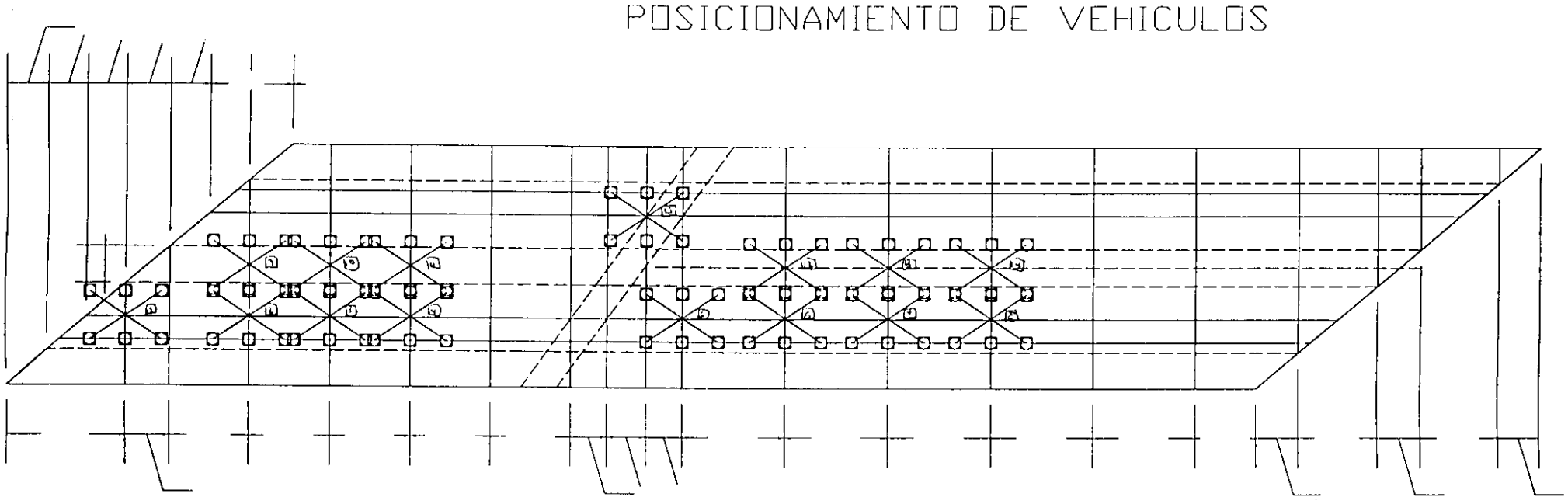
BARRAS VIGA

| BARRA | A(m2) | I(m4) | J(m4) | NM |
|---|---|---|---|---|
| 1_7 | 2,10 | 0,8259 | 0,1395 | 15 |
| 8 | 1,24 | 0,2936 | 0,0100 | 16 |
| 9 | 0,69 | 0,0013 | 0,0026 | 17 |
| 10 | 1,24 | 0,2936 | 0,0100 | 16 |
| 11_19 | 2,10 | 0,8259 | 0,1395 | 15 |
| 20_26 | 2,10 | 0,8259 | 0,1395 | 15 |
| 27 | 1,24 | 0,2936 | 0,0100 | 16 |
| 28 | 0,69 | 0,0013 | 0,0026 | 17 |
| 29 | 1,24 | 0,2936 | 0,0100 | 16 |
| 30_38 | 2,10 | 0,8259 | 0,1395 | 15 |

BARRAS DE RIGIDEZ INFINITA

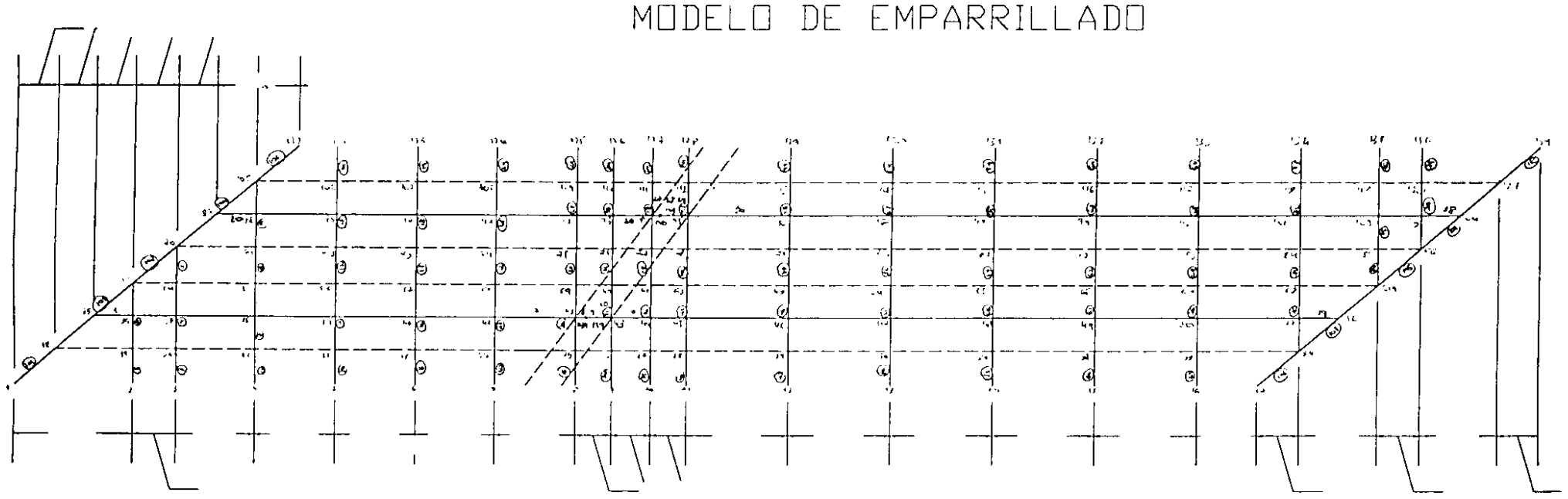
| BARRA | A(m2) | I(m4) | J(m4) | NM |
|---|---|---|---|---|
| 201_ | 100,00 | 100,0000 | 100,0000 | 18 |

## POSICIONAMIENTO DE VEHICULOS





## MODELO DE EMPARRILLADO



2. Esfuerzos generales del tablero

Se obtienen directamente del modelo de emparrillado.

Afectan a las siguientes estados de carga:

- carga muerta *
- sobrecarga uniforme *
- vehículo pesado

* De estos estados de carga se obtienen normales por esfuerzos generales + cortes

2.1. Acciones

Carga muerta: como carga uniforme en barras losa

$q = 0.107\ T/m^2 \times b$ b = ancho barra

Sobrecarga uniforme: como carga uniforme en barras losa

$q = 0.400\ T/m^2 \times b$ b = ancho de losa

Vehículo pesado:

60T (eje de 10T)

Se introducen como cargas en nudos altos de cada, realizando un reparto isostático.

Barandilla - barrera: como carga puntual en vértices

$q = 1.280\ T/ml \cdot 0.107 \times 1.40 \approx 1\ T/m$



2.2 Reparto isostático de ejes del vehículo pesado

| VEH | NUDO | F(T) | VEH | NUDO | F(T) | VEH | NUDO | F(T) |
|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 5 | 4 | 57 | 22 | 9 | 81 | 24 |
| | 19 | 17 | | 58 | 4 | | 82 | 5 |
| | 20 | 8 | 5 | 59 | 10 | | 64 | 3 |
| | 53 | 12 | | 60 | 19 | | 65 | 24 |
| | 54 | 5 | | 61 | 3 | | 66 | 3 |
| 2 | 20 | 4 | | 62 | 10 | 9 | 80 | 5 |
| | 21 | 22 | | 62 | 17 | | 76 | 20 |
| | 22 | 4 | | 63 | 3 | | 67 | 5 |
| | 54 | 4 | 6 | 64 | 3 | | 71 | 5 |
| | 55 | 22 | | 64 | 14 | | 72 | 20 |
| | 56 | 4 | | 80 | 3 | | 73 | 5 |
| 3 | 21 | 4 | | 61 | 3 | 10 | 56 | 5 |
| | 22 | 22 | | 63 | 24 | | 52 | 20 |
| | 23 | 4 | | 64 | 3 | | 58 | 5 |
| | 25 | 4 | 7 | 69 | 3 | | 72 | 5 |
| | 26 | 22 | | 80 | 24 | | 73 | 20 |
| | 57 | 4 | | 81 | 3 | | 74 | 5 |
| 4 | 27 | 4 | | 65 | 3 | 11 | 50 | 5 |
| | 28 | 22 | | 64 | 14 | | 58 | 20 |
| | 24 | 4 | | 65 | 3 | | 59 | 5 |
| | 56 | 4 | 8 | 80 | 3 | | 75 | 5 |

| VEH | NUDO | FG) | VEH | NUDO | FG) |
|---|---|---|---|---|---|
| 11 | 74 | 20 | 15 | 79 | 10 |
| | 75 | 5 | | 111 | 1 |
| 12 | 63 | 5 | | 112 | 1 |
| | 64 | 24 | | 113 | 1 |
| | 65 | 3 | | | |
| | 79 | 3 | | | |
| | 80 | 14 | | | |
| | 81 | 3 | | | |
| 13 | 64 | 3 | | | |
| | 65 | 14 | | | |
| | 66 | 3 | | | |
| | 70 | 3 | | | |
| | 81 | 24 | | | |
| | 82 | 5 | | | |
| 14 | 69 | 3 | | | |
| | 70 | 10 | | | |
| | 67 | 3 | | | |
| | 71 | 5 | | | |
| | 82 | 14 | | | |
| | 83 | 5 | | | |
| 15 | 77 | 10 | | | |
| | 78 | 10 | | | |



3. Esfuerzos sobre el forjado

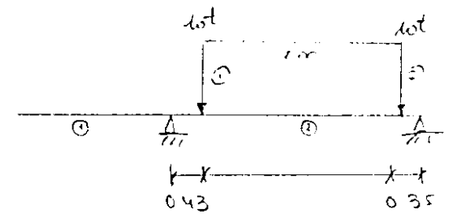
Se obtienen con diferentes modelos de viga continuos que modelizan la losa apoyada sobre los muros.

Afectan a las siguientes estados de cargas:

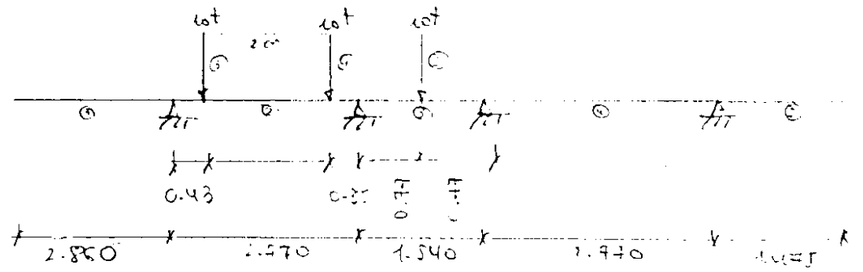
- p.p. losa
- vehículo pesado

3.1. Momentos de cálculo

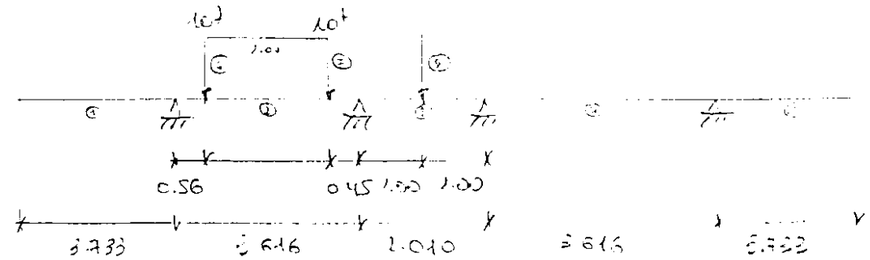
N.1




N.2

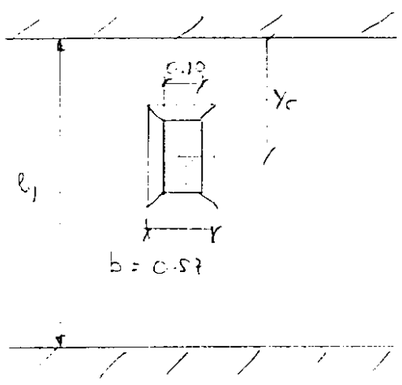


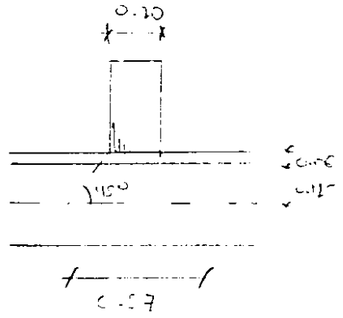

DERECHO



3.2. Anchos eficaces de reparto

i / Ancho eficaz a flexión




$k = 2/3$

$$b_1 = \frac{2}{4} b + \frac{3}{4} \cdot k \cdot l_y$$

$$b_{eff} = b_1 - (b_1 - b) \cdot \left[1 - \frac{a^2/c}{l_y}\right]^2 \leq 1.50 \text{ m}$$

Eje 1 y 5

$b_1 = 1.512$ m

$b_{eff} = 1.224$ m

Eje 2 y 4

$b_1 = 1.812$ m

$b_{eff} = 1.418$ m

Eje 3

$b_1 = 2.197$ m

$b_{eff} = 2.197$ m

Eje 6

$b_1 = 2.235$ m

$b_{eff} = 1.470$ m

Eje 7

$b_1 = 2.032$ m

$b_{eff} = 1.295$ m

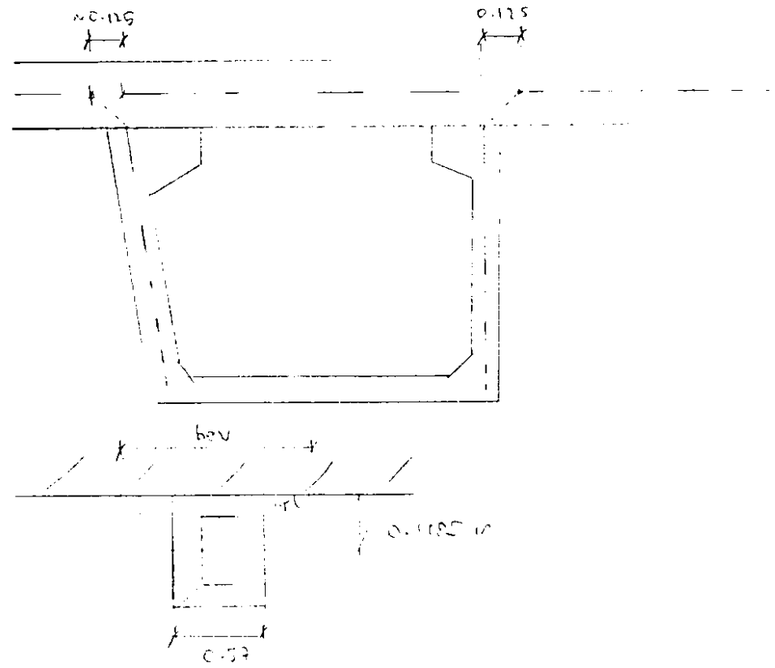
Eje 8

$b_1 = 2.052$ m

$b_{eff} = 1.270$ m



ii / Ancho eficaz a cortante




$b_{ev} = 1.51 \leq 1.50$ m

4. Armadura transversal de losa

4.1. Esfuerzos pésimos

| Barras | $Md^+$ | $Md^-$ | |
|---|---|---|---|
| 1 - 2 | 1.60 | -5.17 | ZONA 1 |
| 3 - 5 | 1.87 | -9.28 | ZONA 2 |
| 6 - 9 | 1.87 | -9.98 | |
| 10 - 14 | 1.87 | -9.46 | |
| 15 - 19 | 1.87 | -10.22 | ZONA 3 |
| 20 - 24 | 1.87 | -11.21 | |
| 25 - 29 | 1.87 | -12.11 | ZONA 4 |
| 30 - 34 | 2.13 | -12.27 | |
| 35 - 39 | 1.87 | -11.24 | ZONA 5 |
| 40 - 44 | 1.87 | -10.18 | |
| 45 - 49 | 1.87 | -10.71 | ZONA 3 |
| 50 - 54 | 1.87 | -10.76 | |
| 55 - 59 | 1.87 | -10.81 | |
| 60 - 64 | 1.87 | -10.81 | |
| 101-105 | 2.49 | -9.40 | |

4.2. Armadura transversal superior

$d^- = 0.25 - 0.03 = 0.22\ m$

$\beta = 0.318$

$Uc = fcd \cdot b \cdot d = \frac{2500}{1.50} \times 1.00 \times 0.22 = 366,66\ T$



$M_{lim} = \beta\ Uc \cdot d = 0.318 \times 366.66 \times 0.22 = 25.65\ mT$

$Md < M_{lim}$

$As^- = 0.85 \times Uc \times \left(1 - \left(1 - \frac{2.353 \times Md}{Uc \cdot d}\right)^{1/2}\right) \times \frac{1}{fyd}$

ZONA 1 :

$As^- = 5.52\ cm^2 < A_{min} \rightarrow \phi 12\ a\ 15$

ZONA 2 :

$As^- = 10,47\ cm^2 \rightarrow \phi 16\ a\ 15$

ZONA 3 :

$As^- = 12,62\ cm^2 \rightarrow \phi 16\ a\ 15$

ZONA 4 :

$As^- = 20,54\ cm^2 \rightarrow \phi 20\ a\ 15$

ZONA 5 :

$As^- = 13,97\ cm^2 \rightarrow \phi 20\ a\ 20$

4.3. Armadura transversal inferior

$d^+ = 0.25 - 0.04 - 0.03 = 0.18\ m$ (+ vuelo)

$Uc^+ = 299,99\ T$

$M_{lim} = 17,17\ mT$

$Md < M_{lim}$

ZONA 1 :

$As^+ = 2{,}04\ cm^2 < Amin \rightarrow \phi 12\ a\ 15$

ZONAS 2, 3 y 5

Amin $\rightarrow \phi 12\ a\ 15$

ZONA 4

$As^+ = 4{,}64\ cm^2 < Amin \rightarrow \phi 12\ a\ 15$

4.3 Armadura mínima

Mecánica : $As \geq 0{,}04 \times \frac{2500}{5{,}1} \times \frac{1{,}15}{150} \times 1000 \times 15 = 3{,}76\ cm^2$

Geométrica : $As \geq \frac{2{,}8}{1000} \times 100 \times 25 = 9\ cm^2 \rightarrow \phi 12\ a\ 15$

5. Comprobación en ELS Fisuración

Se comprueba exhaustivamente a tracción que la cara inferior de la losa está comprimida en las zonas pretensadas.

Momento exterior bajo la combinación característica:

ZONA 1 :

$M_{ext} = -(0{,}42^{cm} - 0{,}31^{pp\ losa} + 0{,}20 \times (0{,}24 + 0{,}17^{sc} + 2{,}74)) = -1{,}37$ mT

ZONA 2

$M_{ext} = -(2{,}55 - 0{,}31 + 0{,}20 \times (0{,}62 + 3{,}84)) = -3{,}079$ mT

ZONA 3

$M_{ext} = -(3{,}45 - 0{,}31 + 0{,}2 \times (0{,}99 + 3{,}57)) = -4{,}052$ mT



ZONA 4

$M_{ext} = -(1{,}791 - 0{,}31 + 0{,}20 \times (1{,}95 + 1{,}76 + 5{,}29)) = -5{,}93$ mT

ZONA 5

$M_{ext} = -(3{,}60 - 0{,}31 + 0{,}20 \times (0{,}96 + 0{,}70 + 3{,}59)) = -4{,}20$ mT

$f_{ct,k} = 0{,}42 \times f_{ck}^{2/3} = 1{,}95$ kp/cm²

$f_{ct,m} = 1{,}3 \times f_{ct,k} = 2{,}6$ kp/cm²

$M_{fis} = -1923$ mT

ZONA 2

$\sigma_2 = (1293{,}8 + 1746{,}6)/2 = 1519{,}2$ kp/cm² > 260 No fisura.

ZONA 3

$\sigma_3 = (1752{,}6 + 1289{,}0)/2 = 1520{,}8$ kp/cm² > 260 No fisura

ZONA 4

$\sigma_4 = (1767{,}3 + 1546{,}3)/2 = 1656{,}8$ kp/cm² > 260 No fisura

ZONA 5

$\sigma_5 = (1621{,}3 + 1345{,}0)/2 = 1483{,}1$ kp/cm² > 260 No fisura

** CALCULO ELASTICO **

Título Sección: LOSA

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : -1.00m.T Munit
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 12.5 | 9.0 | -9.0 | 0.0 | 0.0 | 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 12.5 | 47.9 | 41.9 | 0.0 | 47.9 | 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 12.5 | -47.7 | -53.8 | 0.0 | 53.8 | 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
1

Mfis: $f_{ct,k}/9$ mT = -1.983 mT

** CALCULO ELASTICO **

Título Sección: LOSA

Analisis CON FISURACION ZONA 2

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : -1.98m.T Mfis
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 20.0 | 0.0 | -37.1 | 0.0 | 0.0 | 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 20.0 | 885.1 | 801.8 | 0.0 | 885.1 | 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 20.0 | -103.5 | -165.9 | 0.0 | 165.9 | 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : -3.08m.T Mext
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 20.0 | 0.0 | -57.6 | 0.0 | 0.0 | 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 20.0 | 1373.8 | 1244.6 | 0.0 | 1373.8 | 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 20.0 | -160.6 | -257.5 | 0.0 | 257.5 | 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
2

** CALCULO ELASTICO **

Título Sección: LOSA

Analisis CON FISURACION ZONA 3

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : -4.05m.T Mext
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 20.0 | 0.0 | -75.9 | 0.0 | 0.0 | 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 20.0 | 1808.6 | 1638.5 | 0.0 | 1808.6 | 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 20.0 | -211.4 | -339.0 | 0.0 | 339.0 | 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
1

** CALCULO ELASTICO **

Título Sección: LOSA

Analisis CON FISURACION ZONA 4

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : -1.98m.T Mfis
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 19.0 | 0.0 | -31.8 | 0.0 | 0.0 | 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 19.0 | 591.0 | 517.1 | 0.0 | 591.0 | 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 19.0 | -111.1 | -155.5 | 0.0 | 155.5 | 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : -5.93m.T Mext
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 19.0 | 0.0 | -95.0 | 0.0 | 0.0 | 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 19.0 | 1767.3 | 1546.3 | 0.0 | 1767.3 | 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 19.0 | -332.3 | -464.9 | 0.0 | 464.9 | 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
2

** CALCULO ELASTICO **

Título Sección: LOSA

Analisis CON FISURACION ZONA 5

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : -1.98m.T Mfis
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 19.4 | 0.0 | -34.0 | 0.0 | 0.0 | 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 19.4 | 702.9 | 617.4 | 0.0 | 702.9 | 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| | 19.4 | -109.4 | -160.7 | 0.0 | 160.7 | 3 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : -4.32m.T Mext
Tipo de Solicitacion: SO
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 19.4 | 0.0 | -74.1 | 0.0 | 0.0 | 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 19.4 | 1531.3 | 1345.0 | 0.0 | 1531.3 | 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 19.4 | -238.4 | -350.2 | 0.0 | 350.2 | 3 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 2-21

6. Comprobación a cortante

$$Vd = 1.35 \times \left( \frac{0.943\ t}{1.71\ m} + 0.421 \right) + 1.50 \times \left( \frac{1.06}{1.21} + \frac{3.64 + 3.093}{1.71} + \frac{1.056}{1.221} + \frac{1.456}{1.118} \right) = 1.394 + 1,994 = 11,39\ T$$

$$Vcu,a = 0.12 \cdot Vou \cdot \xi \cdot (1 + 50\rho) = 12,779$$

$$Vou = 2 \cdot \sqrt{\frac{250}{1.50}} \cdot 0,22 = 11,20\ T$$

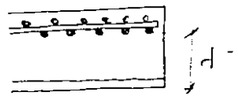
$$\xi = 1.6 - d = 1.39\ m$$

$$\rho = \frac{13.2}{100 \times 22} = 0.0062$$

$11,39\ T < 12,779\ t$ ✓

7. Armadura específica de cordón

Armadura de negativos:




$d^- = 0.25 - 0.05 = 0.20$

$Uc = \frac{2500}{1.50} \times 0.20 = 333,33\ T$

$Mlim = 0.318 \times 333,33 \times 0.20 = 21,20\ mT$

$Md < Mlim$ . $Md = -9.40\ mT$

$As^- = 11.66\ cm^2 \in \phi 16$




$d^+ = 0.25 - 0.04 - 0.05 = 0.16$

$Uc = \frac{2500}{1.50} \times 0.16 = 266,66\ T$

$Mlim = 0.318 \times 266,66 \times 0.16 = 13,56$

$Md < Mlim$ / $Md = 7,49\ mT$

$A_{st}$ = 11,95 → 6 ϕ 16

5. Armadura longitudinal de losa

de dispondrá el 30 % de la transversal

ZONA 1

$A_{sl}$ = 0,30 x 7 cm² = 2,1 cm² → 5 ϕ 8 m/l ≈ ϕ 8 a 20

ZONA 2

$A_{sl}$ = 0,30 x 10,57 cm² = 3,17 cm² → ϕ 10 a 20

ZONA 3

$A_{sl}$ = 0,30 x 12,62 cm² = 3,78 cm² → ϕ 10 a 20

ZONA 4

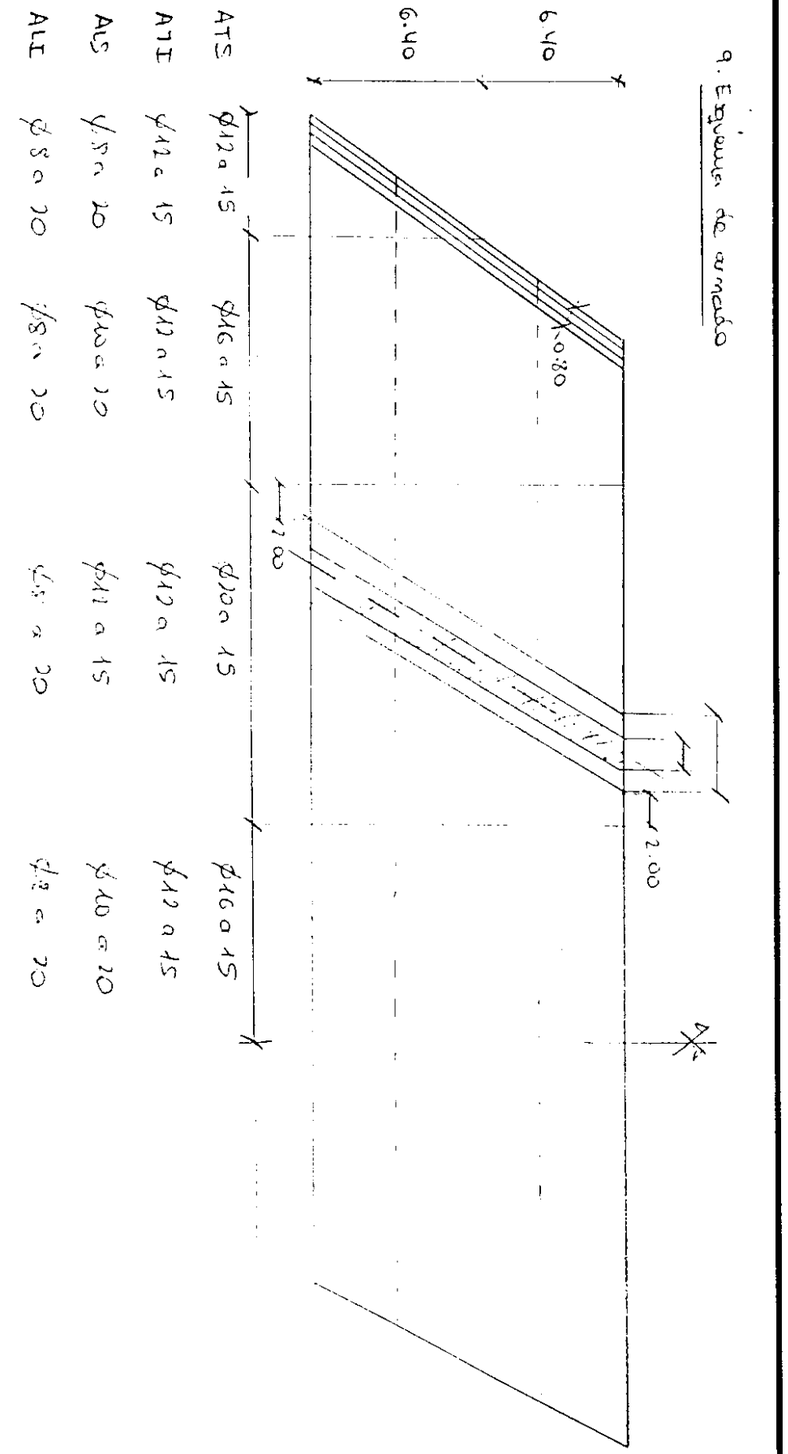
$A_{sl}$ = 0,30 x 10,54 cm² = 6,16 cm² → ϕ 12 a 15

ZONA 5

$A_{sl}$ = 0,30 x 13,97 cm² = 4,19 cm² → ϕ 12 a 20



9. Esquema de armado



3.

ANALISIS DE CONTINUIDADES DE LOSA

DATOS DE LA VIGA (Vano adyacente)

| | | |
|---|---|---|
| Ya | :CANTO TOTAL DE LA VIGA (cm) .....= | 140 |
| Esa | :ESPESOR DEL ALMA DE LA VIGA (cm) .....= | 40 |
| Eila | :RECUBRIMIENTO PRETENSADO INFERIOR (cm) .....= | 5 |
| Losa | :ESPESOR DE LA LOSA (cm) .....= | 25 |
| Porex | :ESPESOR DEL POREXPAN (cm) .....= | 10 |
| Lporex | :LONGITUD TOTAL DEL POREXPAN (m) .....= | 1 |
| Esvla | :ANGULO DE ESVIAJE DEL EXTREMO DE LA VIGA .....= | 40.77 |

DATOS DE LA VIGA (Vano calculo)

| | | |
|---|---|---|
| Yp | :CANTO TOTAL DE LA VIGA (cm) .....= | 140 |
| Esp | :ESPESOR DEL ALMA DE LA VIGA (cm) .....= | 40 |
| Eilp | :RECUBRIMIENTO PRETENSADO INFERIOR (cm) .....= | 7.4 |
| Losp | :ESPESOR DE LA LOSA (cm) .....= | 25 |
| E lp | :ANGULO DE ESVIAJE DEL EXTREMO DE LA VIGA .....= | 40.77 |

DATOS DE LOS MATERIALES

| | | |
|---|---|---|
| Fckl | :RESISTENCIA CARACTERIST. HORMIGON DE LA LOSA (kg/cm2)..= | 250 |
| Fykl | :RESISTENCIA CARACTERISTICA ACERO DE LA LOSA (kg/cm2)...= | 5100 |
| Fcka | :RESISTENCIA CARACT. HORMIGON VIGA ADYACENTE (kg/cm2)...= | 350 |
| Fckp | :RESISTENCIA CARACT. HORMIGON VIGA DE CALCULO(kg/cm2)...= | 350 |
| Fykv | :RESISTENCIA CARACTERISTICA ACERO DE LA VIGA (kg/cm2)...= | 5100 |
| Gcl | :COEFICIENTE MINORACION HORMIGON DE LA LOSA .....= | 1.5 |
| Gyl | :COEFICIENTE MINORACION ACERO DE LA LOSA .....= | 1.15 |
| Gcv | :COEFICIENTE MINORACION HORMIGON DE LA VIGA .....= | 1.4 |
| Gyv | :COEFICIENTE MINORACION ACERO DE LA VIGA .....= | 1.1 |
| Gacc | :COEFICIENTE DE MAYORACION DE ACCIONES .....= | 1.5 |

DATOS DE CARGAS

| | | |
|---|---|---|
| V | :CORTANTE MAYORADO VANO ADYACENTE (Kgr) .....= | 292576.3 |
| V | :CORTANTE MAYORADO VANO DE CALCULO (Kgr) .....= | 402129.9 |
| Perm | :CARGA PERMANENTE (incluso peso propio losa) (Kgr/m2) ..= | 582 |
| Unif | :SOBRECARGA UNIFORME (Kgr/m2) .....= | 400 |
| Punt | :SOBRECARGA PUNTUAL (Kgr) .....= | 10000 |

DATOS DEL VANO DE CALCULO

| | | |
|---|---|---|
| Ficppp | :GIRO DE CARGAS PERMANENTES (rad.*1000) .....= | .967 |
| Fisobp | :GIRO DE SOBRECARGA UNIFORME (rad.*1000) .....= | 1.368 |
| Fivehp | :GIRO DE CARGAS DEL VEHICULO (rad.*1000) .....= | 1.297 |
| | :ARMADURA TRANSVERSAL INFERIOR (nn.dd) .....= | 6.12 |
| | :ARMADURA TRANSVERSAL SUPERIOR (nn.dd) .....= | 6.2 |
| | :ARMADURA LONGITUDINAL INFERIOR (nn.dd) .....= | 5.08 |
| | :ARMADURA LONGITUDINAL SUPERIOR (nn.dd) .....= | 6.12 |

DATOS DEL VANO ADYACENTE

| | | |
|---|---|---|
| Ficppa | :GIRO DE CARGAS PERMANENTES (rad.*1000) .....= | .26 |
| Fisoba | :GIRO DE SOBRECARGA UNIFORME (rad.*1000) .....= | .339 |
| Fiveha | :GIRO DE CARGAS DEL VEHICULO (rad.*1000) .....= | .522 |
| | :ARMADURA TRANSVERSAL INFERIOR (nn.dd) .....= | 6.12 |
| | :ARMADURA TRANSVERSAL SUPERIOR (nn.dd) .....= | 6.2 |
| | :ARMADURA LONGITUDINAL INFERIOR (nn.dd) .....= | 5.08 |
| | :ARMADURA LONGITUDINAL SUPERIOR (nn.dd) .....= | 6.12 |

CALCULO DE LA ZONA DE CONTINUIDAD DE LOSA

| | VANO ADYACENT | VANO CALCULO |
|---|---|---|
| Giro de cargas permanentes: | .000260 | .000967 |
| Giro de sobrecarga uniforme: | .000339 | .001368 |
| Giro del vehiculo: | .000522 | .001297 |

Lporex :LONGITUD DEL POREXPAN (m) .....=1.15
Porex :ESPESOR DEL POREXPAN (cm) .....=10

HIPOTESIS A: CARGAS PERMANENTES EN AMBOS VANOS

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Cargas permanentes : | .65683 | -.90149 | -2.46982 |

HIPOTESIS B: SOBRECARGAS EN VANO ADYACENTE

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Sobrecarga uniforme : | -.99627 | -.24907 | .49814 |
| Sobrecarga vehiculo : | -1.53408 | -.38352 | .76704 |

HIPOTESIS C: SOBRECARGAS EN VANO CALCULO

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Sobrecarga uniforme : | 2.01018 | -1.00509 | -4.02035 |
| Sobrecarga vehiculo : | 1.90585 | -.95292 | -3.81170 |

HIPOTESIS D: CARGAS LOCALES EN LOSA CONTINUIDAD

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Cargas permanentes : | -.06414 | .03207 | -.06414 |
| Sobrecarga uniforme : | -.04408 | .02204 | -.04408 |
| Sobrecarga vehiculo : | -1.63121 | 1.63121 | -1.63121 |

COMBINACIONES PESIMAS:

Pesimo flector negativo : -10.4001
Pesimo flector positivo : 4.4646

ARMADOS LOCALES :

| | Teorica | Real | |
|---|---|---|---|
| Armadura long. inferior : | 20.00041 | 10.15 | ∞ 7 ϕ 10 |
| Armadura long. superior : | 38.70914 | 8.25 | |
| Armadura trans. inferior: | 6.00012 | 6.12 | |
| Armadura trans. superior: | 11.61274 | 6.20 | |

Longitud de la armadura longitudinal: 3.20 m.

COMPROBACION DE LA VIGA ADYACENTE (Valores para un alma, en caso de alma doble disponer la mitad en cada una)

| | |
|---|---|
| Vd (kgrs.)..... | 292576.33 |
| Vul (kgrs.)..... | 405000.00 |
| Vcu (kgrs.)..... | 42690.75 |
| Arm. teorica (cm2)..... | 48.97 |
| Armadura real..... | dobles D16 a 15 |

COMPROBACION DE LA VIGA DE CALCULO (Valores para un alma, en caso de alma doble disponer la mitad en cada una

Agotamiento por compresion oblicua. Vd= 402129.92 Vul= 397800.00

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 3-4 |

# PRELOSAS DE ENCOFRADO PERDIDO

a/ Placas de voladizo GA-60.20.4

Espesor losa = 0.25 m

Luz libre = 1.60

Entrega de cálculo = 0.075 m

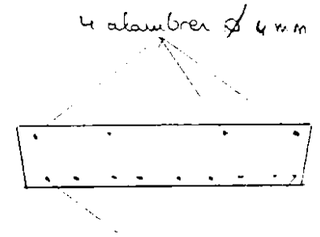
Ancho de placa = 1.20 m

Peso aparato = 100 kg/m l.

Momento de servicio = 0.746

Momento de rotura = 1.428

Coeficiente de seguridad = 1.91




b/ Placas volviendo cayeren GA-60.13.3

Espesor losa = 0.25 m

Luz libre = 1.986

Entrega de cálculo = 0.075

Ancho placa = 1.20 m

Peso aparato = 100 kg/ml

Momento de servicio = 0.456

Momento de rotura = 1.05

Coeficiente seguridad = 2.30

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 3-5 |

c/ Placas unir rajones GA-40.20.2

Espesor losa = 0.25 m

luz libre = 1.764 m

Entrega calculo = 0.075 m

Ancho placa = 1.20 m

Peso aparato = 100 kp/in

Momento servicio = 0.368 MT

Momento rotura = 1.65

Coeficiente seguridad = > 25

# 4. REPARTO LONGITUDINAL Y TRANSVERSAL DE ESFUERZOS

PROGRAMA REPARTO
RESUMEN DE DATOS INTRODUCIDOS
E-1500.4 / SUBTRAMO XV
Unidades de fuerza en t.
Unidades de longitud en m.
Unidades de angulos en grados sexagesimales.

1.- GEOMETRIA

Tipo de geometria en planta: Puente recto

1.1.- Datos del tablero

Numero de vanos: 3

| vano | longitud(m) | Ax(m2) | Ix(m4) | Iy(m4) | Iz(m4) |
|---|---|---|---|---|---|
| 1 | 19.71 | 2.1 | 2.79 | 78.55 | .8259 |
| 2 | 32 | 2.1 | 2.79 | 78.55 | .8259 |
| 3 | 19.65 | 2.1 | 2.79 | 78.55 | .8259 |

1.2.- Datos de las pilas

| Pila | H | Iy | Iz | Ax | Neo 1 | Neo 2 | Or. |
|---|---|---|---|---|---|---|---|
| 1 | 13.06 | .2036 | .2036 | 2.262 | 2 | 0 | 0 |
| 2 | 13.57 | .2036 | .2036 | 2.262 | 2 | 0 | 0 |

H: altura de la pila en metros
Neo 1: numero de neoprenos en el caso de estribos y pilas sin junta;
numero de neoprenos en extremo anterior de juntas
Neo 2: numero de neoprenos en extremo posterior de juntas
Or: angulo de orientacion de los ejes de la pila respecto
a la normal a la directriz en grados sexagesimales

1.3.- Datos de las juntas

No hay juntas en las pilas

1.4.- Datos de los aparatos de apoyo

Estribo 1: 2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .32 | .077 | 2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .32 | .077 | -2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Estribo 2: 2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | .32 | .077 | 2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .32 | .077 | -2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Pila 1 :
2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .24 | .029 | 2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .24 | .029 | -2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Pila 2 :
2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .24 | .029 | 2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .24 | .029 | -2.15 | 0 | 0 |
| | Tipo: Neopreno | | | | |

A.C.: Angulo de colocacion de la linea de aparatos de apoyo
Or.: Angulo de orientacion respecto a la normal a la directriz
de los ejes del aparato de apoyo

2.- CARACTERISTICAS MECANICAS DE LOS MATERIALES

Modulo E del hormigon del tablero: 4248529 t/m2
Segun Instruccion EH
Modulo E del hormigon de las pilas: 3290897 t/m2
Segun Instruccion EH
Modulo E de los neoprenos: 192 t/m2; G = (80 / 160 t/m2)
Coeficiente de dilatacion termica de los materiales: alfa =
.00001
Coeficiente de Poisson de los materiales: .2

3.- COACCIONES:

3.1.- Apoyos coaccionados transversalmente:
(apoyo 1 = estribo 1, apoyo2 = pila 1 ...)

3.2.- Apoyos coaccionados longitudinalmente:
(apoyo 1 = estribo 1, apoyo2 = pila 1 ...)

4.- ACCIONES:

Peso especifico del material tablero: 2.5 t/m3
Peso especifico del material pilas: 2.5 t/m3
Carga muerta: 7.422 t/ml
Carga de frenado: .2778 t/ml
Carga de viento:
Sobre tablero:
Fx = 0 t/ml Fz = 1.162 t/ml
Sobre pilas:
Fx = 0 t/ml Fz = .3 t/ml
Carga debida a la fuerza centrifuga: 0 t/ml
Incremento de temperatura: 30 grados centigrados
Movimiento impuesto por retraccion: .00015
Movimiento impuesto por fluencia: .0002145

E-1500.4 / SUBTRAMO XV AVE
CALCULO DEL REPARTO DE FUERZAS HORIZONTALES:
G=80 t/m2

HIPOTESIS CONSIDERADAS:

HIPOTESIS 1: Carga de Fuerza Centrifuga
HIPOTESIS 2: Carga longitudinal de frenado
HIPOTESIS 3: Carga de Viento sobre tablero y pilas
HIPOTESIS 4: Carga por aumento de temperatura
HIPOTESIS 5: Carga por retraccion
HIPOTESIS 6: Carga por fluencia

REACCIONES EN ESTRIBOS Y BASE DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

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REACCIONES EN ESTRIBO 1:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 5.61 | Ft = | 0.00 | Ml = | 0.84 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -23.48 | Ml = | 0.00 | Mt = | 7.53 |
| 4) | Fl = | 7.05 | Ft = | 0.00 | Ml = | 1.05 | Mt = | 0.00 |
| 5) | Fl = | 3.53 | Ft = | 0.00 | Ml = | 0.53 | Mt = | 0.00 |
| 6) | Fl = | 5.04 | Ft = | 0.00 | Ml = | 0.75 | Mt = | 0.00 |

REACCIONES EN ESTRIBO 2:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Esfuerzos | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 5.61 | Ft = | 0.00 | Ml = | 0.84 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -23.97 | Ml = | 0.00 | Mt = | 7.61 |
| 4) | Fl = | -7.14 | Ft = | 0.00 | Ml = | -1.08 | Mt = | 0.00 |
| 5) | Fl = | -3.57 | Ft = | 0.00 | Ml = | -0.54 | Mt = | 0.00 |
| 6) | Fl = | -5.11 | Ft = | 0.00 | Ml = | -0.77 | Mt = | 0.00 |

REACCIONES EN PILA 1

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 4.45 | Ft = | 0.00 | Ml = | 58.75 | Mt = | -0.00 |
| 3) | Fl = | 0.00 | Ft = | -22.24 | Ml = | 0.00 | Mt = | 263.71 |
| 4) | Fl = | 2.49 | Ft = | 0.00 | Ml = | 32.70 | Mt = | 0.00 |
| 5) | Fl = | 1.25 | Ft = | 0.00 | Ml = | 16.35 | Mt = | 0.00 |
| 6) | Fl = | 1.78 | Ft = | 0.00 | Ml = | 23.38 | Mt = | 0.00 |

REACCIONES EN PILA 2

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 4.15 | Ft = | 0.00 | Ml = | 56.90 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -21.22 | Ml = | 0.00 | Mt = | 258.79 |
| 4) | Fl = | -2.40 | Ft = | 0.00 | Ml = | -32.73 | Mt = | 0.00 |
| 5) | Fl = | -1.20 | Ft = | 0.00 | Ml = | -16.37 | Mt = | 0.00 |
| 6) | Fl = | -1.72 | Ft = | 0.00 | Ml = | -23.40 | Mt = | 0.00 |

ESFUERZOS EN CABEZA DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

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ESFUERZOS EN PILA 1:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -4.45 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 18.33 |
| Hip. | 4) | Flong = | -2.49 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | -1.25 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | -1.78 | Ftrans = | 0.00 |

ESFUERZOS EN PILA 2:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -4.15 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 17.15 |
| Hip. | 4) | Flong = | 2.40 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | 1.20 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | 1.72 | Ftrans = | 0.00 |

DESPLAZAMIENTOS EN LOS NEOPRENOS (segun ejes LOCALES)
Unidades: cm

ESTRIBO E1

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NEOPRENO 1
Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00002 | 0.00000 |
| 3 | 0.00000 | 0.00006 |
| 4 | -0.00003 | 0.00000 |
| 5 | -0.00002 | 0.00000 |
| 6 | -0.00002 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84448 | -0.00000 |
| 3 | 0.00773 | 3.53141 |
| 4 | -1.06023 | 0.00000 |
| 5 | -0.53011 | 0.00000 |
| 6 | -0.75806 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84446 | -0.00000 |
| 3 | 0.00773 | 3.53135 |
| 4 | -1.06020 | 0.00000 |

| | | |
|---|---|---|
| 5 | -0.53010 | 0.00000 |
| 6 | -0.75804 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00002 | 0.00000 |
| 3 | -0.00000 | 0.00006 |
| 4 | -0.00003 | 0.00000 |
| 5 | -0.00002 | 0.00000 |
| 6 | -0.00002 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84448 | -0.00000 |
| 3 | -0.00773 | 3.53141 |
| 4 | -1.06023 | 0.00000 |
| 5 | -0.53011 | 0.00000 |
| 6 | -0.75806 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84446 | -0.00000 |
| 3 | -0.00773 | 3.53135 |
| 4 | -1.06020 | 0.00000 |
| 5 | -0.53010 | 0.00000 |
| 6 | -0.75804 | 0.00000 |

PILA 1

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50042 | -0.00000 |
| 3 | 0.00032 | 2.17400 |
| 4 | -0.27861 | 0.00000 |
| 5 | -0.13931 | 0.00000 |
| 6 | -0.19921 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84512 | -0.00000 |
| 3 | 0.00575 | 3.59554 |
| 4 | -0.47052 | 0.00000 |
| 5 | -0.23526 | 0.00000 |
| 6 | -0.33642 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |

| | | |
|---|---|---|
| 2 | -0.34470 | -0.00000 |
| 3 | 0.00543 | 1.42153 |
| 4 | -0.19191 | 0.00000 |
| 5 | -0.09596 | 0.00000 |
| 6 | -0.13722 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50042 | -0.00000 |
| 3 | -0.00032 | 2.17400 |
| 4 | -0.27861 | 0.00000 |
| 5 | -0.13931 | 0.00000 |
| 6 | -0.19921 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84512 | -0.00000 |
| 3 | -0.00575 | 3.59554 |
| 4 | -0.47052 | 0.00000 |
| 5 | -0.23526 | 0.00000 |
| 6 | -0.33642 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.34470 | -0.00000 |
| 3 | -0.00543 | 1.42153 |
| 4 | -0.19191 | 0.00000 |
| 5 | -0.09596 | 0.00000 |
| 6 | -0.13722 | 0.00000 |

PILA 2

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.52312 | -0.00000 |
| 3 | -0.00007 | 2.29619 |
| 4 | 0.30084 | 0.00000 |
| 5 | 0.15042 | 0.00000 |
| 6 | 0.21510 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84517 | -0.00000 |
| 3 | -0.00127 | 3.62911 |
| 4 | 0.48606 | 0.00000 |
| 5 | 0.24303 | 0.00000 |
| 6 | 0.34753 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.32205 | -0.00000 |
| 3 | -0.00120 | 1.33292 |
| 4 | 0.18522 | 0.00000 |
| 5 | 0.09261 | 0.00000 |
| 6 | 0.13243 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.52312 | -0.00000 |
| 3 | 0.00007 | 2.29619 |
| 4 | 0.30084 | 0.00000 |
| 5 | 0.15042 | 0.00000 |
| 6 | 0.21510 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84517 | -0.00000 |
| 3 | 0.00128 | 3.62911 |
| 4 | 0.48606 | 0.00000 |
| 5 | 0.24303 | 0.00000 |
| 6 | 0.34753 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.32205 | -0.00000 |
| 3 | 0.00120 | 1.33292 |
| 4 | 0.18522 | 0.00000 |
| 5 | 0.09261 | 0.00000 |
| 6 | 0.13243 | 0.00000 |

ESTRIBO E2

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NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00002 | 0.00000 |
| 3 | -0.00000 | 0.00006 |
| 4 | 0.00003 | 0.00000 |
| 5 | 0.00002 | 0.00000 |
| 6 | 0.00002 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84453 | 0.00000 |
| 3 | -0.00331 | 3.60576 |
| 4 | 1.07397 | 0.00000 |
| 5 | 0.53698 | 0.00000 |
| 6 | 0.76789 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84451 | 0.00000 |
| 3 | -0.00331 | 3.60570 |
| 4 | 1.07394 | 0.00000 |
| 5 | 0.53697 | 0.00000 |
| 6 | 0.76787 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00002 | 0.00000 |
| 3 | 0.00000 | 0.00006 |
| 4 | 0.00003 | 0.00000 |
| 5 | 0.00002 | 0.00000 |
| 6 | 0.00002 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84453 | 0.00000 |
| 3 | 0.00331 | 3.60576 |
| 4 | 1.07397 | 0.00000 |
| 5 | 0.53698 | 0.00000 |
| 6 | 0.76789 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.84451 | 0.00000 |
| 3 | 0.00331 | 3.60570 |
| 4 | 1.07394 | 0.00000 |
| 5 | 0.53697 | 0.00000 |
| 6 | 0.76787 | 0.00000 |

E-1500.4 / SUBTRAMO XV
CALCULO DEL REPARTO DE FUERZAS HORIZONTALES:
G=160 t/m2

HIPOTESIS CONSIDERADAS:

HIPOTESIS 1: Carga de Fuerza Centrifuga
HIPOTESIS 2: Carga longitudinal de frenado
HIPOTESIS 3: Carga de Viento sobre tablero y pilas
HIPOTESIS 4: Carga por aumento de temperatura
HIPOTESIS 5: Carga por retraccion
HIPOTESIS 6: Carga por fluencia

REACCIONES EN ESTRIBOS Y BASE DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

---

REACCIONES EN ESTRIBO 1:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 6.72 | Ft = | 0.00 | Ml = | 1.01 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -28.07 | Ml = | 0.00 | Mt = | 10.08 |
| 4) | Fl = | 14.07 | Ft = | 0.00 | Ml = | 2.10 | Mt = | 0.00 |
| 5) | Fl = | 7.04 | Ft = | 0.00 | Ml = | 1.05 | Mt = | 0.00 |
| 6) | Fl = | 10.06 | Ft = | 0.00 | Ml = | 1.50 | Mt = | 0.00 |

REACCIONES EN ESTRIBO 2:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Esfuerzos | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 6.72 | Ft = | 0.00 | Ml = | 1.01 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -28.57 | Ml = | 0.00 | Mt = | 10.15 |
| 4) | Fl = | -14.22 | Ft = | 0.00 | Ml = | -2.13 | Mt = | 0.00 |
| 5) | Fl = | -7.11 | Ft = | 0.00 | Ml = | -1.06 | Mt = | 0.00 |
| 6) | Fl = | -10.17 | Ft = | 0.00 | Ml = | -1.52 | Mt = | 0.00 |

REACCIONES EN PILA 1

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 3.33 | Ft = | 0.00 | Ml = | 43.95 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -17.64 | Ml = | -0.00 | Mt = | 200.96 |
| 4) | Fl = | 3.09 | Ft = | 0.00 | Ml = | 40.74 | Mt = | 0.00 |
| 5) | Fl = | 1.54 | Ft = | 0.00 | Ml = | 20.37 | Mt = | 0.00 |
| 6) | Fl = | 2.21 | Ft = | 0.00 | Ml = | 29.13 | Mt = | 0.00 |

REACCIONES EN PILA 2

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 3.05 | Ft = | 0.00 | Ml = | 41.86 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -16.63 | Ml = | -0.00 | Mt = | 194.02 |
| 4) | Fl = | -2.91 | Ft = | 0.00 | Ml = | -40.02 | Mt = | 0.00 |
| 5) | Fl = | -1.46 | Ft = | 0.00 | Ml = | -20.01 | Mt = | 0.00 |
| 6) | Fl = | -2.08 | Ft = | 0.00 | Ml = | -28.61 | Mt = | 0.00 |

ESFUERZOS EN CABEZA DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

---

ESFUERZOS EN PILA 1:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -3.33 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 13.72 |
| Hip. | 4) | Flong = | -3.09 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | -1.54 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | -2.21 | Ftrans = | 0.00 |

ESFUERZOS EN PILA 2:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -3.05 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 12.55 |
| Hip. | 4) | Flong = | 2.91 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | 1.46 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | 2.08 | Ftrans = | 0.00 |

DESPLAZAMIENTOS EN LOS NEOPRENOS (segun ejes LOCALES)
Unidades: cm

ESTRIBO E1

---

NEOPRENO 1
Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00003 | 0.00000 |
| 3 | 0.00000 | 0.00007 |
| 4 | -0.00006 | 0.00000 |
| 5 | -0.00003 | 0.00000 |
| 6 | -0.00004 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50561 | -0.00000 |
| 3 | 0.00812 | 2.11144 |
| 4 | -1.05780 | 0.00000 |
| 5 | -0.52890 | 0.00000 |
| 6 | -0.75633 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50558 | -0.00000 |
| 3 | 0.00812 | 2.11137 |
| 4 | -1.05774 | 0.00000 |

| | | |
|---|---|---|
| 5 | -0.52887 | 0.00000 |
| 6 | -0.75628 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00003 | 0.00000 |
| 3 | -0.00000 | 0.00007 |
| 4 | -0.00006 | 0.00000 |
| 5 | -0.00003 | 0.00000 |
| 6 | -0.00004 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50561 | -0.00000 |
| 3 | -0.00812 | 2.11144 |
| 4 | -1.05780 | 0.00000 |
| 5 | -0.52890 | 0.00000 |
| 6 | -0.75633 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50558 | -0.00000 |
| 3 | -0.00812 | 2.11137 |
| 4 | -1.05774 | 0.00000 |
| 5 | -0.52887 | 0.00000 |
| 6 | -0.75628 | 0.00000 |

PILA 1

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.37433 | -0.00000 |
| 3 | 0.00058 | 1.63155 |
| 4 | -0.34710 | 0.00000 |
| 5 | -0.17355 | 0.00000 |
| 6 | -0.24818 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50650 | -0.00000 |
| 3 | 0.00557 | 2.17739 |
| 4 | -0.46965 | 0.00000 |
| 5 | -0.23483 | 0.00000 |
| 6 | -0.33580 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |



| | | |
|---|---|---|
| 2 | -0.13217 | -0.00000 |
| 3 | 0.00498 | 0.54584 |
| 4 | -0.12255 | 0.00000 |
| 5 | -0.06128 | 0.00000 |
| 6 | -0.08762 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.37433 | -0.00000 |
| 3 | -0.00058 | 1.63155 |
| 4 | -0.34710 | 0.00000 |
| 5 | -0.17355 | 0.00000 |
| 6 | -0.24818 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50650 | -0.00000 |
| 3 | -0.00556 | 2.17739 |
| 4 | -0.46965 | 0.00000 |
| 5 | -0.23483 | 0.00000 |
| 6 | -0.33580 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.13217 | -0.00000 |
| 3 | -0.00498 | 0.54584 |
| 4 | -0.12255 | 0.00000 |
| 5 | -0.06128 | 0.00000 |
| 6 | -0.08762 | 0.00000 |

PILA 2

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38487 | 0.00000 |
| 3 | -0.00036 | 1.69269 |
| 4 | 0.36786 | 0.00000 |
| 5 | 0.18393 | 0.00000 |
| 6 | 0.26302 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50655 | 0.00000 |
| 3 | -0.00332 | 2.19433 |
| 4 | 0.48417 | 0.00000 |
| 5 | 0.24208 | 0.00000 |
| 6 | 0.34618 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.12168 | 0.00000 |
| 3 | -0.00296 | 0.50164 |
| 4 | 0.11631 | 0.00000 |
| 5 | 0.05815 | 0.00000 |
| 6 | 0.08316 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38487 | 0.00000 |
| 3 | 0.00036 | 1.69269 |
| 4 | 0.36786 | 0.00000 |
| 5 | 0.18393 | 0.00000 |
| 6 | 0.26302 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50655 | 0.00000 |
| 3 | 0.00332 | 2.19433 |
| 4 | 0.48417 | 0.00000 |
| 5 | 0.24208 | 0.00000 |
| 6 | 0.34618 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.12168 | 0.00000 |
| 3 | 0.00296 | 0.50164 |
| 4 | 0.11631 | 0.00000 |
| 5 | 0.05815 | 0.00000 |
| 6 | 0.08316 | 0.00000 |

ESTRIBO E2

---

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00003 | 0.00000 |
| 3 | -0.00000 | 0.00007 |
| 4 | 0.00006 | 0.00000 |
| 5 | 0.00003 | 0.00000 |
| 6 | 0.00004 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50565 | 0.00000 |
| 3 | -0.00593 | 2.14878 |
| 4 | 1.07049 | 0.00000 |
| 5 | 0.53524 | 0.00000 |
| 6 | 0.76540 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50563 | 0.00000 |
| 3 | -0.00593 | 2.14870 |
| 4 | 1.07043 | 0.00000 |
| 5 | 0.53521 | 0.00000 |
| 6 | 0.76536 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00003 | 0.00000 |
| 3 | 0.00000 | 0.00007 |
| 4 | 0.00006 | 0.00000 |
| 5 | 0.00003 | 0.00000 |
| 6 | 0.00004 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50565 | 0.00000 |
| 3 | 0.00593 | 2.14878 |
| 4 | 1.07049 | 0.00000 |
| 5 | 0.53524 | 0.00000 |
| 6 | 0.76540 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.50563 | 0.00000 |
| 3 | 0.00593 | 2.14870 |
| 4 | 1.07043 | 0.00000 |
| 5 | 0.53521 | 0.00000 |
| 6 | 0.76536 | 0.00000 |

E-1500.4 / SUBTRAMO XV
CALCULO DE RIGIDECES EQUIVALENTES DE LA ESTRUCTURA
ACTUANDO SOBRE CADA PILA.
CALCULO DE LONGITUDES DE PANDEO.
G=80 t/m2
ESFUERZOS QUE SE LLEVA LA ESTRUCTURA Y MOVIMIENTOS EN CABEZA DE PILAS
(segun ejes LOCALES)

Unidades: Fuerza t
Desplazamientos cm
Rigideces t/m o m.t/rad

Acciones: Para cada pila dos casos de carga.
1.- Carga longitudinal de 1000 t en cabeza
2.- Carga transversal de 1000 t en cabeza

En caso ser empotrada la pila, dos casos mas:
3.- Momento longitudinal de 1000 m.t en cabeza
4.- Carga transversal de 1000 m.t en cabeza

Las rigideces se calculan: K = F tablero / U cabeza de pila
Kgiro = M tablero / Giro cabeza de pila

---

PILA: 1

Sentido longitudinal:

Flong. = 458.93 t Ulong. = 58.97 cm
Kl. = 778.3 t/m

EIlongitudinal = 670026.63 t.m2

Coeficiente de pandeo: beta = 1.46

Sentido transversal:

Ftrans. = 411.16 t Utrans. = 62.45 cm
Kt. = 658.4 t/m

EItransversal = 670026.63 t.m2

Coeficiente de pandeo: beta = 1.51

PILA: 2

Sentido longitudinal:

Flong. = 489.11 t Ulong. = 62.38 cm
Kl. = 784.1 t/m

EIlongitudinal = 670026.63 t.m2

Coeficiente de pandeo: beta = 1.42

Sentido transversal:

Ftrans. = 439.40 t Utrans. = 66.55 cm
Kt. = 660.2 t/m

EItransversal = 670026.63 t.m2

Coeficiente de pandeo: beta = 1.47

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA:

0. ACCIONES A CONSIDERAR

Peso propio de viga

$q = 1.2385\ m^2 \times 2,50\ T/m^3 = 3,097\ T/m$

Peso propio de losa

$q = 12.80\ m \times 0.25\ m \times 1,50\ T/m^3 = 8\ T/m$

Carga muerta

pavimento $e = 6cm$ : $q = 0.06 \times 2,30\ T/m^2 \times 12.80\ m \times 1.5 = 2649$ T/

acera + impost + barrera antihandiferica - perfil :

acera $= 1.20 \times 0.10 \times 2 \times 2,50 = 1.40\ T/m$

impost $= 0.07 \times 0.60 \times 2 \times 2,50 = 0.210\ T/m$

barrera $= 2 \times 0.10 = 0.20\ T/m$

perfil $= \frac{(0.20+0.50)}{2} \times 0.25\ m \times 2,50\ T/m^3 = 0.450\ T/m$

5.209 T/m

Sobrecarga uniforme

$q = 0.4\ T/m^2 \times 12.80\ m = 5.12\ T/m$

Vehiculo pesado (CA < 12.00 m)

60 t (6 ejes / 10 t)

ESTUDIO: 24785 FECHA: 11-08-00
TITULO: E-1500.4
VANOS 1 Y 3

## ANEJO DE CALCULO DEL TABLERO DE VIGAS CAJON

### 1. DATOS GENERALES

**1.1 Seccion transversal (Datos para el calculo)**
Ancho total plataforma ..... 12.80 m.
Ancho de las aceras (sin trafico). 1.40(Real) 1.40 (Calc.izq)
1.40 (Calc.dch)

**1.2 Seccion longitudinal**
Tramo isostatico
Luz de calculo ..... 20.19 m.
Longitud de la viga ..... 22.58 m.

**1.3 Planta**
Esviaje ..... 40.77 °
Radio curvatura ..... RECTO

### 2. SOLUCION ADOPTADA

El tablero esta formado por vigas prefabricadas pretensadas sobre las que se vierte hormigon fabricado in situ para formar la losa de compresion
Tipo de viga ..... NOAL 382.140.20
Canto de la viga ..... 1.40 m.
Canto de la losa ..... .25 m.
Numero de vigas ..... 2
Separacion entre vigas ..... 4.306 m.
Las caracteristicas de la viga figuran en el listado de resultados

### 3. ACCIONES A CONSIDERAR

Peso propio de la viga ..... 3096.62 Kg/m
Peso propio de la losa ..... 625.00 Kg/m2.
Carga muerta ..... 207.0 Kg/m2.
Carga adicional en bordes debida a aceras .. 1280.00 Kg/m.
Sobrecarga ..... IAP-98

### 4. CARACTERISTICAS DE LOS MATERIALES Y COEFICIENTES DE SEGURIDAD SEGUN EP.-93

**4.1 Hormigon de la viga**
Resistencia caracteristica a los 28 dias .....>= 450 Kgr/cm2
Nivel de control intenso (prefabricacion) .....= 1.4
**4.2 Hormigon de la losa**
Resistencia caracteristica a los 28 dias .....>= 250 Kgr/cm2
Nivel de control normal (fabricacion in situ)...= 1.5
**4.3 Acero de pretensado en viga**
Tension de rotura .....>= 19000 Kgr/cm2
Limite elastico al 0.2 .....>= 17100 Kgr/cm2
Nivel de control intenso (prefabricacion) .....= 1.1
**4.4 Acero pasivo en viga**
Limite elastico .....>= 5100 Kgr/cm2
Nivel de control intenso (prefabricacion) .....= 1.1
**4.5 Acero pasivo en la losa**
Limite elastico .....>= 5100 Kgr/cm2
Nivel de control normal (fabricacion in situ)...= 1.15
**4.6 Acciones**
Cargas permanentes .....= 1.35 Sobrecargas .....= 1.50

ESTUDIO: 24785

DATOS DE LA VIGA NOAL 382.140.20(485)

FICHERO:

DATOS DE FORMA

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BASES EXTERIORES | 382.00 | 382.00 | 262.30 | 264.50 | 67.60 | 40.00 | 40.00 | 91.40 | 96.40 |
| BASES INTERIORES | 0.00 | 0.00 | 0.00 | 0.00 | 196.90 | 227.90 | 245.70 | 196.60 | 198.60 |
| ALTURAS | 9.00 | 0.00 | 9.00 | 0.00 | 13.50 | 71.30 | 17.50 | 19.70 | |

| Y | YG | A | In | Ws | Wi | E | Es |
|---|---|---|---|---|---|---|---|
| 143.00 | 50.62 | 12356.48 | 29367022.36 | 328574.77 | 580112.08 | 40.00 | .29 |

DATOS PRETENSADO

| Asi | Ei | Ass | Es | Ki | Asi | Ei1 | As2 | Ei2 |
|---|---|---|---|---|---|---|---|---|
| 51.800 | 5.000 | 5.600 | 5.000 | .500 | 42.000 | 5.000 | 47.600 | 5.000 |

DATOS MATERIALES

| Fci | fc | Fyv | Fyl | Fc0 | Frr | Ret | Fli | Rel | Nm | Nr | Cap | Cas | Ns |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 331.43 | .75 | 4636.36 | 4434.78 | 14800.00 | 15545.45 | .25 | 2.00 | 4.00 | 11.80 | 5.90 | 1.35 | 1.50 | 0.00 |

CARACTERISTICAS HOMOGENEIZADAS

| Yg | Ac | Ic | YgOp | AOp | IOp | Ygs | As | Is | Ygm | Am | Im |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 57.42 | 13312.84 | 29177059.67 | 49.09 | 12990.16 | 30889824.19 | 49.93 | 12661.50 | 30642877.40 | 49.09 | 12990.16 | 30889824.19 |

# CALCULO GENERAL DE VIGAS

DATOS TABLERO

| ANCH | DVEI | DVED | L | LTE | LMED | NVG | ACEI | ACED | LOS | ELI | ELS | BRAS | FASIG | AINTG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10.60 | 4.19 | 4.30 | 20.19 | 22.58 | 22.58 | 2.00 | 1.40 | 1.40 | 25.00 | 8.00 | 2.60 | 56.40 | 5.16 | 42064.40 |

| CM | PACI | PACD | DPAC | TRL | PE | LAP | CPAR | APOY | NAPO | BEI | BED |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 297 | 1280.00 | 1280.00 | .45 | -50.00 | 5000.00 | 0.00 | 0.00 | 0.00 | 0.00 | 40.77 | 40.77 |

OPCIONES

NEOPRENO

| OPCIS | OPMAN | OPTV | OPCOR | OPAL | OPD1 | OPDF | OPNEO | BNP | DNP | TNP | GNP | CHNP | G | TEMP | SNEO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | -2.00 | -1.00 | -1.00 | -1.00 | 20.00 | 80.00 | 5.20 | 4.08 | .31 | 10.00 | 31.00 | 0.00 |

DATOS DIBUJO

| LM | LTRAN | LPARR | LMIN | PEND | CU | ESV1 | ESV2 | NMAC |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.0 | 12.0 | 2.0 | 0.0 | 0.0 | 40.8 | 40.8 | 0.0 |

| ENTI | ENTD | DAPI | DAPD | APOYOI | APOYOD | ANI | AND | DVII | DVDI | DVIS | DVDS | ALFA | PTR | VGST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .50 | .50 | .25 | .25 | .55 | .55 | 12.80 | 12.80 | 4.30 | 4.30 | 4.19 | 4.19 | 0.00 | 3.50 | 2 |

| LTRAM | LTOTAL | LCALC. |
|---|---|---|
| 19.82 | 22.21 | 19.82 |

| | | |
|---|---|---|
| 32.00 | 33.50 | 32.00 |
| 19.72 | 22.11 | 19.72 |

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

RESUMEN DE RESULTADOS PARA ENLACE CON TENSCAJ

Valores caracteristicos (Kg/m,mTn.)

VIGA EXTERIOR IZQUIERDA

| TIPO DE CARGA | CARGAS VIRTUALES Flexion | Corte |
|---|---|---|
| Peso propio | 7063.495 | 7063.495 |
| Permanentes | 2508.813 | 2445.706 |
| Sobrecarg.I | 3277.203 | 3544.108 |
| Sobrecarg.II | 22899.746 | 24199.798 |
| Viga pesima. | 1.000 | 1.000 |
| Torsor apoyo | -45.561 | -45.561 |
| Torsor L/4 | -51.261 | -51.261 |
| Torsor L/2 | -52.338 | -52.338 |

VIGA EXTERIOR DERECHA

| TIPO DE CARGA | CARGAS VIRTUALES Flexion | Corte |
|---|---|---|
| Peso propio | 7129.745 | 7129.745 |
| Permanentes | 2640.276 | 2790.187 |
| Sobrecarg.I | 3361.693 | 3639.809 |
| Sobrecarg.II | 23190.759 | 24550.445 |
| Viga pesima. | 2.000 | 2.000 |
| Torsor apoyo | -49.195 | -49.195 |
| Torsor L/4 | -55.220 | -55.220 |
| Torsor L/2 | -56.333 | -56.333 |

CARGAS PESIMAS EN NEOPRENOS

Solo validas a efectos del calculo de neoprenos

Valores caracteristicos (Tn,mTn.)

| EXT.IZQ. | Reaccion | Torsor |
|---|---|---|
| Rperm..... | 107.834 | 0.000 |
| Rmax..... | 222.684 | 0.000 |
| Rmin..... | 75.379 | 0.000 |
| T Rmax..... | 222.684 | 0.000 |
| T Rmin..... | 75.379 | 0.000 |

| EXT.DCH. | Reaccion | Torsor |
|---|---|---|
| Rperm..... | 109.742 | 0.000 |

TVC

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

DATOS GENERALES

**********

NC= 2, IT = 1

EC= 296985, EL= 221361

GEOMETRIA Y CARACTERISTICAS MECANICAS

V1 = 3.101, V2 = 3.207

DATOS SECCION SIMPLE [Cm]

| CAJON | X0 | A0 | I0 |
|---|---|---|---|
| 1 | 89.38 | 12386.48 | 29367022.4 |
| 2 | 89.38 | 12386.48 | 29367022.4 |

| HC | EB | C0 | E0 | EA | A1 | A2 | HB |
|---|---|---|---|---|---|---|---|
| 140.00 | 20.00 | 382.00 | 9.00 | 0.00 | 0.00 | 0.00 | 25.00 |

DATOS SECCION COMPUESTA [m]

| CAJON | YC | LC | AC | BC | SC | IC | JC |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 20.19 | 2.186 | 4.629 | 4.306 | .82593327 | 1.02799988 |
| 2 | -4.99 | 20.19 | 2.186 | 4.629 | | .82593327 | 1.02799988 |

COACCIONES

| CAJON | L1 | D1 | T1 | L2 | D2 | T2 |
|---|---|---|---|---|---|---|
| 1 | 0 | -1 | 0 | 0 | -1 | 0 |
| 2 | 0 | -1 | 0 | 0 | -1 | 0 |

CARGAS

PL = 0.000, PV = .207, P1 = 1.280, P2 = 1.280, U1 = .450, U2 = .450

PC = 0.00 0.00

W1= 2.90, W2= 2.90, AL= 0.00, GP = 1.35, GS = 1.50

ESTUDIO:24785 E-1500.4 VANOS 1 Y 3

RESULTADOS: NOTACION Y UNIDADES
**********

CAJONES : M = FLECTOR (M.TON)
Q = CORTANTE (TON.)
T = TORSOR (M.TON)
F = FLECHA (MM)
G = GIRO LONGITUDINAL (MILESIMAS RADIAN)
J = GIRO TORSOR (IDEM)

LOS VALORES DE Q Y T EN LOS EXTREMOS DE LOS CAJONES DEBEN IGNORARSE
TOMANDO COMO TALES LAS REACCIONES R Y T

REACCIONES: M = MOMENTO SEGUN EJE 'X' (M.TON)
R = REACCION VERTICAL (TON.)
T = MOMENTO SEGUN EJE 'Y' (M.TON)

LOSA : M = FLECTOR TRANSVERSAL P.M.L. (M.TON/M)
Q = CORTANTE TRANSVERSAL P.M.L. (TON/M)
T = TORSOR TRANSVERSAL P.M.L. (M.TON/M)
M'= FLECTOR LONGITUDINAL P.M.L. (M.TON/M)
Q'= CORTANTE LONGITUDINAL P.M.L. (TON/M)
T'= TORSOR LONGITUDINAL P.M.L. (M.TON/M)

TVC

ESTUDIO:24785 E-1500.4 VANOS 1 Y 3

RESULTADOS ENVOLVENTES DE LAS 'HIPOTESIS DE CARGA'
**********

* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(ESFUERZOS MAYORADOS. MOVIMIENTOS SIN MAYORAR)

CAJON 1

| | | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | | |
| | MAX. M | 16.09 | 3.35 | 2.93 | | | |
| | MAX. Q | 15.77 | 4.40 | 2.76 | | | |
| | MAX. T | -4.82 | -42.07 | 64.33 | | | |
| | MAX. F | | | | 0.00 | -1.01 | -33.18 |
| | MAX. G | | | | -0.00 | -.01 | -20.37 |
| | MAX. J | | | | 0.00 | -.29 | -11.84 |
| | MIN. M | -24.35 | -123.43 | -22.14 | | | |
| | MIN. Q | -23.72 | -137.24 | -10.14 | | | |
| | MIN. T | -24.35 | -123.43 | -22.14 | | | |
| | MIN. F | | | | -0.00 | -.01 | -20.37 |
| | MIN. G | | | | 0.00 | -1.45 | -33.20 |
| | MIN. J | | | | 0.00 | -1.20 | -37.95 |
| CUARTO LUZ | | | | | | | |
| | MAX. M | 668.97 | -137.24 | 49.69 | | | |
| | MAX. Q | -6.43 | 17.70 | 1.60 | | | |
| | MAX. T | 207.51 | -42.07 | 69.40 | | | |
| | MAX. F | | | | 6.65 | -1.04 | -33.27 |
| | MAX. G | | | | .02 | -0.00 | -20.37 |
| | MAX. J | | | | 1.30 | -.20 | -11.84 |
| | MIN. M | -9.19 | 4.40 | 1.60 | | | |
| | MIN. Q | 668.97 | -137.24 | 49.69 | | | |
| | MIN. T | 488.51 | -101.31 | -52.00 | | | |
| | MIN. F | | | | .02 | -0.00 | -20.37 |
| | MIN. G | | | | 6.65 | -1.04 | -33.27 |
| | MIN. J | | | | 5.37 | -.78 | -37.98 |
| CENTRO LUZ | | | | | | | |
| | MAX. M | 891.67 | -54.66 | -42.54 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. Q | 829.54 | 59.45 | -43.26 | | | |
| MAX. T | 201.27 | 5.51 | 67.26 | | | |
| MAX. F | | | | 9.46 | 0.00 | -33.38 |
| MAX. G | | | | 6.83 | .07 | -36.15 |
| MAX. J | | | | 1.82 | 0.00 | -11.85 |
| MIN. M | -11.59 | 5.13 | -3.70 | | | |
| MIN. Q | 829.54 | -64.67 | -43.26 | | | |
| MIN. T | 498.30 | -20.88 | -78.51 | | | |
| MIN. F | | | | 0.00 | 0.00 | -20.37 |
| MIN. G | | | | 5.69 | -.06 | -22.52 |
| MIN. J | | | | 8.44 | 0.00 | -38.08 |

TRES CUARTOS LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 663.31 | 123.57 | -65.23 | | | |
| MAX. Q | 663.08 | 123.73 | -65.92 | | | |
| MAX. T | 230.64 | 41.32 | 40.67 | | | |
| MAX. F | | | | 6.65 | 1.04 | -33.31 |
| MAX. G | | | | 6.65 | 1.04 | -33.31 |
| MAX. J | | | | 1.29 | .20 | -11.86 |
| MIN. M | -18.56 | 4.78 | -5.84 | | | |
| MIN. Q | 390.07 | -13.44 | -63.76 | | | |
| MIN. T | 423.78 | 79.72 | -76.89 | | | |
| MIN. F | | | | -.01 | -0.00 | -20.38 |
| MIN. G | | | | -.01 | -0.00 | -20.38 |
| MIN. J | | | | 5.38 | .79 | -38.02 |

APOYO '2'

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 14.47 | 118.79 | 1.80 | | | |
| MAX. Q | 13.74 | 123.62 | 1.11 | | | |
| MAX. T | 7.84 | 78.86 | 13.71 | | | |
| MAX. F | | | | 0.00 | 1.03 | -33.34 |
| MAX. G | | | | 0.00 | 1.46 | -33.28 |
| MAX. J | | | | 0.00 | .28 | -11.86 |
| MIN. M | -16.54 | 9.51 | -4.42 | | | |
| MIN. Q | -14.77 | 4.45 | -2.18 | | | |
| MIN. T | 7.14 | 69.91 | -68.34 | | | |
| MIN. F | | | | 0.00 | -0.00 | -19.87 |
| MIN. G | | | | 0.00 | -.01 | -20.39 |
| MIN. J | | | | 0.00 | 1.21 | -38.02 |

CAJON 2

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|

APOYO '1'

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 16.25 | -83.50 | -72.50 | | | |
| MAX. Q | -13.27 | -6.10 | -2.16 | | | |
| MAX. T | 9.05 | -80.12 | 14.87 | | | |
| MAX. F | | | | 0.00 | -1.06 | 34.77 |
| MAX. G | | | | 0.00 | -.02 | 20.12 |
| MAX. J | | | | 0.00 | -1.25 | 39.27 |
| MIN. M | -15.08 | -11.16 | -4.43 | | | |
| MIN. Q | 15.52 | -125.94 | 1.34 | | | |
| MIN. T | 9.26 | -72.60 | -73.79 | | | |
| MIN. F | | | | 0.00 | -.02 | 19.60 |
| MIN. G | | | | 0.00 | -1.50 | 34.67 |
| MIN. J | | | | 0.00 | -.29 | 12.06 |

CUARTO LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 680.19 | -125.89 | -70.23 | | | |
| MAX. Q | 402.76 | 13.01 | -68.69 | | | |
| MAX. T | 240.45 | -42.57 | 44.12 | | | |
| MAX. F | | | | 6.81 | -1.07 | 34.71 |
| MAX. G | | | | .11 | -.02 | 20.11 |
| MAX. J | | | | 5.57 | -.82 | 39.27 |
| MIN. M | -7.00 | -6.43 | -5.84 | | | |
| MIN. Q | 679.97 | -126.05 | -70.92 | | | |
| MIN. T | 443.41 | -82.41 | -82.83 | | | |
| MIN. F | | | | .11 | -.02 | 20.11 |
| MIN. G | | | | 6.81 | -1.07 | 34.71 |
| MIN. J | | | | 1.34 | -.21 | 12.06 |

CENTRO LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 913.13 | 56.32 | -45.33 | | | |
| MAX. Q | 854.26 | 66.31 | -46.02 | | | |
| MAX. T | 217.02 | -4.71 | 72.90 | | | |
| MAX. F | | | | 9.68 | -0.00 | 34.79 |
| MAX. G | | | | 5.82 | .06 | 23.44 |
| MAX. J | | | | 8.70 | -0.00 | 39.32 |
| MIN. M | 3.27 | -3.83 | -3.69 | | | |
| MIN. Q | 854.26 | -59.45 | -46.02 | | | |
| MIN. T | 523.17 | 22.84 | -84.50 | | | |
| MIN. F | | | | .17 | -0.00 | 20.10 |
| MIN. G | | | | 7.09 | -.07 | 37.39 |
| MIN. J | | | | 1.89 | -0.00 | 12.05 |

TRES CUARTOS LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 685.45 | 140.94 | 54.33 | | | |
| MAX. Q | 685.45 | 140.94 | 54.33 | | | |
| MAX. T | 219.64 | 44.86 | 74.96 | | | |
| MAX. F | | | | 6.81 | 1.06 | 34.66 |
| MAX. G | | | | 6.81 | 1.06 | 34.66 |
| MAX. J | | | | 5.55 | .81 | 39.22 |
| MIN. M | 1.85 | -1.62 | 1.27 | | | |
| MIN. Q | 5.75 | -15.56 | 1.27 | | | |
| MIN. T | 505.08 | 105.02 | -55.81 | | | |
| MIN. F | | | | .13 | .02 | 20.10 |
| MIN. G | | | | .13 | .02 | 20.10 |
| MIN. J | | | | 1.35 | .21 | 12.04 |

APOYO '2'

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 14.30 | -.58 | 2.62 | | | |
| MAX. Q | -25.94 | 140.94 | -10.73 | | | |
| MAX. T | -6.78 | 44.86 | 69.53 | | | |
| MAX. F | | | | 0.00 | 1.05 | 34.60 |

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. G | | | | 0.00 | 1.48 | 34.60 |
| MAX. J | | | | 0.00 | 1.24 | 39.20 |
| MIN. M | -26.54 | 127.16 | -23.68 | | | |
| MIN. Q | 13.93 | -1.62 | 2.41 | | | |
| MIN. T | -26.54 | 127.16 | -23.68 | | | |
| MIN. F | | | | -0.00 | .04 | 20.10 |
| MIN. G | | | | -0.00 | .03 | 20.11 |
| MIN. J | | | | 0.00 | .30 | 12.04 |



**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

RESULTADOS ENVOLVENTES DE LAS 'HIPOTESIS DE CARGA'
**********

* REACCIONES *
(VALORES MAYORADOS)

| CAJON | EXTR. | | M | R | T | | M | R | T |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | MAX. M | 0.0 | 175.6 | 0.0 | MIN. M | 0.0 | 26.6 | 0.0 |
| | | MAX. R | 0.0 | 190.4 | 0.0 | MIN. R | 0.0 | -6.3 | 0.0 |
| | | MAX. T | 0.0 | 175.6 | 0.0 | MIN. T | 0.0 | 26.6 | 0.0 |
| 1 | 2 | MAX. M | 0.0 | 86.3 | 0.0 | MIN. M | 0.0 | 24.7 | 0.0 |
| | | MAX. R | 0.0 | 173.1 | 0.0 | MIN. R | 0.0 | 2.9 | 0.0 |
| | | MAX. T | 0.0 | 86.3 | 0.0 | MIN. T | 0.0 | 24.7 | 0.0 |
| 2 | 1 | MAX. M | 0.0 | 62.2 | 0.0 | MIN. M | 0.0 | 25.7 | 0.0 |
| | | MAX. R | 0.0 | 176.4 | 0.0 | MIN. R | 0.0 | 5.2 | 0.0 |
| | | MAX. T | 0.0 | 62.2 | 0.0 | MIN. T | 0.0 | 25.7 | 0.0 |
| 2 | 2 | MAX. M | 0.0 | 63.0 | 0.0 | MIN. M | 0.0 | 28.2 | 0.0 |
| | | MAX. R | 0.0 | 195.4 | 0.0 | MIN. R | 0.0 | -2.6 | 0.0 |
| | | MAX. T | 0.0 | 63.0 | 0.0 | MIN. T | 0.0 | 28.2 | 0.0 |

SITUACION DE ESFUERZOS PESIMOS

| VIGAS | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT. IZQ. | Viga 1 | Viga 1 | Viga 1 |
| EXT. DCHA. | Viga 2 | Viga 2 | Viga 2 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 891.675 | 190.394 | -78.507 |
| EXT.DCH. | 913.131 | 195.410 | -84.500 |



**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

RESULTADOS PARCIALES. 'ACCION' 2
**********

* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(VALORES CARACTERISTICOS)

| CAJON | Y | == ANTE./POST. == M | Q | T | F | G | J |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | -1.68 | -19.76 | -.74 | 0.00 | -.33 | -19.32 |
| | | -1.68 | -19.76 | -.74 | | | |
| | 5.05 | 98.04 | -19.76 | -.74 | 1.49 | -.23 | -19.33 |
| | | 95.28 | -6.45 | -1.90 | | | |
| | 10.10 | 127.84 | -6.45 | -1.90 | 2.09 | 0.00 | -19.34 |
| | | 126.19 | 6.32 | -1.96 | | | |
| | 15.14 | 94.29 | 6.32 | -1.96 | 1.48 | .23 | -19.34 |
| | | 93.79 | 18.57 | -.85 | | | |
| | 20.19 | .05 | 18.57 | -.85 | 0.00 | .33 | -19.35 |
| | | .05 | 18.57 | -.85 | | | |
| 2 | 0.00 | .62 | -19.28 | -.86 | 0.00 | -.34 | 19.64 |
| | | .62 | -19.28 | -.86 | | | |
| | 5.05 | 97.96 | -19.28 | -.86 | 1.55 | -.24 | 19.63 |
| | | 99.55 | -6.40 | -1.99 | | | |
| | 10.10 | 131.84 | -6.40 | -1.99 | 2.19 | -0.00 | 19.63 |
| | | 134.53 | 6.98 | -1.99 | | | |
| | 15.14 | 99.30 | 6.98 | -1.99 | 1.56 | .24 | 19.62 |
| | | 103.20 | 20.92 | -.86 | | | |
| | 20.19 | -2.39 | 20.92 | -.86 | 0.00 | .34 | 19.61 |
| | | -2.39 | 20.92 | -.86 | | | |

TVC

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

RESULTADOS PARCIALES. 'ACCION' 2
**********

* REACCIONES *
(VALORES CARACTERISTICOS)

| CAJON | ==== EXTR.1 ===== M | R | T | ==== EXTR.2 ===== M | R | T |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 26.61 | 0.00 | 0.00 | 24.69 | 0.00 |
| 2 | 0.00 | 25.72 | 0.00 | 0.00 | 28.17 | 0.00 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 127.835 | 24.689 | -1.962 |
| EXT.DCH. | 134.534 | 28.167 | -1.992 |

TVC

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

RESULTADOS ENVOLVENTES DE LAS 'HIPOTESIS DE CARGA'
**********

* ESFUERZOS 'TOTALES' DE LA LOSA *
(ESFUERZOS 'GENERALES' Y 'LOCALES' COMBINADOS)

(VALORES MAYORADOS)

APOYO '1'

| BANDA LONG. | = PUNTO = X | Y | ========== MAX./MIN. ========== M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | .12 | .12 | .01 | .22 | .03 | .16 |
| | | | -.02 | -.02 | -.16 | -.02 | -.16 | -.02 |
| | 1.55 | 0.00 | -.64 | 5.12 | .01 | 0.00 | 0.00 | 0.00 |
| | | | -5.80 | .95 | -.16 | -1.11 | 0.00 | 0.00 |
| | 3.10 | 0.00 | -2.87 | 19.82 | .01 | 0.00 | 0.00 | 0.00 |
| | | | -20.19 | 1.92 | -.16 | -7.83 | 0.00 | 0.00 |
| 2 | 3.10 | 0.00 | -.24 | 7.96 | .22 | 0.00 | 0.00 | 0.00 |
| | | | -16.50 | -17.84 | -.14 | -7.17 | 0.00 | 0.00 |
| | 4.19 | 0.00 | 2.01 | 8.64 | .22 | 2.01 | 0.00 | 0.00 |
| | | | -9.18 | -11.24 | -.14 | -1.24 | 0.00 | 0.00 |
| | 5.29 | 0.00 | 1.75 | 11.61 | .22 | .82 | 0.00 | 0.00 |
| | | | -19.35 | -4.01 | -.14 | -2.83 | 0.00 | 0.00 |
| 3 | 5.29 | 0.00 | 1.75 | 2.69 | 9.63 | 15.06 | 9.55 | -13.65 |
| | | | -19.35 | -14.13 | -6.36 | -22.76 | -7.94 | -44.69 |
| | 6.35 | -2.50 | 5.03 | 5.75 | 1.33 | 18.26 | .99 | -13.32 |
| | | | -16.60 | -5.86 | .34 | -26.23 | -1.08 | -39.97 |
| | 7.41 | -4.99 | 1.95 | 14.01 | 6.62 | 14.20 | 7.39 | -12.83 |
| | | | -18.78 | -2.45 | -6.00 | -15.68 | -6.11 | -43.37 |
| 4 | 7.41 | -4.99 | 1.95 | 4.47 | .15 | .84 | 0.00 | 0.00 |
| | | | -18.78 | -11.48 | -.14 | -2.81 | 0.00 | 0.00 |
| | 8.50 | -4.99 | 1.95 | 11.52 | .15 | 1.99 | 0.00 | 0.00 |
| | | | -8.87 | -8.47 | -.14 | -1.26 | 0.00 | 0.00 |
| | 9.59 | -4.99 | -.23 | 18.12 | .15 | 0.00 | 0.00 | 0.00 |
| | | | -17.28 | -7.78 | -.14 | -7.49 | 0.00 | 0.00 |
| 5 | 9.59 | -4.99 | -3.07 | -1.98 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -21.25 | -20.01 | -.02 | -8.31 | 0.00 | 0.00 |
| | 11.20 | -4.99 | -.68 | -.98 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -5.99 | -5.13 | -.02 | -2.58 | 0.00 | 0.00 |
| | 12.80 | -4.99 | .12 | .02 | .18 | .23 | .03 | .02 |
| | | | -.02 | -.12 | -.02 | -.03 | -.16 | -.15 |

CUARTO LUZ

| BANDA LONG. | = PUNTO = X | Y | ========== MAX./MIN. ========== M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.05 | .01 | .02 | .05 | .91 | .06 | .15 |
| | | | -.03 | -.09 | -.15 | 0.00 | -.13 | -.05 |
| | 1.55 | 5.05 | -.65 | 5.12 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -5.80 | .88 | -.15 | -1.11 | 0.00 | 0.00 |
| | 3.10 | 5.05 | -2.81 | 19.82 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -20.19 | 1.85 | -.15 | -7.83 | 0.00 | 0.00 |
| 2 | 3.10 | 5.05 | -.18 | 7.72 | .30 | 0.00 | 0.00 | 0.00 |
| | | | -16.50 | -17.84 | -.20 | -7.17 | 0.00 | 0.00 |
| | 4.19 | 5.05 | 2.01 | 8.41 | .30 | 2.01 | 0.00 | 0.00 |
| | | | -8.72 | -11.24 | -.20 | -1.24 | 0.00 | 0.00 |
| | 5.29 | 5.05 | 1.75 | 11.61 | .30 | .82 | 0.00 | 0.00 |
| | | | -18.56 | -4.01 | -.20 | -2.83 | 0.00 | 0.00 |
| 3 | 5.29 | 5.05 | 1.75 | 1.79 | 6.81 | 10.87 | 6.22 | -13.54 |
| | | | -18.56 | -14.13 | -4.58 | -16.12 | -5.84 | -42.84 |
| | 6.35 | 2.55 | 5.03 | 5.75 | 1.39 | 2.35 | 1.85 | -13.41 |
| | | | -16.44 | -5.86 | .37 | -2.32 | -1.88 | -39.69 |
| | 7.41 | .05 | 1.95 | 14.01 | 6.10 | 11.27 | 6.47 | -13.02 |
| | | | -18.59 | -2.07 | -4.75 | -14.44 | -5.90 | -42.92 |
| 4 | 7.41 | .05 | 1.95 | 4.47 | .27 | .84 | 0.00 | 0.00 |
| | | | -18.59 | -11.48 | -.21 | -2.81 | 0.00 | 0.00 |
| | 8.50 | .05 | 1.95 | 11.52 | .27 | 1.99 | 0.00 | 0.00 |
| | | | -8.70 | -8.39 | -.21 | -1.26 | 0.00 | 0.00 |
| | 9.59 | .05 | -.15 | 18.12 | .27 | 0.00 | 0.00 | 0.00 |
| | | | -17.28 | -7.71 | -.21 | -7.49 | 0.00 | 0.00 |
| 5 | 9.59 | .05 | -2.99 | -1.90 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -21.25 | -20.01 | -.05 | -8.31 | 0.00 | 0.00 |
| | 11.20 | .05 | -.69 | -.90 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -5.99 | -5.13 | -.05 | -2.58 | 0.00 | 0.00 |
| | 12.80 | .05 | .01 | .10 | .18 | .96 | .06 | .06 |
| | | | -.04 | -.02 | -.05 | 0.00 | -.13 | -.15 |

CENTRO LUZ

| BANDA LONG. | = PUNTO = X | Y | ========== MAX./MIN. ========== M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 10.10 | .01 | .01 | .13 | 1.23 | .09 | .11 |
| | | | -.02 | -.10 | -.11 | 0.00 | -.10 | -.10 |
| | 1.55 | 10.10 | -.64 | 5.12 | .13 | 0.00 | 0.00 | 0.00 |
| | | | -5.80 | .86 | -.11 | -1.11 | 0.00 | 0.00 |
| | 3.10 | 10.10 | -2.78 | 19.82 | .13 | 0.00 | 0.00 | 0.00 |
| | | | -20.19 | 1.83 | -.11 | -7.83 | 0.00 | 0.00 |
| 2 | 3.10 | 10.10 | -.15 | 7.47 | .25 | 0.00 | 0.00 | 0.00 |
| | | | -16.50 | -17.84 | -.19 | -7.17 | 0.00 | 0.00 |
| | 4.19 | 10.10 | 2.01 | 8.15 | .25 | 2.01 | 0.00 | 0.00 |
| | | | -8.49 | -11.24 | -.19 | -1.24 | 0.00 | 0.00 |
| | 5.29 | 10.10 | 1.75 | 11.61 | .25 | .82 | 0.00 | 0.00 |
| | | | -18.07 | -4.01 | -.19 | -2.83 | 0.00 | 0.00 |
| 3 | 5.29 | 10.10 | 1.75 | 1.83 | 5.62 | 10.62 | 5.20 | -13.13 |
| | | | -18.07 | -14.13 | -4.48 | -13.30 | -5.92 | -41.68 |
| | 6.35 | 7.60 | 5.03 | 5.75 | 1.21 | 2.35 | 1.96 | -13.47 |
| | | | -16.44 | -5.86 | .41 | -1.96 | -1.76 | -39.94 |
| | 7.41 | 5.10 | 1.95 | 14.01 | 6.27 | 9.39 | 5.26 | -13.37 |
| | | | -18.68 | -1.55 | -3.95 | -14.84 | -5.84 | -43.12 |
| 4 | 7.41 | 5.10 | 1.95 | 4.47 | .28 | .84 | 0.00 | 0.00 |
| | | | -18.68 | -11.48 | -.17 | -2.81 | 0.00 | 0.00 |
| | 8.50 | 5.10 | 1.95 | 11.52 | .28 | 1.99 | 0.00 | 0.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | -8.79 | -8.45 | -.17 | -1.26 | 0.00 | 0.00 |
| | 9.59 | 5.10 | -.13 | 18.12 | .28 | 0.00 | 0.00 | 0.00 |
| | | | -17.28 | -7.76 | -.17 | -7.49 | 0.00 | 0.00 |
| 5 | 9.59 | 5.10 | -2.97 | -1.89 | .14 | 0.00 | 0.00 | 0.00 |
| | | | -21.25 | -20.01 | -.12 | -8.31 | 0.00 | 0.00 |
| | 11.20 | 5.10 | -.68 | -.89 | .14 | 0.00 | 0.00 | 0.00 |
| | | | -5.99 | -5.13 | -.12 | -2.58 | 0.00 | 0.00 |
| | 12.80 | 5.10 | .01 | .11 | .14 | 1.26 | .11 | .11 |
| | | | -.03 | -.01 | -.12 | 0.00 | -.10 | -.10 |

TRES CUARTOS LUZ

| BANDA | = PUNTO = | | ========== MAX./MIN. ========== | | | | | |
|---|---|---|---|---|---|---|---|---|
| LONG. | X | Y | M | Q | T | M' | Q' | T' |
| 1 | 0.00 | 15.14 | .01 | .02 | .17 | .93 | .12 | .05 |
| | | | -.03 | -.09 | -.05 | -.01 | -.06 | -.14 |
| | 1.55 | 15.14 | -.65 | 5.12 | .17 | 0.00 | 0.00 | 0.00 |
| | | | -5.80 | .88 | -.05 | -1.11 | 0.00 | 0.00 |
| | 3.10 | 15.14 | -2.80 | 19.82 | .17 | 0.00 | 0.00 | 0.00 |
| | | | -20.19 | 1.84 | -.05 | -7.83 | 0.00 | 0.00 |
| 2 | 3.10 | 15.14 | -.17 | 7.40 | .24 | 0.00 | 0.00 | 0.00 |
| | | | -16.50 | -17.84 | -.23 | -7.17 | 0.00 | 0.00 |
| | 4.19 | 15.14 | 2.01 | 8.08 | .24 | 2.01 | 0.00 | 0.00 |
| | | | -8.38 | -11.24 | -.23 | -1.24 | 0.00 | 0.00 |
| | 5.29 | 15.14 | 1.75 | 11.61 | .24 | .82 | 0.00 | 0.00 |
| | | | -17.95 | -4.01 | -.23 | -2.83 | 0.00 | 0.00 |
| 3 | 5.29 | 15.14 | 1.75 | 2.38 | 5.42 | 12.59 | 5.25 | -12.76 |
| | | | -17.95 | -14.13 | -5.31 | -12.84 | -7.21 | -41.40 |
| | 6.35 | 12.65 | 5.03 | 5.75 | 1.43 | 2.35 | 2.08 | -13.42 |
| | | | -16.48 | -5.86 | .38 | -2.26 | -1.67 | -40.14 |
| | 7.41 | 10.15 | 1.95 | 14.01 | 7.51 | 9.52 | 5.19 | -13.80 |
| | | | -19.20 | -1.52 | -4.01 | -17.77 | -6.95 | -44.36 |
| 4 | 7.41 | 10.15 | 1.95 | 4.47 | .33 | .84 | 0.00 | 0.00 |
| | | | -19.20 | -11.48 | -.17 | -2.81 | 0.00 | 0.00 |
| | 8.50 | 10.15 | 1.95 | 11.52 | .33 | 1.99 | 0.00 | 0.00 |
| | | | -9.04 | -8.71 | -.17 | -1.26 | 0.00 | 0.00 |
| | 9.59 | 10.15 | -.16 | 18.12 | .33 | 0.00 | 0.00 | 0.00 |
| | | | -17.28 | -8.03 | -.17 | -7.49 | 0.00 | 0.00 |
| 5 | 9.59 | 10.15 | -3.00 | -1.91 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -21.25 | -20.01 | -.16 | -8.31 | 0.00 | 0.00 |
| | 11.20 | 10.15 | -.70 | -.91 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -5.99 | -5.13 | -.16 | -2.58 | 0.00 | 0.00 |
| | 12.80 | 10.15 | .01 | .10 | .05 | .93 | .13 | .16 |
| | | | -.04 | -.02 | -.16 | 0.00 | -.06 | -.05 |

APOYO '2'

| BANDA | = PUNTO = | | ========== MAX./MIN. ========== | | | | | |
|---|---|---|---|---|---|---|---|---|
| LONG. | X | Y | M | Q | T | M' | Q' | T' |
| 1 | 0.00 | 20.19 | .11 | .11 | .17 | .23 | .15 | .02 |
| | | | -.02 | -.02 | -.02 | -.03 | -.03 | -.14 |
| | 1.55 | 20.19 | -.64 | 5.12 | .17 | 0.00 | 0.00 | 0.00 |
| | | | -5.80 | .95 | -.02 | -1.11 | 0.00 | 0.00 |
| | 3.10 | 20.19 | -2.88 | 19.82 | .17 | 0.00 | 0.00 | 0.00 |
| | | | -20.19 | 1.92 | -.02 | -7.83 | 0.00 | 0.00 |
| 2 | 3.10 | 20.19 | -.25 | 7.47 | .14 | 0.00 | 0.00 | 0.00 |
| | | | -16.50 | -17.84 | -.15 | -7.17 | 0.00 | 0.00 |
| | 4.19 | 20.19 | 2.01 | 8.15 | .14 | 2.01 | 0.00 | 0.00 |
| | | | -8.53 | -11.24 | -.15 | -1.24 | 0.00 | 0.00 |
| | 5.29 | 20.19 | 1.75 | 11.61 | .14 | .82 | 0.00 | 0.00 |
| | | | -18.11 | -4.01 | -.15 | -2.83 | 0.00 | 0.00 |
| 3 | 5.29 | 20.19 | 1.75 | 2.76 | 5.90 | 15.56 | 5.46 | -12.55 |
| | | | -18.11 | -14.13 | -6.57 | -13.97 | -8.11 | -41.77 |
| | 6.35 | 17.69 | 5.03 | 5.75 | 1.26 | 16.19 | 1.22 | -13.31 |
| | | | -16.32 | -5.86 | .32 | -28.69 | -.88 | -39.68 |
| | 7.41 | 15.20 | 1.95 | 14.01 | 10.50 | 13.40 | 7.09 | -13.96 |
| | | | -20.06 | -2.33 | -5.66 | -24.80 | -10.50 | -46.38 |
| 4 | 7.41 | 15.20 | 1.95 | 4.47 | .24 | .84 | 0.00 | 0.00 |
| | | | -20.06 | -11.48 | -.13 | -2.81 | 0.00 | 0.00 |
| | 8.50 | 15.20 | 1.95 | 11.52 | .24 | 1.99 | 0.00 | 0.00 |
| | | | -9.55 | -8.99 | -.13 | -1.26 | 0.00 | 0.00 |
| | 9.59 | 15.20 | -.23 | 18.12 | .24 | 0.00 | 0.00 | 0.00 |
| | | | -17.28 | -8.30 | -.13 | -7.49 | 0.00 | 0.00 |
| 5 | 9.59 | 15.20 | -3.07 | -1.98 | .02 | 0.00 | 0.00 | 0.00 |
| | | | -21.25 | -20.01 | -.18 | -8.31 | 0.00 | 0.00 |
| | 11.20 | 15.20 | -.68 | -.98 | .02 | 0.00 | 0.00 | 0.00 |
| | | | -5.99 | -5.13 | -.18 | -2.58 | 0.00 | 0.00 |
| | 12.80 | 15.20 | .14 | .02 | .02 | .22 | .16 | .17 |
| | | | -.02 | -.12 | -.18 | -.02 | -.03 | -.02 |

NOTA.- Estos esfuerzos incluyen los del peso propio de la losa.

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

ARMADO DE LA LOSA
**********

APOYO '1'

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | 2.56 | 3.38 | | | |
| | 1.55 | 0.00 | 1.88 | 6.20 | | | |
| | 3.10 | 0.00 | 1.88 | 23.72 | | | * |
| 2 | 3.10 | 0.00 | 1.88 | 18.86 | | | * |
| | 4.19 | 0.00 | 3.03 | 10.01 | | | |
| | 5.29 | 0.00 | 2.67 | 22.64 | | | |
| 3 | 5.29 | 0.00 | 74.91 | 91.63 | | | |
| | 6.35 | -2.50 | 72.65 | 81.50 | | | VER NOTA(1) |
| | 7.41 | -4.99 | 73.14 | 88.83 | | | |
| 4 | 7.41 | -4.99 | 2.85 | 21.79 | | | |
| | 8.50 | -4.99 | 2.85 | 9.59 | | | |
| | 9.59 | -4.99 | 1.88 | 19.79 | | | * |
| 5 | 9.59 | -4.99 | 1.88 | 25.25 | | | * |
| | 11.20 | -4.99 | 1.88 | 6.43 | | | |
| | 12.80 | -4.99 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 74.91 | 91.63 | 22.47 | 27.49 | |
| Armad.orientativa | | | 15d25 | 18d25 | 7d20 | 9d20 | |

Cuantia media parcial.. 166.619 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

TVC

ESTUDIO:24785 E-1500.4 VANOS 1 Y 3

ARMADO DE LA LOSA
**********

CUARTO LUZ

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.05 | 2.56 | 3.38 | | | |
| | 1.55 | 5.05 | 1.88 | 6.18 | | | |
| | 3.10 | 5.05 | 1.88 | 23.70 | | | * |
| 2 | 3.10 | 5.05 | 2.56 | 18.96 | | | * |
| | 4.19 | 5.05 | 3.14 | 9.58 | | | |
| | 5.29 | 5.05 | 2.78 | 21.68 | | | |
| 3 | 5.29 | 5.05 | 72.02 | 87.68 | | | |
| | 6.35 | 2.55 | 72.22 | 80.88 | | | VER NOTA(1) |
| | 7.41 | .05 | 72.45 | 87.88 | | | |
| 4 | 7.41 | .05 | 3.01 | 21.69 | | | |
| | 8.50 | .05 | 3.01 | 9.53 | | | |
| | 9.59 | .05 | 2.56 | 19.95 | | | * |
| 5 | 9.59 | .05 | 1.88 | 25.25 | | | * |
| | 11.20 | .05 | 1.88 | 6.43 | | | |
| | 12.80 | .05 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 72.45 | 87.88 | 21.73 | 26.36 | |
| Armad.orientativa | | | 15d25 | 18d25 | 7d20 | 8d20 | |

Cuantia media parcial.. 164.153 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

ARMADO DE LA LOSA
**********

CENTRO LUZ

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 10.10 | 2.56 | 3.38 | | | |
| | 1.55 | 10.10 | 1.88 | 6.16 | | | |
| | 3.10 | 10.10 | 1.88 | 23.67 | | | * |
| 2 | 3.10 | 10.10 | 2.56 | 18.90 | | | * |
| | 4.19 | 10.10 | 3.08 | 9.26 | | | |
| | 5.29 | 10.10 | 2.71 | 20.95 | | | |
| 3 | 5.29 | 10.10 | 70.22 | 85.23 | | | |
| | 6.35 | 7.60 | 72.60 | 81.26 | | VER NOTA(1) | |
| | 7.41 | 5.10 | 72.77 | 88.32 | | | |
| 4 | 7.41 | 5.10 | 3.02 | 21.81 | | | |
| | 8.50 | 5.10 | 3.02 | 9.64 | | | |
| | 9.59 | 5.10 | 2.56 | 19.95 | | | * |
| 5 | 9.59 | 5.10 | 1.88 | 25.19 | | | * |
| | 11.20 | 5.10 | 1.88 | 6.39 | | | |
| | 12.80 | 5.10 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 72.77 | 88.32 | 21.83 | 26.50 | |
| Armad.orientativa | | | 15d25 | 18d25 | 7d20 | 9d20 | |

Cuantia media parcial.. 166.619 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

TVC

ESTUDIO:24785 E-1500.4 VANOS 1 Y 3

ARMADO DE LA LOSA
**********

TRES CUARTOS LUZ

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 15.14 | 2.56 | 3.38 | | | |
| | 1.55 | 15.14 | 1.88 | 6.20 | | | |
| | 3.10 | 15.14 | 1.88 | 23.73 | | | * |
| 2 | 3.10 | 15.14 | 2.56 | 18.89 | | | * |
| | 4.19 | 15.14 | 3.07 | 9.14 | | | |
| | 5.29 | 15.14 | 2.70 | 20.79 | | | |
| 3 | 5.29 | 15.14 | 69.79 | 84.65 | | | |
| | 6.35 | 12.65 | 72.92 | 81.62 | | VER NOTA(1) | |
| | 7.41 | 10.15 | 74.68 | 90.93 | | | |
| 4 | 7.41 | 10.15 | 3.09 | 22.59 | | | |
| | 8.50 | 10.15 | 3.09 | 9.97 | | | |
| | 9.59 | 10.15 | 2.56 | 20.02 | | | * |
| 5 | 9.59 | 10.15 | 1.88 | 25.22 | | | * |
| | 11.20 | 10.15 | 1.88 | 6.41 | | | |
| | 12.80 | 10.15 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 74.68 | 90.93 | 22.40 | 27.28 | |
| Armad.orientativa | | | 15d25 | 18d25 | 7d20 | 9d20 | |

Cuantia media parcial.. 166.619 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

ARMADO DE LA LOSA
**********

APOYO '2'

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BARRA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 20.19 | 2.56 | 3.38 | | | |
| | 1.55 | 20.19 | 1.88 | 6.21 | | | |
| | 3.10 | 20.19 | 1.88 | 23.73 | | | * |
| 2 | 3.10 | 20.19 | 1.88 | 18.77 | | | * |
| | 4.19 | 20.19 | 2.94 | 9.20 | | | |
| | 5.29 | 20.19 | 2.57 | 20.87 | | | |
| 3 | 5.29 | 20.19 | 70.36 | 85.42 | | | |
| | 6.35 | 17.69 | 72.20 | 80.71 | | | VER NOTA(1) |
| | 7.41 | 15.20 | 77.83 | 95.26 | | | |
| 4 | 7.41 | 15.20 | 2.96 | 23.65 | | | |
| | 8.50 | 15.20 | 2.97 | 10.46 | | | |
| | 9.59 | 15.20 | 2.56 | 19.90 | | | * |
| 5 | 9.59 | 15.20 | 1.88 | 25.24 | | | * |
| | 11.20 | 15.20 | 1.88 | 6.43 | | | |
| | 12.80 | 15.20 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 77.83 | 95.26 | 23.35 | 28.58 | |
| Armad.orientativa | | | 16d25 | 19d25 | 8d20 | 9d20 | |

Cuantia media parcial.. 176.792 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

Cuantia media ponderada 167.274 Kgr/m2

TVC

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CB
**********

* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(ESFUERZOS MAYORADOS. MOVIMIENTOS SIN MAYORAR)

CAJON 1

| | | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | | |
| | MAX. M | 7.89 | 10.69 | 1.57 | | | |
| | MAX. Q | 7.70 | 10.89 | 1.47 | | | |
| | MAX. T | 7.89 | 10.69 | 1.57 | | | |
| | MAX. F | | | | 0.00 | -.42 | -5.76 |
| | MAX. G | | | | -0.00 | .09 | -3.00 |
| | MAX. J | | | | 0.00 | -.06 | 1.52 |
| | MIN. M | -9.58 | -39.49 | -2.67 | | | |
| | MIN. Q | -9.38 | -39.70 | -2.56 | | | |
| | MIN. T | -9.58 | -39.49 | -2.67 | | | |
| | MIN. F | | | | -0.00 | .09 | -3.00 |
| | MIN. G | | | | 0.00 | -.42 | -5.76 |
| | MIN. J | | | | 0.00 | -.27 | -10.29 |
| CUARTO LUZ | | | | | | | |
| | MAX. M | 191.00 | -39.70 | -3.42 | | | |
| | MAX. Q | -47.26 | 10.89 | 1.47 | | | |
| | MAX. T | -46.04 | 10.69 | 1.57 | | | |
| | MAX. F | | | | 1.90 | -.29 | -5.77 |
| | MAX. G | | | | -.44 | .07 | -3.00 |
| | MAX. J | | | | .25 | -.04 | 1.52 |
| | MIN. M | -47.26 | 10.89 | 1.47 | | | |
| | MIN. Q | 191.00 | -39.70 | -3.42 | | | |
| | MIN. T | 191.00 | -39.70 | -3.42 | | | |
| | MIN. F | | | | -.44 | .07 | -3.00 |
| | MIN. G | | | | 1.90 | -.29 | -5.77 |
| | MIN. J | | | | 1.21 | -.19 | -10.29 |
| CENTRO LUZ | | | | | | | |
| | MAX. M | 250.48 | -4.65 | -3.80 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. Q | 188.34 | 15.09 | -4.52 | | | |
| MAX. T | -62.14 | 5.23 | .60 | | | |
| MAX. F | | | | 2.68 | 0.00 | -5.78 |
| MAX. G | | | | 1.34 | 0.00 | -8.68 |
| MAX. J | | | | .36 | 0.00 | 1.52 |
| MIN. M | -62.14 | 5.23 | -.71 | | | |
| MIN. Q | 188.34 | -14.65 | -4.52 | | | |
| MIN. T | 188.34 | .58 | -4.52 | | | |
| MIN. F | | | | -.63 | 0.00 | -3.00 |
| MIN. G | | | | .71 | -0.00 | -.10 |
| MIN. J | | | | 1.70 | 0.00 | -10.29 |

TRES CUARTOS LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 189.85 | 34.01 | -1.50 | | | |
| MAX. Q | 189.63 | 34.17 | -2.19 | | | |
| MAX. T | 48.99 | 9.70 | .05 | | | |
| MAX. F | | | | 1.90 | .29 | -5.79 |
| MAX. G | | | | 1.90 | .29 | -5.79 |
| MAX. J | | | | .25 | .04 | 1.51 |
| MIN. M | -50.61 | -6.21 | -1.40 | | | |
| MIN. Q | -50.38 | -6.37 | -.71 | | | |
| MIN. T | 139.24 | 27.80 | -2.90 | | | |
| MIN. F | | | | -.45 | -.07 | -3.00 |
| MIN. G | | | | -.45 | -.07 | -3.00 |
| MIN. J | | | | 1.20 | .19 | -10.30 |

APOYO '2'

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 6.58 | 29.23 | -0.00 | | | |
| MAX. Q | 5.85 | 34.06 | -.69 | | | |
| MAX. T | .02 | 9.70 | .05 | | | |
| MAX. F | | | | 0.00 | .42 | -5.88 |
| MAX. G | | | | 0.00 | .42 | -5.79 |
| MAX. J | | | | 0.00 | .05 | 1.51 |
| MIN. M | -7.31 | -1.54 | -1.26 | | | |
| MIN. Q | -6.58 | -6.37 | -.57 | | | |
| MIN. T | -.75 | 17.99 | -1.31 | | | |
| MIN. F | | | | -0.00 | -.10 | -2.91 |
| MIN. G | | | | -0.00 | -.10 | -3.00 |
| MIN. J | | | | 0.00 | .26 | -10.30 |

CAJON 2

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|

APOYO '1'

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 6.93 | -30.01 | -.02 | | | |
| MAX. Q | -6.25 | 6.03 | -.55 | | | |
| MAX. T | .02 | -9.70 | .05 | | | |
| MAX. F | | | | 0.00 | -.43 | 6.28 |
| MAX. G | | | | -0.00 | .10 | 2.84 |
| MAX. J | | | | 0.00 | -.28 | 10.53 |
| MIN. M | -6.98 | 1.20 | -1.25 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| MIN. Q | 6.20 | -34.84 | -.71 | | | |
| MIN. T | -.06 | -19.11 | -1.31 | | | |
| MIN. F | | | | -0.00 | .10 | 2.75 |
| MIN. G | | | | 0.00 | -.43 | 6.18 |
| MIN. J | | | | 0.00 | -.05 | -1.51 |

CUARTO LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 194.83 | -34.79 | -1.53 | | | |
| MAX. Q | -47.76 | 6.03 | -.70 | | | |
| MAX. T | 48.98 | -9.70 | .05 | | | |
| MAX. F | | | | 1.95 | -.30 | 6.18 |
| MAX. G | | | | -.43 | .07 | 2.84 |
| MAX. J | | | | 1.27 | -.20 | 10.53 |
| MIN. M | -47.98 | 5.87 | -1.39 | | | |
| MIN. Q | 194.61 | -34.95 | -2.22 | | | |
| MIN. T | 146.85 | -28.92 | -2.92 | | | |
| MIN. F | | | | -.43 | .07 | 2.84 |
| MIN. G | | | | 1.95 | -.30 | 6.18 |
| MIN. J | | | | .25 | -.04 | -1.51 |

CENTRO LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 256.94 | 5.09 | -3.89 | | | |
| MAX. Q | 198.07 | 15.08 | -4.58 | | | |
| MAX. T | -58.87 | -4.95 | .56 | | | |
| MAX. F | | | | 2.74 | -0.00 | 6.17 |
| MAX. G | | | | .71 | 0.00 | .10 |
| MAX. J | | | | 1.80 | -0.00 | 10.53 |
| MIN. M | -58.87 | -4.95 | -.70 | | | |
| MIN. Q | 198.07 | -14.98 | -4.58 | | | |
| MIN. T | 198.07 | .13 | -4.58 | | | |
| MIN. F | | | | -.59 | -0.00 | 2.84 |
| MIN. G | | | | 1.44 | -0.00 | 8.91 |
| MIN. J | | | | .36 | -0.00 | -1.52 |

TRES CUARTOS LUZ

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 195.95 | 40.77 | -3.51 | | | |
| MAX. Q | 195.95 | 40.77 | -3.51 | | | |
| MAX. T | -43.54 | -10.11 | 1.50 | | | |
| MAX. F | | | | 1.95 | .30 | 6.16 |
| MAX. G | | | | 1.95 | .30 | 6.16 |
| MAX. J | | | | 1.28 | .20 | 10.52 |
| MIN. M | -44.76 | -10.32 | 1.39 | | | |
| MIN. Q | -44.76 | -10.32 | 1.39 | | | |
| MIN. T | 195.95 | 40.77 | -3.51 | | | |
| MIN. F | | | | -.42 | -.06 | 2.84 |
| MIN. G | | | | -.42 | -.06 | 2.84 |
| MIN. J | | | | .25 | .04 | -1.52 |

APOYO '2'

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. M | 7.50 | -10.11 | 1.50 | | | |
| MAX. Q | -9.85 | 40.77 | -2.65 | | | |
| MAX. T | 7.50 | -10.11 | 1.50 | | | |
| MAX. F | | | | 0.00 | .43 | 6.16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. G | | | | 0.00 | .43 | 6.16 |
| MAX. J | | | | 0.00 | .28 | 10.52 |
| MIN. M | -10.04 | 40.57 | -2.75 | | | |
| MIN. Q | 7.31 | -10.32 | 1.39 | | | |
| MIN. T | -10.04 | 40.57 | -2.75 | | | |
| MIN. F | | | | -0.00 | -.09 | 2.84 |
| MIN. G | | | | -0.00 | -.09 | 2.84 |
| MIN. J | | | | 0.00 | .06 | -1.52 |



**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CB
**********

* REACCIONES *
(VALORES MAYORADOS)

| CAJON | EXTR. | | M | R | T | | M | R | T |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | MAX. M | 0.0 | 38.9 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 53.7 | 0.0 | MIN. R | 0.0 | -14.8 | 0.0 |
| | | MAX. T | 0.0 | 38.9 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 1 | 2 | MAX. M | 0.0 | 36.7 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 46.4 | 0.0 | MIN. R | 0.0 | -9.7 | 0.0 |
| | | MAX. T | 0.0 | 36.7 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 1 | MAX. M | 0.0 | 38.3 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 47.5 | 0.0 | MIN. R | 0.0 | -9.2 | 0.0 |
| | | MAX. T | 0.0 | 38.3 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 2 | MAX. M | 0.0 | 41.1 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 55.1 | 0.0 | MIN. R | 0.0 | -14.0 | 0.0 |
| | | MAX. T | 0.0 | 41.1 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 250.482 | 53.667 | -4.517 |
| EXT.DCH. | 256.940 | 55.116 | -4.583 |

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CR
**********

* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(ESFUERZOS MAYORADOS. MOVIMIENTOS SIN MAYORAR)

CAJON 1

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | |
| MAX. M | 9.87 | 12.43 | 2.10 | | | |
| MAX. Q | 9.75 | 13.26 | 2.03 | | | |
| MAX. T | -11.04 | -33.00 | 63.49 | | | |
| MAX. F | | | | 0.00 | -.26 | -8.69 |
| MAX. G | | | | -0.00 | .12 | -3.67 |
| MAX. J | | | | 0.00 | 0.00 | 0.00 |
| MIN. M | -12.51 | -57.27 | -18.47 | | | |
| MIN. Q | -12.07 | -70.86 | -6.58 | | | |
| MIN. T | -12.51 | -57.27 | -18.47 | | | |
| MIN. F | | | | -0.00 | .11 | -3.67 |
| MIN. G | | | | 0.00 | -.68 | -8.72 |
| MIN. J | | | | 0.00 | -.59 | -8.76 |
| CUARTO LUZ | | | | | | |
| MAX. M | 345.62 | -70.86 | 55.67 | | | |
| MAX. Q | -57.21 | 13.26 | 2.03 | | | |
| MAX. T | 155.51 | -33.00 | 68.56 | | | |
| MAX. F | | | | 3.15 | -.50 | -8.77 |
| MAX. G | | | | -.54 | .08 | -3.67 |
| MAX. J | | | | 0.00 | 0.00 | 0.00 |
| MIN. M | -57.21 | 13.26 | 2.03 | | | |
| MIN. Q | 345.62 | -70.86 | 55.67 | | | |
| MIN. T | 165.15 | -34.94 | -46.02 | | | |
| MIN. F | | | | -.54 | .08 | -3.67 |
| MIN. G | | | | 3.15 | -.50 | -8.77 |
| MIN. J | | | | 2.61 | -.36 | -8.77 |
| CENTRO LUZ | | | | | | |
| MAX. M | 468.61 | -41.31 | -36.09 | | | |
| MAX. Q | 468.61 | 35.83 | -36.09 | | | |
| MAX. T | 135.58 | 6.74 | 68.56 | | | |
| MAX. F | | | | 4.52 | 0.00 | -8.86 |
| MAX. G | | | | 3.34 | .06 | -8.63 |
| MAX. J | | | | 0.00 | 0.00 | 0.00 |
| MIN. M | -75.65 | 6.35 | -1.03 | | | |
| MIN. Q | 468.61 | -41.31 | -36.09 | | | |
| MIN. T | 137.38 | -12.76 | -71.34 | | | |
| MIN. F | | | | -.76 | 0.00 | -3.67 |
| MIN. G | | | | 3.36 | -.06 | -8.63 |
| MIN. J | | | | 4.52 | 0.00 | -8.86 |
| TRES CUARTOS LUZ | | | | | | |
| MAX. M | 346.17 | 64.49 | -61.08 | | | |
| MAX. Q | 346.17 | 64.49 | -61.08 | | | |
| MAX. T | 87.37 | 13.05 | 41.47 | | | |
| MAX. F | | | | 3.15 | .50 | -8.79 |
| MAX. G | | | | 3.15 | .50 | -8.79 |
| MAX. J | | | | 0.00 | 0.00 | 0.00 |
| MIN. M | -61.75 | -7.59 | -2.48 | | | |
| MIN. Q | 346.17 | -13.40 | -61.08 | | | |
| MIN. T | 157.25 | 26.85 | -71.34 | | | |
| MIN. F | | | | -.55 | -.09 | -3.67 |
| MIN. G | | | | -.55 | -.09 | -3.67 |
| MIN. J | | | | 2.63 | .37 | -8.79 |
| APOYO '2' | | | | | | |
| MAX. M | 7.82 | 64.49 | 2.95 | | | |
| MAX. Q | 7.82 | 64.49 | 2.95 | | | |
| MAX. T | 7.77 | 50.58 | 14.51 | | | |
| MAX. F | | | | 0.00 | .27 | -8.71 |
| MAX. G | | | | 0.00 | .69 | -8.75 |
| MAX. J | | | | 0.00 | 0.00 | 0.00 |
| MIN. M | -9.28 | -7.52 | -2.31 | | | |
| MIN. Q | -8.24 | -7.75 | -.75 | | | |
| MIN. T | 7.82 | 26.85 | -65.88 | | | |
| MIN. F | | | | -0.00 | -.12 | -3.27 |
| MIN. G | | | | -0.00 | -.12 | -3.67 |
| MIN. J | | | | 0.00 | .60 | -8.79 |

CAJON 2

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | |
| MAX. M | 8.48 | -27.45 | -71.32 | | | |
| MAX. Q | -7.64 | 7.15 | -.74 | | | |
| MAX. T | 8.41 | -51.14 | 15.68 | | | |
| MAX. F | | | | 0.00 | -.28 | 9.43 |
| MAX. G | | | | -0.00 | .11 | 3.38 |
| MAX. J | | | | 0.00 | -.61 | 9.49 |
| MIN. M | -8.73 | 6.92 | -2.32 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | MIN. Q | 8.47 | -65.06 | 3.21 | | |
| | MIN. T | 8.48 | -27.45 | -71.32 | | |
| | MIN. F | | | | -0.00 | .11 | 2.98 |
| | MIN. G | | | | 0.00 | -.70 | 9.43 |
| | MIN. J | | | | 0.00 | 0.00 | 0.00 |
| CUARTO LUZ | | | | | | | |
| | MAX. M | 350.97 | -65.06 | -66.01 | | |
| | MAX. Q | 350.97 | 13.37 | -66.01 | | |
| | MAX. T | 91.92 | -13.59 | 44.93 | | |
| | MAX. F | | | | 3.19 | -.51 | 9.48 |
| | MAX. G | | | | -.51 | .08 | 3.38 |
| | MAX. J | | | | 2.67 | -.37 | 9.50 |
| | MIN. M | -56.98 | 6.98 | -2.47 | | |
| | MIN. Q | 350.97 | -65.06 | -66.01 | | |
| | MIN. T | 162.18 | -27.45 | -77.23 | | |
| | MIN. F | | | | -.51 | .08 | 3.38 |
| | MIN. G | | | | 3.19 | -.51 | 9.48 |
| | MIN. J | | | | 0.00 | 0.00 | 0.00 |
| C' 'TRO LUZ | | | | | | | |
| | MAX. M | 474.57 | 41.81 | -38.75 | | |
| | MAX. Q | 474.57 | 41.81 | -38.75 | | |
| | MAX. T | 141.36 | -6.73 | 74.33 | | |
| | MAX. F | | | | 4.58 | -0.00 | 9.56 |
| | MAX. G | | | | 3.42 | .06 | 9.32 |
| | MAX. J | | | | 4.58 | -0.00 | 9.56 |
| | MIN. M | -69.69 | -5.86 | -1.00 | | |
| | MIN. Q | 474.57 | -35.83 | -38.75 | | |
| | MIN. T | 143.47 | 13.28 | -77.23 | | |
| | MIN. F | | | | -.70 | -0.00 | 3.38 |
| | MIN. G | | | | 3.40 | -.06 | 9.32 |
| | MIN. J | | | | 0.00 | 0.00 | 0.00 |
| TRES CUARTOS LUZ | | | | | | | |
| | MAX. M | 350.18 | 71.93 | 60.52 | | |
| | MAX. Q | 350.18 | 71.93 | 60.52 | | |
| | MAX. T | 159.98 | 34.05 | 74.33 | | |
| | MAX. F | | | | 3.19 | .51 | 9.46 |
| | MAX. G | | | | 3.19 | .51 | 9.46 |
| | MAX. J | | | | 2.65 | .37 | 9.48 |
| | MIN. M | -52.68 | -12.22 | 1.88 | | |
| | MIN. Q | -52.68 | -12.22 | 1.88 | | |
| | MIN. T | 169.81 | 36.01 | -49.61 | | |
| | MIN. F | | | | -.49 | -.08 | 3.38 |
| | MIN. G | | | | -.49 | -.08 | 3.38 |
| | MIN. J | | | | 0.00 | 0.00 | 0.00 |
| APOYO '2' | | | | | | | |
| | MAX. M | 9.19 | -11.38 | 1.98 | | |
| | MAX. Q | -12.87 | 71.93 | -6.92 | | |
| | MAX. T | -11.89 | 34.05 | 68.89 | | |
| | MAX. F | | | | 0.00 | .27 | 9.41 |
| | MAX. G | | | | 0.00 | .69 | 9.41 |
| | MAX. J | | | | 0.00 | .60 | 9.46 |
| | MIN. M | -13.27 | 58.35 | -19.77 | | |
| | MIN. Q | 9.01 | -12.22 | 1.88 | | |
| | MIN. T | -13.27 | 58.35 | -19.77 | | |
| | MIN. F | | | | -0.00 | -.10 | 3.38 |
| | MIN. G | | | | -0.00 | -.11 | 3.38 |
| | MIN. J | | | | 0.00 | 0.00 | 0.00 |

**ESTUDIO:24785 E-1500.4 VANOS 1 Y 3**

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CR
**********

* REACCIONES *
(VALORES MAYORADOS)

| CAJON | EXTR. | | M | R | T | | M | R | T |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | MAX. M | 0.0 | 100.8 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 100.8 | 0.0 | MIN. R | 0.0 | -18.2 | 0.0 |
| | | MAX. T | 0.0 | 100.8 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 1 | 2 | MAX. M | 0.0 | 16.2 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 93.3 | 0.0 | MIN. R | 0.0 | -12.1 | 0.0 |
| | | MAX. T | 0.0 | 16.2 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 1 | MAX. M | 0.0 | -10.9 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 94.2 | 0.0 | MIN. R | 0.0 | -11.2 | 0.0 |
| | | MAX. T | 0.0 | -10.9 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 2 | MAX. M | 0.0 | -16.2 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 102.3 | 0.0 | MIN. R | 0.0 | -16.7 | 0.0 |
| | | MAX. T | 0.0 | -16.2 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 468.615 | 100.809 | -71.340 |
| EXT.DCH. | 474.570 | 102.269 | -77.228 |

ELECCION VIGA PESIMA A FLEXION
******** **** ****** * *******

SECCIONES COMPUESTAS

| | SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| VIGA EXTERIOR IZQ. | 462.94 | 92.45 | 21012.90 | 82593327.0 | 90.36 | 21616.58 | 86771624.5 | 91.82 | 21277.92 | 84450532.8 |
| VIGA EXTERIOR DCHA | 462.94 | 92.45 | 21012.90 | 82593327.0 | 90.36 | 21616.58 | 86771624.5 | 91.82 | 21277.92 | 84450532.8 |

MOMENTOS FLECTORES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=29.10
======== ========= === === ====== =========== == ==== ==== * =======

| VIGA | SCAJ | SDER | SIZQ | S | MF | MM | MSOB | TINF |
|---|---|---|---|---|---|---|---|---|
| EXT. IZQ. | 382.00 | 24.30 | 228.40 | 634.70 | 337318.01 | 125348.68 | 479394.00 | -27.20 |
| EXT. DCHA. | 382.00 | 239.00 | 24.30 | 645.30 | 363292.68 | 134534.01 | 487673.37 | -33.01 |

CALCULO VIGA PESIMA A FLEXION
======= **** ****** * *******

DATOS DE LUCES Y CARGAS DE CALCULO

| PP | PCM | PSOB | P | b | L1 | Cap | Cas |
|---|---|---|---|---|---|---|---|
| [illegible] | 2447.20 | 3361.69 | 23190.76 | 1.50 | 23.10 | 1.35 | 1.50 |

DATOS DE ESFUERZOS

| MF | ML | MCM | MS |
|---|---|---|---|
| 1777[illegible] | 0.00 | 134534.00 | 487673.3 |

SECCIONES COMPUESTAS

| SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | 92.45 | 21012.90 | 82593327.0 | 90.36 | 21616.58 | 86771624.5 | 91.82 | 21277.92 | 84450532.8 |

PERDIDAS PRETENSADO

| DT3 | FR1 | DTS | DT4 | DT5 | DT6 | PPP |
|---|---|---|---|---|---|---|
| 536.22 | 1430.78 | 0.00 | 450.62 | 333.13 | 573.17 | 1140[illegible] |

TENSIONES

| | PARCIALES | | | | ACUMULADAS | | | |
|---|---|---|---|---|---|---|---|---|
| | SL | IL | SV | IV | SL | IL | SV | IV |
| PRET INIC | 0.00 | 0.00 | -16.43 | 113.75 | 0.00 | 0.00 | -16.43 | 113.75 |
| PRET FIN | 0.00 | 0.00 | -13.23 | 91.59 | 0.00 | 0.00 | -13.23 | 91.59 |
| PPROP.VIGA | 0.00 | 0.00 | 46.44 | -25.08 | 0.00 | 0.00 | 33.24 | 66.51 |
| PPROP.LOSA | 0.00 | 0.00 | 60.48 | -32.66 | 0.00 | 0.00 | 93.72 | 33.85 |
| CAR.MUERTA | 11.57 | 7.70 | 7.70 | -14.01 | 11.57 | 7.70 | 101.41 | 19.84 |
| SOB.CASI-PERM | 9.49 | 5.60 | 5.60 | -10.57 | 20.06 | 13.30 | 107.01 | 9.08 |
| SOB.FRECUENTE | 21.22 | 14.00 | 14.00 | -26.42 | 32.79 | 21.70 | 115.41 | -6.78 |
| SOB.CARACT. | 42.43 | 28.00 | 28.00 | -52.85 | 54.01 | 35.69 | 129.41 | -33.20 |

FISURACION C2 COMPROBADA

CALCULO A ROTURA

MOMENTO DE ROTURA 1350077.19

MOMENTO NECESARIO 1403576.07

REFUERZO 2D 25 EN 9.24 m

ELECCION VIGA PESIMA A CORTANTE

SECCIONES COMPUESTAS

| | SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| VIGA EXTERIOR IZQ. | 606.30 | 99.22 | 23684.27 | 91279897.9 | 97.19 | 24287.95 | 96091786.3 | 98.32 | 23949.29 | 93416629.1 |
| VIGA EXTERIOR DCHA. | 606.30 | 99.22 | 23684.27 | 91279897.9 | 97.19 | 24287.95 | 96091786.3 | 98.32 | 23949.29 | 93416629.1 |

ESFUERZOS CORTANTES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=20.19

| VIGA | SCAJ | SDER | SIZQ | S | QF | QM | QSOB | VRD |
|---|---|---|---|---|---|---|---|---|
| EXT. IZQ. | 382.00 | 24.30 | 226.40 | 634.70 | 66828.73 | 24833.22 | 102983.44 | 278218.79 |
| EXT. DCHA. | 382.00 | 239.00 | 24.30 | 645.30 | 71974.78 | 28168.94 | 104923.34 | 292576.33 |

## CALCULO VIGA PESIMA A CORTANTE

DATOS VIGA SECCION SIMPLE Y COMPUESTA (cm)

| Y | YG | A | I | E | OP | SEF | LOS | R | YC | YSC | AC | IC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140.00 | 50.62 | 12386.48 | 29367022.36 | 40.00 | 0.00 | 606.30 | 25.00 | .75 | 165.00 | 99.22 | 23684.27 | 91279897.87 |

PRETENSADO Y MATERIALES (kg y cm)

| FI | FS | EI | ES | FCD | FYD | PP | PCM | PSOB | F | B | LCAL | CSP | CSS | OPAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 593628.00 | 64176.00 | 5.00 | 5.00 | 321.43 | 4200.00 | 7129.75 | 2790.19 | 3639.81 | 24550.44 | 1.50 | 20.19 | 1.35 | 1.50 | -2.( |

DATOS LUCES Y CARGAS (kg y m)

DATOS ALAS

| KS | KI | BRAS | HSUP/2 | V |
|---|---|---|---|---|
| .293 | .500 | 56.400 | 16.558 | 40.781 |

ENFUNDADOS

| F1 | EI1 | X1 | F2 | EI2 | X2 |
|---|---|---|---|---|---|
| 481320.00 | 5.00 | 2.63 | 545496.00 | 5.00 | .74 |

## RESULTADOS ESFUERZOS

| X | MPP | MSB | QPP | QSB | MTOR | VRD | VU1 | TUD | TU1 | COEF | ZONA | TRAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.0 | 0.0 | 100141.7 | 104923.3 | 49195 | 292576.3 | 617142.9 | 73791.8 | 603748.2 | .60 | AB | 12.27 |
| 1.00 | 99409.9 | 97725.8 | 90221.8 | 97725.8 | 50388 | 268388.0 | 571674.6 | 75582.3 | 544965.5 | .61 | AB | 11.43 |
| 2.00 | 1289[illegible].1 | 191416.9 | 80301.8 | 90708.5 | 51582 | 244470.2 | 546892.0 | 77372.8 | 521993.7 | .60 | AB | 10.61 |
| 3.00 | 1[illegible]8.5 | 281614.3 | 70381.9 | 83871.4 | 52776 | 220822.7 | 525814.8 | 79163.3 | 548337.7 | .56 | AB | 9.81 |
| 4.00 | 23[illegible].1 | 368858.7 | 60462.0 | 77214.7 | 53969 | 197445.7 | 508928.1 | 80953.8 | 548337.7 | .54 | C | 9.03 |
| 5.00 | 2[illegible].1 | 353691.1 | 50542.1 | 70738.2 | 55163 | 174339.1 | 495884.5 | 82744.3 | 548337.7 | .50 | C | 8.27 |
| 6.00 | 3[illegible].2 | 386662.1 | 40622.1 | 64442.0 | 55430 | 151502.9 | 485784.1 | 83144.6 | 548337.7 | .44 | C | 7.53 |
| 7.00 | 3[illegible].7 | 438282.7 | 30702.2 | 58326.1 | 55650 | 128937.1 | 478246.2 | 83475.5 | 548337.7 | .42 | C | 6.82 |
| 8.00 | 3[illegible].6 | 419123.7 | 20782.3 | 52390.5 | 55871 | 106641.7 | 472994.5 | 83806.4 | 548337.7 | .39 | C | 6.13 |
| 9.00 | 3[illegible].3 | 419716.0 | 10862.3 | 46635.1 | 56092 | 84616.8 | 469842.5 | 84137.3 | 548337.7 | .33 | C | 5.45 |
| 10.00 | 3[illegible].5 | 417603.2 | 942.4 | 41060.0 | 56312 | 62862.3 | 468681.1 | 84468.2 | 548337.7 | .29 | C | 4.80 |
| 4.00 | 23[illegible].6 | 368603.6 | 60511.6 | 77247.5 | 53963 | 197561.9 | 508901.5 | 80944.9 | 548337.7 | .54 | C | 9.03 |
| 2.59 | 1[illegible].4 | 224694.3 | 74411.2 | 86626.7 | 52291 | 230395.2 | 534192.5 | 78436.1 | 548337.7 | .57 | AB | 10.13 |
| 3.37 | 2[illegible].6 | 274473.6 | 66678.2 | 81364.9 | 53221 | 212063.0 | 519215.2 | 79831.8 | 548337.7 | .55 | AB | 9.51 |

RESULTADOS ESFUERZOS LOCALES

- En ala superior .....: Md= 732.16 m*kgr/m Asup= .40 cm2. Ainf= 1.00 cm2.
- En alma :Hacia el interior...: Md= -2055.48 m*kgr/m. Aint= 0.00 cm2. Aext= 2.64 cm2.

RESULTADOS ARMADO

| X | Asup | Ainf | Alos | Alon | Ast1 | Alts | Alta | Alti | Astas |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.74 | 21.11 | 13.05 | 38.83 | 2.04 | 1.94 | 1.95 | 1.95 | 23.34 |
| 1.00 | 3.43 | 19.36 | 9.09 | 23.48 | 2.07 | 1.98 | 1.98 | 1.98 | 18.29 |
| 2.00 | 2.92 | 17.64 | 7.14 | 18.73 | 2.14 | 2.03 | 1.96 | 1.96 | 14.79 |
| 3.00 | 2.31 | 15.93 | 5.89 | 15.11 | 2.19 | 2.08 | 1.99 | 1.99 | 12.10 |
| 4.00 | 1.84 | 14.25 | 4.99 | 17.20 | 2.24 | 2.12 | 2.03 | 2.03 | 16.27 |
| 5.00 | 1.52 | 12.59 | 4.29 | 14.51 | 2.29 | 2.17 | 2.08 | 2.08 | 14.17 |
| 6.00 | 1.23 | 10.93 | 3.74 | 11.96 | 2.33 | 2.18 | 2.09 | 2.09 | 11.94 |
| 7.00 | .95 | 9.30 | 3.31 | 9.47 | 2.31 | 2.19 | 2.09 | 2.10 | 9.50 |
| 8.00 | .68 | 7.69 | 2.89 | 7.01 | 2.32 | 2.20 | 2.10 | 2.10 | 8.57 |
| 9.00 | .33 | 6.11 | 2.47 | 4.58 | 2.33 | 2.21 | 2.11 | 2.11 | 8.57 |
| 10.00 | .03 | 4.54 | 2.07 | 2.19 | 2.34 | 2.22 | 2.12 | 2.12 | 8.57 |
| 4.00 | 1.85 | 14.25 | 4.99 | 17.21 | 2.24 | 2.12 | 2.03 | 2.03 | 16.28 |
| 2.59 | 2.52 | 16.62 | 6.35 | 16.53 | 2.17 | 2.06 | 1.97 | 1.97 | 13.12 |
| 3.37 | 2.12 | 15.38 | 5.53 | 13.97 | 2.21 | 2.09 | 2.00 | 2.00 | 11.24 |

ARMADURA MINIMA ALMA 8.57

CALCULOS A TORSOR SOLO VALIDOS EN SECCION CERRADA.

# RESUMEN DE REACCIONES

(sin mayorar y por extremo)

DATOS DE CARGAS MAXIMAS (EXTREMO ANTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 75.071 | | 80.851 | |
| Permanentes | 29.888 | 0.000 | 28.890 | 0.000 |
| Sobrec.unif (Qmax) | 40.190 | 0.000 | 35.608 | 0.000 |
| Sobrec.unif (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmax) | 67.206 | 0.000 | 62.787 | 0.000 |
| Vehiculo (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |

DATOS DE CARGAS MINIMAS (EXTREMO ANTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 75.071 | | 80.851 | |
| Permanentes | 29.888 | 0.000 | 28.890 | 0.000 |
| Sobrec.unif (Qmin) | -11.048 | 0.000 | -6.924 | 0.000 |
| Sobrec.unif (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmin) | -12.106 | 0.000 | -7.446 | 0.000 |
| Vehiculo (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |

DATOS DE CARGAS MAXIMAS (EXTREMO POSTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 75.071 | | 80.851 | |
| Permanentes | 27.734 | 0.000 | 31.641 | 0.000 |
| Sobrec.unif (Qmax) | 34.783 | 0.000 | 41.275 | 0.000 |
| Sobrec.unif (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmax) | 62.220 | 0.000 | 68.179 | 0.000 |
| Vehiculo (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |

DATOS DE CARGAS MINIMAS (EXTREMO POSTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 75.071 | | 80.851 | |
| Permanentes | 27.734 | 0.000 | 31.641 | 0.000 |
| Sobrec.unif (Qmin) | -7.293 | 0.000 | -10.470 | 0.000 |
| Sobrec.unif (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmin) | -8.063 | 0.000 | -11.161 | 0.000 |
| Vehiculo (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |

CARGAS HORIZONTALES EN LA VIGA PESIMA ( Ver desglose en hoja de calculo de neoprenos).

( ESTUDIO: 24785 L= 20.19 Lte= 22.58 )

MATRIZ AREAS

| | | | |
|---|---|---|---|
| 304.500 | 21.490 | 6.043 | 23.154 |
| 300.000 | 13.832 | 3.877 | 21.458 |
| 524.500 | 10.841 | 1.844 | 16.489 |

MATRIZ ZON

| | | | |
|---|---|---|---|
| 387.500 | 1612.125 | 12.125 | 16.125(5 ramas) |
| 240.000 | 1010.200 | 8.200 | 1212.200 |
| 501.500 | 12.200 | 6.200 | 1710.200 |

Armadura superior en riostra: 2 D 25a 12.5cm

CUANTIA CERCOS (kg/m: 335.61

Armadura longitudinal inferior de la viga 2d16+ 2d16+ 8d 5
Armadura longitudinal del alma de la viga 1d12+ 7d 6 (en cada alma).
Armadura longitudinal superior de la viga 2d16+ 6d 6 (en cada ala superior)

Se ha mantenido la matriz PAS. La matriz vale:

| | |
|---|---|
| 16.18700 | .07400 |
| 16.17500 | .08900 |
| 12.10300 | .13600 |
| 10.14150 | .13600 |
| 8.03225 | .03000 |

| As1 | E1 | Ass | Es | Ki | As1 | E11 | As2 | E12 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 51.800 | 5.000 | 5.600 | 5.000 | .500 | 42.000 | 5.000 | 47.600 | 5.000 | 3.000 | 4.000 |

MATRIZ T

| | | | | | |
|---|---|---|---|---|---|
| 1.0000 | 5.0000 | 1.0038 | 5.0045 | 1.0090 | 3.0045 |
| 1.0000 | 4.5000 | 1.0083 | 4.0045 | 1.0090 | 3.0045 |
| 1.0000 | 4.5000 | 1.0083 | 4.0045 | 1.0090 | 3.0045 |
| 1.0000 | 4.5000 | 1.0083 | 4.0045 | 1.0090 | 3.0045 |
| 1.0000 | 4.5000 | 1.0260 | 1.0090 | 3.0045 | 0.0000 |
| 1.0000 | 112.5000 | 1.0970 | 1.0100 | 2.0045 | 0.0000 |

ESTUDIO: 24785
TITULO: E-1500.4
VANO 2

FECHA: 11-08-00

## ANEJO DE CALCULO DEL TABLERO DE VIGAS CAJON

### 1. DATOS GENERALES

**1.1 Seccion transversal (Datos para el calculo)**
Ancho total plataforma ..... 12.80 m.
Ancho de las aceras (sin trafico). 1.40(Real) 1.40 (Calc.izq)
1.40 (Calc.dch)

**1.2 Seccion longitudinal**
Tramo isostatico
Luz de calculo ..... 32.00 m.
Longitud de la viga ..... 33.50 m.

**1.3 Planta**
Esviaje ..... 40.77 °
Radio curvatura ..... RECTO

### 2. SOLUCION ADOPTADA

El tablero esta formado por vigas prefabricadas pretensadas sobre las que se vierte hormigon fabricado in situ para formar la losa de compresion
Tipo de viga ..... NOAL 382.140.20
Canto de la viga ..... 1.40 m.
Canto de la losa ..... .25 m.
Numero de vigas ..... 2
Separacion entre vigas ..... 4.306 m.
Las caracteristicas de la viga figuran en el listado de resultados

### 3. ACCIONES A CONSIDERAR

Peso propio de la viga ..... 3096.62 Kg/m
Peso propio de la losa ..... 625.00 Kg/m2.
Carga muerta ..... 207.0 Kg/m2.
Carga adicional en bordes debida a aceras .. 1280.00 Kg/m.
Sobrecarga ..... IAP-98

### 4. CARACTERISTICAS DE LOS MATERIALES Y COEFICIENTES DE SEGURIDAD SEGUN EP.-93

**4.1 Hormigon de la viga**
Resistencia caracteristica a los 28 dias .....>= 450 Kgr/cm2
Nivel de control intenso (prefabricacion) .....= 1.4

**4.2 Hormigon de la losa**
Resistencia caracteristica a los 28 dias .....>= 250 Kgr/cm2
Nivel de control normal (fabricacion in situ)...= 1.5

**4.3 Acero de pretensado en viga**
Tension de rotura .....>= 19000 Kgr/cm2
Limite elastico al 0.2 .....>= 17100 Kgr/cm2
Nivel de control intenso (prefabricacion) .....= 1.1

**4.4 Acero pasivo en viga**
Limite elastico .....>= 5100 Kgr/cm2
Nivel de control intenso (prefabricacion) .....= 1.1

**4.5 Acero pasivo en la losa**
Limite elastico .....>= 5100 Kgr/cm2
Nivel de control normal (fabricacion in situ)...= 1.15

**4.6 Acciones**
Cargas permanentes .....= 1.35 Sobrecargas .....= 1.50

ESTUDIO: 24785

DATOS DE LA VIGA NOAL 382.140.20(485)

FICHERO:ARTESAS

DATOS DE FORMA

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BASES EXTERIORES | 382.00 | 382.00 | 262.30 | 264.50 | 67.60 | 40.00 | 40.00 | 91.40 | 96.40 |
| BASES INTERIORES | 0.00 | 0.00 | 0.00 | 0.00 | 196.90 | 227.90 | 245.70 | 198.60 | 198.60 |
| ALTURAS | 9.00 | 0.00 | 9.00 | 0.00 | 13.50 | 71.30 | 17.50 | 18.70 | |

| Y | YG | A | In | Ws | Wi | E | Ks |
|---|---|---|---|---|---|---|---|
| 141.00 | 50.62 | 12386.48 | 29367022.36 | 328574.77 | 580112.08 | 40.00 | .29 |

DATOS PRETENSADO

| As1 | E1 | Ass | Es | K1 | As1 | E11 | As2 | E12 |
|---|---|---|---|---|---|---|---|---|
| 120.400 | 7.400 | 5.600 | 5.000 | .600 | 92.400 | 6.672 | 106.400 | 7.784 |

DATOS MATERIALES

| Fck | fc | Fyv | Fyl | Fpk | Fpr | Rps | Fik | Rsl | Ns | Ns | Cmj | Css | Nu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 501.97 | .75 | 4636.36 | 4434.78 | 14800.00 | 15545.45 | .20 | 2.... | 4.00 | 11.6 | 5.00 | 1.35 | 1.50 | 0.00 |

CARACTERISTICAS HOMOGENEIZADAS

| Yi | Ai | Ii | Ygsp | Adp | Idp | Ygs | As | Is | Ygi | Am | Im |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50.62 | 13384.62 | 29824264.53 | 46.99 | 13711.62 | 31971371.73 | 44.94 | 13909.22 | 30092821.... | 46.99 | 13711.62 | 31971371.73 |

## CALCULO GENERAL DE VIGAS

DATOS TABLERO

| ANCH | CVEI | CVED | L | LTE | LMED | NVG | ACEI | ACED | LOS | ELI | ELS | BRAS | PASIO | AINTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12.8... | 4.19 | 4.30 | 32.00 | 33.50 | 33.50 | 2.00 | 1.40 | 1.40 | 25.00 | 8.00 | 2.50 | 50.40 | 5.16 | 42364.40 |

| CM | PACI | PACD | DPAC | TRL | PE | LAP | CPAR | APOY | NAPO | BEI | BED |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 207 | 1280.00 | 1280.00 | .45 | -50.00 | 5000.00 | 0.00 | 0.00 | 0.00 | 0.00 | 40.77 | 40.77 |

OPCIONES

NEOPRENO

| OPCIR | OPMAN | OPTV | OPCOR | OPAL | OPDI | OPDF | OPNEO | ENP | INP | TNP | GNP | CHNP | G | TEMP | SNEO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | -2.00 | -1.00 | -1.00 | -1.00 | 20.00 | 100.00 | 5.20 | 4.04 | .80 | 10.00 | 30.00 | 0.00 |

DATOS DIBUJO

| LM | LTRAN | LPARR | LMIN | PEND | CU | ESV1 | ESV2 | NMAC |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.0 | 12.0 | 2.0 | 0.0 | 0.0 | 40.8 | 40.8 | 0.0 |

| ENTI | ENTD | DAPI | DAPD | APOYOI | APOYOD | ANI | AND | DVII | DVDI | DVIS | DVDS | ALFA | PTR | VOST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .50 | .50 | .25 | .25 | .55 | .55 | 12.80 | 12.80 | 4.30 | 4.30 | 4.19 | 4.19 | 0.00 | 3.50 | 2 |

| LTRAM | LTOTAL | LCALC. |
|---|---|---|
| 19.82 | 22.21 | 19.82 |

| | | |
|---|---|---|
| 32.00 | 33.50 | 32.00 |
| 19.72 | 22.11 | 19.72 |

**ESTUDIO: 24785 E-1500.4 VANO 2**

RESUMEN DE RESULTADOS PARA ENLACE CON TENSCAJ

Valores caracteristicos (Kg/m,mTn.)

VIGA EXTERIOR IZQUIERDA

| TIPO DE CARGA | CARGAS VIRTUALES Flexion | Corte |
|---|---|---|
| Peso propio | 6619.983 | 6619.983 |
| Permanentes | 2459.952 | 2296.548 |
| Sobrecarg.I | 2992.441 | 3594.460 |
| Sobrecarg.II | 20522.021 | 23941.795 |
| Torsor apoyo | -62.966 | -62.966 |
| Torsor L/4 | -70.410 | -70.410 |
| Torsor L/2 | -74.136 | -74.136 |

VIGA EXTERIOR DERECHA

| TIPO DE CARGA | CARGAS VIRTUALES Flexion | Corte |
|---|---|---|
| Peso propio | 7097.000 | 7097.000 |
| Permanentes | 2604.500 | 2604.500 |
| Sobrecarg.I | 3064.448 | 3687.415 |
| Sobrecarg.II | 20748.326 | 24266.272 |
| Torsor apoyo | -66.366 | -66.366 |
| Torsor L/4 | -73.960 | -73.960 |
| Torsor L/2 | -77.784 | -77.784 |

CARGAS PESIMAS EN EXTREMOS

Solo validas a efectos del calculo de neoprenos

Valores caracteristicos (Tn,mTn.)

| EXT.IZQ. | Reaccion | Torsor |
|---|---|---|
| Rperm..... | 149.798 | 0.000 |
| Rmax..... | 285.590 | 0.000 |
| Rmin..... | 113.753 | 0.000 |
| T.Rmax..... | 285.590 | 0.000 |
| T.Rmin..... | 113.753 | 0.000 |

| EXT.DCH. | Reaccion | Torsor |
|---|---|---|
| Rperm..... | 152.787 | 0.000 |
| Rmax..... | 291.429 | 0.000 |
| Rmin..... | 118.698 | 0.000 |
| T.Rmax..... | 291.429 | 0.000 |
| T.Rmin..... | 118.698 | 0.000 |

**ESTUDIO:24785 E-1500.4 VANO 2**

DATOS GENERALES
**********

NC= 2, IT = 1

EC= 296985, EL= 221361

GEOMETRIA Y CARACTERISTICAS MECANICAS

V1 = 3.151, V2 = 3.257

DATOS SECCION SIMPLE [Cm]

| CAJON | X0 | A0 | I0 |
|---|---|---|---|
| 1 | 89.27 | 10612.43 | 26869759.9 |
| 2 | 89.27 | 10612.43 | 26869759.9 |

| HC | EB | C0 | E0 | EA | A1 | A2 | HB |
|---|---|---|---|---|---|---|---|
| 140.00 | 10.00 | 382.00 | 9.00 | 0.00 | 0.00 | 0.00 | 25.00 |

DATOS SECCION COMPUESTA [m]

| CAJON | YC | LC | AC | BC | SC | IC | JC |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 32.00 | 2.086 | 4.696 | 4.306 | .76996274 | .80457638 |
| 2 | -4.99 | 32.00 | 2.086 | 4.696 | | .76996274 | .80457638 |

COACCIONES

| CAJON | L1 | D1 | T1 | L2 | D2 | T2 |
|---|---|---|---|---|---|---|
| 1 | 0 | -1 | 0 | 0 | -1 | 0 |
| 2 | 0 | -1 | 0 | 0 | -1 | 0 |

CARGAS

PL = 0.000, PV = .207, P1 = 1.280, P2 = 1.280, U1 = .450, U2 = .450

PC = 0.00 0.00

W1= 2.90, W2= 2.90, AL= 0.00, GP = 1.35, GS = 1.50

TVC

**ESTUDIO:24785 E-1500.4 VANO 2**

RESULTADOS: NOTACION Y UNIDADES
**********

CAJONES : M = FLECTOR (M.TON)
Q = CORTANTE (TON.)
T = TORSOR (M.TON)
F = FLECHA (MM)
G = GIRO LONGITUDINAL (MILESIMAS RADIAN)
J = GIRO TORSOR (IDEM)

LOS VALORES DE Q Y T EN LOS EXTREMOS DE LOS CAJONES DEBEN IGNORARSE TOMANDO COMO TALES LAS REACCIONES R Y T

REACCIONES: M = MOMENTO SEGUN EJE 'X' (M.TON)
R = REACCION VERTICAL (TON.)
T = MOMENTO SEGUN EJE 'Y' (M.TON)

LOSA : M = FLECTOR TRANSVERSAL P.M.L. (M.TON/M)
Q = CORTANTE TRANSVERSAL P.M.L. (TON/M)
T = TORSOR TRANSVERSAL P.M.L. (M.TON/M)
M'= FLECTOR LONGITUDINAL P.M.L. (M.TON/M)
Q'= CORTANTE LONGITUDINAL P.M.L. (TON/M)
T'= TORSOR LONGITUDINAL P.M.L. (M.TON/M)

**ESTUDIO:24785 E-1500.4 VANO 2**

RESULTADOS ENVOLVENTES DE LAS 'HIPOTESIS DE CARGA'
**********

* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(ESFUERZOS MAYORADOS. MOVIMIENTOS SIN MAYORAR)

CAJON 1

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | |
| MAX. M | 35.37 | -15.00 | 12.96 | | | |
| MAX. Q | 29.47 | -9.06 | 8.32 | | | |
| MAX. T | -1.80 | -44.09 | 75.59 | | | |
| MAX. F | | | | 0.00 | -3.51 | -31.99 |
| MAX. G | | | | 0.00 | -.41 | -15.14 |
| MAX. J | | | | 0.00 | -1.12 | -10.27 |
| MIN. M | -66.50 | -154.37 | -51.02 | | | |
| MIN. Q | -61.81 | -173.03 | -40.31 | | | |
| MIN. T | -66.50 | -154.37 | -51.02 | | | |
| MIN. F | | | | 0.00 | -.42 | -15.14 |
| MIN. G | | | | 0.00 | -4.76 | -32.83 |
| MIN. J | | | | 0.00 | -4.17 | -35.93 |
| CENTRO LUZ | | | | | | |
| MAX. M | 1322.45 | -173.03 | 20.39 | | | |
| MAX. Q | 704.40 | 18.34 | 47.09 | | | |
| MAX. T | 350.90 | -44.09 | 75.59 | | | |
| MAX. F | | | | 34.65 | -3.40 | -33.11 |
| MAX. G | | | | 2.74 | -.25 | -15.10 |
| MAX. J | | | | 7.93 | -.74 | -10.24 |
| MIN. M | 92.90 | -9.06 | 2.15 | | | |
| MIN. Q | 1322.45 | -173.03 | 20.39 | | | |
| MIN. T | 1016.36 | -134.42 | -86.73 | | | |
| MIN. F | | | | 2.74 | -.25 | -15.10 |
| MIN. G | | | | 34.65 | -3.40 | -33.11 |
| MIN. J | | | | 30.30 | -2.98 | -36.16 |
| CENTRO LUZ | | | | | | |
| MAX. M | 1692.25 | -28.07 | -87.49 | | | |
| MAX. Q | 1584.51 | 74.88 | -96.49 | | | |
| MAX. T | 687.19 | 9.04 | 56.20 | | | |
| MAX. F | | | | 49.12 | .01 | -33.58 |
| MAX. G | | | | 26.11 | .23 | -24.01 |
| MAX. J | | | | 10.77 | .06 | -10.32 |
| MIN. M | 113.53 | 21.31 | -24.95 | | | |
| MIN. Q | 1692.25 | -70.80 | -87.49 | | | |
| MIN. T | 1042.19 | 9.10 | -111.20 | | | |
| MIN. F | | | | 3.54 | .04 | -15.14 |
| MIN. G | | | | 38.00 | -.19 | -30.27 |
| MIN. J | | | | 42.94 | .02 | -36.60 |
| TRES CUARTOS LUZ | | | | | | |
| MAX. M | 1277.86 | 154.87 | -79.14 | | | |
| MAX. Q | 1171.97 | 155.77 | -88.88 | | | |
| MAX. T | 700.83 | 81.15 | 43.79 | | | |
| MAX. F | | | | 34.53 | 3.41 | -33.51 |
| MAX. G | | | | 34.53 | 3.41 | -33.51 |
| MAX. J | | | | 7.32 | .74 | -10.52 |
| MIN. M | 31.58 | 13.21 | -26.48 | | | |
| MIN. Q | 655.73 | -14.37 | -85.34 | | | |
| MIN. T | 545.47 | 71.20 | -105.62 | | | |
| MIN. F | | | | 2.24 | .24 | -15.28 |
| MIN. G | | | | 2.24 | .24 | -15.28 |
| MIN. J | | | | 30.09 | 2.98 | -36.55 |
| APOYO '2' | | | | | | |
| MAX. M | 28.52 | 117.78 | 23.58 | | | |
| MAX. Q | 21.40 | 154.54 | 9.08 | | | |
| MAX. T | 28.52 | 117.78 | 23.58 | | | |
| MAX. F | | | | 0.00 | 3.52 | -32.99 |
| MAX. G | | | | 0.00 | 4.79 | -33.42 |
| MAX. J | | | | 0.00 | .98 | -10.66 |
| MIN. M | -52.66 | 33.81 | -36.48 | | | |
| MIN. Q | -38.24 | 13.21 | -20.60 | | | |
| MIN. T | -17.21 | 57.33 | -94.45 | | | |
| MIN. F | | | | 0.00 | .38 | -13.19 |
| MIN. G | | | | 0.00 | .28 | -15.39 |
| MIN. J | | | | 0.00 | 4.16 | -36.48 |

CAJON 2

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | |
| MAX. M | 31.74 | -120.54 | 25.71 | | | |
| MAX. Q | -34.91 | -15.30 | -19.43 | | | |
| MAX. T | 31.74 | -120.54 | 25.71 | | | |
| MAX. F | | | | 0.00 | -3.64 | 34.47 |
| MAX. G | | | | 0.00 | -.36 | 15.52 |
| MAX. J | | | | 0.00 | -4.30 | 37.82 |
| MIN. M | -48.98 | -36.27 | -35.23 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | MIN. Q | 25.19 | -157.69 | 10.85 | | |
| | MIN. T | -13.35 | -59.80 | -99.55 | | |
| | MIN. F | | | | 0.00 | -.46 | 13.32 |
| | MIN. G | | | | 0.00 | -4.91 | 34.83 |
| | MIN. J | | | | 0.00 | -1.05 | 10.86 |
| CUARTO LUZ | | | | | | | |
| | MAX. M | 1309.03 | -158.02 | -83.43 | | |
| | MAX. Q | 677.92 | 13.77 | -89.59 | | |
| | MAX. T | 850.93 | -99.52 | 48.01 | | |
| | MAX. F | | | | 35.40 | -3.49 | 34.94 |
| | MAX. G | | | | 2.84 | -.30 | 15.41 |
| | MAX. J | | | | 31.09 | -3.07 | 37.90 |
| | MIN. M | 55.36 | -15.30 | -25.48 | | |
| | MIN. Q | 1208.70 | -158.91 | -92.76 | | |
| | MIN. T | 571.19 | -73.66 | -110.94 | | |
| | MIN. F | | | | 2.84 | -.30 | 15.41 |
| | MIN. G | | | | 35.40 | -3.49 | 34.94 |
| | MIN. J | | | | 7.78 | -.79 | 10.72 |
| TRO LUZ | | | | | | | |
| | MAX. M | 1732.12 | 28.82 | -90.89 | | |
| | MAX. Q | 1732.12 | 72.53 | -90.89 | | |
| | MAX. T | 727.90 | -8.35 | 61.51 | | |
| | MAX. F | | | | 50.31 | -.01 | 35.02 |
| | MAX. G | | | | 39.06 | .19 | 31.59 |
| | MAX. J | | | | 44.32 | -.02 | 37.98 |
| | MIN. M | 139.58 | -20.76 | -24.31 | | |
| | MIN. Q | 1630.40 | -75.01 | -99.54 | | |
| | MIN. T | 1088.20 | -8.04 | -116.68 | | |
| | MIN. F | | | | 4.36 | -.04 | 15.28 |
| | MIN. G | | | | 27.06 | -.23 | 24.88 |
| | MIN. J | | | | 11.40 | -.06 | 10.53 |
| RES CUARTOS LUZ | | | | | | | |
| | MAX. M | 1353.62 | 177.50 | 24.44 | | |
| | MAX. Q | 1353.62 | 177.50 | 24.44 | | |
| | MAX. T | 371.94 | 47.21 | 80.85 | | |
| | MAX. F | | | | 35.49 | 3.48 | 34.53 |
| | MAX. G | | | | 35.49 | 3.48 | 34.53 |
| | MAX. J | | | | 31.27 | 3.07 | 37.52 |
| | MIN. M | 112.07 | 12.17 | 1.10 | | |
| | MIN. Q | 725.62 | -16.67 | 51.35 | | |
| | MIN. T | 1047.44 | 138.86 | -91.16 | | |
| | MIN. F | | | | 3.31 | .30 | 15.23 |
| | MIN. G | | | | 3.31 | .30 | 15.23 |
| | MIN. J | | | | 8.38 | .79 | 10.45 |
| APOYO '2' | | | | | | | |
| | MAX. M | 31.74 | 18.10 | 11.81 | | |
| | MAX. Q | -66.38 | 177.50 | -42.35 | | |
| | MAX. T | -5.74 | 47.21 | 80.85 | | |
| | MAX. F | | | | 0.00 | 3.62 | 33.47 |
| | MAX. G | | | | 0.00 | 4.87 | 34.24 |
| | MAX. J | | | | 0.00 | 4.30 | 37.26 |
| | MIN. M | -71.00 | 158.84 | -53.61 | | |
| | MIN. Q | 25.68 | 12.17 | 7.08 | | |
| | MIN. T | -71.00 | 158.84 | -53.61 | | |
| | MIN. F | | | | 0.00 | .49 | 15.27 |
| | MIN. G | | | | 0.00 | .48 | 15.27 |
| | MIN. J | | | | 0.00 | 1.18 | 10.47 |

ESTUDIO:24785 E-1500.4 VANO 2

RESULTADOS ENVOLVENTES DE LAS 'HIPOTESIS DE CARGA'
**********

* REACCIONES *
(VALORES MAYORADOS)

| CAJON | EXTR. | | M | R | T | | M | R | T |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | MAX. M | 0.0 | 228.2 | 0.0 | MIN. M | 0.0 | 44.6 | 0.0 |
| | | MAX. R | 0.0 | 249.1 | 0.0 | MIN. R | 0.0 | 6.5 | 0.0 |
| | | MAX. T | 0.0 | 228.2 | 0.0 | MIN. T | 0.0 | 44.6 | 0.0 |
| 1 | 2 | MAX. M | 0.0 | 118.4 | 0.0 | MIN. M | 0.0 | 36.7 | 0.0 |
| | | MAX. R | 0.0 | 220.2 | 0.0 | MIN. R | 0.0 | 2.4 | 0.0 |
| | | MAX. T | 0.0 | 118.4 | 0.0 | MIN. T | 0.0 | 36.7 | 0.0 |
| 2 | 1 | MAX. M | 0.0 | 96.5 | 0.0 | MIN. M | 0.0 | 38.5 | 0.0 |
| | | MAX. R | 0.0 | 225.4 | 0.0 | MIN. R | 0.0 | 6.1 | 0.0 |
| | | MAX. T | 0.0 | 96.5 | 0.0 | MIN. T | 0.0 | 38.5 | 0.0 |
| 2 | 2 | MAX. M | 0.0 | 117.7 | 0.0 | MIN. M | 0.0 | 46.9 | 0.0 |
| | | MAX. R | 0.0 | 255.9 | 0.0 | MIN. R | 0.0 | 11.3 | 0.0 |
| | | MAX. T | 0.0 | 117.7 | 0.0 | MIN. T | 0.0 | 46.9 | 0.0 |

SITUACION DE ESFUERZOS PESIMOS

| VIGAS | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT. IZQ. | Viga 1 | Viga 1 | Viga 1 |
| EXT. DCHA. | Viga 2 | Viga 2 | Viga 2 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 1692.247 | 249.107 | -111.204 |
| EXT.DCH. | 1732.119 | 255.858 | -116.676 |

TVC

ESTUDIO:24785 E-1500.4 VANO 2

RESULTADOS PARCIALES. 'ACCION' 2
**********

* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(VALORES CARACTERISTICOS)

| CAJON | Y | == ANTE./POST. == M | Q | T | F | G | J |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | -6.20 | -32.18 | -4.30 | 0.00 | -1.38 | -18.50 |
| | | -6.20 | -32.18 | -4.30 | | | |
| | 8.00 | 251.27 | -32.18 | -4.30 | 9.95 | -.95 | -18.53 |
| | | 242.21 | -9.08 | -10.47 | | | |
| | 16.00 | 314.87 | -9.08 | -10.47 | 13.85 | .02 | -18.61 |
| | | 312.18 | 11.27 | -10.85 | | | |
| | 24.00 | 221.99 | 11.27 | -10.85 | 9.73 | .96 | -18.70 |
| | | 225.91 | 28.72 | -4.97 | | | |
| | 32.00 | -3.88 | 28.72 | -4.97 | 0.00 | 1.34 | -18.74 |
| | | -3.88 | 28.72 | -4.97 | | | |
| 2 | 0.00 | -2.46 | -29.78 | -4.52 | 0.00 | -1.40 | 19.20 |
| | | -2.46 | -29.78 | -4.52 | | | |
| | 8.00 | 235.76 | -29.78 | -4.52 | 10.16 | -1.00 | 19.16 |
| | | 233.47 | -11.39 | -10.56 | | | |
| | 16.00 | 324.56 | -11.39 | -10.56 | 14.43 | -.02 | 19.08 |
| | | 328.51 | 9.69 | -10.81 | | | |
| | 24.00 | 250.96 | 9.69 | -10.81 | 10.36 | .99 | 18.99 |
| | | 261.89 | 33.72 | -4.83 | | | |
| | 32.00 | -7.88 | 33.72 | -4.83 | 0.00 | 1.44 | 18.95 |
| | | -7.88 | 33.72 | -4.83 | | | |

**ESTUDIO:24785 E-1500.4 VANO 2**

RESULTADOS PARCIALES. 'ACCION' 2
**********

* REACCIONES *
(VALORES CARACTERISTICOS)

| CAJON | ==== EXTR.1 ===== | | | ==== EXTR.2 ===== | | |
|---|---|---|---|---|---|---|
| | M | R | T | M | R | T |
| 1 | 0.00 | 44.56 | 0.00 | 0.00 | 36.74 | 0.00 |
| 2 | 0.00 | 38.53 | 0.00 | 0.00 | 46.87 | 0.00 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 314.874 | 36.745 | -10.846 |
| EXT.DCH. | 328.510 | 46.874 | -10.811 |



**ESTUDIO:24785 E-1500.4 VANO 2**

RESULTADOS ENVOLVENTES DE LAS 'HIPOTESIS DE CARGA'
**********

* ESFUERZOS 'TOTALES' DE LA LOSA *
(ESFUERZOS 'GENERALES' Y 'LOCALES' COMBINADOS)

(VALORES MAYORADOS)

APOYO '1'

| BANDA LONG. | = PUNTO = X | Y | ========== MAX./MIN. ========== M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | .11 | .11 | .05 | .29 | .02 | .23 |
| | | | -.03 | -.01 | -.13 | -.11 | -.23 | -.06 |
| | 1.58 | 0.00 | -.68 | 5.13 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -5.89 | .98 | -.13 | -1.12 | 0.00 | 0.00 |
| | 3.15 | 0.00 | -3.00 | 18.75 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -20.69 | 1.96 | -.13 | -8.06 | 0.00 | 0.00 |
| 2 | 3.15 | 0.00 | -.29 | 8.81 | .73 | 0.00 | 0.00 | 0.00 |
| | | | -16.88 | -18.47 | -.39 | -7.26 | 0.00 | 0.00 |
| | 4.19 | 0.00 | 1.99 | 9.50 | .73 | 2.01 | 0.00 | 0.00 |
| | | | -9.69 | -11.63 | -.39 | -1.29 | 0.00 | 0.00 |
| | 5.24 | 0.00 | 1.64 | 11.38 | .73 | .78 | 0.00 | 0.00 |
| | | | -20.37 | -4.31 | -.39 | -2.78 | 0.00 | 0.00 |
| 3 | 5.24 | 0.00 | 1.64 | 2.96 | 16.66 | 19.97 | 14.29 | -13.55 |
| | | | -20.37 | -14.01 | -8.84 | -37.56 | -8.22 | -44.96 |
| | 6.35 | -2.50 | 4.95 | 5.71 | 1.75 | 15.94 | 7.46 | -12.71 |
| | | | -15.48 | -6.15 | -.25 | -32.49 | -4.93 | -36.07 |
| | 7.46 | -4.99 | 1.95 | 13.90 | 7.97 | 27.69 | 13.39 | -7.88 |
| | | | -17.16 | -5.26 | -12.27 | -18.00 | -7.79 | -37.74 |
| 4 | 7.46 | -4.99 | 1.95 | 5.04 | .35 | .80 | 0.00 | 0.00 |
| | | | -17.16 | -11.24 | -.54 | -2.76 | 0.00 | 0.00 |
| | 8.50 | -4.99 | 1.92 | 11.93 | .35 | 1.99 | 0.00 | 0.00 |
| | | | -8.08 | -8.07 | -.54 | -1.32 | 0.00 | 0.00 |
| | 9.54 | -4.99 | -.25 | 18.77 | .35 | 0.00 | 0.00 | 0.00 |
| | | | -17.66 | -7.38 | -.54 | -7.56 | 0.00 | 0.00 |
| 5 | 9.54 | -4.99 | -3.18 | -2.02 | .20 | 0.00 | 0.00 | 0.00 |
| | | | -21.75 | -18.93 | -.03 | -8.53 | 0.00 | 0.00 |
| | 11.17 | -4.99 | -.71 | -1.00 | .20 | 0.00 | 0.00 | 0.00 |
| | | | -6.08 | -5.14 | -.03 | -2.62 | 0.00 | 0.00 |
| | 12.80 | -4.99 | .13 | .01 | .20 | .41 | .03 | .03 |
| | | | -.02 | -.10 | -.03 | -.07 | -.20 | -.26 |

CUARTO LUZ

# 5. COMPROBACION DE LOS APOYOS DE NEOPRENO

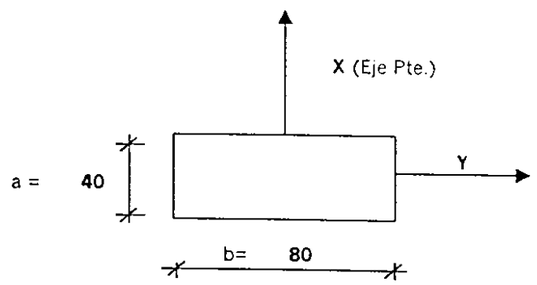
## SUBTRAMO XV AVE / E-1500,4 / VANOS 1 Y 3 EXTREMO ESTRIBO

**COMPROBACIÓN CON SÍSMO:** **NO** (SI / NO)
**TIPO DE TABLERO:** **CARRETERA** (CARRETERA O FERROCARRIL)

### A).- CARACTERISTICAS GEOMETRICAS DEL NEOPRENO:

**Ancho: a =** **40** cm Sentido X-X (Normalmente: a < b)
**Largo: b =** **80** cm Sentido Y-Y

| | | | |
|---|---|---|---|
| Número capas de elastómero | **n =** | **9** | |
| Espesor de capas elastómero | **t =** | **8** | mm |
| Altura total de elastómero | **T =** | **77** | mm |
| Factor de forma **S= a*b / 2*t*(a+b)** | = | **16,7** | |
| Espesor del zuncho o chapa | **e =** | **3** | mm |
| Altura Total del Neopreno | **et =** | **107** | mm |
| Módulo de elasticidad transversal del neopreno | | | |
| | **G =** | **8** | Kp/cm² |
| Tipo de Neopreno | T= n * t + 5 | (Tipo A) | |




### B).- COMPROBACION BAJO CARGAS VERTICALES:

Siendo:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **N.max =** | **221,00** | Tn. | **h2,x max=** | **3,36** | Tn. | **h2,y max=** | **14,29** Tn. |
| **N.min =** | **112,49** | Tn. | **h2,x min=** | **0,00** | Tn. | **h2,y min=** | **0,00** Tn. |

(h2 son fuerzas instantaneas)

Tensión media en neopreno : $\sigma_m$ = **N. max / a * b**

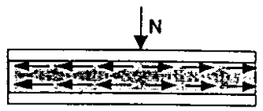
$\sigma_m$ = **69** Kp/cm² < **150** Kp/cm² => **Vale**

Por lo tanto la tensión tangencial $\tau$,n es:

$\tau$,n = **1,5 * σm / S**

$\tau$,n = **6,22** Kp/cm²

et = **107**




### C).- COMPROBACION BAJO CARGAS HORIZONTALES:

* **Deformación lenta, u1: (dilatación, retración y fluencia.)**

$\tau_{,h1}$ = **G * u1 / T**

| | | | | | |
|---|---|---|---|---|---|
| | **u1,x =** | **2,348** cm | **u1,y =** | **2,111** | cm |
| Luego: | **τ,h1x =** | **2,44** Kp/cm² | **τ,h1y =** | **2,19** | Kp/cm² |

* **Fuerza horizontal instantanea, h2, deformación, u2:**

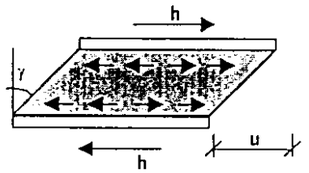
**h2 = u2 * 2 * G * a * b / T** y **$\tau_{,h2}$ = h2 / a * b**
**u2 = h2 * T / 2 * G * a * b**

| | | | | | | |
|---|---|---|---|---|---|---|
| | **h2,x =** | **3,36** | Tn. | **h2,y =** | **14,29** | Tn. |
| | **u2,x =** | **0,51** | cm | **u2,y =** | **2,15** | cm |
| Luego: | **τ,h2x =** | **1,05** | Kp/cm² | **τ,h2y =** | **4,46** | Kp/cm² |

* τ totales, por fuerza horizontal:

**τ,thx = τ,h1x + 0,50 * τ,h2x**
**τ,thy = τ,h1y + 0,50 * τ,h2y**

**τ,t1 = RCUAD [( τ,h1x ) ^ 2 + ( τ,h1y ) ^ 2]**
**τ,t2 = RCUAD [( τ,h2x ) ^ 2 + ( τ,h2y ) ^ 2]**
**τ,th = RCUAD [( τ,thx ) ^ 2 + ( τ,thy ) ^ 2]**




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **τ,thx =** | **2,96** | Kp/cm² | **< 0,7*G=** | **5,60** | Kp/cm² | => | **Vale** |
| **τ,thy =** | **4,43** | Kp/cm² | **< 0,7*G=** | **5,60** | Kp/cm² | => | **Vale** |
| **τ,t1 =** | **3,28** | Kp/cm² | **< 0,5*G=** | **4,00** | Kp/cm² | => | **Vale** |
| **τ,t2 =** | **4,59** | Kp/cm² | | | | | |
| **τ,th =** | **5,33** | Kp/cm² | **< 0,7*G=** | **5,60** | Kp/cm² | => | **Vale** |

* Giros:

**τ,ax = G/2 * ( a / t ) ^ 2 * α,xt**
**τ,ay = G/2 * ( b / t ) ^ 2 * α,yt**

Siendo:

**α,tx =α,Tx / n**
**α,ty =α,Ty / n**

**α,Tx = α,1x + α,scx + α,0x**
**α,Ty = α,1y + α,scy + α,0y**

Donde:

| | | | | | | |
|---|---|---|---|---|---|---|
| **α,1x =** | **0,0003** | rad | **α,1y =** | **0,0000** | rad | (Suma giros c. perman.) |
| **α,scx =** | **0,0009** | rad | **α,scy =** | **0,0000** | rad | (Suma giros sobrecargas) |
| **α,0x =** | **0,0030** | rad | **α,0y =** | **0,0000** | rad | (Giro accidental) |

Por lo tanto:

| | | | | | |
|---|---|---|---|---|---|
| **α,Tx =** | **0,0042** | rad | **α,Ty =** | **0,0000** | rad |
| **α,tx =** | **0,0005** | rad | **α,ty =** | **0,0000** | rad |

*** τ totales, por giros:**

τ,tax = **4,62** Kp/cm² τ,tay = **0,00** Kp/cm²

τ,ta = **4,62** Kp/cm²

*** τ totales debidos al axil, fuerza horizontal y giro:**

Axil:

**τ,n = 1,50 * σm / S**

**τ,n = 6,22** Kp/cm²

Fuerza horizontal y giro:

**τ,tx = τ,tax + τ,thx** **τ,ty = τ,tay + τ,thy**

**τ,tx = 7,59** Kp/cm² **τ,ty = 4,43** Kp/cm²

Total:

**τ,t =τ,n+ RCUAD [( τ,tx ) ^ 2 + ( τ,ty ) ^ 2]**

**τ,t = 15,00** Kp/cm² **< 5 * G = 40,00** Kp/cm² => **Vale**

## D).- CONDICION DE NO DESPLAZAMIENTO DEL APOYO:

Se debe verificar la condición:

**σm => 20 Kp/cm² y H <= f * N**

con: **f =0,10 + 6 / σm** (Para apoyos tipo A)

Siendo **H** la fuerza concomitante con la carga vertical **N**

Siendo **f** el coeficiente de rozamiento

En nuestro caso:

**N,min = 112,49** Tn.

**σ,min = 35,15** Kp/cm² > **20** Kp/cm² => **Vale**

**f = 0,27** **H = 14,67** Tn.

Luego: **H < = 30,45** Tn. => **Vale**

## E).- CONDICION DE ESTABILIDAD:

Se debe verificar la condición:

**a / 10 <= T <= a / 5**

En nuestro caso:

Como **a = 400** mm

**a/10 = 40** mm

**a/5 = 80** mm Como **T = 77** mm => **Vale**

## F).- CONDICION DE NO LEVANTAMIENTO:

Se debe verificar la condición:

**α,t = α,T / n <= ( 3 / S ) * ( t^2 / a^2 ) * ( σm / G )**

**α,Tx = 0,0042** rad **α,Ty = 0,0000** rad

**α,tx = 0,0005** rad **α,ty = 0,0000** rad

**α,tx = 0,0005** rad <= **0,0006** rad => **Vale**

**α,ty = 0,0000** rad <= **0,0002** rad => **Vale**

## G).- ESPESOR DE LOS ZUNCHOS:

El espesor del zuncho, debe cumplir:

**e >= ( a / S ) * ( σm/σe )** σe= límite elástico del acero (Kp/cm²)

**e >= 2 mm**

Para **σe= 2400** Kp/cm²

**e = 0,7** mm.

Como **e = 3** mm. => **Vale**

## COMPROBACION DE LOS APOYOS DE NEOPRENO

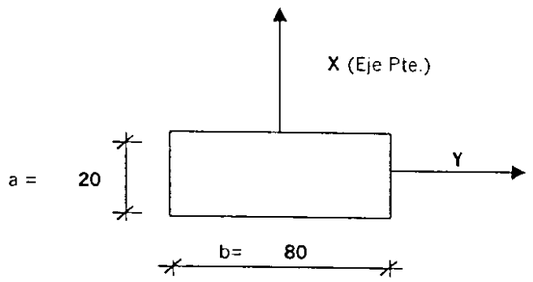
### SUBTRAMO XV AVE / E-1500,4 / VANOS 1 Y 3 EXTREMO PILA (MEDIA MADERA)

**COMPROBACIÓN CON SÍSMO:** **NO** (SI / NO)
**TIPO DE TABLERO:** **CARRETERA** (CARRETERA O FERROCARRIL)

### A).- CARACTERISTICAS GEOMETRICAS DEL NEOPRENO:

**Ancho: a =** 20 cm Sentido X-X (Normalmente: a < b)
**Largo: b =** 80 cm Sentido Y-Y

| | | | |
|---|---|---|---|
| Número capas de elastómero | n = | 2 | |
| Espesor de capas elastómero | t = | 8 | mm |
| Altura total de elastómero | T = | 21 | mm |
| Factor de forma S= a*b / 2*t*(a+b) = | | 10,0 | |
| Espesor del zuncho o chapa | e = | 3 | mm |
| Altura Total del Neopreno | et = | 30 | mm |
| Módulo de elasticidad transversal del neopreno | | | |
| | G = | 8 | Kp/cm² |
| Tipo de Neopreno | T= n * t + 5 | (Tipo A) | |




### B).- COMPROBACION BAJO CARGAS VERTICALES:

Siendo:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N.max = | 221,00 | Tn. | h2,x max= | 0,00 | Tn. | h2,y max= | 0,00 Tn. |
| N.min = | 112,49 | Tn. | h2,x min= | 0,00 | Tn. | h2,y min= | 0,00 Tn. |

(h2 son fuerzas instantaneas)

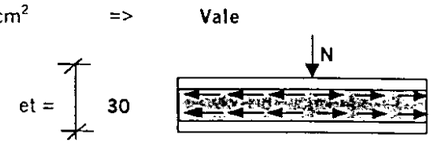
Tensión media en neopreno : $\sigma_m$ = N. max / a * b

$\sigma_m$ = 138 Kp/cm² < 150 Kp/cm² => Vale

Por lo tanto la tensión tangencial $\tau$,n es:

$\tau$,n = 1,5 * $\sigma$m / S

$\tau$,n = 20,72 Kp/cm²




### C).- COMPROBACION BAJO CARGAS HORIZONTALES:

* **Deformación lenta, u1: (dilatación, retración y fluencia.)**

$\tau_{,h1}$ = G * u1 / T

| | | | | | |
|---|---|---|---|---|---|
| | u1,x = | 0,320 | cm | u1,y = | 0,000 cm |
| Luego: | $\tau$,h1x = | 1,22 | Kp/cm² | $\tau$,h1y = | 0,00 Kp/cm² |

* **Fuerza horizontal instantanea, h2, deformación, u2:**

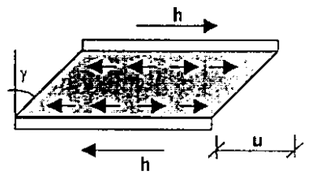
h2 = u2 * 2 * G * a * b / T y $\tau_{,h2}$ = h2 / a * b
u2 = h2 * T / 2 * G * a * b

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | h2,x = | 0,00 | Tn. | | h2,y = | 0,00 | Tn. |
| | u2,x = | 0,00 | cm | | u2,y = | 0,00 | cm |
| Luego: | $\tau$,h2x = | 0,00 | Kp/cm² | | $\tau$,h2y = | 0,00 | Kp/cm² |

* $\tau$ totales, por fuerza horizontal:

$\tau$,thx = $\tau$,h1x + 0,50 * $\tau$,h2x
$\tau$,thy = $\tau$,h1y + 0,50 * $\tau$,h2y

$\tau$,t1 = RCUAD [( $\tau$,h1x ) ^ 2 + ( $\tau$,h1y ) ^ 2]
$\tau$,t2 = RCUAD [( $\tau$,h2x ) ^ 2 + ( $\tau$,h2y ) ^ 2]
$\tau$,th = RCUAD [( $\tau$,thx ) ^ 2 + ( $\tau$,thy ) ^ 2]




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\tau$,thx = | 1,22 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| $\tau$,thy = | 0,00 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| $\tau$,t1 = | 1,22 | Kp/cm² | < 0,5*G= | 4,00 | Kp/cm² | => | Vale |
| $\tau$,t2 = | 0,00 | Kp/cm² | | | | | |
| $\tau$,th = | 1,22 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |

* Giros:

$\tau$,ax = G/2 * ( a / t ) ^ 2 * $\alpha$,xt
$\tau$,ay = G/2 * ( b / t ) ^ 2 * $\alpha$,yt

Siendo:

$\alpha$,tx = $\alpha$,Tx / n
$\alpha$,ty = $\alpha$,Ty / n

$\alpha$,Tx = $\alpha$,1x + $\alpha$,scx + $\alpha$,0x
$\alpha$,Ty = $\alpha$,1y + $\alpha$,scy + $\alpha$,0y

Donde:

| | | | | | |
|---|---|---|---|---|---|
| $\alpha$,1x = | 0,0003 | rad | $\alpha$,1y = | 0,0000 | rad (Suma giros c. perman.) |
| $\alpha$,scx = | 0,0009 | rad | $\alpha$,scy = | 0,0000 | rad (Suma giros sobrecargas) |
| $\alpha$,0x = | 0,0030 | rad | $\alpha$,0y = | 0,0000 | rad (Giro accidental) |

Por lo tanto:

| | | | |
|---|---|---|---|
| $\alpha$,Tx = | 0,0042 | rad | $\alpha$,Ty = 0,0000 rad |
| $\alpha$,tx = | 0,0021 | rad | $\alpha$,ty = 0,0000 rad |

*** τ totales, por giros:**

τ,tax = 5,20 Kp/cm² τ,tay = 0,00 Kp/cm²

τ,ta = 5,20 Kp/cm²

*** τ totales debidos al axil, fuerza horizontal y giro:**

Axil:

τ,n = 1,50 * $\sigma_m$ / S

τ,n = 20,72 Kp/cm²

Fuerza horizontal y giro:

τ,tx = τ,tax + τ,thx τ,ty = τ,tay + τ,thy

τ,tx = 6,42 Kp/cm² τ,ty = 0,00 Kp/cm²

Total:

τ,t =τ,n+ RCUAD [( τ,tx ) ^ 2 + ( τ,ty ) ^ 2]

τ,t = 27,14 Kp/cm² < 5 * G = 40,00 Kp/cm² => Vale

## D).- CONDICION DE NO DESPLAZAMIENTO DEL APOYO:

Se debe verificar la condición:

$\sigma_m$ => 20 Kp/cm² y H <= f * N

con: f =0,10 + 6 / σm (Para apoyos tipo A)

Siendo H la fuerza concomitante con la carga vertical N

Siendo f el coeficiente de rozamiento

En nuestro caso:

N,min = 112,49 Tn.

σ,min = 70,31 Kp/cm² > 20 Kp/cm² => Vale

f = 0,19 H = 0,00 Tn.

Luego: H < = 20,85 Tn. => Vale

## E).- CONDICION DE ESTABILIDAD:

Se debe verificar la condición:

a / 10 <= T <= a / 5

En nuestro caso:

Como a = 200 mm

a/10 = 20 mm

a/5 = 40 mm Como T = 21 mm => Vale

## F).- CONDICION DE NO LEVANTAMIENTO:

Se debe verificar la condición:

α,t = α,T / n <= ( 3 / S ) * ( t^2 / a^2 ) * ( σm / G )

α,Tx = 0,0042 rad α,Ty = 0,0000 rad

α,tx = 0,0021 rad α,ty = 0,0000 rad

α,tx = 0,0021 rad <= 0,0083 rad => Vale

α,ty = 0,0000 rad <= 0,0005 rad => Vale

## G).- ESPESOR DE LOS ZUNCHOS:

El espesor del zuncho, debe cumplir:

e >= ( a / S ) * ( σm/σe ) σe= límite elástico del acero (Kp/cm²)

e >= 2 mm

Para σe= 2400 Kp/cm²

e = 1,2 mm.

Como e = 3 mm. => Vale

# COMPROBACION DE LOS APOYOS DE NEOPRENO

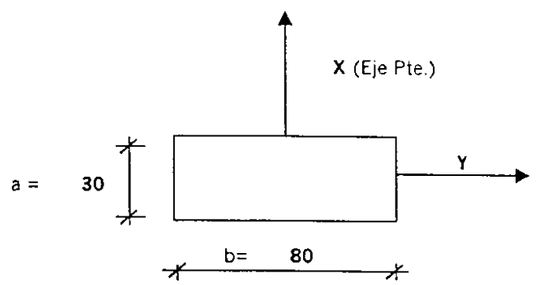
## SUBTRAMO XV AVE / E-1500,4 / VANO 2

**COMPROBACIÓN CON SÍSMO:** NO (SI / NO)
**TIPO DE TABLERO:** CARRETERA (CARRETERA O FERROCARRIL)

### A).- CARACTERISTICAS GEOMETRICAS DEL NEOPRENO:

**Ancho: a =** 30 cm Sentido X-X (Normalmente: a < b)
**Largo: b =** 80 cm Sentido Y-Y

| | | | |
|---|---|---|---|
| Número capas de elastómero | n = | 3 | |
| Espesor de capas elastómero | t = | 8 | mm |
| Altura total de elastómero | T = | 29 | mm |
| Factor de forma S= a*b / 2*t*(a+b) = | | 13,6 | |
| Espesor del zuncho o chapa | e = | 3 | mm |
| Altura Total del Neopreno | et = | 41 | mm |
| Módulo de elasticidad transversal del neopreno | | | |
| | G = | 8 | Kp/cm² |
| Tipo de Neopreno | T= n * t + 5 | (Tipo A) | |




### B).- COMPROBACION BAJO CARGAS VERTICALES:

Siendo:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N.max = | 299,78 | Tn. | h2,x max= | 1,67 | Tn. | h2,y max= | 6,86 Tn. |
| N.min = | 131,92 | Tn. | h2,x min= | 0,00 | Tn. | h2,y min= | 0,00 Tn. |

(h2 son fuerzas instantaneas)

Tensión media en neopreno : $\sigma_m$ = **N. max / a * b**

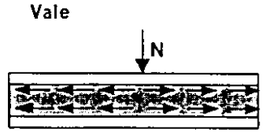
$\sigma_m$ = **125** Kp/cm² < **150** Kp/cm² => **Vale**

Por lo tanto la tensión tangencial $\tau$,n es:

$\tau$,n = 1,5 * $\sigma$m / S

$\tau$,n = **13,74** Kp/cm²

et = 41




### C).- COMPROBACION BAJO CARGAS HORIZONTALES:

* **Deformación lenta, u1: (dilatación, retración y fluencia.)**

$\tau_{,h1}$ = G * u1 / T

| | | | | | | |
|---|---|---|---|---|---|---|
| | u1,x = | 0,425 | cm | u1,y = | 0,546 | cm |
| Luego: | $\tau$,h1x = | 1,17 | Kp/cm² | $\tau$,h1y = | 1,51 | Kp/cm² |

* **Fuerza horizontal instantanea, h2, deformación, u2:**

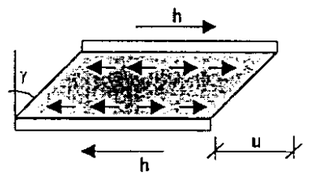
h2 = u2 * 2 * G * a * b / T y $\tau_{,h2}$ = h2 / a * b
u2 = h2 * T / 2 * G * a * b

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | h2,x = | 1,67 | Tn. | h2,y = | 6,86 | Tn. |
| | u2,x = | 0,13 | cm | u2,y = | 0,52 | cm |
| Luego: | $\tau$,h2x = | 0,69 | Kp/cm² | $\tau$,h2y = | 2,86 | Kp/cm² |

* $\tau$ totales, por fuerza horizontal:

$\tau$,thx = $\tau$,h1x + 0,50 * $\tau$,h2x
$\tau$,thy = $\tau$,h1y + 0,50 * $\tau$,h2y

$\tau$,t1 = RCUAD [( $\tau$,h1x ) ^ 2 + ( $\tau$,h1y ) ^ 2]
$\tau$,t2 = RCUAD [( $\tau$,h2x ) ^ 2 + ( $\tau$,h2y ) ^ 2]
$\tau$,th = RCUAD [( $\tau$,thx ) ^ 2 + ( $\tau$,thy ) ^ 2]




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\tau$,thx = | 1,52 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| $\tau$,thy = | 2,93 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| $\tau$,t1 = | 1,91 | Kp/cm² | < 0,5*G= | 4,00 | Kp/cm² | => | Vale |
| $\tau$,t2 = | 2,94 | Kp/cm² | | | | | |
| $\tau$,th = | 3,30 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |

* Giros:

$\tau$,ax = G/2 * ( a / t ) ^ 2 * $\alpha$,xt
$\tau$,ay = G/2 * ( b / t ) ^ 2 * $\alpha$,yt

Siendo:

$\alpha$,tx = $\alpha$,Tx / n
$\alpha$,ty = $\alpha$,Ty / n

$\alpha$,Tx = $\alpha$,1x + $\alpha$,scx + $\alpha$,0x
$\alpha$,Ty = $\alpha$,1y + $\alpha$,scy + $\alpha$,0y

Donde:

| | | | | | |
|---|---|---|---|---|---|
| $\alpha$,1x = | 0,0010 rad | $\alpha$,1y = | 0,0000 | rad | (Suma giros c. perman.) |
| $\alpha$,scx = | 0,0027 rad | $\alpha$,scy = | 0,0000 | rad | (Suma giros sobrecargas) |
| $\alpha$,0x = | 0,0030 rad | $\alpha$,0y = | 0,0000 | rad | (Giro accidental) |

Por lo tanto:

| | | | |
|---|---|---|---|
| $\alpha$,Tx = | 0,0067 rad | $\alpha$,Ty = | 0,0000 rad |
| $\alpha$,tx = | 0,0022 rad | $\alpha$,ty = | 0,0000 rad |

*** τ totales, por giros:**

τ,tax = **12,50** Kp/cm² τ,tay = **0,00** Kp/cm²

τ,ta = **12,50** Kp/cm²

*** τ totales debidos al axil, fuerza horizontal y giro:**

Axil:

τ,n = 1,50 * $\sigma_m$ / S

τ,n = **13,74** Kp/cm²

Fuerza horizontal y giro:

τ,tx = τ,tax + τ,thx τ,ty = τ,tay + τ,thy

τ,tx = **14,02** Kp/cm² τ,ty = **2,93** Kp/cm²

Total:

τ,t =τ,n+ RCUAD [( τ,tx ) ^ 2 + ( τ,ty ) ^ 2]

τ,t = **28,06** Kp/cm² < 5 * G = **40,00** Kp/cm² => **Vale**

## D).- CONDICION DE NO DESPLAZAMIENTO DEL APOYO:

Se debe verificar la condición:

$\sigma_m$ => 20 Kp/cm² y H <= f * N

con: f =0,10 + 6 / σm (Para apoyos tipo A)

Siendo **H** la fuerza concomitante con la carga vertical **N**

Siendo **f** el coeficiente de rozamiento

En nuestro caso:

N,min = **131,92** Tn.

σ,min = **54,97** Kp/cm² > **20** Kp/cm² => **Vale**

f = **0,21** H = **7,06** Tn.

Luego: H < = **27,59** Tn. => **Vale**

## E).- CONDICION DE ESTABILIDAD:

Se debe verificar la condición:

a / 10 <= T <= a / 5

En nuestro caso:

Como a = **300** mm

a/10 = **30** mm

a/5 = **60** mm Como T = **29** mm

## F).- CONDICION DE NO LEVANTAMIENTO:

Se debe verificar la condición:

α,t = α,T / n <= ( 3 / S ) * ( t^2 / a^2 ) * ( σm / G )

α,Tx = **0,0067** rad α,Ty = **0,0000** rad

α,tx = **0,0022** rad α,ty = **0,0000** rad

α,tx = **0,0022** rad <= **0,0024** rad => **Vale**

α,ty = **0,0000** rad <= **0,0003** rad => **Vale**

## G).- ESPESOR DE LOS ZUNCHOS:

El espesor del zuncho, debe cumplir:

e >= ( a / S ) * ( σm/σe ) σe= límite elástico del acero (Kp/cm²)

e >= 2 mm

Para σe= **2400** Kp/cm²

e = **1,1** mm.

Como e = **3** mm. => **Vale**

## 6. COMPROBACION DE PILAS

Se realiza la comprobación para una longitud de pila de 13.62 m y coeficientes de pandeo 1,46 y 1,51 longitudinal y transversal respectivamente. Así mismo para las reacciones en cabeza de pilas (horizontales) se tomarán las máximas.

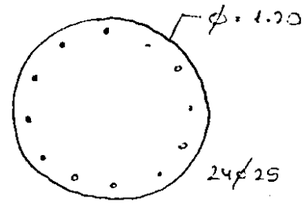
Esfuerzos en cabeza de pila (sin mayorar) en (T, mT)

| Carga | N | FL | FT | ML | MT | Cfav | Cdesfav |
|---|---|---|---|---|---|---|---|
| p.p. | 220,94 | 0,00 | 0,00 | 0,00 | 0,00 | 1.00 | 1.35 |
| S.C. | 112,61 | 1.66 | 0,00 | 0.166 | 0.00 | 0.00 | 1.50 |
| termico | 0,00 | 1.10 | 0.00 | 0.12 | 0.00 | 0.00 | 1.50 |
| retracción | 0,00 | 1.51 | 0,00 | 0.15 | 0.00 | 0.00 | 1.35 |
| viento t. | 0,00 | 0.00 | 6,86 | 0,00 | 16,63 | 0.00 | 1.50 |
| S.C. | -37,78 | 1.66 | 0.00 | 0,16 | 0.00 | 0.00 | 1.50 |

NOTA: Las reacciones verticales se obtuvieron directamente del resumen de reacciones del cálculo del tablero. Las reacciones horizontales se tomaron del reparto horizontal de cargas con G = 80 t/m para movimientos lentos (retracción, diferencia de temperatura) y con G = 160 t/m para acciones instantáneas (frenada y viento transversal).



### Constantes estáticas de las pilas




$A_x = 1.1307\ m^2$

$I_z = I_y = 0.1018\ m^4$

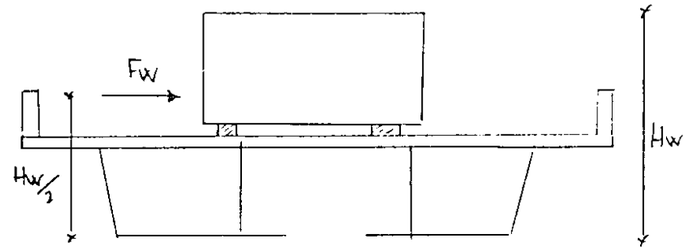
$H = 13.62\ m$

H-300 $\gamma_c = 1.50$ (x 0.90 hormigonado vertical)

AEH-500 $\gamma_s = 1.15$

### Acción del viento

$W = 0.250\ T/m^2$ (según proyecto)




$Hw = 1.40 + 0.15 + 2 \times 0.50 + 2.00 = 4.65\ m$
(viga, losa, barreras, peltrato)

$Hw/2 = 2.325\ m$

Del reparto transversal de cargas

$Hw = 13,72\ T/2 = 6,86$

$Mw$ (en cabeza pila) $= \frac{13,72}{2} \times (2.325 + 0.10) = \frac{33,27}{2}\ mT = 16,63$
(negativo + retenta)

$Fw_{pila} = 0.25\ T/m^2 \times 1.20\ m = 0.300\ T/m$

Peso propio de pila

$P_{PILA} = 1.1209\ m^3 \times 2{,}5\ T/m^3 = 2.827\ T/m$

Coeficiente β de pandeo

Directamente del resto horizontal de carga para G=80 t/m:

$\beta_{long} = 1.46$

$\beta_{trans} = 1.51$

COMPROBACIÓN ARMADURA LONGITUDINAL DE PILA

Armadura dispuesta en proyecto:

$24\phi 25 = 117{,}60\ cm^2$ ¡SUFICIENTE!

COMPROBACIÓN ARMADURA DE CORTANTE (en base de pila)

$Vd_L = \max\{Vd_{L1}; Vd_{L2}; Vd_{L3}\}$

$Vd_{L1} = 1.35\times(1{,}51) + 1{,}50\times(1{,}66 + 0{,}60\times(1{,}20 + 0{,}50\times 0{,}30\times 13{,}62))$

$= 7{,}447\ T$ (s.c. uso dominante)

$Vd_{L2} = 1.35\times 1{,}51 + 1{,}50\times(1{,}20 + 0{,}60\times(1{,}66 + 0.30\times 13{,}62)) =$

$= 9{,}009\ T$ (T.ª dominante)

$Vd_{L3} = 1.35\times 1{,}51 = 1{,}50\times(0{,}30\times 13{,}62 + 0{,}6\times 1{,}20) =$

$= \underline{9{,}247\ T}$ (viento long. dominante)

$Vd_T = 1{,}50\times(6{,}86 + 0.30\times 13{,}62) = \underline{16{,}42\ T}$



$\tau d = Vd/(b\cdot z) = 16{,}42^t/(1.20\times 0.9\times(1.20-0.045)) = 15{,}16\ T/m^2$

Comprobación biela compresión:

$\tau d \le 0.3\times(0.90\times fcd) = 0.17\times 3000/1.50 = 540\ T/m^2$

Dimensionamiento armadura

$Vcu = 5\cdot\sqrt{0.90\times fcd}\times b\cdot d = 5\cdot(0.20\times\frac{3000}{150})^{1/2}\times 1.20\times(1.20-0.045)$

$= 92{,}97\ t$

$Vcu \ge Vd$

$A_{s\,min} = 0.02\times\frac{3000}{1.50}\times 0.90\times\frac{1.15}{5.1}\times 1.10 = 9.928\ cm^2/m$

$A_{s\,disp} = 1\phi 12\ a\ 20 = 11{,}30\ cm^2/m > A_{s\,min}$ ✓

¡SUFICIENTE!

```
"*************************************************************************
"       PROGRAMA  PILAS  v1.1
"       PLANTILLA PARA FICHERO DE ENTRADA
"*************************************************************************

"--------------------- Definicion de la seccion --------------------------
* TITULO
  ESTRUCTURA E-1500.4 . SUBTRAMO XV

* SECCION
"  Introduzca los comandos de definicion de la seccion de la pila, o bien
"  el comando NOMBRE nombre_fichero, donde nombre_fichero es el nombre
"  del fichero de definicion de la seccion (extension .QS) creado con el
"  programa FAGUS2. nombre_fichero debe introducirse SIN EXTENSION.

NOMBRE  pl      "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
            "de la seccion creado con FAGUS2. Desactive el codigo CREAR
"CREAR      ?     "Introduzca el nombre (SIN EXTENSION) del fichero de
definicion
            "de la seccion que se va a crear con el programa PILAS.
            "Desactive el codigo NOMBRE

"  Los siguientes codigos se utilizan si se ha seleccionado la opcion CREAR

"Unidad_long      ?     "Unidad de longitud para entrada de la seccion

"-------------
"Rectangular            "Active este codigo para definir secciones rectangulares
"Dim_trans  ?     "Dimension transversal de la seccion
"Dim_long   ?     "Dimension longitudinal de la seccion
"Hormigon   ?     "Tipo de hormigon de la seccion
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"Cuantia_long     ?     ?     "Cuantia de armadura en la direccion longitudinal
                        "(en una cara); incluya el codigo de dimensionamiento
"Coef_c_tr  ?     ?     "Coeficiente para cuantia transversal (en una cara);
                        "incluya el codigo de dimensionamiento
"Recubrimiento    ?     "Distancia del paramento a eje de redondos
"Acero            ?     "Tipo de acero de las armaduras

"-------------
"Rectangular_Hueca      "Active este codigo para definir secciones rectangulares
                  "huecas
"Dim_trans_ext    ?     "Dimension transversal contorno exterior
"Dim_long_ext     ?     "Dimension longitudinal contorno exterior
"Hormigon   ?     "Tipo de hormigon de la seccion
"Dim_trans_int    ?     "Dimension transversal contorno interior
"Dim_long_int     ?     "Dimension longitudinal contorno interior
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"Cuantia_long_ext ?     ?     "Cuantia longitudinal (por cara) contorno
exterior;
                        "incluya el codigo de dimensionamiento
"Coef_c_tr_ext    ?     ?     "Coeficiente cuantia transversal (por cara)
contorno
                  "exterior; incluya el codigo de dimensionamiento
"Recubrimiento_ext      ?     "Distancia paramento exterior a eje de redondos
"Cuantia_long_int ?     ?     "Cuantia longitudinal (por cara) contorno
interior;
                        "incluya el codigo de dimensionamiento
"Coef_c_tr_int    ?     ?     "Coeficiente cuantia transversal (por cara)
contorno
                  "interior; incluya el codigo de dimensionamiento
"Recubrimiento_int      ?     "Distancia paramento interior a eje de redondos
"Acero            ?           "Tipo de acero de las armaduras

"-------------
"Circular         "Active este codigo para crear secciones circulares
"Radio            ?     "Radio de la seccion
"Hormigon   ?     "Tipo de hormigon de la seccion
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"N_redondos ?     "Numero de redondos a disponer perimetralmente
"Cuantia    ?     ?     "Cuantia de armadura en % area hormigon; incluya el
                        "codigo de dimensionamiento
"Recubrimiento    ?     "Distancia paramento a eje de redondos
"Acero            ?     "Tipo de acero de las armaduras

"-------------
"Circular_Hueca         "Active este codigo para crear secc. circulares huecas
"Radio_ext  ?     "Radio contorno exterior
"Radio_int  ?     "Radio contorno interior
"Hormigon   ?     "Tipo de hormigon de la seccion
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"N_redondos_ext   ?     "Numero de redondos contorno exterior
"Cuantia_ext      ?     ?     "Cuantia de armadura exterior en % area hormigon;
                        "incluya el codigo de dimensionamiento
"Recubrimiento_ext      ?     "Distancia paramento exterior a eje de redondos
"N_redondos_int         ?     "Numero de redondos contorno interior
"Cuantia_int      ?     ?     "Cuantia de armadura interior en % area hormigon;
                        "incluya el codigo de dimensionamiento
"Recubrimiento_int      ?     "Distancia paramento interior a eje de redondos
"Acero            ?           "Tipo de acero de las armaduras

"-------------------------------------------------------------------------


"----------------------- Estados de carga ------------------------------
* EC

"  Introduzca el nombre del grupo de cargas; introduzca tantos grupos como
"  desee.

+ GRUPO normal   "cargas comunes"

"  Introduzca los estados de carga segun el siguiente formato:
"  NO OLVIDE LA COMA ANTES DEL CAMPO OPCIONAL DE GRUPO

"cod    N               Fl              Ft              Ml              Mt
Gf      Gd [,   Grupo]
```

```
pp      280.940         0               0               0               0
1.0     1.35
sc      172.61          1.66            0               0.16            0
0       1.50
sc      -37.78          1.66            0               0.16            0
0       1.50
term    0               1.20            0               0.12            0
0       1.50
reol    0               1.51            0               0.15            0
0       1.35
vt      0               0               6.86            0               16.630
0       1.50

+ COMBINAR

"  Introduzca la combinacion de grupos de carga y las hipotesis que se deseen
"  calcular en cada combinacion:
"  NO OLVIDE LA COMA ANTES DEL CAMPO OPCIONAL DE HIPOTESIS

"nombre_grupo nombre_grupo ....  [, Hipotesis ? ? ?]

normal , Hipotesis 1 2 4

+ FUSTE

"  Introduzca los esfuerzos en el fuste, definiendo una ley de cargas
"  repartidas en el fuste (t/m) dada por el valor en cabeza y base.

"tipo_carga valor_cabeza      valor_base
pp              2.827           2.827
vt              0.3             0.3
vl              0.3             0.3


"-------------------------------------------------------------------------


"------------------------- Datos de pandeo -------------------------------
* PANDEO

fyd             4434.78 "Resistencia de calculo del acero en kp/cm2
alfapl          1.46    "Coeficiente de pandeo longitudinal
alfapt          1.51    "Coeficiente de pandeo transversal
lpila           13.62   "Altura de pila en m
hl              1.20    "Canto longitudinal en m
ht              1.20    "Canto transversal en m
inl             0.1018   "Inercia longitudinal
int             0.1018   "Inercia transversal
area            1.1309  "Area seccion transversal
plano_pandeo    long      "Plano de pandeo: introduzca (long), (trans) o (ambos)
"salida         completa        "Por defecto la salida es reducida; introduzca
(completa)
"                       para incluir el calculo de excentricidades

"-------------------------------------------------------------------------


"------------------------- Opciones de control  --------------------------
* OPCIONES

"  Introduzca los comandos de control del programa. Entre () se indican
"  los valores por defecto

compresiones    positivas       "Introduzca (positivas) o (negativas).
"                       Codigo obligatorio. No hay valor por defecto
acero       AEH500      "Introduzca el tipo de acero de las armaduras.
"                  C¢digo obligatorio
base_pila       B3      "Introduzca el nombre de la armadura de base de pila
"                  C¢digo obligatorio

ndiv            1       "Numero de secciones intermedias de calculo (0)
"solo_base        "Active este codigo para calcular unicamente la base del fuste
"solo_cabeza            "Active este codigo para calcular unicamente la cabeza
del fuste
"umbral           ?     "Valor umbral para cargas significativas (0)
"salida           ?     "Introduzca (completa) o (reducida). (reducida)
f_hipviento     1       "Factor de reduccion general para hipotesis de viento
(0.9)
f_hipsismo      1       "Factor de reduccion de cp y sc en hipotesis con sismo
(0.8)
c_vsc          0.3      "Factor de concomitancia viento - sobrecarga (0.5)
c_vsis          0       "Factor de concomitancia viento - sismo (0.25)

"-------------------------------------------------------------------------


"---------------------METODO COLUMNA MODELO-------------------------------

* COL_MOD

"  Los siguientes c¢digos definen par metros de entrada para el programa
"  CMOD (Aplicaci¢n del m,todo de la Columna Modelo para obtenci¢n de
"  excentricidades de 2§ orden en base de pila)

"ndiv ?      " N£mero de divisiones del diagrama M-X
"completo    " Active este c¢digo para calcular el diagrama M-X completo,
             " comenzando desde el valor 0 del momento

"-------------------------------------------------------------------------
```

Programa PILAS v1.1 P A
C A D A R, S.A.
PANDEO LONG
ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 638.18 | 0.62 | 0.00 | 175.06 |
| 2 | Nmin Mlmax Mtmax | 224.27 | 0.62 | 0.00 | 61.52 |
| 3 | Mlmax Mtmax Nmax | 638.18 | 0.62 | 0.00 | 175.06 |
| 4 | Mlmax Mtmax Nmin | 539.85 | 0.62 | 0.00 | 148.09 |
| 5 | Mtmax Nmax Mlmax | 638.18 | 0.62 | 0.00 | 175.06 |
| 6 | Mtmax Nmin Mlmax | 224.27 | 0.62 | 0.00 | 61.52 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 7 | Nmax Mlmax Mtmax | 379.27 | 0.38 | 24.94 | 104.04 |
| 8 | Nmin Mlmax Mtmax | 280.94 | 0.38 | 24.94 | 77.06 |
| 9 | Mlmax Mtmax Nmax | 379.27 | 0.38 | 24.94 | 104.04 |
| 10 | Mlmax Mtmax Nmin | 280.94 | 0.38 | 24.94 | 77.06 |
| 11 | Mtmax Nmax Mlmax | 379.27 | 0.38 | 24.94 | 104.04 |
| 12 | Mtmax Nmin Mlmax | 280.94 | 0.38 | 24.94 | 77.06 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 638.18 | 0.62 | 7.48 | 175.06 |
| 14 | Nmin Mlmax Mtmax | 224.27 | 0.62 | 7.48 | 61.52 |
| 15 | Mlmax Mtmax Nmax | 638.18 | 0.62 | 7.48 | 175.06 |
| 16 | Mlmax Mtmax Nmin | 539.85 | 0.62 | 7.48 | 148.09 |
| 17 | Mtmax Nmax Mlmax | 638.18 | 0.62 | 7.48 | 175.06 |
| 18 | Mtmax Nmin Mlmax | 224.27 | 0.62 | 7.48 | 61.52 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 19 | Nmax Mlmax Mtmax | 664.17 | 43.72 | 0.00 | 188.29 |
| 20 | Nmin Mlmax Mtmax | 243.52 | 43.72 | 0.00 | 106.32 |
| 21 | Mlmax Mtmax Nmax | 664.17 | 43.72 | 0.00 | 188.29 |
| 22 | Mlmax Mtmax Nmin | 559.11 | 43.72 | 0.00 | 169.04 |
| 23 | Mtmax Nmax Mlmax | 664.17 | 43.72 | 0.00 | 188.29 |
| 24 | Mtmax Nmin Mlmax | 559.11 | 43.72 | 0.00 | 169.04 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 25 | Nmax Mlmax Mtmax | 405.26 | 26.52 | 105.45 | 114.65 |
| 26 | Nmin Mlmax Mtmax | 300.19 | 26.52 | 105.45 | 95.23 |
| 27 | Mlmax Mtmax Nmax | 405.26 | 26.52 | 105.45 | 114.65 |
| 28 | Mlmax Mtmax Nmin | 300.19 | 26.52 | 105.45 | 95.23 |
| 29 | Mtmax Nmax Mlmax | 405.26 | 26.52 | 105.45 | 114.65 |
| 30 | Mtmax Nmin Mlmax | 300.19 | 26.52 | 105.45 | 95.23 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 31 | Nmax Mlmax Mtmax | 664.17 | 43.72 | 31.64 | 188.29 |
| 32 | Nmin Mlmax Mtmax | 243.52 | 43.72 | 31.64 | 106.32 |
| 33 | Mlmax Mtmax Nmax | 664.17 | 43.72 | 31.64 | 188.29 |
| 34 | Mlmax Mtmax Nmin | 559.11 | 43.72 | 31.64 | 169.04 |
| 35 | Mtmax Nmax Mlmax | 664.17 | 43.72 | 31.64 | 188.29 |
| 36 | Mtmax Nmin Mlmax | 559.11 | 43.72 | 31.64 | 169.04 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 37 | Nmax Mlmax Mtmax | 690.16 | 86.82 | 0.00 | 254.52 |
| 38 | Nmin Mlmax Mtmax | 262.77 | 86.82 | 0.00 | 160.04 |
| 39 | Mlmax Mtmax Nmax | 690.16 | 86.82 | 0.00 | 254.52 |
| 40 | Mlmax Mtmax Nmin | 578.36 | 86.82 | 0.00 | 231.44 |
| 41 | Mtmax Nmax Mlmax | 690.16 | 86.82 | 0.00 | 254.52 |

42 Mtmax Nmin Mlmax 578.36 86.82 0.00 231.44



ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 43 | Nmax Mlmax Mtmax | 431.25 | 52.66 | 206.83 | 156.94 |
| 44 | Nmin Mlmax Mtmax | 319.44 | 52.66 | 206.83 | 133.72 |
| 45 | Mlmax Mtmax Nmax | 431.25 | 52.66 | 206.83 | 156.94 |
| 46 | Mlmax Mtmax Nmin | 319.44 | 52.66 | 206.83 | 133.72 |
| 47 | Mtmax Nmax Mlmax | 431.25 | 52.66 | 206.83 | 156.94 |
| 48 | Mtmax Nmin Mlmax | 319.44 | 52.66 | 206.83 | 133.72 |



ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 49 | Nmax Mlmax Mtmax | 690.16 | 86.82 | 62.05 | 254.52 |
| 50 | Nmin Mlmax Mtmax | 262.77 | 86.82 | 62.05 | 160.04 |
| 51 | Mlmax Mtmax Nmax | 690.16 | 86.82 | 62.05 | 254.52 |
| 52 | Mlmax Mtmax Nmin | 578.36 | 86.82 | 62.05 | 231.44 |
| 53 | Mtmax Nmax Mlmax | 690.16 | 86.82 | 62.05 | 254.52 |
| 54 | Mtmax Nmin Mlmax | 578.36 | 86.82 | 62.05 | 231.44 |

□ESFUERZOS ADICIONALES

| N | Ml | Mt | Mlpan |
|---|---|---|---|



ESTRUCTURA E-1500.4 . SUBTRAMO XV
PANDEO LONG

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax Mlmax Mtmax | 638.18 | 175.06 | 0.00 | 44.72 |
| 2 | 1 | B1 | 1 | Nmin Mlmax Mtmax | 224.27 | 61.52 | 0.00 | 44.72 |
| 3 | 1 | B1 | 1 | Mlmax Mtmax Nmax | 638.18 | 175.06 | 0.00 | 44.72 |
| 4 | 1 | B1 | 1 | Mlmax Mtmax Nmin | 539.85 | 148.09 | 0.00 | 44.72 |
| 5 | 1 | B1 | 1 | Mtmax Nmax Mlmax | 638.18 | 175.06 | 0.00 | 44.72 |
| 6 | 1 | B1 | 1 | Mtmax Nmin Mlmax | 224.27 | 61.52 | 0.00 | 44.72 |
| 7 | 1 | B1 | 2 | Nmax Mlmax Mtmax | 379.27 | 104.04 | 24.94 | 44.72 |
| 8 | 1 | B1 | 2 | Nmin Mlmax Mtmax | 280.94 | 77.06 | 24.94 | 44.72 |
| 9 | 1 | B1 | 2 | Mlmax Mtmax Nmax | 379.27 | 104.04 | 24.94 | 44.72 |
| 10 | 1 | B1 | 2 | Mlmax Mtmax Nmin | 280.94 | 77.06 | 24.94 | 44.72 |
| 11 | 1 | B1 | 2 | Mtmax Nmax Mlmax | 379.27 | 104.04 | 24.94 | 44.72 |
| 12 | 1 | B1 | 2 | Mtmax Nmin Mlmax | 280.94 | 77.06 | 24.94 | 44.72 |
| 13 | 1 | B1 | 4 | Nmax Mlmax Mtmax | 638.18 | 175.06 | 7.48 | 44.72 |
| 14 | 1 | B1 | 4 | Nmin Mlmax Mtmax | 224.27 | 61.52 | 7.48 | 44.72 |
| 15 | 1 | B1 | 4 | Mlmax Mtmax Nmax | 638.18 | 175.06 | 7.48 | 44.72 |
| 16 | 1 | B1 | 4 | Mlmax Mtmax Nmin | 539.85 | 148.09 | 7.48 | 44.72 |
| 17 | 1 | B1 | 4 | Mtmax Nmax Mlmax | 638.18 | 175.06 | 7.48 | 44.72 |
| 18 | 1 | B1 | 4 | Mtmax Nmin Mlmax | 224.27 | 61.52 | 7.48 | 44.72 |

ESTRUCTURA E-1500.4 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 19 | 1 | B2 | 1 | Nmax Mlmax Mtmax | 664.17 | 188.29 | 0.00 | 44.72 |
| 20 | 1 | B2 | 1 | Nmin Mlmax Mtmax | 243.52 | 106.32 | 0.00 | 44.72 |
| 21 | 1 | B2 | 1 | Mlmax Mtmax Nmax | 664.17 | 188.29 | 0.00 | 44.72 |
| 22 | 1 | B2 | 1 | Mlmax Mtmax Nmin | 559.11 | 169.04 | 0.00 | 44.72 |
| 23 | 1 | B2 | 1 | Mtmax Nmax Mlmax | 664.17 | 188.29 | 0.00 | 44.72 |
| 24 | 1 | B2 | 1 | Mtmax Nmin Mlmax | 559.11 | 169.04 | 0.00 | 44.72 |
| 25 | 1 | B2 | 2 | Nmax Mlmax Mtmax | 405.26 | 114.65 | 105.45 | 44.72 |
| 26 | 1 | B2 | 2 | Nmin Mlmax Mtmax | 300.19 | 95.23 | 105.45 | 44.72 |
| 27 | 1 | B2 | 2 | Mlmax Mtmax Nmax | 405.26 | 114.65 | 105.45 | 44.72 |
| 28 | 1 | B2 | 2 | Mlmax Mtmax Nmin | 300.19 | 95.23 | 105.45 | 44.72 |
| 29 | 1 | B2 | 2 | Mtmax Nmax Mlmax | 405.26 | 114.65 | 105.45 | 44.72 |
| 30 | 1 | B2 | 2 | Mtmax Nmin Mlmax | 300.19 | 95.23 | 105.45 | 44.72 |
| 31 | 1 | B2 | 4 | Nmax Mlmax Mtmax | 664.17 | 188.29 | 31.64 | 44.72 |
| 32 | 1 | B2 | 4 | Nmin Mlmax Mtmax | 243.52 | 106.32 | 31.64 | 44.72 |
| 33 | 1 | B2 | 4 | Mlmax Mtmax Nmax | 664.17 | 188.29 | 31.64 | 44.72 |
| 34 | 1 | B2 | 4 | Mlmax Mtmax Nmin | 559.11 | 169.04 | 31.64 | 44.72 |
| 35 | 1 | B2 | 4 | Mtmax Nmax Mlmax | 664.17 | 188.29 | 31.64 | 44.72 |
| 36 | 1 | B2 | 4 | Mtmax Nmin Mlmax | 559.11 | 169.04 | 31.64 | 44.72 |

Programa PILAS v1.1 P A C A D A R,
S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 37 | 1 | B3 | 1 | Nmax Mlmax Mtmax | 690.16 | 254.52 | 0.00 | 44.72 |
| 38 | 1 | B3 | 1 | Nmin Mlmax Mtmax | 262.77 | 160.04 | 0.00 | 44.72 |
| 39 | 1 | B3 | 1 | Mlmax Mtmax Nmax | 690.16 | 254.52 | 0.00 | 44.72 |
| 40 | 1 | B3 | 1 | Mlmax Mtmax Nmin | 578.36 | 231.44 | 0.00 | 44.72 |
| 41 | 1 | B3 | 1 | Mtmax Nmax Mlmax | 690.16 | 254.52 | 0.00 | 44.72 |
| 42 | 1 | B3 | 1 | Mtmax Nmin Mlmax | 578.36 | 231.44 | 0.00 | 44.72 |
| 43 | 1 | B3 | 2 | Nmax Mlmax Mtmax | 431.25 | 156.94 | 206.83 | 117.60 |
| 44 | 1 | B3 | 2 | Nmin Mlmax Mtmax | 319.44 | 133.72 | 206.83 | 117.60 |
| 45 | 1 | B3 | 2 | Mlmax Mtmax Nmax | 431.25 | 156.94 | 206.83 | 117.60 |
| 46 | 1 | B3 | 2 | Mlmax Mtmax Nmin | 319.44 | 133.72 | 206.83 | 117.60 |
| 47 | 1 | B3 | 2 | Mtmax Nmax Mlmax | 431.25 | 156.94 | 206.83 | 117.60 |
| 48 | 1 | B3 | 2 | Mtmax Nmin Mlmax | 319.44 | 133.72 | 206.83 | 117.60 |
| 49 | 1 | B3 | 4 | Nmax Mlmax Mtmax | 690.16 | 254.52 | 62.05 | 44.72 |
| 50 | 1 | B3 | 4 | Nmin Mlmax Mtmax | 262.77 | 160.04 | 62.05 | 44.72 |
| 51 | 1 | B3 | 4 | Mlmax Mtmax Nmax | 690.16 | 254.52 | 62.05 | 44.72 |
| 52 | 1 | B3 | 4 | Mlmax Mtmax Nmin | 578.36 | 231.44 | 62.05 | 44.72 |
| 53 | 1 | B3 | 4 | Mtmax Nmax Mlmax | 690.16 | 254.52 | 62.05 | 44.72 |
| 54 | 1 | B3 | 4 | Mtmax Nmin Mlmax | 578.36 | 231.44 | 62.05 | 44.72 |

Programa PILAS v1.1 P A
C A D A R, S.A.
PANDEO TRANS
ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 638.18 | 0.62 | 0.00 | 184.59 |
| 2 | Nmin Mlmax Mtmax | 224.27 | 0.62 | 0.00 | 64.87 |
| 3 | Mlmax Mtmax Nmax | 638.18 | 0.62 | 0.00 | 184.59 |
| 4 | Mlmax Mtmax Nmin | 539.85 | 0.62 | 0.00 | 156.15 |
| 5 | Mtmax Nmax Mlmax | 638.18 | 0.62 | 0.00 | 184.59 |
| 6 | Mtmax Nmin Mlmax | 224.27 | 0.62 | 0.00 | 64.87 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 7 | Nmax Mlmax Mtmax | 379.27 | 0.38 | 24.94 | 113.24 |
| 8 | Nmin Mlmax Mtmax | 280.94 | 0.38 | 24.94 | 93.79 |
| 9 | Mlmax Mtmax Nmax | 379.27 | 0.38 | 24.94 | 113.24 |
| 10 | Mlmax Mtmax Nmin | 280.94 | 0.38 | 24.94 | 93.79 |
| 11 | Mtmax Nmax Mlmax | 379.27 | 0.38 | 24.94 | 113.24 |
| 12 | Mtmax Nmin Mlmax | 280.94 | 0.38 | 24.94 | 93.79 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 638.18 | 0.62 | 7.48 | 184.59 |
| 14 | Nmin Mlmax Mtmax | 224.27 | 0.62 | 7.48 | 64.87 |
| 15 | Mlmax Mtmax Nmax | 638.18 | 0.62 | 7.48 | 184.59 |
| 16 | Mlmax Mtmax Nmin | 539.85 | 0.62 | 7.48 | 156.15 |
| 17 | Mtmax Nmax Mlmax | 638.18 | 0.62 | 7.48 | 184.59 |
| 18 | Mtmax Nmin Mlmax | 224.27 | 0.62 | 7.48 | 64.87 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 19 | Nmax Mlmax Mtmax | 664.17 | 43.72 | 0.00 | 192.11 |
| 20 | Nmin Mlmax Mtmax | 243.52 | 43.72 | 0.00 | 70.44 |
| 21 | Mlmax Mtmax Nmax | 664.17 | 43.72 | 0.00 | 192.11 |
| 22 | Mlmax Mtmax Nmin | 559.11 | 43.72 | 0.00 | 161.72 |
| 23 | Mtmax Nmax Mlmax | 664.17 | 43.72 | 0.00 | 192.11 |
| 24 | Mtmax Nmin Mlmax | 559.11 | 43.72 | 0.00 | 161.72 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 25 | Nmax Mlmax Mtmax | 405.26 | 26.52 | 105.45 | 222.82 |
| 26 | Nmin Mlmax Mtmax | 300.19 | 26.52 | 105.45 | 195.54 |
| 27 | Mlmax Mtmax Nmax | 405.26 | 26.52 | 105.45 | 222.82 |
| 28 | Mlmax Mtmax Nmin | 300.19 | 26.52 | 105.45 | 195.54 |
| 29 | Mtmax Nmax Mlmax | 405.26 | 26.52 | 105.45 | 222.82 |
| 30 | Mtmax Nmin Mlmax | 300.19 | 26.52 | 105.45 | 195.54 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 31 | Nmax Mlmax Mtmax | 664.17 | 43.72 | 31.64 | 192.11 |
| 32 | Nmin Mlmax Mtmax | 243.52 | 43.72 | 31.64 | 95.27 |
| 33 | Mlmax Mtmax Nmax | 664.17 | 43.72 | 31.64 | 192.11 |
| 34 | Mlmax Mtmax Nmin | 559.11 | 43.72 | 31.64 | 161.72 |
| 35 | Mtmax Nmax Mlmax | 664.17 | 43.72 | 31.64 | 192.11 |
| 36 | Mtmax Nmin Mlmax | 559.11 | 43.72 | 31.64 | 161.72 |

Programa PILAS v1.1 P A
C A D A R, S.A.

ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 37 | Nmax Mlmax Mtmax | 690.16 | 86.82 | 0.00 | 199.62 |
| 38 | Nmin Mlmax Mtmax | 262.77 | 86.82 | 0.00 | 76.00 |
| 39 | Mlmax Mtmax Nmax | 690.16 | 86.82 | 0.00 | 199.62 |
| 40 | Mlmax Mtmax Nmin | 578.36 | 86.82 | 0.00 | 167.28 |
| 41 | Mtmax Nmax Mlmax | 690.16 | 86.82 | 0.00 | 199.62 |

42 Mtmax Nmin Mlmax 578.36 86.82 0.00 167.28



ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 43 | Nmax Mlmax Mtmax | 431.25 | 52.66 | 206.83 | 340.28 |
| 44 | Nmin Mlmax Mtmax | 319.44 | 52.66 | 206.83 | 308.09 |
| 45 | Mlmax Mtmax Nmax | 431.25 | 52.66 | 206.83 | 340.28 |
| 46 | Mlmax Mtmax Nmin | 319.44 | 52.66 | 206.83 | 308.09 |
| 47 | Mtmax Nmax Mlmax | 431.25 | 52.66 | 206.83 | 340.28 |
| 48 | Mtmax Nmin Mlmax | 319.44 | 52.66 | 206.83 | 308.09 |



ESTRUCTURA E-1500.4 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 49 | Nmax Mlmax Mtmax | 690.16 | 86.82 | 62.05 | 231.53 |
| 50 | Nmin Mlmax Mtmax | 262.77 | 86.82 | 62.05 | 137.18 |
| 51 | Mlmax Mtmax Nmax | 690.16 | 86.82 | 62.05 | 231.53 |
| 52 | Mlmax Mtmax Nmin | 578.36 | 86.82 | 62.05 | 208.42 |
| 53 | Mtmax Nmax Mlmax | 690.16 | 86.82 | 62.05 | 231.53 |
| 54 | Mtmax Nmin Mlmax | 578.36 | 86.82 | 62.05 | 208.42 |

DESFUERZOS ADICIONALES

| N | Ml | Mt | Mtpan |
|---|---|---|---|



PANDEO TRANS
ESTRUCTURA E-1500.4 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax Mlmax Mtmax | 638.18 | 0.62 | 184.59 | 44.72 |
| 2 | 1 | B1 | 1 | Nmin Mlmax Mtmax | 224.27 | 0.62 | 64.87 | 44.72 |
| 3 | 1 | B1 | 1 | Mlmax Mtmax Nmax | 638.18 | 0.62 | 184.59 | 44.72 |
| 4 | 1 | B1 | 1 | Mlmax Mtmax Nmin | 539.85 | 0.62 | 156.15 | 44.72 |
| 5 | 1 | B1 | 1 | Mtmax Nmax Mlmax | 638.18 | 0.62 | 184.59 | 44.72 |
| 6 | 1 | B1 | 1 | Mtmax Nmin Mlmax | 224.27 | 0.62 | 64.87 | 44.72 |
| 7 | 1 | B1 | 2 | Nmax Mlmax Mtmax | 379.27 | 0.38 | 113.24 | 44.72 |
| 8 | 1 | B1 | 2 | Nmin Mlmax Mtmax | 280.94 | 0.38 | 93.79 | 44.72 |
| 9 | 1 | B1 | 2 | Mlmax Mtmax Nmax | 379.27 | 0.38 | 113.24 | 44.72 |
| 10 | 1 | B1 | 2 | Mlmax Mtmax Nmin | 280.94 | 0.38 | 93.79 | 44.72 |
| 11 | 1 | B1 | 2 | Mtmax Nmax Mlmax | 379.27 | 0.38 | 113.24 | 44.72 |
| 12 | 1 | B1 | 2 | Mtmax Nmin Mlmax | 280.94 | 0.38 | 93.79 | 44.72 |
| 13 | 1 | B1 | 4 | Nmax Mlmax Mtmax | 638.18 | 0.62 | 184.59 | 44.72 |
| 14 | 1 | B1 | 4 | Nmin Mlmax Mtmax | 224.27 | 0.62 | 64.87 | 44.72 |
| 15 | 1 | B1 | 4 | Mlmax Mtmax Nmax | 638.18 | 0.62 | 184.59 | 44.72 |
| 16 | 1 | B1 | 4 | Mlmax Mtmax Nmin | 539.85 | 0.62 | 156.15 | 44.72 |
| 17 | 1 | B1 | 4 | Mtmax Nmax Mlmax | 638.18 | 0.62 | 184.59 | 44.72 |
| 18 | 1 | B1 | 4 | Mtmax Nmin Mlmax | 224.27 | 0.62 | 64.87 | 44.72 |

ESTRUCTURA E-1500.4 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 19 | 1 | B2 | 1 | Nmax Mlmax Mtmax | 664.17 | 43.72 | 192.11 | 44.72 |
| 20 | 1 | B2 | 1 | Nmin Mlmax Mtmax | 243.52 | 43.72 | 70.44 | 44.72 |
| 21 | 1 | B2 | 1 | Mlmax Mtmax Nmax | 664.17 | 43.72 | 192.11 | 44.72 |
| 22 | 1 | B2 | 1 | Mlmax Mtmax Nmin | 559.11 | 43.72 | 161.72 | 44.72 |
| 23 | 1 | B2 | 1 | Mtmax Nmax Mlmax | 664.17 | 43.72 | 192.11 | 44.72 |
| 24 | 1 | B2 | 1 | Mtmax Nmin Mlmax | 559.11 | 43.72 | 161.72 | 44.72 |
| 25 | 1 | B2 | 2 | Nmax Mlmax Mtmax | 405.26 | 26.52 | 222.82 | 44.72 |
| 26 | 1 | B2 | 2 | Nmin Mlmax Mtmax | 300.19 | 26.52 | 195.54 | 44.72 |
| 27 | 1 | B2 | 2 | Mlmax Mtmax Nmax | 405.26 | 26.52 | 222.82 | 44.72 |
| 28 | 1 | B2 | 2 | Mlmax Mtmax Nmin | 300.19 | 26.52 | 195.54 | 44.72 |
| 29 | 1 | B2 | 2 | Mtmax Nmax Mlmax | 405.26 | 26.52 | 222.82 | 44.72 |
| 30 | 1 | B2 | 2 | Mtmax Nmin Mlmax | 300.19 | 26.52 | 195.54 | 44.72 |
| 31 | 1 | B2 | 4 | Nmax Mlmax Mtmax | 664.17 | 43.72 | 192.11 | 44.72 |
| 32 | 1 | B2 | 4 | Nmin Mlmax Mtmax | 243.52 | 43.72 | 95.27 | 44.72 |
| 33 | 1 | B2 | 4 | Mlmax Mtmax Nmax | 664.17 | 43.72 | 192.11 | 44.72 |
| 34 | 1 | B2 | 4 | Mlmax Mtmax Nmin | 559.11 | 43.72 | 161.72 | 44.72 |
| 35 | 1 | B2 | 4 | Mtmax Nmax Mlmax | 664.17 | 43.72 | 192.11 | 44.72 |
| 36 | 1 | B2 | 4 | Mtmax Nmin Mlmax | 559.11 | 43.72 | 161.72 | 44.72 |

Programa PILAS v1.1
S.A.

P A C A D A R,

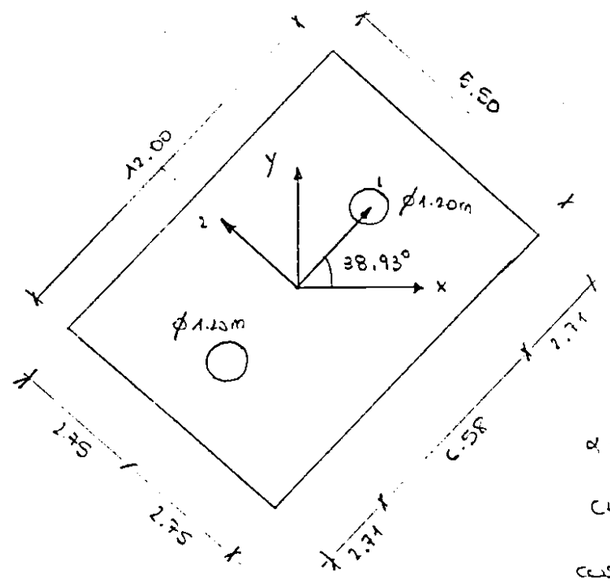
ESTRUCTURA E-1500.4 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 37 | 1 | B3 | 1 | Nmax Mlmax Mtmax | 690.16 | 86.82 | 199.62 | 44.72 |
| 38 | 1 | B3 | 1 | Nmin Mlmax Mtmax | 262.77 | 86.82 | 76.00 | 44.72 |
| 39 | 1 | B3 | 1 | Mlmax Mtmax Nmax | 690.16 | 86.82 | 199.62 | 44.72 |
| 40 | 1 | B3 | 1 | Mlmax Mtmax Nmin | 578.36 | 86.82 | 167.28 | 44.72 |
| 41 | 1 | B3 | 1 | Mtmax Nmax Mlmax | 690.16 | 86.82 | 199.62 | 44.72 |
| 42 | 1 | B3 | 1 | Mtmax Nmin Mlmax | 578.36 | 86.82 | 167.28 | 44.72 |
| 43 | 1 | B3 | 2 | Nmax Mlmax Mtmax | 431.25 | 52.66 | 340.28 | 117.60 |
| 44 | 1 | B3 | 2 | Nmin Mlmax Mtmax | 319.44 | 52.66 | 308.09 | 117.60 |
| 45 | 1 | B3 | 2 | Mlmax Mtmax Nmax | 431.25 | 52.66 | 340.28 | 117.60 |
| 46 | 1 | B3 | 2 | Mlmax Mtmax Nmin | 319.44 | 52.66 | 308.09 | 117.60 |
| 47 | 1 | B3 | 2 | Mtmax Nmax Mlmax | 431.25 | 52.66 | 340.28 | 117.60 |
| 48 | 1 | B3 | 2 | Mtmax Nmin Mlmax | 319.44 | 52.66 | 308.09 | 117.60 |
| 49 | 1 | B3 | 4 | Nmax Mlmax Mtmax | 690.16 | 86.82 | 231.53 | 44.72 |
| 50 | 1 | B3 | 4 | Nmin Mlmax Mtmax | 262.77 | 86.82 | 137.18 | 44.72 |
| 51 | 1 | B3 | 4 | Mlmax Mtmax Nmax | 690.16 | 86.82 | 231.53 | 44.72 |
| 52 | 1 | B3 | 4 | Mlmax Mtmax Nmin | 578.36 | 86.82 | 208.42 | 44.72 |
| 53 | 1 | B3 | 4 | Mtmax Nmax Mlmax | 690.16 | 86.82 | 231.53 | 44.72 |
| 54 | 1 | B3 | 4 | Mtmax Nmin Mlmax | 578.36 | 86.82 | 208.42 | 44.72 |

## 7. COMPROBACION DE ZAPATAS

Se extraen directamente con los esfuerzos del programa 'PILAS' en base de cimentación :

| Nd | $F_{Ld_x}$ | $F_{Td_y}$ | $M_{Ld_y}$ | $M_{Td_x}$ |
|---|---|---|---|---|
| 431,250 | 9,247 | 16,420 | 156,940 | 340,280 |




canto : 1.50 m

$\alpha$ : 38,93°

cos$\alpha$ : 0,628

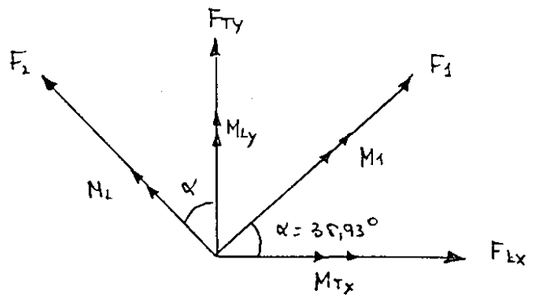
sen$\alpha$ : 0,778

$F_1 = F_{Lx} \cdot \cos\alpha + F_{Ty} \cdot \operatorname{sen}\alpha$

$F_2 = |-F_{Lx} \cdot \operatorname{sen}\alpha| + F_{Ty} \cdot \cos\alpha$

$M_1 = M_{Tx} \cdot \cos\alpha + M_{Ly} \cdot \operatorname{sen}\alpha$

$M_2 = |-M_{Tx} \cdot \operatorname{sen}\alpha| + M_{Ly} \cdot \cos\alpha$




Dado que los esfuerzos de sobrecarga pueden alternar en su signo, se consideran los valores negativos en valor absoluto.



Finalmente :

$F_1 = 0.778 \cdot F_{Lx} + 0.628 \cdot F_{Ty}$

$F_2 = 0.628 \cdot F_{Lx} + 0.778 \cdot F_{Ty}$

$M_1 = 0.778 \cdot M_{Tx} + 0.628 \cdot M_{Ly}$

$M_2 = 0.628 \cdot M_{Tx} + 0.778 \cdot M_{Ly}$

Se considerará la zapata como viga flotante según la dirección "1" y como zapata según la dirección "2".

Además de estos esfuerzos habrá que considerar el peso propio de la cimentación y el incremento de momentos que producirá la cortante "Fi" en la base de la cimentación.

Esfuerzos característicos en base de zapata excepto p.p. zapata que se introducirá como carga uniforme en la viga flotante :

$N = 431,250 / 1.40 = 308,03$ T

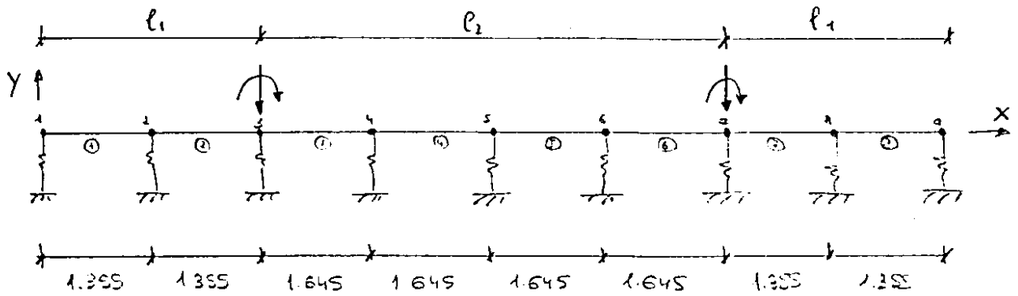
$F_1 = (0.778 \times 9,247 + 0.628 \times 16,42) / 1.40 = 12,50$ T

$F_2 = (0.628 \times 9.427 + 0.778 \times 16,42) / 1.40 = 13,35$ T

$M_1 = (0.778 \times 340,28 + 0.628 \times 156,94) / 1.40 + 13,35 \times 1.50 = 279,52$ mT

$M_2 = (0.628 \times 340,28 + 0.778 \times 156,94) / 1.40 + 12.50 \times 1.50 = 258,60$ mT

Para el cálculo de la cimentación corrida ajustamos un modelo con las siguientes características




$K_{balasto} = 10\ kg/cm^3$ $(\sigma = K \cdot y)$

$\sigma_{adm} = 26\ T/m^2$

$l_2 < 1{,}75 \left(\frac{EI}{Kb}\right)^{1/4} = 5{,}305$ x

$l_1 < 0{,}78 \left(\frac{EI}{kb}\right)^{1/4} = 2.668$ x

Calculo como viga flexible (viga Balasto).

$E = 3.504.163\ T/m^2$

$I = \frac{1}{12} \times 5.50 \times 1.50^3 = 1{,}5469\ m^4$

$K = 10.000\ T/m^3$

$b = 5{,}50$

Características mecánicas de las barras

$A = 5.50 \times 1.50 = 8.25\ m^2$

$J = 0.184 \times 5.50 \times 1.50^3 = 5.272\ m^4$

$I_L = 1.547\ m^4$

$I_T = \frac{1}{12} \times 1.50 \times 5.50^3 = 20{,}797\ m^4$



Obtención de $k_2$:

$K_1 = K_9 = 10000 \times 1.355/2 \times 5.50 = 37.262{,}5\ T/m$

$K_2 = K_8 = 10.000 \times 1{,}355 \times 5.50 = 74.525\ T/m$

$K_3 = K_7 = 10.000 \times (1.355 + 1.645)/2 \times 5.50 = 82.500\ T/m$

$K_4 = K_5 = K_6 = 10.000 \times 1.645 \times 5.50 = 90.475\ T/m$

| Reacciones en nudos | | Movimientos en nudos (y) $\times 10^{-3}$ m |
|---|---|---|
| $R_1$ = 20,80 | t | $y_1$ = 0.4511 |
| $R_2$ = 47,53 | t | $y_2$ = 0.6233 |
| $R_3$ = 60,10 | t | $y_3$ = 0.7923 |
| $R_4$ = 75,42 | t | $y_4$ = 0.8781 |
| $R_5$ = 84,41 | t | $y_5$ = 0.9201 |
| $R_6$ = 93,67 | t | $y_6$ = 1.0054 |
| $R_7$ = 94,70 | t | $y_7$ = 1.1146 |
| $R_8$ = 91,48 | t | $y_8$ = 1.135 |
| $R_9$ = 48,54 | t | $y_9$ = 1.291 |

Se obtienen las tensiones en el terreno en los nudos del modelo con la formula $\sigma_i = 10.000 \cdot y_i$

| | | | | | |
|---|---|---|---|---|---|
| $\sigma_1$ = 4.51 | T/m² | $\sigma_4$ = 8,72 | T/m² | $\sigma_7$ = 11,46 | T/m² |
| $\sigma_2$ = 6,23 | " | $\sigma_5$ = 9,20 | " | $\sigma_8$ = 12,35 | " |
| $\sigma_3$ = 7,82 | " | $\sigma_6$ = 10,04 | " | $\sigma_9$ = 12,91 | " |

Dichas tensiones son válidas para armar la viga flotante. Para obtener las tensiones en el terreno se le sumará a las anteriores el peso propio de la zapata, que resulta ser de:

$\sigma_{pp} = 2{,}50\,T/m^3 \times 1{,}50\,m = 3{,}75\,T/m^2$

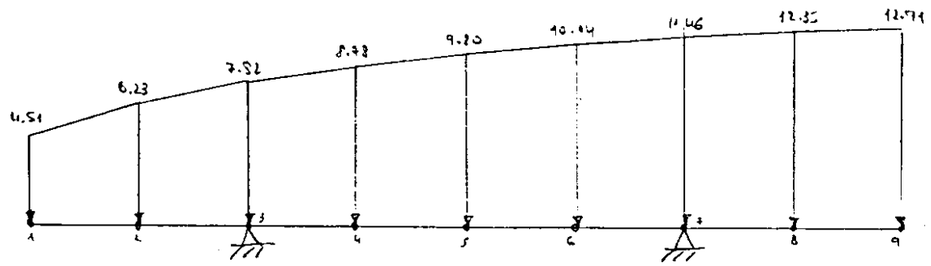
la tensión pésima resulta de valer.

$\sigma_{punta} = 12{,}91 + 3{,}75 = 16{,}66\,T/m^2 < \sigma_{adm} \times 1{,}33 = 34{,}58\,T/m^2$

la tensión media resulta de valer:

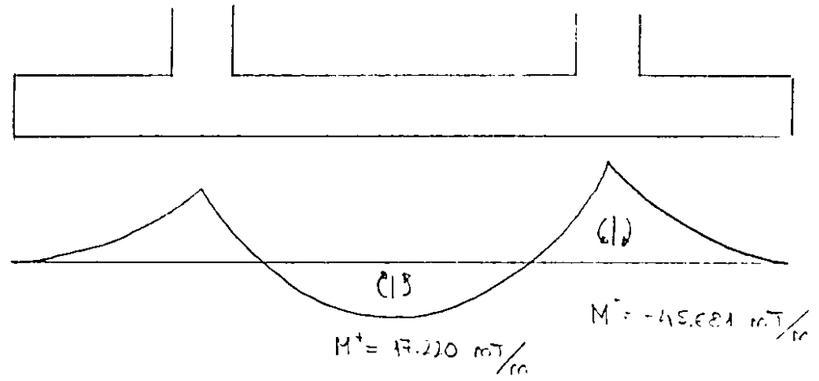
$\sigma_{med} = 308{,}63 \times 2 / (5{,}50 \times 12{,}10) + 3{,}75 = 13{,}08\,T/m^2 < \sigma_{adm} = 26\,T/m^2$

Para obtener esfuerzos sobre viga flotante se introducirán dichas tensiones sobre un nuevo modelo de viga apoyada en los pilares, obteniéndose esfuerzos por metro lineal:






1/ Comprobación de la viga flotante a flexión




$Md^+ = 1.40 \times 17{,}220 \times 5.50\,m = 132{,}59\,mT$

$Md^- = 1.40 \times -45{,}681 \times 5.50\,m = -351{,}74\,mT$

$Uc = fcd \times b \times d = 2500/1.50 \times 5.50 \times (1.50 - 0.06) = 13.200\,T$

$Mlim = \beta\,Uc \cdot d = 0.318 \times 13.200 \times 1.44 = 6041{,}54\,mT$

$Md^+ < Mlim$ :

$Us^+ = 0.85 \times 13200 \times \left[1 - \left(1 - 2{,}353 \times 132{,}59 / (13200 \times 1.44)\right)^{1/2}\right] = 92{,}46\,T$

$As^+ = 92{,}46 \times 1{,}15/5{,}10 = 20{,}84\,cm^2$

$Us^- = 0.85 \times 13200 \times \left[1 - \left(1 - 2{,}353 \times 351{,}74 / (13200 \times 1.44)\right)^{1/2}\right] = 246{,}98\,T$

$As^- = 246{,}98 \times 1{,}15/5{,}10 = 55{,}69\,cm^2$

Cuantía mecánica mínima :

$A_s < 0.04 \times U_c / f_{yd} = 0.04 \times 12200 / 5.2/1.15 = 119,06 \text{ cm}^2$

$A_s^+ < A_s$ :

$\alpha = 1.5 - 12,5 \times U_{s1}^+ / U_c = 1.1407$

$\alpha \cdot A_s^+ = 29,23 \text{ cm}^2$

$A_s^- < A_s$ :

$\alpha = 1.166$

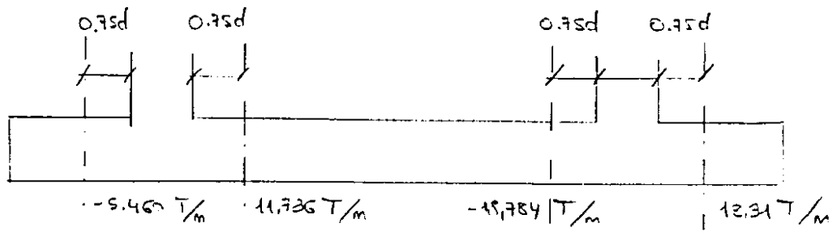
$\alpha A_s^- = 70,81 \text{ cm}^2$

Cuantía geométrica

$1,5/1000 \times 550 \times 150 = 123,75 \text{ cm}^2$ → Disponemos $\varnothing 25$ a $0.20 =$

$= 134,25 \text{ cm}^2$ ✓

2/ Comprobación de la viga flotante a cortante




$0.75 d = 1.08 \text{ m}$

$Vd = 1.40 \times 18,784 \times 5.50 = 144,63 \text{ T}$

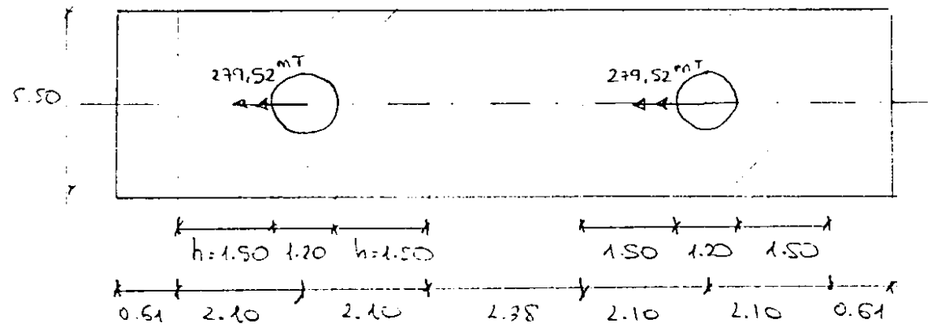
$Vau = 5 \sqrt{fcd} \times b \times d = 5 \sqrt{250/1.50} \times 550 \times 1.44 = 511,23 \text{ T}$

$Vd < Vau$ ✓

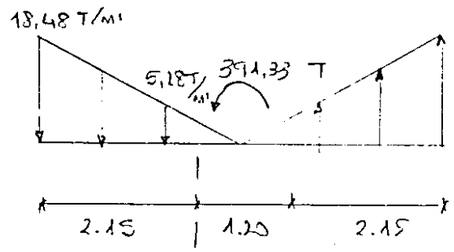


3/ Comprobación transversal de la viga flotante

Transversalmente a la viga flotante tendremos un comportamiento como zapata. Según cap 6.3 "Cálculo de estructuras de cimentación", J Calavera, se considerará la siguiente geometría resistente




$Md = 279,52 \times 1.40 = 391,33 \text{ mT}$




Sección de cálculo a flexión

Cálculo a flexión de la zapata :

$Md = 5,28 \times 2,15^2/2 + \frac{1}{2} \times 2,15^2 \times (18,48 - 5,28) \times \frac{2}{3} = 12,20 +$

$+ 20,34 = 32,54 \text{ mT/m}$

$U_c = f_{cd} \times b \times d = \frac{2500}{1.50} \times 4.20 \times 2.44 = 10.080\ T$

$M_{lim} = 0{,}315 \times 10.080 \times 1.44 = 4615\ mT$

$M_d = M_{lim}$

$U_{s2}^{+} = 0.95 \times 10080 \times \left[1 - \sqrt{1 - 2{,}354 \times \frac{4.20}{10.080 \times 2.44}}\right] =$

$= 95{,}44\ T$

$A_{s2}^{+} = \frac{95{,}44 \times 1.15}{5.10} = 21{,}52\ cm^2 \quad (\text{en } 1\text{ m}) \rightarrow 5{,}12\ cm^2/m$

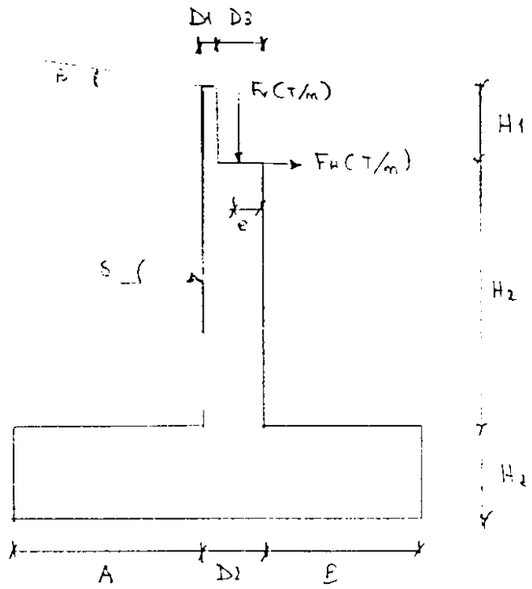
$\rightarrow$ Disponen /20 a 15 $= 20{,}19\ cm^2$ ✓

Armadura mínima = 20 % cuantía geométrica

$0{,}20 \times 5 \times 4{,}20 = 4{,}2\ cm^2/m < 20{,}19\ cm^2/m$



## 8. COMPROBACIÓN DE ESTRIBOS




Las cargas Fv y FH se aplican sobre el centro de todo el alzado con cargas (19,90 m)

Hipótesis de cálculo:

HIPÓTESIS 1 : Estribo en vacío con tierras colaborantes y una sobrecarga de 1 T/m² sobre las tierras.

HIPÓTESIS 2 : Carga muerta + 1 T/m² sobre las tierras

HIPÓTESIS 3 : Sobrecarga + 1 T/m² sobre las tierras

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 8-2 |

ESTRIBO E-1

D1 = 0.30 E = 3.50

D2 = 3.30 A = 5.00

D3 = 2.00 H2 = 2.00

H1 = 1.75

H 2 = (12.60 + 13.02) / 2 = 12.81 m

$\gamma_{TERRENO}$ = 1.80 T/m³ Fck = 250 kg/cm²

$\phi$ = 32° Fyk = 5100 kg/cm²

$\beta = \delta = 0°$ $\gamma_c$ = 1.50

$\sigma_{med}$ = 3.4 T/m² $\gamma_s$ = 1.15

$C_{rozam.}$ = 0.572 ($t_{g\phi}$)

HIPOTESIS 1

Eactivo = 1

Qsdo = 1 T/m²

Fv = 0 T/m

FH = 0 T/m

e = 0.75 m

$\gamma_f$ = 1.35

$\gamma_{desliz}$ = 1.35

$\gamma_{vuelco}$ = 1.62

$\gamma_{sismo}$ = 0.00

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 8-3 |

HIPOTESIS 2

Fv = 207.76 T / 19.70 = 10.54 T/m

FH = (3.53 T + 8.00 T / [illegible] = [illegible] T/m (ver hoja 8-2)
19.70 m

$\gamma_f$ = 1.35

$\gamma_{desliz}$ = 1.50

$\gamma_{vuelco}$ = 1.80

$\gamma_{sismo}$ = 0.00

HIPOTESIS 3

Fv = 10.54 T/m + (10.19 + 1.32 + 67.200) / 19.70 = 13.95 T/m

FH = 0.432 T/m + [illegible] / 19.70 = 2.7767 T/m

$\gamma_f$ = 1.80

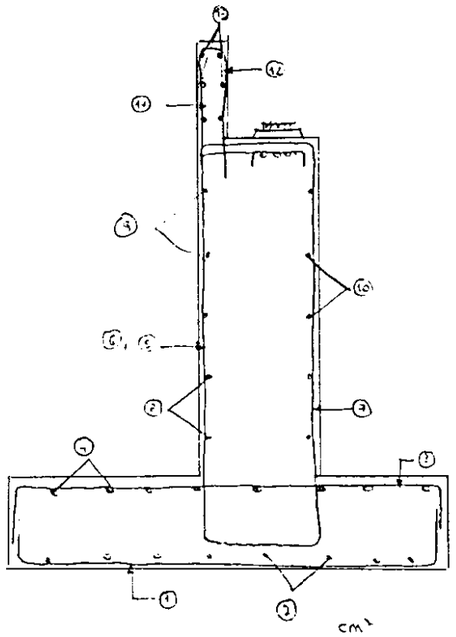
$\gamma_{desliz}$ = [illegible]0

$\gamma_{vuelco}$ = 1.80

$\gamma_{sismo}$ = 0.00

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 8-4 |

Armaduras dispuestas :



| Armadura tipo | cm² Necesario | cm²/n.ϕ Dispuesta | |
|---|---|---|---|
| ① | 38 | 49 / ϕ25 a 10 | ✓ |
| ② | 10 | 15,7 / ϕ10 a 10 | ✓ |
| ③ | 30 | 49 / ϕ25 a 10 | ✓ |
| ④ | 8 | 15,7 / ϕ20 a 20 | ✓ |
| ⑤ | 42 | 53,5 / ϕ32 a 15 | ✓ |
| ⑥ | 34 | 32,6 / ϕ25 a 15 | ✗ |
| ⑦ | 14 | 10,05 / ϕ16 a 20 | ✗ |
| ⑧ | 23 | 32,63 / ϕ25 a 15 | ✓ |
| ⑨ | 23 | " " | ✓ |
| ⑩ | 23 | 32,63 / ϕ25 a 15 | ✓ |
| ⑫ | 2 | 5,65 / ϕ12 a 20 | ✓ |

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 8-5 |

| Armadura tipo | cm² Necesario | cm²/n.ϕ Dispuesta | |
|---|---|---|---|
| ⑫ | 1 | 5,65 / ϕ12 a 20 | ✓ |
| ⑬ | 3 | 5,65 / ϕ12 a 20 | ✓ |

Falla la armadura tipo ⑬, al tener la armadura a cortante y la rotación con el [illegible] es de 1,4 cm²/m

Un tanteo válido a rotura nos lleva a :

$T = Md/z = 166,74^{mm}/0,90 \times (2,00^{m} - 0,03^{m}) = [illegible]$ T

$A_s \geq 94,40^{t} \times 1,15 / 5,1^{t}/cm^2 = 21,28\ cm^2/m$ > 21,6 cm²/m

$A_{min} \geq 0,04\ Uc = 0,04 \times \frac{2500}{1,50} \times [illegible] = 26,66\ cm^2/m$

$\geq 25,12\ cm^2/m$ ✓

$A_{trans} \geq \frac{6}{1000} \times 100 \times (200 - 3,25) = 235,5\ cm^2/19,25 = 11,75\ cm^2/m$ ✓

Finalmente todas las condiciones necesarias, para dar válida la armadura dispuesta se supone por qué el programa "Pilar" obliga a que los diámetros de las armaduras ⑤ y ⑥ sean iguales, lo que lleva a una armadura sobreabundante.

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 8-6 |

Falla la armadura tipo ① en 4 cm²/m. Se estudia la sección de boca de cimbra en máxima, con la armadura dispuesta en soporte con el programa 'CYPE':

Nd = 95,1 T → Mu = -161,20 MT > 166,74

Armadura necesaria:

$\frac{0,9}{1000} \times 220 \times 100 = 18$ cm² se dispone en una cuantía inferior al 30 % de Asmin: 5,4 cm² < 10,03 cm²

según EH-91 (Art° 23.3).

De nuevo el cálculo del programa 'CYPE' resulta más conservador de lo necesario en la normativa EH-91

Se vuelve a hacer la VALIDEZ de los cálculos.

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

ítulo Sección: BASE

* PRESOLICITACIONES ELASTICAS *

nalisis SIN FISURACION

ecuencia Incrementos de Carga:

ncremento de Carga 1 :
Axil : 95.04Tn. AXIL
xcentricidad: 100.00cm.(respecto a la directriz)
eccion Afectada: TOTAL

ENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| sp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 4.5 | 4.8 | 0.0 | 0.0 | 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 $$$$$$ | 31.3 | 31.3 | 0.0 | 31.3 | 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 $$$$$$ | 33.8 | 33.8 | 0.0 | 33.8 | 3 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 |

Incrementos de Carga:
1

ESTUDIO SECCION COMPLETA

nalisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
eformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

LEXION PURA POSITIVA:

Mu(m.T): 90.9 Xu(cm.): -3.1

u(Tn.): 95.1 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= .00017 Etmx= .01000
ompe la fibra inferior de la S.parcial 1
ibra referencia Momento Ultimo: Yo= 0.0 cm.

LEXION PURA NEGATIVA:

Mu(m.T): -261.2 Xu(cm.): 180.2

u(Tn.): 95.7 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00108 Etmx= .01000
ompe la fibra superior de la S.parcial 1
ibra referencia Momento Ultimo: Yo= 0.0 cm.

OMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3115.5 aplicado en Yo(cm)= 94.2

TRACCION SIMPLE(Rigido/Plastico):

STUDIO: 24785
OMBRE SECCION DE MURO: BASE

DEFINICION GEOMETRICA

| | | |
|---|---|---|
| D1 ..... | .30 | [m] |
| D2 ..... | 2.30 | [m] |
| D3 ..... | 2.00 | [m] |
| H1 ..... | 1.75 | [m] |
| H2 ..... | 12.84 | [m] |
| A ..... | 5.00 | [m] |
| B ..... | 3.50 | [m] |
| Hz ..... | 2.00 | [m] |

CARACTERISTICAS DEL TERRENO

| | | |
|---|---|---|
| Gamatt ..... | 1.80 | [Mp/m3] |
| Fi ..... | 30.00 | [grados] |
| Beta..... | 0.00 | [grados] |
| Delta..... | 0.00 | [grados] |
| Sadmt ..... | 34.00 | [Mp/m2] |
| Coefr ..... | .577 | |

CARACTERISTICAS DE LOS MATERIALES
Y COEFICIENTES DE MINORACION

| | | |
|---|---|---|
| Fck ..... | 250 | [Kp/cm2] |
| Fyk ..... | 5100 | [Kp/cm2] |
| Gamac ..... | 1.50 | |
| Gamas ..... | 1.15 | |

DATOS DE APOYO PUNTUAL

| | | |
|---|---|---|
| Bnp..... | 40.00 | [Cm] |
| Dnp..... | 80.00 | [Cm] |
| Sepvig..... | 6.08 | [M] |

HIPOTESIS DE CARGA

| ipot. | Ea | q | Fv [Mp] | Fh [Mp] | Efv [Mp] | Gamaf | Cd | Cv | Sish | Sisv |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 1.00 | 0.00 | 0.00 | .75 | 1.35 | 1.35 | 1.62 | 0.000 | 0.000 |
| 2 | 1.000 | 1.00 | 10.54 | .44 | .75 | 1.35 | 1.50 | 1.80 | 0.000 | 0.000 |
| 3 | 1.000 | 1.00 | 17.75 | .78 | .75 | 1.50 | 1.50 | 1.80 | 0.000 | 0.000 |

VALORES GEOMETRICOS CALCULADOS

| | | |
|---|---|---|
| D1 ..... | .30 | [m] |
| D2 ..... | 2.30 | [m] |

RESULTADOS COMPROBACION DESLIZAMIENTO,
VUELCO , Y TENSIONES SOBRE EL TERRENO

| Hipotesis | Deslizamiento Nv [Mp] | Nh [Mp] | Cdc | Vuelco Mv [Mpm] | Mh [Mpm] | Cvc | N [Mp] | Tensiones e [m] | Tmax [Mp/m2] | Tmin | Zona |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 260.5 | 88.1 | 1.7 | 1732.2 | 502.5 | 3.4 | 260.5 | .7 | 33.2 | 15.0 | 10.80 |
| 2 | 271.0 | 88.5 | 1.8 | 1777.0 | 508.9 | 3.5 | 271.0 | .7 | 35.1 | 15.0 | 10.80 |
| 3 | 278.2 | 88.9 | 1.8 | 1807.6 | 514.0 | 3.5 | 278.2 | .7 | 36.5 | 15.0 | 10.80 |

ESFUERZOS DE DIMENSIONAMIENTO ZAPATA

| Hipotesis | Talon Ms [Mpm] | Vs [Mp] | Vsa [Mp] | Puntera Ms [Mpm] | Vs [Mp] | Vsa [Mp] |
|---|---|---|---|---|---|---|
| 1 | -243.521 | -60.401 | -87.939 | 259.948 | 88.904 | 129.614 |
| 2 | -238.200 | -59.206 | -84.815 | 276.959 | 94.727 | 137.874 |
| 3 | -261.053 | -64.985 | -91.999 | 320.943 | 109.774 | 159.594 |

ESFUERZOS DE DIMENSIONAMIENTO MURO

| Hip. | Muro abajo Msi [Mpm] | Nsi [Mp] | Vsi [Mp] | Muro medio Msm [Mpm] | Nsm [Mp] | Vsm [Mp] | Muro sup.-Murete Vss [Mp] | Ms [Mpm] | Vs [Mp] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 465.399 | 101.442 | 92.777 | 132.411 | 61.574 | 40.452 | 2.028 | 1.413 | 2.028 |
| 2 | 478.631 | 115.671 | 93.364 | 142.626 | 75.803 | 41.040 | 2.615 | 1.413 | 2.028 |
| 3 | 542.706 | 139.339 | 104.250 | 166.740 | 95.041 | 46.111 | 3.417 | 1.570 | 2.253 |

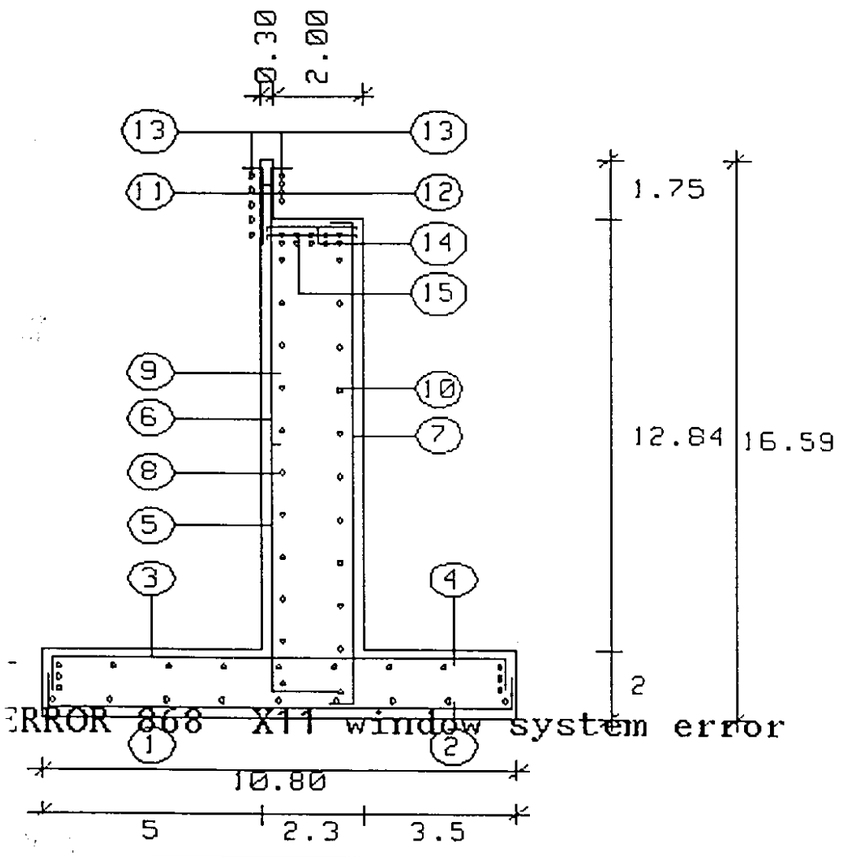
DETALLE DE LA ARMADURA

| Tipo | Anec. (cm2) | Aexis. (cm2) | n | Phy | l (m) | ln (m) | Obs |
|---|---|---|---|---|---|---|---|
| 1 | 38 | 39 | 8 | 25 | 14.70 | 0.00 | |
| 2 | 10 | 10 | 9 | 12 | 1.00 | 0.00 | |
| 3 | 30 | 31 | 10 | 20 | 10.70 | 0.00 | |
| 4 | 8 | 9 | 8 | 12 | 1.00 | 0.00 | |
| 5 | 42 | 44 | 9 | 25 | 10.34 | .50 | |
| 6 | 34 | 34 | 7 | 25 | 5.50 | .50 | |
| 7 | 14 | 14 | 7 | 16 | 14.74 | .32 | |
| 8 | 23 | 25 | 8 | 20 | 1.00 | 0.00 | |
| 9 | 23 | 25 | 8 | 20 | 1.00 | 0.00 | |
| 10 | 23 | 25 | 8 | 20 | 1.00 | 0.00 | |
| 11 | 2 | 3 | 4 | 10 | 2.75 | .20 | |
| 12 | 1 | 2 | 3 | 10 | 2.75 | .20 | |
| 13 | 3 | 3 | 4 | 10 | 1.00 | 0.00 | |
| 14 | 4 | 5 | 6 | 10 | 2.70 | 0.00 | # |
| 15 | 4 | 5 | 6 | 10 | 1.00 | 0.00 | ## |

MEDICIONES (sin mayorar)

| | Hormigon (m3) | Acero (Kp) |
|---|---|---|
| ZAPATA | 21.60 | 731.75 |
| ALZADO | 30.06 | 791.80 |
| TOTAL | 51.66 | 1523.56 |

\# Armadura no por m. sino bajo cada carga a repartir en 3 m.en planta
\## Armadura total bajo cada carga
#/## Armaduras a repetir en 2 capas entre .15 m. y 1.5 m. en vertical
l longitud principal
ln longitud patilla
NOTA: Las armaduras indicadas deben distribuirse por metro salvo las 14 y 15 que se dan por apoyo




ERROR 868 X11 window system error

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 9-1 |

9. CONCLUSION :

Se concluye que todas las alzadas de la E-1000 son aceptables.

| BANDA LONG. | = PUNTO = X | Y | M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| | | | ========== MAX./MIN. ========== | | | | | |
| 1 | 0.00 | 8.00 | .02 | .01 | .10 | 1.77 | .04 | .19 |
| | | | -.04 | -.06 | -.11 | 0.00 | -.19 | -.09 |
| | 1.58 | 8.00 | -.70 | 5.13 | .10 | 0.00 | 0.00 | 0.00 |
| | | | -5.89 | .92 | -.11 | -1.12 | 0.00 | 0.00 |
| | 3.15 | 8.00 | -2.96 | 18.75 | .10 | 0.00 | 0.00 | 0.00 |
| | | | -20.69 | 1.91 | -.11 | -8.06 | 0.00 | 0.00 |
| 2 | 3.15 | 8.00 | -.24 | 7.71 | .62 | 0.00 | 0.00 | 0.00 |
| | | | -16.88 | -18.47 | -.23 | -7.26 | 0.00 | 0.00 |
| | 4.19 | 8.00 | 1.99 | 8.40 | .62 | 2.01 | 0.00 | 0.00 |
| | | | -8.32 | -11.63 | -.23 | -1.29 | 0.00 | 0.00 |
| | 5.24 | 8.00 | 1.64 | 11.38 | .62 | .78 | 0.00 | 0.00 |
| | | | -17.77 | -4.31 | -.23 | -2.78 | 0.00 | 0.00 |
| 3 | 5.24 | 8.00 | 1.64 | .69 | 7.62 | 6.49 | 5.89 | -13.75 |
| | | | -17.77 | -14.01 | -2.85 | -17.22 | -3.11 | -39.10 |
| | 6.35 | 5.50 | 4.95 | 5.71 | 1.73 | 3.91 | 1.80 | -12.87 |
| | | | -15.36 | -5.81 | -.11 | -2.19 | -.70 | -36.15 |
| | 7.46 | 3.01 | 1.95 | 13.90 | 3.57 | 10.83 | 6.17 | -11.36 |
| | | | -16.34 | -2.05 | -4.78 | -8.10 | -3.20 | -35.88 |
| 4 | 7.46 | 3.01 | 1.95 | 5.04 | .30 | .80 | 0.00 | 0.00 |
| | | | -16.34 | -11.24 | -.39 | -2.76 | 0.00 | 0.00 |
| | 8.50 | 3.01 | 1.92 | 11.93 | .30 | 1.99 | 0.00 | 0.00 |
| | | | -7.57 | -7.66 | -.39 | -1.32 | 0.00 | 0.00 |
| | 9.54 | 3.01 | -.20 | 18.77 | .30 | 0.00 | 0.00 | 0.00 |
| | | | -17.66 | -6.97 | -.39 | -7.56 | 0.00 | 0.00 |
| 5 | 9.54 | 3.01 | -3.13 | -1.97 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -21.75 | -18.93 | -.04 | -8.53 | 0.00 | 0.00 |
| | 11.17 | 3.01 | -.72 | -.95 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -6.08 | -5.14 | -.04 | -2.62 | 0.00 | 0.00 |
| | 12.80 | 3.01 | .04 | .07 | .18 | 1.87 | .05 | .06 |
| | | | -.03 | -.01 | -.04 | 0.00 | -.14 | -.24 |

CENTRO LUZ

| BANDA LONG. | = PUNTO = X | Y | M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| | | | ========== MAX./MIN. ========== | | | | | |
| 1 | 0.00 | 16.00 | .03 | 0.00 | .15 | 2.38 | .07 | .12 |
| | | | -.02 | -.07 | -.08 | 0.00 | -.11 | -.17 |
| | 1.58 | 16.00 | -.67 | 5.13 | .15 | 0.00 | 0.00 | 0.00 |
| | | | -5.89 | .91 | -.08 | -1.12 | 0.00 | 0.00 |
| | 3.15 | 16.00 | -2.92 | 18.75 | .15 | 0.00 | 0.00 | 0.00 |
| | | | -20.69 | 1.90 | -.08 | -8.06 | 0.00 | 0.00 |
| 2 | 3.15 | 16.00 | -.20 | 7.04 | .30 | 0.00 | 0.00 | 0.00 |
| | | | -16.88 | -18.47 | -.19 | -7.26 | 0.00 | 0.00 |
| | 4.19 | 16.00 | 1.99 | 7.74 | .30 | 2.01 | 0.00 | 0.00 |
| | | | -7.68 | -11.63 | -.19 | -1.29 | 0.00 | 0.00 |
| | 5.24 | 16.00 | 1.64 | 11.38 | .30 | .78 | 0.00 | 0.00 |
| | | | -16.52 | -4.31 | -.19 | -2.78 | 0.00 | 0.00 |
| 3 | 5.24 | 16.00 | 1.64 | .68 | 3.57 | 5.41 | 2.64 | -12.23 |
| | | | -16.52 | -14.01 | -2.37 | -8.11 | -3.08 | -36.29 |
| | 6.35 | 13.50 | 4.95 | 5.71 | 1.16 | 3.33 | .81 | -13.04 |
| | | | -15.35 | -5.81 | .40 | -.30 | -.91 | -36.07 |
| | 7.46 | 11.01 | 1.95 | 13.90 | 4.00 | 4.67 | 2.70 | -12.41 |
| | | | -16.91 | -.51 | -2.04 | -9.06 | -3.00 | -37.16 |
| 4 | 7.46 | 11.01 | 1.95 | 5.04 | .33 | .80 | 0.00 | 0.00 |
| | | | -16.91 | -11.24 | -.16 | -2.76 | 0.00 | 0.00 |
| | 8.50 | 11.01 | 1.92 | 11.93 | .33 | 1.99 | 0.00 | 0.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | -7.87 | -7.92 | -.16 | -1.32 | 0.00 | 0.00 |
| | 9.54 | 11.01 | -.18 | 18.77 | .33 | 0.00 | 0.00 | 0.00 |
| | | | -17.66 | -7.23 | -.16 | -7.56 | 0.00 | 0.00 |
| | 9.54 | 11.01 | -3.11 | -1.96 | .16 | 0.00 | 0.00 | 0.00 |
| | | | -21.75 | -18.93 | -.09 | -8.53 | 0.00 | 0.00 |
| | 11.17 | 11.01 | -.71 | -.94 | .16 | 0.00 | 0.00 | 0.00 |
| | | | -6.08 | -5.14 | -.09 | -2.62 | 0.00 | 0.00 |
| | 12.80 | 11.01 | .04 | .08 | .16 | 2.45 | .11 | .13 |
| | | | -.02 | -0.00 | -.09 | 0.00 | -.08 | -.18 |

TRES CUARTOS LUZ

| BANDA LONG. | = PUNTO = X | Y | MAX./MIN. M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 24.00 | .03 | .01 | .16 | 1.82 | .14 | .06 |
| | | | -.02 | -.06 | -.04 | 0.00 | -.05 | -.23 |
| | 1.58 | 24.00 | -.68 | 5.13 | .16 | 0.00 | 0.00 | 0.00 |
| | | | -5.89 | .92 | -.04 | -1.12 | 0.00 | 0.00 |
| | 3.15 | 24.00 | -2.93 | 18.75 | .16 | 0.00 | 0.00 | 0.00 |
| | | | -20.69 | 1.90 | -.04 | -8.06 | 0.00 | 0.00 |
| 2 | 3.15 | 24.00 | -.22 | 6.73 | .26 | 0.00 | 0.00 | 0.00 |
| | | | -16.88 | -18.47 | -.43 | -7.26 | 0.00 | 0.00 |
| | 4.19 | 24.00 | 1.99 | 7.42 | .26 | 2.01 | 0.00 | 0.00 |
| | | | -7.32 | -11.63 | -.43 | -1.29 | 0.00 | 0.00 |
| | 5.24 | 24.00 | 1.64 | 11.38 | .26 | .78 | 0.00 | 0.00 |
| | | | -15.84 | -4.31 | -.43 | -2.78 | 0.00 | 0.00 |
| 3 | 5.24 | 24.00 | 1.64 | 2.30 | 3.09 | 12.03 | 2.71 | -11.13 |
| | | | -15.84 | -14.01 | -5.31 | -7.02 | -6.74 | -34.76 |
| | 6.35 | 21.50 | 4.95 | 5.71 | 1.80 | 3.95 | .56 | -12.90 |
| | | | -15.43 | -5.81 | -.09 | -2.02 | -1.96 | -36.60 |
| | 7.46 | 19.01 | 1.95 | 13.90 | 8.26 | 5.35 | 2.63 | -13.99 |
| | | | -18.27 | -.48 | -2.34 | -18.66 | -6.45 | -40.23 |
| 4 | 7.46 | 19.01 | 1.95 | 5.04 | .68 | .80 | 0.00 | 0.00 |
| | | | -18.27 | -11.24 | -.19 | -2.76 | 0.00 | 0.00 |
| | 8.50 | 19.01 | 1.92 | 11.93 | .68 | 1.99 | 0.00 | 0.00 |
| | | | -8.56 | -8.65 | -.19 | -1.32 | 0.00 | 0.00 |
| | 9.54 | 19.01 | -.22 | 18.77 | .68 | 0.00 | 0.00 | 0.00 |
| | | | -17.66 | -7.96 | -.19 | -7.56 | 0.00 | 0.00 |
| 5 | 9.54 | 19.01 | -3.15 | -1.97 | .10 | 0.00 | 0.00 | 0.00 |
| | | | -21.75 | -18.93 | -.13 | -8.53 | 0.00 | 0.00 |
| | 11.17 | 19.01 | -.74 | -.95 | .10 | 0.00 | 0.00 | 0.00 |
| | | | -6.08 | -5.14 | -.13 | -2.62 | 0.00 | 0.00 |
| | 12.80 | 19.01 | .03 | .07 | .10 | 1.81 | .19 | .21 |
| | | | -.04 | -.01 | -.13 | 0.00 | -.04 | -.09 |

APOYO '2'

| BANDA LONG. | = PUNTO = X | Y | MAX./MIN. M | Q | T | M' | Q' | T' |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 32.00 | .11 | .09 | .18 | .39 | .20 | .04 |
| | | | -.02 | -.01 | -.03 | -.07 | -.03 | -.24 |
| | 1.58 | 32.00 | -.67 | 5.13 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -5.89 | .97 | -.03 | -1.12 | 0.00 | 0.00 |
| | 3.15 | 32.00 | -2.99 | 18.75 | .18 | 0.00 | 0.00 | 0.00 |
| | | | -20.69 | 1.96 | -.03 | -8.06 | 0.00 | 0.00 |
| 2 | 3.15 | 32.00 | -.27 | 7.00 | .32 | 0.00 | 0.00 | 0.00 |
| | | | -16.88 | -18.47 | -.58 | -7.26 | 0.00 | 0.00 |
| | 4.19 | 32.00 | 1.99 | 7.69 | .32 | 2.01 | 0.00 | 0.00 |
| | | | -7.70 | -11.63 | -.58 | -1.29 | 0.00 | 0.00 |
| | 5.24 | 32.00 | 1.64 | 11.38 | .32 | .78 | 0.00 | 0.00 |
| | | | -16.43 | -4.31 | -.58 | -2.78 | 0.00 | 0.00 |
| 3 | 5.24 | 32.00 | 1.64 | 5.68 | 7.16 | 29.76 | 7.00 | -7.59 |
| | | | -16.43 | -14.01 | -13.20 | -16.18 | -14.34 | -36.09 |
| | 6.35 | 29.50 | 4.95 | 6.59 | 1.82 | 14.09 | 4.52 | -12.73 |
| | | | -15.43 | -5.81 | -.23 | -34.78 | -7.96 | -36.52 |
| | 7.46 | 27.01 | 1.95 | 13.90 | 17.79 | 17.92 | 7.37 | -13.90 |
| | | | -21.13 | -2.58 | -7.93 | -40.10 | -15.31 | -46.66 |
| 4 | 7.46 | 27.01 | 1.95 | 5.04 | .78 | .80 | 0.00 | 0.00 |
| | | | -21.13 | -11.24 | -.35 | -2.76 | 0.00 | 0.00 |
| | 8.50 | 27.01 | 1.92 | 11.93 | .78 | 1.99 | 0.00 | 0.00 |
| | | | -10.08 | -9.86 | -.35 | -1.32 | 0.00 | 0.00 |
| | 9.54 | 27.01 | -.27 | 18.77 | .78 | 0.00 | 0.00 | 0.00 |
| | | | -17.66 | -9.16 | -.35 | -7.56 | 0.00 | 0.00 |
| 5 | 9.54 | 27.01 | -3.20 | -2.03 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -21.75 | -18.93 | -.15 | -8.53 | 0.00 | 0.00 |
| | 11.17 | 27.01 | -.72 | -1.01 | .05 | 0.00 | 0.00 | 0.00 |
| | | | -6.08 | -5.14 | -.15 | -2.62 | 0.00 | 0.00 |
| | 12.80 | 27.01 | .12 | .01 | .05 | .30 | .24 | .25 |
| | | | -.03 | -.12 | -.15 | -.11 | -.02 | -.05 |

NOTA.- Estos esfuerzos incluyen los del peso propio de la losa.

**ESTUDIO:24785 E-1500.4 VANO 2**

ARMADO DE LA LOSA
**********

APOYO '1'

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | 2.56 | 3.38 | | | |
| | 1.58 | 0.00 | 1.88 | 6.26 | | | |
| | 3.15 | 0.00 | 1.88 | 24.38 | | | * |
| 2 | 3.15 | 0.00 | 2.56 | 20.03 | | | * |
| | 4.19 | 0.00 | 3.72 | 11.19 | | | |
| | 5.24 | 0.00 | 3.23 | 24.78 | | | |
| 3 | 5.24 | 0.00 | 75.14 | 93.47 | | | |
| | 6.35 | -2.50 | 66.46 | 74.16 | | | VER NOTA(1) |
| | 7.46 | -4.99 | 64.41 | 78.04 | | | |
| 4 | 7.46 | -4.99 | 3.40 | 20.14 | | | |
| | 8.50 | -4.99 | 3.35 | 9.13 | | | |
| | 9.54 | -4.99 | 2.56 | 20.79 | | | * |
| 5 | 9.54 | -4.99 | 1.88 | 25.99 | | | * |
| | 11.17 | -4.99 | 1.88 | 6.55 | | | |
| | 12.80 | -4.99 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 75.14 | 93.47 | 22.54 | 28.04 | |
| Armad.orientativa | | | 15d25 | 19d25 | 7d20 | 9d20 | |

Cuantia media parcial.. 170.473 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

TVC

**ESTUDIO:24785 E-1500.4 VANO 2**

ARMADO DE LA LOSA
**********

CUARTO LUZ

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 8.00 | 2.56 | 3.38 | | | |
| | 1.58 | 8.00 | 1.88 | 6.24 | | | |
| | 3.15 | 8.00 | 1.88 | 24.35 | | | * |
| 2 | 3.15 | 8.00 | 2.56 | 19.88 | | | * |
| | 4.19 | 8.00 | 3.57 | 9.49 | | | |
| | 5.24 | 8.00 | 3.07 | 21.05 | | | |
| 3 | 5.24 | 8.00 | 66.03 | 80.84 | | | |
| | 6.35 | 5.50 | 66.60 | 74.16 | | | VER NOTA(1) |
| | 7.46 | 3.01 | 61.52 | 74.11 | | | |
| 4 | 7.46 | 3.01 | 3.18 | 18.86 | | | |
| | 8.50 | 3.01 | 3.14 | 8.39 | | | |
| | 9.54 | 3.01 | 2.56 | 20.59 | | | * |
| 5 | 9.54 | 3.01 | 1.88 | 25.96 | | | * |
| | 11.17 | 3.01 | 1.88 | 6.53 | | | |
| | 12.80 | 3.01 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 66.60 | 80.84 | 19.98 | 24.25 | |
| Armad.orientativa | | | 13d25 | 16d25 | 7d20 | 8d20 | |

Cuantia media parcial.. 148.740 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

**ESTUDIO:24785 E-1500.4 VANO 2**

ARMADO DE LA LOSA
**********

CENTRO LUZ

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 16.00 | 2.56 | 3.38 | | | |
| | 1.58 | 16.00 | 1.88 | 6.28 | | | |
| | 3.15 | 16.00 | 1.88 | 24.40 | | | * |
| 2 | 3.15 | 16.00 | 2.56 | 19.46 | | | * |
| | 4.19 | 16.00 | 3.11 | 8.42 | | | |
| | 5.24 | 16.00 | 2.62 | 18.99 | | | |
| 3 | 5.24 | 16.00 | 61.67 | 74.91 | | | |
| | 6.35 | 13.50 | 66.46 | 74.01 | | | VER NOTA(1) |
| | 7.46 | 11.01 | 63.51 | 76.81 | | | |
| 4 | 7.46 | 11.01 | 3.11 | 19.53 | | | |
| | 8.50 | 11.01 | 3.07 | 8.67 | | | |
| | 9.54 | 11.01 | 2.56 | 20.52 | | | * |
| 5 | 9.54 | 11.01 | 1.88 | 25.94 | | | * |
| | 11.17 | 11.01 | 1.88 | 6.51 | | | |
| | 12.80 | 11.01 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 66.46 | 76.81 | 19.94 | 23.04 | |
| Armad.orientativa | | | 13d25 | 15d25 | 7d20 | 7d20 | |

Cuantia media parcial.. 142.420 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

TVC

**ESTUDIO:24785 E-1500.4 VANO 2**

ARMADO DE LA LOSA
**********

TRES CUARTOS LUZ

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BANDA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 24.00 | 2.56 | 3.38 | | | |
| | 1.58 | 24.00 | 1.88 | 6.30 | | | |
| | 3.15 | 24.00 | 1.88 | 24.43 | | | * |
| 2 | 3.15 | 24.00 | 2.56 | 19.63 | | | * |
| | 4.19 | 24.00 | 3.29 | 8.16 | | | |
| | 5.24 | 24.00 | 2.80 | 18.28 | | | |
| 3 | 5.24 | 24.00 | 59.28 | 71.68 | | | |
| | 6.35 | 21.50 | 67.29 | 74.92 | | | VER NOTA(1) |
| | 7.46 | 19.01 | 68.28 | 83.33 | | | |
| 4 | 7.46 | 19.01 | 3.59 | 21.80 | | | |
| | 8.50 | 19.01 | 3.54 | 9.83 | | | |
| | 9.54 | 19.01 | 2.56 | 20.97 | | | * |
| 5 | 9.54 | 19.01 | 1.88 | 25.88 | | | * |
| | 11.17 | 19.01 | 1.88 | 6.47 | | | |
| | 12.80 | 19.01 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 68.28 | 83.33 | 20.49 | 25.00 | |
| Armad.orientativa | | | 14d25 | 17d25 | 7d20 | 8d20 | |

Cuantia media parcial.. 156.446 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

**ESTUDIO:24785 E-1500.4 VANO 2**

ARMADO DE LA LOSA
**********

APOYO '2'

ESPESOR = 25.00 CM
HORMIGON: FCK = 250 Kp/cm2 gamma-C = 1.50 Recubr.sup. = 2.50 cm.
ACERO: FYK = 5100 Kp/cm2 gamma-S = 1.15 Recubr.inf. = 8.00 cm.

gamma-F = datos GP y GS del listado general

Armado según Instrucc.EH82 en base a los momentos equivalentes de WOOD y ARMER

| BARRA LONG. | PUNTO X | PUNTO Y | ARMADURA TRANSVERSAL inferior cm2/m | ARMADURA TRANSVERSAL superior cm2/m | ARMADURA LONGITUDINAL inferior cm2/m | ARMADURA LONGITUDINAL superior cm2/m | NOTA |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 32.00 | 2.56 | 3.38 | | | |
| | 1.58 | 32.00 | 1.88 | 6.32 | | | |
| | 3.15 | 32.00 | 1.88 | 24.45 | | | * |
| 2 | 3.15 | 32.00 | 2.56 | 19.83 | | | * |
| | 4.19 | 32.00 | 3.51 | 8.75 | | | |
| | 5.24 | 32.00 | 3.01 | 19.23 | | | |
| 3 | 5.24 | 32.00 | 61.34 | 74.47 | | | |
| | 6.35 | 29.50 | 67.16 | 74.79 | | | VER NOTA(1) |
| | 7.46 | 27.01 | 78.27 | 97.22 | | | |
| 4 | 7.46 | 27.01 | 3.74 | 25.93 | | | |
| | 8.50 | 27.01 | 3.69 | 11.69 | | | |
| | 9.54 | 27.01 | 2.56 | 21.12 | | | * |
| 5 | 9.54 | 27.01 | 1.88 | 25.91 | | | * |
| | 11.17 | 27.01 | 1.88 | 6.49 | | | |
| | 12.80 | 27.01 | 2.56 | 3.38 | | | |
| Armadura teorica. | | | 78.27 | 97.22 | 23.48 | 29.17 | |
| Armad.orientativa | | | 16d25 | 19d25 | 8d20 | 9d20 | |

Cuantia media parcial.. 176.792 Kgr/m2

El armado de la losa incluye los esfuerzos de su peso propio

(1) Como armadura longitudinal se toma el 30% de la armadura transversal con un minimo de 2.50 cm2

Cuantia media ponderada 155.310 Kgr/m2

TVC

**ESTUDIO:24785 E-1500.4 VANO 2**

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CB
**********

* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(ESFUERZOS MAYORADOS. MOVIMIENTOS SIN MAYORAR)

CAJON 1

| | | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | | |
| | MAX. M | 21.99 | 11.12 | 8.59 | | | |
| | MAX. Q | 20.08 | 12.57 | 7.27 | | | |
| | MAX. T | 21.99 | 11.12 | 8.59 | | | |
| | MAX. F | | | | 0.00 | -1.65 | -7.30 |
| | MAX. G | | | | -0.00 | .29 | -1.04 |
| | MAX. J | | | | 0.00 | -.28 | 1.94 |
| | MIN. M | -29.86 | -58.24 | -14.94 | | | |
| | MIN. Q | -27.95 | -59.70 | -13.62 | | | |
| | MIN. T | -29.86 | -58.24 | -14.94 | | | |
| | MIN. F | | | | -0.00 | .29 | -1.04 |
| | MIN. G | | | | 0.00 | -1.65 | -7.30 |
| | MIN. J | | | | 0.00 | -1.08 | -10.27 |
| CUARTO LUZ | | | | | | | |
| | MAX. M | 449.63 | -59.70 | -15.77 | | | |
| | MAX. Q | -80.47 | 12.57 | 7.27 | | | |
| | MAX. T | -66.94 | 11.12 | 8.59 | | | |
| | MAX. F | | | | 11.95 | -1.15 | -7.38 |
| | MAX. G | | | | -2.18 | .22 | -1.00 |
| | MAX. J | | | | 2.00 | -.19 | 1.94 |
| | MIN. M | -80.47 | 12.57 | 7.27 | | | |
| | MIN. Q | 449.63 | -59.70 | -15.77 | | | |
| | MIN. T | 449.63 | -59.70 | -18.09 | | | |
| | MIN. F | | | | -2.18 | .22 | -1.00 |
| | MIN. G | | | | 11.95 | -1.15 | -7.38 |
| | MIN. J | | | | 7.77 | -.75 | -10.31 |
| CENTRO LUZ | | | | | | | |
| | MAX. M | 574.55 | -3.36 | -20.31 | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. Q | 466.81 | 21.57 | -29.31 | | | | | |
| | MAX. T | 227.59 | -6.54 | 2.68 | | | | | |
| | MAX. F | | | | 16.79 | 0.00 | -7.47 | | |
| | MAX. G | | | | -.44 | .03 | .93 | | |
| | MAX. J | | | | 2.74 | .01 | 1.92 | | |
| | MIN. M | -107.74 | 5.53 | -9.00 | | | | | |
| | MIN. Q | 574.55 | -18.61 | -20.31 | | | | | |
| | MIN. T | 466.81 | 2.18 | -29.31 | | | | | |
| | MIN. F | | | | -3.18 | .02 | -.99 | | |
| | MIN. G | | | | 14.05 | -.01 | -9.39 | | |
| | MIN. J | | | | 10.86 | .01 | -10.37 | | |

TRES CUARTOS LUZ

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. M | 437.17 | 51.52 | .26 | | | | | |
| | MAX. Q | 331.28 | 52.42 | -9.48 | | | | | |
| | MAX. T | 374.96 | 42.81 | 7.06 | | | | | |
| | MAX. F | | | | 11.94 | 1.16 | -7.51 | | |
| | MAX. G | | | | 11.94 | 1.16 | -7.51 | | |
| | MAX. J | | | | 1.89 | .19 | 1.88 | | |
| | MIN. M | -105.89 | -8.53 | -9.73 | | | | | |
| | MIN. Q | -105.89 | -8.53 | -9.73 | | | | | |
| | MIN. T | 65.55 | 13.71 | -17.62 | | | | | |
| | MIN. F | | | | -2.38 | -.22 | -1.04 | | |
| | MIN. G | | | | -2.38 | -.22 | -1.04 | | |
| | MIN. J | | | | 7.67 | .75 | -10.42 | | |

APOYO '2'

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. M | 17.71 | 42.81 | 7.06 | | | | | |
| | MAX. Q | 12.88 | 51.19 | 2.41 | | | | | |
| | MAX. T | 17.71 | 42.81 | 7.06 | | | | | |
| | MAX. F | | | | 0.00 | 1.64 | -8.00 | | |
| | MAX. G | | | | 0.00 | 1.67 | -7.49 | | |
| | MAX. J | | | | 0.00 | .26 | 1.86 | | |
| | MIN. M | -24.70 | -.15 | -14.39 | | | | | |
| | MIN. Q | -19.88 | -8.53 | -9.73 | | | | | |
| | MIN. T | -24.70 | -.15 | -14.39 | | | | | |
| | MIN. F | | | | -0.00 | -.32 | -.58 | | |
| | MIN. G | | | | -0.00 | -.35 | -1.09 | | |
| | MIN. J | | | | 0.00 | 1.06 | -10.44 | | |

CAJON 2

| | | M | Q | T | F | G | J | | |
|---|---|---|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | | | | |
| | MAX. M | 18.58 | -43.98 | 7.33 | | | | | |
| | MAX. Q | -18.95 | 8.07 | -9.33 | | | | | |
| | MAX. T | 18.58 | -43.98 | 7.33 | | | | | |
| | MAX. F | | | | 0.00 | -1.69 | 8.46 | | |
| | MAX. G | | | | -0.00 | .33 | 1.02 | | |
| | MAX. J | | | | 0.00 | -1.12 | 10.83 | | |
| | MIN. M | -23.77 | -.31 | -13.99 | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MIN. Q | 13.76 | -52.36 | 2.67 | | | | | |
| | MIN. T | -23.77 | -.31 | -13.99 | | | | | |
| | MIN. F | | | | -0.00 | .31 | .51 | | |
| | MIN. G | | | | 0.00 | -1.71 | 7.95 | | |
| | MIN. J | | | | 0.00 | -.26 | -1.86 | | |

CUARTO LUZ

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. M | 448.27 | -52.69 | .53 | | | | | |
| | MAX. Q | -100.33 | 8.07 | -9.33 | | | | | |
| | MAX. T | 386.07 | -43.98 | 7.33 | | | | | |
| | MAX. F | | | | 12.23 | -1.19 | 7.97 | | |
| | MAX. G | | | | -2.25 | .21 | .97 | | |
| | MAX. J | | | | 8.09 | -.79 | 10.82 | | |
| | MIN. M | -100.33 | 8.07 | -9.33 | | | | | |
| | MIN. Q | 347.94 | -53.58 | -8.81 | | | | | |
| | MIN. T | 71.10 | -14.18 | -17.22 | | | | | |
| | MIN. F | | | | -2.25 | .21 | .97 | | |
| | MIN. G | | | | 12.23 | -1.19 | 7.97 | | |
| | MIN. J | | | | 1.89 | -.19 | -1.88 | | |

CENTRO LUZ

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. M | 588.37 | 3.89 | -20.68 | | | | | |
| | MAX. Q | 588.37 | 19.14 | -20.68 | | | | | |
| | MAX. T | 247.46 | 7.37 | 2.63 | | | | | |
| | MAX. F | | | | 17.19 | -0.00 | 7.93 | | |
| | MAX. G | | | | 14.45 | .01 | 9.85 | | |
| | MAX. J | | | | 11.44 | -.01 | 10.77 | | |
| | MIN. M | -101.72 | -5.24 | -8.65 | | | | | |
| | MIN. Q | 486.66 | -21.52 | -29.34 | | | | | |
| | MIN. T | 486.66 | -1.35 | -29.34 | | | | | |
| | MIN. F | | | | -3.01 | -.02 | .92 | | |
| | MIN. G | | | | -.26 | -.03 | -1.00 | | |
| | MIN. J | | | | 2.74 | -.01 | -1.92 | | |

TRES CUARTOS LUZ

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. M | 460.45 | 61.20 | -16.20 | | | | | |
| | MAX. Q | 460.45 | 61.20 | -16.20 | | | | | |
| | MAX. T | -62.36 | -10.42 | 8.26 | | | | | |
| | MAX. F | | | | 12.23 | 1.18 | 7.84 | | |
| | MAX. G | | | | 12.23 | 1.18 | 7.84 | | |
| | MAX. J | | | | 8.18 | .79 | 10.70 | | |
| | MIN. M | -75.90 | -11.87 | 6.93 | | | | | |
| | MIN. Q | -75.90 | -11.87 | 6.93 | | | | | |
| | MIN. T | 460.45 | 61.20 | -18.52 | | | | | |
| | MIN. F | | | | -2.05 | -.21 | .93 | | |
| | MIN. G | | | | -2.05 | -.21 | .93 | | |
| | MIN. J | | | | 2.00 | .19 | -1.94 | | |

APOYO '2'

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. M | 21.01 | -10.42 | 8.26 | | | | | |
| | MAX. Q | -29.14 | 61.20 | -14.04 | | | | | |
| | MAX. T | 21.01 | -10.42 | 8.26 | | | | | |
| | MAX. F | | | | 0.00 | 1.69 | 7.76 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| MAX. G | | | | 0.00 | 1.69 | 7.76 |
| MAX. J | | | | 0.00 | 1.13 | 10.67 |
| MIN. M | -31.05 | 59.74 | -15.37 | | | |
| MIN. Q | 19.10 | -11.87 | 6.93 | | | |
| MIN. T | -31.05 | 59.74 | -15.37 | | | |
| MIN. F | | | | -0.00 | -.27 | .97 |
| MIN. G | | | | -0.00 | -.27 | .97 |
| MIN. J | | | | 0.00 | .28 | -1.94 |



**ESTUDIO:24785 E-1500.4 VANO 2**

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CB
**********

* REACCIONES *
(VALORES MAYORADOS)

| CAJON | EXTR. | | M | R | T | | M | R | T |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | MAX. M | 0.0 | 65.4 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 86.3 | 0.0 | MIN. R | 0.0 | -20.9 | 0.0 |
| | | MAX. T | 0.0 | 65.4 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 1 | 2 | MAX. M | 0.0 | 54.5 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 73.2 | 0.0 | MIN. R | 0.0 | -18.8 | 0.0 |
| | | MAX. T | 0.0 | 54.5 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 1 | MAX. M | 0.0 | 57.2 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 75.1 | 0.0 | MIN. R | 0.0 | -17.9 | 0.0 |
| | | MAX. T | 0.0 | 57.2 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 2 | MAX. M | 0.0 | 68.7 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 88.5 | 0.0 | MIN. R | 0.0 | -19.8 | 0.0 |
| | | MAX. T | 0.0 | 68.7 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 574.549 | 86.267 | -29.311 |
| EXT.DCH. | 588.374 | 88.498 | -29.338 |

ESTUDIO:24785 E-1500.4 VANO 2

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CR
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* ESFUERZOS Y MOVIMIENTOS DE LOS CAJONES *
(ESFUERZOS MAYORADOS. MOVIMIENTOS SIN MAYORAR)

CAJON 1

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | |
| MAX. M | 19.58 | 6.07 | 8.67 | | | |
| MAX. Q | 15.58 | 10.55 | 5.35 | | | |
| MAX. T | -17.59 | -23.02 | 71.31 | | | |
| MAX. F | | | | 0.00 | -.48 | -6.77 |
| MAX. G | | | | -0.00 | .24 | -1.17 |
| MAX. J | | | | -0.00 | .12 | .54 |
| MIN. M | -28.26 | -52.68 | -30.26 | | | |
| MIN. Q | -25.49 | -69.89 | -20.88 | | | |
| MIN. T | -28.26 | -52.68 | -30.26 | | | |
| MIN. F | | | | -0.00 | .23 | -1.17 |
| MIN. G | | | | 0.00 | -1.68 | -7.57 |
| MIN. J | | | | 0.00 | -1.68 | -7.57 |
| CUARTO LUZ | | | | | | |
| MAX. M | 533.61 | -69.89 | 50.30 | | | |
| MAX. Q | 533.61 | 14.86 | 50.30 | | | |
| MAX. T | 166.58 | -23.02 | 71.31 | | | |
| MAX. F | | | | 12.37 | -1.25 | -7.73 |
| MAX. G | | | | -1.83 | .18 | -1.14 |
| MAX. J | | | | -1.02 | .11 | .59 |
| MIN. M | -68.84 | 10.55 | 5.35 | | | |
| MIN. Q | 533.61 | -69.89 | 50.30 | | | |
| MIN. T | 227.52 | -31.28 | -54.50 | | | |
| MIN. F | | | | -1.83 | .18 | -1.14 |
| MIN. G | | | | 12.37 | -1.25 | -7.73 |
| MIN. J | | | | 12.37 | -1.25 | -7.73 |
| CENTRO LUZ | | | | | | |
| MAX. M | 692.62 | -39.93 | -52.54 | | | |
| MAX. Q | 692.62 | 38.09 | -52.54 | | | |
| MAX. T | 144.73 | 4.31 | 63.99 | | | |
| MAX. F | | | | 17.90 | -.01 | -8.01 |
| MAX. G | | | | 13.04 | .17 | -7.23 |
| MAX. J | | | | -1.64 | .03 | .58 |
| MIN. M | -90.91 | 4.50 | -5.10 | | | |
| MIN. Q | 692.62 | -39.93 | -52.54 | | | |
| MIN. T | 150.30 | -8.29 | -67.25 | | | |
| MIN. F | | | | -2.65 | .01 | -1.14 |
| MIN. G | | | | 13.20 | -.19 | -7.27 |
| MIN. J | | | | 17.90 | -.01 | -8.01 |
| TRES CUARTOS LUZ | | | | | | |
| MAX. M | 535.71 | 64.57 | -64.76 | | | |
| MAX. Q | 535.71 | 64.57 | -64.76 | | | |
| MAX. T | 99.96 | 9.62 | 41.69 | | | |
| MAX. F | | | | 12.45 | 1.25 | -7.83 |
| MAX. G | | | | 12.45 | 1.25 | -7.83 |
| MAX. J | | | | -1.35 | -.11 | .49 |
| MIN. M | -84.52 | -6.98 | -5.90 | | | |
| MIN. Q | 535.71 | -17.11 | -64.76 | | | |
| MIN. T | 174.94 | 18.71 | -73.36 | | | |
| MIN. F | | | | -1.96 | -.18 | -1.17 |
| MIN. G | | | | -1.96 | -.18 | -1.17 |
| MIN. J | | | | 12.45 | 1.25 | -7.83 |
| APOYO '2' | | | | | | |
| MAX. M | 14.69 | 46.24 | 21.49 | | | |
| MAX. Q | 13.75 | 64.57 | 13.38 | | | |
| MAX. T | 14.69 | 46.24 | 21.49 | | | |
| MAX. F | | | | 0.00 | .53 | -6.81 |
| MAX. G | | | | 0.00 | 1.72 | -7.72 |
| MAX. J | | | | -0.00 | -.21 | .41 |
| MIN. M | -22.73 | -4.81 | -15.39 | | | |
| MIN. Q | -14.49 | -6.98 | -5.90 | | | |
| MIN. T | 12.72 | 18.71 | -73.36 | | | |
| MIN. F | | | | -0.00 | -.21 | .41 |
| MIN. G | | | | -0.00 | -.28 | -1.20 |
| MIN. J | | | | 0.00 | 1.72 | -7.72 |

CAJON 2

| | M | Q | T | F | G | J |
|---|---|---|---|---|---|---|
| APOYO '1' | | | | | | |
| MAX. M | 15.61 | -46.78 | 22.90 | | | |
| MAX. Q | -13.51 | 6.40 | -5.58 | | | |
| MAX. T | 15.61 | -46.78 | 22.90 | | | |
| MAX. F | | | | 0.00 | -.55 | 7.35 |
| MAX. G | | | | -0.00 | .26 | 1.09 |
| MAX. J | | | | 0.00 | -1.74 | 8.20 |
| MIN. M | -21.89 | 4.24 | -15.14 | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MIN. Q | 14.75 | -65.14 | 14.28 | | | | MAX. G | | | | 0.00 | 1.70 | 8.05 |
| | MIN. T | 13.74 | -19.29 | -79.46 | | | | MAX. J | | | | 0.00 | 1.70 | 8.05 |
| | MIN. F | | | | -0.00 | .19 | -.52 | | | | | | | |
| | MIN. G | | | | 0.00 | -1.74 | 8.20 | MIN. M | -29.32 | 53.57 | -31.72 | | | |
| | MIN. J | | | | -0.00 | .19 | -.52 | MIN. Q | 14.45 | -9.68 | 4.98 | | | |
| | | | | | | | | MIN. T | -29.32 | 53.57 | -31.72 | | | |
| CUARTO LUZ | | | | | | | | MIN. F | | | | -0.00 | -.21 | 1.06 |
| | | | | | | | | MIN. G | | | | -0.00 | -.22 | 1.06 |
| | MAX. M | 542.48 | -65.14 | -69.70 | | | | MIN. J | | | | -0.00 | -.10 | -.65 |
| | MAX. Q | 542.48 | 17.09 | -69.70 | | | | | | | | | | |
| | MAX. T | 229.10 | -25.76 | 45.20 | | | | | | | | | | |
| | MAX. F | | | | 12.61 | -1.27 | 8.32 | | | | | | | |
| | MAX. G | | | | -1.80 | .17 | 1.06 | | | | | | | |
| | MAX. J | | | | 12.61 | -1.27 | 8.32 | | | | | | | |
| | | | | | | | | | | | | | | |
| | MIN. M | -77.78 | 6.40 | -5.58 | | | | | | | | | | |
| | MIN. Q | 542.48 | -65.14 | -69.70 | | | | | | | | | | |
| | MIN. T | 181.81 | -19.29 | -79.46 | | | | | | | | | | |
| | MIN. F | | | | -1.80 | .17 | 1.06 | | | | | | | |
| | MIN. G | | | | 12.61 | -1.27 | 8.32 | | | | | | | |
| | MIN. J | | | | -1.20 | .10 | -.60 | | | | | | | |
| C TRO LUZ | | | | | | | | | | | | | | |
| | MAX. M | 700.26 | 40.30 | -55.61 | | | | | | | | | | |
| | MAX. Q | 700.26 | 40.30 | -55.61 | | | | | | | | | | |
| | MAX. T | 151.94 | -4.34 | 69.45 | | | | | | | | | | |
| | MAX. F | | | | 18.12 | .01 | 8.52 | | | | | | | |
| | MAX. G | | | | 13.42 | .19 | 7.76 | | | | | | | |
| | MAX. J | | | | 18.12 | .01 | 8.52 | | | | | | | |
| | | | | | | | | | | | | | | |
| | MIN. M | -83.26 | -4.13 | -4.84 | | | | | | | | | | |
| | MIN. Q | 700.26 | -38.12 | -55.61 | | | | | | | | | | |
| | MIN. T | 158.06 | 8.68 | -72.74 | | | | | | | | | | |
| | MIN. F | | | | -2.43 | -.01 | 1.03 | | | | | | | |
| | MIN. G | | | | 13.25 | -.17 | 7.72 | | | | | | | |
| | MIN. J | | | | -1.42 | -.03 | -.69 | | | | | | | |
| TRES CUARTOS LUZ | | | | | | | | | | | | | | |
| | MAX. M | 539.63 | 70.78 | 55.23 | | | | | | | | | | |
| | MAX. Q | 539.63 | 70.78 | 55.23 | | | | | | | | | | |
| | MAX. T | 172.41 | 23.91 | 77.42 | | | | | | | | | | |
| | MAX. F | | | | 12.52 | 1.27 | 8.22 | | | | | | | |
| | MAX. G | | | | 12.52 | 1.27 | 8.22 | | | | | | | |
| | MAX. J | | | | 12.52 | 1.27 | 8.22 | | | | | | | |
| | | | | | | | | | | | | | | |
| | MIN. M | -62.99 | -9.68 | 4.98 | | | | | | | | | | |
| | MIN. Q | 539.63 | -14.49 | 55.23 | | | | | | | | | | |
| | MIN. T | 233.44 | 32.14 | -58.04 | | | | | | | | | | |
| | MIN. F | | | | -1.67 | -.17 | 1.04 | | | | | | | |
| | MIN. G | | | | -1.67 | -.17 | 1.04 | | | | | | | |
| | MIN. J | | | | -.86 | -.10 | -.69 | | | | | | | |
| APOYO '2' | | | | | | | | | | | | | | |
| | MAX. M | 18.60 | -5.20 | 8.38 | | | | | | | | | | |
| | MAX. Q | -26.61 | 70.78 | -21.79 | | | | | | | | | | |
| | MAX. T | -18.88 | 23.91 | 77.42 | | | | | | | | | | |
| | MAX. F | | | | 0.00 | .50 | 7.31 | | | | | | | |

**ESTUDIO:24785 E-1500.4 VANO 2**

ENVOLVENTES PARCIALES SOBRECARGAS DE USO TIPO CR
**********

* REACCIONES *
(VALORES MAYORADOS)

| CAJON | EXTR. | | M | R | T | | M | R | T |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | MAX. M | 0.0 | 102.7 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 102.7 | 0.0 | MIN. R | 0.0 | -17.2 | 0.0 |
| | | MAX. T | 0.0 | 102.7 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 1 | 2 | MAX. M | 0.0 | 14.3 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 97.3 | 0.0 | MIN. R | 0.0 | -15.6 | 0.0 |
| | | MAX. T | 0.0 | 14.3 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 1 | MAX. M | 0.0 | -12.7 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 98.4 | 0.0 | MIN. R | 0.0 | -14.6 | 0.0 |
| | | MAX. T | 0.0 | -12.7 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |
| 2 | 2 | MAX. M | 0.0 | -14.3 | 0.0 | MIN. M | 0.0 | 0.0 | 0.0 |
| | | MAX. R | 0.0 | 104.1 | 0.0 | MIN. R | 0.0 | -15.8 | 0.0 |
| | | MAX. T | 0.0 | -14.3 | 0.0 | MIN. T | 0.0 | 0.0 | 0.0 |

VALORES DE LOS ESFUERZOS PESIMOS

| VIGA | MOMENTO | CORTANTE | TORSOR |
|---|---|---|---|
| EXT.IZQ. | 692.618 | 102.688 | -73.355 |
| EXT.DCH. | 700.256 | 104.080 | -79.459 |

ELECCION VIGA PESIMA A FLEXION
******** **** ****** * *******

SECCIONES COMPUESTAS

| | SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| VIGA EXTERIOR IZQ. | 474.60 | 93.06 | 21230.18 | 83380199.9 | 68.36 | 22555.32 | 92277159.4 | 91.93 | 21811.92 | 87405404.5 |
| VIGA EXTERIOR DCHA. | 474.60 | 93.06 | 21230.18 | 83380199.9 | 68.36 | 22555.32 | 92277159.4 | 91.93 | 21811.92 | 87405404.5 |

MOMENTOS FLECTORES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=32.00
******** ********* *** *** ****** ************ ** **** **** * *******

| VIGA | SCAJ | SDER | SIZQ | S | MF | MM | MEDE | TINF |
|---|---|---|---|---|---|---|---|---|
| EXT. IZQ. | 382.00 | 24.30 | 226.40 | 634.70 | 847357.76 | 314873.92 | 844777.88 | -27.70 |
| EXT. DCHA. | 382.00 | 239.00 | 24.30 | 645.30 | 908416.00 | 333376.00 | 859086.06 | -33.94 |

CALCULO VIGA PESIMA A FLEXION
******* **** ****** * *******

DATOS DE LUCES Y CARGAS DE CALCULO

| L1 | PCM | PSOB | P | B | Lc | Csp | Csc |
|---|---|---|---|---|---|---|---|
| 32.00 | 3478.5 | 3484.45 | 20748.33 | 1.50 | 32.0 | 1.35 | 1.50 |

DATOS DE ESFUERZOS

| MF | ML | MCM | MS |
|---|---|---|---|
| 847357.76 | 310144.64 | 333376.00 | 859086.06 |

SECCIONES COMPUESTAS

| SEFIC | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|
| 474.60 | 93.06 | 21230.18 | 83380199.9 | 68.36 | 22555.32 | 92277159.4 | 91.93 | 21811.92 | 87405404.5 |

PERDIDAS PRETENSADO

| DT3 | FRI | DTS | DT4 | DT5 | DT6 | FPF |
|---|---|---|---|---|---|---|
| 1228.83 | 13571.17 | 0.00 | 480.00 | 858.63 | 439.16 | 11481.37 |

TENSIONES

| | PARCIALES | | | | ACUMULADAS | | | |
|---|---|---|---|---|---|---|---|---|
| | SL | IL | SV | IV | SL | IL | SV | IV |
| PRET INIC | 0.00 | 0.00 | -59.36 | 254.47 | 0.00 | 0.00 | -59.36 | 254.47 |
| PRET FIN | 0.00 | 0.00 | -50.13 | 214.64 | 0.00 | 0.00 | -87.13 | 214.64 |
| PPROP.VIGA | 0.00 | 0.00 | 115.31 | -58.26 | 0.00 | 0.00 | 65.16 | 156.62 |
| PPROP.LOSA | 0.00 | 0.00 | 148.90 | -75.26 | 0.00 | 0.00 | 214.14 | 81.36 |
| CAR.MUERTA | 27.69 | 18.66 | 18.66 | -31.92 | 27.69 | 18.66 | 232.79 | 49.43 |
| SOB.CASI-PERM | 14.56 | 9.65 | 9.65 | -17.97 | 42.25 | 28.30 | 242.44 | 31.46 |
| SOB.FRECUENTE | 36.40 | 24.12 | 24.12 | -44.69 | 64.09 | 42.77 | 256.91 | 4.75 |
| SOB.CARACT. | 72.80 | 48.23 | 48.23 | -89.37 | 100.49 | 66.89 | 281.02 | -39.94 |

FISURACION C2 COMPROBADA

CALCULO A ROTURA

MOMENTO DE ROTURA 2955230.21

MOMENTO NECESARIO 2965049.19

REFUERZO 1D 16 EN 6.42 m

ELECCION VIGA PESIMA A CORTANTE

SECCIONES COMPUESTAS

| | SEPIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| VIGA EXTERIOR IZQ. | 606.30 | 99.22 | 23684.27 | 91279897.9 | 94.66 | 25039.42 | 101509820.5 | 97.15 | 24266.02 | 95896129.4 |
| VIGA EXTERIOR DCHA. | 606.30 | 99.22 | 23684.27 | 91279897.9 | 94.66 | 25039.42 | 101509820.5 | 97.15 | 24266.02 | 95896129.4 |

ESFUERZOS CORTANTES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=32.00

| VIGA | SCAJ | SDER | SIZQ | S | QP | QM | QSOB | VRD |
|---|---|---|---|---|---|---|---|---|
| EXT. IZQ. | 382.00 | 24.30 | 228.40 | 634.70 | 135919.72 | 36744.77 | 125069.93 | 361551.96 |
| EXT. DCHA. | 382.00 | 230.00 | 24.30 | 645.30 | 113652.00 | 41672.33 | 126385.01 | 402128.92 |

CALCULO VIGA PESIMA A CORTANTE

DATOS VIGA SECCION SIMPLE Y COMPUESTA (cm)

| Y | YS | A | I | E | OP | SEF | LOS | R | YC | YSC | AC | IC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 147.00 | 50.62 | 12386.48 | 29367022.36 | 40.00 | 0.00 | 606.30 | 25.00 | .75 | 165.00 | 93.22 | 23684.27 | 91279897.87 |

PRETENSADO Y MATERIALES (kg y cm)

| FI | FS | EI | ES | FCD | FYD | PP | PCM | PSOB | F | B | LCAL | CSP | CSS | OPAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1372784.07 | -94176.00 | 7.40 | 5.00 | 321.43 | 4200.00 | 7097.00 | 2604.60 | 3687.42 | 24356.27 | 1.50 | 33.00 | 1.35 | 1.50 | -2.7 |

DATOS LUCES Y CARGAS (kg y m

DATOS ALAS

| KS | KI | BRAS | HSUP/2 | V |
|---|---|---|---|---|
| .293 | .500 | 56.400 | 15.658 | 40.760 |

EMPOTRADOS

| F1 | EI1 | X1 | F2 | EI2 | X2 |
|---|---|---|---|---|---|
| 1056924.60 | 6.67 | 5.41 | 1219341.1 | 7.88 | 1.62 |

RESULTADOS ESFUERZOS

| X | MPP | MSB | QPP | QSB | MTOR | VRD | VU1 | TUD | TU1 | COEF | ZONA | TRAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | .0 | 0.0 | 155224.0 | 128385.0 | 66366 | 402129.9 | 610693.7 | 99548.6 | 613748.2 | .82 | AB | 15.01 |
| 1.0 | 11[illegible] | 122480.3 | 145522.5 | 122480.3 | 67315 | 380175.8 | 538481.4 | 100972.6 | 548337.7 | .88 | AB | 14.32 |
| 2.00 | 31[illegible] | 233381.4 | 135821.0 | 116690.7 | 68264 | 358394.4 | 501592.7 | 102396.5 | 548337.7 | .90 | AB | 13.64 |
| 3.00 | 44[illegible] | 333049.3 | 126119.5 | 111016.4 | 69214 | 336786.0 | 472227.1 | 103820.4 | 548337.7 | .90 | AB | 12.98 |
| 4.00 | 53[illegible] | 421829.4 | 116419.0 | 105457.4 | 70163 | 315350.3 | 448765.0 | 105244.4 | 548337.7 | .89 | AB | 12.33 |
| 5.0 | 47[illegible] | 500647.6 | 106716.5 | 100013.5 | 71112 | 294087.6 | 429824.8 | 106668.4 | 548337.7 | .88 | C | 11.69 |
| 6.00 | 3835[illegible] | 568109.5 | 97015.0 | 94684.9 | 72062 | 272997.6 | 411433.1 | 108092.4 | 548337.7 | .86 | C | 11.07 |
| 7.0 | 62[illegible] | 626300.8 | 87313.5 | 89471.5 | 73011 | 252080.5 | 396469.8 | 109516.4 | 548337.7 | .84 | C | 10.46 |
| 8.00 | 67[illegible] | 674087.2 | 77612.0 | 84373.4 | 73960 | 231336.3 | 386313.1 | 110940.4 | 548337.7 | .80 | C | 9.87 |
| 9.00 | 73463[illegible] | 714514.4 | 67910.5 | 79390.5 | 74438 | 210764.9 | 377953.9 | 111657.4 | 548337.7 | .76 | C | 9.28 |
| 10.00 | 76[illegible] | 745228.2 | 58209.0 | 74522.8 | 74916 | 190366.4 | 371121.7 | 112374.3 | 548337.7 | .72 | C | 8.71 |
| 11.00 | 81[illegible] | 767474.1 | 48507.5 | 69770.4 | 75394 | 170140.7 | 366615.0 | 113091.3 | 548337.7 | .67 | C | 8.16 |
| 12.0 | 85[illegible] | 781597.9 | 38806.0 | 65133.2 | 75872 | 150087.8 | 361283.7 | 113808.3 | 548337.7 | .62 | C | 7.62 |
| 13.00 | -78[illegible] | 787048.3 | 29104.5 | 60611.2 | 76350 | 130207.6 | 359017.3 | 114525.3 | 548337.7 | .57 | C | 7.09 |
| 14.00 | 8[illegible] | 784802.0 | 19403.0 | 56204.4 | 76828 | 110500.7 | 355736.7 | 115242.3 | 548337.7 | .52 | C | 6.57 |
| 15.0 | 7[illegible] | 774803.6 | 9701.5 | 51912.9 | 77306 | 90966.4 | 354346.7 | 115959.3 | 548337.7 | .47 | C | 6.07 |
| 16.00 | 8[illegible] | 768786.0 | 0.0 | 47736.6 | 77784 | 71604.9 | 353942.7 | 116676.2 | 548337.7 | .42 | C | 5.58 |
| 4.21 | 41[illegible] | 438305.3 | 114477.7 | 104359.4 | 70353 | 311083.9 | 444651.6 | 105529.2 | 548337.7 | .44 | C | 12.20 |
| 5.37 | 5[illegible] | 520486.6 | 103116.7 | 98022.8 | 71465 | 286241.8 | 423716.3 | 107199.8 | 548337.7 | .37 | C | 11.46 |
| 6.84 | [illegible] | 612[illegible].9 | 84337.6 | 90016.4 | 72911 | 25428[illegible].4 | 401141.3 | 109377.1 | 548337.7 | .28 | C | 10.53 |

RESULTADOS ESFUERZOS LOCALES

- En ala superior ..... Mi= 782.11 m*kg/m. As,p= .40 cm2 As,t= [illegible] cm2.
- En ala hacia el interior.: Mi= -2058.46 m*kg/m. Ainf= 3.07 cm2 As,t= 3.04 cm2.

RESULTADOS ARMADO

| X | Asup | Ainf | Alos | Aor | Aor | Alts | Alts | Alt1 | Amas |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 9.58 | 29.01 | 16.62 | 57.71 | 2.79 | 2.61 | 2.5 | 2.5 | 32.61 |
| 1.0 | 6.43 | 27.43 | 11.17 | 32.38 | 2.83 | 2.65 | 2.53 | 2.53 | 25.78 |
| 2.00 | 6.02 | 25.86 | 8.76 | 26.36 | 2.84 | 2.69 | 2.57 | 2.57 | 21.42 |
| 3.00 | 5.65 | 24.30 | 7.34 | 22.14 | 2.88 | 2.72 | 2.61 | 2.61 | 18.27 |
| 4.0 | 5.32 | 22.75 | 6.33 | 18.92 | 2.92 | 2.76 | 2.64 | 2.64 | 15.81 |
| 5.0 | 5.04 | 21.22 | 6.30 | 24.57 | 2.96 | 2.80 | 2.68 | 2.68 | 19.30 |
| 6.0 | 5.78 | 19.70 | 5.92 | 22.87 | 3.00 | 2.84 | 2.71 | 2.71 | 17.42 |
| 7.00 | 2.66 | 18.19 | 5.54 | 21.16 | 3.03 | 2.87 | 2.75 | 2.75 | 15.74 |
| 8.00 | 2.38 | 16.69 | 5.17 | 19.42 | 3.07 | 2.91 | 2.79 | 2.79 | 14.33 |
| 9.00 | 2.09 | 15.21 | 4.80 | 17.69 | 3.09 | 2.93 | 2.80 | 2.80 | 13.03 |
| 10.0 | 1.73 | 13.73 | 4.44 | 15.98 | 3.11 | 2.95 | 2.82 | 2.82 | 11.85 |
| 11.00 | 1.49 | 12.28 | 4.08 | 14.28 | 3.13 | 2.97 | 2.84 | 2.84 | 10.77 |
| 12.00 | 1.19 | 10.83 | 3.73 | 12.05 | 3.15 | 2.99 | 2.86 | 2.86 | 9.46 |
| 13.00 | .80 | 9.39 | 3.39 | 9.83 | 3.17 | 3.01 | 2.87 | 2.87 | 8.57 |
| 14.00 | .60 | 7.97 | 3.05 | 7.62 | 3.19 | 3.02 | 2.89 | 2.89 | 8.57 |
| 15.00 | .30 | 6.56 | 2.72 | 5.44 | 3.21 | 3.04 | 2.91 | 2.91 | 8.57 |
| 16.00 | 0.00 | 5.17 | 2.39 | 3.27 | 3.23 | 3.06 | 2.93 | 2.93 | 8.57 |
| 4.21 | 3.82 | 22.44 | 6.61 | 25.99 | 2.92 | 2.77 | 2.65 | 2.65 | 21.10 |
| 5.37 | 3.17 | 20.65 | 6.16 | 23.91 | 2.97 | 2.81 | 2.69 | 2.69 | 19.55 |
| 6.84 | 2.71 | 18.35 | 5.58 | 21.30 | 3.03 | 2.87 | 2.75 | 2.75 | 16.92 |

ARMADURA MINIMA ALMA 8.57

CALCULOS A TORSOR SOLO VALIDOS EN SECCION CERRADA.

# RESUMEN DE REACCIONES

(sin mayorar y por extremo)

DATOS DE CARGAS MAXIMAS (EXTREMO ANTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 111.216 | | 119.230 | |
| Permanentes | 46.785 | 0.000 | 40.458 | 0.000 |
| Sobrec.unif (Qmax) | 60.387 | 0.000 | 52.541 | 0.000 |
| Sobrec.unif (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmax) | 68.459 | 0.000 | 65.669 | 0.000 |
| Vehiculo (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |

DATOS DE CARGAS MINIMAS (EXTREMO ANTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 111.216 | | 119.230 | |
| Permanentes | 46.785 | 0.000 | 40.458 | 0.000 |
| Sobrec.unif (Qmin) | -14.627 | 0.000 | -12.606 | 0.000 |
| Sobrec.unif (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmin) | -11.449 | 0.000 | -9.734 | 0.000 |
| Vehiculo (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |

DATOS DE CARGAS MAXIMAS (EXTREMO POSTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 111.216 | | 119.230 | |
| Permanentes | 38.582 | 0.000 | 49.218 | 0.000 |
| Sobrec.unif (Qmax) | 51.273 | 0.000 | 61.940 | 0.000 |
| Sobrec.unif (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmax) | 64.899 | 0.000 | 69.386 | 0.000 |
| Vehiculo (Tmax) | 0.000 | 0.000 | 0.000 | 0.000 |

DATOS DE CARGAS MINIMAS (EXTREMO POSTERIOR):

| | VIGAS EXT. IZQ. | | VIGAS EXT. DCHA. | |
|---|---|---|---|---|
| | Q Tn. | T mTn | Q Tn. | T mTn |
| Peso propio | 111.216 | | 119.230 | |
| Permanentes | 38.582 | 0.000 | 49.218 | 0.000 |
| Sobrec.unif (Qmin) | -13.135 | 0.000 | -13.852 | 0.000 |
| Sobrec.unif (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |
| Vehiculo (Qmin) | -10.376 | 0.000 | -10.540 | 0.000 |
| Vehiculo (Tmin) | 0.000 | 0.000 | 0.000 | 0.000 |

CARGAS HORIZONTALES EN LA VIGA PESIMA ( Ver desglose en hoja de calculo de neoprenos).

( ESTUDIO: 24785 L= 32.00 Lte= 33.50 )

MATRIZ AREAS

| | | | |
|---|---|---|---|
| 260.000 | 31.611 | 9.533 | 31.772 |
| 300.000 | 18.956 | 6.430 | 30.227 |
| 300.000 | 15.919 | 3.515 | 25.669 |
| 300.000 | 13.613 | 2.651 | 21.222 |
| 515.000 | 11.103 | 1.787 | 16.849 |

MATRIZ ZON

| | | | |
|---|---|---|---|
| 387.500 | 1616.125 | 12.125 | 20.125(5 ramas |
| 200.000 | 16.200 | 10.200 | 1612.200 |
| 300.000 | 1010.200 | 8.200 | 1610.200 |
| 300.000 | 1010.200 | 6.200 | 16.200 |
| 487.500 | 12.200 | 6.200 | 16.200 |

Armadura superior en riostra: 6+6 Ø20

CUANTIA CERCOS (kg/m) 364.21

Armadura longitudinal inferior de la viga 4 d16+ 4d16+ 8 l 8

Armadura longitudinal del alma de la viga 1d12+ 7d 8 (en cada alma).

Armadura longitudinal superior de la viga 2d16+ 6d 8 (en cada ala superior)

Se ha mantenido la matriz PAS. La matriz vale:

| | |
|---|---|
| 16.1671 | .1340 |
| 16.1750 | .085000 |
| 12.10330 | .13600 |
| 10.14150 | .13600 |
| 8.00000 | 0.00000 |

| Asi | Ei | Ass | Es | Ki | Ast | Eti | Ast2 | Et2 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 120.400 | 7.400 | 5.600 | 5.000 | .530 | 92.400 | 6.672100.400 | | 7.064 | 10.000 | 10.000 |

MATRIZ T

| | | | | | |
|---|---|---|---|---|---|
| 1.0000 | 5.0000 | 1.0038 | 5.0045 | 1.0000 | 3.0045 |
| 1.0000 | 4.5000 | 1.0083 | 4.0045 | 1.0000 | 3.0045 |
| 1.0000 | 4.5000 | 1.0083 | 4.0045 | 1.0000 | 3.0045 |
| 1.0000 | 4.5000 | 1.0083 | 4.0045 | 1.0000 | 3.0045 |
| 1.0000 | 4.5000 | 1.0260 | 1.0000 | 3.0045 | 0.0000 |
| 1.0000 | 112.5000 | 1.0970 | 1.0100 | 2.0045 | 0.0000 |

PASO SUPERIOR E-1500.4

3º CALCULO DE PILAS

## MODELO DE VIGA CONTINUA CON APOYOS ESVIADOS

**Datos de las acciones actuantes sobre el modelo:**

**Cargas permanentes**

| | | |
|---|---|---|
| Peso especifico del hormigón: | **2.50** | (t/m3) |
| Carga muerta (barrera+aceras+pavimento) | **5.40** | (t/m) |

**Sobrecarga repartida**

| | | |
|---|---|---|
| Valor de la sobrecarga uniforme | **0.40** | (t/m2) |
| Ancho de tablero donde puede actuar la sobrecarg: | **12.80** | (m.) |

**Vehiculo pesado**

| | | |
|---|---|---|
| Peso del carro | **60.00** | (t.) |
| Momento torsor debido al carro | **210.00** | (m.t) |

**Gradiente Térmico**

| | | |
|---|---|---|
| Gradiente termico a considerar | **5.00** | (°C) |

**Pretensado**

| | |
|---|---|
| Número de familias de cables de pretensado | **1** |

Introduzca el camino y nombre de los ficheros creados por el programa "CABLE.EXE"

Camino de los ficheros de familias:

**G:\MAZAXV.2\E-1500.4\TABLERO\PRETENSA**

| Familia nº | | Nombre fichero "COS" (sin extension) |
|---|---|---|
| 1 | ----> | **CabITB01** |
| 2 | ----> | |
| 3 | ----> | |
| 4 | ----> | |
| 5 | ----> | |
| 6 | ----> | |
| 7 | ----> | |
| 8 | ----> | |
| 9 | ----> | |
| 10 | ----> | |

| | |
|---|---|
| Coeficiente por el que hay que multiplicar el pretensado inicial para obtener el final: | **0.9** |

## CÁLCULO DE REACCIONES VERTICALES PUENTES ESVIADOS: Datos previos

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1500.4

**Coeficientes de ponderacion de acciones**

| ESTADOS LIMITES ULTIMOS | γ | ESTADOS LIMITES DE SERVICIO | γ |
|---|---|---|---|
| Acciones permanentes favorables | 0.90 | Acciones permanentes favorables | 1.00 |
| Acciones permanentes desfav. | 1.50 | Acciones permanentes desfav. | 1.00 |
| Acciones variables favorables | 0.00 | Acciones variables favorables | 0.00 |
| Acciones variables desfavorables | 1.50 | Acciones variables desfavorables | 1.00 |
| Pretensado Hiperestatico favorable | 0.70 | Pretensado Hiperestatico favorable | 0.90 |
| Pretensado Hiperestatico desfav. | 1.00 | Pretensado Hiperestatico desfav. | 1.10 |

**Reacciones modelo de viga continua(valores caracteristicos)**

| APOYO | RPP (ton) | RSE (ton) | R+SR (ton) | R-SR (ton) | R+CA (ton) | R-CA (ton) | Peso de riostras (ton.) | Reaccion.Max. Pret.Hiperestat. (m.ton) | Reaccion.Min. Pret.Hiperestat. (m.ton) | Reacc.Grad. Termico (m.ton) |
|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 118.10 | 16.65 | 33.48 | -17.68 | 62.41 | -16.90 | 54.55 | -3.33 | -3.70 | -2.67 |
| 64 | 95.33 | 17.98 | 17.72 | -0.68 | 48.45 | -5.42 | 54.55 | 46.40 | 41.76 | 15.21 |
| 65 | 393.20 | 91.20 | 101.32 | -14.86 | 71.41 | -16.62 | | -1.94 | -2.16 | 7.65 |
| 66 | 359.60 | 68.66 | 82.73 | -17.63 | 66.05 | -18.92 | | -31.97 | -35.52 | -20.36 |
| 67 | 374.60 | 71.85 | 84.60 | -16.49 | 66.66 | -19.01 | | -29.54 | -32.82 | -23.40 |
| 68 | 377.00 | 87.65 | 98.39 | -15.28 | 70.38 | -17.15 | | -2.62 | -2.91 | 10.29 |
| 69 | 98.13 | 18.47 | 17.86 | -0.35 | 48.97 | -5.25 | 54.55 | 46.40 | 41.76 | 15.04 |
| 70 | 116.00 | 16.35 | 32.90 | -17.40 | 61.17 | -16.46 | 54.55 | -4.23 | -4.70 | -1.77 |

## CÁLCULO DE REACCIONES VERTICALES: Resumen de reacciones

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1500.4

| | RESUMEN REACCIONES MÁXIMAS Y MÍNIMAS | | | | DIMENSIONES DE APOYOS DE NEOPRENO | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ESTADO LIMITE ÚLTIMO | | ESTADO LIMITE DE SERVICIO | | DIMENSIONES DE NEOPRENOS | | COMPROBACION DE TENSIONES (kp/cm2) | | | |
| APOYO | REACCION MÁXIMA | REACCION MÍNIMA | REACCION MÁXIMA | REACCION MÍNIMA | a(m.) | b(m.) | Tensiones maximas Smax | | Tensiones minimas Smin | |
| 63 | 425.46 | 110.79 | 282.19 | 147.98 | 0.45 | 0.60 | **105** | VALE | **55** | VALE |
| 64 | 420.26 | 171.16 | 300.28 | 199.35 | 0.45 | 0.60 | **111** | VALE | **74** | VALE |
| 65 | 995.82 | 386.59 | 663.04 | 450.55 | 0.80 | 0.63 | **132** | VALE | **90** | VALE |
| 66 | 843.18 | 264.55 | 548.27 | 332.28 | 0.80 | 0.63 | **109** | VALE | **66** | VALE |
| 67 | 875.89 | 280.63 | 571.13 | 351.44 | 0.80 | 0.63 | **114** | VALE | **70** | VALE |
| 68 | 963.73 | 366.63 | 641.35 | 429.02 | 0.80 | 0.63 | **128** | VALE | **85** | VALE |
| 69 | 425.94 | 174.87 | 304.07 | 203.14 | 0.45 | 0.60 | **113** | VALE | **75** | VALE |
| 70 | 418.51 | 110.07 | 277.17 | 146.10 | 0.45 | 0.60 | **103** | VALE | **54** | VALE |

## CÁLCULO DE REACCIONES VERTICALES PUENTES ESVIADOS:Estado Limite Servicio

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1500.4

### REACCIONES EN ESTADO LIMITE SERVICIO (en cada aparato de apoyo)

**REACCIONES MAXIMAS(ponderadas)**

| APOYO | RPP (ton.) | RSE (ton.) | R SR (ton.) | R CA (ton.) | HIP.PRET (ton.) | GRAD.TER (ton.) | RIOSTRA (ton.) | TOTAL (ton.) |
|---|---|---|---|---|---|---|---|---|
| 63 | 118.10 | 16.65 | 33.48 | 62.41 | -3.00 | 0.00 | 54.55 | **282.19** |
| 64 | 95.33 | 17.98 | 17.72 | 48.45 | 51.04 | 15.21 | 54.55 | **300.28** |
| 65 | 393.20 | 91.20 | 101.32 | 71.41 | -1.75 | 7.65 | 0.00 | **663.04** |
| 66 | 359.60 | 68.66 | 82.73 | 66.05 | -28.77 | 0.00 | 0.00 | **548.27** |
| 67 | 374.60 | 71.85 | 84.60 | 66.66 | -26.59 | 0.00 | 0.00 | **571.13** |
| 68 | 377.00 | 87.65 | 98.39 | 70.38 | -2.36 | 10.29 | 0.00 | **641.35** |
| 69 | 98.13 | 18.47 | 17.86 | 48.97 | 51.04 | 15.04 | 54.55 | **304.07** |
| 70 | 116.00 | 16.35 | 32.90 | 61.17 | -3.81 | 0.00 | 54.55 | **277.17** |

**REACCIONES MINIMAS(ponderadas)**

| APOYO | RPP | RSE | R SR | R CA | HIP.PRET | GRAD.TER | RIOSTRA | TOTAL |
|---|---|---|---|---|---|---|---|---|
| 63 | 118.10 | 16.65 | -17.68 | -16.90 | -4.07 | -2.67 | 54.55 | **147.98** |
| 64 | 95.33 | 17.98 | -0.68 | -5.42 | 37.58 | 0.00 | 54.55 | **199.35** |
| 65 | 393.20 | 91.20 | -14.86 | -16.62 | -2.37 | 0.00 | 0.00 | **450.55** |
| 66 | 359.60 | 68.66 | -17.63 | -18.92 | -39.07 | -20.36 | 0.00 | **332.28** |
| 67 | 374.60 | 71.85 | -16.49 | -19.01 | -36.11 | -23.40 | 0.00 | **351.44** |
| 68 | 377.00 | 87.65 | -15.28 | -17.15 | -3.20 | 0.00 | 0.00 | **429.02** |
| 69 | 98.13 | 18.47 | -0.35 | -5.25 | 37.58 | 0.00 | 54.55 | **203.14** |
| 70 | 116.00 | 16.35 | -17.40 | -16.46 | -5.17 | -1.77 | 54.55 | **146.10** |

## CÁLCULO DE REACCIONES VERTICALES PUENTES ESVIADOS:Estado Limite Ultimo

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1500.4

### REACCIONES EN ESTADO LIMITE ULTIMO (en cada aparato de apoyo)

**REACCIONES MAXIMAS(ponderadas)**

| APOYO | RPP (ton.) | RSE (ton.) | R SR (ton.) | R CA (ton.) | HIP.PRET (ton.) | GRAD.TER (ton.) | RIOSTRA (ton.) | TOTAL (ton.) |
|---|---|---|---|---|---|---|---|---|
| 63 | 177.15 | 24.98 | 50.22 | 93.62 | -2.33 | 0.00 | 81.83 | **425.46** |
| 64 | 143.00 | 26.97 | 26.58 | 72.68 | 46.40 | 22.82 | 81.83 | **420.26** |
| 65 | 589.80 | 136.80 | 151.98 | 107.12 | -1.36 | 11.48 | 0.00 | **995.82** |
| 66 | 539.40 | 102.99 | 124.10 | 99.08 | -22.38 | 0.00 | 0.00 | **843.18** |
| 67 | 561.90 | 107.78 | 126.90 | 99.99 | -20.68 | 0.00 | 0.00 | **875.89** |
| 68 | 565.50 | 131.48 | 147.59 | 105.57 | -1.83 | 15.44 | 0.00 | **963.73** |
| 69 | 147.20 | 27.71 | 26.80 | 73.46 | 46.40 | 22.56 | 81.83 | **425.94** |
| 70 | 174.00 | 24.53 | 49.36 | 91.76 | -2.96 | 0.00 | 81.83 | **418.51** |

**REACCIONES MINIMAS(ponderadas)**

| APOYO | RPP | RSE | R SR | R CA | HIP.PRET | GRAD.TER | RIOSTRA | TOTAL |
|---|---|---|---|---|---|---|---|---|
| 63 | 106.29 | 14.99 | -26.53 | -25.35 | -3.70 | -4.01 | 49.10 | 110.79 |
| 64 | 85.80 | 16.18 | -1.01 | -8.13 | 29.23 | 0.00 | 49.10 | 171.16 |
| 65 | 353.88 | 82.08 | -22.28 | -24.93 | -2.16 | 0.00 | 0.00 | 386.59 |
| 66 | 323.64 | 61.79 | -26.44 | -28.38 | -35.52 | -30.54 | 0.00 | 264.55 |
| 67 | 337.14 | 64.67 | -24.74 | -28.52 | -32.82 | -35.10 | 0.00 | 280.63 |
| 68 | 339.30 | 78.89 | -22.92 | -25.73 | -2.91 | 0.00 | 0.00 | 366.63 |
| 69 | 88.32 | 16.62 | -0.52 | -7.88 | 29.23 | 0.00 | 49.10 | 174.87 |
| 70 | 104.40 | 14.72 | -26.10 | -24.69 | -4.70 | -2.66 | 49.10 | 110.07 |

## DATOS DE ACCIONES SOBRE TABLERO Y MODULOS DE MATERIALES

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1500.4

**Módulos de elásticidad de materiales:**

| | | |
|---|---|---|
| Módulo de deformación del neopreno frente a acciones RAPIDAS --> | Gr(t/m2)= | 160 |
| Módulo de deformación del neopreno frente a acciones LENTAS --> | Gl(t/m2)= | 80 |
| Módulo de deformación del hormigón frente a acciones RAPIDAS --> | Er(t/m2)= | 3,000,000 |
| Módulo de deformación del hormigón frente a acciones LENTAS --> | El(t/m2)= | 1,000,000 |

**ACCIONES ACTUANTES SOBRE LA ESTRUCTURA**

**Frenado y fuerza centrifuga :**

| | |
|---|---|
| RADIO DEL TABLERO CON SU SIGNO (si es recto poner un número alto)(m.) | -1000.00 |
| VELOCIDAD CIRCULACION SOBRECARGA(km/h): | 120.00 |
| ANCHO DE TABLERO (para evaluar carga de frenado y fuerza centrífuga)(en m.): | 12.80 |
| VALOR DE LA SOBRECARGA UNIFORME DE USO(t/m2): | 0.40 |
| FUERZA DE FRENADO TOTAL (t.): | **21.43** |
| FUERZA CENTRIFUGA TOTAL | **-8.38** |

**Viento:**

| | |
|---|---|
| SOBRECANTO FRENTE AL VIENTO (normalmente 2 x alto barrera + peralte ) (m.): | 2.95 |
| PRESION UNITARIA DEL VIENTO (t/m2): | 0.25 |

**Coacciones:**

| | |
|---|---|
| DESPLAZ. IMPUESTO POR FLUENCIA+RETR+TEMP(mm/metro) | **1.00** |

**Acciones sismicas:**

| | |
|---|---|
| ACELERACION DE CALCULO ( ac/g ) (si no hay sismo poner cero) | 0 |

Datos cotas

| Elemento | Cota de Terreno natural | Cota de fondo de cuneta(1) | Reguardo respecto terr. natural(m.) | Resguardo respecto fondo cuneta(m.) | Cota cara sup. zapata en Inf. Geotécnico | Cota de tablero(2) | ota cara su zapata máxima | Altura de fustes Hf(m.) |
|---|---|---|---|---|---|---|---|---|
| ESTRIBO 1 | 294.000 | 294.000 | 0.500 | 0.500 | 292.500 | 304.616 | 292.500 | 12.116 |
| PILA 1 | 294.000 | 294.000 | 0.500 | 0.500 | 292.000 | 305.181 | 292.000 | 13.181 |
| PILA 2 | 294.000 | 294.000 | 0.500 | 0.500 | 292.000 | 305.699 | 292.000 | 13.699 |
| ESTRIBO 2 | 294.000 | 294.000 | 0.500 | 0.500 | 292.500 | 305.781 | 292.500 | 13.281 |

Datos geométricos

## DATOS GEOMÉTRICOS DE FUSTES Y NEOPRENOS

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1500.4

| Elemento | Altura del fuste (m.) | Número de apoyos neopreno | Tipo de pila 1=circular 2=prismatica | Dimensiones base pila: ancho o diametro(m.) | Dimensiones base pila: espesor (m.) | Dimensiones cabeza de pil: ancho (m.) | Dimensiones cabeza de pil: espesor (m.) | Dimensiones de neoprenos: a (m.) | Dimensiones de neoprenos: b (m.) | Dimensiones de neoprenos: e (m.) | Desplazamiento maximo admisible neoprenos en (mm.) | Rigidez pila+neopreno acciones rapidas dir. transversal (t/m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESTRIBO 1 | 12.12 | 2 | 2 | 100.00 | 100.00 | 100.00 | 100.00 | 0.45 | 0.60 | 0.066 | 46.20 | 1309 |
| PILA 1 | 13.18 | 2 | 1 | 1.20 | 1.20 | 1.20 | 1.20 | 0.80 | 0.63 | 0.059 | 41.30 | 619 |
| PILA 2 | 13.70 | 2 | 1 | 1.20 | 1.20 | 1.20 | 1.20 | 0.80 | 0.63 | 0.059 | 41.30 | 565 |
| ESTRIBO 2 | 13.28 | 2 | 2 | 100.00 | 100.00 | 100.00 | 100.00 | 0.45 | 0.60 | 0.066 | 46.20 | 1309 |

## COMPROBACIÓN DE MOVIMIENTOS EN NEOPRENOS

PROYECTO: L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
ESTRUCTURA: Estructura E-1500.4

(Todos los valores estan en mm.)

| Apoyo | Elemento neopreno Nº | HIPOTESIS MOVIMIENTOS IMPUESTOS | | | | | HIPOTESIS DE FRENADO | | | | | HIPOTESIS DE FUERZA CENTRIFUGA | | | | | HIPOTESIS DE VIENTO | | | | | MOVIMIENTOS COMBINADOS | | | Maximo mov. admitido por neop. | Compro-bacion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CARA SUPERIOR | | CARA INFERIOR | | Mov. Relativ. | CARA SUPERIOR | | CARA INFERIOR | | Mov. Relativ. | CARA SUPERIOR | | CARA INFERIOR | | Mov. Relativ. | CARA SUPERIOR | | CARA INFERIOR | | Mov. Relativ. | HIPOTESIS 1 | HIPOTESIS 2 | HIPOTESIS 3 | | |
| | | UX | UY | UX | UY | | UX | UY | UX | UY | | UX | UY | UX | UY | | UX | UY | UX | UY | | U | U | U | | |
| ESTRIBO 1 | 69 | -28 | 22 | 0 | 0 | 36 | -5 | 4 | 0 | 0 | 6 | 1 | 2 | 0 | 0 | 2 | 14 | 18 | 0 | 0 | 23 | 42 | 43 | 40 | 46 | vale |
| ESTRIBO 1 | 70 | -28 | 22 | 0 | 0 | 36 | -5 | 4 | 0 | 0 | 6 | 1 | 2 | 0 | 0 | 2 | 14 | 17 | 0 | 0 | 22 | 42 | 42 | 39 | 46 | vale |
| PILA1 | 71 | -12 | 10 | -10 | 8 | 3 | -4 | 4 | -3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 15 | 18 | 12 | 14 | 5 | 5 | 6 | 5 | 41 | vale |
| PILA1 | 72 | -12 | 10 | -10 | 8 | 3 | -4 | 4 | -3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 15 | 18 | 12 | 14 | 5 | 5 | 6 | 5 | 41 | vale |
| PILA2 | 73 | 12 | -11 | 9 | -9 | 3 | -4 | 4 | -3 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 16 | 18 | 13 | 14 | 5 | 5 | 6 | 5 | 41 | vale |
| PILA2 | 74 | 12 | -11 | 9 | -9 | 3 | -4 | 4 | -3 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 16 | 18 | 13 | 14 | 5 | 5 | 6 | 5 | 41 | vale |
| ESTRIBO 2 | 75 | 27 | -24 | 0 | 0 | 36 | -4 | 4 | 0 | 0 | 6 | 2 | 2 | 0 | 0 | 2 | 16 | 17 | 0 | 0 | 23 | 42 | 43 | 40 | 46 | vale |
| ESTRIBO 2 | 76 | 27 | -24 | 0 | 0 | 36 | -4 | 4 | 0 | 0 | 6 | 2 | 2 | 0 | 0 | 2 | 16 | 17 | 0 | 0 | 23 | 42 | 43 | 40 | 46 | vale |

## ESFUERZOS HORIZONTALES EN CABEZA DE PILAS

PROYECTO: L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
ESTRUCTURA: Estructura E-1500.4

(Todos los valores estan en toneladas y según los ejes principales de la pila.)
(En los esfuerzos de sismo y viento ya esta incluida la accion sobre el fuste, excepto en los estribos)

| Apoyo | FUSTE Nº | MOVIMIENTOS IMPUESTOS | | FRENADO | | FUERZA CENTRIFUGA | | ACCION DEL VIENTO | | SISMO LONGITUDINAL | | SISMO TRANSVERSAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dirección transversal (Y) | Dirección longitudinal (Z) | Dirección transversal (Y) | Dirección longitudinal (Z) | Dirección transversal (Y) | Dirección longitudinal (Z) | Dirección transversal (Y) | Dirección longitudinal (Z) | Dirección transversal (Y) | Dirección longitudinal (Z) | Dirección transversal (Y) | Dirección longitudinal (Z) |
| ESTRIBO 1 | 1 | 18.24 | 14.72 | 5.90 | 4.96 | -1.85 | 2.31 | -18.55 | 23.19 | 0.00 | 0.00 | 0.00 | 0.00 |
| PILA1 | 1 | 1.18 | 0.94 | 1.20 | 1.02 | -0.40 | 0.48 | -4.38 | 5.27 | 0.00 | 0.00 | 0.00 | 0.00 |
| PILA1 | 2 | 1.18 | 0.94 | 1.20 | 1.02 | -0.40 | 0.48 | -4.38 | 5.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| PILA2 | 1 | -1.02 | -0.96 | 1.09 | 0.94 | -0.38 | 0.43 | -4.20 | 4.72 | 0.00 | 0.00 | 0.00 | 0.00 |
| PILA2 | 2 | -1.02 | -0.96 | 1.09 | 0.95 | -0.38 | 0.43 | -4.20 | 4.75 | 0.00 | 0.00 | 0.00 | 0.00 |
| ESTRIBO 2 | 1 | -17.39 | -16.02 | 5.77 | 5.10 | -2.05 | 2.21 | -20.62 | 22.21 | 0.00 | 0.00 | 0.00 | 0.00 |

PROGRAMA PARA EL CALCULO DE CABLES DE PRETENSADO

DEPARTAMENTO DE ESTRUCTURAS.GINPRO.S.A.
Ingenieros y arquitectos consultores

PROYECTO:MAZAXV
REFERENCIA CABLE:CablTB01.LIS

PARAMETROS DE TRAZADO

Numero de tramos de cableado NTC= 3

Tipo de cableado(1-2-3-4) para tramo nº1 TIPO=1
Parametros del tramo:
S0= 0.000 S1= 9.000 S2= 0.000 S3= 9.000 S4= 2.000 SR= 1.000
H1= 0.616 H2= 1.000 H3= 1.000 H4= 0.400

Tipo de cableado(1-2-3-4) para tramo nº2 TIPO=3
Parametros del tramo:
S1= 3.200 S2= 12.800 S3= 0.000 S4= 12.800 S5= 3.200
H1= 0.400 H2= 1.250 H3= 1.250 H5= 0.400

Tipo de cableado(1-2-3-4) para tramo nº3 TIPO=2
Parametros del tramo:
S0= 0.000 S1= 9.000 S2= 0.000 S3= 9.000 S4= 2.000 SR= 1.000
H1= 0.616 H2= 1.000 H3= 1.000 H4= 0.400

DATOS GENERALES

Anclaje IZQUIERDO (1=ACTIVO)(2=PASIVO)...1
Anclaje DERECHO (1=ACTIVO)(2=PASIVO)...1
Anclaje desde el que se tesa primero..(1=IZDO.)(2=DCHO.)...1

Fuerza de tesado inicial P0(ton)= 4848.0
Fuerza de tesado final P1(ton)= 4548.0
Area del cable (cm2)=319.200012
Coef.rozamiento cable-vaina NU=0.210000
Coef.rozamientos parasitos (K/NU)=0.006000
Penetracion de cuñas a(mm.)=5.000000
Modulo de elasticidad del acero pretensar Ep(kp/cm2)= 1900000
Se incluyen perdidas por Acortamiento Elástico de Hormigón(0=SI 1=NO)...OP=0

GEOMETRIA DEL CABLE

TRAZADO EN ALZADO:
Numero de tramos de parabola o rectas en la forma(y=Ax^2+Bx+C) NA=12

| tramo | Xinic(m.) | Xfinal(m.) | A | B | C |
|---|---|---|---|---|---|
| 1 | 0.000000 | 1.000000 | 0.000000 | 0.076800 | 0.616000 |
| 2 | 1.000000 | 9.000000 | -0.004800 | 0.086400 | 0.611200 |
| 3 | 9.000000 | 18.000000 | -0.006061 | 0.109091 | 0.509091 |
| 4 | 18.000000 | 20.000000 | 0.027273 | -1.090909 | 11.309092 |
| 5 | 20.000000 | 23.200001 | 0.016602 | -0.664062 | 7.040624 |
| 6 | 23.200001 | 36.000000 | -0.004150 | 0.298828 | -4.128906 |
| 7 | 36.000000 | 48.799999 | -0.004150 | 0.298828 | -4.128906 |
| 8 | 48.799999 | 52.000000 | 0.016602 | -1.726562 | 45.290615 |
| 9 | 52.000000 | 54.000000 | 0.027273 | -2.836364 | 74.145447 |
| 10 | 54.000000 | 63.000000 | -0.006061 | 0.763636 | -23.054544 |
| 11 | 63.000000 | 71.000000 | -0.004800 | 0.604800 | -18.051203 |
| 12 | 71.000000 | 72.000000 | 0.000000 | -0.076800 | 6.145600 |

TRAZADO EN PLANTA:
El trazado el planta es recto.

ANGULOS DE DESVIACION ACUMULADOS EN ALZADO:

Angulos comenzando por el anclaje IZDO.(rad):

| tramo | Xinic(m.) | Xfinal(m.) | alfa1 | alfa2 |
|---|---|---|---|---|
| 1 | 0.000000 | 1.000000 | 0.000000 | 0.000000 |
| 2 | 1.000000 | 9.000000 | 0.000000 | 0.076650 |
| 3 | 9.000000 | 18.000000 | 0.076650 | 0.185311 |
| 4 | 18.000000 | 20.000000 | 0.185311 | 0.293972 |
| 5 | 20.000000 | 23.200001 | 0.293972 | 0.399825 |
| 6 | 23.200001 | 36.000000 | 0.399825 | 0.505678 |
| 7 | 36.000000 | 48.799999 | 0.505678 | 0.611531 |
| 8 | 48.799999 | 52.000000 | 0.611531 | 0.717384 |
| 9 | 52.000000 | 54.000000 | 0.717384 | 0.826045 |
| 10 | 54.000000 | 63.000000 | 0.826045 | 0.934706 |
| 11 | 63.000000 | 71.000000 | 0.934706 | 1.011356 |
| 12 | 71.000000 | 72.000000 | 1.011356 | 1.011356 |

Angulos comenzando por el anclaje DCHO.(rad):

| tramo | Xinic(m.) | Xfinal(m.) | alfa1 | alfa2 |
|---|---|---|---|---|
| 1 | 0.000000 | 1.000000 | 1.011356 | 1.011356 |
| 2 | 1.000000 | 9.000000 | 1.011356 | 0.934706 |
| 3 | 9.000000 | 18.000000 | 0.934706 | 0.826045 |
| 4 | 18.000000 | 20.000000 | 0.826045 | 0.717384 |
| 5 | 20.000000 | 23.200001 | 0.717384 | 0.611531 |
| 6 | 23.200001 | 36.000000 | 0.611531 | 0.505678 |
| 7 | 36.000000 | 48.799999 | 0.505678 | 0.399825 |
| 8 | 48.799999 | 52.000000 | 0.399825 | 0.293972 |
| 9 | 52.000000 | 54.000000 | 0.293972 | 0.185311 |
| 10 | 54.000000 | 63.000000 | 0.185311 | 0.076650 |
| 11 | 63.000000 | 71.000000 | 0.076650 | 0.000000 |
| 12 | 71.000000 | 72.000000 | 0.000000 | 0.000000 |

ALARGAMIENTOS POR PENETRACION DE CUÑAS Y RETESADO

Penetracion de cuñas por izda. a_izda= 5.000(mm.)
Penetracion por retesado por izda. retesado _izda= 2.664(mm.)
Penetracion de cuñas ficticia por izda. a_ficticia_izda= 7.664(mm.)

Alcance de penetracion de cuñas+retesado por izda. x= 16.543(m.) perdidas= 5.445%

Penetracion de cuñas por dcha. a_dcha= 5.000(mm.)
Penetracion por retesado por dcha. retesado _dcha= 2.664(mm.)
Penetracion de cuñas ficticia por dcha. a_ficticia_dcha= 7.664(mm.)

Alcance de penetracion de cuñas+retesado por dcha. x= 55.457(m.) perdidas= 5.445%

Punto de interseccion de curvas de perdidas x= 36.000(m.) perdidas= 14.063%

CURVA DE PERDIDAS POR ROZAMIENTO + PENET.CUÑAS + RETESADO

| tramo | Xinic(m.) | Xfinal(m.) | K1(%) | K2(%) | Axil-1(ton.) | Axil-2(ton.) |
|---|---|---|---|---|---|---|
| 1 | 0.000000 | 1.000000 | 10.9 | 10.8 | 4320.1 | 4326.2 |
| 2 | 1.000000 | 9.000000 | 10.8 | 8.2 | 4326.2 | 4451.3 |
| 3 | 9.000000 | 16.542679 | 8.2 | 5.4 | 4451.3 | 4584.0 |
| 4 | 16.542679 | 18.000000 | 5.4 | 6.0 | 4584.0 | 4558.4 |
| 5 | 18.000000 | 20.000000 | 6.0 | 8.3 | 4558.4 | 4444.3 |
| 6 | 20.000000 | 23.200001 | 8.3 | 10.7 | 4444.3 | 4329.1 |
| 7 | 23.200001 | 36.000000 | 10.7 | 14.1 | 4329.1 | 4166.2 |
| 8 | 36.000000 | 48.799999 | 14.1 | 10.7 | 4166.2 | 4329.1 |
| 9 | 48.799999 | 52.000000 | 10.7 | 8.3 | 4329.1 | 4444.3 |
| 10 | 52.000000 | 54.000000 | 8.3 | 6.0 | 4444.3 | 4558.4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 54.000000 | 55.457321 | 6.0 | 5.4 | 4558.4 | 4584.0 |
| 12 | 55.457321 | 63.000000 | 5.4 | 8.2 | 4584.0 | 4451.3 |
| 13 | 63.000000 | 71.000000 | 8.2 | 10.8 | 4451.3 | 4326.2 |
| 14 | 71.000000 | 72.000000 | 10.8 | 10.9 | 4326.2 | 4320.1 |

ALARGAMIENTOS DEL CABLE

Alargamiento por la izda.(mm.)= 496.748
Alargamiento por la dcha.(mm.)= 38.237
ALARGAMIENTO TOTAL(mm.)= 534.985

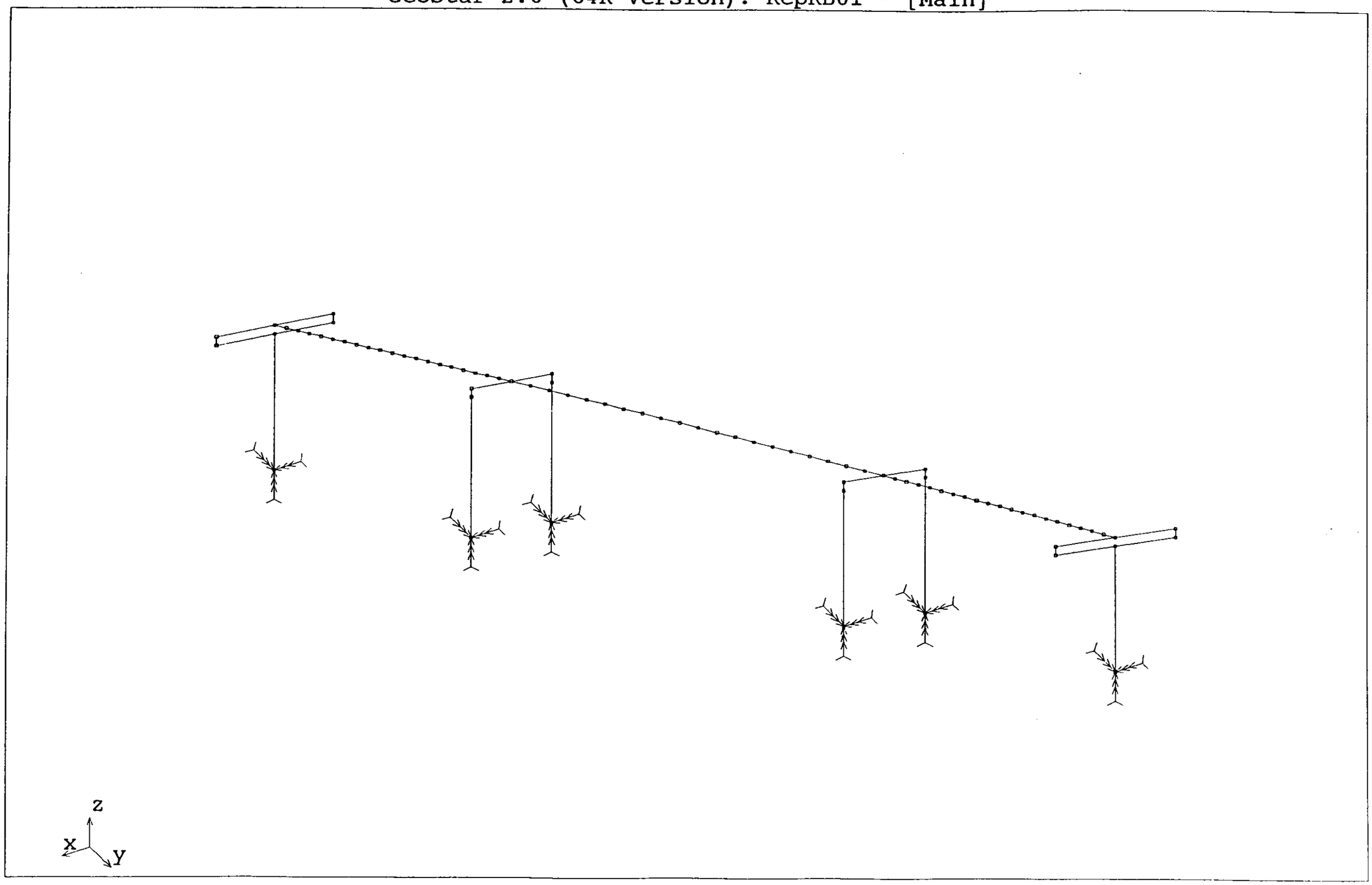
CARGAS VERTICALES POR UD. DE LONGITUD(TON/M.)

| tramo | Xinic(m.) | Xfinal(m.) | Q1 | Q2 |
|---|---|---|---|---|
| 1 | 0.000000 | 1.000000 | 0.000 | 0.000 |
| 2 | 1.000000 | 9.000000 | 41.167 | 42.732 |
| 3 | 9.000000 | 16.542679 | 53.955 | 54.875 |
| 4 | 16.542679 | 18.000000 | 54.875 | 54.281 |
| 5 | 18.000000 | 20.000000 | -244.266 | -242.419 |
| 6 | 20.000000 | 23.200001 | -147.566 | -141.341 |
| 7 | 23.200001 | 36.000000 | 35.335 | 34.583 |
| 8 | 36.000000 | 48.799999 | 34.583 | 35.335 |
| 9 | 48.799999 | 52.000000 | -141.341 | -147.566 |
| 10 | 52.000000 | 54.000000 | -242.419 | -244.266 |
| 11 | 54.000000 | 55.457321 | 54.281 | 54.875 |
| 12 | 55.457321 | 63.000000 | 54.875 | 53.955 |
| 13 | 63.000000 | 71.000000 | 42.732 | 41.167 |
| 14 | 71.000000 | 72.000000 | 0.000 | 0.000 |

CARGAS PUNTUALES EN ALZADO (TON.)

| Punto aplicacion | | Componente Vertical | Componente Longitudinal |
|---|---|---|---|
| x= | 0.000 | -330.809 | 4307.407 |
| x= | 72.000 | -330.809 | -4307.407 |

GeoStar 2.0 (64K Version): RepRB01 - [Main]



```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**  CCCC   0000   SSSS   M     M   0000   SSSS     ! M     M  **
**  C      O  O   S      MM   MM   O  O   S      !  MM   MM  **
**  C      O  O   SSSS   M M M M   O  O   SSSS   !  M M M M  **
**  C      O  O      S   M  M  M   O  O      S  !   M  M  M  **
**  CCCC   0000   SSSS   M     M   0000   SSSS !    M     M  **
**                                                                  **
**                                                                  **
**                        VERSION: 2.00                             **
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**                                                                  **
**********************************************************************
**********************************************************************
Problem name:
Date       :                Time:
Title      :
Subtitle   :
```

Element group data

Element group number= 1
Element name:
BEAM3D Three dimensional Elastic Beam elements
Type of beam element = . . . . . 0
EQ. 0 ; Symmetric beam element
EQ. 1 ; Unsymmetric beam element
EQ. 2 ; Symmetric tapered beam element
Element group number= 2
Element name:
BEAM3D Three dimensional Elastic Beam elements
Type of beam element = . . . . . 2
EQ. 0 ; Symmetric beam element
EQ. 1 ; Unsymmetric beam element
EQ. 2 ; Symmetric tapered beam element

Material propery data

Material property set 1

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Material property set 2

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |

Material property set 3

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | 100.00 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |

Material property set 4

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .30000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Real constant data

Real constant set 1
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 2
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 3
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 4
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 5
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 6
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 7
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 8
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 9
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 10
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 11
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 12
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 13
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 14
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 15
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 16
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 17
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 18
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 19
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 20
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 21
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 22
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 10.349
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.9499
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.5430
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 23
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 24
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 25
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 26
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 27
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 28
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 29
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 30
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 31
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 32
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 33
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 34
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 35
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 36
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 37
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 38
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 8.7784
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.8367
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.4140
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 39
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 10.349
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 1.9499
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.5430
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 40
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 77.776
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 41
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 42
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 43
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 44
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 45
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 46
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 47
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 48
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 49
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 50
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 51
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 52
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 53
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 54
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 55
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 56
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 57
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 58
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 59
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 60
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 11.920
Moment of Inertia about element Y-axis = 86.808
Moment of Inertia about element Z-axis = 2.0630
Depth of beam (y-axis) = 1.4000
Width of beam (z-axis) = 12.800
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = 3.6719
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = 5.0000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 61
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+07
Moment of Inertia about element Y-axis = .10000E+07
Moment of Inertia about element Z-axis = .10000E+07
Depth of beam (y-axis) = 10.000
Width of beam (z-axis) = 10.000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .10000E+07
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 62
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = 1.2932
Moment of Inertia about element Z-axis = 1.2932
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 63
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = 2.6931
Moment of Inertia about element Z-axis = 2.6931
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 64
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = 2.6931
Moment of Inertia about element Z-axis = 2.6931
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000

Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 65
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = 1.2932
Moment of Inertia about element Z-axis = 1.2932
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 66
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area of cross section at node I = 10000.
Area of cross section at node J = 10000.
Moment of inertia about Y-axis at node I = .83333E+07
Moment of inertia about Y-axis at node J = .83333E+07
Moment of inertia about Z-axis at node I = .83333E+07
Moment of inertia about Z-axis at node J = .83333E+07
Depth of beam along Y-axis at node I = 100.00
Depth of beam along Y-axis at node J = 100.00
Depth of beam along Z-axis at node I = 100.00
Depth of beam along Z-axis at node J = 100.00
End release code at node I = 00000
End release code at node J = 00000
Moment of inertia about X-axis at node I = .14083E+08
Moment of inertia about X-axis at node J = .14083E+08
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Perimeter = .00000
Torsion const for max shear stress = .00000
Orientation angle = .00000
Real constant set 67
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area of cross section at node I = 1.1310
Area of cross section at node J = 1.1310
Moment of inertia about Y-axis at node I = .10179
Moment of inertia about Y-axis at node J = .10179
Moment of inertia about Z-axis at node I = .10179
Moment of inertia about Z-axis at node J = .10179
Depth of beam along Y-axis at node I = 1.2000
Depth of beam along Y-axis at node J = 1.2000
Depth of beam along Z-axis at node I = 1.2000
Depth of beam along Z-axis at node J = 1.2000
End release code at node I = 00000
End release code at node J = 00000
Moment of inertia about X-axis at node I = .20358
Moment of inertia about X-axis at node J = .20358
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Perimeter = .00000
Torsion const for max shear stress = .00000
Orientation angle = .00000
Real constant set 68

Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area of cross section at node I = 1.1310
Area of cross section at node J = 1.1310
Moment of inertia about Y-axis at node I = .10179
Moment of inertia about Y-axis at node J = .10179
Moment of inertia about Z-axis at node I = .10179
Moment of inertia about Z-axis at node J = .10179
Depth of beam along Y-axis at node I = 1.2000
Depth of beam along Y-axis at node J = 1.2000
Depth of beam along Z-axis at node I = 1.2000
Depth of beam along Z-axis at node J = 1.2000
End release code at node I = 00000
End release code at node J = 00000
Moment of inertia about X-axis at node I = .20358
Moment of inertia about X-axis at node J = .20358
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Perimeter = .00000
Torsion const for max shear stress = .00000
Orientation angle = .00000
Real constant set 69
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area of cross section at node I = 1.1310
Area of cross section at node J = 1.1310
Moment of inertia about Y-axis at node I = .10179
Moment of inertia about Y-axis at node J = .10179
Moment of inertia about Z-axis at node I = .10179
Moment of inertia about Z-axis at node J = .10179
Depth of beam along Y-axis at node I = 1.2000
Depth of beam along Y-axis at node J = 1.2000
Depth of beam along Z-axis at node I = 1.2000
Depth of beam along Z-axis at node J = 1.2000
End release code at node I = 00000
End release code at node J = 00000
Moment of inertia about X-axis at node I = .20358
Moment of inertia about X-axis at node J = .20358
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Perimeter = .00000
Torsion const for max shear stress = .00000
Orientation angle = .00000
Real constant set 70
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area of cross section at node I = 1.1310
Area of cross section at node J = 1.1310
Moment of inertia about Y-axis at node I = .10179
Moment of inertia about Y-axis at node J = .10179
Moment of inertia about Z-axis at node I = .10179
Moment of inertia about Z-axis at node J = .10179
Depth of beam along Y-axis at node I = 1.2000
Depth of beam along Y-axis at node J = 1.2000
Depth of beam along Z-axis at node I = 1.2000
Depth of beam along Z-axis at node J = 1.2000
End release code at node I = 00000
End release code at node J = 00000
Moment of inertia about X-axis at node I = .20358
Moment of inertia about X-axis at node J = .20358
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000

Perimeter = .00000
Torsion const for max shear stress = .00000
Orientation angle = .00000
Real constant set 71
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area of cross section at node I = 10000.
Area of cross section at node J = 10000.
Moment of inertia about Y-axis at node I = .83333E+07
Moment of inertia about Y-axis at node J = .83333E+07
Moment of inertia about Z-axis at node I = .83333E+07
Moment of inertia about Z-axis at node J = .83333E+07
Depth of beam along Y-axis at node I = 100.00
Depth of beam along Y-axis at node J = 100.00
Depth of beam along Z-axis at node I = 100.00
Depth of beam along Z-axis at node J = 100.00
End release code at node I = 00000
End release code at node J = 00000
Moment of inertia about X-axis at node I = .14083E+08
Moment of inertia about X-axis at node J = .14083E+08
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Perimeter = .00000
Torsion const for max shear stress = .00000
Orientation angle = .00000

Nodal input data

| NODE POINT | BOUNDARY CONDITION CODES (0 = FREE ; 1 = FREE) | | | | | | NODAL COORDINATES | | |
|---|---|---|---|---|---|---|---|---|---|
| | X | Y | Z | XX | YY | ZZ | X | Y | Z |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | .00000 | .00000 | .10000E+09 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 23.896 | 303.07 | .00000 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 24.459 | 302.24 | .00000 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 25.024 | 301.42 | .00000 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 25.589 | 300.60 | .00000 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 26.155 | 299.77 | .00000 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 26.722 | 298.95 | .00000 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 27.289 | 298.12 | .00000 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 27.858 | 297.30 | .00000 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 28.427 | 296.48 | .00000 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 28.997 | 295.66 | .00000 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 29.569 | 294.84 | .00000 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 30.140 | 294.02 | .00000 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 30.713 | 293.20 | .00000 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 31.286 | 292.38 | .00000 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 31.861 | 291.56 | .00000 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 32.436 | 290.74 | .00000 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 33.012 | 289.92 | .00000 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 33.588 | 289.11 | .00000 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 34.166 | 288.29 | .00000 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 34.744 | 287.47 | .00000 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 35.323 | 286.66 | .00000 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 36.252 | 285.36 | .00000 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 37.182 | 284.05 | .00000 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 38.115 | 282.75 | .00000 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 39.049 | 281.45 | .00000 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 39.986 | 280.16 | .00000 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 40.925 | 278.86 | .00000 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 41.865 | 277.57 | .00000 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 42.808 | 276.27 | .00000 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 43.753 | 274.98 | .00000 |
| 32 | 0 | 0 | 0 | 0 | 0 | 0 | 44.701 | 273.69 | .00000 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 45.649 | 272.41 | .00000 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 46.601 | 271.12 | .00000 |
| 35 | 0 | 0 | 0 | 0 | 0 | 0 | 47.554 | 269.83 | .00000 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 | 48.509 | 268.55 | .00000 |
| 37 | 0 | 0 | 0 | 0 | 0 | 0 | 49.466 | 267.27 | .00000 |
| 38 | 0 | 0 | 0 | 0 | 0 | 0 | 50.426 | 265.99 | .00000 |
| 39 | 0 | 0 | 0 | 0 | 0 | 0 | 51.387 | 264.71 | .00000 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 | 52.350 | 263.43 | .00000 |
| 41 | 0 | 0 | 0 | 0 | 0 | 0 | 53.316 | 262.16 | .00000 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0 | 54.284 | 260.88 | .00000 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 | 54.889 | 260.09 | .00000 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | 55.496 | 259.29 | .00000 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 56.103 | 258.50 | .00000 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 56.711 | 257.70 | .00000 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 57.320 | 256.91 | .00000 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 57.930 | 256.12 | .00000 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 58.540 | 255.32 | .00000 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 59.152 | 254.53 | .00000 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 59.764 | 253.74 | .00000 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 60.377 | 252.95 | .00000 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 60.991 | 252.16 | .00000 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 61.605 | 251.37 | .00000 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 | 62.220 | 250.59 | .00000 |
| 56 | 0 | 0 | 0 | 0 | 0 | 0 | 62.836 | 249.80 | .00000 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 63.453 | 249.01 | .00000 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 64.071 | 248.22 | .00000 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 64.689 | 247.44 | .00000 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 65.308 | 246.65 | .00000 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 65.928 | 245.87 | .00000 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 66.549 | 245.09 | .00000 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 28.558 | 301.83 | .00000 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 19.096 | 304.36 | .00000 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 38.449 | 285.89 | .00000 |
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 32.058 | 287.46 | .00000 |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 57.432 | 260.21 | .00000 |
| 68 | 0 | 0 | 0 | 0 | 0 | 0 | 50.995 | 261.58 | .00000 |
| 69 | 0 | 0 | 0 | 0 | 0 | 0 | 71.288 | 244.18 | .00000 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0 | 61.668 | 246.02 | .00000 |
| 71 | 1 | 1 | 1 | 1 | 1 | 1 | -72.718 | 328.88 | .00000 |
| 72 | 1 | 1 | 1 | 1 | 1 | 1 | -61.787 | 310.53 | .00000 |
| 73 | 1 | 1 | 1 | 1 | 1 | 1 | -43.542 | 281.64 | .00000 |
| 74 | 1 | 1 | 1 | 1 | 1 | 1 | -31.672 | 263.88 | .00000 |
| 75 | 0 | 0 | 0 | 0 | 0 | 0 | 28.558 | 301.83 | -.84000 |
| 76 | 0 | 0 | 0 | 0 | 0 | 0 | 19.096 | 304.36 | -.84000 |
| 77 | 0 | 0 | 0 | 0 | 0 | 0 | 38.449 | 285.89 | -.84000 |
| 78 | 0 | 0 | 0 | 0 | 0 | 0 | 32.058 | 287.46 | -.84000 |
| 79 | 0 | 0 | 0 | 0 | 0 | 0 | 57.432 | 260.21 | -.84000 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0 | 50.995 | 261.58 | -.84000 |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 71.288 | 244.18 | -.84000 |
| 82 | 0 | 0 | 0 | 0 | 0 | 0 | 61.668 | 246.02 | -.84000 |
| 83 | 0 | 0 | 0 | 0 | 0 | 0 | 23.896 | 303.07 | -.84000 |
| 84 | 1 | 1 | 1 | 1 | 1 | 1 | 23.896 | 303.07 | -12.956 |
| 85 | 1 | 1 | 1 | 1 | 1 | 1 | 38.449 | 285.89 | -14.021 |
| 86 | 1 | 1 | 1 | 1 | 1 | 1 | 32.058 | 287.46 | -14.021 |
| 87 | 1 | 1 | 1 | 1 | 1 | 1 | 57.432 | 260.21 | -14.538 |
| 88 | 1 | 1 | 1 | 1 | 1 | 1 | 50.995 | 261.58 | -14.538 |
| 89 | 0 | 0 | 0 | 0 | 0 | 0 | 66.549 | 245.09 | -.84000 |
| 90 | 1 | 1 | 1 | 1 | 1 | 1 | 66.549 | 245.09 | -14.121 |

Element input data

| ELEM | EGRP | MP | REAL | ECS | NODE 1 | NODE 2 | NODE 3 | NODE 4 | NODE 5 | NODE 6 | NODE 7 | NODE 8 | NODE 9 | NODE10 | NODE11 | NODE12 | NODE13 | NODE14 | NODE15 | NODE16 | NODE17 | NODE18 | NODE19 | NODE20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | -1 | 2 | 3 | 1 | | | | | | | | | | | | | | | | | |
| 2 | 1 | 1 | 2 | -1 | 3 | 4 | 1 | | | | | | | | | | | | | | | | | |
| 3 | 1 | 1 | 3 | -1 | 4 | 5 | 1 | | | | | | | | | | | | | | | | | |
| 4 | 1 | 1 | 4 | -1 | 5 | 6 | 1 | | | | | | | | | | | | | | | | | |
| 5 | 1 | 1 | 5 | -1 | 6 | 7 | 1 | | | | | | | | | | | | | | | | | |
| 6 | 1 | 1 | 6 | -1 | 7 | 8 | 1 | | | | | | | | | | | | | | | | | |
| 7 | 1 | 1 | 7 | -1 | 8 | 9 | 1 | | | | | | | | | | | | | | | | | |
| 8 | 1 | 1 | 8 | -1 | 9 | 10 | 1 | | | | | | | | | | | | | | | | | |
| 9 | 1 | 1 | 9 | -1 | 10 | 11 | 1 | | | | | | | | | | | | | | | | | |
| 10 | 1 | 1 | 10 | -1 | 11 | 12 | 1 | | | | | | | | | | | | | | | | | |
| 11 | 1 | 1 | 11 | -1 | 12 | 13 | 1 | | | | | | | | | | | | | | | | | |
| 12 | 1 | 1 | 12 | -1 | 13 | 14 | 1 | | | | | | | | | | | | | | | | | |
| 13 | 1 | 1 | 13 | -1 | 14 | 15 | 1 | | | | | | | | | | | | | | | | | |
| 14 | 1 | 1 | 14 | -1 | 15 | 16 | 1 | | | | | | | | | | | | | | | | | |
| 15 | 1 | 1 | 15 | -1 | 16 | 17 | 1 | | | | | | | | | | | | | | | | | |
| 16 | 1 | 1 | 16 | -1 | 17 | 18 | 1 | | | | | | | | | | | | | | | | | |
| 17 | 1 | 1 | 17 | -1 | 18 | 19 | 1 | | | | | | | | | | | | | | | | | |
| 18 | 1 | 1 | 18 | -1 | 19 | 20 | 1 | | | | | | | | | | | | | | | | | |
| 19 | 1 | 1 | 19 | -1 | 20 | 21 | 1 | | | | | | | | | | | | | | | | | |
| 20 | 1 | 1 | 20 | -1 | 21 | 22 | 1 | | | | | | | | | | | | | | | | | |
| 21 | 1 | 1 | 21 | -1 | 22 | 23 | 1 | | | | | | | | | | | | | | | | | |
| 22 | 1 | 1 | 22 | -1 | 23 | 24 | 1 | | | | | | | | | | | | | | | | | |
| 23 | 1 | 1 | 23 | -1 | 24 | 25 | 1 | | | | | | | | | | | | | | | | | |
| 24 | 1 | 1 | 24 | -1 | 25 | 26 | 1 | | | | | | | | | | | | | | | | | |
| 25 | 1 | 1 | 25 | -1 | 26 | 27 | 1 | | | | | | | | | | | | | | | | | |
| 26 | 1 | 1 | 26 | -1 | 27 | 28 | 1 | | | | | | | | | | | | | | | | | |
| 27 | 1 | 1 | 27 | -1 | 28 | 29 | 1 | | | | | | | | | | | | | | | | | |
| 28 | 1 | 1 | 28 | -1 | 29 | 30 | 1 | | | | | | | | | | | | | | | | | |
| 29 | 1 | 1 | 29 | -1 | 30 | 31 | 1 | | | | | | | | | | | | | | | | | |
| 30 | 1 | 1 | 30 | -1 | 31 | 32 | 1 | | | | | | | | | | | | | | | | | |
| 31 | 1 | 1 | 31 | -1 | 32 | 33 | 1 | | | | | | | | | | | | | | | | | |
| 32 | 1 | 1 | 32 | -1 | 33 | 34 | 1 | | | | | | | | | | | | | | | | | |
| 33 | 1 | 1 | 33 | -1 | 34 | 35 | 1 | | | | | | | | | | | | | | | | | |
| 34 | 1 | 1 | 34 | -1 | 35 | 36 | 1 | | | | | | | | | | | | | | | | | |
| 35 | 1 | 1 | 35 | -1 | 36 | 37 | 1 | | | | | | | | | | | | | | | | | |
| 36 | 1 | 1 | 36 | -1 | 37 | 38 | 1 | | | | | | | | | | | | | | | | | |
| 37 | 1 | 1 | 37 | -1 | 38 | 39 | 1 | | | | | | | | | | | | | | | | | |
| 38 | 1 | 1 | 38 | -1 | 39 | 40 | 1 | | | | | | | | | | | | | | | | | |
| 39 | 1 | 1 | 39 | -1 | 40 | 41 | 1 | | | | | | | | | | | | | | | | | |
| 40 | 1 | 1 | 40 | -1 | 41 | 42 | 1 | | | | | | | | | | | | | | | | | |
| 41 | 1 | 1 | 41 | -1 | 42 | 43 | 1 | | | | | | | | | | | | | | | | | |
| 42 | 1 | 1 | 42 | -1 | 43 | 44 | 1 | | | | | | | | | | | | | | | | | |
| 43 | 1 | 1 | 43 | -1 | 44 | 45 | 1 | | | | | | | | | | | | | | | | | |
| 44 | 1 | 1 | 44 | -1 | 45 | 46 | 1 | | | | | | | | | | | | | | | | | |
| 45 | 1 | 1 | 45 | -1 | 46 | 47 | 1 | | | | | | | | | | | | | | | | | |
| 46 | 1 | 1 | 46 | -1 | 47 | 48 | 1 | | | | | | | | | | | | | | | | | |
| 47 | 1 | 1 | 47 | -1 | 48 | 49 | 1 | | | | | | | | | | | | | | | | | |
| 48 | 1 | 1 | 48 | -1 | 49 | 50 | 1 | | | | | | | | | | | | | | | | | |
| 49 | 1 | 1 | 49 | -1 | 50 | 51 | 1 | | | | | | | | | | | | | | | | | |
| 50 | 1 | 1 | 50 | -1 | 51 | 52 | 1 | | | | | | | | | | | | | | | | | |
| 51 | 1 | 1 | 51 | -1 | 52 | 53 | 1 | | | | | | | | | | | | | | | | | |
| 52 | 1 | 1 | 52 | -1 | 53 | 54 | 1 | | | | | | | | | | | | | | | | | |
| 53 | 1 | 1 | 53 | -1 | 54 | 55 | 1 | | | | | | | | | | | | | | | | | |
| 54 | 1 | 1 | 54 | -1 | 55 | 56 | 1 | | | | | | | | | | | | | | | | | |
| 55 | 1 | 1 | 55 | -1 | 56 | 57 | 1 | | | | | | | | | | | | | | | | | |
| 56 | 1 | 1 | 56 | -1 | 57 | 58 | 1 | | | | | | | | | | | | | | | | | |
| 57 | 1 | 1 | 57 | -1 | 58 | 59 | 1 | | | | | | | | | | | | | | | | | |
| 58 | 1 | 1 | 58 | -1 | 59 | 60 | 1 | | | | | | | | | | | | | | | | | |
| 59 | 1 | 1 | 59 | -1 | 60 | 61 | 1 | | | | | | | | | | | | | | | | | |
| 60 | 1 | 1 | 60 | -1 | 61 | 62 | 1 | | | | | | | | | | | | | | | | | |
| 61 | 1 | 2 | 61 | -1 | 63 | 2 | 1 | | | | | | | | | | | | | | | | | |
| 62 | 1 | 2 | 61 | -1 | 2 | 64 | 1 | | | | | | | | | | | | | | | | | |
| 63 | 1 | 2 | 61 | -1 | 65 | 22 | 1 | | | | | | | | | | | | | | | | | |
| 64 | 1 | 2 | 61 | -1 | 22 | 66 | 1 | | | | | | | | | | | | | | | | | |
| 65 | 1 | 2 | 61 | -1 | 67 | 42 | 1 | | | | | | | | | | | | | | | | | |
| 66 | 1 | 2 | 61 | -1 | 42 | 68 | 1 | | | | | | | | | | | | | | | | | |
| 67 | 1 | 2 | 61 | -1 | 69 | 62 | 1 | | | | | | | | | | | | | | | | | |
| 68 | 1 | 2 | 61 | -1 | 62 | 70 | 1 | | | | | | | | | | | | | | | | | |
| 69 | 1 | 3 | 62 | -1 | 63 | 75 | 71 | | | | | | | | | | | | | | | | | |
| 70 | 1 | 3 | 62 | -1 | 64 | 76 | 71 | | | | | | | | | | | | | | | | | |
| 71 | 1 | 3 | 63 | -1 | 65 | 77 | 72 | | | | | | | | | | | | | | | | | |
| 72 | 1 | 3 | 63 | -1 | 66 | 78 | 72 | | | | | | | | | | | | | | | | | |
| 73 | 1 | 3 | 64 | -1 | 67 | 79 | 73 | | | | | | | | | | | | | | | | | |
| 74 | 1 | 3 | 64 | -1 | 68 | 80 | 73 | | | | | | | | | | | | | | | | | |
| 75 | 1 | 3 | 65 | -1 | 69 | 81 | 74 | | | | | | | | | | | | | | | | | |
| 76 | 1 | 3 | 65 | -1 | 70 | 82 | 74 | | | | | | | | | | | | | | | | | |
| 77 | 1 | 2 | 61 | -1 | 75 | 83 | 1 | | | | | | | | | | | | | | | | | |
| 78 | 1 | 2 | 61 | -1 | 83 | 76 | 1 | | | | | | | | | | | | | | | | | |
| 79 | 2 | 4 | 66 | -1 | 83 | 84 | 71 | | | | | | | | | | | | | | | | | |
| 80 | 2 | 4 | 67 | -1 | 77 | 85 | 72 | | | | | | | | | | | | | | | | | |
| 81 | 2 | 4 | 68 | -1 | 78 | 86 | 72 | | | | | | | | | | | | | | | | | |
| 82 | 2 | 4 | 69 | -1 | 79 | 87 | 73 | | | | | | | | | | | | | | | | | |
| 83 | 2 | 4 | 70 | -1 | 80 | 88 | 73 | | | | | | | | | | | | | | | | | |
| 84 | 1 | 2 | 61 | -1 | 81 | 89 | 1 | | | | | | | | | | | | | | | | | |
| 85 | 1 | 2 | 61 | -1 | 89 | 82 | 1 | | | | | | | | | | | | | | | | | |
| 86 | 2 | 4 | 71 | -1 | 89 | 90 | 74 | | | | | | | | | | | | | | | | | |

## COMBINACIONES PARA EL CÁLCULO DE PILAS EN ESTADO LIMITE ÚLTIMO

| | |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1500.4 |

HIPOTESIS :

**Hipótesis I**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.50 |
| Coeficiente mayoración acciones favorables permanentes = | 0.90 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |

**Hipótesis II**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de viento.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.50 |
| Coeficiente mayoración acciones favorables permanentes = | 0.90 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |

**Hipótesis III**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Sobrecargas de viento / 2.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.35 |
| Coeficiente mayoración acciones favorables permanentes = | 0.81 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |

**Hipótesis IV**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
60% de las sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Sobrecargas de viento / 2.
Sobrecargas accidentales o sísmicas.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.20 |
| Coeficiente mayoración acciones favorables permanentes = | 0.72 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración sobrecarga de viento = | 1.00 |
| Coeficiente mayoración sobrecarga sísmica = | 1.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |



## Cálculo de Pilas en Estado Limite Último — PILA Nº 1

| | |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1500.4 |

**DATOS**

Altura pila 13.18 m

**ESFUERZOS SIN MAYORAR EN CORONACION DE PILAS POR EL TABLERO**

ESFUERZOS HORIZONTALES

| | Longitudinal - Z (Ton.) | Transversal - Y (Ton.) |
|---|---|---|
| Viento | 5.27 | -4.38 |
| Deformaciones | 0.94 | 1.18 |
| Frenado | 1.02 | 1.20 |
| Centrifuga | 0.48 | -0.40 |
| Sismo longitudinal | 0.00 | 0.00 |
| Sismo transversal | 0.00 | 0.00 |

ESFUERZOS VERTICALES

AXIL máximo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X (Ton) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -359.60 | 0.00 | 0.00 |
| Superestructura | -68.66 | 0.00 | 0.00 |
| Pretensado | 35.52 | 0.00 | 0.00 |
| Temperatura | 20.36 | 0.00 | 0.00 |
| Sobrecarga repartida | 17.63 | 0.00 | 0.00 |
| Carro | 18.92 | 0.00 | 0.00 |

AXIL mínimo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X (Ton) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -393.20 | 0.00 | 0.00 |
| Superestructura | -91.20 | 0.00 | 0.00 |
| Pretensado | 1.94 | 0.00 | 0.00 |
| Temperatura | -7.65 | 0.00 | 0.00 |
| Sobrecarga repartida | -101.32 | 0.00 | 0.00 |
| Carro | -71.41 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y máximo

| | AXIL - X (Ton) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y mínimo

| | AXIL - X (Ton) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z máximo - MOMENTO Y concomitante

| | AXIL - X (Ton) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z mínimo - MOMENTO Y concomitante

| | AXIL - X (Ton) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

**RESULTADOS**
**CARGAS DE CALCULO EN CORONACION DE PILA**

**Hipótesis I**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 85.36 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 85.36 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 85.36 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 85.36 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -270.58 | 0.00 | 0.00 | 2.25 | 1.19 | 1 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -270.58 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -270.58 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -270.58 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 2.25 | 1.19 | 2 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 1.50 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 1.50 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 85.36 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 85.36 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 85.36 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 85.36 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -270.58 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -270.58 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -270.58 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -270.58 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.80 | -2.40 | |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 2.25 | 1.19 | |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.53 | -1.80 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 1.53 | 1.80 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.80 | -2.40 | |

**Hipótesis II**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X ( Ton ) | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X ( Ton ) | MOMENTOS (mT) | | FUERZAS ( T ) | |
| | | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 30.54 | 0.00 | 0.00 | 7.90 | -6.57 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 30.54 | 0.00 | 0.00 | -7.90 | 6.57 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 30.54 | 0.00 | 0.00 | -7.90 | 6.57 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 30.54 | 0.00 | 0.00 | 7.90 | -6.57 |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -11.48 | 0.00 | 0.00 | 7.90 | -6.57 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -11.48 | 0.00 | 0.00 | -7.90 | 6.57 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -11.48 | 0.00 | 0.00 | -7.90 | 6.57 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -11.48 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 1.50 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 1.50 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | 7.90 | -6.57 |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 30.54 | 0.00 | 0.00 | 7.90 | -6.57 |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 30.54 | 0.00 | 0.00 | -7.90 | 6.57 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -349.91 | 0.00 | 0.00 | 1.40 | 1.77 | 30.54 | 0.00 | 0.00 | -7.90 | 6.57 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -349.91 | 0.00 | 0.00 | 0.00 | 0.00 | 30.54 | 0.00 | 0.00 | 7.90 | -6.57 |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -11.48 | 0.00 | 0.00 | 7.90 | -6.57 |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -11.48 | 0.00 | 0.00 | -7.90 | 6.57 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -725.24 | 0.00 | 0.00 | 1.40 | 1.77 | -11.48 | 0.00 | 0.00 | -7.90 | 6.57 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -725.24 | 0.00 | 0.00 | 0.00 | 0.00 | -11.48 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.40 | 1.77 | 0.00 | 0.00 | 0.00 | -7.90 | 6.57 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | -6.57 |

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**Hipótesis III**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -311.37 | 0.00 | 0.00 | 1.26 | 1.60 | 76.83 | 0.00 | 0.00 | 5.58 | -1.88 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -311.37 | 0.00 | 0.00 | 0.00 | 0.00 | 76.83 | 0.00 | 0.00 | -4.93 | 1.34 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -311.37 | 0.00 | 0.00 | 1.26 | 1.60 | 76.83 | 0.00 | 0.00 | -2.18 | 4.57 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -311.37 | 0.00 | 0.00 | 0.00 | 0.00 | 76.83 | 0.00 | 0.00 | 2.83 | -5.11 |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -652.58 | 0.00 | 0.00 | 1.26 | 1.60 | -243.52 | 0.00 | 0.00 | 5.58 | -1.88 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -652.58 | 0.00 | 0.00 | 0.00 | 0.00 | -243.52 | 0.00 | 0.00 | -4.93 | 1.34 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -652.58 | 0.00 | 0.00 | 1.26 | 1.60 | -243.52 | 0.00 | 0.00 | -2.18 | 4.57 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -652.58 | 0.00 | 0.00 | 0.00 | 0.00 | -243.52 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 1.35 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.35 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 1.35 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.35 | 0.00 | 0.00 | 2.83 | -5.11 |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -311.37 | 0.00 | 0.00 | 1.26 | 1.60 | 76.83 | 0.00 | 0.00 | 5.58 | -1.88 |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -311.37 | 0.00 | 0.00 | 0.00 | 0.00 | 76.83 | 0.00 | 0.00 | -4.93 | 1.34 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -311.37 | 0.00 | 0.00 | 1.26 | 1.60 | 76.83 | 0.00 | 0.00 | -2.18 | 4.57 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -311.37 | 0.00 | 0.00 | 0.00 | 0.00 | 76.83 | 0.00 | 0.00 | 2.83 | -5.11 |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -652.58 | 0.00 | 0.00 | 1.26 | 1.60 | -243.52 | 0.00 | 0.00 | 5.58 | -1.88 |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -652.58 | 0.00 | 0.00 | 0.00 | 0.00 | -243.52 | 0.00 | 0.00 | -4.93 | 1.34 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -652.58 | 0.00 | 0.00 | 1.26 | 1.60 | -243.52 | 0.00 | 0.00 | -2.18 | 4.57 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -652.58 | 0.00 | 0.00 | 0.00 | 0.00 | -243.52 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -5.11 |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | 5.58 | -1.88 |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -4.93 | 1.34 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 1.26 | 1.60 | 0.00 | 0.00 | 0.00 | -2.18 | 4.57 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -5.11 |

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| Cálculo de Pilas en Estado Limite Último | PILA Nº 2 |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1500.4 |

**DATOS**

Altura pila 13.70 m

**ESFUERZOS SIN MAYORAR EN CORONACION DE PILAS POR EL TABLERO**

ESFUERZOS HORIZONTALES

| | Longitudinal - Z ( Ton. ) | Transversal - Y ( Ton. ) |
|---|---|---|
| Viento | 4.72 | -4.20 |
| Deformaciones | -0.96 | -1.02 |
| Frenado | 0.94 | 1.09 |
| Centrífuga | 0.43 | -0.38 |
| Sismo longitudinal | 0.00 | 0.00 |
| Sismo transversal | 0.00 | 0.00 |

ESFUERZOS VERTICALES

AXIL máximo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -374.60 | 0.00 | 0.00 |
| Superestructura | -71.85 | 0.00 | 0.00 |
| Pretensado | 32.82 | 0.00 | 0.00 |
| Temperatura | 23.40 | 0.00 | 0.00 |
| Sobrecarga repartida | 16.49 | 0.00 | 0.00 |
| Carro | 19.01 | 0.00 | 0.00 |

AXIL mínimo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -377.00 | 0.00 | 0.00 |
| Superestructura | -87.65 | 0.00 | 0.00 |
| Pretensado | 2.62 | 0.00 | 0.00 |
| Temperatura | -10.29 | 0.00 | 0.00 |
| Sobrecarga repartida | -98.39 | 0.00 | 0.00 |
| Carro | -70.38 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y máximo

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y mínimo

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

Pila-2 peeluB01 XLS

AXIL concomitante - MOMENTO Z máximo - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z mínimo - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | 0.00 | 0.00 | 0.00 |
| Superestructura | 0.00 | 0.00 | 0.00 |
| Pretensado | 0.00 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | 0.00 | 0.00 | 0.00 |
| Carro | 0.00 | 0.00 | 0.00 |

**RESULTADOS**
**CARGAS DE CALCULO EN CORONACION DE PILA**

**Hipótesis I**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 88.35 | 0.00 | 0.00 | 2.06 | 1.05 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 88.35 | 0.00 | 0.00 | -1.41 | -1.63 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 88.35 | 0.00 | 0.00 | 1.41 | 1.63 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 88.35 | 0.00 | 0.00 | -0.77 | -2.21 |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -268.59 | 0.00 | 0.00 | 2.06 | 1.05 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -268.59 | 0.00 | 0.00 | -1.41 | -1.63 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -268.59 | 0.00 | 0.00 | 1.41 | 1.63 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -268.59 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 1.50 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 1.50 | 0.00 | 0.00 | -0.77 | -2.21 |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 88.35 | 0.00 | 0.00 | 2.06 | 1.05 |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 88.35 | 0.00 | 0.00 | -1.41 | -1.63 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 88.35 | 0.00 | 0.00 | 1.41 | 1.63 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 88.35 | 0.00 | 0.00 | -0.77 | -2.21 |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -268.59 | 0.00 | 0.00 | 2.06 | 1.05 |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -268.59 | 0.00 | 0.00 | -1.41 | -1.63 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -268.59 | 0.00 | 0.00 | 1.41 | 1.63 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -268.59 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -0.77 | -2.21 |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.06 | 1.05 |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -1.41 | -1.63 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.63 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -0.77 | -2.21 |

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**Hipótesis II**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 35.10 | 0.00 | 0.00 | 7.07 | -6.31 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 35.10 | 0.00 | 0.00 | -7.07 | 6.31 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 35.10 | 0.00 | 0.00 | -7.07 | 6.31 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 35.10 | 0.00 | 0.00 | 7.07 | -6.31 |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -15.44 | 0.00 | 0.00 | 7.07 | -6.31 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -15.44 | 0.00 | 0.00 | -7.07 | 6.31 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -15.44 | 0.00 | 0.00 | -7.07 | 6.31 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -15.44 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 1.50 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 1.50 | 0.00 | 0.00 | 7.07 | -6.31 |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 35.10 | 0.00 | 0.00 | 7.07 | -6.31 |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 35.10 | 0.00 | 0.00 | -7.07 | 6.31 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -368.98 | 0.00 | 0.00 | 0.00 | 0.00 | 35.10 | 0.00 | 0.00 | -7.07 | 6.31 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -368.98 | 0.00 | 0.00 | -1.44 | -1.53 | 35.10 | 0.00 | 0.00 | 7.07 | -6.31 |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -15.44 | 0.00 | 0.00 | 7.07 | -6.31 |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -15.44 | 0.00 | 0.00 | -7.07 | 6.31 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -695.14 | 0.00 | 0.00 | 0.00 | 0.00 | -15.44 | 0.00 | 0.00 | -7.07 | 6.31 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -695.14 | 0.00 | 0.00 | -1.44 | -1.53 | -15.44 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -7.07 | 6.31 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.44 | -1.53 | 0.00 | 0.00 | 0.00 | 7.07 | -6.31 |

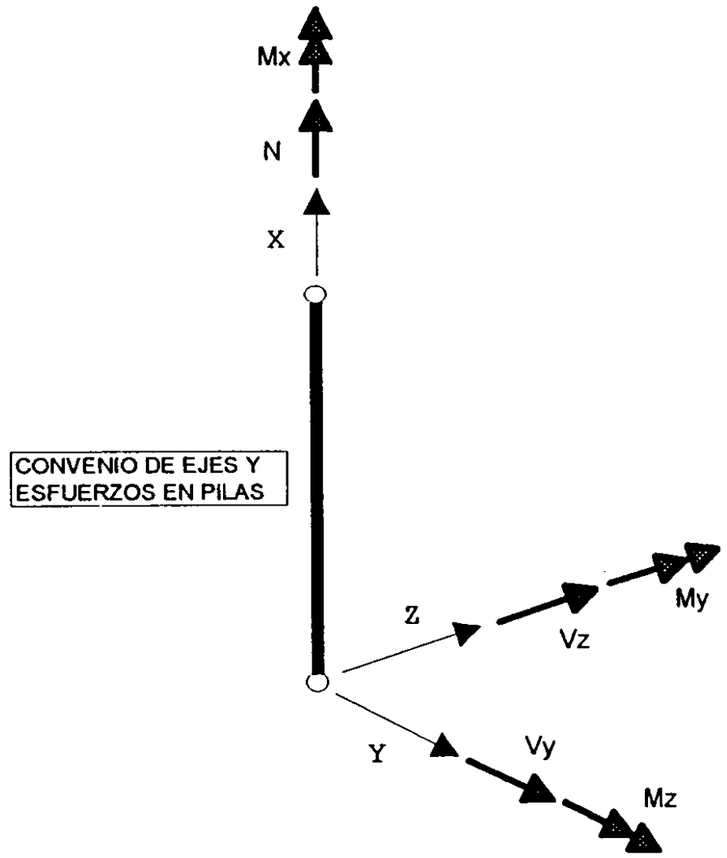
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**Hipótesis III**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -328.80 | 0.00 | 0.00 | 0.00 | 0.00 | 79.52 | 0.00 | 0.00 | 5.04 | -1.89 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -328.80 | 0.00 | 0.00 | -1.29 | -1.38 | 79.52 | 0.00 | 0.00 | -4.46 | 1.37 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -328.80 | 0.00 | 0.00 | 0.00 | 0.00 | 79.52 | 0.00 | 0.00 | -1.91 | 4.30 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -328.80 | 0.00 | 0.00 | -1.29 | -1.38 | 79.52 | 0.00 | 0.00 | 2.49 | -4.82 |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -625.44 | 0.00 | 0.00 | 0.00 | 0.00 | -241.73 | 0.00 | 0.00 | 5.04 | -1.89 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -625.44 | 0.00 | 0.00 | -1.29 | -1.38 | -241.73 | 0.00 | 0.00 | -4.46 | 1.37 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -625.44 | 0.00 | 0.00 | 0.00 | 0.00 | -241.73 | 0.00 | 0.00 | -1.91 | 4.30 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -625.44 | 0.00 | 0.00 | -1.29 | -1.38 | -241.73 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.35 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 1.35 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.35 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 1.35 | 0.00 | 0.00 | 2.49 | -4.82 |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -328.80 | 0.00 | 0.00 | 0.00 | 0.00 | 79.52 | 0.00 | 0.00 | 5.04 | -1.89 |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -328.80 | 0.00 | 0.00 | -1.29 | -1.38 | 79.52 | 0.00 | 0.00 | -4.46 | 1.37 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -328.80 | 0.00 | 0.00 | 0.00 | 0.00 | 79.52 | 0.00 | 0.00 | -1.91 | 4.30 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -328.80 | 0.00 | 0.00 | -1.29 | -1.38 | 79.52 | 0.00 | 0.00 | 2.49 | -4.82 |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -625.44 | 0.00 | 0.00 | 0.00 | 0.00 | -241.73 | 0.00 | 0.00 | 5.04 | -1.89 |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -625.44 | 0.00 | 0.00 | -1.29 | -1.38 | -241.73 | 0.00 | 0.00 | -4.46 | 1.37 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -625.44 | 0.00 | 0.00 | 0.00 | 0.00 | -241.73 | 0.00 | 0.00 | -1.91 | 4.30 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -625.44 | 0.00 | 0.00 | -1.29 | -1.38 | -241.73 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | 2.49 | -4.82 |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.04 | -1.89 |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | -4.46 | 1.37 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -1.91 | 4.30 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | 0.00 | 0.00 | 0.00 | -1.29 | -1.38 | 0.00 | 0.00 | 0.00 | 2.49 | -4.82 |

# RESUMEN DE RESULTADOS DE CÁLCULO EN ROTURA DE PILAS

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1500.4




CONVENIO DE EJES Y ESFUERZOS EN PILAS

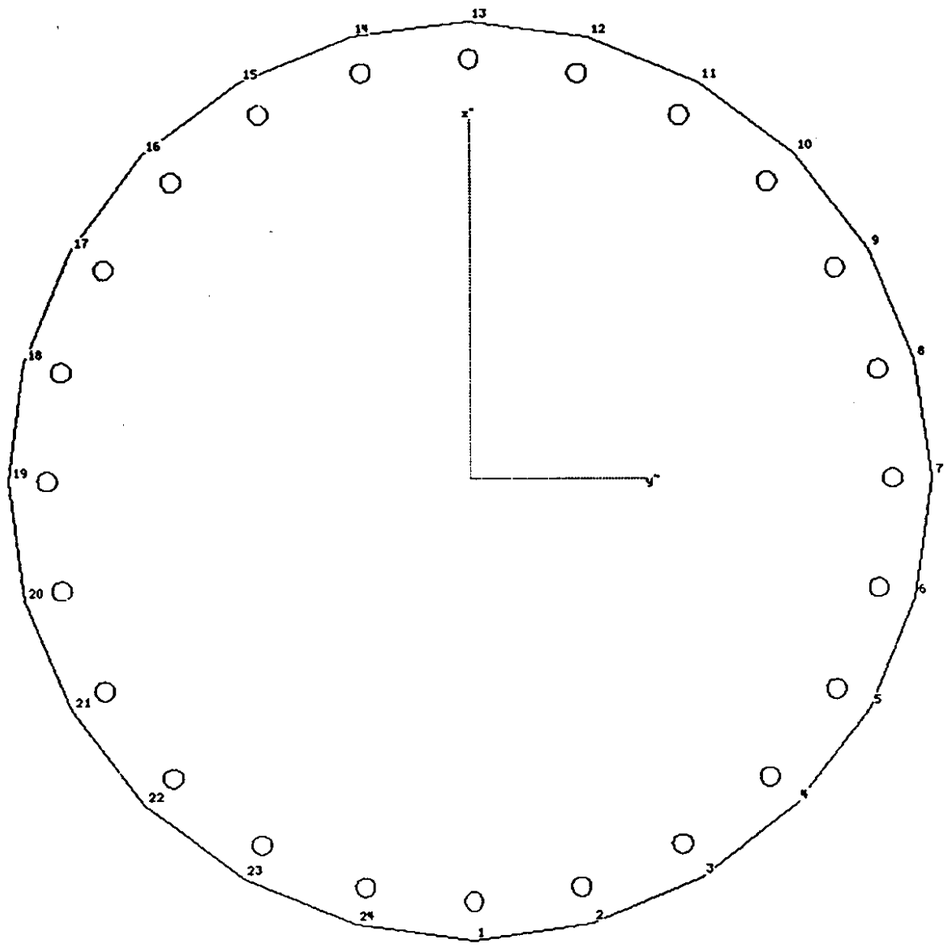
PILA Nº1
Esfuerzos de en base de pila mediante cálculo en 2º orden

| HIPOTESIS N | N(t.) | Vy(t.) | Vz(t.) | Mx(m.t.) | My(m.t.) | Mz(m.t.) | (%) agotamiento |
|---|---|---|---|---|---|---|---|
| 1 | **-1047.06** | **-2.97** | **-3.65** | **0.08** | **133.73** | **131.19** | 71 |
| 2 | -51.24 | -2.97 | -3.65 | 0.01 | 49.03 | 39.89 | 20 |
| 3 | -787.97 | 4.80 | -9.30 | 0.67 | 217.59 | -57.64 | 68 |
| 4 | -787.97 | -6.57 | 7.90 | 0.00 | -155.49 | 129.38 | 64 |
| 5 | -51.24 | 4.80 | -9.30 | 0.09 | 124.93 | -64.23 | 51 |
| 6 | -51.24 | -6.57 | 7.90 | 0.00 | -106.00 | 88.20 | 50 |
| 7 | -942.22 | 0.29 | -6.84 | 0.28 | 171.35 | 30.30 | 65 |
| 8 | -942.22 | -1.34 | 4.93 | 0.00 | -101.84 | 27.72 | 55 |
| 9 | -46.12 | 0.29 | -6.84 | 0.05 | 91.69 | -3.70 | 32 |
| 10 | -46.12 | -1.34 | 4.93 | 0.00 | -65.93 | 17.95 | 23 |

PILA Nº2
Esfuerzos de en base de pila mediante cálculo en 2º orden

| HIPOTESIS N | N(t.) | Vy(t.) | Vz(t.) | Mx(m.t.) | My(m.t.) | Mz(m.t.) | (%) agotamiento |
|---|---|---|---|---|---|---|---|
| 1 | **-1016.99** | **3.16** | **2.85** | **-0.01** | **-133.46** | **-145.25** | 71 |
| 2 | -53.26 | 3.16 | 2.85 | 0.00 | -39.90 | -44.21 | 19 |
| 3 | -763.83 | 6.31 | -7.07 | 0.00 | 148.06 | -132.01 | 63 |
| 4 | -763.83 | -4.77 | 8.51 | 0.72 | -223.37 | 63.10 | 69 |
| 5 | -53.26 | 6.31 | -7.07 | 0.00 | 98.86 | -88.14 | 48 |
| 6 | -53.26 | -4.77 | 8.51 | 0.09 | -119.09 | 66.56 | 49 |
| 7 | -915.11 | 1.89 | -5.04 | 0.00 | 110.97 | -41.66 | 55 |
| 8 | -915.11 | 0.01 | 5.75 | 0.24 | -162.21 | -37.23 | 62 |
| 9 | -47.93 | 1.89 | -5.04 | 0.00 | 70.18 | -26.34 | 25 |
| 10 | -47.93 | 0.01 | 5.75 | 0.04 | -80.23 | -0.24 | 27 |

Mstb. 1 : 8.0




Sección :"PILA" Armadura :"B1"
Tipo : tipo viga/ Círculo/tubo Unidades :[cm]
Material :"H300PIL"

Diámetro exterior = 120.000 cm

Características mecánicas de la sección:
Area : Ax= 1.118 [m2]
Momentos de inercia : Iy= 0.099487 [m4] Iz= 0.099487 [m4]
Inercia a torsión : Ix= 0.203575 [m4]

Posición del centro de gravedad: ys= 0.000 [m] zs= 0.600000 [m]

| | I: | R=dist.borde [m] | W=I/R [m3] | W/Ax [m] |
|---|---|---|---|---|
| izq. | Iz | -0.600 | -0.165812 | 0.148 |
| dch. | Iz | 0.600 | 0.165812 | -0.148 |
| abajo | Iy | -0.600 | -0.165812 | 0.148 |
| arriba | Iy | 0.600 | 0.165812 | -0.148 |



Armadura: "B1"

| Nº | Nom.mat | Cod.dim. | Area [cm2] | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] |
|---|---|---|---|---|---|---|---|
| 1 | AEH500 | (2) | 4.91 | 0.00 | 5.00 | | |
| 2 | AEH500 | (2) | 4.91 | 14.24 | 6.87 | | |
| 3 | AEH500 | (2) | 4.91 | 27.50 | 12.37 | | |
| 4 | AEH500 | (2) | 4.91 | 38.89 | 21.11 | | |
| 5 | AEH500 | (2) | 4.91 | 47.63 | 32.50 | | |
| 6 | AEH500 | (2) | 4.91 | 53.13 | 45.77 | | |
| 7 | AEH500 | (2) | 4.91 | 55.00 | 60.00 | | |
| 8 | AEH500 | (2) | 4.91 | 53.13 | 74.23 | | |
| 9 | AEH500 | (2) | 4.91 | 47.63 | 87.50 | | |
| 10 | AEH500 | (2) | 4.91 | 38.89 | 98.89 | | |
| 11 | AEH500 | (2) | 4.91 | 27.50 | 107.63 | | |
| 12 | AEH500 | (2) | 4.91 | 14.24 | 113.13 | | |
| 13 | AEH500 | (2) | 4.91 | 0.00 | 115.00 | | |
| 14 | AEH500 | (2) | 4.91 | -14.24 | 113.13 | | |
| 15 | AEH500 | (2) | 4.91 | -27.50 | 107.63 | | |
| 16 | AEH500 | (2) | 4.91 | -38.89 | 98.89 | | |
| 17 | AEH500 | (2) | 4.91 | -47.63 | 87.50 | | |
| 18 | AEH500 | (2) | 4.91 | -53.13 | 74.23 | | |
| 19 | AEH500 | (2) | 4.91 | -55.00 | 60.00 | | |
| 20 | AEH500 | (2) | 4.91 | -53.13 | 45.77 | | |
| 21 | AEH500 | (2) | 4.91 | -47.63 | 32.50 | | |
| 22 | AEH500 | (2) | 4.91 | -38.89 | 21.11 | | |
| 23 | AEH500 | (2) | 4.91 | -27.50 | 12.37 | | |
| 24 | AEH500 | (2) | 4.91 | -14.24 | 6.87 | | |
| | Total: | | 117.81 | Cuantía de armadura: 1.054 [o/o] | | | |

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

¡No se han definido valores para el cálculo a cortante!

Características del material:

| Nom.Mat. | Módulo E [ kp/cm2] | 0.85*fcd,fyd [ kp/cm2] | eps-fc [o/oo] | fct [ kp/cm2] | fcv [ kp/cm2] | fcw,min [ kp/cm2] |
|---|---|---|---|---|---|---|
| "H300PIL" | 310000.0 | -153.000 | -2.000 | 0.0 | 6.700 | 270.000 |
| "AEH500" | 2.10E+06 | 4434.700 | | | | |

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Pila ''1U1'
**********

Título : 'Estructura E-1500.4 PILA N¦ 1 1'
Altura de la pila : 13.181 [m]
Long. max. de barra: Altura pila / 6

NUDOS x Apoyo
Nu [m] d-xyz r-xyz

| Nu | [m] | d-xyz | r-xyz |
|---|---|---|---|
| 2 | 13.181 | | |
| 1 | 0.000 | BBB | BBB |

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

| Ba | Nu | Sección | Tipo | Exc: ey [m] | ez [m] | Arm: Zona | fac |
|---|---|---|---|---|---|---|---|
| 1 | 2-1 | 'PILA' | SecFAGUS | | | 1 | 1.000 |

CARGAS :

| Nu/Ba | | Tipo Car. | Dim. | Valor Val.arriba | ey[m] Val.abajo | ez[m] |
|---|---|---|---|---|---|---|
| Comp. Carga G1 : | | | | | | |
| Nudo | 2 | Fuerza | x [kN] | -7252.401 | | |
| | | Fuerza | y [kN] | 17.745 | | |
| | | Fuerza | z [kN] | 14.031 | | |
| Barra | 1 | Fuerza | x [kN/m] | -42.412 | | |
| Comp. Carga Q1 : | | | | | | |
| Nudo | 2 | Fuerza | x [kN] | -2705.760 | | |
| | | Fuerza | y [kN] | 11.935 | | |
| | | Fuerza | z [kN] | 22.509 | | |



D I M E N S I O N A M I E N T O (global) <B.1U1.1>

PARAMETROS DE CALCULO:
Norma..... EH
Criterio de rotura..... Agotamiento de secciones o del sistema
Rotura de secciones..... Limitación de deformaciones según FAGUS-2
- Hormigón (def. centrada).... -2.000 [o/oo]
- Hormigón (flexión)..... -3.500 [o/oo]
- Acero ..... 10.00 [o/oo]
Coef. min. resist. (gamma_r)... 1.000
Coeficiente de fluencia..... 2.500
Carga contribuyente a fluencia. 1.000 * Carga permanente G1
No de elementos ..... 6
Tolerancia desequi. fuerzas.... 0.105 [kN]
Tolerancia desequi. momentos... 48E-4 [kNm]
Mayoración de cargas..... 1.000 * Carga permanente G1
+ 1.000 * Carga variable Q1

RESULTADOS DEL CALCULO NO LINEAL:
La aramdura mínima (o existente) es suficiente.

DATOS DE LA SECCION

| Nombre | Ancho dy [m] | Canto dz [m] | Materiales Horm. / Acero | Distrib. de la armadura | Armadura fija[cm²] |
|---|---|---|---|---|---|
| PILA | 1.200 | 1.200 | H30OPIL AEH500 B1 | | 0.000 |

DEFORMACIONES sin deformaciones accidentales

| | DX [mm] | DY [mm] | DZ [mm] | RX [o/oo] | RY [o/oo] | RZ [o/oo] |
|---|---|---|---|---|---|---|
| Mínima | -17.29 | 0.00 | 0.00 | 0.000 | -9.816 | 0.000 |
| Máxima | 0.00 | 90.45 | 84.07 | 0.009 | 0.000 | 10.582 |

ESFUERZOS (global)

| | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| Mínima | -10470.60 | -29.68 | -36.54 | 0.00 | 0.00 | 0.00 |
| Máxima | -10004.75 | -29.68 | -36.54 | 0.81 | 1337.33 | 1311.90 |

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

| | sigHorm. [N/mm²] | sigAcero [N/mm²] | epsHorm. [o/oo] | epsAcero [o/oo] | Ely [kNm²] | Elz [kNm²] |
|---|---|---|---|---|---|---|
| Mínima | -12.7 | -443.5 | -1.172 | -2.380 | 4.576E+3 | 9.312E+5 |
| Máxima | 0.0 | -53.9 | 0.136 | -0.257 | 1.058E+6 | 1.536E+6 |



DIMENSIONAMIENTO SEGUN TEORIA DE 2ª ORDEN

| Zona | Coord-x [m] | Nombre de la sección | Armadura [cm²] | [o/o] | Agotamiento [o/o] |
|---|---|---|---|---|---|
| 1 | 13.18 | PILA | 117.8 | 1.05 | 45 |
| | 10.98 | PILA | 117.8 | 1.05 | 50 |
| | 8.787 | PILA | 117.8 | 1.05 | 55 |
| | 6.590 | PILA | 117.8 | 1.05 | 60 |
| | 4.394 | PILA | 117.8 | 1.05 | 65 |
| | 2.197 | PILA | 117.8 | 1.05 | 69 |
| | 0.000 | PILA | 117.8 | 1.05 | 71 |

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

ESFUERZOS (global)
<B.1U1.1> Carga: 1.00*G1 1.00*Q1

| Coord-x | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| 13.181 | -10004.75 | -29.68 | -36.54 | 0.00 | 0.00 | 0.00 |
| 10.984 | -10004.75 | -29.68 | -36.54 | 0.21 | 293.76 | 295.34 |
| 10.984 | -10097.92 | -29.68 | -36.54 | 0.21 | 293.76 | 295.34 |
| 8.787 | -10097.92 | -29.68 | -36.54 | 0.40 | 576.06 | 578.21 |
| 8.787 | -10191.09 | -29.68 | -36.54 | 0.40 | 576.06 | 578.21 |
| 6.590 | -10191.09 | -29.68 | -36.54 | 0.57 | 833.53 | 834.13 |
| 6.590 | -10284.26 | -29.68 | -36.54 | 0.57 | 833.53 | 834.13 |
| 4.394 | -10284.26 | -29.68 | -36.54 | 0.70 | 1053.54 | 1049.49 |
| 4.394 | -10377.43 | -29.68 | -36.54 | 0.70 | 1053.54 | 1049.49 |
| 2.197 | -10377.43 | -29.68 | -36.54 | 0.78 | 1224.79 | 1212.22 |
| 2.197 | -10470.60 | -29.68 | -36.54 | 0.78 | 1224.79 | 1212.22 |
| 0.000 | -10470.60 | -29.68 | -36.54 | 0.81 | 1337.33 | 1311.90 |

D I M E N S I O N A M I E N T O (global) <B.2U1.2>

PARAMETROS DE CALCULO:

| | |
|---|---|
| Norma | EH |
| Criterio de rotura | Agotamiento de secciones o del sistema |
| Rotura de secciones | Limitación de deformaciones según FAGUS-2 |
| - Hormigón (def. centrada) | -2.000 [o/oo] |
| - Hormigón (flexión) | -3.500 [o/oo] |
| - Acero | 10.00 [o/oo] |
| Coef. min. resist. (gamma_r) | 1.000 |
| Coeficiente de fluencia | 2.500 |
| Carga contribuyente a fluencia. | 1.000 * Carga permanente G1 |
| No de elementos | 6 |
| Tolerancia desequi. fuerzas | 0.102 [kN] |
| Tolerancia desequi. momentos | 46E-4 [kNm] |
| Mayoración de cargas | 1.000 * Carga permanente G1 |
| | + 1.000 * Carga variable Q1 |

RESULTADOS DEL CALCULO NO LINEAL:
La aramdura mínima (o existente) es suficiente.

DATOS DE LA SECCION

| Nombre | Ancho dy [m] | Canto dz [m] | Materiales Horm. / Acero | Distrib. de la armadura | Armadura fija[cm²] |
|---|---|---|---|---|---|
| PILA | 1.200 | 1.200 | H30OPIL AEH500 B1 | | 0.000 |

DEFORMACIONES sin deformaciones accidentales

| | DX [mm] | DY [mm] | DZ [mm] | RX [o/oo] | RY [o/oo] | RZ [o/oo] |
|---|---|---|---|---|---|---|
| Mínima | -17.50 | -103.33 | -95.67 | -8.596E-4 | 0.000 | -11.620 |
| Máxima | 0.00 | 0.00 | 0.00 | 0.000E+0 | 10.761 | 0.000 |

ESFUERZOS (global)

| | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| Mínima | -10169.87 | 31.62 | 28.53 | -0.08 | -1334.64 | -1452.54 |
| Máxima | -9685.73 | 31.62 | 28.53 | 0.00 | 0.00 | 0.00 |

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

| | sigHorm. [N/mm²] | sigAcero [N/mm²] | epsHorm. [o/oo] | epsAcero [o/oo] | EIy [kNm²] | EIz [kNm²] |
|---|---|---|---|---|---|---|
| Mínima | -12.8 | -443.5 | -1.199 | -2.395 | 9.632E+5 | 5.887E+4 |
| Máxima | 0.0 | -32.0 | 0.192 | -0.153 | 1.532E+6 | 1.027E+6 |



DIMENSIONAMIENTO SEGUN TEORIA DE 2º ORDEN

| Zona | Coord-x [m] | Nombre de la sección | Armadura [cm²] | [o/o] | Agotamiento [o/o] |
|---|---|---|---|---|---|
| 1 | 13.70 | PILA | 117.8 | 1.05 | 44 |
| | 11.42 | PILA | 117.8 | 1.05 | 49 |
| | 9.132 | PILA | 117.8 | 1.05 | 54 |
| | 6.849 | PILA | 117.8 | 1.05 | 60 |
| | 4.566 | PILA | 117.8 | 1.05 | 65 |
| | 2.283 | PILA | 117.8 | 1.05 | 69 |
| | 0.000 | PILA | 117.8 | 1.05 | 71 |

(≤) : Armadura ≤ $\mu$_min = 0.40%
(≥) : Armadura ≥ $\mu$_max = 8.00%

ESFUERZOS (global)
<B.2U1.2> Carga: 1.00*G1 1.00*Q1

| Coord-x | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| 13.698 | -9685.73 | 31.62 | 28.53 | 0.00 | 0.00 | 0.00 |
| 11.415 | -9685.73 | 31.62 | 28.53 | -0.02 | -300.59 | -326.46 |
| 11.415 | -9782.56 | 31.62 | 28.53 | -0.02 | -300.59 | -326.46 |
| 9.132 | -9782.56 | 31.62 | 28.53 | -0.04 | -588.61 | -639.35 |
| 9.132 | -9879.38 | 31.62 | 28.53 | -0.04 | -588.61 | -639.34 |
| 6.849 | -9879.38 | 31.62 | 28.53 | -0.05 | -849.23 | -922.67 |
| 6.849 | -9976.21 | 31.62 | 28.53 | -0.05 | -849.23 | -922.67 |
| 4.566 | -9976.21 | 31.62 | 28.53 | -0.07 | -1068.50 | -1161.36 |
| 4.566 | -10073.04 | 31.62 | 28.53 | -0.07 | -1068.50 | -1161.36 |
| 2.283 | -10073.04 | 31.62 | 28.53 | -0.07 | -1233.96 | -1341.94 |
| 2.283 | -10169.87 | 31.62 | 28.53 | -0.07 | -1233.96 | -1341.94 |
| 0.000 | -10169.87 | 31.62 | 28.53 | -0.08 | -1334.64 | -1452.54 |



Pila ''2U1'
**********

Título : 'Estructura E-1500.4 PILA N| 1 PILA N| 2 1'
Altura de la pila : 13.698 [m]
Long. max. de barra: Altura pila / 6

NUDOS

| Nu | x [m] | Apoyo d-xyz | Apoyo r-xyz |
|---|---|---|---|
| 2 | 13.698 | | |
| 1 | 0.000 | BBB | BBB |

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.linea: barra abajo)

| Ba | Nu | Sección | Tipo | Exc: ey [m] | ez [m] | Arm: Zona | fac |
|---|---|---|---|---|---|---|---|
| 1 | 2-1 | 'PILA' | SecFAGUS | | | 1 | 1.000 |

CARGAS :

| Nu/Ba | Tipo Car. | Dim. | Valor Val.arriba | Valor Val.abajo | ey[m] | ez[m] |
|---|---|---|---|---|---|---|
| Comp. Carga G1 : | | | | | | |
| Nudo 2 | Fuerza | x [kN] | -6951.412 | | | |
| | Fuerza | y [kN] | -15.330 | | | |
| | Fuerza | z [kN] | -14.382 | | | |
| Barra 1 | Fuerza | x [kN/m] | -42.412 | | | |
| Comp. Carga Q1 : | | | | | | |
| Nudo 2 | Fuerza | x [kN] | -2685.900 | | | |
| | Fuerza | y [kN] | -16.290 | | | |
| | Fuerza | z [kN] | -14.148 | | | |

| Cálculo de Cimentación de Pilas | PILA Nº 1 |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1500.4 |

CARACTERISTICAS DEL TERRENO

| | | |
|---|---|---|
| Tensión media admisible = | 3.0 | Kp/cm² |
| Coeficiente de rozamiento zapata-terreno = | 0.6 | |

DIMENSIONES GEOMETRICAS (en metros)

| | |
|---|---|
| Medida zapata según Y = | 12.0 |
| Medida zapata según Z = | 5.5 |
| Canto zapata = | 1.5 |
| Peso zapata(ton.)= | 247.50 |

| | |
|---|---|
| Numero de fustes | 2 |
| Separacion de ejes fustes consecutivos | 6.58 |
| Diametro de los fustes | 1.20 |
| Altura de la pila | 13.18 |

CUADRO DE CONTROL

| | Valor | Control |
|---|---|---|
| Tension(kp/cm2) = | 2.57 | Verifica |
| Seguridad deslizamiento | 48.69 | Verifica |
| Seguridad al vuelco | 5.68 | Verifica |
| Armaduras flexión | — | Vale |
| Acte (Vu.max= 496.06 T. | 359.09 | No necesita |

CUADRO DE ARMADURAS (cm2/m)

| | Calculadas | Minimas | | A disponer |
|---|---|---|---|---|
| Ay,inf= | 22.25 | 12.48 | —> | **22.25** |
| Ay,sup= | 22.25 | 12.48 | —> | **22.25** |
| Az,inf= | 16.48 | 12.48 | —> | **16.48** |
| Az,sup= | 4.45 | 12.48 | —> | **12.48** |

| CCIONES TOTALES EN CABEZA DE PILAS E.L.U SERVICIO (signos del FAGU | | | | | | | ESFUERZOS EN CARA SUP. ZAPATA CON 2º ORDEN (valores para el calculo de armaduras) | | | | | ESFUERZOS EN CARA INF. DE ZAPATA CON 2º ORDEN | | | | | TENSION ADMISIBLE | SEGURIDAD AL DESLIZAMIENTO | SEGURIDAD AL VUELCO | | Armadura inferior dir. Y | | | Armadura superior dir. Y | | | Armadura inferior dir. Z | | | Cortante |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Sigma(Kp/cm2) | Coef.Seguridad | CoefSeg Y | CoefSeg Z | Md (m.t/m) | As (cm2/m) | Comp | Md (m.t/m) | As (cm2/m) | Comp. | Md (m.t/m) | As (cm2/m) | Comp. | Vd |
| 1 | -841.55 | 3.96 | 4.87 | 0.00 | 391.73 | 1.00 | -916.09 | 3.96 | 4.87 | -276.57 | 648.96 | -1163.59 | 3.96 | 4.87 | -283.88 | 654.90 | **2.13** | **107.50** | **10.66** | **11.27** | 101.77 | **16.32** | Vale | 101.77 | **16.32** | Vale | 82.04 | **13.11** | Vale | 286.69 |
| 2 | -841.55 | -2.39 | -2.04 | 0.00 | 391.73 | 1.00 | -916.09 | -2.39 | -2.04 | 212.64 | 170.36 | -1163.59 | -2.39 | -2.04 | 215.70 | 166.77 | **1.94** | **214.52** | **41.86** | **14.84** | 82.45 | **13.18** | Vale | 82.14 | **13.13** | Vale | 69.98 | **11.16** | Vale | 253.70 |
| 3 | -841.55 | 4.76 | 3.91 | 0.00 | 391.73 | 1.00 | -916.09 | 4.76 | 3.91 | -256.25 | 685.96 | -1163.59 | 4.76 | 3.91 | -262.12 | 673.10 | **2.13** | **109.53** | **10.37** | **12.21** | 102.46 | **16.44** | Vale | 102.46 | **16.44** | Vale | 81.38 | **13.00** | Vale | 285.12 |
| 4 | -841.55 | -3.20 | -1.08 | 0.00 | 391.73 | 1.00 | -916.09 | -3.20 | -1.08 | 187.28 | 151.43 | -1163.59 | -3.20 | -1.08 | 188.90 | 146.64 | **1.91** | **200.02** | **47.61** | **16.94** | 81.78 | **13.07** | Vale | 81.36 | **13.00** | Vale | 68.40 | **10.90** | Vale | 250.05 |
| 5 | -1102.34 | 3.96 | 4.87 | 0.00 | 124.93 | 1.00 | -1176.87 | 3.96 | 4.87 | -326.09 | 430.38 | -1424.37 | 3.96 | 4.87 | -333.40 | 436.32 | **2.49** | **131.59** | **19.59** | **11.75** | 114.19 | **18.36** | Vale | 114.19 | **18.36** | Vale | 96.42 | **15.45** | Vale | 342.43 |
| 6 | -1102.34 | -2.39 | -2.04 | 0.00 | 124.93 | 1.00 | -1176.87 | -2.39 | -2.04 | 258.31 | -142.54 | -1424.37 | -2.39 | -2.04 | 261.37 | -146.13 | **2.35** | **262.60** | **58.48** | **14.99** | 103.22 | **16.56** | Vale | 102.39 | **16.43** | Vale | 87.75 | **14.04** | Vale | 320.72 |
| 7 | -1102.34 | 4.76 | 3.91 | 0.00 | 124.93 | 1.00 | -1176.87 | 4.76 | 3.91 | -304.41 | 448.52 | -1424.37 | 4.76 | 3.91 | -310.28 | 455.66 | **2.48** | **134.08** | **18.76** | **12.62** | 114.94 | **18.48** | Vale | 114.94 | **18.48** | Vale | 95.71 | **15.34** | Vale | 340.83 |
| 8 | -1102.34 | -3.20 | -1.08 | 0.00 | 124.93 | 1.0 | -1176.87 | -3.20 | -1.08 | 231.98 | -162.52 | -1424.37 | -3.20 | -1.08 | 233.60 | -167.32 | **2.34** | **244.85** | **51.08** | **16.77** | 103.93 | **16.68** | Vale | 103.21 | **16.56** | Vale | 86.85 | **13.89** | Vale | 318.83 |
| 9 | -977.60 | 3.96 | 4.87 | 0.00 | 957.45 | 1.00 | -1052.13 | 3.96 | 4.87 | -301.66 | 1239.24 | -1299.63 | 3.96 | 4.87 | -308.98 | 1245.18 | **2.57** | **120.07** | **6.26** | **11.57** | 137.14 | **22.13** | Vale | 137.14 | **22.13** | Vale | 102.71 | **16.48** | Vale | 359.09 |
| 10 | -977.60 | -2.39 | -2.04 | 0.00 | 957.45 | 1.00 | -1052.13 | -2.39 | -2.04 | 236.21 | 712.35 | -1299.63 | -2.39 | -2.04 | 239.27 | 708.76 | **2.32** | **239.61** | **11.00** | **14.94** | 115.53 | **18.58** | Vale | 89.67 | **14.35** | Vale | 317.30 |
| 11 | -977.60 | 4.76 | 3.91 | 0.00 | 957.45 | 1.00 | -1052.13 | 4.76 | 3.91 | -280.79 | 1256.70 | -1299.63 | 4.76 | 3.91 | -286.65 | 1263.64 | **2.55** | **122.34** | **6.17** | **12.47** | 137.85 | **22.25** | Vale | 137.85 | **22.25** | Vale | 102.03 | **16.37** | Vale | 357.46 |
| 12 | -977.60 | -3.20 | -1.08 | 0.00 | 957.45 | 1.00 | -1052.13 | -3.20 | -1.08 | 210.51 | 693.01 | -1299.63 | -3.20 | -1.08 | 212.13 | 688.22 | **2.30** | **223.41** | **11.33** | **16.85** | 114.73 | **18.45** | Vale | 114.73 | **18.45** | Vale | 88.07 | **14.09** | Vale | 313.18 |
| 13 | -1013.40 | 3.96 | 4.87 | 0.00 | -342.03 | 1.00 | -1087.93 | 3.96 | 4.87 | -309.35 | -52.91 | -1335.43 | 3.96 | 4.87 | -316.66 | -46.97 | **2.23** | **123.37** | **170.58** | **11.60** | 92.63 | **14.83** | Vale | 91.42 | **14.64** | Vale | 83.05 | **13.28** | Vale | 300.57 |
| 14 | -1013.40 | -2.39 | -2.04 | 0.00 | -342.03 | 1.00 | -1087.93 | -2.39 | -2.04 | 242.78 | -593.85 | -1335.43 | -2.39 | -2.04 | 245.85 | -597.44 | **2.34** | **246.21** | **13.41** | **14.94** | 113.60 | **18.26** | Vale | 113.60 | **18.26** | Vale | 89.97 | **14.40** | Vale | 320.03 |
| 15 | -1013.40 | 4.76 | 3.91 | 0.00 | -342.03 | 1.00 | -1087.93 | 4.76 | 3.91 | -288.10 | -35.14 | -1335.43 | 4.76 | 3.91 | -293.97 | -28.00 | **2.21** | **125.71** | **286.18** | **12.49** | 92.00 | **14.73** | Vale | 90.69 | **14.52** | Vale | 81.69 | **13.06** | Vale | 297.39 |
| 16 | -1013.40 | -3.20 | -1.08 | 0.00 | -342.03 | 1.00 | -1087.93 | -3.20 | -1.08 | 216.75 | -613.50 | -1335.43 | -3.20 | -1.08 | 218.37 | -618.30 | **2.33** | **229.57** | **12.96** | **16.82** | 114.41 | **18.39** | Vale | 114.41 | **18.39** | Vale | 89.09 | **14.26** | Vale | 318.08 |
| 17 | -858.50 | -6.40 | 12.34 | 0.00 | 337.00 | 1.00 | -933.04 | -6.40 | 12.34 | -414.22 | 26.80 | -1180.54 | -6.40 | 12.34 | -432.73 | 17.21 | **2.07** | **49.26** | **411.59** | **7.50** | 78.78 | **12.58** | Vale | 77.64 | **12.40** | Vale | 78.07 | **12.47** | Vale | 274.70 |
| 18 | -858.50 | 8.76 | -10.47 | 0.00 | 337.00 | 1.00 | -933.04 | 8.76 | -10.47 | 383.20 | 690.71 | -1180.54 | 8.76 | -10.47 | 398.91 | 703.86 | **2.26** | **50.16** | **10.06** | **8.14** | 104.87 | **16.83** | Vale | 104.87 | **16.83** | Vale | 89.02 | **14.25** | Vale | 307.43 |
| 19 | -858.50 | 11.13 | -8.60 | 0.00 | 337.00 | 1.00 | -933.04 | 11.13 | -8.60 | 350.80 | 731.26 | -1180.54 | 11.13 | -8.60 | 363.70 | 747.96 | **2.25** | **48.69** | **9.47** | **8.93** | 106.53 | **17.10** | Vale | 106.53 | **17.10** | Vale | 88.21 | **14.12** | Vale | 305.46 |
| 20 | -858.50 | -8.76 | 10.47 | 0.00 | 337.00 | 1.00 | -933.04 | -8.76 | 10.47 | -383.20 | -16.71 | -1180.54 | -8.76 | 10.47 | -398.91 | -29.85 | **2.05** | **50.16** | **237.25** | **8.14** | 78.42 | **12.53** | Vale | 77.22 | **12.33** | Vale | 76.38 | **12.19** | Vale | 270.31 |
| 21 | -882.14 | -6.40 | 12.34 | 0.00 | 211.28 | 1.00 | -956.68 | -6.40 | 12.34 | -419.79 | -103.78 | -1204.18 | -6.40 | 12.34 | -438.30 | -113.37 | **2.14** | **50.25** | **63.73** | **7.56** | 83.48 | **13.35** | Vale | 82.74 | **13.23** | Vale | 81.24 | **12.98** | Vale | 284.84 |
| 22 | -882.14 | 8.76 | -10.47 | 0.00 | 211.28 | 1.00 | -956.68 | 8.76 | -10.47 | 388.58 | 570.17 | -1204.18 | 8.76 | -10.47 | 404.28 | 583.31 | **2.26** | **51.16** | **12.39** | **8.19** | 101.86 | **16.34** | Vale | 101.86 | **16.34** | Vale | 88.47 | **14.16** | Vale | 306.21 |
| 23 | -882.14 | 11.13 | -8.60 | 0.00 | 211.28 | 1.00 | -956.68 | 11.13 | -8.60 | 355.96 | 610.99 | -1204.18 | 11.13 | -8.60 | 368.86 | 627.68 | **2.25** | **49.67** | **11.51** | **8.98** | 103.54 | **16.61** | Vale | 103.54 | **16.61** | Vale | 87.66 | **14.03** | Vale | 304.22 |
| 24 | -882.14 | -8.76 | 10.47 | 0.00 | 211.28 | 1.00 | -956.68 | -8.76 | 10.47 | -388.58 | -147.61 | -1204.18 | -8.76 | 10.47 | -404.28 | -160.76 | **2.13** | **51.16** | **44.94** | **8.19** | 85.03 | **13.60** | Vale | 84.53 | **13.52** | Vale | 80.55 | **12.87** | Vale | 283.07 |
| 25 | -858.50 | -6.40 | 12.34 | 0.00 | 337.00 | 1.00 | -933.04 | -6.40 | 12.34 | -414.22 | 26.80 | -1180.54 | -6.40 | 12.34 | -432.73 | 17.21 | **2.07** | **49.26** | **411.59** | **7.50** | 78.78 | **12.58** | Vale | 77.64 | **12.40** | Vale | 78.07 | **12.47** | Vale | 274.70 |
| 26 | -858.50 | 8.76 | -10.47 | 0.00 | 337.00 | 1.00 | -933.04 | 8.76 | -10.47 | 383.20 | 690.71 | -1180.54 | 8.76 | -10.47 | 398.91 | 703.86 | **2.26** | **50.16** | **10.06** | **8.14** | 104.87 | **16.83** | Vale | 104.87 | **16.83** | Vale | 89.02 | **14.25** | Vale | 307.43 |
| 27 | -858.50 | 11.13 | -8.60 | 0.00 | 337.00 | 1.00 | -933.04 | 11.13 | -8.60 | 350.80 | 731.26 | -1180.54 | 11.13 | -8.60 | 363.70 | 747.96 | **2.25** | **48.69** | **9.47** | **8.93** | 106.53 | **17.10** | Vale | 106.53 | **17.10** | Vale | 88.21 | **14.12** | Vale | 305.46 |
| 28 | -858.50 | -8.76 | 10.47 | 0.00 | 337.00 | 1.00 | -933.04 | -8.76 | 10.47 | -383.20 | -16.71 | -1180.54 | -8.76 | 10.47 | -398.91 | -29.85 | **2.05** | **50.16** | **237.25** | **8.14** | 78.42 | **12.53** | Vale | 77.22 | **12.33** | Vale | 76.38 | **12.19** | Vale | 270.31 |
| 29 | -881.14 | -6.40 | 12.34 | 0.00 | 211.28 | 1.00 | -955.68 | -6.40 | 12.34 | -419.56 | -103.58 | -1203.18 | -6.40 | 12.34 | -438.07 | -113.17 | **2.13** | **50.21** | **63.79** | **7.55** | 83.39 | **13.33** | Vale | 82.64 | **13.21** | Vale | 81.16 | **12.97** | Vale | 284.56 |
| 30 | -881.14 | 8.76 | -10.47 | 0.00 | 211.28 | 1.00 | -955.68 | 8.76 | -10.47 | 388.36 | 569.96 | -1203.18 | 8.76 | -10.47 | 404.06 | 583.10 | **2.26** | **51.12** | **12.38** | **8.19** | 101.77 | **16.33** | Vale | 101.77 | **16.33** | Vale | 88.40 | **14.15** | Vale | 305.94 |
| 31 | -881.14 | 11.13 | -8.60 | 0.00 | 211.28 | 1.00 | -955.68 | 11.13 | -8.60 | 355.75 | 610.77 | -1203.18 | 11.13 | -8.60 | 368.64 | 627.46 | **2.25** | **49.62** | **11.51** | **8.98** | 103.45 | **16.60** | Vale | 103.45 | **16.60** | Vale | 87.59 | **14.01** | Vale | 303.95 |
| 32 | -881.14 | -8.76 | 10.47 | 0.00 | 211.28 | 1.00 | -955.68 | -8.76 | 10.47 | -388.36 | -147.40 | -1203.18 | -8.76 | 10.47 | -404.06 | -160.54 | **2.12** | **51.12** | **44.97** | **8.19** | 84.94 | **13.58** | Vale | 84.44 | **13.50** | Vale | 80.48 | **12.86** | Vale | 282.80 |
| 33 | -753.25 | -0.38 | 9.10 | 0.00 | 364.93 | 0.90 | -820.33 | -0.38 | 9.10 | -334.98 | 214.10 | -1043.08 | -0.38 | 9.10 | -348.63 | 213.53 | **1.86** | **66.44** | **29.31** | **8.23** | 76.08 | **12.15** | Vale | 76.08 | **12.15** | Vale | 70.80 | **11.29** | Vale | 247.47 |
| 34 | -753.25 | 1.79 | -6.55 | 0.00 | 364.93 | 0.90 | -820.33 | 1.79 | -6.55 | 290.03 | 554.34 | -1043.08 | 1.79 | -6.55 | 299.85 | 557.02 | **1.94** | **89.13** | **11.24** | **9.57** | 90.03 | **14.41** | Vale | 90.03 | **14.41** | Vale | 75.01 | **11.97** | Vale | 260.65 |
| 35 | -753.25 | 8.23 | -1.19 | 0.00 | 364.93 | 0.90 | -820.33 | 8.23 | -1.19 | 173.81 | 684.97 | -1043.08 | 8.23 | -1.19 | 175.59 | 697.31 | **1.89** | **72.78** | **8.98** | **16.34** | 95.39 | **15.28** | Vale | 95.39 | **15.28** | Vale | 71.84 | **11.46** | Vale | 253.69 |
| 36 | -753.25 | -6.82 | 3.74 | 0.00 | 364.93 | 0.90 | -820.33 | -6.82 | 3.74 | -234.55 | 69.91 | -1043.08 | -6.82 | 3.74 | -240.16 | 59.68 | **1.74** | **77.78** | **104.86** | **11.94** | 70.91 | **11.31** | Vale | 70.16 | **11.19** | Vale | 83.25 | **10.07** | Vale | 228.19 |
| 37 | -989.05 | -0.38 | 9.10 | 0.00 | 121.55 | 0.90 | -1056.13 | -0.38 | 9.10 | -385.95 | -69.33 | -1278.88 | -0.38 | 9.10 | -399.59 | -69.90 | **2.21** | **81.46** | **109.77** | **8.80** | 90.56 | **14.50** | Vale | 89.48 | **14.32** | Vale | 85.09 | **13.61** | Vale | 302.57 |
| 38 | -989.05 | 1.79 | -6.55 | 0.00 | 121.55 | 0.90 | -1056.13 | 1.79 | -6.55 | 337.84 | 352.21 | -1278.88 | 1.79 | -6.55 | 347.66 | 354.89 | **2.25** | **109.28** | **21.62** | **10.12** | 101.08 | **16.21** | Vale | 101.08 | **16.21** | Vale | 88.07 | **14.09** | Vale | 310.94 |
| 39 | -989.05 | 8.23 | -1.19 | 0.00 | 121.55 | 0.90 | -1056.13 | 8.23 | -1.19 | 214.42 | 491.53 | -1278.88 | 8.23 | -1.19 | 216.21 | 503.87 | **2.21** | **89.23** | **15.23** | **16.27** | 106.80 | **17.15** | Vale | 106.80 | **17.15** | Vale | 84.73 | **13.55** | Vale | 303.74 |
| 40 | -989.05 | -6.82 | 3.74 | 0.00 | 121.55 | 0.90 | -1056.13 | -6.82 | 3.74 | -278.43 | -221.64 | -1278.88 | -6.82 | 3.74 | -284.04 | -231.87 | **2.17** | **95.37** | **33.09** | **12.38** | 95.95 | **15.38** | Vale | 95.73 | **15.34** | Vale | 82.76 | **13.23** | Vale | 297.41 |
| 41 | -875.69 | -0.38 | 9.10 | 0.00 | 874.08 | 0.90 | -942.77 | -0.38 | 9.10 | -360.29 | 702.47 | -1165.52 | -0.38 | 9.10 | -373.93 | 701.90 | **2.22** | **74.24** | **9.96** | **8.57** | 106.15 | **17.04** | Vale | 106.15 | **17.04** | Vale | 88.73 | **14.20** | Vale | 307.18 |
| 42 | -875.69 | 1.79 | -6.55 | 0.00 | 874.08 | 0.90 | -942.77 | 1.79 | -6.55 | 313.89 | 1084.68 | -1165.52 | 1.79 | -6.55 | 323.71 | 1087.36 | **2.33** | **99.59** | **6.43** | **8.90** | 121.83 | **19.61** | Vale | 121.83 | **19.61** | Vale | 93.66 | **15.00** | Vale | 326.08 |
| 43 | -875.69 | 8.23 | -1.19 | 0.00 | 874.08 | 0.90 | -942.77 | 8.23 | -1.19 | 194.78 | 1218.95 | -1165.52 | 8.23 | -1.19 | 196.56 | 1231.29 | **2.28** | **81.32** | **5.68** | **16.31** | 127.33 | **20.52** | Vale | 127.33 | **20.52** | Vale | 90.42 | **14.47** | Vale | 319.26 |
| 44 | -875.69 | -6.82 | 3.74 | 0.00 | 874.08 | 0.90 | -942.77 | -6.82 | 3.74 | -256.75 | 555.04 | -1165.52 | -6.82 | 3.74 | -262.36 | 544.81 | **2.09** | **86.92** | **12.84** | **12.22** | 100.10 | **16.05** | Vale | 100.10 | **16.05** | Vale | 80.97 | **12.94** | Vale | 285.08 |
| 45 | -909.01 | -0.38 | 9.10 | 0.00 | -298.72 | 0.90 | -976.09 | -0.38 | 9.10 | -368.89 | -476.01 | -1198.84 | -0.38 | 9.10 | -382.53 | -476.58 | **2.20** | **76.36** | **15.09** | **8.62** | 99.59 | **15.97** | Vale | 99.59 | **15.97** | Vale | 86.96 | **13.91** | Vale | 302.64 |
| 46 | -909.01 | 1.79 | -6.55 | 0.00 | -298.72 | 0.90 | -976.09 | 1.79 | -6.55 | 321.81 | -82.01 | -1198.84 | 1.79 | -6.55 | 331.63 | -79.33 | **2.04** | **102.44** | **90.67** | **9.94** | 84.33 | **13.48** | Vale | 83.43 | **13.34** | Vale | 77.30 | **12.34** | Vale | 276.37 |
| 47 | -909.01 | 8.23 | -1.19 | 0.00 | -298.72 | 0.90 | -976.09 | 8.23 | -1.19 | 200.66 | 54.54 | -1198.84 | 8.23 | -1.19 | 202.45 | 66.88 | **1.95** | **83.65** | **107.55** | **16.28** | 83.35 | **13.33** | Vale | 82.31 | **13.16** | Vale | 70.93 | **11.31** | Vale | 261.64 |
| 48 | -909.01 | -6.82 | 3.74 | 0.00 | -298.72 | 0.90 | -976.09 | -6.82 | 3.74 | -263.66 | -625.76 | -1198.84 | -6.82 | 3.74 | -269.27 | -635.99 | **2.17** | **89.40** | **11.31** | **12.24** | 105.74 | **16.97** | Vale | 105.74 | **16.97** | Vale | 84.68 | **13.54** | Vale | 297.77 |

| Cálculo de Cimentación de Pilas | PILA Nº 2 |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1500.4 |

CARACTERISTICAS DEL TERRENO

| | | |
|---|---|---|
| Tensión media admisible = | 3.0 | Kp/cm² |
| Coeficiente de rozamiento zapata-terreno = | 0.6 | |

DIMENSIONES GEOMETRICAS (en metros)

| | |
|---|---|
| Medida zapata según Y = | 12.0 |
| Medida zapata según Z = | 5.5 |
| Canto zapata = | 1.5 |
| Peso zapata(ton.)= | 247.50 |

| | |
|---|---|
| Número de fustes | 2 |
| Separacion de ejes fustes consecutivos | 6.58 |
| Diametro de los fustes | 1.20 |
| Altura de la pila | 13.70 |

CUADRO DE CONTROL

| | Valor | Control |
|---|---|---|
| Tension(kp/cm2) = | 2.58 | Verifica |
| Seguridad deslizamiento | 52.60 | Verifica |
| Seguridad al vuelco | 5.56 | Verifica |
| Armaduras flexión | — | Vale |
| Acte (Vu.max= 496.06 T. | 361.57 | No necesita |

CUADRO DE ARMADURAS (cm2/m)

| | Calculadas | Minimas | | A disponer |
|---|---|---|---|---|
| Ay,inf= | 22.48 | 12.48 | —> | 22.48 |
| Ay,sup= | 22.48 | 12.48 | —> | 22.48 |
| Az,inf= | 16.59 | 12.48 | —> | 16.59 |
| Az,sup= | 4.50 | 12.48 | —> | 12.48 |

| CCIONES TOTALES EN CABEZA DE PILAS E.L.U.SERVICIO (signos del FAGU | | | | | | | ESFUERZOS EN CARA SUP. ZAPATA CON 2º ORDEN (valores para el calculo de armaduras) | | | | | ESFUERZOS EN CARA INF. DE ZAPATA CON 2º ORDE | | | | | TENSION ADMISIBLE | SEGURIDAD AL DESLIZAMIENTO | SEGURIDAD AL VUELCO | | Armadura inferior dir. Y | | | Armadura superior dir. Y | | | Armadura inferior dir. Z | | | Cortante |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Sigma(Kp/cm2) | Coef.Seguridad | CoefSeg.Y | CoefSeg.Z | Md (m.t/m) | As (cm2/m) | Comp. | Md (m.t/m) | As (cm2/m) | Comp. | Md (m.t/m) | As (cm2/m) | Comp. | Vd |
| 1 | -841.80 | 1.40 | 2.76 | 0.00 | -391.39 | 1.00 | -919.26 | 1.40 | 2.76 | -248.82 | -178.95 | -1166.76 | 1.40 | 2.76 | -252.95 | -176.85 | 1.97 | 218.83 | 39.59 | 12.68 | 83.05 | 13.28 | Vale | 82.73 | 13.22 | Vale | 72.08 | 11.50 | Vale | 258.86 |
| 2 | -841.80 | -4.22 | -3.81 | 0.00 | -391.39 | 1.00 | -919.26 | -4.22 | -3.81 | 274.36 | -675.05 | -1166.76 | -4.22 | -3.81 | 280.07 | -681.38 | 2.15 | 119.08 | 10.27 | 11.46 | 103.07 | 16.54 | Vale | 103.07 | 16.54 | Vale | 82.62 | 13.21 | Vale | 288.63 |
| 3 | -841.80 | 2.17 | 1.89 | 0.00 | -391.39 | 1.00 | -919.26 | 2.17 | 1.89 | -226.17 | -157.69 | -1166.76 | 2.17 | 1.89 | -229.01 | -154.43 | 1.95 | 234.89 | 45.33 | 14.01 | 82.30 | 13.15 | Vale | 81.85 | 13.08 | Vale | 70.59 | 11.26 | Vale | 255.30 |
| 4 | -841.80 | -4.98 | -2.95 | 0.00 | -391.39 | 1.00 | -919.26 | -4.98 | -2.95 | 253.62 | -692.06 | -1166.76 | -4.98 | -2.95 | 258.04 | -699.54 | 2.14 | 116.86 | 10.01 | 12.43 | 103.77 | 16.65 | Vale | 103.77 | 16.65 | Vale | 81.94 | 13.10 | Vale | 287.01 |
| 5 | -1101.53 | 1.40 | 2.76 | 0.00 | -112.59 | 1.00 | -1178.99 | 1.40 | 2.76 | -299.06 | 148.30 | -1426.49 | 1.40 | 2.76 | -303.19 | 150.40 | 2.38 | 267.54 | 56.91 | 12.94 | 103.64 | 16.63 | Vale | 102.77 | 16.49 | Vale | 89.96 | 14.40 | Vale | 325.87 |
| 6 | -1101.53 | -4.22 | -3.81 | 0.00 | -112.59 | 1.00 | -1178.99 | -4.22 | -3.81 | 326.21 | -448.75 | -1426.49 | -4.22 | -3.81 | 331.93 | -455.07 | 2.49 | 145.59 | 18.81 | 11.82 | 115.09 | 18.50 | Vale | 115.09 | 18.50 | Vale | 96.90 | 15.53 | Vale | 343.83 |
| 7 | -1101.53 | 2.17 | 1.89 | 0.00 | -112.59 | 1.00 | -1178.99 | 2.17 | 1.89 | -275.20 | 170.52 | -1426.49 | 2.17 | 1.89 | -278.04 | 173.77 | 2.37 | 287.18 | 49.25 | 14.11 | 104.42 | 16.76 | Vale | 103.68 | 16.64 | Vale | 89.22 | 14.28 | Vale | 324.29 |
| 8 | -1101.53 | -4.98 | -2.95 | 0.00 | -112.59 | 1.00 | -1178.99 | -4.98 | -2.95 | 304.14 | -466.97 | -1426.49 | -4.98 | -2.95 | 308.56 | -474.45 | 2.48 | 142.87 | 18.04 | 12.71 | 115.84 | 18.63 | Vale | 115.84 | 18.63 | Vale | 96.18 | 15.41 | Vale | 342.18 |
| 9 | -1013.86 | 1.40 | 2.76 | 0.00 | 350.60 | 1.00 | -1091.33 | 1.40 | 2.76 | -282.18 | 595.16 | -1338.83 | 1.40 | 2.76 | -286.32 | 597.27 | 2.38 | 251.10 | 13.45 | 12.86 | 113.90 | 18.31 | Vale | 113.90 | 18.31 | Vale | 92.11 | 14.75 | Vale | 325.49 |
| 10 | -1013.86 | -4.22 | -3.81 | 0.00 | 350.60 | 1.00 | -1091.33 | -4.22 | -3.81 | 308.83 | 32.02 | -1338.83 | -4.22 | -3.81 | 314.55 | 25.70 | 2.23 | 136.64 | 312.59 | 11.71 | 92.20 | 14.76 | Vale | 90.81 | 14.54 | Vale | 82.84 | 13.24 | Vale | 300.30 |
| 11 | -1013.86 | 2.17 | 1.89 | 0.00 | 350.60 | 1.00 | -1091.33 | 2.17 | 1.89 | -258.70 | 617.09 | -1338.83 | 2.17 | 1.89 | -261.54 | 620.34 | 2.37 | 269.54 | 12.95 | 14.08 | 114.80 | 18.46 | Vale | 114.80 | 18.46 | Vale | 91.39 | 14.63 | Vale | 323.89 |
| 12 | -1013.86 | -4.98 | -2.95 | 0.00 | 350.60 | 1.00 | -1091.33 | -4.98 | -2.95 | 287.18 | 14.19 | -1338.83 | -4.98 | -2.95 | 291.60 | 6.71 | 2.20 | 134.09 | 1197.55 | 12.63 | 91.57 | 14.66 | Vale | 90.08 | 14.42 | Vale | 81.46 | 13.02 | Vale | 297.09 |
| 13 | -976.88 | 1.40 | 2.76 | 0.00 | -960.15 | 1.00 | -1054.34 | 1.40 | 2.76 | -274.51 | -722.68 | -1301.84 | 1.40 | 2.76 | -278.64 | -720.58 | 2.36 | 244.16 | 10.84 | 12.85 | 116.10 | 18.67 | Vale | 116.10 | 18.67 | Vale | 91.85 | 14.71 | Vale | 322.98 |
| 14 | -976.88 | -4.22 | -3.81 | 0.00 | -960.15 | 1.00 | -1054.34 | -4.22 | -3.81 | 300.68 | -1270.40 | -1301.84 | -4.22 | -3.81 | 306.39 | -1276.72 | 2.58 | 132.87 | 6.12 | 11.68 | 138.56 | 22.37 | Vale | 138.56 | 22.37 | Vale | 103.39 | 16.59 | Vale | 361.57 |
| 15 | -976.88 | 2.17 | 1.89 | 0.00 | -960.15 | 1.00 | -1054.34 | 2.17 | 1.89 | -251.41 | -701.08 | -1301.84 | 2.17 | 1.89 | -254.25 | -697.82 | 2.33 | 262.09 | 11.19 | 14.08 | 115.21 | 18.52 | Vale | 115.21 | 18.52 | Vale | 90.33 | 14.46 | Vale | 318.93 |
| 16 | -976.88 | -4.98 | -2.95 | 0.00 | -960.15 | 1.00 | -1054.34 | -4.98 | -2.95 | 279.42 | -1287.91 | -1301.84 | -4.98 | -2.95 | 283.84 | -1295.39 | 2.57 | 130.39 | 6.03 | 12.61 | 139.28 | 22.48 | Vale | 139.28 | 22.48 | Vale | 102.69 | 16.47 | Vale | 359.88 |
| 17 | -858.68 | -8.41 | 9.46 | 0.00 | -338.00 | 1.00 | -936.15 | -8.41 | 9.46 | -392.58 | -711.07 | -1183.65 | -8.41 | 9.46 | -406.78 | -723.68 | 2.28 | 54.23 | 9.81 | 8.00 | 105.93 | 17.00 | Vale | 105.93 | 17.00 | Vale | 90.04 | 14.41 | Vale | 310.67 |
| 18 | -858.68 | 6.36 | -11.38 | 0.00 | -338.00 | 1.00 | -936.15 | 6.36 | -11.38 | 426.63 | -4.77 | -1183.65 | 6.36 | -11.38 | 443.70 | 4.78 | 2.08 | 52.65 | 1486.49 | 7.34 | 78.29 | 12.50 | Vale | 76.97 | 12.29 | Vale | 78.45 | 12.53 | Vale | 275.87 |
| 19 | -858.68 | 8.41 | -9.46 | 0.00 | -338.00 | 1.00 | -936.15 | 8.41 | -9.46 | 392.58 | 35.07 | -1183.65 | 8.41 | -9.46 | 406.78 | 47.68 | 2.06 | 54.23 | 148.95 | 8.00 | 79.36 | 12.68 | Vale | 78.21 | 12.49 | Vale | 77.37 | 12.36 | Vale | 273.04 |
| 20 | -858.68 | -10.45 | 7.55 | 0.00 | -338.00 | 1.00 | -936.15 | -10.45 | 7.55 | -356.64 | -748.32 | -1183.65 | -10.45 | 7.55 | -367.96 | -764.00 | 2.27 | 53.25 | 9.30 | 8.85 | 107.46 | 17.25 | Vale | 107.46 | 17.25 | Vale | 89.01 | 14.24 | Vale | 307.97 |
| 21 | -882.16 | -8.41 | 9.46 | 0.00 | -200.23 | 1.00 | -959.62 | -8.41 | 9.46 | -398.28 | -578.86 | -1207.12 | -8.41 | 9.46 | -412.47 | -591.47 | 2.27 | 55.30 | 12.25 | 8.05 | 102.43 | 16.43 | Vale | 102.43 | 16.43 | Vale | 89.29 | 14.29 | Vale | 308.66 |
| 22 | -882.16 | 6.36 | -11.38 | 0.00 | -200.23 | 1.00 | -959.62 | 6.36 | -11.38 | 432.56 | 138.26 | -1207.12 | 6.36 | -11.38 | 449.63 | 147.81 | 2.16 | 53.69 | 49.00 | 7.38 | 84.98 | 13.59 | Vale | 84.37 | 13.49 | Vale | 82.68 | 13.22 | Vale | 288.88 |
| 23 | -882.16 | 8.41 | -9.46 | 0.00 | -200.23 | 1.00 | -959.62 | 8.41 | -9.46 | 398.28 | 178.40 | -1207.12 | 8.41 | -9.46 | 412.47 | 191.01 | 2.15 | 55.30 | 37.92 | 8.05 | 86.40 | 13.82 | Vale | 86.01 | 13.76 | Vale | 81.78 | 13.07 | Vale | 286.50 |
| 24 | -882.16 | -10.45 | 7.55 | 0.00 | -200.23 | 1.00 | -959.62 | -10.45 | 7.55 | -362.08 | -616.37 | -1207.12 | -10.45 | 7.55 | -373.40 | -632.04 | 2.26 | 54.31 | 11.46 | 8.89 | 103.97 | 16.68 | Vale | 103.97 | 16.68 | Vale | 88.24 | 14.12 | Vale | 305.97 |
| 25 | -882.16 | -8.41 | 9.46 | 0.00 | -200.23 | 1.00 | -959.62 | -8.41 | 9.46 | -398.28 | -578.86 | -1207.12 | -8.41 | 9.46 | -412.47 | -591.47 | 2.27 | 55.30 | 12.25 | 8.05 | 102.43 | 16.43 | Vale | 102.43 | 16.43 | Vale | 89.29 | 14.29 | Vale | 308.66 |
| 26 | -882.16 | 6.36 | -11.38 | 0.00 | -200.23 | 1.00 | -959.62 | 6.36 | -11.38 | 432.56 | 138.26 | -1207.12 | 6.36 | -11.38 | 449.63 | 147.81 | 2.16 | 53.69 | 49.00 | 7.38 | 84.98 | 13.59 | Vale | 84.37 | 13.49 | Vale | 82.68 | 13.22 | Vale | 288.88 |
| 27 | -882.16 | 8.41 | -9.46 | 0.00 | -200.23 | 1.00 | -959.62 | 8.41 | -9.46 | 398.28 | 178.40 | -1207.12 | 8.41 | -9.46 | 412.47 | 191.01 | 2.15 | 55.30 | 37.92 | 8.05 | 86.40 | 13.82 | Vale | 86.01 | 13.76 | Vale | 81.78 | 13.07 | Vale | 286.50 |
| 28 | -882.16 | -10.45 | 7.55 | 0.00 | -200.23 | 1.00 | -959.62 | -10.45 | 7.55 | -362.08 | -616.37 | -1207.12 | -10.45 | 7.55 | -373.40 | -632.04 | 2.26 | 54.31 | 11.46 | 8.89 | 103.97 | 16.68 | Vale | 103.97 | 16.68 | Vale | 88.24 | 14.12 | Vale | 305.97 |
| 29 | -857.68 | -8.41 | 9.46 | 0.00 | -338.00 | 1.00 | -935.15 | -8.41 | 9.46 | -392.34 | -710.84 | -1182.65 | -8.41 | 9.46 | -406.54 | -723.45 | 2.28 | 54.18 | 9.81 | 8.00 | 105.84 | 16.99 | Vale | 105.84 | 16.99 | Vale | 89.97 | 14.40 | Vale | 310.40 |
| 30 | -857.68 | 6.36 | -11.38 | 0.00 | -338.00 | 1.00 | -935.15 | 6.36 | -11.38 | 426.38 | -4.99 | -1182.65 | 6.36 | -11.38 | 443.46 | 4.56 | 2.08 | 52.60 | 1556.41 | 7.33 | 78.21 | 12.49 | Vale | 76.90 | 12.28 | Vale | 78.38 | 12.52 | Vale | 275.62 |
| 31 | -857.68 | 8.41 | -9.46 | 0.00 | -338.00 | 1.00 | -935.15 | 8.41 | -9.46 | 392.34 | 34.84 | -1182.65 | 8.41 | -9.46 | 406.54 | 47.45 | 2.06 | 54.18 | 149.54 | 8.00 | 79.27 | 12.66 | Vale | 78.12 | 12.48 | Vale | 77.29 | 12.34 | Vale | 272.76 |
| 32 | -857.68 | -10.45 | 7.55 | 0.00 | -338.00 | 1.00 | -935.15 | -10.45 | 7.55 | -356.42 | -748.08 | -1182.65 | -10.45 | 7.55 | -367.74 | -763.76 | 2.26 | 53.21 | 9.29 | 8.84 | 107.37 | 17.24 | Vale | 107.37 | 17.24 | Vale | 88.93 | 14.23 | Vale | 307.70 |
| 33 | -753.69 | -2.52 | 6.74 | 0.00 | -362.81 | 0.90 | -823.40 | -2.52 | 6.74 | -315.55 | -586.99 | -1046.15 | -2.52 | 6.74 | -325.66 | -590.77 | 1.97 | 84.33 | 10.62 | 8.83 | 91.60 | 14.67 | Vale | 91.60 | 14.67 | Vale | 77.04 | 12.30 | Vale | 266.70 |
| 34 | -753.69 | -0.01 | -7.69 | 0.00 | -362.81 | 0.90 | -823.40 | -0.01 | -7.69 | 333.50 | -513.93 | -1046.15 | -0.01 | -7.69 | 345.03 | -513.95 | 1.96 | 78.92 | 12.21 | 8.34 | 88.60 | 14.18 | Vale | 88.60 | 14.18 | Vale | 76.54 | 12.22 | Vale | 264.74 |
| 35 | -753.69 | 5.74 | -2.56 | 0.00 | -362.81 | 0.90 | -823.40 | 5.74 | -2.56 | 225.05 | -66.96 | -1046.15 | 5.74 | -2.56 | 228.88 | -58.35 | 1.74 | 96.59 | 107.58 | 12.57 | 71.08 | 11.34 | Vale | 70.27 | 11.21 | Vale | 62.92 | 10.02 | Vale | 227.67 |
| 36 | -753.69 | -8.27 | 1.61 | 0.00 | -362.81 | 0.90 | -823.40 | -8.27 | 1.61 | -200.13 | -707.00 | -1046.15 | -8.27 | 1.61 | -202.54 | -719.40 | 1.93 | 72.02 | 8.73 | 14.20 | 96.52 | 15.47 | Vale | 96.52 | 15.47 | Vale | 73.72 | 11.76 | Vale | 258.93 |
| 37 | -988.48 | -2.52 | 6.74 | 0.00 | -109.10 | 0.90 | -1058.20 | -2.52 | 6.74 | -367.58 | -378.78 | -1280.95 | -2.52 | 6.74 | -377.69 | -382.56 | 2.29 | 103.26 | 20.09 | 9.33 | 102.31 | 16.41 | Vale | 102.31 | 16.41 | Vale | 90.14 | 14.43 | Vale | 316.40 |
| 38 | -988.48 | -0.01 | -7.69 | 0.00 | -109.10 | 0.90 | -1058.20 | -0.01 | -7.69 | 386.87 | -303.21 | -1280.95 | -0.01 | -7.69 | 398.40 | -303.23 | 2.28 | 96.63 | 25.35 | 8.84 | 99.22 | 15.91 | Vale | 99.22 | 15.91 | Vale | 89.65 | 14.35 | Vale | 314.83 |
| 39 | -988.48 | 5.74 | -2.56 | 0.00 | -109.10 | 0.90 | -1058.20 | 5.74 | -2.56 | 270.60 | 237.30 | -1280.95 | 5.74 | -2.56 | 274.43 | 245.90 | 2.17 | 118.27 | 31.25 | 12.84 | 96.71 | 15.50 | Vale | 96.51 | 15.47 | Vale | 82.80 | 13.24 | Vale | 297.72 |
| 40 | -988.48 | -8.27 | 1.61 | 0.00 | -109.10 | 0.90 | -1058.20 | -8.27 | 1.61 | -244.34 | -507.44 | -1280.95 | -8.27 | 1.61 | -246.75 | -519.85 | 2.24 | 88.19 | 14.78 | 14.28 | 107.59 | 17.28 | Vale | 107.59 | 17.28 | Vale | 86.60 | 13.85 | Vale | 308.42 |
| 41 | -909.58 | -2.52 | 6.74 | 0.00 | 307.76 | 0.90 | -979.30 | -2.52 | 6.74 | -350.31 | 53.29 | -1202.05 | -2.52 | 6.74 | -360.41 | 49.51 | 2.06 | 96.90 | 145.67 | 9.17 | 83.61 | 13.37 | Vale | 82.50 | 13.19 | Vale | 78.33 | 12.51 | Vale | 279.06 |
| 42 | -909.58 | -0.01 | -7.69 | 0.00 | 307.76 | 0.90 | -979.30 | -0.01 | -7.69 | 369.15 | 128.10 | -1202.05 | -0.01 | -7.69 | 380.69 | 128.08 | 2.10 | 90.68 | 56.31 | 8.68 | 86.26 | 13.80 | Vale | 85.56 | 13.69 | Vale | 80.64 | 12.89 | Vale | 284.99 |
| 43 | -909.58 | 5.74 | -2.56 | 0.00 | 307.76 | 0.90 | -979.30 | 5.74 | -2.56 | 255.38 | 637.36 | -1202.05 | 5.74 | -2.56 | 259.21 | 645.97 | 2.17 | 110.99 | 11.17 | 12.75 | 106.45 | 17.09 | Vale | 106.45 | 17.09 | Vale | 84.70 | 13.54 | Vale | 298.10 |
| 44 | -909.58 | -8.27 | 1.61 | 0.00 | 307.76 | 0.90 | -979.30 | -8.27 | 1.61 | -229.53 | -72.61 | -1202.05 | -8.27 | 1.61 | -231.94 | -85.02 | 1.98 | 82.76 | 84.83 | 14.25 | 84.29 | 13.48 | Vale | 83.29 | 13.32 | Vale | 72.86 | 11.63 | Vale | 266.27 |
| 45 | -873.95 | -2.52 | 6.74 | 0.00 | -874.70 | 0.90 | -943.67 | -2.52 | 6.74 | -341.11 | -1121.76 | -1166.42 | -2.52 | 6.74 | -351.22 | -1125.54 | 2.36 | 94.03 | 6.22 | 9.13 | 123.39 | 19.87 | Vale | 123.39 | 19.87 | Vale | 95.72 | 15.34 | Vale | 332.83 |
| 46 | -873.95 | -0.01 | -7.69 | 0.00 | -874.70 | 0.90 | -943.67 | -0.01 | -7.69 | 359.65 | -1047.83 | -1166.42 | -0.01 | -7.69 | 371.18 | -1047.85 | 2.35 | 87.99 | 6.68 | 8.64 | 120.36 | 19.37 | Vale | 120.36 | 19.37 | Vale | 95.23 | 15.26 | Vale | 330.21 |
| 47 | -873.95 | 5.74 | -2.56 | 0.00 | -874.70 | 0.90 | -943.67 | 5.74 | -2.56 | 247.95 | -553.93 | -1166.42 | 5.74 | -2.56 | 251.79 | -545.32 | 2.08 | 107.70 | 12.83 | 12.74 | 100.10 | 16.05 | Vale | 100.10 | 16.05 | Vale | 80.58 | 12.88 | Vale | 284.09 |
| 48 | -873.95 | -8.27 | 1.61 | 0.00 | -874.70 | 0.90 | -943.67 | -8.27 | 1.61 | -222.55 | -1245.40 | -1166.42 | -8.27 | 1.61 | -224.96 | -1257.80 | 2.32 | 80.30 | 5.56 | 14.26 | 128.46 | 20.70 | Vale | 128.46 | 20.70 | Vale | 92.32 | 14.78 | Vale | 325.05 |

PASO SUPERIOR E-1500.4

## 4º CALCULO DE ESTRIBOS

# CALCULO ESTRIBOS CERRADOS

| | |
|---|---|
| **NOMBRE PROYECTO :** | **L.A.V. MADRID - ZARAGOZA. Subtramo XV.** |
| **NOMBRE OBRA :** | **E-1500.4. Estribos 1 y 2.** |

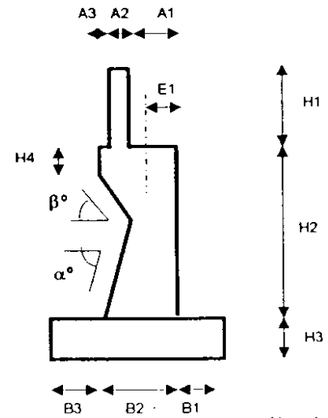
## DATOS REQUERIDOS:

### GESTION FICHEROS

| | |
|---|---|
| Directorio fichero generación modelo (.GEO) : | G:\MAZAXV.2\E-1500.4\ESTRIBOS |
| Directorio fichero listados (.LIS) : | G:\MAZAXV.2\E-1500.4\ESTRIBOS\COSMOS |

### MURO FRONTAL

| | | |
|---|---|---|
| H1. Altura murete (m) : | 1.750 | |
| H2. Altura muro frontal (m) : | 13.00 | |
| H3. Canto zapata (m) : | 2.00 | |
| Altura tierras en trasdós (superior zapata)(m) : | 14.75 | |
| B1. Puntera zapata (m) : | 3.50 | Zapata tipo I |
| B2. Canto muro en base (m) : | 2.00 | |
| B3. Talón zapata (m) : | 5.00 | Zapata tipo III |
| A1 (m) : | 2.05 | |
| A2. Canto murete de guarda (m) : | 0.30 | |
| A3. Vuelo ménsula apoyo losa transición (m) : | 0.00 | |
| H4. Canto min. apoyo losa transición (m) : | 0.30 | |
| α . Angulo trasdós muro (°) : | 90.00 | |
| β . Angulo inferior apoyo losa transición (°) : | 45.00 | |
| E1. Distancia apoyo tablero (m) : | 0.75 | |
| Longitud (m) : | 19.59 | |

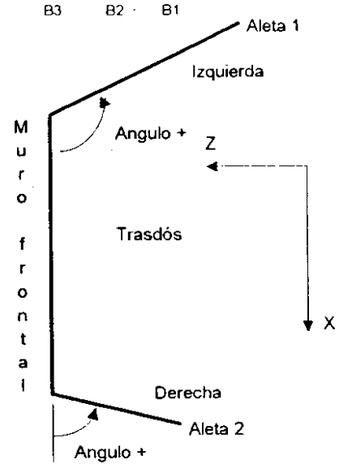



### MUROS EN VUELTA (intradós vertical)

| | Izquierdo (1) | Derecho (2) |
|---|---|---|
| Longitud (m) : | 5.53 | |
| Canto en base (m) : | 1.80 | |
| Canto coronación (m) : | 0.35 | |
| Angulo ( ° ) : | 139.23 | 139.23 |

### ALETAS

| | Izquierda (1) | Derecha (2) |
|---|---|---|
| Canto aleta en empotramiento (m) : | 2.50 | 2.50 |
| Canto aleta en extremo (m) : | 0.50 | 0.50 |
| Longitud aleta (m) : | 3.00 | 4.53 |
| Espesor aleta (m) : | 0.35 | 0.35 |




### CARACTERISTICAS DE TERRENO

| | |
|---|---|
| Peso específico (T/m³) : | 2.00 |
| Angulo rozamiento interno (°) : | 30.00 |
| Coeficiente rozamiento zapata-terreno : | 0.58 |
| Angulo rozamiento tierras muro (°) : | 0.00 |
| Tension admisible (T / m²) : | 35.00 |

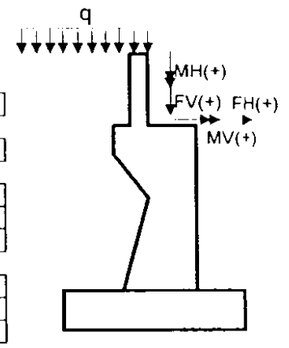
### CARACTERISTICAS DE LOS MATERIALES

| | |
|---|---|
| Peso específico hormigón (T / m³) : | 2.50 |
| Límite elástico acero (T / m²) : | 51000.00 |
| Resistencia hormigón cimientos (T / m²) : | 2500.00 |
| Resistencia hormigón alzado (T / m²) : | 2500.00 |
| Mod. Elasticidad Hormigón alzado (T / m²) : | 3000000 |



### CARGAS SOBRE EL ESTRIBO (Carga total sobre el estribo sin mayorar)

| | |
|---|---|
| q (Sobrecarga de tráfico (T / m²) : | 1.00 |
| Peso barrera en muros en vuelta y aletas (T / m) : | 1.60 |




| | FV (T) | MV (mT) | FH (T) | MH (mT) |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio y carga muerta tablero : | 357.61 | | --- | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero : | 40.09 | | --- | --- |
| Retracción y fluencia tablero : | --- | --- | 16.00 | |
| Asientos estructura : | 0.00 | | --- | --- |
| **Acciones Variables (Q)** | | | | |
| Sobrecarga de uso máxima tablero : | 107.70 | | 30.60 | |
| Sobrecarga de uso mínima tablero : | -28.60 | | 30.60 | |
| Efectos térmicos tablero : | 12.91 | | 0.00 | |

### COEFICIENTES DE SEGURIDAD

| | | |
|---|---|---|
| Seguridad al deslizamiento | Csd= | 1.50 |
| Seguridad al vuelco | Csv= | 1.80 |
| Minoracion acero | γs= | 1.15 |
| Minoracion hormigon | γc= | 1.50 |

| | Estado Límite Ultimo | |
|---|---|---|
| | Favorable | Desfavorable |
| **Acciones permanentes (G)** | | |
| Peso propio, cargas muertas : | 0.90 | 1.50 |
| **Acciones permanentes de valor no constante (G*)** | | |
| Pretensado : | 0.00 | 1.00 |
| Reológicas (retracción y fluencia) : | 0.00 | 1.50 |
| Terreno (pesopropio, empujes y asientos) : | 0.00 | 1.50 |
| **Acciones variables (Q)** | | |
| Sobrecargas, viento, temperatura : | 0.00 | 1.50 |

| | | |
|---|---|---|
| Ψ0 (coeficiente valor de combinación variables) : | 1.00 | (poner 1 según antigua instrucción) |

### DATOS VARIOS

| | | |
|---|---|---|
| Número de apoyos : | 2.00 | |
| Separación apoyos (m) : | 8.000 | |
| Recubrimiento armadura (m) : | 0.05 | |
| Distancia sección 1-1 (a superior zapata) (m) : | 4.60 | Vale |
| Tamaño medio elementos mallado (m) : | 1.00 | |

## RESUMEN ACCIONES SOBRE EL ESTRIBO

| | | F.vertical (T / m) | X ( m ) | F. Horizontal (T / m) | Y ( m ) |
|---|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | | |
| Peso propio estribo | Base murete (ΣV i, i=1..1) | 1.313 | 5.700 | --- | --- |
| | Sección 1 (ΣV' i, i=1..6) | 43.728 | 4.547 | --- | --- |
| | Base muro (ΣV i, i=1..5) | 66.728 | 4.531 | --- | --- |
| | Inf. cimentación (ΣV i, i=1..6) | 119.228 | 4.847 | --- | --- |
| Carga permanente tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 18.254 | 4.250 | --- | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | | |
| Pretensado tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 2.046 | 4.250 | --- | --- |
| Retracción y fluencia tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | --- | --- | 0.817 | 15.000 |
| Tierras | Base murete (ΣE i, i=1..1) | 0.000 | 5.850 | 1.021 | 15.583 |
| | Sección 1 (ΣE' i, i=1..4) | 0.000 | 5.514 | 34.341 | 9.983 |
| | Base muro (ΣE i, i=1..3) | 0.000 | 5.507 | 72.521 | 6.917 |
| | Inf. cimentación (ΣE i+Pt j, i=1..4, j=1..6) | 145.943 | 8.025 | 93.521 | 5.583 |
| Asientos estructura | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 4.250 | --- | --- |
| **Acciones variables (Q)** | | | | | |
| Sobrecarga de tráfico | Base murete (ΣEsc i, i=1..1) | 0.000 | 5.850 | 0.583 | 15.875 |
| | Sección 1 (ΣEsc' i, i=1..4) | 0.000 | 5.571 | 3.383 | 11.675 |
| | Base muro (ΣEsc i, i=1..3) | 0.000 | 5.549 | 4.917 | 9.375 |
| | Inf. cimentación (ΣEsc i + Psc, i=1..4) | 4.950 | 8.025 | 5.583 | 8.375 |
| Efectos térmicos tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.659 | 4.250 | 0.000 | 15.000 |
| Sobrecarga de uso tablero máxima | Base murete | --- | --- | --- | --- |
| | Resto secciones | 5.498 | 4.250 | 1.562 | 15.000 |
| Sobrecarga de uso tablero mínima | Base murete | --- | --- | --- | --- |
| | Resto secciones | -1.460 | 4.250 | 1.562 | 15.000 |



## COMPROBACIONES

### SEGURIDAD AL DESLIZAMIENTO (Planteamiento clásico)

$$C_{SD} = \frac{\sum_i \text{Fuerzas} \; - \; \text{opuestas}}{\sum_i \text{Fuerzas} \; - \; \text{deslizantes}}$$

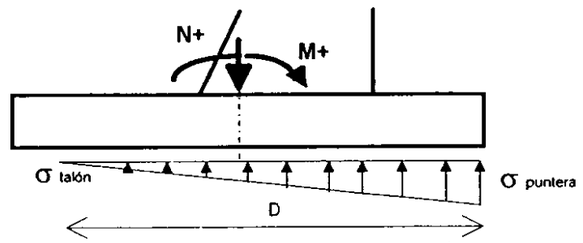
| | uerzas en construcción (T / m) Opuestas | Deslizantes | Fuerzas en servicio (T / m) Opuestas | Deslizantes |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 69.152 | --- | 69.152 | --- |
| Carga permanente tablero | --- | --- | 10.588 | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 1.187 | --- |
| Retracción y fluencia tablero | --- | --- | --- | 0.817 |
| Tierras | 84.647 | 93.521 | 84.647 | 93.521 |
| Asientos estructura | --- | --- | 0.000 | --- |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 2.871 | 5.583 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | --- | --- |
| Sobrecarga de uso tablero mínima | --- | --- | 0.000 | 2.409 |
| **TOTAL** | **153.799** | **93.521** | **168.444** | **102.330** |
| **Csd=** | **1.6** | VALE | **1.6** | VALE |

### SEGURIDAD AL VUELCO (Planteamiento clásico)

$$C_{SV} = \frac{\sum_i \text{Momentos} \; - \; \text{estabilizadores}}{\sum_i \text{Momentos} \; - \; \text{volcadores}}$$

| | Momentos construcción (mT / m) Estabilizadores | Volcadores | Momentos servicio (mT / m) Estabilizadores | Volcadores |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 577.956 | --- | 577.956 | --- |
| Carga permanente tablero | --- | --- | 77.581 | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 8.697 | --- |
| Retracción y fluencia tablero | --- | --- | --- | 12.251 |
| Tierras | 1171.168 | 522.158 | 1171.168 | 522.158 |
| Asientos estructura | --- | --- | 0.000 | --- |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 39.724 | 46.760 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | --- | --- |
| Sobrecarga de uso tablero mínima | --- | --- | 0.000 | 29.635 |
| **TOTAL** | **1749.124** | **522.158** | **1875.127** | **610.805** |
| **Csv=** | **3.3** | VALE | **3.1** | VALE |

## TENSIONES MAXIMAS Y MINIMAS EN CIMENTACION




| | Construcción | | Servicio | |
|---|---|---|---|---|
| | N (T / m) | M (mT / m) | N (T / m) | M (mT / m) |
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 119.228 | 47.992 | 119.228 | 47.992 |
| Carga permanente tablero | --- | --- | 18.254 | 18.254 |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 2.046 | 2.046 |
| Retracción y fluencia tablero | --- | --- | 0.000 | 12.251 |
| Tierras | 145.943 | 117.188 | 145.943 | 117.188 |
| Asientos estructura | --- | --- | 0.000 | 0.000 |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 4.950 | 33.024 |
| Efectos térmicos tablero | --- | --- | 0.659 | 0.659 |
| Sobrecarga de uso tablero máxima | --- | --- | 5.498 | 28.928 |
| Sobrecarga de uso tablero mínima | --- | --- | --- | --- |
| **TOTAL** | **265.171** | **165.179** | **296.578** | **260.342** |
| **D =** | **10.50 (m)** | | **10.50 (m)** | |
| **σ puntera=** | **34.24 (T / m²)** | | **42.41 (T / m²)** | |
| **σ talón=** | **16.26 (T / m²)** | | **14.08 (T / m²)** | |
| **σmed=** | **25.25 (T / m²)** | | **28.25 (T / m²)** | |
| **σcob=** | **28.65 (T / m²)** | | **33.92 (T / m²)** | |
| | **VALE** | | **VALE** | |



## CALCULO DE ARMADURAS

| Elemento | Sección | | |
|---|---|---|---|
| | Designacion | Ancho (b)(m) | Canto (h)(m) |
| MURO | 0-0 | 1.00 | 2.00 |
| | 1-1 | 1.00 | 2.00 |
| MURETE | 4-4 | 1.00 | 0.30 |
| PUNTERA | 2-2 (+) | 1.00 | 2.00 |
| | 2-2 (-) | 1.00 | 2.00 |
| TALÓN | 3-3 (+) | 1.00 | 2.00 |
| | 3-3 (-) | 1.00 | 2.00 |

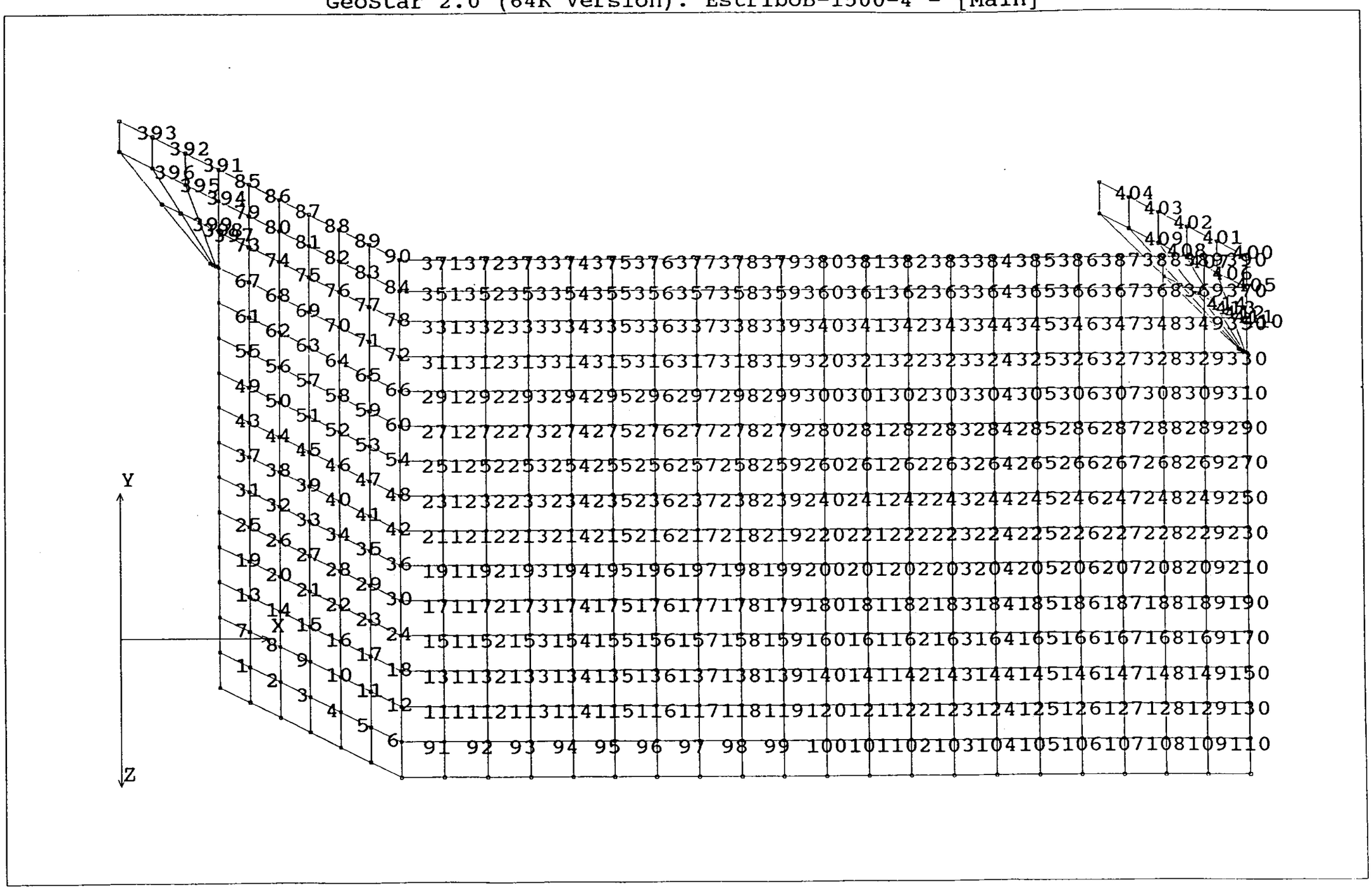
| Elemento | Sección | Armadura de flexión | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Nd (T) | Md (mT) | As (cm²/m) | Control cálculo | |
| MURO | 0-0 | 1.00 | 2.00 | 74.29 | 637.33 | 86.156 | Vale | Dominio 2. |
| | 1-1 | 1.00 | 2.00 | 53.59 | 231.72 | 33.356 | Vale | Dominio 2. |
| MURETE | 4-4 | 1.00 | 0.30 | 1.18 | 1.66 | 1.668 | Vale | Dominio 2. |
| PUNTERA | 2-2 (+) | 1.00 | 2.00 | --- | 367.16 | 44.012 | Vale | --- |
| | 2-2 (-) | 1.00 | 2.00 | --- | 70.37 | 8.191 | Vale | --- |
| TALÓN | 3-3 (+) | 1.00 | 2.00 | --- | -295.18 | 35.123 | Vale | --- |
| | 3-3 (-) | 1.00 | 2.00 | --- | -366.04 | 43.872 | Vale | --- |

| Elemento | Sección | Armadura de cortante | | | | |
|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Vd (T) | As (cm²/m²) | Control cálculo |
| MURO | 0-0 | 1.00 | 2.00 | 119.72 | 0.00 | Vale. As min = 7.94 |
| | 1-1 | 1.00 | 2.00 | 60.15 | 0.00 | Vale. As min = 7.94 |
| MURETE | 4-4 | 1.00 | 0.30 | 2.41 | 0.00 | Vale. As min = 7.94 |
| PUNTERA | 2-2 (+) | 1.00 | 2.00 | 128.45 | 0.00 | Vale. As min = 0.00 |
| | 2-2 (-) | 1.00 | 2.00 | 24.62 | 0.00 | Vale. As min = 0.00 |
| TALÓN | 3-3 (+) | 1.00 | 2.00 | 36.20 | 0.00 | Vale. As min = 7.94 |
| | 3-3 (-) | 1.00 | 2.00 | -111.73 | 0.00 | Vale. As min = 7.94 |

| Designacion armaduras | Sección Designacion | Armadura de cálculo(cm²/m) | | |
|---|---|---|---|---|
| | | Necesaria | Minima | **Adoptada** |
| Vert. trasdos | 0-0 | 86.2 | 12.0 | **86.2** |
| Vert. trasdos | 1-1 | 33.4 | 12.0 | **33.4** |
| Vert. trasdos | 4-4 | 1.7 | 1.7 | **1.7** |
| Vert. intrados | 0-0 1-1 | 0.0 | 6.0 | **6.0** |
| Vert. intrados | 4-4 | 0.0 | 1.0 | **1.0** |
| Hor. trasdos | 0-0 1-1 | 17.2 | 16.0 | **17.2** |
| Hor. trasdos | 4-4 | 0.3 | 2.4 | **2.4** |
| Hor, intrados | 0-0 1-1 | 0.0 | 16.0 | **16.0** |
| Hor, intrados | 4-4 | 0.0 | 2.4 | **2.4** |
| Cortante alzado | 0-0 1-1 | 0.0 | 7.9 | **7.9** |
| Cortante muret | 4-4 | 0.0 | 7.9 | **7.9** |
| As inf L. | 2-2 3-3 | 8.8 | 14.5 | **14.5** |
| As inf T. | 2-2 3-3 | 44.0 | 14.5 | **44.0** |
| As sup L. | 2-2 3-3 | 8.8 | 14.4 | **14.4** |
| As sup T. | 2-2 3-3 | 43.9 | 14.4 | **43.9** |
| Cortante cim | 2-2 3-3 | 0.0 | 7.9 | **7.9** |

NOTA: las armaduras longitudinales en talón y puntera y horizontales de muro que aparecen en las casillas de armadura "necesaria" han sido obtenidas multiplicando la armadura transversal o vertical por el coeficiente de poisson.

GeoStar 2.0 (64K Version): EstriboB-1500-4 - [Main]



## CALCULO DE ARMADURAS EN ESTRIBOS (modelo 3-D)

**Proyecto :** L.A.V. MADRID - ZARAGOZA. Subtramo XV.
**Nombre obra :** E-1500.4. Estribos 1 y 2.

—>(ver espacio a la derecha para pasar a FAGUS2 )

| | |
|---|---|
| Directorio del grupo: | G:\MAZAXV.2\FAGUS |
| Nombre obra: | E-1500-4 |

### CALCULO ARMADURAS VERTICALES

| ZONA | FAJA | Elemento Nº | Ny,d ( T/m ) | My,d ( mT/m ) | Vy,d ( T/m ) | Canto elemento (m.) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BORDE | 1 | 815.70 | -221.30 | 76.01 | 1.75 | 0.00 | Vale | 122.18 | 122.18 |
| | | 7 | 688.50 | -154.70 | 66.77 | 1.65 | 0.00 | Vale | 100.09 | 100.09 |
| | | 13 | 586.30 | -106.70 | 58.26 | 1.55 | 0.00 | Vale | 82.65 | 82.65 |
| | | 19 | 492.50 | -71.87 | 49.62 | 1.46 | 0.00 | Vale | 67.49 | 67.49 |
| | | 25 | 403.10 | -47.60 | 41.50 | 1.36 | 0.00 | Vale | 53.98 | 53.98 |
| | | 31 | 319.50 | -31.44 | 34.34 | 1.26 | 0.00 | Vale | 42.13 | 42.13 |
| | | 37 | 243.60 | -21.19 | 28.25 | 1.16 | 0.00 | Vale | 31.97 | 31.97 |
| | | 43 | 176.90 | -14.94 | 23.22 | 1.06 | 0.00 | Vale | 23.45 | 23.45 |
| | | 49 | 120.00 | -11.18 | 19.16 | 0.96 | 0.00 | Vale | 16.45 | 16.45 |
| | | 55 | 73.27 | -8.73 | 15.97 | 0.87 | 0.00 | Vale | 10.83 | 10.83 |
| | | 61 | 36.55 | -6.73 | 13.62 | 0.77 | 0.00 | Vale | 6.39 | 6.39 |
| | | 67 | 9.32 | -4.62 | 12.16 | 0.67 | 0.00 | Vale | 2.81 | 1.00 |
| | | 73 | -0.45 | -1.32 | 4.96 | 0.57 | 0.00 | Vale | 1.00 | 1.00 |
| MURO IZQUIERDO | BASE | 1 | 815.70 | -221.30 | 76.01 | 1.75 | 0.00 | Vale | 122.18 | 122.18 |
| | | 2 | 471.40 | -216.30 | 78.62 | 1.75 | 0.00 | Vale | 82.69 | 82.69 |
| | | 3 | 238.50 | -207.70 | 72.51 | 1.75 | 0.00 | Vale | 55.23 | 1.00 |
| | | 4 | 36.62 | -198.60 | 65.67 | 1.75 | 0.00 | Vale | 31.36 | 1.00 |
| | | 5 | -171.80 | -192.60 | 61.95 | 1.75 | 0.00 | Vale | 8.00 | 1.00 |
| | | 6 | -433.00 | -193.00 | 65.20 | 1.75 | 0.00 | Vale | 1.00 | 1.00 |

### CALCULO DE ARMADURAS HORIZONTALES

| ZONA MURO FRONTAL | FAJA BIS.IZDA | Elemento | Nx ( T/m ) | Mx ( mT/m ) | Vx ( T/m ) | Canto elemento (m.) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BISAGRA | 6 | -85.02 | -44.69 | 0.65 | 1.75 | 0.00 | Vale | 1.00 | 1.00 |
| | | 12 | -48.99 | -41.50 | 0.73 | 1.65 | 0.00 | Vale | 1.00 | 1.00 |
| | | 18 | -16.79 | -42.20 | -4.53 | 1.55 | 0.00 | Vale | 4.54 | 1.00 |
| | | 24 | 11.08 | -47.17 | -12.24 | 1.46 | 0.00 | Vale | 8.98 | 1.00 |
| | | 30 | 33.64 | -53.90 | -19.90 | 1.36 | 0.00 | Vale | 13.34 | 1.00 |
| | | 36 | 50.52 | -60.20 | -26.20 | 1.26 | 0.00 | Vale | 17.27 | 1.00 |
| | | 42 | 61.98 | -64.53 | -30.55 | 1.16 | 0.00 | Vale | 20.54 | 1.00 |
| | | 48 | 68.87 | -65.95 | -32.78 | 1.06 | 0.00 | Vale | 23.02 | 1.00 |
| | | 54 | 72.52 | -64.07 | -32.93 | 0.96 | 0.00 | Vale | 24.65 | 1.00 |
| | | 60 | 74.66 | -58.93 | -31.21 | 0.87 | 0.00 | Vale | 25.47 | 1.00 |
| | | 66 | 77.42 | -51.01 | -28.07 | 0.77 | 0.00 | Vale | 25.61 | 1.00 |
| | | 72 | 83.22 | -40.98 | -24.58 | 0.67 | 0.00 | Vale | 25.25 | 1.00 |
| | | 78 | 90.88 | -29.12 | -19.34 | 0.57 | 0.00 | Vale | 23.90 | 1.00 |
| MURO IZQUIERDO | BISAGRA | 84 | 65.05 | -14.46 | -5.22 | 0.48 | 0.00 | Vale | 15.77 | 1.00 |
| | | 90 | 19.52 | -6.78 | -2.75 | 0.39 | 0.00 | Vale | 7.01 | 1.00 |
| MURO FRONTAL | BIS.IZDA | 91 | -98.64 | -66.83 | -12.15 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 111 | -56.83 | -51.82 | -21.08 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 131 | -23.15 | -49.51 | -12.92 | 2.00 | 0.00 | Vale | 3.20 | 1.00 |
| | | 151 | 8.17 | -52.68 | -2.69 | 2.00 | 0.00 | Vale | 7.11 | 1.00 |
| | | 171 | 35.10 | -58.13 | 6.31 | 2.00 | 0.00 | Vale | 10.81 | 1.00 |
| | | 191 | 56.20 | -63.56 | 13.43 | 2.00 | 0.00 | Vale | 13.86 | 1.00 |
| | | 211 | 71.14 | -67.30 | 18.69 | 2.00 | 0.00 | Vale | 16.00 | 1.00 |
| | | 231 | 80.47 | -68.25 | 22.30 | 2.00 | 0.00 | Vale | 10.83 | 1.00 |
| | | 251 | 85.31 | -65.89 | 24.54 | 2.00 | 0.00 | Vale | 17.44 | 17.44 |
| | | 271 | 87.23 | -60.15 | 25.61 | 2.00 | 0.00 | Vale | 16.97 | 16.97 |
| | | 291 | 88.21 | -51.37 | 25.65 | 2.00 | 0.00 | Vale | 16.04 | 16.04 |
| | | 311 | 91.65 | -39.73 | 26.47 | 2.00 | 0.00 | Vale | 15.05 | 15.05 |
| | | 331 | 140.20 | -39.33 | 61.92 | 2.17 | 0.00 | Vale | 20.10 | 20.10 |
| MURO FRONTAL | BIS.IZDA | 351 | 30.90 | -1.55 | 6.42 | 0.30 | 0.00 | Vale | 4.92 | 4.92 |
| | | 371 | 25.85 | -3.87 | 7.07 | 0.30 | 0.00 | Vale | 6.89 | 1.00 |
| MURO FRONTAL | BIS.DCHA | 110 | 21.58 | -71.28 | 9.69 | 2.00 | 0.00 | Vale | 10.83 | 1.00 |
| | | 130 | 3.01 | -18.94 | 17.67 | 2.00 | 0.00 | Vale | 2.55 | 1.00 |
| | | 150 | 0.59 | -7.73 | 10.98 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 170 | 0.28 | -3.86 | 5.68 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 190 | 0.17 | -1.89 | 2.53 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 210 | 0.13 | -0.65 | 0.65 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 230 | 0.13 | 0.20 | -0.57 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 250 | 0.15 | 0.81 | -1.38 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 270 | 0.19 | 1.23 | -1.88 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 290 | 0.19 | 1.46 | -1.99 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 310 | 0.20 | 1.33 | -1.50 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 330 | 3.05 | -0.43 | -0.56 | 2.00 | 0.00 | Vale | 1.00 | 1.00 |
| | | 350 | 10.07 | -8.21 | -9.94 | 2.17 | 0.00 | Vale | 2.03 | 1.00 |
| MURO FRONTAL | BIS.DCHA | 370 | -1.30 | -1.11 | -3.32 | 0.30 | 0.00 | Vale | 1.00 | 1.00 |
| | | 390 | -2.16 | -2.79 | -5.14 | 0.30 | 0.00 | Vale | 2.23 | 1.00 |
| MURO FRONTAL | CENTRAL | 97 | -31.66 | -86.70 | -6.08 | 2.00 | 0.00 | Vale | 6.69 | 1.00 |
| | | 117 | -33.99 | -67.20 | -10.41 | 2.00 | 0.00 | Vale | 4.09 | 1.00 |
| | | 137 | -29.01 | -50.16 | -8.73 | 2.00 | 0.00 | Vale | 2.62 | 1.00 |
| | | 157 | -18.54 | -35.17 | -6.04 | 2.00 | 0.00 | Vale | 2.02 | 1.00 |
| | | 177 | -4.58 | -22.00 | -3.39 | 2.00 | 0.00 | Vale | 2.05 | 1.00 |
| | | 197 | 11.25 | -10.47 | -1.02 | 2.00 | 0.00 | Vale | 2.51 | 1.00 |
| | | 217 | 27.84 | -0.38 | 0.96 | 2.00 | 0.00 | Vale | 6.06 | 6.06 |
| | | 237 | 44.78 | 8.50 | 2.51 | 2.00 | 0.00 | Vale | 6.06 | 6.06 |
| | | 257 | 62.30 | 16.46 | 3.63 | 2.00 | 0.00 | Vale | 8.98 | 8.98 |
| | | 277 | 81.17 | 23.91 | 4.39 | 2.00 | 0.00 | Vale | 11.99 | 11.99 |
| | | 297 | 102.60 | 31.41 | 5.10 | 2.00 | 0.00 | Vale | 15.29 | 15.29 |
| | | 317 | 127.90 | 39.39 | 6.87 | 2.00 | 0.00 | Vale | 19.09 | 19.09 |
| | | 337 | 172.30 | 57.01 | 28.88 | 2.17 | 0.00 | Vale | 25.64 | 25.64 |

NOMBRE PROYECTO : L.A.V. MADID - ZARAGOZA. Subtramo XV

DESIGNACION ESTRIBO: ALETAS ESTRIBOS 1 y 2

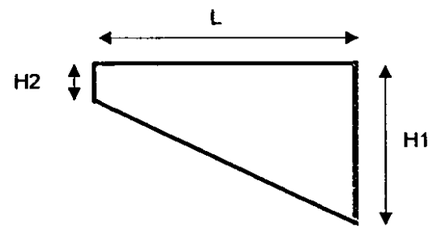
## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 2.5
H2= 0.5
L= 3

Espesor= 0.35
Recubrim.= 0.05




**CARACTERISTICAS DE TERRENO**

| | |
|---|---|
| Peso tierras(T/m3) | γ= 2 |
| Angulo rozamiento interno (º) | φ= 30 |
| Ang. rozamiento tierras muro (º) | δ= 0 |

**COEFICIENTES DE SEGURIDAD**

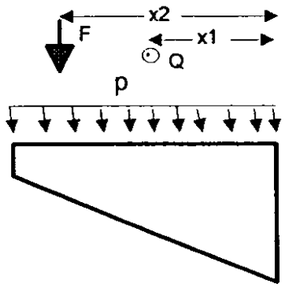
| | |
|---|---|
| Mayoracion de cargas | γf= 1.5 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.5 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γη= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hormigon (T/m2) | Fck= 2500 |

**CARGAS (valores sin mayorar)**

| | |
|---|---|
| Cargas verticales | |
| Sobrecarga vertical (t/m) | p= 1.6 |
| Carga vertical (t.) | F= 0.00 |
| Situacion x2 (m) | x2= 0 |
| Cargas horizontales | |
| Carga horizontal (t.) | Q= 0 |
| Posicion x1 (m) | x1= 0 |
| Sobrecarga sobre terreno (ton/m2) | |
| | q= 1 |




**CUANTIAS MINIMAS**

| | |
|---|---|
| LONGITUDINAL SUPERIOR | 0.400 o/oo |
| LONGITUDINAL INFERIOR | 0.400 o/oo |
| CORTANTE | 2.778 CM2/M |
| HORIZONTAL MUROS ALETA | 0.900 o/oo |
| VERTICAL MUROS ALETA | 1.600 o/oo |
| CORTANTE MUROS | 0.000 CM2/M |

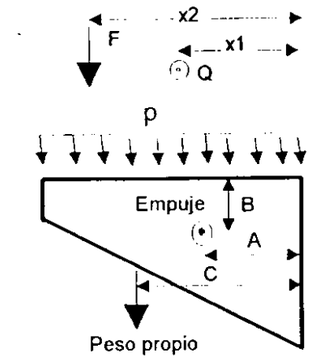
CALCULOS AletB01.xls

NOMBRE PROYECTO : L.A.V. MADID - ZARAGOZA. Subtramo XV

DESIGNACION ESTRIBO: ALETAS ESTRIBOS 1 y 2

HOJA DE CALCULO DE ALETAS DE ESTRIBOS

**CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)**




**COEFICIENTES EMPUJE ACTIVO ALETA**

| | |
|---|---|
| Coef. empuje activo λh= | 0.333 |
| Coef. empuje activo λv= | 0.000 |

**PESO PROPIO**

| | Peso | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Peso aux. 1 | 1.313 | 1.500 | 0.250 |
| Peso aux. 2 | 2.625 | 1.000 | 1.167 |
| Peso propio | **3.938** | **1.167** | **0.861** |

**EMPUJE DE TIERRAS**

HORIZONTAL

| | Empuje. | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Auxiliar | 0.083 | 2.250 | - |
| Auxiliar | 0.417 | 1.500 | - |
| Auxiliar | 2.083 | 0.750 | - |
| Auxiliar | 0.250 | 2.000 | - |
| Auxiliar | 1.250 | 1.000 | - |
| Empuje hor. | **4.083** | **1.010** | **1.112** |

VERTICAL

| | Empuje. | Dist.emp. |
|---|---|---|
| Empuje aux.1 | 0.000 | 2.250 |
| Empuje aux.2 | 0.000 | 1.500 |
| Empuje aux.3 | 0.000 | 0.750 |
| Empuje aux.4 | 0.000 | 2.000 |
| Empuje aux.5 | 0.000 | 1.000 |
| Empuje vert. | **0.000** | **0.000** |

NOMBRE PROYECTO : **L.A.V. MADID - ZARAGOZA. Subtramo XV**

DESIGNACION ESTRIBO: **ALETAS ESTRIBOS 1 y 2**

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### CALCULOS

**ESFUERZOS DE DISEÑO**

**(Para cargas verticales, momentos positivos implica tracciones en cara superior)**

| Acciones | Verticales | Horizontales |
|---|---|---|
| M peso propio | 4.594 | 0.000 |
| M empuje hor. | 0.000 | 4.125 |
| M empuje vert. | 0.000 | 0.000 |
| M sobrec.vert. | 7.200 | 0.000 |
| M carga vert. | 0.000 | 0.000 |
| M carga hor. | 0.000 | 0.000 |
| **Md (mt)** | **17.691** | **6.188** |
| V peso propio | 3.938 | 0.000 |
| V empuje hor. | 0.000 | 4.083 |
| V empuje vert. | 0.000 | 0.000 |
| V sobrec.vert. | 4.800 | 0.000 |
| V carga vert. | 0.000 | 0.000 |
| V carga hor. | 0.000 | 0.000 |
| **Vd (mt)** | **13.106** | **6.125** |

**CALCULO DE SECCIONES**

| | | | |
|---|---|---|---|
| Fcd | 1666.67 | | |
| 0,85*Fcd | 1416.67 | | |
| Fcv | 64.55 | | |
| Es | 21000000 | | |
| Fyd | 44347.83 | | |
| FYAD | 42000.00 | | |
| Acciones | Verticales | Horizontales | |
| Md(m.t) | 17.691 | 6.188 | |
| Md max/Md med | 1.000 | 1.610 | |
| Md a usar calculo | 17.691 | 9.961 | |
| Canto seccion | 2.500 | 0.350 | |
| Canto util | 2.450 | 0.300 | |
| ancho seccion | 0.350 | 2.500 | |
| Ancho calculo | 0.350 | 2.471 | |
| Def acero | 0.010 | 0.010 | |
| Tension acero | 44348 | 44348 | |
| X | 0.015 | 0.010 | |
| **As (cm.2)** | **1.633** | **7.609** | |
| Prof. fibra neutra | 0.174 | 0.029 | |
| Def. hormigon | 0.001 | 0.001 | |
| Comentarios | VALE | VALE | |
| Vd | 13.106 | 6.125 | |
| Vd compuesto | | | 14.467 |
| Vu1 | | | 370.618 |
| Vsu | | | 0.000 |
| Vcu | | | 47.847 |
| Vu2 | | | 47.847 |
| Comentarios | | | |
| **As (cm.2)** | | | **0.000** |

CALCULOS AletB01.xls

NOMBRE PROYECTO : **L.A.V. MADID - ZARAGOZA. Subtramo XV**

DESIGNACION ESTRIBO: **ALETAS ESTRIBOS 1 y 2**

HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### ARMADO

| | Calculo | Minima | total |
|---|---|---|---|
| Long. superior | 1.633 | 3.500 | **3.500** |
| Long inferior | 0.000 | 3.500 | **3.500** |
| Cortante | 0.000 | 8.333 | **8.333** |
| Horizontal trasdos | 7.609 | 3.938 | **7.609** |
| Vertical trasdos | 0.000 | 8.400 | **8.400** |
| Horizontal intrados | 0.000 | 3.938 | **3.938** |
| Vertical intrados | 0.000 | 8.400 | **8.400** |
| Cortante transversal | | NO | |

**TOTAL ENVOLVENTE ARMADURA**

| | cm² | cm²/m |
|---|---|---|
| **Long. superior** | **3.5** | --- |
| **Long inferior** | **3.5** | --- |
| **Horizontal trasdos** | 7.6 | **3.0** |
| **Horizontal intrados** | 3.9 | **1.6** |
| **Estribos** | 25.1 | **8.4** |

PASO SUPERIOR E-1500.4

# 5º PROYECTO DE PRUEBA DE CARGA

**PRUEBA DE CARGA**

OBJETO DE LA PRUEBA

El objeto de la prueba es comprobar la respuesta estructural, frente a situaciones de carga estática, de manera tal que confrontando la respuesta real con la teórica, determinar la fiabilidad del comportamiento en servicio del puente.

CARGA DE PRUEBA

La prueba se realizará empleando camiones, el la disposición que se adjunta a continuación, de tres ejes separados 3.825 y 1.36 m. con cargas por eje de 7.6, 13.7 y 13.7 T.

APARATOS DE MEDIDA Y MEDICIONES

Para la realización de las mediciones se colocarán flexímetros en el centro del vano (medidas f1) y apoyos (medidas f2). Los valores de los desplazamientos que se adjuntan son los descensos relativos esperados entre los puntos de los vanos y los fijos de los apoyos. Estos valores deben ser del orden de la magnitud del valor f1-f2 medido en obra.

La apreciación mínima de cualquiera de los flexímetros será del orden del 3% de los valores máximos esperados de las magnitudes a medir.

El rango de los aparatos deberá ser como mínimo superior en un 50% a los esperados de dicha magnitud.

Las medidas se realizarán inmediatamente antes de la carga, inmediatamente después de su colocación y a los quince minutos de haberla retirado.

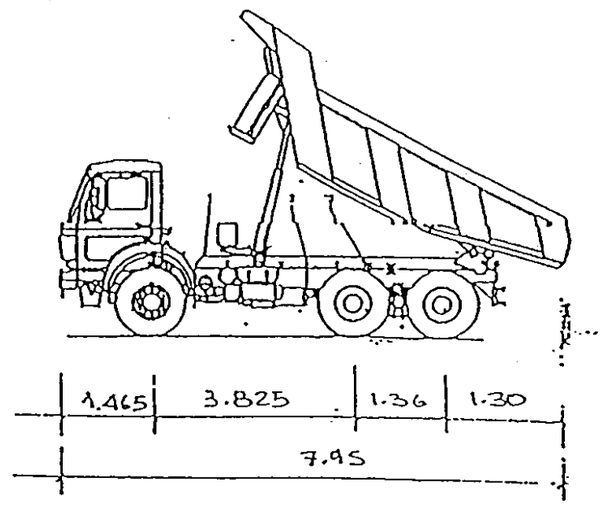
Durante la realización de la prueba se deberá anotar las condiciones climatológicas existentes a lo largo de la misma.

ANALISIS

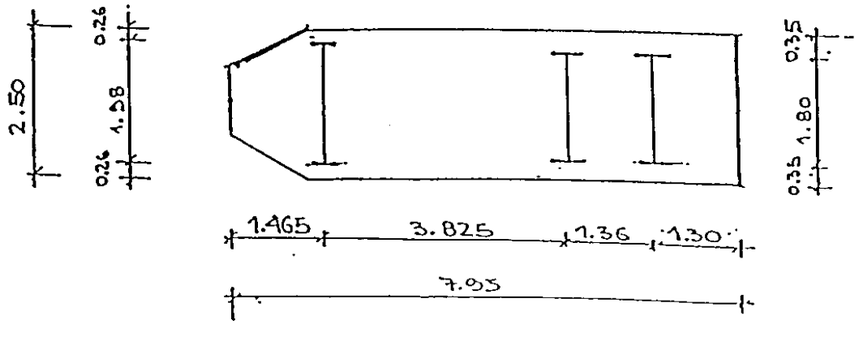
Para obtener las solicitaciones y desplazamientos verticales en los puntos a medir se procesó la estructura mediante los programas PUENTE y PRETENSA de Julián Díaz del Valle. El modelo es el mismo usado en el cálculo del tablero. Bajo esta geometría, la carga de prueba debe producir en las secciones críticas esfuerzos del orden del 70 - 80% de los calculados en el proyecto del tablero.

| ASUNTO | FECHA |
|---|---|
| DEFINICION TREN DE CARGAS | PAG. 1 |

CAMION VOLQUETE DE 35 Ton.




ALZADO




PLANTA

IBM

Ordenador Personal

PROGRAMA

PRETENSA

PRETENSADO DE TABLEROS DE PUENTES

(C) Copyright J.Diaz del Valle, 1985

PROYECTO :

Referencia ..... : E-1500.4

Fecha ..... :

## PRUEBA DE CARGA

NUMERO DE EJES DE LA SOBRECARGA REAL ..... = 6

EJE Nº 1 . . . ABSCISA = 29.51 . . . CARGA = 22.80

EJE Nº 2 . . . ABSCISA = 33.34 . . . CARGA = 41.10

EJE Nº 3 . . . ABSCISA = 34.70 . . . CARGA = 41.10

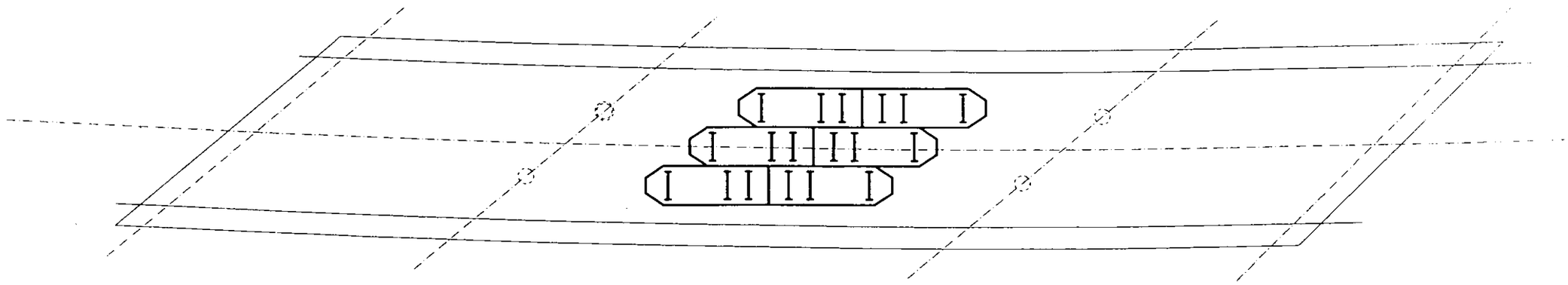
EJE Nº 4 . . . ABSCISA = 37.30 . . . CARGA = 41.10

EJE Nº 5 . . . ABSCISA = 38.66 . . . CARGA = 41.10

EJE Nº 6 . . . ABSCISA = 42.49 . . . CARGA = 22.80

## RESULTADOS CALCULADOS

| VANO | SECC. | ABSCISA (m) | FLECTOR (mxt) | CORTANTE (t) | FLECHA (mm) | GIRO(x1000) (RAD) |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.00 | 0.00 | -29.41 | 0.00 | -0.27 |
| 1 | 2 | 1.00 | -29.41 | -29.41 | -0.27 | -0.27 |
| 1 | 3 | 2.00 | -58.81 | -29.41 | -0.54 | -0.26 |
| 1 | 4 | 3.00 | -88.22 | -29.41 | -0.80 | -0.25 |
| 1 | 5 | 4.00 | -117.63 | -29.41 | -1.05 | -0.24 |
| 1 | 6 | 5.00 | -147.03 | -29.41 | -1.28 | -0.22 |
| 1 | 7 | 6.00 | -176.44 | -29.41 | -1.49 | -0.20 |
| 1 | 8 | 7.00 | -205.85 | -29.41 | -1.67 | -0.17 |
| 1 | 9 | 8.00 | -235.25 | -29.41 | -1.83 | -0.14 |
| 1 | 10 | 9.00 | -264.66 | -29.41 | -1.95 | -0.11 |
| 1 | 11 | 10.00 | -294.07 | -29.41 | -2.04 | -0.07 |
| 1 | 12 | 11.00 | -323.48 | -29.41 | -2.09 | -0.03 |
| 1 | 13 | 12.00 | -352.88 | -29.41 | -2.09 | 0.02 |
| 1 | 14 | 13.00 | -382.29 | -29.41 | -2.05 | 0.07 |
| 1 | 15 | 14.00 | -411.70 | -29.41 | -1.95 | 0.13 |
| 1 | 16 | 15.00 | -441.10 | -29.41 | -1.79 | 0.19 |
| 1 | 17 | 16.00 | -470.51 | -29.41 | -1.57 | 0.25 |
| 1 | 18 | 17.00 | -499.92 | -29.41 | -1.29 | 0.32 |
| 1 | 19 | 18.00 | -529.32 | -29.41 | -0.94 | 0.39 |
| 1 | 20 | 19.00 | -558.73 | -29.41 | -0.52 | 0.46 |
| 1 | 21 | 20.00 | -588.14 | -29.41 | 0.00 | 0.54 |
| 2 | 1 | 20.00 | -588.14 | 105.00 | 0.00 | 0.54 |
| 2 | 2 | 21.60 | -420.14 | 105.00 | 0.96 | 0.65 |
| 2 | 3 | 23.20 | -252.14 | 105.00 | 2.07 | 0.73 |
| 2 | 4 | 24.80 | -84.14 | 105.00 | 3.27 | 0.77 |
| 2 | 5 | 26.40 | 83.86 | 105.00 | 4.52 | 0.77 |
| 2 | 6 | 28.00 | 251.86 | 105.00 | 5.72 | 0.73 |
| 2 | 7 | 29.60 | 417.93 | 82.20 | 6.83 | 0.65 |
| 2 | 8 | 31.20 | 549.45 | 82.20 | 7.77 | 0.53 |
| 2 | 9 | 32.80 | 680.97 | 82.20 | 8.50 | 0.37 |
| 2 | 10 | 34.40 | 768.92 | 41.10 | 8.95 | 0.19 |
| 2 | 11 | 36.00 | 781.25 | 0.00 | 9.11 | 0.00 |
| 2 | 12 | 37.60 | 768.92 | -41.10 | 8.95 | -0.19 |
| 2 | 13 | 39.20 | 680.97 | -82.20 | 8.50 | -0.37 |
| 2 | 14 | 40.80 | 549.45 | -82.20 | 7.77 | -0.53 |
| 2 | 15 | 42.40 | 417.93 | -82.20 | 6.83 | -0.65 |
| 2 | 16 | 44.00 | 251.86 | -105.00 | 5.72 | -0.73 |
| 2 | 17 | 45.60 | 83.86 | -105.00 | 4.52 | -0.77 |
| 2 | 18 | 47.20 | -84.14 | -105.00 | 3.27 | -0.77 |
| 2 | 19 | 48.80 | -252.14 | -105.00 | 2.07 | -0.73 |
| 2 | 20 | 50.40 | -420.14 | -105.00 | 0.96 | -0.65 |
| 2 | 21 | 52.00 | -588.14 | -105.00 | 0.00 | -0.54 |
| 3 | 1 | 52.00 | -588.14 | 29.41 | 0.00 | -0.54 |
| 3 | 2 | 53.00 | -558.73 | 29.41 | -0.50 | -0.46 |
| 3 | 3 | 54.00 | -529.32 | 29.41 | -0.93 | -0.39 |
| 3 | 4 | 55.00 | -499.92 | 29.41 | -1.28 | -0.32 |
| 3 | 5 | 56.00 | -470.51 | 29.41 | -1.56 | -0.25 |
| 3 | 6 | 57.00 | -441.10 | 29.41 | -1.78 | -0.19 |
| 3 | 7 | 58.00 | -411.70 | 29.41 | -1.93 | -0.13 |
| 3 | 8 | 59.00 | -382.29 | 29.41 | -2.03 | -0.07 |
| 3 | 9 | 60.00 | -352.88 | 29.41 | -2.08 | -0.02 |
| 3 | 10 | 61.00 | -323.47 | 29.41 | -2.08 | 0.03 |
| 3 | 11 | 62.00 | -294.07 | 29.41 | -2.03 | 0.07 |
| 3 | 12 | 63.00 | -264.66 | 29.41 | -1.94 | 0.11 |
| 3 | 13 | 64.00 | -235.25 | 29.41 | -1.82 | 0.14 |
| 3 | 14 | 65.00 | -205.85 | 29.41 | -1.66 | 0.17 |
| 3 | 15 | 66.00 | -176.44 | 29.41 | -1.47 | 0.20 |
| 3 | 16 | 67.00 | -147.03 | 29.41 | -1.26 | 0.22 |
| 3 | 17 | 68.00 | -117.63 | 29.41 | -1.03 | 0.24 |
| 3 | 18 | 69.00 | -88.22 | 29.41 | -0.78 | 0.25 |
| 3 | 19 | 70.00 | -58.81 | 29.41 | -0.53 | 0.26 |
| 3 | 20 | 71.00 | -29.41 | 29.41 | -0.26 | 0.27 |
| 3 | 21 | 72.00 | 0.00 | 29.41 | 0.00 | 0.27 |



DISPOSICION CAMIONES EN PRUEBA DE CARGA



**PRUEBA DE CARGA. Comparación solicitaciones**

| | |
|---|---|
| Proyecto : | L.A.V. Madrid - Zaragoza. Subtramo XV. |
| Obra : | E-1500.4 |

| | CAMIONES | | CARRO + SOBRECARGA UNIFORME | | RELACION MOMENTOS | RELACION CORTANTES |
|---|---|---|---|---|---|---|
| Sección | M (mT) | Q (T) | Mmax (mT) | Qmax (T) | | |
| Pila 1 | -588.1 | 105.0 | -863.9 | 285.3 | **68%** | **37%** |
| Centro vano 2 | 781.3 | --- | 954.2 | --- | **82%** | --- |

## *4.3.2 Paso superior E-1505.0, E-1511.3 Y E-1514.2*

# 4.3.2 PASOS SUPERIORES E-1505.0, E-1511.3 Y E-1514.2

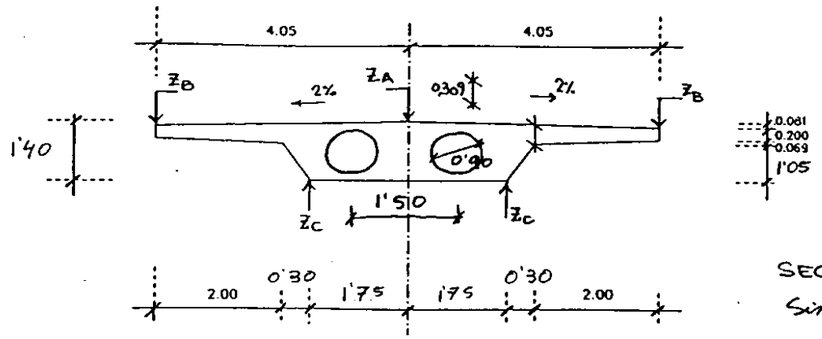
## ÍNDICE


1. DEFINICIÓN GEOMÉTRICA
2. CÁLCULO DEL TABLERO
3. CÁLCULO DE PILAS
4. CÁLCULO DE ESTRIBOS
5. PROYECTO DE PRUEBA DE CARGA

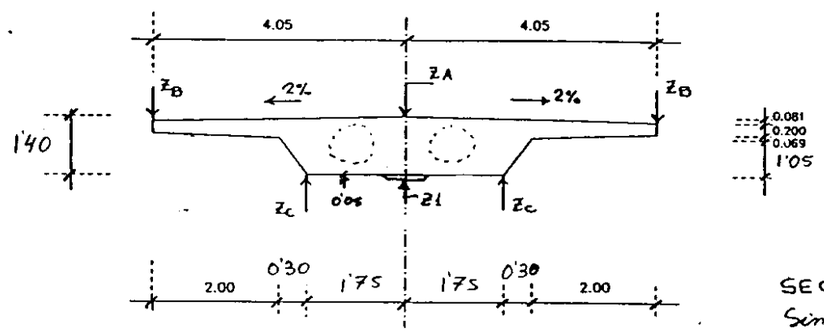
PASOS SUPERIORES E-1505.0, E-1511.3 Y E-1514.2

## 1º DEFINICION GEOMETRICA

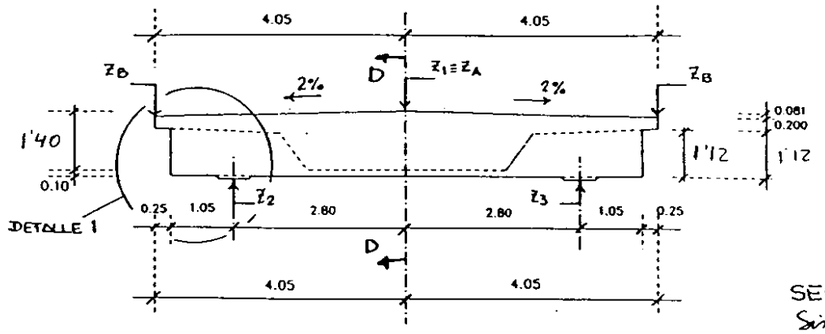
# TABLERO



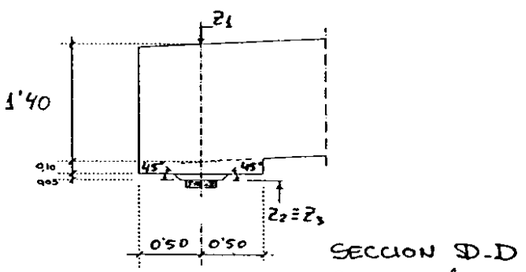

SECCION A-A
Sin escala



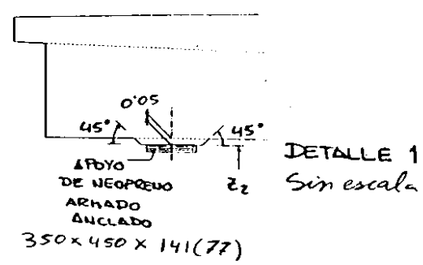

SECCION B-B
Sin escala




SECCION C.C
Sin escala

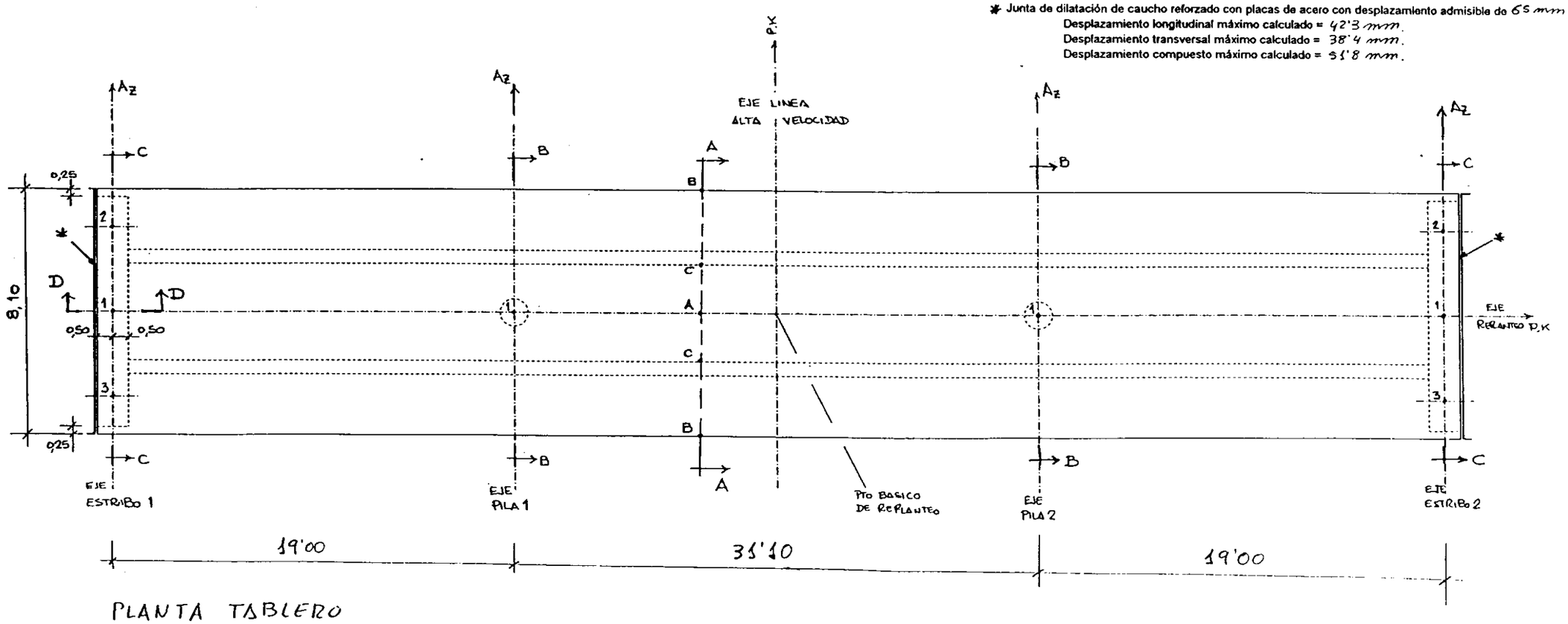



SECCION D-D
Sin escala



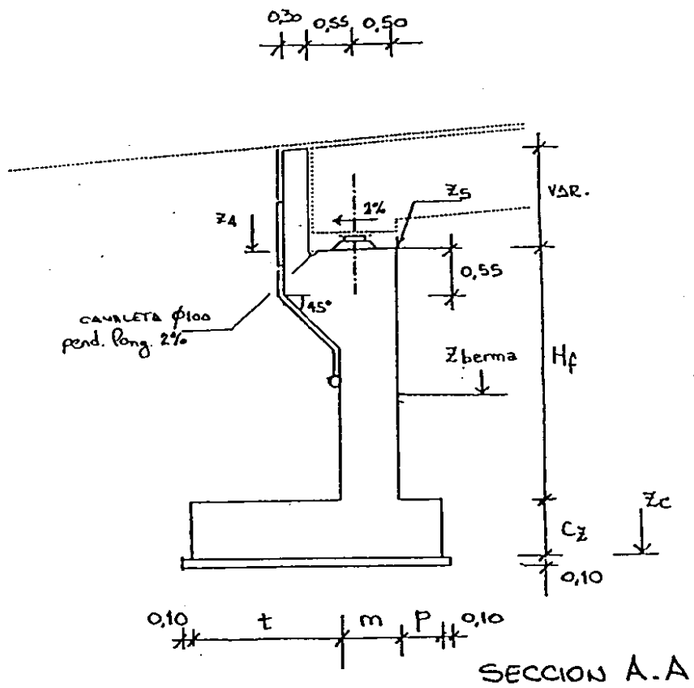

DETALLE 1
Sin escala

✱ Junta de dilatación de caucho reforzado con placas de acero con desplazamiento admisible de 65 mm
Desplazamiento longitudinal máximo calculado = 42'3 mm.
Desplazamiento transversal máximo calculado = 38'4 mm.
Desplazamiento compuesto máximo calculado = 51'8 mm.

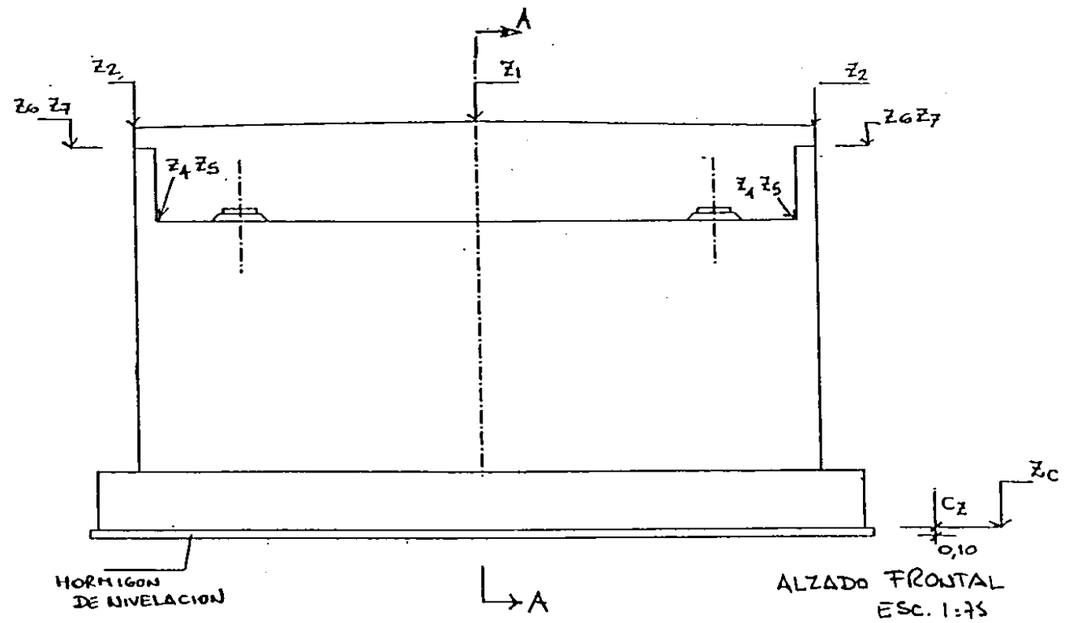



PLANTA TABLERO
Sin escala

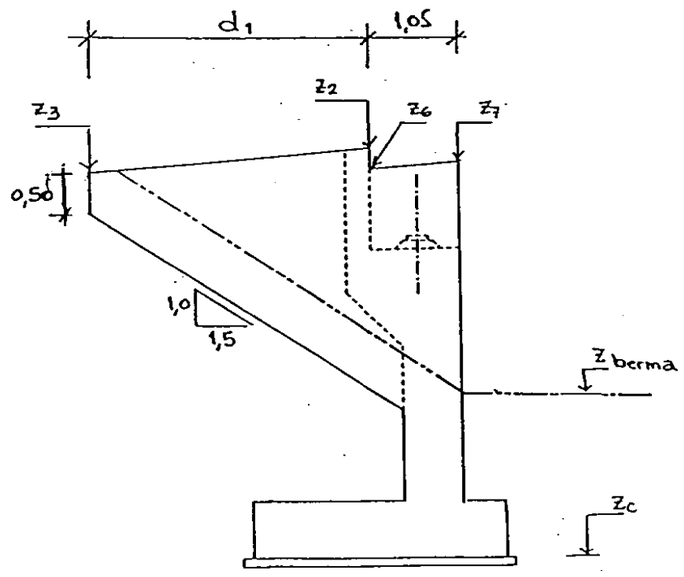
**ESQUEMA DE ESTRIBOS**
**Válido para : E-1505.5 ( E-1 )**



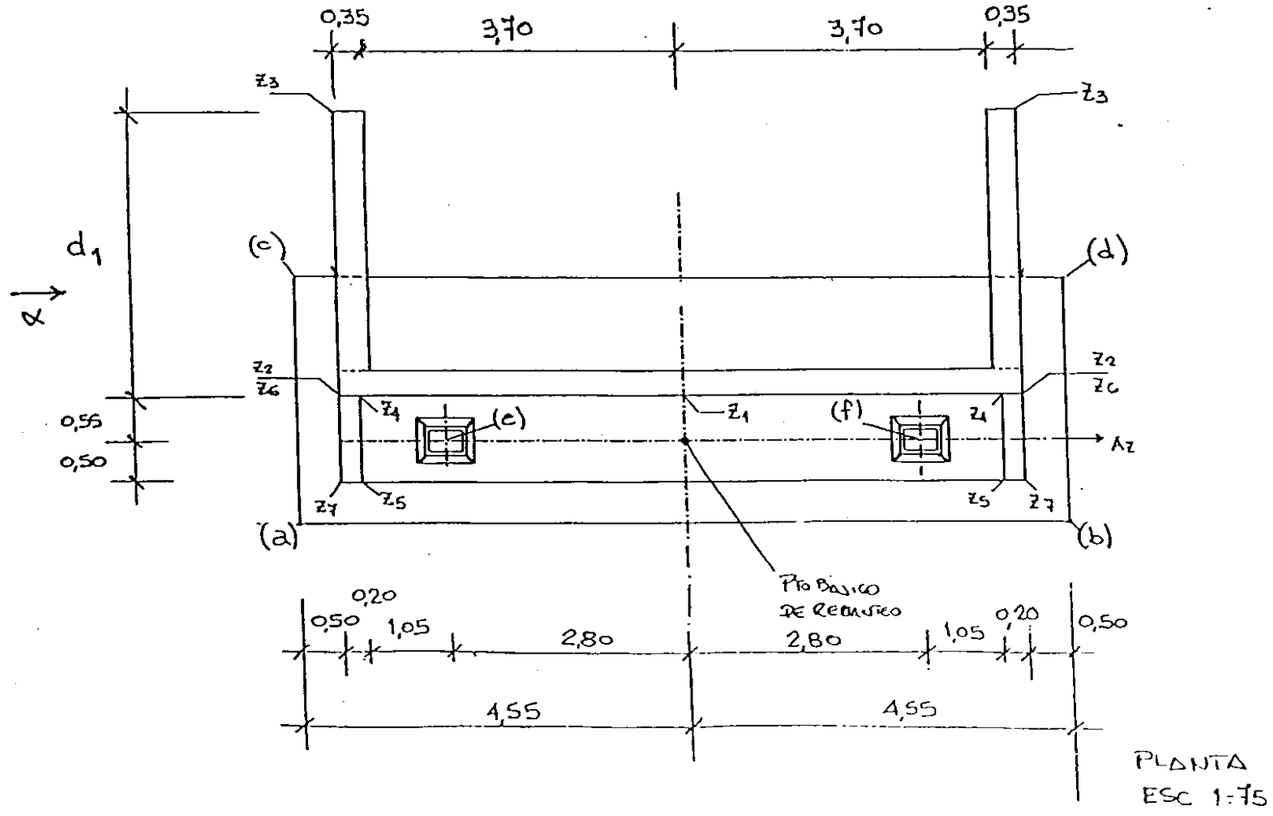

SECCION A.A
ESC. 1:75




ALZADO FRONTAL
ESC. 1:75

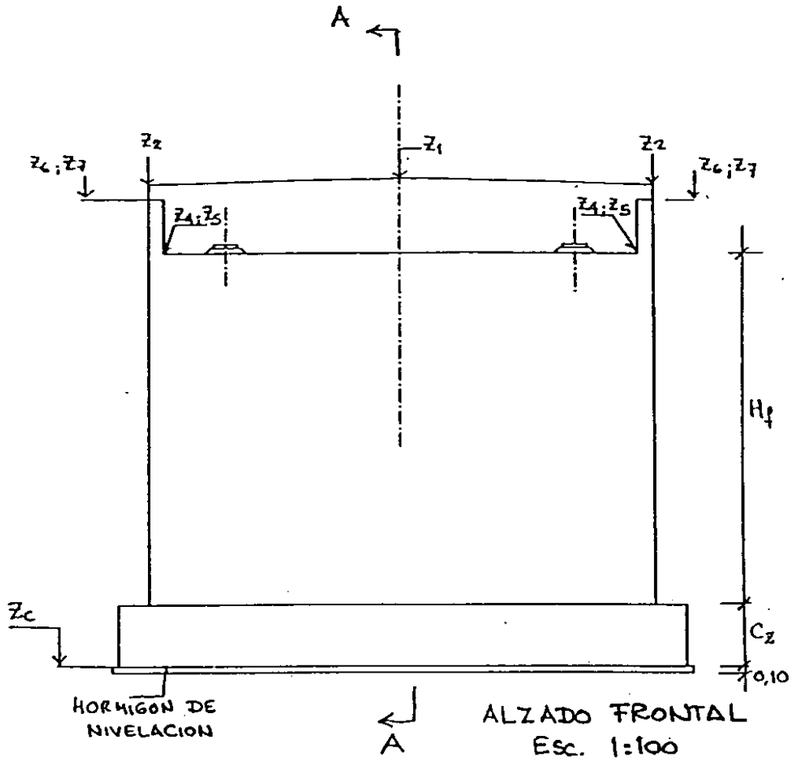



ALZADO POR α
ESC. 1:75

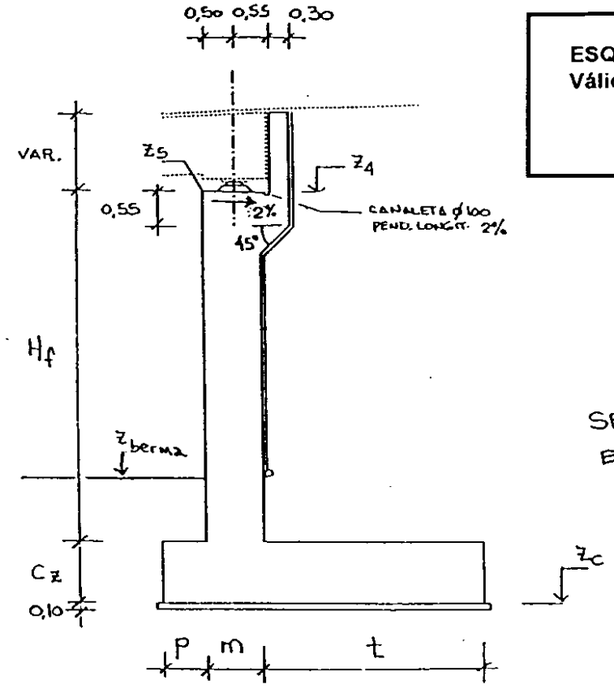



PLANTA
ESC 1:75

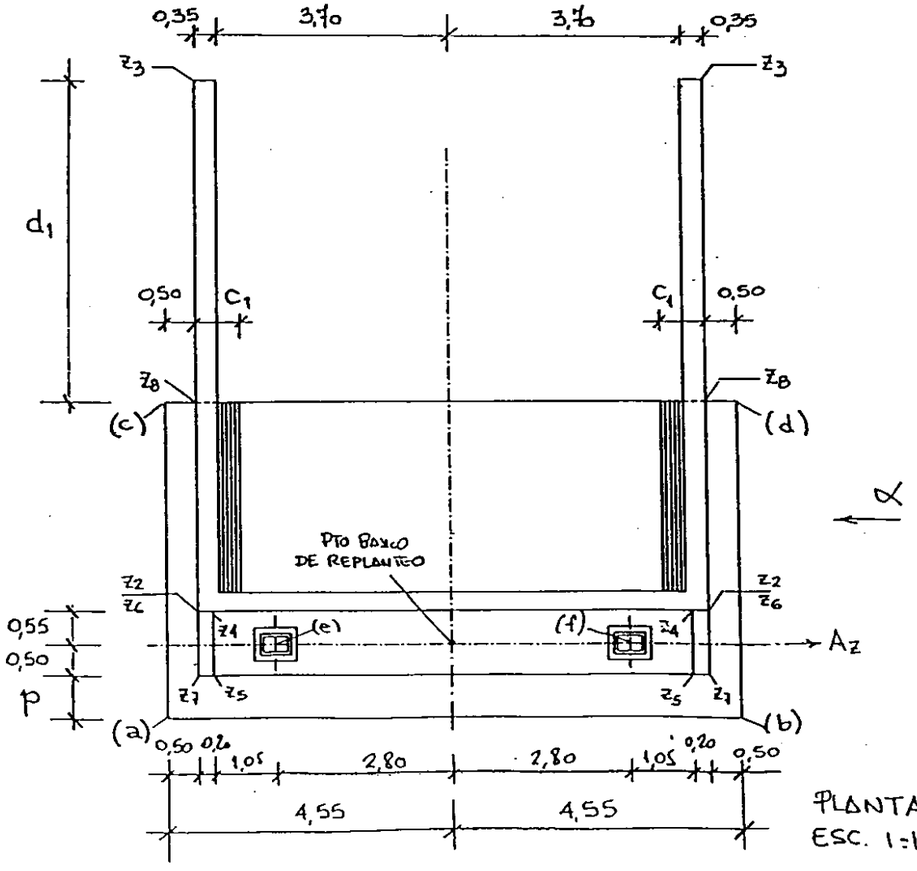
**ESQUEMA DE ESTRIBOS**
**Válido para : E-1505.5 ( E-2 )**
**E-1511.3 ( E-1 y E-2 )**
**E-1514.2 ( E-1 y E-2 )**



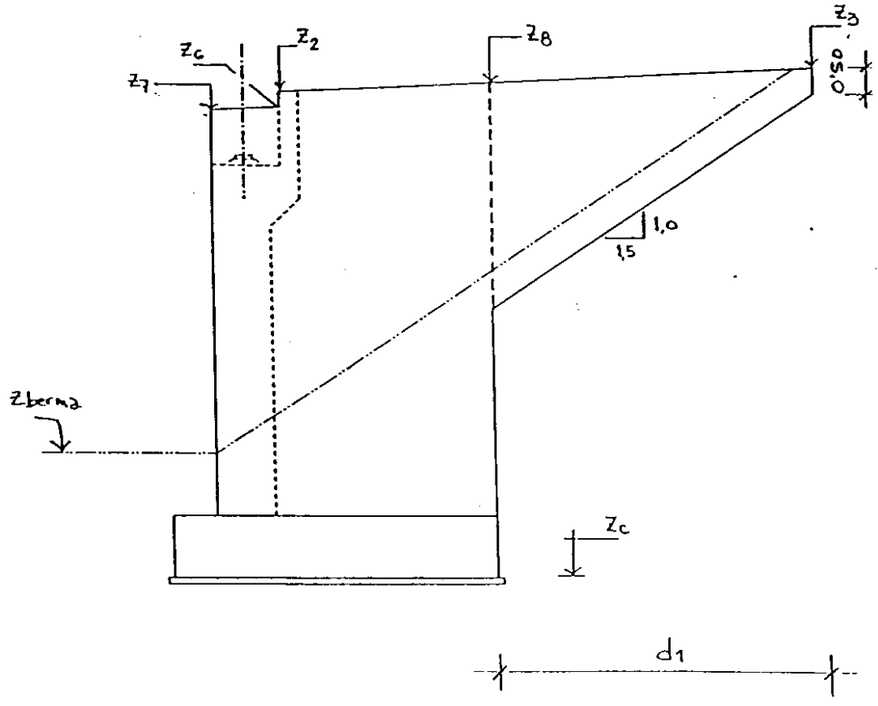

ALZADO FRONTAL
Esc. 1:100




SECCION A-A
ESC. 1:100

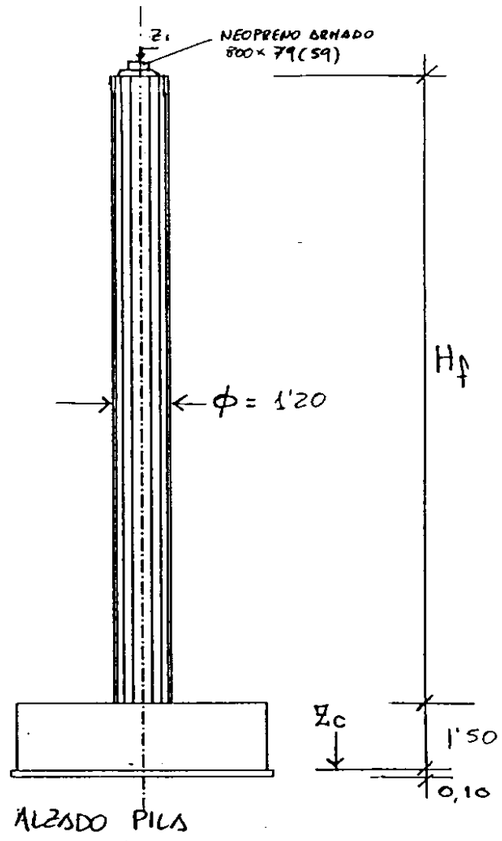



PLANTA
ESC. 1:100



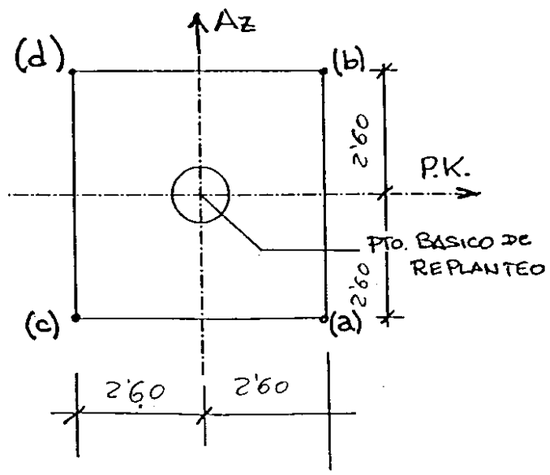

ALZADO PORα
ESC. 1:100

## PILAS




ALZADO PILA

Sin escala




PLANTA PILA

Sin escala

**E-1505.5** **TABLERO**

| PUNTO BASICO DE REPLANTEO | | | | | |
|---|---|---|---|---|---|
| P.K.camino | Az camino (g.) | P.K. LAV | Az LAV (g.) | X | Y |
| 314.523 | 219.319 | 1505000.004 | 119.319 | 668796.398 | 4609728.736 |
| | | | | | |

**REPLANTEO LINEA DE APOYOS ESTRIBO 1**

| P.K. = | 279.973 | Az(g.) = | 119.319 |
|---|---|---|---|
| | | | |
| PUNTO | X | Y | Z |
| 1 | 668806.722 | 4609761.707 | 302.906 |
| 2 | 668809.394 | 4609760.871 | 301.356 |
| 3 | 668804.050 | 4609762.544 | 301.356 |

**REPLANTEO LINEA DE APOYOS PILA 1**

| P.K. = | 298.973 | Az(g.) = | 119.319 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 668801.045 | 4609743.575 | 303.162 |
| | | | |

**REPLANTEO LINEA DE APOYOS PILA 2**

| P.K. = | 330.073 | Az(g.) = | 119.319 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 668791.751 | 4609713.897 | 303.013 |
| | | | |

**REPLANTEO LINEA DE APOYOS ESTRIBO 2**

| P.K. = | 349.073 | Az(g.) = | 119.319 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 668786.074 | 4609695.765 | 302.576 |
| 2 | 668788.746 | 4609694.928 | 301.026 |
| 3 | 668783.402 | 4609696.601 | 301.026 |

**VANO 1**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 279.973 | 302.906 | 302.825 | 301.956 |
| 2 | 282.348 | 302.961 | 302.880 | 302.011 |
| 3 | 284.723 | 303.011 | 302.930 | 302.061 |
| 4 | 287.098 | 303.056 | 302.975 | 302.106 |
| 5 | 289.473 | 303.096 | 303.015 | 302.146 |
| 6 | 291.848 | 303.132 | 303.051 | 302.182 |
| 7 | 294.223 | 303.164 | 303.083 | 302.214 |
| 8 | 296.598 | 303.190 | 303.109 | 302.240 |
| 9 | 298.973 | 303.212 | 303.131 | 302.262 |

**VANO 2**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 298.973 | 303.212 | 303.131 | 302.262 |
| 2 | 302.083 | 303.233 | 303.152 | 302.283 |
| 3 | 305.193 | 303.247 | 303.166 | 302.297 |
| 4 | 308.303 | 303.252 | 303.171 | 302.302 |
| 5 | 311.413 | 303.249 | 303.168 | 302.299 |
| 6 | 314.523 | 303.238 | 303.157 | 302.288 |
| 7 | 317.633 | 303.219 | 303.138 | 302.269 |
| 8 | 320.743 | 303.193 | 303.112 | 302.243 |
| 9 | 323.853 | 303.158 | 303.077 | 302.208 |
| 10 | 326.963 | 303.114 | 303.033 | 302.164 |
| 11 | 330.073 | 303.063 | 302.982 | 302.113 |

**VANO 3**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 330.073 | 303.063 | 302.982 | 302.113 |
| 2 | 332.448 | 303.019 | 302.938 | 302.069 |
| 3 | 334.823 | 302.970 | 302.889 | 302.020 |
| 4 | 337.198 | 302.916 | 302.835 | 301.966 |
| 5 | 339.573 | 302.857 | 302.776 | 301.907 |
| 6 | 341.948 | 302.794 | 302.713 | 301.844 |
| 7 | 344.323 | 302.726 | 302.645 | 301.776 |
| 8 | 346.698 | 302.653 | 302.572 | 301.703 |
| 9 | 349.073 | 302.576 | 302.495 | 301.626 |

**E-1505.5 ESTRIBO 1**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 279.973 | 668806.722 | 4609761.707 | 119.319 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Zc | 291.100 | t | 4.15 |
| Z1 | 302.893 | m | 1.55 |
| Z2 | 302.812 | p | 1.80 |
| Z3 | 302.693 | Cz | 1.60 |
| Z4 | 301.165 | Hf | 8.49 |
| Z5 | 301.186 | d1 | 4.50 |
| Z6 | 302.562 | C1 | 0.00 |
| Z7 | 302.587 | | |
| Z8 | --- | | |
| Z berma | 299.250 | | |
| NEOPRENOS (mm.) | | a | 350 |
| | | b | 450 |
| | | h(e) | 141 ( 77 ) |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 668801.693 | 4609760.872 |
| b | 668810.377 | 4609758.153 |
| c | 668803.934 | 4609768.029 |
| d | 668812.618 | 4609765.310 |

| COORDENADAS DE NEOPRENOS | | | |
|---|---|---|---|
| PUNTO | X | Y | Z |
| e | 668804.050 | 4609762.544 | 301.336 |
| f | 668809.394 | 4609760.871 | 301.336 |

**E-1505.5 ESTRIBO 2**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 349.073 | 668786.074 | 4609695.765 | 319.319 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Zc | 294.750 | t | 3.50 |
| Z1 | 302.557 | m | 0.90 |
| Z2 | 302.476 | p | 0.70 |
| Z3 | 302.244 | Cz | 1.00 |
| Z4 | 300.835 | Hf | 5.11 |
| Z5 | 300.856 | d1 | 3.00 |
| Z6 | 302.226 | C1 | 0.65 |
| Z7 | 302.262 | | |
| Z8 | 302.358 | | |
| Z berma | 296.800 | | |
| NEOPRENOS (mm.) | | a | 350 |
| | | b | 450 |
| | | h(e) | 141 ( 77 ) |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 668790.774 | 4609695.550 |
| b | 668782.090 | 4609698.269 |
| c | 668789.250 | 4609690.683 |
| d | 668780.566 | 4609693.403 |

| COORDENADAS DE NEOPRENOS | | | |
|---|---|---|---|
| PUNTO | X | Y | Z |
| e | 668788.746 | 4609694.928 | 301.006 |
| f | 668783.402 | 4609696.601 | 301.006 |



**E-1505.5 PILA 1**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 298.973 | 668801.045 | 4609743.575 | 119.319 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Z1 | 303.162 | a | 5.20 |
| Zc | 289.950 | b | 5.20 |
| NEOPRENOS (mm.) | | Φ | 1.20 |
| Φ neop | 800 | Hf | 11.58 |
| h(e) | 79(59) | Cz | 1.50 |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 668797.787 | 4609741.871 |
| b | 668802.749 | 4609740.317 |
| c | 668799.340 | 4609746.834 |
| d | 668804.303 | 4609745.280 |

**E-1505.5 PILA 2**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 330.073 | 668791.751 | 4609713.897 | 119.319 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Z1 | 303.013 | a | 5.20 |
| Zc | 289.950 | b | 5.20 |
| NEOPRENOS (mm.) | | Φ | 1.20 |
| Φ neop | 800 | Hf | 11.43 |
| h(e) | 79(59) | Cz | 1.50 |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 668795.009 | 4609715.601 |
| b | 668790.047 | 4609717.155 |
| c | 668793.456 | 4609710.638 |
| d | 668788.493 | 4609712.192 |

**E-1511.3** **TABLERO**

| PUNTO BASICO DE REPLANTEO | | | | | |
|---|---|---|---|---|---|
| P.K.camino | Az camino (g.) | P.K. LAV | Az LAV (g.) | X | Y |
| 101.005 | 212.507 | 1511341.250 | 112.507 | 674953.000 | 4608214.472 |

**REPLANTEO LINEA DE APOYOS ESTRIBO 1**

| P.K. = | 66.455 | Az(g.) = | 112.507 |
|---|---|---|---|
| | | | |
| PUNTO | X | Y | Z |
| 1 | 674959.744 | 4608248.357 | 307.804 |
| 2 | 674962.490 | 4608247.811 | 306.254 |
| 3 | 674956.998 | 4608248.904 | 306.254 |

**REPLANTEO LINEA DE APOYOS PILA 1**

| P.K. = | 85.455 | Az(g.) = | 112.507 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 674956.035 | 4608229.723 | 308.001 |

**REPLANTEO LINEA DE APOYOS PILA 2**

| P.K. = | 116.555 | Az(g.) = | 112.507 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 674949.965 | 4608199.221 | 308.405 |

**REPLANTEO LINEA DE APOYOS ESTRIBO 2**

| P.K. = | 135.555 | Az(g.) = | 112.507 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 674946.256 | 4608180.587 | 308.702 |
| 2 | 674949.002 | 4608180.040 | 307.152 |
| 3 | 674943.510 | 4608181.133 | 307.152 |

**VANO 1**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 66.455 | 307.804 | 307.723 | 306.854 |
| 2 | 68.830 | 307.835 | 307.754 | 306.885 |
| 3 | 71.205 | 307.866 | 307.785 | 306.916 |
| 4 | 73.580 | 307.897 | 307.816 | 306.947 |
| 5 | 75.955 | 307.927 | 307.846 | 306.977 |
| 6 | 78.330 | 307.958 | 307.877 | 307.008 |
| 7 | 80.705 | 307.989 | 307.908 | 307.039 |
| 8 | 83.080 | 308.020 | 307.939 | 307.070 |
| 9 | 85.455 | 308.051 | 307.970 | 307.101 |

**VANO 2**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 85.455 | 308.051 | 307.970 | 307.101 |
| 2 | 88.565 | 308.091 | 308.010 | 307.141 |
| 3 | 91.675 | 308.132 | 308.051 | 307.182 |
| 4 | 94.785 | 308.172 | 308.091 | 307.222 |
| 5 | 97.895 | 308.213 | 308.132 | 307.263 |
| 6 | 101.005 | 308.253 | 308.172 | 307.303 |
| 7 | 104.115 | 308.293 | 308.212 | 307.343 |
| 8 | 107.225 | 308.334 | 308.253 | 307.384 |
| 9 | 110.335 | 308.374 | 308.293 | 307.424 |
| 10 | 113.445 | 308.415 | 308.334 | 307.465 |
| 11 | 116.555 | 308.455 | 308.374 | 307.505 |

**VANO 3**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 116.555 | 308.455 | 308.374 | 307.505 |
| 2 | 118.930 | 308.486 | 308.405 | 307.536 |
| 3 | 121.305 | 308.517 | 308.436 | 307.567 |
| 4 | 123.680 | 308.548 | 308.467 | 307.598 |
| 5 | 126.055 | 308.579 | 308.498 | 307.629 |
| 6 | 128.430 | 308.610 | 308.529 | 307.660 |
| 7 | 130.805 | 308.640 | 308.559 | 307.690 |
| 8 | 133.180 | 308.671 | 308.590 | 307.721 |
| 9 | 135.555 | 308.702 | 308.621 | 307.752 |

**E-1511.3 ESTRIBO 1**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 66.455 | 674959.744 | 4608248.357 | 112.507 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Zc | 300.000 | t | 3.50 |
| Z1 | 307.797 | m | 0.90 |
| Z2 | 307.716 | p | 0.70 |
| Z3 | 307.633 | Cz | 1.00 |
| Z4 | 306.063 | Hf | 5.08 |
| Z5 | 306.084 | d1 | 3.00 |
| Z6 | 307.466 | C1 | 0.65 |
| Z7 | 307.479 | | |
| Z8 | 307.672 | | |
| Z berma | 303.650 | | |
| NEOPRENOS (mm.) | | a | 350 |
| | | b | 450 |
| | | h(e) | 141 ( 77 ) |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 674955.047 | 4608248.069 |
| b | 674963.972 | 4608246.292 |
| c | 674956.043 | 4608253.071 |
| d | 674964.968 | 4608251.294 |

| COORDENADAS DE NEOPRENOS | | | |
|---|---|---|---|
| PUNTO | X | Y | Z |
| e | 674956.998 | 4608248.904 | 306.234 |
| f | 674962.490 | 4608247.811 | 306.234 |

**E-1511.3 ESTRIBO 2**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 135.555 | 674946.256 | 4608180.587 | 312.507 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Zc | 300.900 | t | 3.50 |
| Z1 | 308.709 | m | 0.90 |
| Z2 | 308.628 | p | 0.70 |
| Z3 | 308.711 | Cz | 1.00 |
| Z4 | 306.961 | Hf | 5.08 |
| Z5 | 306.982 | d1 | 3.00 |
| Z6 | 308.378 | C1 | 0.65 |
| Z7 | 308.365 | | |
| Z8 | 308.672 | | |
| Z berma | 303.850 | | |
| NEOPRENOS (mm.) | | a | 350 |
| | | b | 450 |
| | | h(e) | 141 ( 77 ) |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 674950.953 | 4608180.875 |
| b | 674942.028 | 4608182.652 |
| c | 674949.957 | 4608175.873 |
| d | 674941.032 | 4608177.650 |

| COORDENADAS DE NEOPRENOS | | | |
|---|---|---|---|
| PUNTO | X | Y | Z |
| e | 674949.002 | 4608180.040 | 307.132 |
| f | 674943.510 | 4608181.133 | 307.132 |



**E-1511.3 PILA 1**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 85.455 | 674956.035 | 4608229.723 | 112.507 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Z1 | 308.001 | a | 5.00 |
| Zc | 294.000 | b | 5.00 |
| NEOPRENOS (mm.) | | Φ | 1.20 |
| Φ neop | 800 | Hf | 12.37 |
| h(e) | 79(59) | Cz | 1.50 |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 674953.095 | 4608227.759 |
| b | 674957.999 | 4608226.783 |
| c | 674954.071 | 4608232.663 |
| d | 674958.975 | 4608231.687 |

**E-1511.3 PILA 2**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 116.555 | 674949.965 | 4608199.221 | 112.507 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Z1 | 308.405 | a | 5.00 |
| Zc | 294.000 | b | 5.00 |
| NEOPRENOS (mm.) | | Φ | 1.20 |
| Φ neop | 800 | Hf | 12.78 |
| h(e) | 79(59) | Cz | 1.50 |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 674952.905 | 4608201.185 |
| b | 674948.001 | 4608202.161 |
| c | 674951.929 | 4608196.281 |
| d | 674947.025 | 4608197.257 |

**E-1514.2** **TABLERO**

| PUNTO BASICO DE REPLANTEO | | | | | |
|---|---|---|---|---|---|
| P.K.camino | Az camino (g.) | P.K. LAV | Az LAV (g.) | X | Y |
| 133.257 | 204.526 | 1514280.004 | 104.526 | 677880.884 | 4608085.729 |

**REPLANTEO LINEA DE APOYOS ESTRIBO 1**

| P.K. = | 98.707 | Az(g.) = | 104.526 |
|---|---|---|---|
| | | | |
| PUNTO | X | Y | Z |
| 1 | 677883.338 | 4608120.192 | 285.378 |
| 2 | 677886.131 | 4608119.993 | 283.828 |
| 3 | 677880.545 | 4608120.391 | 283.828 |

**REPLANTEO LINEA DE APOYOS PILA 1**

| P.K. = | 117.707 | Az(g.) = | 104.526 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 677881.989 | 4608101.240 | 285.547 |

**REPLANTEO LINEA DE APOYOS PILA 2**

| P.K. = | 148.807 | Az(g.) = | 104.526 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 677879.779 | 4608070.218 | 285.904 |

**REPLANTEO LINEA DE APOYOS ESTRIBO 2**

| P.K. = | 167.807 | Az(g.) = | 104.526 |
|---|---|---|---|
| PUNTO | X | Y | Z |
| 1 | 677878.430 | 4608051.266 | 286.173 |
| 2 | 677881.223 | 4608051.067 | 284.623 |
| 3 | 677875.637 | 4608051.465 | 284.623 |

**VANO 1**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 98.707 | 285.378 | 285.297 | 284.428 |
| 2 | 101.082 | 285.405 | 285.324 | 284.455 |
| 3 | 103.457 | 285.433 | 285.352 | 284.483 |
| 4 | 105.832 | 285.460 | 285.379 | 284.510 |
| 5 | 108.207 | 285.487 | 285.406 | 284.537 |
| 6 | 110.582 | 285.515 | 285.434 | 284.565 |
| 7 | 112.957 | 285.542 | 285.461 | 284.592 |
| 8 | 115.332 | 285.569 | 285.488 | 284.619 |
| 9 | 117.707 | 285.597 | 285.516 | 284.647 |

**VANO 2**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 117.707 | 285.597 | 285.516 | 284.647 |
| 2 | 120.817 | 285.632 | 285.551 | 284.682 |
| 3 | 123.927 | 285.668 | 285.587 | 284.718 |
| 4 | 127.037 | 285.704 | 285.623 | 284.754 |
| 5 | 130.147 | 285.740 | 285.659 | 284.790 |
| 6 | 133.257 | 285.775 | 285.694 | 284.825 |
| 7 | 136.367 | 285.811 | 285.730 | 284.861 |
| 8 | 139.477 | 285.847 | 285.766 | 284.897 |
| 9 | 142.587 | 285.883 | 285.802 | 284.933 |
| 10 | 145.697 | 285.919 | 285.838 | 284.969 |
| 11 | 148.807 | 285.954 | 285.873 | 285.004 |

**VANO 3**

| SECCION Nº | P.K. | ZA | ZB | ZC |
|---|---|---|---|---|
| 1 | 148.807 | 285.954 | 285.873 | 285.004 |
| 2 | 151.182 | 285.982 | 285.901 | 285.032 |
| 3 | 153.557 | 286.009 | 285.928 | 285.059 |
| 4 | 155.932 | 286.036 | 285.955 | 285.086 |
| 5 | 158.307 | 286.064 | 285.983 | 285.114 |
| 6 | 160.682 | 286.091 | 286.010 | 285.141 |
| 7 | 163.057 | 286.118 | 286.037 | 285.168 |
| 8 | 165.432 | 286.145 | 286.064 | 285.195 |
| 9 | 167.807 | 286.173 | 286.092 | 285.223 |

**E-1514.2 ESTRIBO 1**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 98.707 | 677883.338 | 4608120.192 | 104.526 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Zc | 277.500 | t | 3.50 |
| Z1 | 285.372 | m | 0.90 |
| Z2 | 285.291 | p | 0.70 |
| Z3 | 285.192 | Cz | 1.00 |
| Z4 | 283.637 | Hf | 5.16 |
| Z5 | 283.658 | d1 | 5.20 |
| Z6 | 285.041 | C1 | 0.65 |
| Z7 | 285.053 | | |
| Z8 | 285.252 | | |
| Z berma | 279.800 | | |
| NEOPRENOS (mm.) | | a | 350 |
| | | b | 450 |
| | | h(e) | 141 ( 77 ) |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 677878.714 | 4608119.318 |
| b | 677887.792 | 4608118.672 |
| c | 677879.077 | 4608124.405 |
| d | 677888.154 | 4608123.759 |

| COORDENADAS DE NEOPRENOS | | | |
|---|---|---|---|
| PUNTO | X | Y | Z |
| e | 677880.545 | 4608120.391 | 283.808 |
| f | 677886.131 | 4608119.993 | 283.808 |

**E-1514.2 ESTRIBO 2**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 167.807 | 677878.430 | 4608051.266 | 304.526 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Zc | 278.300 | t | 3.50 |
| Z1 | 286.179 | m | 0.90 |
| Z2 | 286.098 | p | 0.70 |
| Z3 | 286.196 | Cz | 1.00 |
| Z4 | 284.432 | Hf | 5.15 |
| Z5 | 284.453 | d1 | 5.20 |
| Z6 | 285.848 | C1 | 0.65 |
| Z7 | 285.836 | | |
| Z8 | 286.137 | | |
| Z berma | 280.000 | | |
| NEOPRENOS (mm.) | | a | 350 |
| | | b | 450 |
| | | h(e) | 141 ( 77 ) |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 677883.054 | 4608052.140 |
| b | 677873.976 | 4608052.786 |
| c | 677882.691 | 4608047.053 |
| d | 677873.614 | 4608047.699 |

| COORDENADAS DE NEOPRENOS | | | |
|---|---|---|---|
| PUNTO | X | Y | Z |
| e | 677881.223 | 4608051.067 | 284.603 |
| f | 677875.637 | 4608051.465 | 284.603 |



**E-1514.2 PILA 1**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 117.707 | 677881.989 | 4608101.240 | 104.526 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Z1 | 285.547 | a | 5.00 |
| Zc | 270.150 | b | 5.00 |
| NEOPRENOS (mm.) | | Φ | 1.20 |
| Φ neop | 800 | Hf | 13.77 |
| h(e) | 79(59) | Cz | 1.50 |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 677879.317 | 4608098.924 |
| b | 677884.305 | 4608098.568 |
| c | 677879.672 | 4608103.911 |
| d | 677884.660 | 4608103.556 |

**E-1514.2 PILA 2**

| PUNTO BASICO DE REPLANTEO | | | |
|---|---|---|---|
| P.K. | X | Y | Az(g.) |
| 148.807 | 677879.779 | 4608070.218 | 104.526 |

| COTAS | | DIMENSIONES (m.) | |
|---|---|---|---|
| Z1 | 285.904 | a | 5.00 |
| Zc | 270.150 | b | 5.00 |
| NEOPRENOS (mm.) | | Φ | 1.20 |
| Φ neop | 800 | Hf | 14.13 |
| h(e) | 79(59) | Cz | 1.50 |

| COORDENADAS DE ZAPATA | | |
|---|---|---|
| PUNTO | X | Y |
| a | 677882.451 | 4608072.534 |
| b | 677877.463 | 4608072.890 |
| c | 677882.096 | 4608067.547 |
| d | 677877.108 | 4608067.902 |

PASOS SUPERIORES E-1505.0, E-1511.3 Y E-1514.2

## 2º CALCULO DEL TABLERO

# 2. CÁLCULO DEL TABLERO

## ÍNDICE


2.1 CÁLCULO DEL TABLERO E-1505.0

1. BASES DE CÁLCULO
2. INSTRUCCIONES Y NORMAS CONSIDERADAS
3. CARACTERÍSTICAS DE LOS MATERIALES
4. ACCIONES A CONSIDERAR
5. CONSTANTES ESTÁTICAS
6. MODELO DE CÁLCULO
7. ESFUERZOS LONGITUDINALES
8. CONTROL EN SERVICIO
9. CONTROL EN ROTURA
10. ANÁLISIS TRANSVERSAL DE ESFUERZOS
11. JUNTA HÚMEDA
12. ARMADURAS DE DIFUSIÓN DE PRETENSADO
13. MACIZADOS DE TALLES. RIOSTRA “IN SITU”
14. ANÁLISIS TRANSVERSAL DE LOSA
15. PRELOSAS DE ENCOFRADO PERDIDO
16. REACCIONES
17. DEFORMACIONES

ANEXO 1. LISTADOS DE ESFUERZOS Y MOVIMIENTOS

ANEXO 2. CONSTANTES ESTÁTICAS EVOLUTIVAS

ANEXO 3. TENSIONES ISOSTÁTICAS DE PRETENSADO Y RETRACCIÓN

ANEXO 4. MOMENTOS ÚLTIMOS EN FASES DE MONTAJE

ANEXO 5. MOMENTOS ÚLTIMOS EN ESTRUCTURA COMPLETA

ANEXO 6. JUNTA HÚMEDA

- COMPROBACIÓN DE PILAS ESTRIBOS Y CIMENTACIONES

2.2 CÁLCULO DE LOS TABLEROS E-1511.3 Y E-1514.2

- ANEJO DE CÁLCULO DEL TABLERO DE VIGAS CAJÓN
- CÁLCULO DE LOS DINTELES
- COMPROBACIÓN DE LAS PILAS Y ZAPATAS
- CÁLCULO ARMADURA CONEXIÓN PILA-DINTEL

# 2.1 Cálculo del tablero E-1505.0

# 1.BASES DE CALCULO

## 1.- BASES DE CALCULO

El cálculo completo de la estructura del puente se ha llevado a cabo mediante criterios generales de la Mecánica Elástica en cuanto a la deducción de las solicitaciones en las secciones resistentes producidas por el conjunto de las acciones expresadas en las Instrucciones y Normas que más adelante se señalan expresamente.

El estudio de las secciones se ha efectuado mediante criterios de Estados Límites, considerando:

- Por una parte, el Estado Límite de Servicio, bajo las combinaciones de acciones más desfavorables valores característicos y con los materiales, asimismo, sin minorar; comprobando que los estados y tensiones y deformaciones en todos los elementos de la estructura se encuentran en condiciones adecuadas; es decir con valores inferiores a los límites expresados en las Instrucciones y Normas citadas.

- Por otra parte, el Estado Límite último de las secciones, comprobando que las solicitaciones más desfavorables mayoradas (valores de cálculo) de las diferentes acciones de la estructura presenta valores inferiores a los esfuerzos de agotamiento de dichas secciones; es decir, teniendo en cuenta las oportunas minoraciones de las resistencias de los diferentes materiales, así como las interacciones de las solicitaciones combinadas de cortantes, flectores y torsores.

- El desarrollo de los cálculos, como es ya hoy en día habitual, se ha efectuado, por regla general, mediante la ayuda de programas de cálculo electrónico, suficientemente contrastados por la experiencia, tales como los correspondientes a los sistemas de entramados y emparrillados. En todos los casos (independientemente de exponer todos los desarrollos numéricos deducidos) los cálculos se completaron con comprobaciones manuales de tipo aproximado que garantizan la correspondencia entre el cálculo y la realidad.

- En particular, en aquellos en los que las simplificaciones requeridas pueden alterar los resultados, se aplican cálculos con variantes importantes de los parámetros así simplificados que cubren los extremos del espectro posible, adoptando los valores más desfavorables del análisis conjunto.

- Independientemente de las generalizaciones aquí expuestas, en cada fase del desarrollo del cálculo que presente una cierta entidad, se expondrán con mayor detalle las hipótesis y criterios considerados, así como las simplificaciones aplicadas y su justificación.

# 2.INSTRUCCIONES Y NORMAS CONSIDERADAS

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: |

## 2. INSTRUCCIONES Y NORMAS CONSIDERADAS

- EH-91 y EP-93
- IAP-98
- Para los estados límites de esfuerzos tangentes se utilizó la instrucción EHE.

# 3.CARACTERISTICAS DE LOS MATERIALES

| PACADAR | ESTUDIO: 24.785 | OBRA: ESTRUCTURA E-1505.0 SUBTRAMO XV AVE | FECHA: 7-06-00 HOJA: 3-1 |
|---|---|---|---|

## 3. CARACTERÍSTICAS DE LOS MATERIALES

- HORMIGÓN

Cajones prefabricados

$f_{ck} \geq 450 kg/cm^2$ $\quad \gamma = 1.40$ $\quad E_c = 387088 kg/cm^2$

Losa tablero

$f_{ck} \geq 250 kg/cm^2$ $\quad \gamma = 1.50$ $\quad E_c = 320753 kg/cm^2$

- Coeficientes de fluencia y retracción

  - CAJÓN PREFABRICADO

Retracción

$$\varepsilon_{0,28} = \beta_{28}\, \varepsilon_{01}\, \varepsilon_{02}$$

$$\varepsilon_{28,\infty} = (\beta_\infty - \beta_{28})\, \varepsilon_{01}\, \varepsilon_{02}$$

$$\varepsilon_{01} = 32 \times 10^{-5}$$

$$e = 1.5 \cdot \frac{2 \times 1.1496}{11.55} = 0.2986\ m = 298.6\ mm \Rightarrow \varepsilon_{02} = 0.85$$

$$\beta_{28} = 0.15$$

$$\beta_\infty = 1.0$$

$$\varepsilon_{0,28} = 0.15 \times 32 \cdot 10^{-5} \times 0.85 = 4{,}08 \times 10^{-5}$$

$$\varepsilon_{\infty,28} = 0.85 \times 32 \times 10^{-5} \times 0.85 = 23{,}1 \times 10^{-5}$$

| PACADAR | ESTUDIO: 24.785 | OBRA: ESTRUCTURA E-1505.0 SUBTRAMO XV AVE | FECHA: 7-06-00 HOJA: 3-2 |
|---|---|---|---|

Fluencia

$$\varphi_t = \beta_a(j) + \varphi_{01}\, \varphi_{02}\, (\beta_t - \beta_j) + 0{,}4\, \beta'_{t-j}$$

Vamos a evaluar la fluencia para dos instantes $t$:

$t_1 = 28$ días

$t_2 = \infty$ días

en cualquier caso $j = 3$ días:

$$\beta_a(3) = 0.8\,(1 - 0.38) = 0.496$$

$\varphi_{01} = 2.0$

$\varphi_{02} = 1.48$

$\beta_{28} = 0.37$

$\beta_3 = 0.15$

$\beta_\infty = 1.0$

$\beta'_{28-3} = 0.50$

$\beta'_{\infty-3} = 1.0$

$\varphi_{28} = 1.347$

$\varphi_\infty = 3.412$

$\varphi_\infty - \varphi_{28} = 2.065$

• LOSA

Retracción

$$\varepsilon = 1.5 \times \frac{2 \times 2.353}{16.7} = 0.422\,m = 422\,mm$$

$\varepsilon_{01} = -32 \times 10^{-5}$ $\quad \varepsilon_{02} = 0.80$

$\beta_{\infty} = 1.0$

$\varepsilon_{\infty} = 1.0 \times 32 \times 10^{-5} \times 0.80 = 25.6 \times 10^{-5}$

Fluencia

$\varphi_{01} = 2.0$ $\quad \beta_a(3) = 0.496$

$\varphi_{02} = 1.40$

$\beta_3 = 0.15$

$\varphi_{\infty} = 0.496 + 2.0 \times 1.40 \times 0.85 + 0.4$

$\varphi_{\infty} = 3.276$

Sin término instantáneo:

$\varphi_{\infty} = 2.78$

• ARMADURAS

• Pasivas

AEH-500N $\quad f_{yk} = 5100\,kg/cm^2$ $\quad \gamma = 1.10$ prefabricado

$\gamma = 1.15$ "in situ"



• Activas

en ~~barras~~ torones $\phi 0.6''$ $\quad f_{máx,k} = 19000\,kg/cm^2$

$\gamma_p = 1.10$ $\quad f_{yk} = 17100\,kg/cm^2$

en barras $\quad f_{máx,k} = 10.300\,kg/cm^2$

$\gamma_b = 1.15$ $\quad f_{yk} = 8350\,kg/cm^2$

# 4.ACCIONES A CONSIDERAR

| PACADAR | ESTUDIO: 24.785 | OBRA: ESTRUCTURA E-1505-0 SUBTRAMO XV AVE | FECHA: 7-06-00 HOJA: 4-1 |
|---|---|---|---|

## 4. ACCIONES A CONSIDERAR

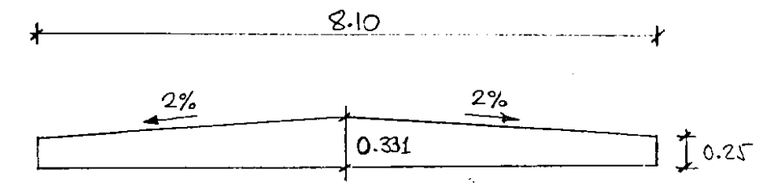
- Peso Propio de viga

Se toma una densidad para el hormigón armado de 2.5T/m³.

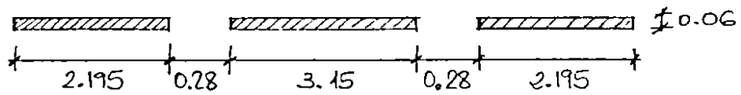
Sección con alma 20 cm  p = 2.958 Tau/ml

Macizado en extremos  p = 3.517 Tau/ml

- Peso Propio de losa

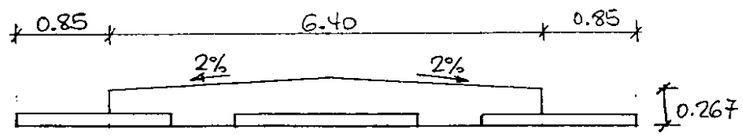



- Prelosas



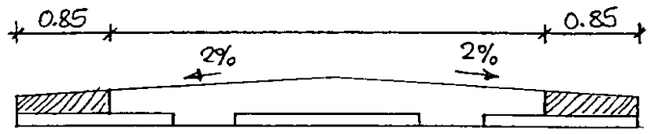

$$P_{PREZOSA} = 7.54 \times 0.06 \times 2.50 = 1.131 \text{ Tau/ml}$$

- losa 1ª fase de hormigonado




$$P_{1^{fase}} = \left(\frac{0.331+0.267}{2}\right) \times 6.40 \times 2.50 - \underbrace{0.876}_{\text{PP. prelosas}} = 3.908 \text{ Tau/ml}$$

• Losa 2ª fase de hormigonado.




$$P_{2ª\,fase} = \left(\frac{0.267+0.25}{2} - 0.06\right) \times 0.85 \times 2.0 \times 2.50 = 0.844 \text{ Tou/ml}$$

• Carga muerte

• Pavimento e= 6.0 cm

$0.06 \times 1.50 \times 2.30 \times 6.0 = 1.242$ Tou/ml

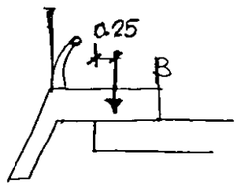
• Acera + Imposte + bionda + barrera antivandélica

Acera = $1.40 \times 0.20 \times 2 \times 2.50 = 1.40$ Tou/ml

Imposte = $0.07 \times 0.60 \times 2 \times 2.50 = 0.21$ Tou/ml

Bionda + Barrera antivandélica = $2 \times 0.10$ Tou/ml

Centro gravedad




Total acera + imposte + bionda + barrera = $2 \times 0.905$

= 1.81 Tou/ml

Total carga muerte = 3.052 Tou/ml



• Sobrecarga Uniforme

$q = 0.40 \times 8.10 = 3.24$ Tou/ml

$q_{torsión} = 0.40 \times \frac{8.10}{2} = 1.62$ Tou/ml  $t = 1.62 \times \frac{8.10}{4} = 3.28$ mt

• Vehículo Pesado

3 ejes de 20 Tou con torres de:

$20\left(\frac{8.10}{2} - 1.05 - 0.5 - 1.0\right) = 30$ mt/eje

• Térmico

• Gradiente

$\Delta T_{SI} = (k_1 \times k_2 \times k_3) \times \Delta T_{SI,ref}$

$k_1 = 1.25$

$k_2 = 1.06$

$k_3 = 1.0$

$\Delta T_{SI,ref} = 8.0$ °C

$\Delta T_{SI} = 10,60$ °C

Gradiente = $\frac{10.60°C}{1.40_m} = 7.57$ °C/m

Para entrar en el "BARRA" $(7,57\ °C/_m)/_{1.20} = 6,31\ °C/_m$

| PACADAR | ESTUDIO: 24.785 | OBRA: ESTRUCTURA E-1505.0 SUBTRAMO XV AVE | FECHA: 7-06-00 HOJA: 4-4 |
|---|---|---|---|

- Dilatación

$\Delta T = K z^a h^b s^c$

$z = 4$

$h = 1.40\ m$

$s = 1.0$

$K = 29.13$

$a = 0.301$

$b = -0.148$

$c = 0$

$\Delta T = 42.07\ ^\circ C$

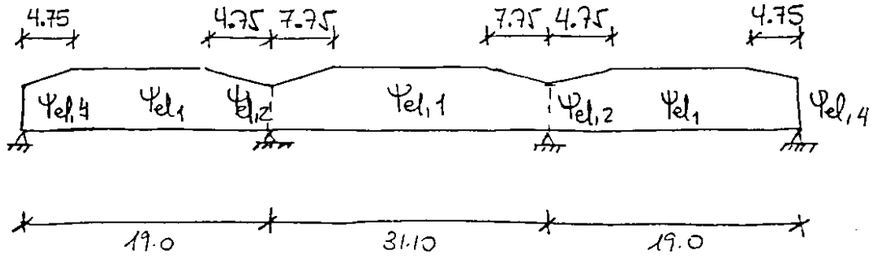
Esta diferencia de temperaturas es entre la máxima y mínima, si suponemos que sólo se producirá un recorrido de $\frac{2}{3}\Delta T$ desde el momento de construcción del puente y la máxima:

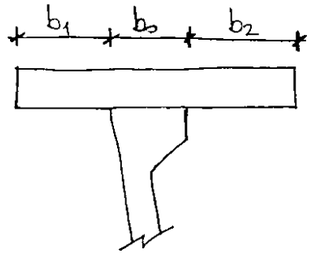
$\Delta T_{dilat.} = \frac{2}{3}\Delta T = 28.0\ ^\circ C$

# 5.CONSTANTES ESTATICAS

## 5. CONSTANTES ESTÁTICAS

- Anchos eficaces de losa




$b_0 = 0.434\ m$

$b_1 = 2.11\ m$

$b_2 = 1.50\ m$

Vano lateral

$\frac{b_1}{L} = \frac{2.11}{0.85 \times 19} = 0.13065$ $\quad \Psi_{el,1} = 0.9015 \Rightarrow \Psi'_{el,1} = \frac{\Psi_{el,1}}{0.80} = 1.12 > 1.0$

$\Psi_{el,4} = 0.668 \Rightarrow \Psi'_{el,4} = 0.835$

$\frac{b_2}{L} = \frac{1.50}{0.85 \times 19} = 0.093$ $\quad \Psi_{el,1} = 0.9475 \Rightarrow \Psi'_{el,1} = \frac{\Psi_{el,1}}{0.80} = 1.18 > 1.0$

$\Psi_{el,4} = 0.776 \Rightarrow \Psi'_{el,4} = 0.970$

Vano central

$\frac{b_1}{L} = \frac{2.11}{0.70 \times 31.10} = 0.0969$ $\quad \Psi_{el,1} = 0.9433 \Rightarrow \Psi'_{el,1} = 1.18 > 1$

$\Psi_{el,2} = 0.6264 \Rightarrow \Psi'_{el,2} = 0.783$

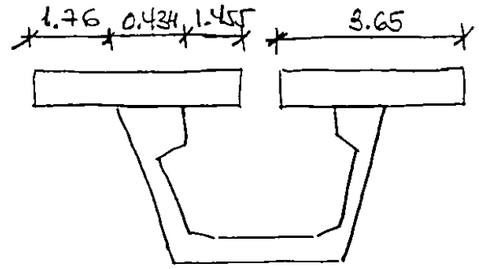
$\frac{b_2}{L} = \frac{1.50}{0.70 \times 31.10} = 0.0689$ $\quad \Psi_{el,1} = 0.9705 \Rightarrow \Psi'_{el,1} = 1.213 > 1$

$\Psi_{el,2} = 0.7037 \Rightarrow \Psi'_{el,2} = 0.88$



Secciones eficaces de losa (sin homogeneizar)

Sección en estribo

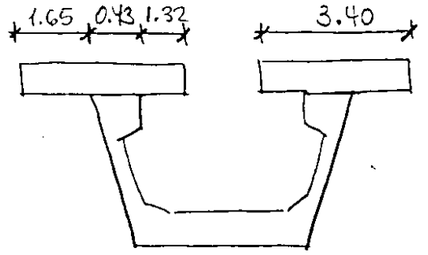



Coef. homogeinización:

$n_v = E_v / E_e = 1.20$

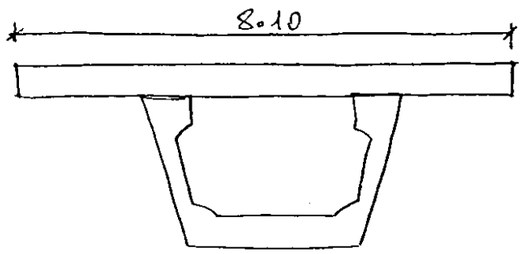
$b_{homog} = \frac{3.65 \times 2}{1.20} = 6.08\ m$

Sección en pila




$b_{homog} = \frac{3.40 \times 2}{1.20} = 5,66\ m$

Sección en centro de vano




$b_{homog} = \frac{8.10}{1.20} = 6.75\ m$

## 4 MAMPARO PILA (MP)

*CONSTANTES ESTÁTICAS A t=0* $n_{cl}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 4.126 | $b_l$= 0.000 | $A_R^{(0)}$= 4.126 | $z_{sl}^{(0)}$= 0.560 |
| $Y_{gv}$= 0.560 | $A_l$= 0.000 | $Y_{gR}^{(0)}$= 0.560 | $z_{il}^{(0)}$= 0.560 |
| $X_{gv}$= 0.590 | $b_{lR}^{(0)}$= 0.000 | $X_{gR}^{(0)}$= 0.590 | $z_{sv}^{(0)}$= 0.560 |
| $I_{gv}$= 0.454 | $A_{lR}^{(0)}$= 0.000 | $I_{gR}^{(0)}$= 0.454 | $z_{iv}^{(0)}$= 0.590 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.000 | $h_R^{(0)}$= 1.150 | |
| $w_{sv}$= 0.811 | $X_{glR}^{(0)}$= 0.000 | $w_{sl}^{(0)}$= 0.811 | |
| $w_{iv}$= 0.768 | $I_{glR}^{(0)}$= 0.000 | $w_{il}^{(0)}$= 0.811 | |
| | $h_l$= 0.000 | $w_{sv}^{(0)}$= 0.811 | |
| | | $w_{iv}^{(0)}$= 0.768 | |




v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 22 CAJON ESTRIBO MACIZADO BC LOSA(CBCEM)

*CONSTANTES ESTÁTICAS A t=0* $n_{cl}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 2.633 | $b_l$= 6.303 | $A_R^{(0)}$= 3.938 | $z_{sl}^{(0)}$= 0.657 |
| $Y_{gv}$= 0.736 | $A_l$= 1.576 | $Y_{gR}^{(0)}$= 0.657 | $z_{il}^{(0)}$= 0.407 |
| $X_{gv}$= 0.414 | $b_{lR}^{(0)}$= 5.223 | $X_{gR}^{(0)}$= 0.743 | $z_{sv}^{(0)}$= 0.407 |
| $I_{gv}$= 0.198 | $A_{lR}^{(0)}$= 1.306 | $I_{gR}^{(0)}$= 0.591 | $z_{iv}^{(0)}$= 0.743 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.269 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.899 | |
| $w_{iv}$= 0.478 | $I_{glR}^{(0)}$= 0.007 | $w_{il}^{(0)}$= 1.450 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.450 | |
| | | $w_{iv}^{(0)}$= 0.796 | |




v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 23 CAJON ESTRIBO BC LOSA(CBCE)

*CONSTANTES ESTÁTICAS A t=0* $n_{cl}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 1.156 | $b_l$= 6.303 | $A_R^{(0)}$= 2.462 | $z_{sl}^{(0)}$= 0.617 |
| $Y_{gv}$= 0.750 | $A_l$= 1.576 | $Y_{gR}^{(0)}$= 0.617 | $z_{il}^{(0)}$= 0.367 |
| $X_{gv}$= 0.400 | $b_{lR}^{(0)}$= 5.223 | $X_{gR}^{(0)}$= 0.783 | $z_{sv}^{(0)}$= 0.367 |
| $I_{gv}$= 0.170 | $A_{lR}^{(0)}$= 1.306 | $I_{gR}^{(0)}$= 0.513 | $z_{iv}^{(0)}$= 0.783 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.226 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.831 | |
| $w_{iv}$= 0.424 | $I_{glR}^{(0)}$= 0.007 | $w_{il}^{(0)}$= 1.397 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.397 | |
| | | $w_{iv}^{(0)}$= 0.656 | |



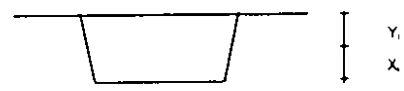

v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## CARACTERÍSTICAS MECANICAS BRUTAS A T=0 DE LAS DISTINTAS SECCION [Ud]=(T;m)

## 1 CAJON (CA)

*CONSTANTES ESTÁTICAS A t=0* $n_{cl}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 1.156 | $b_l$= 0.000 | $A_R^{(0)}$= 1.156 | $z_{sl}^{(0)}$= 0.750 |
| $Y_{gv}$= 0.750 | $A_l$= 0.000 | $Y_{gR}^{(0)}$= 0.750 | $z_{il}^{(0)}$= 0.750 |
| $X_{gv}$= 0.400 | $b_{lR}^{(0)}$= 0.000 | $X_{gR}^{(0)}$= 0.400 | $z_{sv}^{(0)}$= 0.750 |
| $I_{gv}$= 0.170 | $A_{lR}^{(0)}$= 0.000 | $I_{gR}^{(0)}$= 0.170 | $z_{iv}^{(0)}$= 0.400 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.000 | $h_R^{(0)}$= 1.150 | |
| $w_{sv}$= 0.226 | $X_{glR}^{(0)}$= 0.000 | $w_{sl}^{(0)}$= 0.226 | |
| $w_{iv}$= 0.424 | $I_{glR}^{(0)}$= 0.000 | $w_{il}^{(0)}$= 0.226 | |
| | $h_l$= 0.000 | $w_{sv}^{(0)}$= 0.226 | |
| | | $w_{iv}^{(0)}$= 0.424 | |

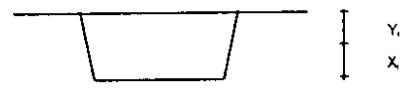



v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 2 CAJON MACIZADO ESTRIBO(CME)

*CONSTANTES ESTÁTICAS A t=0* $n_{cl}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 2.633 | $b_l$= 0.000 | $A_R^{(0)}$= 2.633 | $z_{sl}^{(0)}$= 0.736 |
| $Y_{gv}$= 0.736 | $A_l$= 0.000 | $Y_{gR}^{(0)}$= 0.736 | $z_{il}^{(0)}$= 0.736 |
| $X_{gv}$= 0.414 | $b_{lR}^{(0)}$= 0.000 | $X_{gR}^{(0)}$= 0.414 | $z_{sv}^{(0)}$= 0.736 |
| $I_{gv}$= 0.198 | $A_{lR}^{(0)}$= 0.000 | $I_{gR}^{(0)}$= 0.198 | $z_{iv}^{(0)}$= 0.414 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.000 | $h_R^{(0)}$= 1.150 | |
| $w_{sv}$= 0.269 | $X_{glR}^{(0)}$= 0.000 | $w_{sl}^{(0)}$= 0.269 | |
| $w_{iv}$= 0.478 | $I_{glR}^{(0)}$= 0.000 | $w_{il}^{(0)}$= 0.269 | |
| | $h_l$= 0.000 | $w_{sv}^{(0)}$= 0.269 | |
| | | $w_{iv}^{(0)}$= 0.478 | |

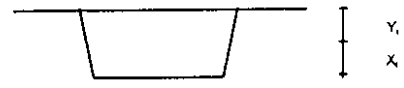



v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 3 CAJON MACIZADO PILA(CMP)

*CONSTANTES ESTÁTICAS A t=0* $n_{cl}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 2.387 | $b_l$= 0.000 | $A_R^{(0)}$= 2.387 | $z_{sl}^{(0)}$= 0.731 |
| $Y_{gv}$= 0.731 | $A_l$= 0.000 | $Y_{gR}^{(0)}$= 0.731 | $z_{il}^{(0)}$= 0.731 |
| $X_{gv}$= 0.420 | $b_{lR}^{(0)}$= 0.000 | $X_{gR}^{(0)}$= 0.420 | $z_{sv}^{(0)}$= 0.731 |
| $I_{gv}$= 0.227 | $A_{lR}^{(0)}$= 0.000 | $I_{gR}^{(0)}$= 0.227 | $z_{iv}^{(0)}$= 0.420 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.000 | $h_R^{(0)}$= 1.150 | |
| $w_{sv}$= 0.311 | $X_{glR}^{(0)}$= 0.000 | $w_{sl}^{(0)}$= 0.311 | |
| $w_{iv}$= 0.541 | $I_{glR}^{(0)}$= 0.000 | $w_{il}^{(0)}$= 0.311 | |
| | $h_l$= 0.000 | $w_{sv}^{(0)}$= 0.311 | |
| | | $w_{iv}^{(0)}$= 0.541 | |



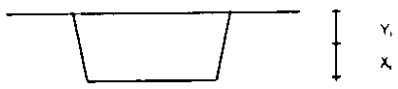

v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

Sin ancho eficaz

## 52 TOTAL ESTRIBO MACIZADO (TEM)

*CONSTANTES ESTÁTICAS A t=0* $n_{cf}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 2.633 | $b_l$= 7.300 | $A_R^{(0)}$= 4.145 | $z_{sl}^{(0)}$= 0.650 |
| $Y_{gv}$= 0.736 | $A_l$= 1.825 | $Y_{gR}^{(0)}$= 0.650 | $z_{il}^{(0)}$= 0.400 |
| $X_{gv}$= 0.414 | $b_{lR}^{(0)}$= 6.049 | $X_{gR}^{(0)}$= 0.750 | $z_{sv}^{(0)}$= 0.400 |
| $I_{gv}$= 0.198 | $A_{lR}^{(0)}$= 1.512 | $I_{gR}^{(0)}$= 0.641 | $z_{iv}^{(0)}$= 0.750 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.269 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.987 | |
| $w_{iv}$= 0.478 | $I_{glR}^{(0)}$= 0.008 | $w_{il}^{(0)}$= 1.605 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.605 | |
| | | $w_{iv}^{(0)}$= 0.855 | |

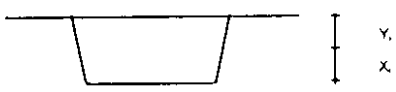



v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 53 TOTAL ESTRIBO (TE)

*CONSTANTES ESTÁTICAS A t=0* $n_{cf}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 1.156 | $b_l$= 7.300 | $A_R^{(0)}$= 2.669 | $z_{sl}^{(0)}$= 0.608 |
| $Y_{gv}$= 0.750 | $A_l$= 1.825 | $Y_{gR}^{(0)}$= 0.608 | $z_{il}^{(0)}$= 0.358 |
| $X_{gv}$= 0.400 | $b_{lR}^{(0)}$= 6.049 | $X_{gR}^{(0)}$= 0.792 | $z_{sv}^{(0)}$= 0.358 |
| $I_{gv}$= 0.170 | $A_{lR}^{(0)}$= 1.512 | $I_{gR}^{(0)}$= 0.554 | $z_{iv}^{(0)}$= 0.792 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.226 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.910 | |
| $w_{iv}$= 0.424 | $I_{glR}^{(0)}$= 0.008 | $w_{il}^{(0)}$= 1.546 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.546 | |
| | | $w_{iv}^{(0)}$= 0.699 | |




v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 51 TOTAL (T)

*CONSTANTES ESTÁTICAS A t=0* $n_{cf}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 1.156 | $b_l$= 8.100 | $A_R^{(0)}$= 2.834 | $z_{sl}^{(0)}$= 0.602 |
| $Y_{gv}$= 0.750 | $A_l$= 2.025 | $Y_{gR}^{(0)}$= 0.602 | $z_{il}^{(0)}$= 0.352 |
| $X_{gv}$= 0.400 | $b_{lR}^{(0)}$= 6.712 | $X_{gR}^{(0)}$= 0.798 | $z_{sv}^{(0)}$= 0.352 |
| $I_{gv}$= 0.170 | $A_{lR}^{(0)}$= 1.678 | $I_{gR}^{(0)}$= 0.585 | $z_{iv}^{(0)}$= 0.798 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.226 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.972 | |
| $w_{iv}$= 0.424 | $I_{glR}^{(0)}$= 0.009 | $w_{il}^{(0)}$= 1.663 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.663 | |
| | | $w_{iv}^{(0)}$= 0.733 | |




v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 21 CAJON BC LOSA(CBC)

*CONSTANTES ESTÁTICAS A t=0* $n_{cf}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 1.156 | $b_l$= 6.400 | $A_R^{(0)}$= 2.482 | $z_{sl}^{(0)}$= 0.616 |
| $Y_{gv}$= 0.750 | $A_l$= 1.600 | $Y_{gR}^{(0)}$= 0.616 | $z_{il}^{(0)}$= 0.366 |
| $X_{gv}$= 0.400 | $b_{lR}^{(0)}$= 5.303 | $X_{gR}^{(0)}$= 0.784 | $z_{sv}^{(0)}$= 0.366 |
| $I_{gv}$= 0.170 | $A_{lR}^{(0)}$= 1.326 | $I_{gR}^{(0)}$= 0.517 | $z_{iv}^{(0)}$= 0.784 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.226 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.839 | |
| $w_{iv}$= 0.424 | $I_{glR}^{(0)}$= 0.007 | $w_{il}^{(0)}$= 1.411 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.411 | |
| | | $w_{iv}^{(0)}$= 0.660 | |

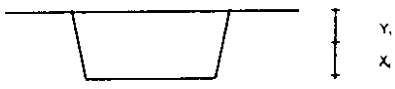



v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 24 CAJON PILA BC LOSA(CBCP)

*CONSTANTES ESTÁTICAS A t=0* $n_{cf}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 1.156 | $b_l$= 6.030 | $A_R^{(0)}$= 2.406 | $z_{sl}^{(0)}$= 0.620 |
| $Y_{gv}$= 0.750 | $A_l$= 1.508 | $Y_{gR}^{(0)}$= 0.620 | $z_{il}^{(0)}$= 0.370 |
| $X_{gv}$= 0.400 | $b_{lR}^{(0)}$= 4.997 | $X_{gR}^{(0)}$= 0.780 | $z_{sv}^{(0)}$= 0.370 |
| $I_{gv}$= 0.170 | $A_{lR}^{(0)}$= 1.249 | $I_{gR}^{(0)}$= 0.502 | $z_{iv}^{(0)}$= 0.780 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.226 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.809 | |
| $w_{iv}$= 0.424 | $I_{glR}^{(0)}$= 0.007 | $w_{il}^{(0)}$= 1.355 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.355 | |
| | | $w_{iv}^{(0)}$= 0.643 | |




v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 25 CAJON PILA MAMPARO BC LOSA (CBCPM)

*CONSTANTES ESTÁTICAS A t=0* $n_{cf}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 4.126 | $b_l$= 6.030 | $A_R^{(0)}$= 5.375 | $z_{sl}^{(0)}$= 0.546 |
| $Y_{gv}$= 0.560 | $A_l$= 1.508 | $Y_{gR}^{(0)}$= 0.546 | $z_{il}^{(0)}$= 0.296 |
| $X_{gv}$= 0.590 | $b_{lR}^{(0)}$= 4.997 | $X_{gR}^{(0)}$= 0.854 | $z_{sv}^{(0)}$= 0.296 |
| $I_{gv}$= 0.454 | $A_{lR}^{(0)}$= 1.249 | $I_{gR}^{(0)}$= 0.682 | $z_{iv}^{(0)}$= 0.854 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.811 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 1.250 | |
| $w_{iv}$= 0.768 | $I_{glR}^{(0)}$= 0.007 | $w_{il}^{(0)}$= 2.306 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 2.306 | |
| | | $w_{iv}^{(0)}$= 0.799 | |




v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

**CONSTANTES ESTATICAS**

**CAJON**

---------- REGIONES ----------

Area: 11564.8589
Perimetro: 1153.3965
Caja de abarque: X: -193.7500 -- 193.7500
Y: 0.0000 -- 115.0000

Centro de gravedad: X: 0.0000
Y: 40.0218

Momentos de inercia: X: 35478549.5931
Y: 2123670612807

Producto de inercia: XY: 0.0000

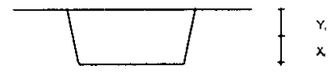
Radios de giro: X: 55.3876
Y: 135.5106

Momentos principales y direcciones X-Y alrededor del centro de gravedad:
I: 1695,4630.2221 a lo largo de [1.0000 0.0000]
J: 21236,7061.2807 a lo largo de [0.0000 1.0000]

## 54 TOTAL PILA (TP)

*CONSTANTES ESTÁTICAS A t=0* $n_{ci}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 1.156 | $b_l$= 6.800 | $A_R^{(0)}$= 2.565 | $z_{sl}^{(0)}$= 0.613 |
| $Y_{gv}$= 0.750 | $A_l$= 1.700 | $Y_{gR}^{(0)}$= 0.613 | $z_{il}^{(0)}$= 0.363 |
| $X_{gv}$= 0.400 | $b_{lR}^{(0)}$= 5.635 | $X_{gR}^{(0)}$= 0.787 | $z_{sv}^{(0)}$= 0.363 |
| $I_{gv}$= 0.170 | $A_{lR}^{(0)}$= 1.409 | $I_{gR}^{(0)}$= 0.534 | $z_{iv}^{(0)}$= 0.787 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.226 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 0.871 | |
| $w_{iv}$= 0.424 | $I_{glR}^{(0)}$= 0.007 | $w_{il}^{(0)}$= 1.471 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 1.471 | |
| | | $w_{iv}^{(0)}$= 0.678 | |

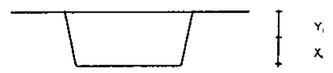



v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

## 55 TOTAL PILA MAMPARO (TPM)

*CONSTANTES ESTÁTICAS A t=0* $n_{ci}^{(0)}$= 1.207

| VIGA | LOSA | SECCION COMPUESTA | |
|---|---|---|---|
| $E_v(28)$= 3870880 | $E_l(28)$= 3207530 | $E_R(28)$= 3870880 | |
| $A_v$= 4.126 | $b_l$= 6.800 | $A_R^{(0)}$= 5.534 | $z_{sl}^{(0)}$= 0.544 |
| $Y_{gv}$= 0.560 | $A_l$= 1.700 | $Y_{gR}^{(0)}$= 0.544 | $z_{il}^{(0)}$= 0.294 |
| $X_{gv}$= 0.590 | $b_{lR}^{(0)}$= 5.635 | $X_{gR}^{(0)}$= 0.856 | $z_{sv}^{(0)}$= 0.294 |
| $I_{gv}$= 0.454 | $A_{lR}^{(0)}$= 1.409 | $I_{gR}^{(0)}$= 0.710 | $z_{iv}^{(0)}$= 0.856 |
| $h_v$= 1.150 | $Y_{glR}^{(0)}$= 0.125 | $h_R^{(0)}$= 1.400 | |
| $w_{sv}$= 0.811 | $X_{glR}^{(0)}$= 0.125 | $w_{sl}^{(0)}$= 1.304 | |
| $w_{iv}$= 0.768 | $I_{glR}^{(0)}$= 0.007 | $w_{il}^{(0)}$= 2.411 | |
| | $h_l$= 0.250 | $w_{sv}^{(0)}$= 2.411 | |
| | | $w_{iv}^{(0)}$= 0.830 | |




v: viga
l: losa
sl: fibra superior de losa
il: fibra inferior de losa
sv: fibra superior de viga
iv: fibra inferior de viga

**CONSTANTES ESTATICAS**
**CAJON MACIZADO ESTRIBO**

---------- REGIONES ----------

Area: 26326.9789
Perímetro: 1089.4638
Caja de abarque: X: -193.7500 -- 193.7500
Y: 0.0000 -- 115.0000
Centro de gravedad: X: 0.0000
Y: 41.4329
Momentos de inercia: X: 64984233.8416
Y: 329343395.1986
Producto de inercia: XY: 0.0000
Radios de giro: X: 49.6825
Y: 111.8469
Momentos principales y direcciones X-Y alrededor del centro de gravedad:
I: 1978,9117.3930 a lo largo de [1.0000 0.0000]
J: 329343395.1986 a lo largo de [0.0000 1.0000]

**CONSTANTES ESTATICAS**
**CAJON MACIZADO PILA**

---------- REGIONES ----------

Area: 23868.7500
Perímetro: 1084.5786
Caja de abarque: X: -265.5069 -- 121.9931
Y: 0.0000 -- 115.0000
Centro de gravedad: X: -71.7569
Y: 41.9434
Momentos de inercia: X: 64693307.2917
Y: 464539938.0072
Producto de inercia: XY: -71838408.7352
Radios de giro: X: 52.0613
Y: 139.5072
Momentos principales y direcciones X-Y alrededor del centro de gravedad:
I: 22702330.7008 a lo largo de [1.0000 0.0000]
J: 341638367.5130 a lo largo de [0.0000 1.0000]

**CARACTERISTICAS MECANICAS**
**MAMPARO PILA**

---------- REGIONES ----------

Area: 41256.2500
Perímetro: 954.5786
Caja de abarque: X: -193.7500 -- 193.7500
Y: 0.0000 -- 115.0000
Centro de gravedad: X: 0.0000
Y: 59.0360
Momentos de inercia: X: 189158828.1250
Y: 445320392.2526
Producto de inercia: XY: 0.0000
Radios de giro: X: 67.7124
Y: 103.8942
Momentos principales y direcciones X-Y alrededor del centro de gravedad:
I: 45370489.2264 a lo largo de [1.0000 0.0000]
J: 445320392.2526 a lo largo de [0.0000 1.0000]

# 6.MODELO DE CALCULO

## 6. MODELO DE CALCULO

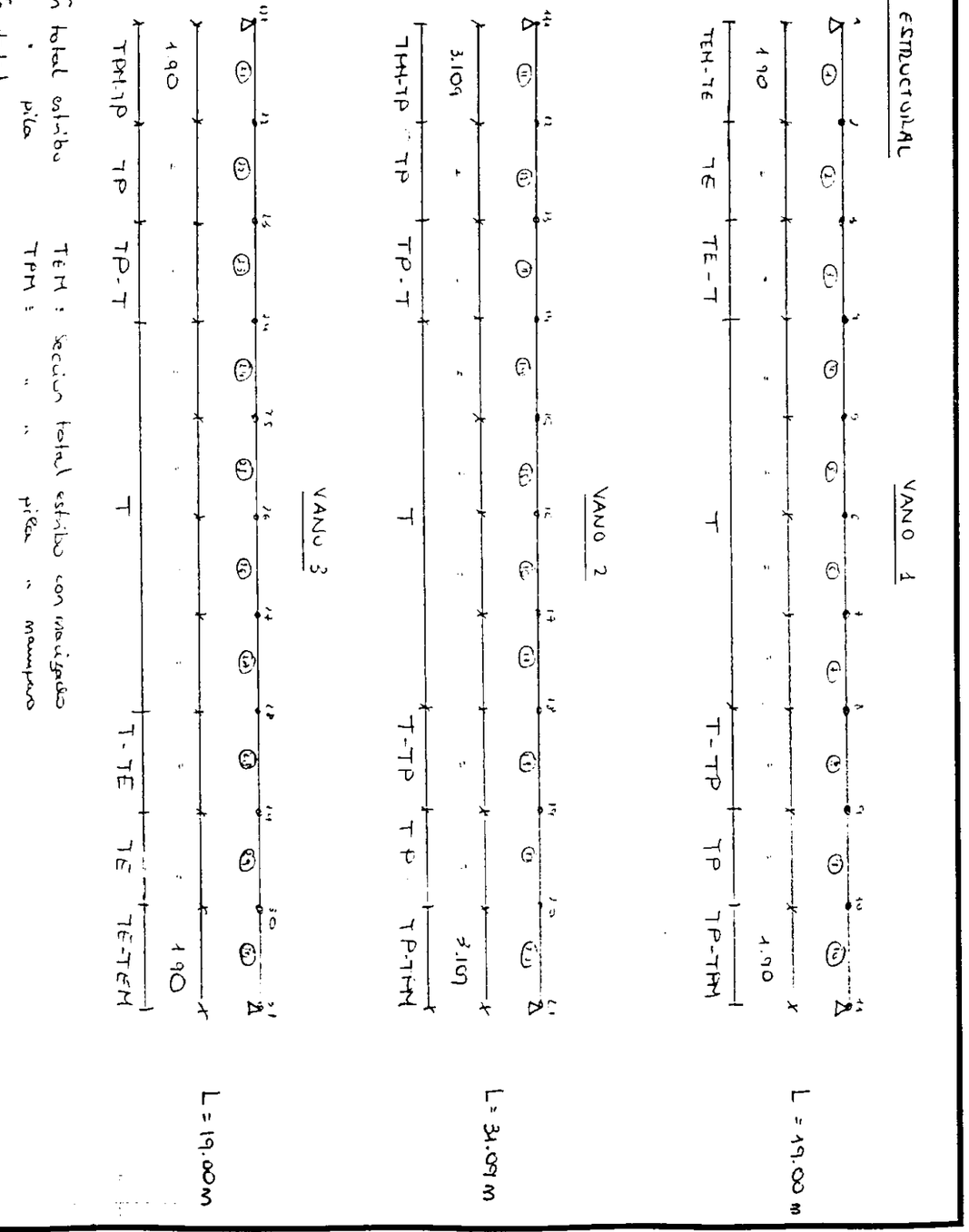
El estudio completo de la estructura tanto a t=inf como durante las fases de montaje, se realizó en base a varios modelos evolutivos de la estructura encuadrados en las siguientes familias.

- estructura ideal (estructura completa t=inf)
- fases de montaje (estructura evolutiva t=c.)

Todos los modelos de cálculo se generaron y calcularon con el programa 'BARRA' modelizando la estructura tipo marco, asignando a cada barra las características mecánicas que le correspondan en cada instante.



## 1. MODELO ESTRUCTURAL



2. ACCIONES SOBRE EL MODELO · FASES CONSTRUCTIVAS .

FASE 1 . pp. cajón (colocación vigas)

$q = 2{,}958$ T/m

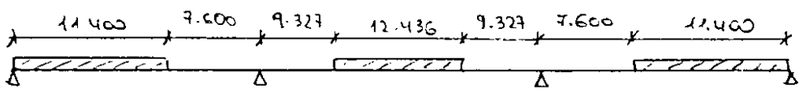
El peso de los macizados de las vigas en sus extremos no se tendrá en cuenta en el modelo aunque se considerará en el calculo de las reacciones

FASE 2 . colocación de prelosas

$q = 1.131$ T/m

FASE 3 . hormigonado de banda central (BC) de losa en centro de vano

$q = 3{,}908$ T/m



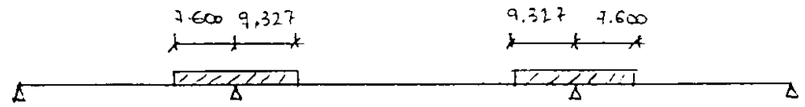

FASE 4 : Ejecución de mamparos y cosido de vigas

No se considera actuando en el modelo al no producir esfuerzos significativos.
Se tendrán en cuenta en las reacciones y el control en servicio respectivamente



FASE 5 : Hormigonado de BC el resto de losa

$q = 3.908$ T/m




FASE 6 : Hormigonado de voladizos

$q = 0.844$ T/m

3. ACCIONES SOBRE ESTRUCTURA COMPLETA (E ideal)

ESTADO 1 : p.p. cajón

$q = 2{,}958$ T/m

ESTADO 2 p.p. losa

$q = 5{,}883$ T/m

ESTADO 3 : carga muerta

$q = 3.052$ T/m

ESTADO 4 : sobrecarga uniforme 400 Kp/m²

$q = 3{,}240$ T/m

ESTADO 5 : vehículo pesado

3 ejes de 25t a 1.50 m

ESTADO 6 : gradiente térmico

7,36°C/m

4. MODELO DE PRETENSADO

Del tanteo final del pretensado realizado en el cap. 8 se obtiene el modelo adjunto de pretensado.

# 7.ESFUERZOS LONGITUDINALES

# 7. ESFUERZOS LONGITUDINALES

## 7.1 Cálculo sobre estructura completa (E ideal)

Se introducen sobre el modelo de viga continua (cap. 6) los siguientes estados de carga:

- p.p. viga
- p.p. losa
- c.m (carga muerta)
- s.c.u (sobrecarga uniforme)
- v.p (vehículo pesado)
- gradiente térmico

A partir de los momentos obtenidos se realiza un primer tanteo del pretensado de taller. Posteriormente en el cap. 8 se realizan nuevos tanteos para encajar el puente en servicio y en rotura.

### 7.1.1. Modelo de pretensado / Primer tanteo

- Características mecánicas brutas sección completa en cdv:

$A = 2{,}834\ m^2$

$W_{IV} = 0{,}733\ m^3$

$x_G = 0{,}798\ m$



Tanteo en vanos 1 y 3

$M_{ext}^{+} = 44{,}506 + 88{,}516 + 45{,}920 + 123{,}358 + 111{,}788 + 90{,}188 =$

$= 604{,}276\ mT$

$\sigma_{IV} = M_{ext}^{+} / W_{IV} = 604{,}276 / 0{,}733 = 824{,}387\ T/m^2$ (tracción)

$\sigma_{IV_{pret}} = 0{,}76 \times P \times \left[ \frac{1}{A} + \frac{e \times x_G}{W_{IV}} \right]$, se estiman unas pérdidas de pretensado del 24% a t=inf, y una redistribución del hiperestático de pretensado del 35% del isostático de pretensado

Tracción límite en fibra inferior de viga $= 400\ T/m^2$

$e = x_G - 0.05 = 0.748\ m$

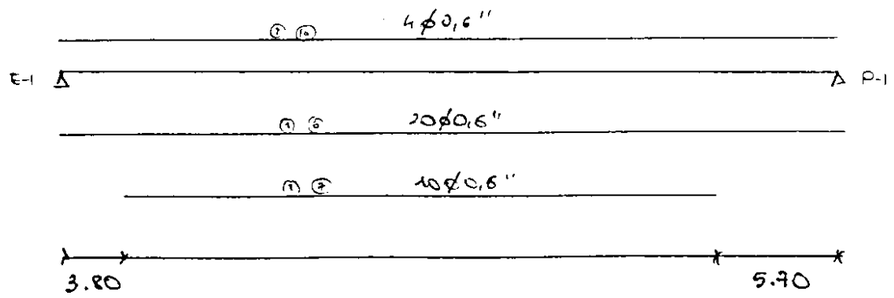
$824{,}387 - 400 = 0{,}8277 \times P$

$P = 515{,}84\ t / 20{,}72\ t/toron = 25\ \phi 0{,}6''$

Armadura mínima de pretensado:

$A_p \geq 0{,}25 \times f_{cd} \times \frac{W_{IV}}{h} \times \frac{1}{f_{pd}} = 0{,}25 \times \frac{4500\ t/m^2}{1{,}40} \times \frac{0{,}733\ m^3}{1{,}40\ m} \times \frac{1}{15{,}545\ t/cm^2}$

$= 27{,}06\ cm^2 / 1.4\ cm^2/toron = 20\ \phi\ 0{,}6''$



| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 7.3 |

Tanteo vano 2

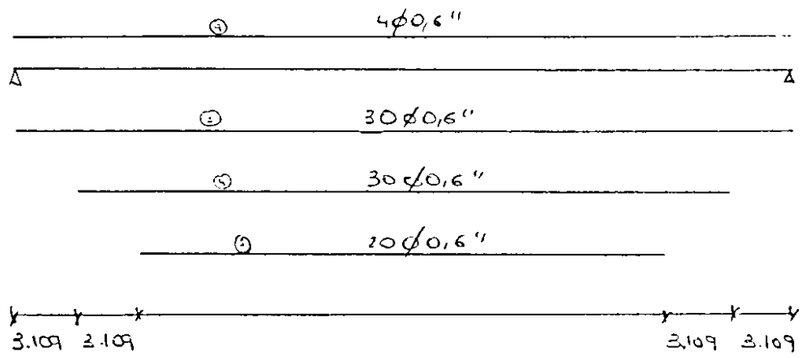
$M_{ext}^{+} = 148{,}310 + 294{,}965 + 153{,}023 + 204{,}945 + 271{,}233 + 215{,}476 =$

$= 1297{,}946$ mT

$\sigma_{IV} = 1297{,}946 / 0{,}733 = 1770{,}73$ T/m²

$1770{,}73 - 400 = 0{,}8227 \times P$

$P = 1666{,}13^{t} / 20{,}72\ t/torón = 80\ \phi\ 0{,}6''$




SUB.XV.AVE.MADRID-BARCELONA / E-1505.0

ESFUERZOS SOBRE ESTRUCTURA IDEAL

| BARRA | p vigas tin | pp losa tinf | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | suma + | suma - |
|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1(2) | 14.90 | 29.60 | 15.40 | 25.70 | -9.30 | 45.70 | -9.00 | 11.30 | 142.60 | 41.60 |
| 1(3) | 27.10 | 54.00 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 269.50 | 72.50 |
| 2(1) | 27.10 | 54.00 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 269.50 | 72.50 |
| 2(2) | 36.70 | 73.00 | 37.90 | 68.20 | -28.00 | 122.70 | -26.90 | 33.80 | 372.30 | 92.70 |
| 2(3) | 43.60 | 86.70 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 457.70 | 102.20 |
| 3(1) | 43.60 | 86.70 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 457.70 | 102.20 |
| 3(2) | 47.80 | 95.10 | 49.40 | 99.00 | -46.60 | 173.40 | -44.80 | 56.40 | 521.10 | 100.90 |
| 3(3) | 49.40 | 98.20 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 566.30 | 88.80 |
| 4(1) | 49.40 | 98.20 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 566.30 | 88.80 |
| 4(2) | 48.30 | 96.00 | 49.80 | 118.20 | -65.30 | 201.90 | -62.70 | 78.90 | 593.10 | 66.10 |
| 4(3) | 44.50 | 88.50 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 604.30 | 32.60 |
| 5(1) | 44.50 | 88.50 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 604.30 | 32.60 |
| 5(2) | 38.10 | 75.70 | 39.30 | 125.60 | -83.90 | 209.00 | -80.70 | 101.50 | 589.20 | -11.50 |
| 5(3) | 28.90 | 57.60 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 564.80 | -66.50 |
| 6(1) | 28.90 | 57.60 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 564.80 | -66.50 |
| 6(2) | 17.10 | 34.10 | 17.70 | 121.40 | -102.60 | 198.90 | -98.60 | 124.00 | 513.20 | -132.30 |
| 6(3) | 2.70 | 5.30 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 450.20 | -208.60 |
| 7(1) | 2.70 | 5.30 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 450.20 | -208.60 |
| 7(2) | -14.40 | -28.70 | -14.90 | 105.40 | -121.20 | 170.20 | -116.50 | 146.60 | 364.20 | -295.70 |
| 7(3) | -34.20 | -68.10 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 263.80 | -393.70 |
| 8(1) | -34.20 | -68.10 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 263.80 | -393.70 |
| 8(2) | -56.70 | -112.80 | -58.50 | 77.80 | -139.90 | 125.70 | -134.40 | 169.10 | 144.60 | -502.30 |
| 8(3) | -81.80 | -162.80 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 10.10 | -621.60 |
| 9(1) | -81.80 | -162.80 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 10.10 | -621.60 |
| 9(2) | -109.60 | -218.10 | -113.10 | 39.80 | -159.90 | 69.10 | -152.40 | 191.60 | -140.30 | -753.10 |
| 9(3) | -140.10 | -278.70 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | -296.00 | -905.00 |
| 10(1) | -140.10 | -278.70 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | -296.00 | -905.00 |
| 10(2) | -173.30 | -344.60 | -178.80 | 20.30 | -210.10 | 27.00 | -170.30 | 214.20 | -435.20 | -1077.10 |
| 10(3) | -209.10 | -415.80 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | -567.40 | -1268.20 |

*ESFUERZOS SOBRE ESTRUCTURA IDEAL*

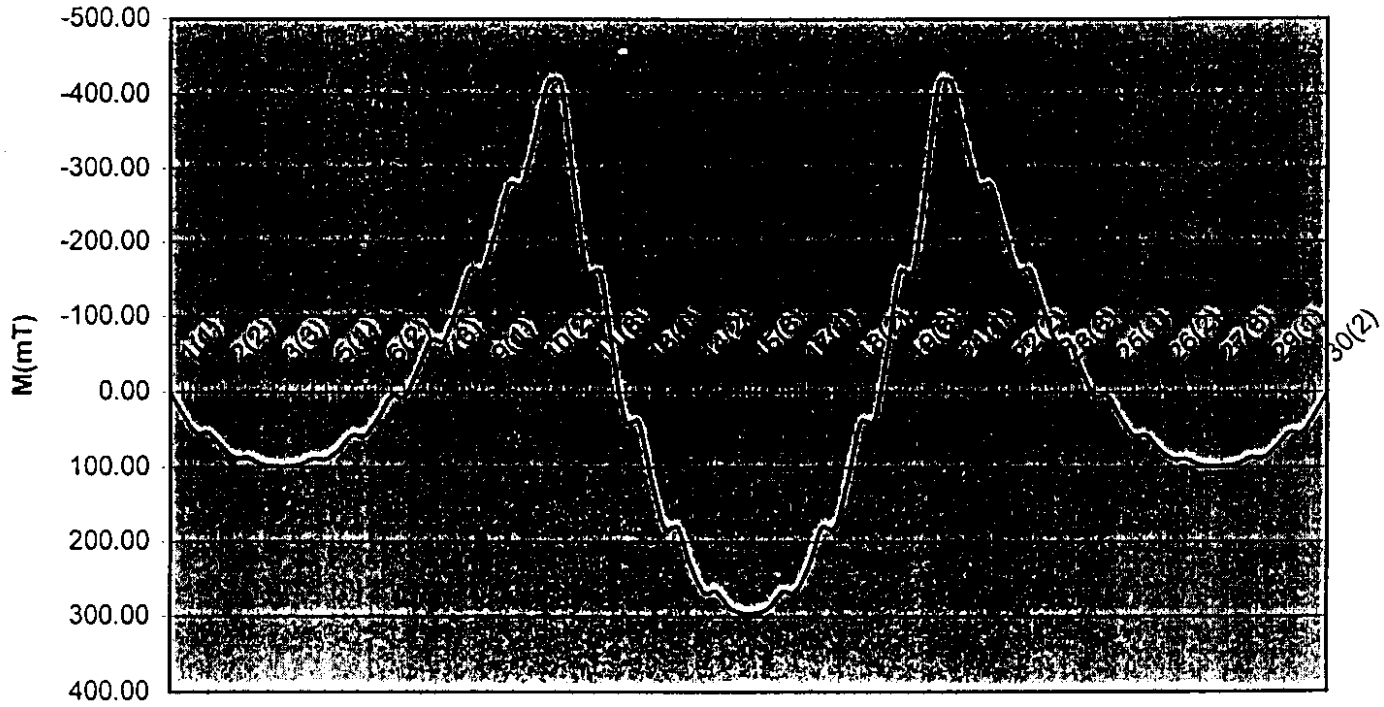
| BARRA | p vigas tin | pp losa tinf | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | suma + | suma - |
|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | -209.10 | -415.80 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | -567.40 | -1268.20 |
| 21(2) | -173.30 | -344.60 | -178.80 | 20.30 | -210.10 | 27.00 | -170.30 | 214.20 | -435.20 | -1077.10 |
| 21(3) | -140.10 | -278.70 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | -296.00 | -905.00 |
| 22(1) | -140.10 | -278.70 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | -296.00 | -905.00 |
| 22(2) | -109.60 | -218.10 | -113.10 | 39.80 | -159.90 | 69.10 | -152.40 | 191.60 | -140.30 | -753.10 |
| 22(3) | -81.80 | -162.80 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 10.10 | -621.60 |
| 23(1) | -81.80 | -162.80 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 10.10 | -621.60 |
| 23(2) | -56.70 | -112.80 | -58.50 | 77.80 | -139.90 | 125.70 | -134.40 | 169.10 | 144.60 | -502.30 |
| 23(3) | -34.20 | -68.10 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 263.80 | -393.70 |
| 24(1) | -34.20 | -68.10 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 263.80 | -393.70 |
| 24(2) | -14.40 | -28.70 | -14.90 | 105.40 | -121.20 | 170.20 | -116.50 | 146.60 | 364.20 | -295.70 |
| 24(3) | 2.70 | 5.30 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 450.20 | -208.60 |
| 25(1) | 2.70 | 5.30 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 450.20 | -208.60 |
| 25(2) | 17.10 | 34.10 | 17.70 | 121.40 | -102.60 | 198.90 | -98.60 | 124.00 | 513.20 | -132.30 |
| 25(3) | 28.90 | 57.60 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 564.80 | -66.50 |
| 26(1) | 28.90 | 57.60 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 564.80 | -66.50 |
| 26(2) | 38.10 | 75.70 | 39.30 | 125.60 | -83.90 | 209.00 | -80.70 | 101.50 | 589.20 | -11.50 |
| 26(3) | 44.50 | 88.50 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 604.30 | 32.60 |
| 27(1) | 44.50 | 88.50 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 604.30 | 32.60 |
| 27(2) | 48.30 | 96.00 | 49.80 | 118.20 | -65.30 | 201.90 | -62.70 | 78.90 | 593.10 | 66.10 |
| 27(3) | 49.40 | 98.20 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 566.30 | 88.80 |
| 28(1) | 49.40 | 98.20 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 566.30 | 88.80 |
| 28(2) | 47.80 | 95.10 | 49.40 | 99.00 | -46.60 | 173.40 | -44.80 | 56.40 | 521.10 | 100.90 |
| 28(3) | 43.60 | 86.70 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 457.70 | 102.20 |
| 29(1) | 43.60 | 86.70 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 457.70 | 102.20 |
| 29(2) | 36.70 | 73.00 | 37.90 | 68.20 | -28.00 | 122.70 | -26.90 | 33.80 | 372.30 | 92.70 |
| 29(3) | 27.10 | 54.00 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 269.50 | 72.50 |
| 30(1) | 27.10 | 54.00 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 269.50 | 72.50 |
| 30(2) | 14.90 | 29.60 | 15.40 | 25.70 | -9.30 | 45.70 | -9.00 | 11.30 | 142.60 | 41.60 |
| 30(3) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

5.43

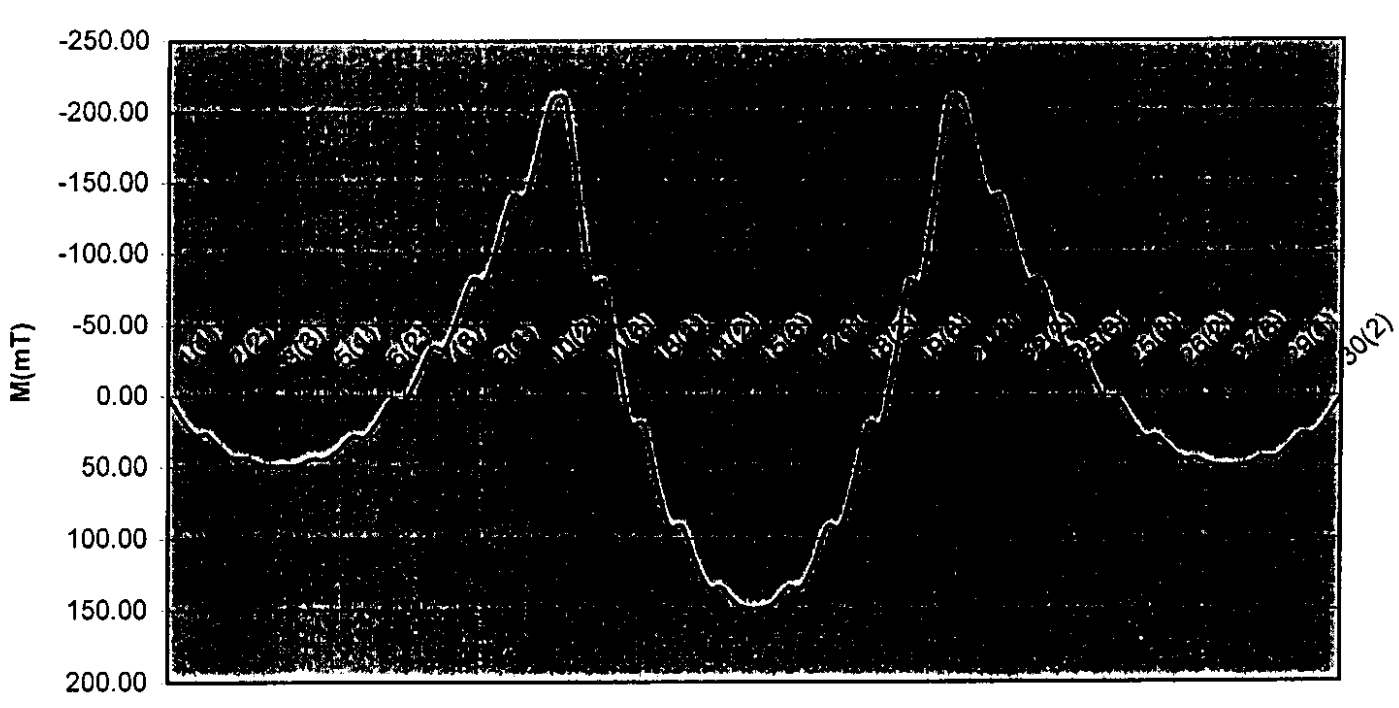
*ESFUERZOS SOBRE ESTRUCTURA IDEAL*

| BARRA | p vigas tin | pp losa tinf | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | suma + | suma - |
|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | -209.10 | -415.80 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | -567.40 | -1268.20 |
| 11(2) | -141.20 | -280.80 | -145.70 | 18.40 | -173.10 | 22.50 | -121.60 | 225.50 | -301.30 | -862.40 |
| 11(3) | -80.40 | -160.00 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | -17.50 | -515.60 |
| 12(1) | -80.40 | -160.00 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | -17.50 | -515.60 |
| 12(2) | -26.80 | -53.30 | -27.70 | 41.90 | -71.30 | 97.20 | -73.00 | 225.50 | 256.80 | -252.10 |
| 12(3) | 19.60 | 39.10 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 513.10 | -36.80 |
| 13(1) | 19.60 | 39.10 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 513.10 | -36.80 |
| 13(2) | 59.00 | 117.30 | 60.80 | 107.10 | -42.50 | 175.60 | -61.10 | 225.50 | 745.30 | 133.50 |
| 13(3) | 91.10 | 181.20 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 942.70 | 268.70 |
| 14(1) | 91.10 | 181.20 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 942.70 | 268.70 |
| 14(2) | 116.10 | 231.00 | 119.80 | 169.70 | -42.50 | 235.00 | -49.20 | 225.50 | 1097.10 | 375.20 |
| 14(3) | 134.00 | 266.50 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 1208.70 | 453.10 |
| 15(1) | 134.00 | 266.50 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 1208.70 | 453.10 |
| 15(2) | 144.70 | 287.90 | 149.30 | 201.00 | -42.50 | 266.70 | -37.20 | 225.50 | 1275.10 | 502.20 |
| 15(3) | 148.30 | 295.00 | 153.00 | 204.90 | -42.50 | 271.20 | -31.30 | 225.50 | 1297.90 | 522.50 |
| 16(1) | 148.30 | 295.00 | 153.00 | 204.90 | -42.50 | 271.20 | -31.30 | 225.50 | 1297.90 | 522.50 |
| 16(2) | 144.70 | 287.90 | 149.30 | 201.00 | -42.50 | 266.70 | -37.20 | 225.50 | 1275.10 | 502.20 |
| 16(3) | 134.00 | 266.50 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 1208.70 | 453.10 |
| 17(1) | 134.00 | 266.50 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 1208.70 | 453.10 |
| 17(2) | 116.10 | 231.00 | 119.80 | 169.70 | -42.50 | 235.00 | -49.20 | 225.50 | 1097.10 | 375.20 |
| 17(3) | 91.10 | 181.20 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 942.70 | 268.70 |
| 18(1) | 91.10 | 181.20 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 942.70 | 268.70 |
| 18(2) | 59.00 | 117.30 | 60.80 | 107.10 | -42.50 | 175.60 | -61.10 | 225.50 | 745.30 | 133.50 |
| 18(3) | 19.60 | 39.10 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 513.10 | -36.80 |
| 19(1) | 19.60 | 39.10 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 513.10 | -36.80 |
| 19(2) | -26.80 | -53.30 | -27.70 | 41.90 | -71.30 | 97.20 | -73.00 | 225.50 | 256.80 | -252.10 |
| 19(3) | -80.40 | -160.00 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | -17.50 | -515.60 |
| 20(1) | -80.40 | -160.00 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | -17.50 | -515.60 |
| 20(2) | -141.20 | -280.80 | -145.70 | 18.40 | -173.10 | 22.50 | -121.60 | 225.50 | -301.30 | -862.40 |
| 20(3) | -209.10 | -415.80 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | -567.40 | -1268.20 |

pp losa tinf

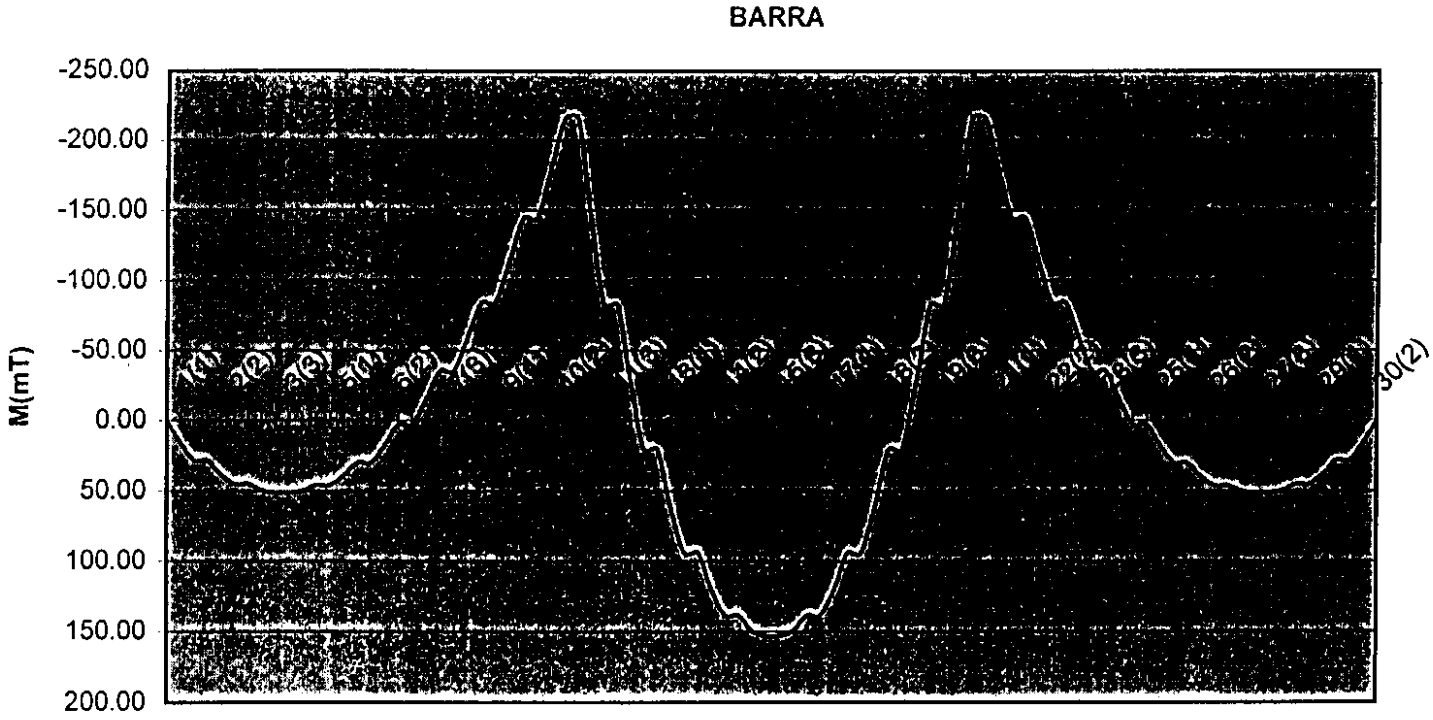



pp vigas tinf

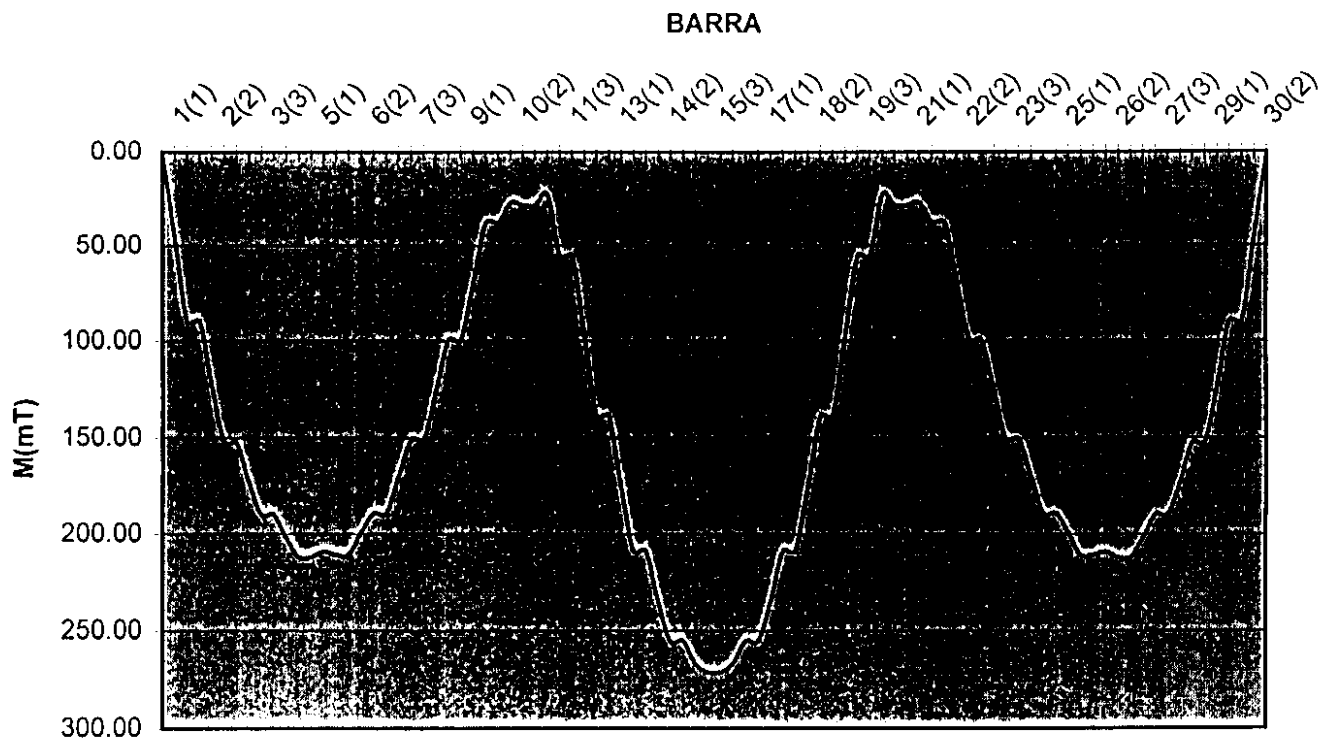


scu(pos)
BARRA
1(1) 2(2) 3(3) 5(1) 6(2) 7(3) 9(1) 10(2) 11(3) 13(1) 14(2) 15(3) 17(1) 18(2) 19(3) 21(1) 22(2) 23(3) 25(1) 26(2) 27(3) 29(1) 30(2)
0.00
50.00
100.00
150.00
200.00
250.00
M(mT)

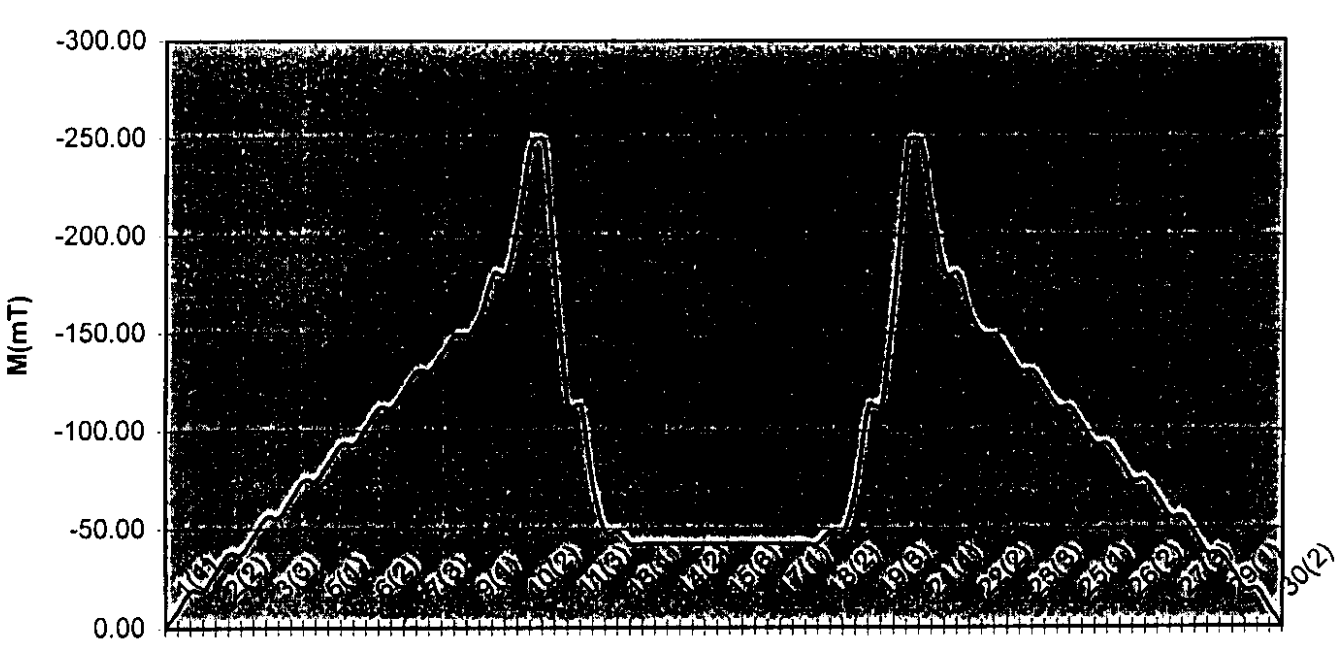
cm


BARRA
-250.00
-200.00
-150.00
-100.00
-50.00
0.00
50.00
100.00
150.00
200.00
M(mT)
30(2)

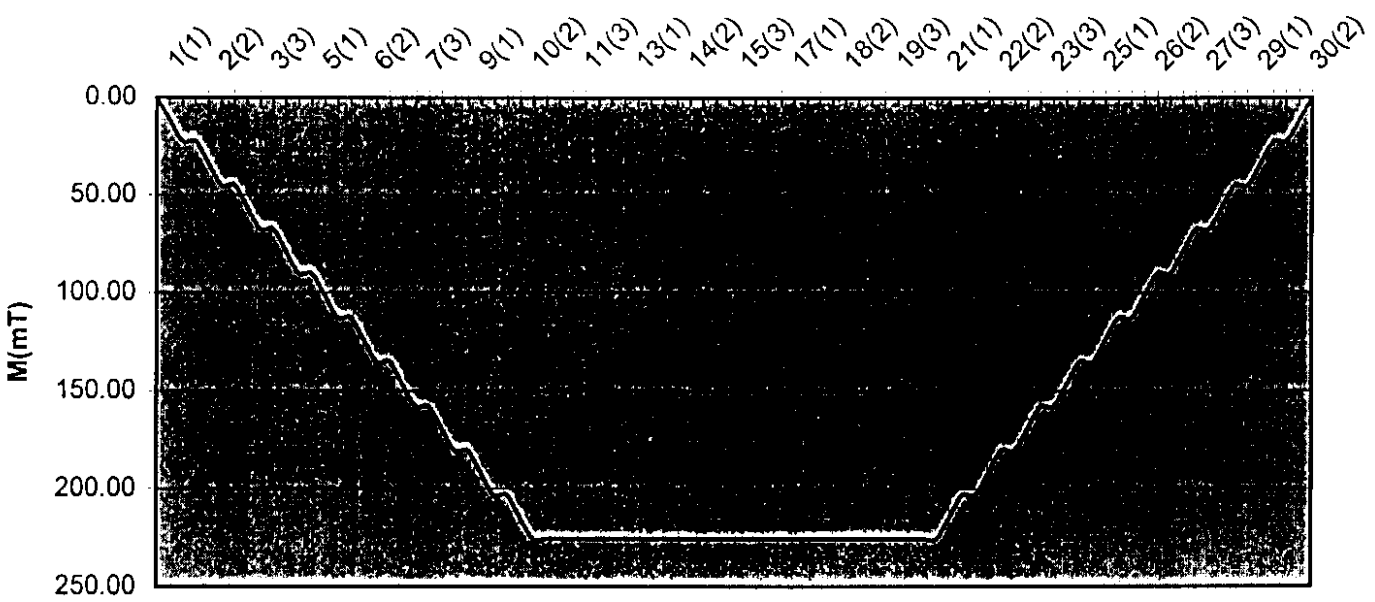
vp(pos)



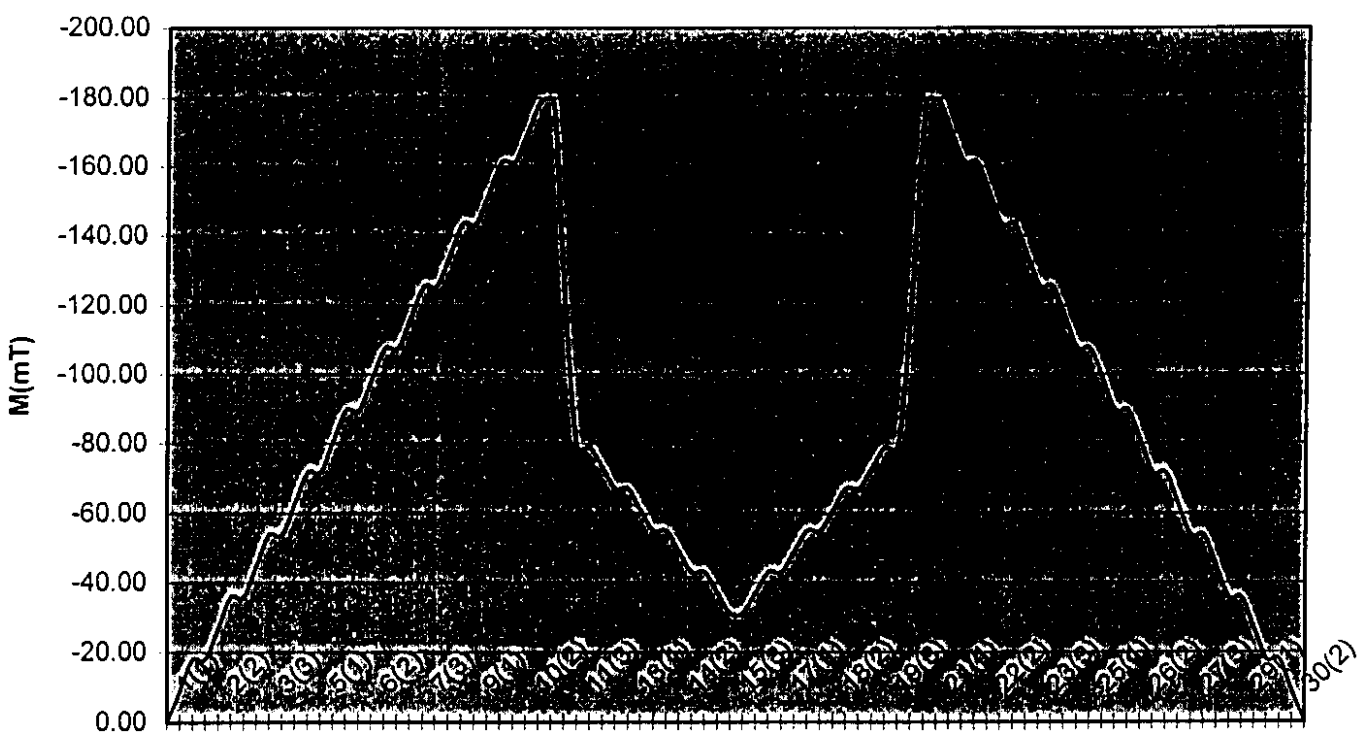

scu(neg)



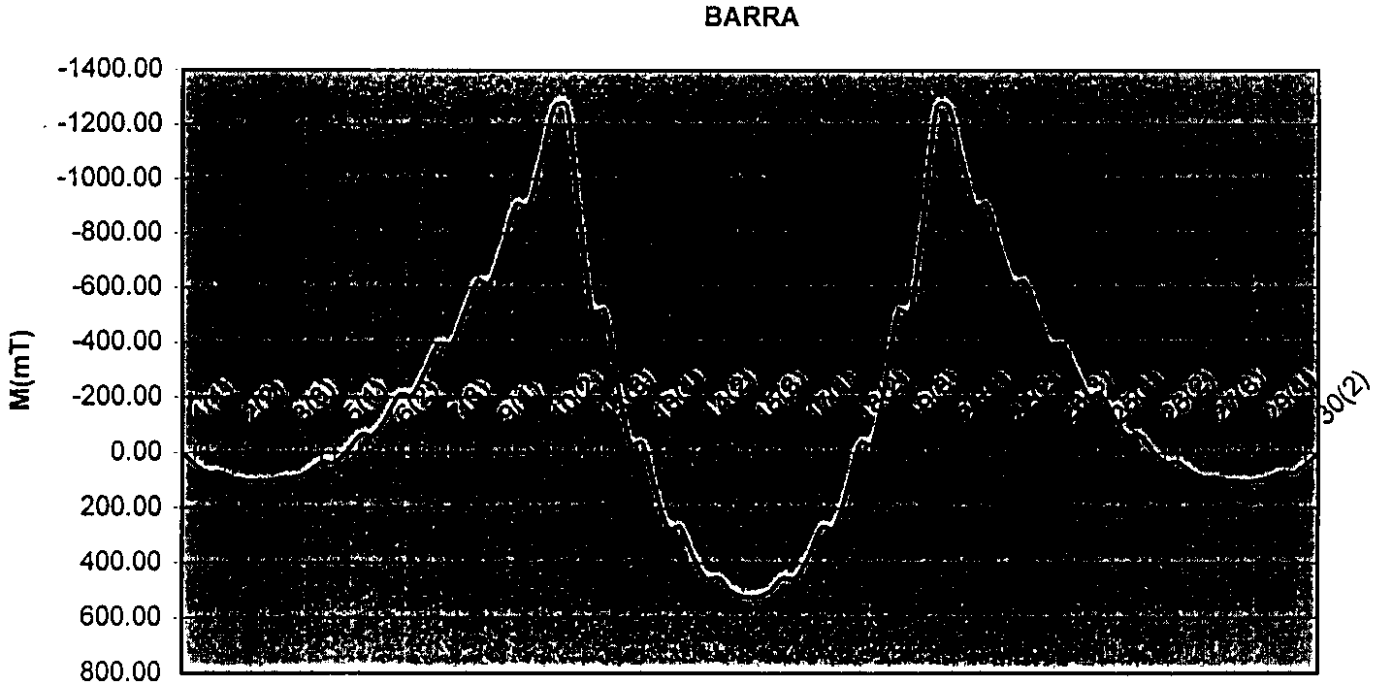
gradiente



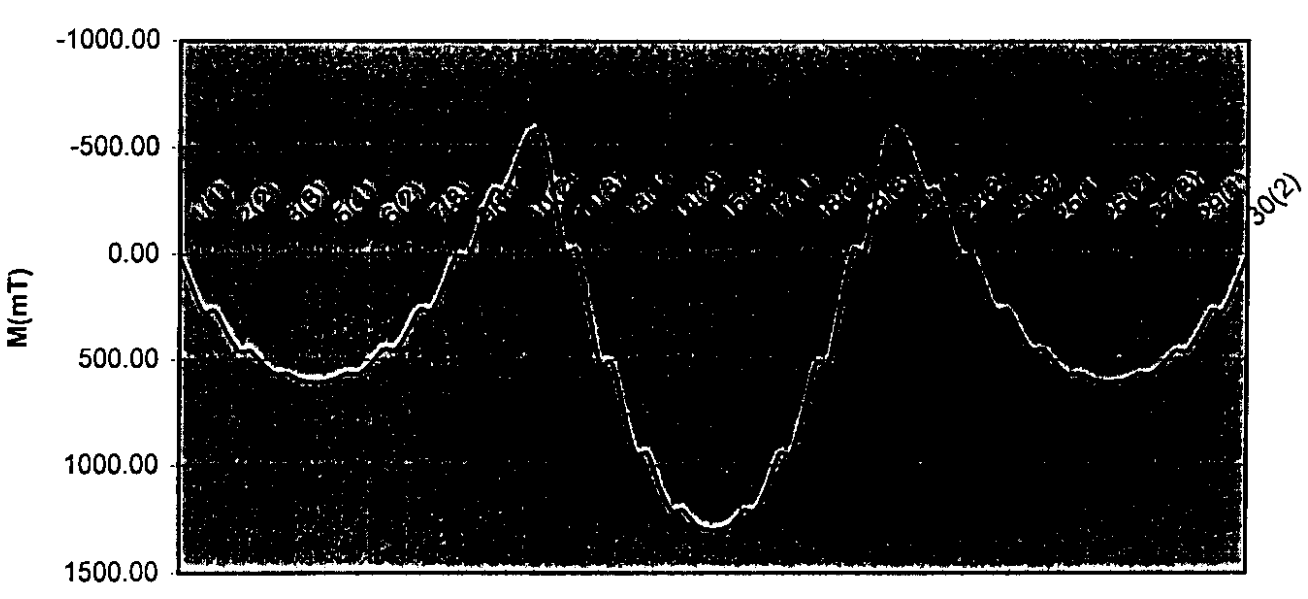

vp(neg)



suma -




suma +




195

## 7.2. Desmontaje de la estructura

Se calculan con el programa 'BARRA' los esfuerzos producidos en cada fase de montaje de la estructura, asignando a cada barra las características mecánicas correspondientes y a los nudos sus vinculaciones reales (continuidad o no sobre pilas).

Fases de montaje.

FASE 1: Colocación de vigas

FASE 2: Colocación de prelosas

FASE 3: Hormigonado de BC de losa en centro de vanos.

FASE 4: Cosido de juntas y hormigonado de mampara. No produce esfuerzos

FASE 5: Hormigonado de resto de BC de losa

FASE 6: Hormigonado de voladizos



## 7.3. Cálculo de las hiperestáticas de pretensado

Sobre el modelo de estructura ideal (o completa a $t=\infty$) se introduce la definición de cables de pretensado de las vigas y se obtienen los esfuerzos hiperestáticos correspondientes.

## 7.4. Cálculo de las redistribuciones por fluencia

Se dividen a su vez en dos tipos:

- redistribuciones de cargas exteriores
- redistribuciones del hiperestático de pretensado

La situación final será:

$$S_{final} = 0{,}85 \times S_{t\infty} + 0{,}15 \times S_{t0} + \text{Pérdidas} = S_{t0} + \text{Redistribuciones} + \text{Pérdidas}$$

por lo que las redistribuciones serán:

$$\underline{\text{Redistribuciones}} = 0{,}85 \times (S_{t\infty} - S_{t0})$$

### 7.4.1. Redistribuciones por cargas exteriores

$$\underline{R_{ext}} = 0{,}85 \times \left(\text{p.p.viga}_{t=\inf} + \text{p.p.losa}_{t=\inf}\right) - 0{,}85 \times (\text{Fase 1} + \text{Fase 2} + \text{Fase 4} + \text{Fase 5} + \text{Fase 6})$$

### 7.4.2 Redistribuciones del hiperestático de pretensado

$$R_{Hpret} = 0{,}85 \times \left(\text{Hip.pret}_{t=\inf}\right)$$ ya que para $t=0$, $\text{Hip}_{pret} = 0$.

**ESFUERZOS LONGITUDINALES**

| BARR | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Hip.pret. | Red.ppviga | Redpptosa | Redpret+perd | Red.total | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | BARR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1(1) |
| 1(2) | 25.40 | 9.70 | 32.10 | -3.00 | 4.30 | 52.80 | -8.93 | -11.48 | 32.74 | 12.34 | 15.40 | 25.70 | -9.30 | 45.70 | -9.00 | 11.30 | 1(2) |
| 1(3) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | 105.60 | -17.85 | -22.87 | 65.47 | 24.76 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 1(3) |
| 2(1) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | 105.60 | -17.85 | -22.87 | 65.47 | 24.76 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 2(1) |
| 2(2) | 68.10 | 26.00 | 85.70 | -9.00 | 10.50 | 158.50 | -26.69 | -34.17 | 98.27 | 37.41 | 37.90 | 68.20 | -28.00 | 122.70 | -26.90 | 33.80 | 2(2) |
| 2(3) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | 211.30 | -35.53 | -45.65 | 131.01 | 49.83 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 2(3) |
| 3(1) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | 211.30 | -35.53 | -45.65 | 131.01 | 49.83 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 3(1) |
| 3(2) | 100.10 | 38.30 | 125.20 | -15.00 | 13.80 | 264.10 | -44.46 | -57.12 | 163.74 | 62.17 | 49.40 | 99.00 | -46.60 | 173.40 | -44.80 | 56.40 | 3(2) |
| 3(3) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | 316.90 | -53.30 | -68.51 | 196.48 | 74.67 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 3(3) |
| 4(1) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | 316.90 | -53.30 | -68.51 | 196.48 | 74.67 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 4(1) |
| 4(2) | 121.50 | 46.40 | 150.60 | -21.00 | 13.90 | 369.80 | -62.22 | -79.82 | 229.28 | 87.24 | 49.80 | 118.20 | -65.30 | 201.90 | -62.70 | 78.90 | 4(2) |
| 4(3) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | 422.60 | -71.06 | -91.29 | 262.01 | 99.66 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 4(3) |
| 5(1) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | 422.60 | -71.06 | -91.29 | 262.01 | 99.66 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 5(1) |
| 5(2) | 132.10 | 50.50 | 161.90 | -27.00 | 11.00 | 475.40 | -79.90 | -102.60 | 294.75 | 112.25 | 39.30 | 125.60 | -83.90 | 209.00 | -80.70 | 101.50 | 5(2) |
| 5(3) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | 528.20 | -88.91 | -113.99 | 327.48 | 124.59 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 5(3) |
| 6(1) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | 528.20 | -88.91 | -113.99 | 327.48 | 124.59 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 6(1) |
| 6(2) | 132.10 | 50.50 | 159.10 | -33.00 | 5.10 | 581.10 | -97.75 | -125.46 | 360.28 | 137.07 | 17.70 | 121.40 | -102.60 | 198.90 | -98.60 | 124.00 | 6(2) |
| 6(3) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | 633.90 | -106.59 | -136.94 | 393.02 | 149.49 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 6(3) |
| 7(1) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | 633.90 | -106.59 | -136.94 | 393.02 | 149.49 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 7(1) |
| 7(2) | 121.50 | 46.40 | 142.10 | -39.00 | -3.80 | 686.70 | -115.52 | -148.24 | 425.75 | 162.00 | -14.90 | 105.40 | -121.20 | 170.20 | -116.50 | 146.60 | 7(2) |
| 7(3) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | 739.50 | -124.36 | -159.72 | 458.49 | 174.42 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 7(3) |
| 8(1) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | 739.50 | -124.36 | -159.72 | 458.49 | 174.42 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 8(1) |
| 8(2) | 100.10 | 38.30 | 111.10 | -45.00 | -15.90 | 792.30 | -133.28 | -171.11 | 491.23 | 186.84 | -58.50 | 77.80 | -139.90 | 125.70 | -134.40 | 169.10 | 8(2) |
| 8(3) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | 845.20 | -142.12 | -182.50 | 524.02 | 199.41 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 8(3) |
| 9(1) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | 845.20 | -142.12 | -182.50 | 524.02 | 199.41 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 9(1) |
| 9(2) | 68.10 | 26.00 | 67.70 | -52.80 | -30.90 | 898.00 | -151.05 | -193.89 | 556.76 | 211.83 | -113.10 | 39.80 | -159.90 | 69.10 | -152.40 | 191.60 | 9(2) |
| 9(3) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | 950.80 | -159.97 | -205.28 | 589.50 | 224.25 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | 9(3) |
| 10(1) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | 950.80 | -159.97 | -205.28 | 589.50 | 224.25 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | 10(1) |
| 10(2) | 25.40 | 9.70 | 22.60 | -72.90 | -49.00 | 1003.60 | -168.90 | -216.75 | 622.23 | 236.59 | -178.80 | 20.30 | -210.10 | 27.00 | -170.30 | 214.20 | 10(2) |
| 10(3) | 0.00 | 0.00 | -88.30 | -59.20 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | 10(3) |

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 7.19

7.4.3. Cálculo de pérdidas de pretensado

- instantáneas = 7 %
- diferidas = 20 %

27 % Total

La redistribución del hiperestático de pretensado + pérdidas será finalmente.

$$R_{H\,pret+perd} = 0{,}85 \times (0{,}93 \times Hip_{pret\,1.inf} - 0{,}20 \times Hip_{pret\,1.inf}) =$$

$$= 0{,}62 \times Hip.pret_{1.inf}$$

***ESFUERZOS LONGITUDINALES***

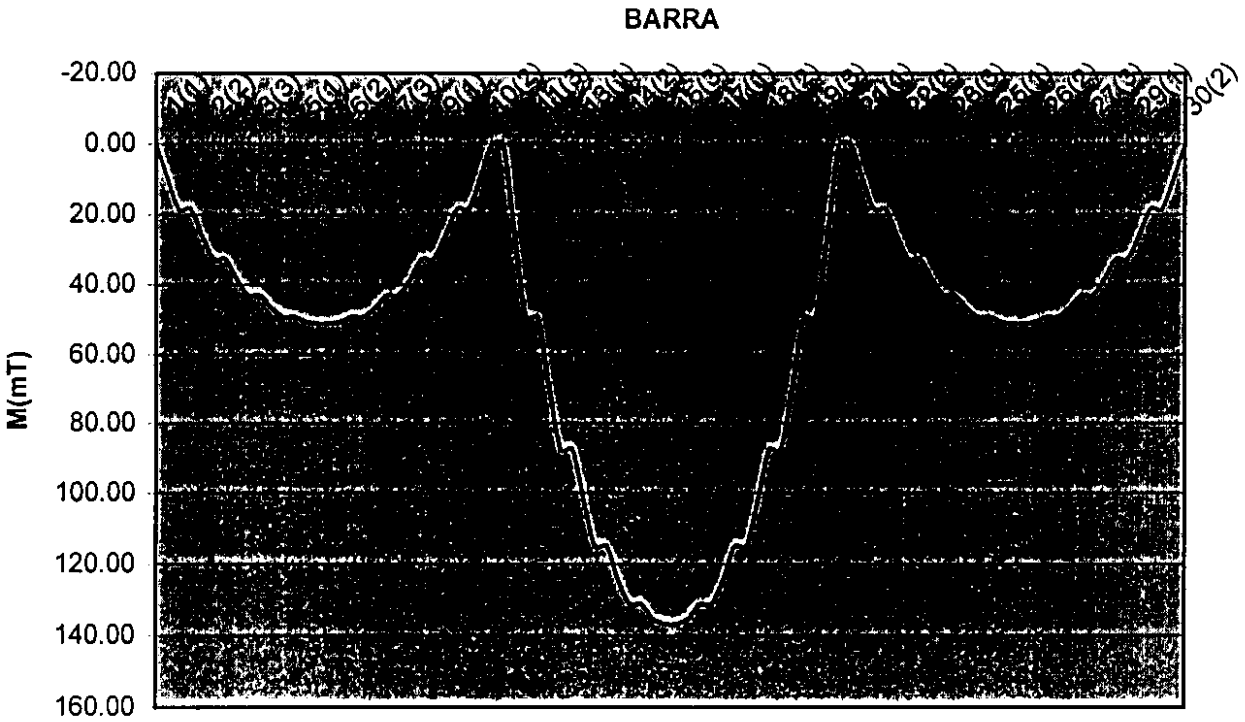
| BARR | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Hip.pret. | Red.ppviga | Redpplosa | Redpret+perd | Red.total | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | BARR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 0.00 | 0.00 | 0.00 | -88.30 | -59.20 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | 21(1) |
| 21(2) | 25.40 | 9.70 | 22.60 | -72.90 | -49.00 | 1003.60 | -168.90 | -216.75 | 622.23 | 236.59 | -178.80 | 20.30 | -210.10 | 27.00 | -170.30 | 214.20 | 21(2) |
| 21(3) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | 950.80 | -159.97 | -205.28 | 589.50 | 224.25 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | 21(3) |
| 22(1) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | 950.80 | -159.97 | -205.28 | 589.50 | 224.25 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 202.90 | 22(1) |
| 22(2) | 68.10 | 26.00 | 67.70 | -52.80 | -30.90 | 898.00 | -151.05 | -193.89 | 556.76 | 211.83 | -113.10 | 39.80 | -159.90 | 69.10 | -152.40 | 191.60 | 22(2) |
| 22(3) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | 845.20 | -142.12 | -182.50 | 524.02 | 199.41 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 22(3) |
| 23(1) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | 845.20 | -142.12 | -182.50 | 524.02 | 199.41 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 180.40 | 23(1) |
| 23(2) | 100.10 | 38.30 | 111.10 | -45.00 | -15.90 | 792.30 | -133.28 | -171.11 | 491.23 | 186.84 | -58.50 | 77.80 | -139.90 | 125.70 | -134.40 | 169.10 | 23(2) |
| 23(3) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | 739.50 | -124.36 | -159.72 | 458.49 | 174.42 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 23(3) |
| 24(1) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | 739.50 | -124.36 | -159.72 | 458.49 | 174.42 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 157.80 | 24(1) |
| 24(2) | 121.50 | 46.40 | 142.10 | -39.00 | -3.80 | 686.70 | -115.52 | -148.24 | 425.75 | 162.00 | -14.90 | 105.40 | -121.20 | 170.20 | -116.50 | 146.60 | 24(2) |
| 24(3) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | 633.90 | -106.59 | -136.94 | 393.02 | 149.49 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 24(3) |
| 25(1) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | 633.90 | -106.59 | -136.94 | 393.02 | 149.49 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 135.30 | 25(1) |
| 25(2) | 132.10 | 50.50 | 159.10 | -33.00 | 5.10 | 581.10 | -97.75 | -125.46 | 360.28 | 137.07 | 17.70 | 121.40 | -102.60 | 198.90 | -98.60 | 124.00 | 25(2) |
| 25(3) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | 528.20 | -88.91 | -113.99 | 327.48 | 124.59 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 25(3) |
| 26(1) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | 528.20 | -88.91 | -113.99 | 327.48 | 124.59 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 112.70 | 26(1) |
| 26(2) | 132.10 | 50.50 | 161.90 | -27.00 | 11.00 | 475.40 | -79.90 | -102.60 | 294.75 | 112.25 | 39.30 | 125.60 | -83.90 | 209.00 | -80.70 | 101.50 | 26(2) |
| 26(3) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | 422.60 | -71.06 | -91.29 | 262.01 | 99.66 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 26(3) |
| 27(1) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | 422.60 | -71.06 | -91.29 | 262.01 | 99.66 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 90.20 | 27(1) |
| 27(2) | 121.50 | 46.40 | 150.60 | -21.00 | 13.90 | 369.80 | -62.22 | -79.82 | 229.28 | 87.24 | 49.80 | 118.20 | -65.30 | 201.90 | -62.70 | 78.90 | 27(2) |
| 27(3) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | 316.90 | -53.30 | -68.51 | 196.48 | 74.67 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 27(3) |
| 28(1) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | 316.90 | -53.30 | -68.51 | 196.48 | 74.67 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 67.60 | 28(1) |
| 28(2) | 100.10 | 38.30 | 125.20 | -15.00 | 13.80 | 264.10 | -44.46 | -57.12 | 163.74 | 62.17 | 49.40 | 99.00 | -46.60 | 173.40 | -44.80 | 56.40 | 28(2) |
| 28(3) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | 211.30 | -35.53 | -45.65 | 131.01 | 49.83 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 28(3) |
| 29(1) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | 211.30 | -35.53 | -45.65 | 131.01 | 49.83 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 45.10 | 29(1) |
| 29(2) | 68.10 | 26.00 | 85.70 | -9.00 | 10.50 | 158.50 | -26.69 | -34.17 | 98.27 | 37.41 | 37.90 | 68.20 | -28.00 | 122.70 | -26.90 | 33.80 | 29(2) |
| 29(3) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | 105.60 | -17.85 | -22.87 | 65.47 | 24.76 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 29(3) |
| 30(1) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | 105.60 | -17.85 | -22.87 | 65.47 | 24.76 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 22.50 | 30(1) |
| 30(2) | 25.40 | 9.70 | 32.10 | -3.00 | 4.30 | 52.80 | -8.93 | -11.48 | 32.74 | 12.34 | 15.40 | 25.70 | -9.30 | 45.70 | -9.00 | 11.30 | 30(2) |
| 30(3) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 30(3) |



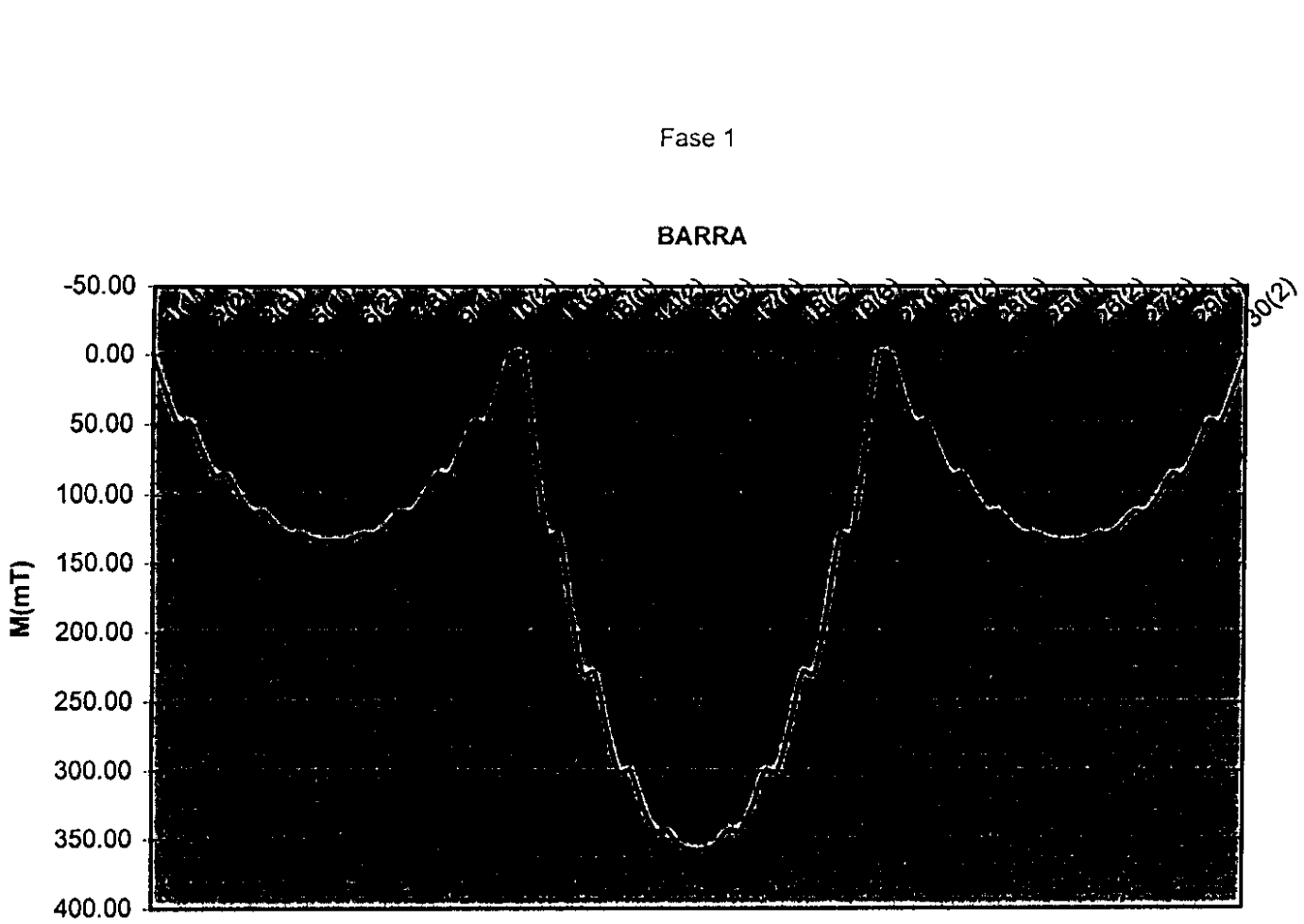
***ESFUERZOS LONGITUDINALES***

| BARR | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Hip.pret. | Red.ppviga | Redpplosa | Redpret+perd | Red.total | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | BARR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 0.00 | 0.00 | 0.00 | -88.30 | -59.20 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | 11(1) |
| 11(2) | 67.90 | 26.00 | 37.80 | -36.30 | -39.90 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | -145.70 | 18.40 | -173.10 | 22.50 | -121.60 | 225.50 | 11(2) |
| 11(3) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | 11(3) |
| 12(1) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | 12(1) |
| 12(2) | 182.30 | 69.70 | 113.30 | 39.20 | -7.20 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | -27.70 | 41.90 | -71.30 | 97.20 | -73.00 | 225.50 | 12(2) |
| 12(3) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 12(3) |
| 13(1) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 13(1) |
| 13(2) | 268.00 | 102.50 | 188.90 | 77.00 | 17.20 | 1056.50 | -177.65 | -228.06 | 655.03 | 249.33 | 60.80 | 107.10 | -42.50 | 175.60 | -61.10 | 225.50 | 13(2) |
| 13(3) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 13(3) |
| 14(1) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 14(1) |
| 14(2) | 325.20 | 124.40 | 259.70 | 81.70 | 33.60 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | 119.80 | 169.70 | -42.50 | 235.00 | -49.20 | 225.50 | 14(2) |
| 14(3) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 14(3) |
| 15(1) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 15(1) |
| 15(2) | 353.80 | 135.30 | 297.50 | 81.70 | 41.70 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 149.30 | 201.00 | -42.50 | 266.70 | -37.20 | 225.50 | 15(2) |
| 15(3) | 357.40 | 136.70 | 302.20 | 81.70 | 42.70 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 153.00 | 204.90 | -42.50 | 271.20 | -31.30 | 225.50 | 15(3) |
| 16(1) | 357.40 | 136.70 | 302.20 | 81.70 | 42.70 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 153.00 | 204.90 | -42.50 | 271.20 | -31.30 | 225.50 | 16(1) |
| 16(2) | 353.80 | 135.30 | 297.50 | 81.70 | 41.70 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 149.30 | 201.00 | -42.50 | 266.70 | -37.20 | 225.50 | 16(2) |
| 16(3) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 16(3) |
| 17(1) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 225.50 | 17(1) |
| 17(2) | 325.20 | 124.40 | 259.70 | 81.70 | 33.60 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | 119.80 | 169.70 | -42.50 | 235.00 | -49.20 | 225.50 | 17(2) |
| 17(3) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 17(3) |
| 18(1) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 225.50 | 18(1) |
| 18(2) | 268.00 | 102.50 | 188.90 | 77.00 | 17.20 | 1056.50 | -177.65 | -228.06 | 655.03 | 249.33 | 60.80 | 107.10 | -42.50 | 175.60 | -61.10 | 225.50 | 18(2) |
| 18(3) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 18(3) |
| 19(1) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 225.50 | 19(1) |
| 19(2) | 182.30 | 69.70 | 113.30 | 39.20 | -7.20 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | -27.70 | 41.90 | -71.30 | 97.20 | -73.00 | 225.50 | 19(2) |
| 19(3) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | 19(3) |
| 20(1) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 225.50 | 20(1) |
| 20(2) | 67.90 | 26.00 | 37.80 | -36.30 | -39.90 | 1056.50 | -177.74 | -228.14 | 655.03 | 249.16 | -145.70 | 18.40 | -173.10 | 22.50 | -121.60 | 225.50 | 20(2) |
| 20(3) | 0.00 | 0.00 | 0.00 | -88.30 | -59.20 | 1056.50 | -177.74 | -228.06 | 655.03 | 249.24 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 225.50 | 20(3) |

Fase 2

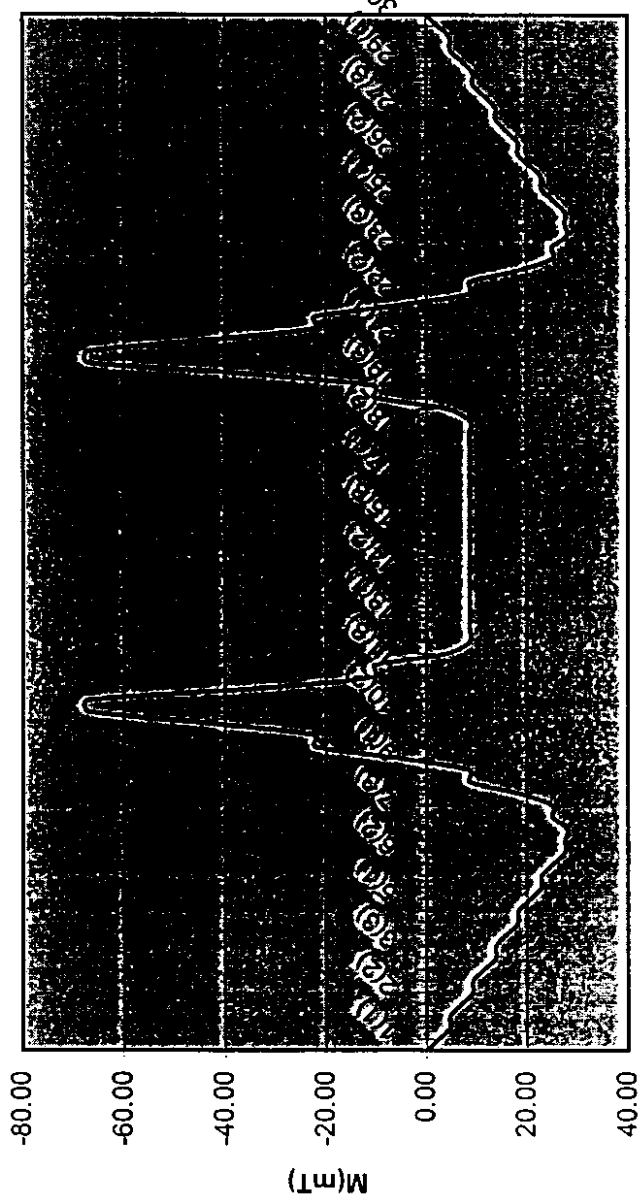

BARRA
M(mT)
-20.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
30(2)

Fase 1


BARRA
M(mT)
-50.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
30(2)

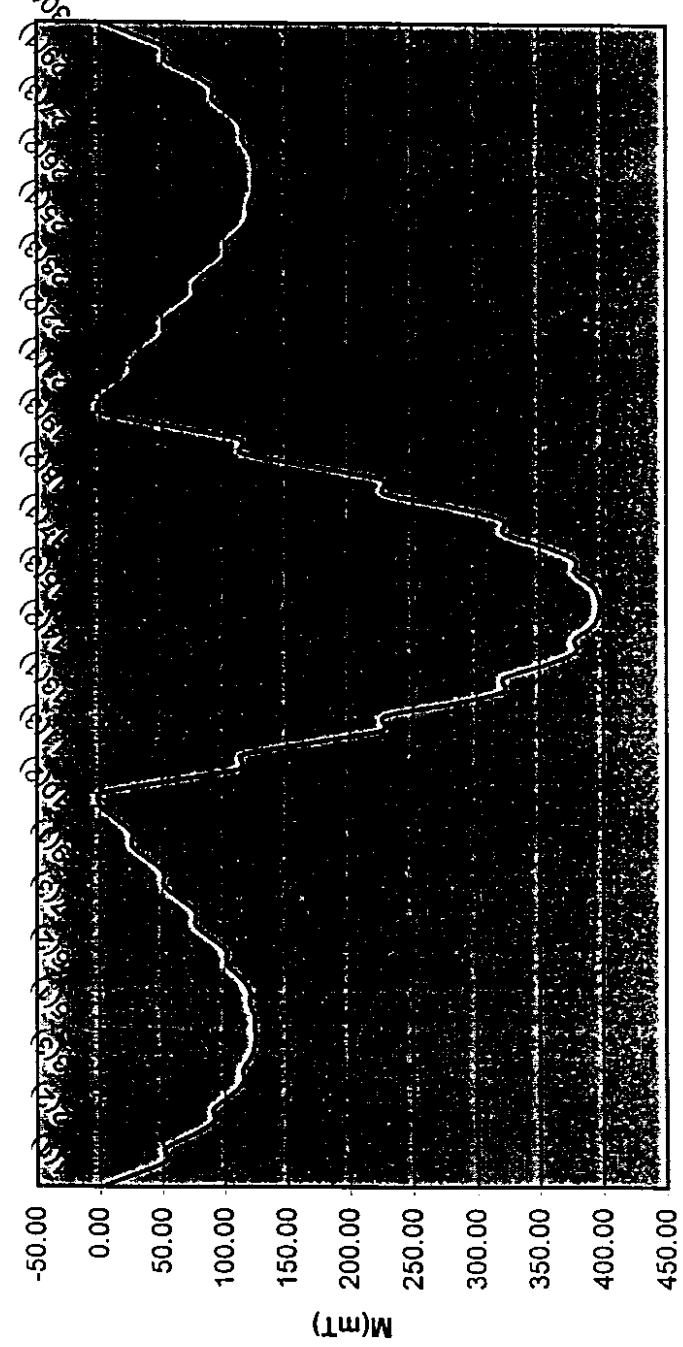
Fase 5

BARRA

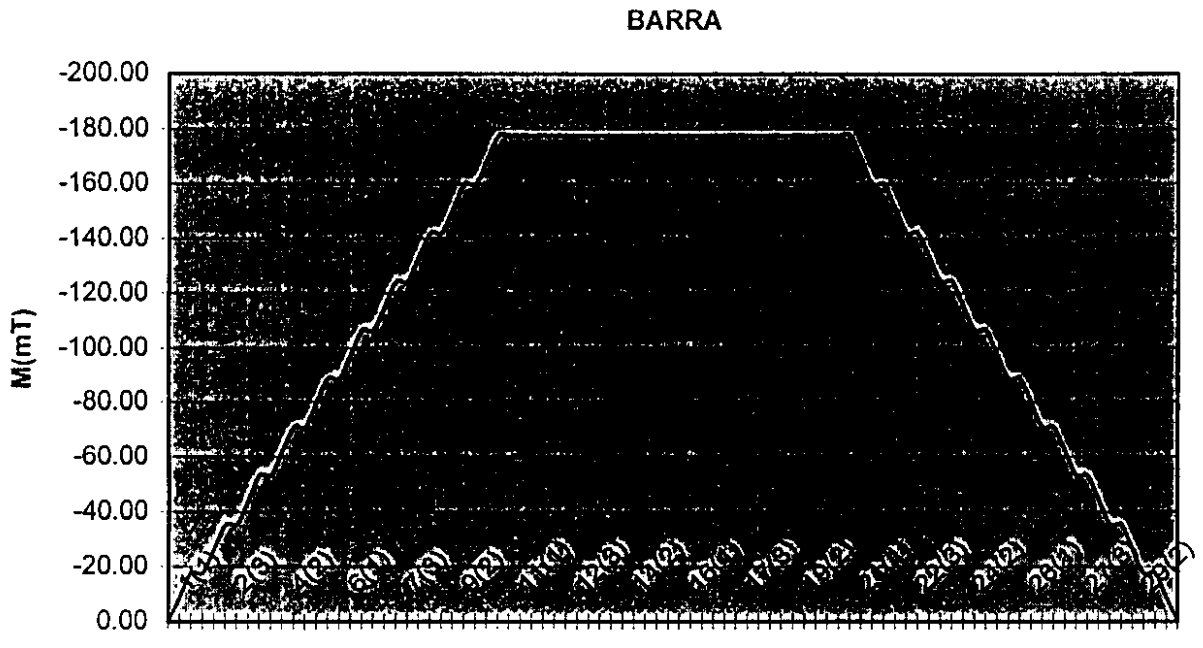



Fase 3

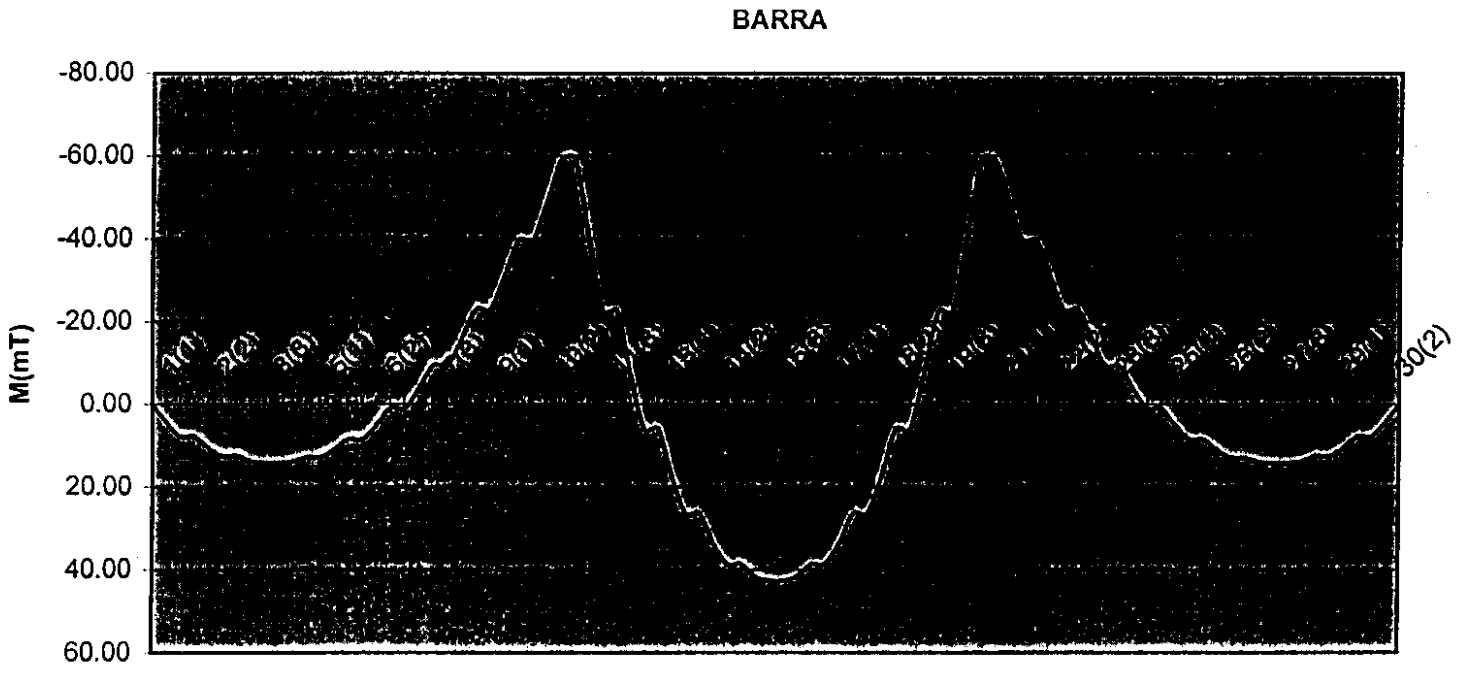
BARRA



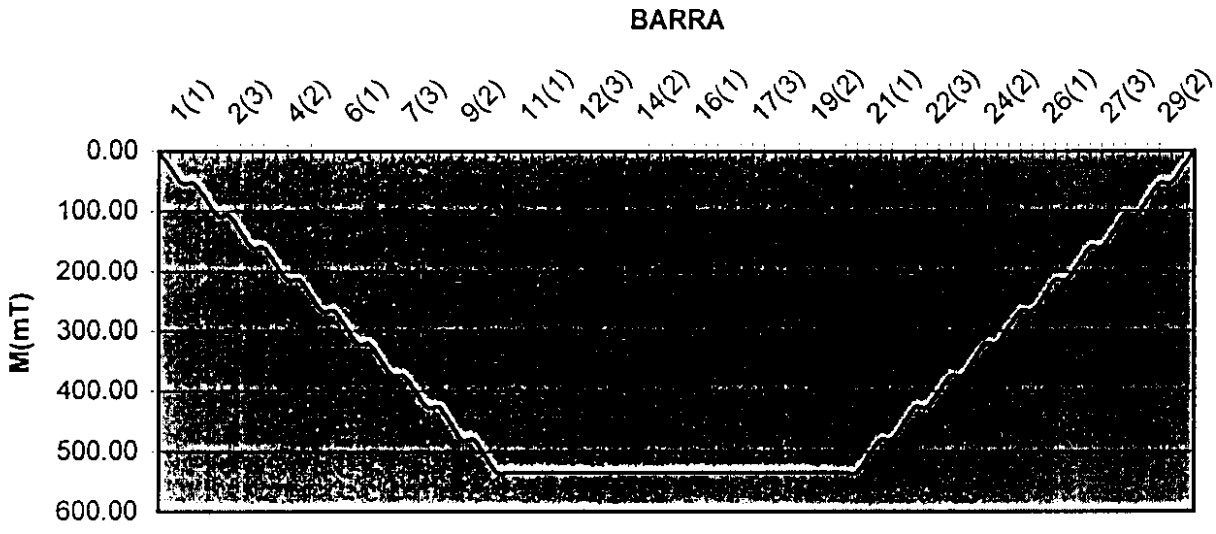
Redistr.p.p.viga



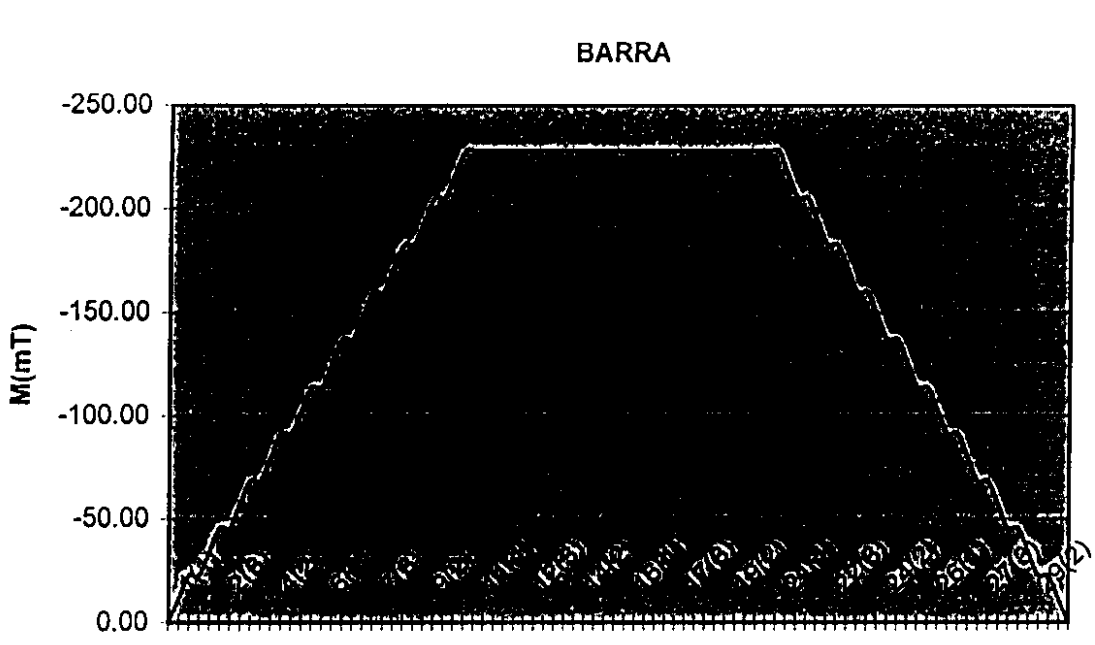

Fase 6



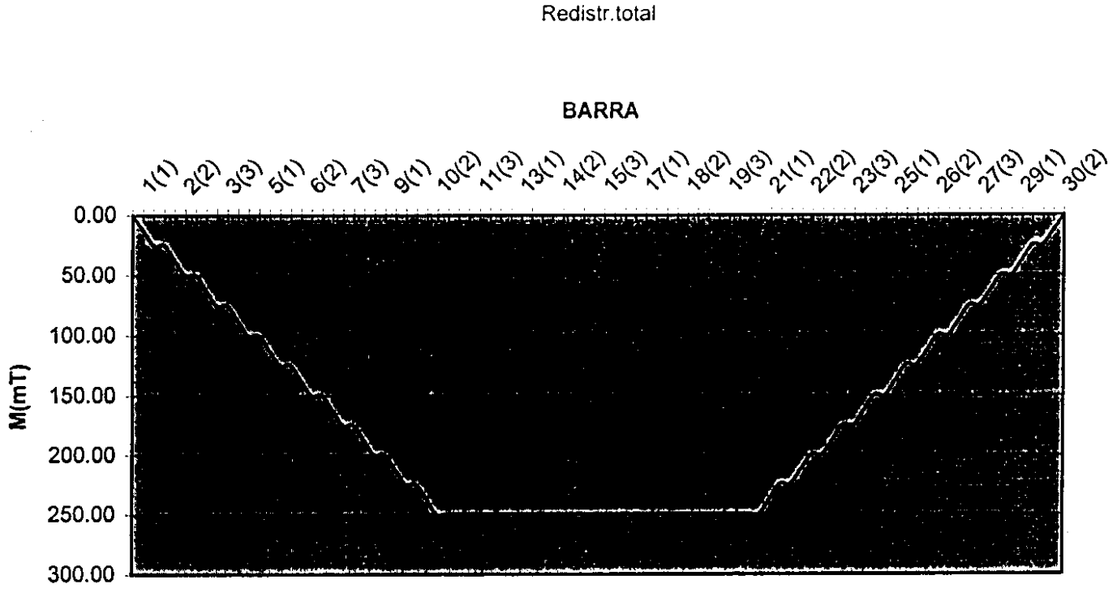
Redistr.pretensado+perdidas




Redistr.p.p.losa



# 8.CONTROL EN SERVICIO



# 8. CONTROL EN SERVICIO

## 8.1 ESTADOS TENSIONALES (Según IAP-98)

### i) Coeficientes de combinación de acciones variables

- Acciones aisladas : $Q_K$
- Acciones combinadas :

$\psi_0 \cdot Q_K$ valor de combinación

$\psi_1 \cdot Q_K$ valor frecuente

$\psi_2 \cdot Q_K$ valor casi-permanente

| $\psi_0$ | $\psi_1$ | $\psi_2$ |
|---|---|---|
| 0.60 | 0.50 | 0.20 |

- Acciones accidentales : no afectan al tablero (tuna sin sismo)

### ii) Coeficientes de seguridad de acciones $\gamma_f$

| TIPO DE ACCIÓN | $\gamma_{FAV}$ | $\gamma_{DESFAV}$ |
|---|---|---|
| P.P. VIGAS | 1,00 | 1,00 |
| RP. LOSA | 1,00 | 1,00 |
| C.M. | 1,00 | 1,00 |
| S.C.U. | 0,00 | 1,00 |
| V.P. | 0,00 | 1,00 |
| GRADIENTE | 0,00 | 1,00 |
| REDISTRIBUCIONES POR FLUENCIA | 1,00 | 1,00 |
| PRETENSADO DE VIGAS | 0,95 | 1,05 |



### iii) Combinaciones de acciones

- Combinación característica

$$\sum \gamma_{Gi} G_{Ki} + \sum \gamma^*_{Gi} \cdot G^*_{Ki} + \gamma_{Q,1} \cdot Q_{K,1} + \sum \gamma_{Q,i} \cdot \psi_{0,i} \cdot Q_{K,i}$$

- Combinación frecuente

$$\sum \gamma_{Gi} \cdot G_{K,i} + \sum \gamma^*_{Gi} \cdot G^*_{Ki} + \gamma_{Q,1} \cdot \psi_{1,1} \cdot Q_{K,1} + \sum \gamma_{Q,i} \cdot \psi_{2,i} \cdot Q_{K,i}$$

- Combinación casi-permanente

$$\sum \gamma_{Gi} \cdot G_{K,i} + \sum \gamma^*_{Gi} G_{K,i} + \sum \gamma_{Q,i} \cdot \psi_{2,i} \cdot Q_{K,i}$$

Lo que se traduce en las siguientes combinaciones :

Combinación de acciones a $T = 0$

- Montaje de la estructura :
- Tras colocar vigas :

0.95 x PRETTO + FASE1

- Tras colocar pretesar

0,95 x PRETTO + FASE1 + FASE2

- Tras hormigonar BC losa en CDV

0,95 x PRETTO + FASE1 + FASE2 + FASE3

- Tras ejecución de riostras y cosir vigas

Este estado se analiza expresamente en el cap.

- Tras hormigonado resto de BC losa

0,95 x PRETTO + FASE1 + FASE2 + FASE3 + FASE5

- Tras retracción de losa

0,95 x PRETTO + FASE1 + FASE2 + FASE3 + FASE5 + FASE6

- Tras carga muerta (CPTO)

0,95x PRETTO + FASE1 + FAJE2 + FASE3 + FASE5 + FASE6 + CM

- Combinación cuasipermanente:

CPTO + 0.20x (SCUPOS + VPPOS + GRADIENTE)

CPTO + 0,20 x (SCUNEG + VPNEG)

- Combinación frecuente

CPTO + 0,50 x (SCUPOS + VPPOS) + 0.10 x GRADIENTE

CPTO + 0.20 x (SCUPOS + VPPOS) + 0.50 x GRADIENTE

CPTO + 0.50 x (SCUNEG + VPNEG)

- Combinación característica

CPTO + 1,0x (SCUPOS + VPPOS) + 0.6 x GRADIENTE

CPTO + 0.6 x (SCUPOS + VPPOS) + 1,0 x GRADIENTE

CPTO + 1,0 x (SCUNEG + VPNEG)

Combinación de acciones a T = INF

- Carga permanente a t = INF (CPTINF)

CPTO + REDISTRIBUCIONES + RETRACCION

- Combinación cuasipermanente

CPTINF + 0.20 x (SCUPOS + VPPOS + GRADIENTE)

CPTINF + 0.20 x (SCUNEG + VPNEG)

- Combinación frecuente

CPTINF + 0.20x (SCUPOS + VPPOS) + 0.50 x GRADIENTE

CPTINF + 0.50x (SCUPOS + VPPOS) + 0.20 x GRADIENTE

CPTINF + 0.50x (SCUNEG + VPNEG)



- Combinación característica

CPTINF + 1,0x (SCUPOS + VPPOS) + 0.60x GRADIENTE

CPTINF + 0.60 x (SCUPOS + VPPOS) + 1,0x GRADIENTE

CPTINF + 1,0 x (SCUNEG + VPNEG)

8.1.1 Calculo tensional

Se realiza con el método de la sección ideal basado en la homogeneización de la sección al hormigón de la viga y el empleo de los coeficientes (0), (1) y (2) para la evaluación de las redistribuciones de tensiones entre viga, losa y armaduras, a nivel seccional.

(véase cap. III. "Construcción Mixta", J.M. Calzón)

$$\sigma_{iL} = \frac{1}{n_L^{(a)}} \times \left[ \frac{1}{A_R^{(a)}} + \frac{(x_i - x_{GR}^{(a)}) \cdot M_{GR}^{(a)}}{I_R^{(a)}} \right] \quad \text{fibra i de la losa}$$

$$\sigma_{iV} = \frac{1}{A_R^{(a)}} + \frac{(x_i - x_{GR}^{(a)}) \cdot M_{GR}^{(a)}}{I_R^{(a)}}$$

(a): coeficientes (0), (1) ó (2) según el tipo de carga y el instante "t" de estudio (t=0, t=inf)

En el cálculo de las redistribuciones por retracción se empleó el método simplificado expuesto en el cap. III.3.2. del citado texto.

Todo el cálculo tensional así como la obtención de los coeficientes estáticos se realiza con el programa "CSEC".

8.1.1. Constantes estáticas evolutivas

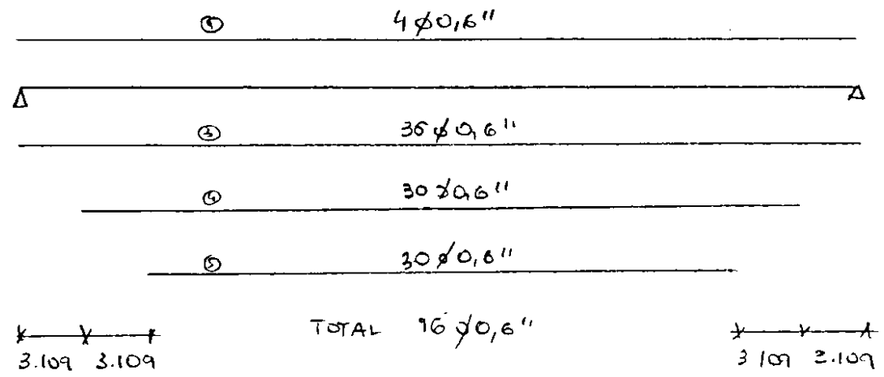
**CONSTANTES ESTÁTICAS EVOLUTIVAS**

| | | 1/AREA con momentos en m*T y tensiones en kp/cm² | | | | MODULOS RESISTENTES W¹ con momentos en m*T y tensiones en kp/cm² | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Fibras | | | | Fibras | | | |
| Nº Sec. | Sec. parcial | 1/Asupiosa | 1/Ainfiosa | 1/Asupcajón | 1/Ainfcajón | 1/Wsupiosa | 1/Winfiosa | 1/Wsupcajón | 1/Winfcajón | "Cte" |
| 1 | CA | 0 | 0 | 8.30E-02 | 8.30E-02 | 0 | 0 | -4.30E-01 | 2.28E-01 | 0 |
| 2 | CME | 0 | 0 | 3.75E-02 | 3.75E-02 | 0 | 0 | -3.63E-01 | 2.01E-01 | 0 |
| 3 | CMP | 0 | 0 | 4.15E-02 | 4.15E-02 | 0 | 0 | -3.17E-01 | 1.79E-01 | 0 |
| 4 | MP | 0 | 0 | 2.60E-02 | 2.60E-02 | 0 | 0 | -1.34E-01 | 1.31E-01 | 0 |
| 5 | CBCEM | 2.07E-02 | 2.07E-02 | 2.50E-02 | 2.50E-02 | -6.61E-02 | -4.25E-02 | -5.13E-02 | 7.97E-02 | 0 |
| 6 | CBCE | 3.26E-02 | 3.26E-02 | 3.93E-02 | 3.93E-02 | -6.68E-02 | -3.59E-02 | -4.33E-02 | 1.28E-01 | 0 |
| 7 | CBC | 3.23E-02 | 3.23E-02 | 3.90E-02 | 3.90E-02 | -6.59E-02 | -3.52E-02 | -4.25E-02 | 1.28E-01 | 0 |
| 8 | CBCP | 3.31E-02 | 3.31E-02 | 3.99E-02 | 3.99E-02 | -6.90E-02 | -3.73E-02 | -4.50E-02 | 1.31E-01 | 0 |
| 9 | CBCPM | 1.60E-02 | 1.60E-02 | 1.93E-02 | 1.93E-02 | -5.74E-02 | -3.53E-02 | -4.26E-02 | 8.00E-02 | 0 |
| 10 | TEM | 1.97E-02 | 1.97E-02 | 2.38E-02 | 2.38E-02 | -5.90E-02 | -3.71E-02 | -4.47E-02 | 7.71E-02 | 0 |
| 11 | TE | 3.01E-02 | 3.01E-02 | 3.64E-02 | 3.64E-02 | -5.99E-02 | -3.05E-02 | -3.68E-02 | 1.27E-01 | 0 |
| 12 | T | 2.84E-02 | 2.84E-02 | 3.43E-02 | 3.43E-02 | -5.54E-02 | -2.69E-02 | -3.25E-02 | 1.25E-01 | 0 |
| 13 | TP | 3.11E-02 | 3.11E-02 | 3.75E-02 | 3.75E-02 | -6.31E-02 | -3.27E-02 | -3.95E-02 | 1.29E-01 | 0 |
| 14 | TPM | -3.30E-03 | 4.10E-03 | 5.00E-03 | 4.61E-02 | -5.25E-02 | -3.16E-02 | -3.82E-02 | 7.76E-02 | 0 |
| 51 | CA | 0.0006 | 0.0134 | 1.94E-02 | 9.28E-02 | -0.0495 | -0.0249 | -5.31E-02 | 1.22E-01 | 1 |
| 52 | CME | 1.10E-03 | 7.50E-03 | 1.05E-02 | 4.69E-02 | -5.35E-02 | -3.37E-02 | -5.96E-02 | -8.05E-02 | 1 |
| 53 | CMP | -2.70E-03 | 4.10E-03 | 6.40E-03 | -3.20E-03 | -4.73E-02 | -2.87E-02 | -5.14E-02 | 7.91E-02 | 1 |
| 54 | MP | 4.70E-03 | 8.60E-03 | 1.13E-02 | 3.30E-02 | -4.78E-02 | -2.90E-02 | -4.17E-02 | 7.68E-02 | 1 |
| 55 | CBCEM | 1.74E-02 | 1.81E-02 | 2.18E-02 | 2.56E-02 | -5.64E-02 | -3.53E-02 | -4.26E-02 | 7.46E-02 | 1 |
| 56 | CBCE | 2.73E-02 | 2.81E-02 | 3.39E-02 | 3.77E-02 | -5.68E-02 | -2.91E-02 | -3.51E-02 | 1.19E-01 | 1 |
| 57 | CBC | 2.50E-02 | 2.62E-02 | 3.17E-02 | 3.83E-02 | -5.29E-02 | -2.61E-02 | -3.14E-02 | 1.18E-01 | 1 |
| 58 | CBCP | 2.74E-02 | 2.83E-02 | 3.42E-02 | 3.92E-02 | -5.97E-02 | -3.06E-02 | -3.70E-02 | 1.25E-01 | 1 |
| 59 | CBCPM | 1.40E-02 | 1.44E-02 | 1.74E-02 | 1.97E-02 | -5.02E-02 | -3.03E-02 | -3.65E-02 | 7.44E-02 | 1 |
| 60 | TEM | 1.88E-02 | 1.90E-02 | 2.29E-02 | 2.36E-02 | -5.61E-02 | -3.51E-02 | -4.23E-02 | 7.45E-02 | 1 |
| 61 | TE | 2.89E-02 | 2.89E-02 | 3.48E-02 | 3.45E-02 | -5.65E-02 | -2.88E-02 | -3.48E-02 | 1.19E-01 | 1 |
| 62 | T | 2.74E-02 | 2.73E-02 | 3.29E-02 | 3.25E-02 | -5.24E-02 | -2.56E-02 | -3.10E-02 | 1.18E-01 | 1 |
| 63 | TP | 2.87E-02 | 2.89E-02 | 3.49E-02 | 3.61E-02 | -5.95E-02 | -3.04E-02 | -3.67E-02 | 1.25E-01 | 1 |
| 64 | TPM | -2.90E-03 | 4.20E-03 | 5.10E-03 | 4.47E-02 | -5.00E-02 | -3.01E-02 | -3.63E-02 | 7.43E-02 | 1 |
| 101 | TEM | 1.92E-02 | 1.92E-02 | 2.32E-02 | 2.36E-02 | -5.72E-02 | -3.58E-02 | -4.32E-02 | 7.55E-02 | 2 |
| 102 | TE | 2.94E-02 | 2.94E-02 | 3.54E-02 | 3.52E-02 | -5.78E-02 | -2.95E-02 | -3.56E-02 | 1.22E-01 | 2 |
| 103 | T | 5.51E-02 | 5.50E-02 | 6.64E-02 | 6.57E-02 | -5.36E-02 | -2.62E-02 | -3.16E-02 | 1.21E-01 | 2 |
| 104 | TP | 2.96E-02 | 2.98E-02 | 3.59E-02 | 3.67E-02 | -6.09E-02 | -3.13E-02 | -3.78E-02 | 1.26E-01 | 2 |
| 105 | TPM | -5.90E-03 | 8.40E-03 | 1.02E-02 | 8.99E-02 | -5.10E-02 | -3.07E-02 | -3.70E-02 | 7.56E-02 | 2 |

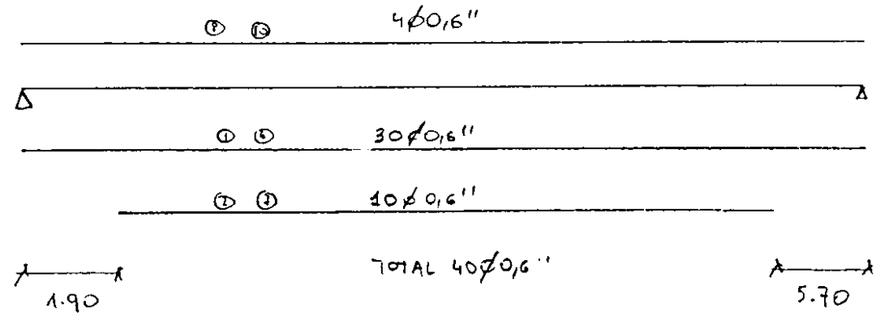
PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 8-6

8.1.3 Segundo tanteo de pretensado de taller

Se modifica el pretensado del vano 2:




Se modifica el pretensado de los vanos 1 y 3

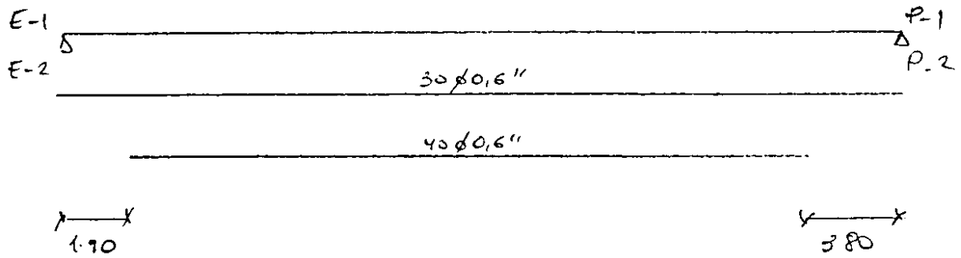


| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 8-7 |

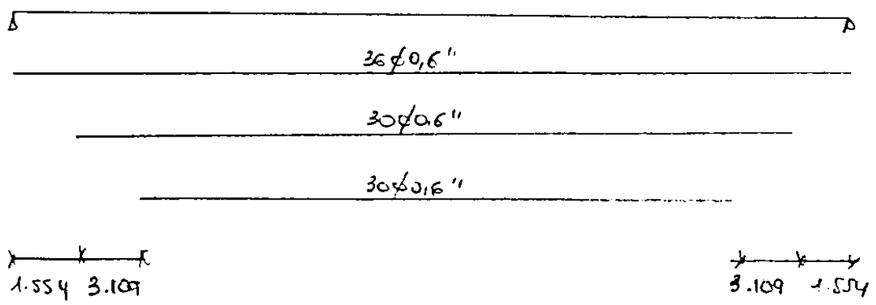
8.1.4 Tercer tesado de pretensado

Se realiza simplemente un ajuste de la ubicación de los anclados por lo que no se realiza un nuevo calculo de hiperestáticos de pretensado.

Vanos 1 y 3




Vano 2




8.1.4. TENSIONES INDIVIDUALES

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

**ISOSTATICO DE PRETENSADO T=0**

**FASE 1**

| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 0.00 | 2 | 0 | 0 | 36.9 | -61.4 | 2 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1(2) | 0.95 | 2 | 0 | 0 | 36.9 | -61.4 | 2 | 0.0 | 0.0 | -3.5 | 2.0 |
| 1(3) | 1.90 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 2(1) | 1.90 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 2(2) | 2.85 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -11.2 | 5.9 |
| 2(3) | 3.80 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 3(1) | 3.80 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 3(2) | 4.75 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -16.5 | 8.7 |
| 3(3) | 5.70 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 4(1) | 5.70 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 4(2) | 6.65 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -20.0 | 10.6 |
| 4(3) | 7.60 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 5(1) | 7.60 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 5(2) | 8.55 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.7 | 11.5 |
| 5(3) | 9.50 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.9 | 11.6 |
| 6(1) | 9.50 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.9 | 11.6 |
| 6(2) | 10.45 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.7 | 11.5 |
| 6(3) | 11.40 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 7(1) | 11.40 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 7(2) | 12.35 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -20.0 | 10.6 |
| 7(3) | 13.30 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 8(1) | 13.30 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 8(2) | 14.25 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -16.5 | 8.7 |
| 8(3) | 15.20 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 9(1) | 15.20 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 9(2) | 16.15 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -11.2 | 5.9 |
| 9(3) | 17.10 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 10(1) | 17.10 | 1 | 0 | 0 | 27.5 | -61.2 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 10(2) | 18.05 | 3 | 0 | 0 | 27.5 | -61.2 | 3 | 0.0 | 0.0 | -3.1 | 1.7 |
| 10(3) | 19.00 | 3 | 0 | 0 | 27.5 | -61.2 | 3 | 0.0 | 0.0 | 0.0 | 0.0 |

**FASE 2**

| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 0.00 | 2 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1(2) | 0.95 | 2 | -9.2 | 5.1 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | -3.5 | 2.0 |
| 1(3) | 1.90 | 1 | -20.7 | 10.9 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 2(1) | 1.90 | 1 | -20.7 | 10.9 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 2(2) | 2.85 | 1 | -29.3 | 15.5 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -11.2 | 5.9 |
| 2(3) | 3.80 | 1 | -36.7 | 19.4 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 3(1) | 3.80 | 1 | -36.7 | 19.4 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 3(2) | 4.75 | 1 | -43.1 | 22.8 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -16.5 | 8.7 |
| 3(3) | 5.70 | 1 | -48.2 | 25.5 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 4(1) | 5.70 | 1 | -48.2 | 25.5 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 4(2) | 6.65 | 1 | -52.3 | 27.6 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -20.0 | 10.6 |
| 4(3) | 7.60 | 1 | -55.1 | 29.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 5(1) | 7.60 | 1 | -55.1 | 29.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 5(2) | 8.55 | 1 | -56.8 | 30.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.7 | 11.5 |
| 5(3) | 9.50 | 1 | -57.4 | 30.4 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.9 | 11.6 |
| 6(1) | 9.50 | 1 | -57.4 | 30.4 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.9 | 11.6 |
| 6(2) | 10.45 | 1 | -56.8 | 30.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.7 | 11.5 |
| 6(3) | 11.40 | 1 | -55.1 | 29.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 7(1) | 11.40 | 1 | -55.1 | 29.1 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 7(2) | 12.35 | 1 | -52.3 | 27.6 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -20.0 | 10.6 |
| 7(3) | 13.30 | 1 | -48.2 | 25.5 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 8(1) | 13.30 | 1 | -48.2 | 25.5 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 8(2) | 14.25 | 1 | -43.1 | 22.8 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -16.5 | 8.7 |
| 8(3) | 15.20 | 1 | -36.7 | 19.4 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 9(1) | 15.20 | 1 | -36.7 | 19.4 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 9(2) | 16.15 | 1 | -29.3 | 15.5 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -11.2 | 5.9 |
| 9(3) | 17.10 | 1 | -20.7 | 10.9 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 10(1) | 17.10 | 1 | -20.7 | 10.9 | 0.0 | 0.0 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 10(2) | 18.05 | 3 | -8.1 | 4.5 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | -3.1 | 1.7 |
| 10(3) | 19.00 | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | ISOSTATICO DE PRETENSADO T=0 | | | | | FASE 1 | | | | | FASE 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | 3 | 0 | 0 | 27.5 | -61.2 | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 0.0 | 0.0 |
| 21(2) | 51.04 | 3 | 0 | 0 | 27.5 | -61.2 | 3 | 0.0 | 0.0 | -8.1 | 4.5 | 3 | 0.0 | 0.0 | -3.1 | 1.7 |
| 21(3) | 51.99 | 1 | 0 | 0 | 27.5 | -61.2 | 1 | 0.0 | 0.0 | -20.7 | 10.9 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 22(1) | 51.99 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -20.7 | 10.9 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 22(2) | 52.94 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -29.3 | 15.5 | 1 | 0.0 | 0.0 | -11.2 | 5.9 |
| 22(3) | 53.89 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -36.7 | 19.4 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 23(1) | 53.89 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -36.7 | 19.4 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 23(2) | 54.84 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -43.1 | 22.8 | 1 | 0.0 | 0.0 | -16.5 | 8.7 |
| 23(3) | 55.79 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -48.2 | 25.5 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 24(1) | 55.79 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -48.2 | 25.5 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 24(2) | 56.74 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -52.3 | 27.6 | 1 | 0.0 | 0.0 | -20.0 | 10.6 |
| 24(3) | 57.69 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -55.1 | 29.1 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 25(1) | 57.69 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -55.1 | 29.1 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 25(2) | 58.64 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -56.8 | 30.1 | 1 | 0.0 | 0.0 | -21.7 | 11.5 |
| 25(3) | 59.59 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -57.4 | 30.4 | 1 | 0.0 | 0.0 | -21.9 | 11.6 |
| 26(1) | 59.59 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -57.4 | 30.4 | 1 | 0.0 | 0.0 | -21.9 | 11.6 |
| 26(2) | 60.54 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -56.8 | 30.1 | 1 | 0.0 | 0.0 | -21.7 | 11.5 |
| 26(3) | 61.49 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -55.1 | 29.1 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 27(1) | 61.49 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -55.1 | 29.1 | 1 | 0.0 | 0.0 | -21.1 | 11.1 |
| 27(2) | 62.44 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -52.3 | 27.6 | 1 | 0.0 | 0.0 | -20.0 | 10.6 |
| 27(3) | 63.39 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -48.2 | 25.5 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 28(1) | 63.39 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -48.2 | 25.5 | 1 | 0.0 | 0.0 | -18.5 | 9.8 |
| 28(2) | 64.34 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -43.1 | 22.8 | 1 | 0.0 | 0.0 | -16.5 | 8.7 |
| 28(3) | 65.29 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -36.7 | 19.4 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 29(1) | 65.29 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -36.7 | 19.4 | 1 | 0.0 | 0.0 | -14.1 | 7.4 |
| 29(2) | 66.24 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -29.3 | 15.5 | 1 | 0.0 | 0.0 | -11.2 | 5.9 |
| 29(3) | 67.19 | 1 | 0 | 0 | 26.5 | -128.7 | 1 | 0.0 | 0.0 | -20.7 | 10.9 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 30(1) | 67.19 | 1 | 0 | 0 | 13.2 | -96.4 | 1 | 0.0 | 0.0 | -20.7 | 10.9 | 1 | 0.0 | 0.0 | -7.9 | 4.2 |
| 30(2) | 68.14 | 2 | 0 | 0 | 36.9 | -61.4 | 2 | 0.0 | 0.0 | -9.2 | 5.1 | 2 | 0.0 | 0.0 | -3.5 | 2.0 |
| 30(3) | 69.09 | 2 | 0 | 0 | 36.9 | -61.4 | 2 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | ISOSTATICO DE PRETENSADO T=0 | | | | | FASE 1 | | | | | FASE 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 3 | 0 | 0 | 36.5 | -74.2 | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11(2) | 20.55 | 3 | 0 | 0 | 52.6 | -206.1 | 3 | 0.0 | 0.0 | -21.5 | 12.2 | 3 | 0.0 | 0.0 | -8.2 | 4.7 |
| 11(3) | 22.11 | 1 | 0 | 0 | 52.6 | -206.1 | 1 | 0.0 | 0.0 | -55.4 | 29.3 | 1 | 0.0 | 0.0 | -21.2 | 11.2 |
| 12(1) | 22.11 | 1 | 0 | 0 | 52.6 | -206.1 | 1 | 0.0 | 0.0 | -55.4 | 29.3 | 1 | 0.0 | 0.0 | -21.2 | 11.2 |
| 12(2) | 23.66 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -78.4 | 41.5 | 1 | 0.0 | 0.0 | -30.0 | 15.9 |
| 12(3) | 25.22 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -98.4 | 52.0 | 1 | 0.0 | 0.0 | -37.7 | 19.9 |
| 13(1) | 25.22 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -98.4 | 52.0 | 1 | 0.0 | 0.0 | -37.7 | 19.9 |
| 13(2) | 26.77 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -115.3 | 61.0 | 1 | 0.0 | 0.0 | -44.1 | 23.3 |
| 13(3) | 28.33 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -129.2 | 68.3 | 1 | 0.0 | 0.0 | -49.4 | 26.1 |
| 14(1) | 28.33 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -129.2 | 68.3 | 1 | 0.0 | 0.0 | -49.4 | 26.1 |
| 14(2) | 29.88 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -139.9 | 74.0 | 1 | 0.0 | 0.0 | -53.5 | 28.3 |
| 14(3) | 31.44 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -147.6 | 78.1 | 1 | 0.0 | 0.0 | -56.5 | 29.8 |
| 15(1) | 31.44 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -147.6 | 78.1 | 1 | 0.0 | 0.0 | -56.5 | 29.8 |
| 15(2) | 32.99 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -152.2 | 80.5 | 1 | 0.0 | 0.0 | -58.2 | 30.8 |
| 15(3) | 34.55 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -153.8 | 81.3 | 1 | 0.0 | 0.0 | -58.8 | 31.1 |
| 16(1) | 34.55 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -153.8 | 81.3 | 1 | 0.0 | 0.0 | -58.8 | 31.1 |
| 16(2) | 36.10 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -152.2 | 80.5 | 1 | 0.0 | 0.0 | -58.2 | 30.8 |
| 16(3) | 37.65 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -147.6 | 78.1 | 1 | 0.0 | 0.0 | -56.5 | 29.8 |
| 17(1) | 37.65 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -147.6 | 78.1 | 1 | 0.0 | 0.0 | -56.5 | 29.8 |
| 17(2) | 39.21 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -139.9 | 74.0 | 1 | 0.0 | 0.0 | -53.5 | 28.3 |
| 17(3) | 40.76 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -129.2 | 68.3 | 1 | 0.0 | 0.0 | -49.4 | 26.1 |
| 18(1) | 40.76 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -129.2 | 68.3 | 1 | 0.0 | 0.0 | -49.4 | 26.1 |
| 18(2) | 42.32 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -115.3 | 61.0 | 1 | 0.0 | 0.0 | -44.1 | 23.3 |
| 18(3) | 43.87 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -98.4 | 52.0 | 1 | 0.0 | 0.0 | -37.7 | 19.9 |
| 19(1) | 43.87 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -98.4 | 52.0 | 1 | 0.0 | 0.0 | -37.7 | 19.9 |
| 19(2) | 45.43 | 1 | 0 | 0 | 75.1 | -283 | 1 | 0.0 | 0.0 | -78.4 | 41.5 | 1 | 0.0 | 0.0 | -30.0 | 15.9 |
| 19(3) | 46.98 | 1 | 0 | 0 | 52.6 | -206.1 | 1 | 0.0 | 0.0 | -55.4 | 29.3 | 1 | 0.0 | 0.0 | -21.2 | 11.2 |
| 20(1) | 46.98 | 1 | 0 | 0 | 52.6 | -206.1 | 1 | 0.0 | 0.0 | -55.4 | 29.3 | 1 | 0.0 | 0.0 | -21.2 | 11.2 |
| 20(2) | 48.54 | 3 | 0 | 0 | 52.6 | -206.1 | 3 | 0.0 | 0.0 | -21.5 | 12.2 | 3 | 0.0 | 0.0 | -8.2 | 4.7 |
| 20(3) | 50.09 | 3 | 0 | 0 | 36.5 | -74.2 | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | FASE 3 | | | | | FASE 5 | | | | | FASE 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 28.0 | -15.8 | 9 | 3.4 | 2.1 | 2.5 | -4.7 |
| 11(2) | 20.55 | 3 | 0.0 | 0.0 | -12.0 | 6.8 | 3 | 0.0 | 0.0 | 11.5 | -6.5 | 9 | 2.3 | 1.4 | 1.7 | -3.2 |
| 11(3) | 22.11 | 1 | 0.0 | 0.0 | -32.5 | 17.2 | 1 | 0.0 | 0.0 | -2.7 | 1.4 | 8 | 1.6 | 0.8 | 1.0 | -2.9 |
| 12(1) | 22.11 | 1 | 0.0 | 0.0 | -32.5 | 17.2 | 1 | 0.0 | 0.0 | -2.7 | 1.4 | 8 | 1.6 | 0.8 | 1.0 | -2.9 |
| 12(2) | 23.66 | 1 | 0.0 | 0.0 | -48.8 | 25.8 | 1 | 0.0 | 0.0 | -16.9 | 8.9 | 8 | 0.5 | 0.3 | 0.3 | -0.9 |
| 12(3) | 25.22 | 1 | 0.0 | 0.0 | -65.0 | 34.4 | 1 | 0.0 | 0.0 | -27.0 | 14.3 | 8 | -0.4 | -0.2 | -0.3 | 0.8 |
| 13(1) | 25.22 | 1 | 0.0 | 0.0 | -65.0 | 34.4 | 1 | 0.0 | 0.0 | -27.0 | 14.3 | 8 | -0.4 | -0.2 | -0.3 | 0.8 |
| 13(2) | 26.77 | 1 | 0.0 | 0.0 | -81.3 | 43.0 | 1 | 0.0 | 0.0 | -33.1 | 17.5 | 8 | -1.2 | -0.6 | -0.8 | 2.2 |
| 13(3) | 28.33 | 1 | 0.0 | 0.0 | -97.5 | 51.6 | 1 | 0.0 | 0.0 | -35.2 | 18.6 | 7 | -1.7 | -0.9 | -1.1 | 3.4 |
| 14(1) | 28.33 | 1 | 0.0 | 0.0 | -97.5 | 51.6 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -1.7 | -0.9 | -1.1 | 3.4 |
| 14(2) | 29.88 | 1 | 0.0 | 0.0 | -111.7 | 59.1 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.2 | -1.2 | -1.4 | 4.3 |
| 14(3) | 31.44 | 1 | 0.0 | 0.0 | -121.9 | 64.5 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.6 | -1.4 | -1.6 | 5.0 |
| 15(1) | 31.44 | 1 | 0.0 | 0.0 | -121.9 | 64.5 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.6 | -1.4 | -1.6 | 5.0 |
| 15(2) | 32.99 | 1 | 0.0 | 0.0 | -128.0 | 67.7 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.7 | -1.5 | -1.8 | 5.3 |
| 15(3) | 34.55 | 1 | 0.0 | 0.0 | -130.0 | 68.8 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.8 | -1.5 | -1.8 | 5.5 |
| 16(1) | 34.55 | 1 | 0.0 | 0.0 | -130.0 | 68.8 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.8 | -1.5 | -1.8 | 5.5 |
| 16(2) | 36.10 | 1 | 0.0 | 0.0 | -128.0 | 67.7 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.7 | -1.5 | -1.8 | 5.3 |
| 16(3) | 37.65 | 1 | 0.0 | 0.0 | -121.9 | 64.5 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.6 | -1.4 | -1.6 | 5.0 |
| 17(1) | 37.65 | 1 | 0.0 | 0.0 | -121.9 | 64.5 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.6 | -1.4 | -1.6 | 5.0 |
| 17(2) | 39.21 | 1 | 0.0 | 0.0 | -111.7 | 59.1 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -2.2 | -1.2 | -1.4 | 4.3 |
| 17(3) | 40.76 | 1 | 0.0 | 0.0 | -97.5 | 51.6 | 7 | -5.4 | -2.9 | -3.5 | 10.5 | 7 | -1.7 | -0.9 | -1.1 | 3.4 |
| 18(1) | 40.76 | 1 | 0.0 | 0.0 | -97.5 | 51.6 | 1 | 0.0 | 0.0 | -35.2 | 18.6 | 7 | -1.7 | -0.9 | -1.1 | 3.4 |
| 18(2) | 42.32 | 1 | 0.0 | 0.0 | -81.3 | 43.0 | 1 | 0.0 | 0.0 | -33.1 | 17.5 | 8 | -1.2 | -0.6 | -0.8 | 2.2 |
| 18(3) | 43.87 | 1 | 0.0 | 0.0 | -65.0 | 34.4 | 1 | 0.0 | 0.0 | -27.0 | 14.3 | 8 | -0.4 | -0.2 | -0.3 | 0.8 |
| 19(1) | 43.87 | 1 | 0.0 | 0.0 | -65.0 | 34.4 | 1 | 0.0 | 0.0 | -27.0 | 14.3 | 8 | -0.4 | -0.2 | -0.3 | 0.8 |
| 19(2) | 45.43 | 1 | 0.0 | 0.0 | -48.8 | 25.8 | 1 | 0.0 | 0.0 | -16.9 | 8.9 | 8 | 0.5 | 0.3 | 0.3 | -0.9 |
| 19(3) | 46.98 | 1 | 0.0 | 0.0 | -32.5 | 17.2 | 1 | 0.0 | 0.0 | -2.7 | 1.4 | 8 | 1.6 | 0.8 | 1.0 | -2.9 |
| 20(1) | 46.98 | 1 | 0.0 | 0.0 | -32.5 | 17.2 | 1 | 0.0 | 0.0 | -2.7 | 1.4 | 8 | 1.6 | 0.8 | 1.0 | -2.9 |
| 20(2) | 48.54 | 3 | 0.0 | 0.0 | -12.0 | 6.8 | 3 | 0.0 | 0.0 | 11.5 | -6.5 | 9 | 2.3 | 1.4 | 1.7 | -3.2 |
| 20(3) | 50.09 | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 28.0 | -15.8 | 9 | 3.4 | 2.1 | 2.5 | -4.7 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | FASE 3 | | | | | FASE 5 | | | | | FASE 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | 2 | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1(2) | 0.95 | 2 | 0.0 | 0.0 | -11.7 | 6.5 | 5 | 0.2 | 0.1 | 0.2 | -0.2 | 5 | -0.3 | -0.2 | -0.2 | 0.3 |
| 1(3) | 1.90 | 1 | 0.0 | 0.0 | -26.1 | 13.8 | 6 | 0.4 | 0.2 | 0.3 | -0.8 | 6 | -0.5 | -0.3 | -0.3 | 1.0 |
| 2(1) | 1.90 | 1 | 0.0 | 0.0 | -26.1 | 13.8 | 6 | 0.4 | 0.2 | 0.3 | -0.8 | 6 | -0.5 | -0.3 | -0.3 | 1.0 |
| 2(2) | 2.85 | 1 | 0.0 | 0.0 | -36.9 | 19.5 | 6 | 0.6 | 0.3 | 0.4 | -1.2 | 6 | -0.7 | -0.4 | -0.5 | 1.3 |
| 2(3) | 3.80 | 1 | 0.0 | 0.0 | -46.1 | 24.4 | 6 | 0.8 | 0.4 | 0.5 | -1.5 | 6 | -0.8 | -0.4 | -0.5 | 1.6 |
| 3(1) | 3.80 | 1 | 0.0 | 0.0 | -46.1 | 24.4 | 6 | 0.8 | 0.4 | 0.5 | -1.5 | 6 | -0.8 | -0.4 | -0.5 | 1.6 |
| 3(2) | 4.75 | 1 | 0.0 | 0.0 | -53.9 | 28.5 | 6 | 1.0 | 0.5 | 0.6 | -1.9 | 6 | -0.9 | -0.5 | -0.6 | 1.8 |
| 3(3) | 5.70 | 1 | 0.0 | 0.0 | -60.1 | 31.8 | 7 | 1.2 | 0.6 | 0.8 | -2.3 | 7 | -0.9 | -0.5 | -0.6 | 1.8 |
| 4(1) | 5.70 | 1 | 0.0 | 0.0 | -60.1 | 31.8 | 7 | 1.2 | 0.6 | 0.8 | -2.3 | 7 | -0.9 | -0.5 | -0.6 | 1.8 |
| 4(2) | 6.65 | 1 | 0.0 | 0.0 | -64.8 | 34.3 | 7 | 1.4 | 0.7 | 0.9 | -2.7 | 7 | -0.9 | -0.5 | -0.6 | 1.8 |
| 4(3) | 7.60 | 1 | 0.0 | 0.0 | -68.0 | 35.9 | 7 | 1.6 | 0.8 | 1.0 | -3.1 | 7 | -0.9 | -0.5 | -0.5 | 1.7 |
| 5(1) | 7.60 | 1 | 0.0 | 0.0 | -68.0 | 35.9 | 7 | 1.6 | 0.8 | 1.0 | -3.1 | 7 | -0.9 | -0.5 | -0.5 | 1.7 |
| 5(2) | 8.55 | 1 | 0.0 | 0.0 | -69.7 | 36.8 | 7 | 1.8 | 1.0 | 1.1 | -3.5 | 7 | -0.7 | -0.4 | -0.5 | 1.4 |
| 5(3) | 9.50 | 1 | 0.0 | 0.0 | -69.8 | 36.9 | 7 | 2.0 | 1.1 | 1.3 | -3.8 | 7 | -0.6 | -0.3 | -0.4 | 1.1 |
| 6(1) | 9.50 | 1 | 0.0 | 0.0 | -69.8 | 36.9 | 7 | 2.0 | 1.1 | 1.3 | -3.8 | 7 | -0.6 | -0.3 | -0.4 | 1.1 |
| 6(2) | 10.45 | 1 | 0.0 | 0.0 | -68.5 | 36.2 | 7 | 2.2 | 1.2 | 1.4 | -4.2 | 7 | -0.3 | -0.2 | -0.2 | 0.7 |
| 6(3) | 11.40 | 1 | 0.0 | 0.0 | -65.6 | 34.7 | 7 | 2.4 | 1.3 | 1.5 | -4.6 | 7 | -0.1 | 0.0 | 0.0 | 0.1 |
| 7(1) | 11.40 | 1 | 0.0 | 0.0 | -65.6 | 34.7 | 1 | 0.0 | 0.0 | 15.5 | -8.2 | 7 | -0.1 | 0.0 | 0.0 | 0.1 |
| 7(2) | 12.35 | 1 | 0.0 | 0.0 | -61.1 | 32.3 | 1 | 0.0 | 0.0 | 16.8 | -8.9 | 7 | 0.3 | 0.1 | 0.2 | -0.5 |
| 7(3) | 13.30 | 1 | 0.0 | 0.0 | -55.3 | 29.2 | 1 | 0.0 | 0.0 | 18.1 | -9.6 | 7 | 0.6 | 0.3 | 0.4 | -1.2 |
| 8(1) | 13.30 | 1 | 0.0 | 0.0 | -55.3 | 29.2 | 1 | 0.0 | 0.0 | 18.1 | -9.6 | 7 | 0.6 | 0.3 | 0.4 | -1.2 |
| 8(2) | 14.25 | 1 | 0.0 | 0.0 | -47.8 | 25.3 | 1 | 0.0 | 0.0 | 19.4 | -10.2 | 8 | 1.1 | 0.6 | 0.7 | -2.1 |
| 8(3) | 15.20 | 1 | 0.0 | 0.0 | -38.9 | 20.5 | 1 | 0.0 | 0.0 | 20.7 | -10.9 | 8 | 1.6 | 0.9 | 1.0 | -3.0 |
| 9(1) | 15.20 | 1 | 0.0 | 0.0 | -38.9 | 20.5 | 1 | 0.0 | 0.0 | 20.7 | -10.9 | 8 | 1.6 | 0.9 | 1.0 | -3.0 |
| 9(2) | 16.15 | 1 | 0.0 | 0.0 | -29.1 | 15.4 | 1 | 0.0 | 0.0 | 22.7 | -12.0 | 8 | 2.1 | 1.2 | 1.4 | -4.0 |
| 9(3) | 17.10 | 1 | 0.0 | 0.0 | -19.4 | 10.3 | 1 | 0.0 | 0.0 | 26.3 | -13.9 | 8 | 2.7 | 1.5 | 1.8 | -5.2 |
| 10(1) | 17.10 | 1 | 0.0 | 0.0 | -19.4 | 10.3 | 1 | 0.0 | 0.0 | 26.3 | -13.9 | 8 | 2.7 | 1.5 | 1.8 | -5.2 |
| 10(2) | 18.05 | 3 | 0.0 | 0.0 | -7.2 | 4.0 | 3 | 0.0 | 0.0 | 23.1 | -13.1 | 9 | 2.8 | 1.7 | 2.1 | -3.9 |
| 10(3) | 19.00 | 3 | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 0.0 | 0.0 | 28.0 | -15.8 | 9 | 3.4 | 2.1 | 2.5 | -4.7 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | CM | | | | | SCU(POS) | | | | | SCU(NEG) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | **10** | 0.0 | 0.0 | 0.0 | 0.0 | **10** | 0.0 | 0.0 | 0.0 | 0.0 | **10** | 0.0 | 0.0 | 0.0 | 0.0 |
| 1(2) | 0.95 | **10** | -0.9 | -0.6 | -0.7 | 1.2 | **10** | -1.5 | -1.0 | -1.1 | 2.0 | **10** | 0.5 | 0.3 | 0.4 | -0.7 |
| 1(3) | 1.90 | **11** | -1.7 | -0.9 | -1.0 | 3.5 | **11** | -2.9 | -1.5 | -1.8 | 6.1 | **11** | 1.1 | 0.6 | 0.7 | -2.4 |
| 2(1) | 1.90 | **11** | -1.7 | -0.9 | -1.0 | 3.5 | **11** | -2.9 | -1.5 | -1.8 | 6.1 | **11** | 1.1 | 0.6 | 0.7 | -2.4 |
| 2(2) | 2.85 | **11** | -2.3 | -1.2 | -1.4 | 4.8 | **11** | -4.1 | -2.1 | -2.5 | 8.6 | **11** | 1.7 | 0.9 | 1.0 | -3.5 |
| 2(3) | 3.80 | **11** | -2.7 | -1.4 | -1.7 | 5.7 | **11** | -5.1 | -2.6 | -3.1 | 10.8 | **11** | 2.2 | 1.1 | 1.4 | -4.7 |
| 3(1) | 3.80 | **11** | -2.7 | -1.4 | -1.7 | 5.7 | **11** | -5.1 | -2.6 | -3.1 | 10.8 | **11** | 2.2 | 1.1 | 1.4 | -4.7 |
| 3(2) | 4.75 | **11** | -3.0 | -1.5 | -1.8 | 6.2 | **11** | -5.9 | -3.0 | -3.6 | 12.5 | **11** | 2.8 | 1.4 | 1.7 | -5.9 |
| 3(3) | 5.70 | **12** | -2.8 | -1.4 | -1.7 | 6.4 | **12** | -6.1 | -3.0 | -3.6 | 13.8 | **12** | 3.1 | 1.5 | 1.8 | -7.0 |
| 4(1) | 5.70 | **12** | -2.8 | -1.4 | -1.7 | 6.4 | **12** | -6.1 | -3.0 | -3.6 | 13.8 | **12** | 3.1 | 1.5 | 1.8 | -7.0 |
| 4(2) | 6.65 | **12** | -2.8 | -1.3 | -1.6 | 6.2 | **12** | -6.5 | -3.2 | -3.8 | 14.8 | **12** | 3.6 | 1.8 | 2.1 | -8.2 |
| 4(3) | 7.60 | **12** | -2.5 | -1.2 | -1.5 | 5.8 | **12** | -6.8 | -3.3 | -4.0 | 15.5 | **12** | 4.1 | 2.0 | 2.4 | -9.3 |
| 5(1) | 7.60 | **12** | -2.5 | -1.2 | -1.5 | 5.8 | **12** | -6.8 | -3.3 | -4.0 | 15.5 | **12** | 4.1 | 2.0 | 2.4 | -9.3 |
| 5(2) | 8.55 | **12** | -2.2 | -1.1 | -1.3 | 4.9 | **12** | -7.0 | -3.4 | -4.1 | 15.7 | **12** | 4.6 | 2.3 | 2.7 | -10.5 |
| 5(3) | 9.50 | **12** | -1.7 | -0.8 | -1.0 | 3.7 | **12** | -6.9 | -3.4 | -4.1 | 15.7 | **12** | 5.2 | 2.5 | 3.0 | -11.7 |
| 6(1) | 9.50 | **12** | -1.7 | -0.8 | -1.0 | 3.7 | **12** | -6.9 | -3.4 | -4.1 | 15.7 | **12** | 5.2 | 2.5 | 3.0 | -11.7 |
| 6(2) | 10.45 | **12** | -1.0 | -0.5 | -0.6 | 2.2 | **12** | -6.7 | -3.3 | -3.9 | 15.2 | **12** | 5.7 | 2.8 | 3.3 | -12.9 |
| 6(3) | 11.40 | **12** | -0.2 | -0.1 | -0.1 | 0.4 | **12** | -6.4 | -3.1 | -3.7 | 14.4 | **12** | 6.2 | 3.0 | 3.6 | -14.0 |
| 7(1) | 11.40 | **12** | -0.2 | -0.1 | -0.1 | 0.4 | **12** | -6.4 | -3.1 | -3.7 | 14.4 | **12** | 6.2 | 3.0 | 3.6 | -14.0 |
| 7(2) | 12.35 | **12** | 0.8 | 0.4 | 0.5 | -1.9 | **12** | -5.8 | -2.8 | -3.4 | 13.2 | **12** | 6.7 | 3.3 | 3.9 | -15.2 |
| 7(3) | 13.30 | **12** | 2.0 | 0.9 | 1.1 | -4.4 | **12** | -5.2 | -2.5 | -3.0 | 11.7 | **12** | 7.2 | 3.5 | 4.2 | -16.4 |
| 8(1) | 13.30 | **12** | 2.0 | 0.9 | 1.1 | -4.4 | **12** | -5.2 | -2.5 | -3.0 | 11.7 | **12** | 7.2 | 3.5 | 4.2 | -16.4 |
| 8(2) | 14.25 | **13** | 3.7 | 1.9 | 2.3 | -7.6 | **13** | -4.9 | -2.5 | -3.1 | 10.0 | **13** | 8.8 | 4.6 | 5.5 | -18.1 |
| 8(3) | 15.20 | **13** | 5.3 | 2.8 | 3.3 | -10.9 | **13** | -3.8 | -1.9 | -2.4 | 7.7 | **13** | 9.4 | 4.9 | 5.9 | -19.3 |
| 9(1) | 15.20 | **13** | 5.3 | 2.8 | 3.3 | -10.9 | **13** | -3.8 | -1.9 | -2.4 | 7.7 | **13** | 9.4 | 4.9 | 5.9 | -19.3 |
| 9(2) | 16.15 | **13** | 7.1 | 3.7 | 4.5 | -14.6 | **13** | -2.5 | -1.3 | -1.6 | 5.1 | **13** | 10.1 | 5.2 | 6.3 | -20.6 |
| 9(3) | 17.10 | **13** | 9.1 | 4.7 | 5.7 | -18.7 | **13** | -1.7 | -0.9 | -1.1 | 3.5 | **13** | 11.4 | 5.9 | 7.1 | -23.3 |
| 10(1) | 17.10 | **13** | 9.1 | 4.7 | 5.7 | -18.7 | **13** | -1.7 | -0.9 | -1.1 | 3.5 | **13** | 11.4 | 5.9 | 7.1 | -23.3 |
| 10(2) | 18.05 | **14** | 9.4 | 5.7 | 6.8 | -13.9 | **14** | -1.1 | -0.6 | -0.8 | 1.6 | **14** | 11.0 | 6.6 | 8.0 | -16.3 |
| 10(3) | 19.00 | **14** | 11.3 | 6.8 | 8.2 | -16.7 | **14** | -1.0 | -0.6 | -0.7 | 1.5 | **14** | 13.0 | 7.8 | 9.5 | -19.3 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | FASE 3 | | | | | FASE 5 | | | | | FASE 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | **3** | 0.0 | 0.0 | 0.0 | 0.0 | **3** | 0.0 | 0.0 | 28.0 | -15.8 | **9** | 3.4 | 2.1 | 2.5 | -4.7 |
| 21(2) | 51.04 | **3** | 0.0 | 0.0 | -7.2 | 4.0 | **3** | 0.0 | 0.0 | 23.1 | -13.1 | **9** | 2.8 | 1.7 | 2.1 | -3.9 |
| 21(3) | 51.99 | **1** | 0.0 | 0.0 | -19.4 | 10.3 | **1** | 0.0 | 0.0 | 26.3 | -13.9 | **8** | 2.7 | 1.5 | 1.8 | -5.2 |
| 22(1) | 51.99 | **1** | 0.0 | 0.0 | -19.4 | 10.3 | **1** | 0.0 | 0.0 | 26.3 | -13.9 | **8** | 2.7 | 1.5 | 1.8 | -5.2 |
| 22(2) | 52.94 | **1** | 0.0 | 0.0 | -29.1 | 15.4 | **1** | 0.0 | 0.0 | 22.7 | -12.0 | **8** | 2.1 | 1.2 | 1.4 | -4.0 |
| 22(3) | 53.89 | **1** | 0.0 | 0.0 | -38.9 | 20.5 | **1** | 0.0 | 0.0 | 20.7 | -10.9 | **8** | 1.6 | 0.9 | 1.0 | -3.0 |
| 23(1) | 53.89 | **1** | 0.0 | 0.0 | -38.9 | 20.5 | **1** | 0.0 | 0.0 | 20.7 | -10.9 | **8** | 1.6 | 0.9 | 1.0 | -3.0 |
| 23(2) | 54.84 | **1** | 0.0 | 0.0 | -47.8 | 25.3 | **1** | 0.0 | 0.0 | 19.4 | -10.2 | **8** | 1.1 | 0.6 | 0.7 | -2.1 |
| 23(3) | 55.79 | **1** | 0.0 | 0.0 | -55.3 | 29.2 | **1** | 0.0 | 0.0 | 18.1 | -9.6 | **7** | 0.6 | 0.3 | 0.4 | -1.2 |
| 24(1) | 55.79 | **1** | 0.0 | 0.0 | -55.3 | 29.2 | **1** | 0.0 | 0.0 | 18.1 | -9.6 | **7** | 0.6 | 0.3 | 0.4 | -1.2 |
| 24(2) | 56.74 | **1** | 0.0 | 0.0 | -61.1 | 32.3 | **1** | 0.0 | 0.0 | 16.8 | -8.9 | **7** | 0.3 | 0.1 | 0.2 | -0.5 |
| 24(3) | 57.69 | **1** | 0.0 | 0.0 | -65.6 | 34.7 | **1** | 0.0 | 0.0 | 15.5 | -8.2 | **7** | -0.1 | 0.0 | 0.0 | 0.1 |
| 25(1) | 57.69 | **1** | 0.0 | 0.0 | -65.6 | 34.7 | **7** | 2.4 | 1.3 | 1.5 | -4.6 | **7** | -0.1 | 0.0 | 0.0 | 0.1 |
| 25(2) | 58.64 | **1** | 0.0 | 0.0 | -68.5 | 36.2 | **7** | 2.2 | 1.2 | 1.4 | -4.2 | **7** | -0.3 | -0.2 | -0.2 | 0.7 |
| 25(3) | 59.59 | **1** | 0.0 | 0.0 | -69.8 | 36.9 | **7** | 2.0 | 1.1 | 1.3 | -3.8 | **7** | -0.6 | -0.3 | -0.4 | 1.1 |
| 26(1) | 59.59 | **1** | 0.0 | 0.0 | -69.8 | 36.9 | **7** | 2.0 | 1.1 | 1.3 | -3.8 | **7** | -0.6 | -0.3 | -0.4 | 1.1 |
| 26(2) | 60.54 | **1** | 0.0 | 0.0 | -69.7 | 36.8 | **7** | 1.8 | 1.0 | 1.1 | -3.5 | **7** | -0.7 | -0.4 | -0.5 | 1.4 |
| 26(3) | 61.49 | **1** | 0.0 | 0.0 | -68.0 | 35.9 | **7** | 1.6 | 0.8 | 1.0 | -3.1 | **7** | -0.9 | -0.5 | -0.5 | 1.7 |
| 27(1) | 61.49 | **1** | 0.0 | 0.0 | -68.0 | 35.9 | **7** | 1.6 | 0.8 | 1.0 | -3.1 | **7** | -0.9 | -0.5 | -0.5 | 1.7 |
| 27(2) | 62.44 | **1** | 0.0 | 0.0 | -64.8 | 34.3 | **7** | 1.4 | 0.7 | 0.9 | -2.7 | **7** | -0.9 | -0.5 | -0.6 | 1.8 |
| 27(3) | 63.39 | **1** | 0.0 | 0.0 | -60.1 | 31.8 | **7** | 1.2 | 0.6 | 0.8 | -2.3 | **7** | -0.9 | -0.5 | -0.6 | 1.8 |
| 28(1) | 63.39 | **1** | 0.0 | 0.0 | -60.1 | 31.8 | **7** | 1.2 | 0.6 | 0.8 | -2.3 | **7** | -0.9 | -0.5 | -0.6 | 1.8 |
| 28(2) | 64.34 | **1** | 0.0 | 0.0 | -53.9 | 28.5 | **6** | 1.0 | 0.5 | 0.6 | -1.9 | **6** | -0.9 | -0.5 | -0.6 | 1.8 |
| 28(3) | 65.29 | **1** | 0.0 | 0.0 | -46.1 | 24.4 | **6** | 0.8 | 0.4 | 0.5 | -1.5 | **6** | -0.8 | -0.4 | -0.5 | 1.6 |
| 29(1) | 65.29 | **1** | 0.0 | 0.0 | -46.1 | 24.4 | **6** | 0.8 | 0.4 | 0.5 | -1.5 | **6** | -0.8 | -0.4 | -0.5 | 1.6 |
| 29(2) | 66.24 | **1** | 0.0 | 0.0 | -36.9 | 19.5 | **6** | 0.6 | 0.3 | 0.4 | -1.2 | **6** | -0.7 | -0.4 | -0.5 | 1.3 |
| 29(3) | 67.19 | **1** | 0.0 | 0.0 | -26.1 | 13.8 | **6** | 0.4 | 0.2 | 0.3 | -0.8 | **6** | -0.5 | -0.3 | -0.3 | 1.0 |
| 30(1) | 67.19 | **1** | 0.0 | 0.0 | -26.1 | 13.8 | **6** | 0.4 | 0.2 | 0.3 | -0.8 | **6** | -0.5 | -0.3 | -0.3 | 1.0 |
| 30(2) | 68.14 | **2** | 0.0 | 0.0 | -11.7 | 6.5 | **5** | 0.2 | 0.1 | 0.2 | -0.2 | **5** | -0.3 | -0.2 | -0.2 | 0.3 |
| 30(3) | 69.09 | **2** | 0.0 | 0.0 | 0.0 | 0.0 | **5** | 0.0 | 0.0 | 0.0 | 0.0 | **5** | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | CM | | | | | SCU(POS) | | | | | SCU(NEG) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | 14 | 11.3 | 6.8 | 8.2 | -16.7 | 14 | -1.0 | -0.6 | -0.7 | 1.5 | 14 | 13.0 | 7.8 | 9.5 | -19.3 |
| 21(2) | 51.04 | 14 | 9.4 | 5.7 | 6.8 | -13.9 | 14 | -1.1 | -0.6 | -0.8 | 1.6 | 14 | 11.0 | 6.6 | 8.0 | -16.3 |
| 21(3) | 51.99 | 13 | 9.1 | 4.7 | 5.7 | -18.7 | 13 | -1.7 | -0.9 | -1.1 | 3.5 | 13 | 11.4 | 5.9 | 7.1 | -23.3 |
| 22(1) | 51.99 | 13 | 9.1 | 4.7 | 5.7 | -18.7 | 13 | -1.7 | -0.9 | -1.1 | 3.5 | 13 | 11.4 | 5.9 | 7.1 | -23.3 |
| 22(2) | 52.94 | 13 | 7.1 | 3.7 | 4.5 | -14.6 | 13 | -2.5 | -1.3 | -1.6 | 5.1 | 13 | 10.1 | 5.2 | 6.3 | -20.6 |
| 22(3) | 53.89 | 13 | 5.3 | 2.8 | 3.3 | -10.9 | 13 | -3.8 | -1.9 | -2.4 | 7.7 | 13 | 9.4 | 4.9 | 5.9 | -19.3 |
| 23(1) | 53.89 | 13 | 5.3 | 2.8 | 3.3 | -10.9 | 13 | -3.8 | -1.9 | -2.4 | 7.7 | 13 | 9.4 | 4.9 | 5.9 | -19.3 |
| 23(2) | 54.84 | 13 | 3.7 | 1.9 | 2.3 | -7.6 | 13 | -4.9 | -2.5 | -3.1 | 10.0 | 13 | 8.8 | 4.6 | 5.5 | -18.1 |
| 23(3) | 55.79 | 12 | 2.0 | 0.9 | 1.1 | -4.4 | 12 | -5.2 | -2.5 | -3.0 | 11.7 | 12 | 7.2 | 3.5 | 4.2 | -16.4 |
| 24(1) | 55.79 | 12 | 2.0 | 0.9 | 1.1 | -4.4 | 12 | -5.2 | -2.5 | -3.0 | 11.7 | 12 | 7.2 | 3.5 | 4.2 | -16.4 |
| 24(2) | 56.74 | 12 | 0.8 | 0.4 | 0.5 | -1.9 | 12 | -5.8 | -2.8 | -3.4 | 13.2 | 12 | 6.7 | 3.3 | 3.9 | -15.2 |
| 24(3) | 57.69 | 12 | -0.2 | -0.1 | -0.1 | 0.4 | 12 | -6.4 | -3.1 | -3.7 | 14.4 | 12 | 6.2 | 3.0 | 3.6 | -14.0 |
| 25(1) | 57.69 | 12 | -0.2 | -0.1 | -0.1 | 0.4 | 12 | -6.4 | -3.1 | -3.7 | 14.4 | 12 | 6.2 | 3.0 | 3.6 | -14.0 |
| 25(2) | 58.64 | 12 | -1.0 | -0.5 | -0.6 | 2.2 | 12 | -6.7 | -3.3 | -3.9 | 15.2 | 12 | 5.7 | 2.8 | 3.3 | -12.9 |
| 25(3) | 59.59 | 12 | -1.7 | -0.8 | -1.0 | 3.7 | 12 | -6.9 | -3.4 | -4.1 | 15.7 | 12 | 5.2 | 2.5 | 3.0 | -11.7 |
| 26(1) | 59.59 | 12 | -1.7 | -0.8 | -1.0 | 3.7 | 12 | -6.9 | -3.4 | -4.1 | 15.7 | 12 | 5.2 | 2.5 | 3.0 | -11.7 |
| 26(2) | 60.54 | 12 | -2.2 | -1.1 | -1.3 | 4.9 | 12 | -7.0 | -3.4 | -4.1 | 15.7 | 12 | 4.6 | 2.3 | 2.7 | -10.5 |
| 26(3) | 61.49 | 12 | -2.5 | -1.2 | -1.5 | 5.8 | 12 | -6.8 | -3.3 | -4.0 | 15.5 | 12 | 4.1 | 2.0 | 2.4 | -9.3 |
| 27(1) | 61.49 | 12 | -2.5 | -1.2 | -1.5 | 5.8 | 12 | -6.8 | -3.3 | -4.0 | 15.5 | 12 | 4.1 | 2.0 | 2.4 | -9.3 |
| 27(2) | 62.44 | 12 | -2.8 | -1.3 | -1.6 | 6.2 | 12 | -6.5 | -3.2 | -3.8 | 14.8 | 12 | 3.6 | 1.8 | 2.1 | -8.2 |
| 27(3) | 63.39 | 12 | -2.8 | -1.4 | -1.7 | 6.4 | 12 | -6.1 | -3.0 | -3.6 | 13.8 | 12 | 3.1 | 1.5 | 1.8 | -7.0 |
| 28(1) | 63.39 | 12 | -2.8 | -1.4 | -1.7 | 6.4 | 12 | -6.1 | -3.0 | -3.6 | 13.8 | 12 | 3.1 | 1.5 | 1.8 | -7.0 |
| 28(2) | 64.34 | 11 | -3.0 | -1.5 | -1.8 | 6.2 | 11 | -5.9 | -3.0 | -3.6 | 12.5 | 11 | 2.8 | 1.4 | 1.7 | -5.9 |
| 28(3) | 65.29 | 11 | -2.7 | -1.4 | -1.7 | 5.7 | 11 | -5.1 | -2.6 | -3.1 | 10.8 | 11 | 2.2 | 1.1 | 1.4 | -4.7 |
| 29(1) | 65.29 | 11 | -2.7 | -1.4 | -1.7 | 5.7 | 11 | -5.1 | -2.6 | -3.1 | 10.8 | 11 | 2.2 | 1.1 | 1.4 | -4.7 |
| 29(2) | 66.24 | 11 | -2.3 | -1.2 | -1.4 | 4.8 | 11 | -4.1 | -2.1 | -2.5 | 8.6 | 11 | 1.7 | 0.9 | 1.0 | -3.5 |
| 29(3) | 67.19 | 11 | -1.7 | -0.9 | -1.0 | 3.5 | 11 | -2.9 | -1.5 | -1.8 | 6.1 | 11 | 1.1 | 0.6 | 0.7 | -2.4 |
| 30(1) | 67.19 | 11 | -1.7 | -0.9 | -1.0 | 3.5 | 11 | -2.9 | -1.5 | -1.8 | 6.1 | 11 | 1.1 | 0.6 | 0.7 | -2.4 |
| 30(2) | 68.14 | 10 | -0.9 | -0.6 | -0.7 | 1.2 | 10 | -1.5 | -1.0 | -1.1 | 2.0 | 10 | 0.5 | 0.3 | 0.4 | -0.7 |
| 30(3) | 69.09 | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | CM | | | | | SCU(POS) | | | | | SCU(NEG) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 14 | 11.3 | 6.8 | 8.2 | -16.7 | 14 | -1.0 | -0.6 | -0.7 | 1.5 | 14 | 13.0 | 7.8 | 9.5 | -19.3 |
| 11(2) | 20.55 | 14 | 7.6 | 4.6 | 5.6 | -11.3 | 14 | -1.0 | -0.6 | -0.7 | 1.4 | 14 | 9.1 | 5.5 | 6.6 | -13.4 |
| 11(3) | 22.11 | 13 | 5.2 | 2.7 | 3.3 | -10.7 | 13 | -1.6 | -0.8 | -1.0 | 3.2 | 13 | 7.1 | 3.7 | 4.5 | -14.6 |
| 12(1) | 22.11 | 13 | 5.2 | 2.7 | 3.3 | -10.7 | 13 | -1.6 | -0.8 | -1.0 | 3.2 | 13 | 7.1 | 3.7 | 4.5 | -14.6 |
| 12(2) | 23.66 | 13 | 1.7 | 0.9 | 1.1 | -3.6 | 13 | -2.6 | -1.4 | -1.7 | 5.4 | 13 | 4.5 | 2.3 | 2.8 | -9.2 |
| 12(3) | 25.22 | 13 | -1.3 | -0.7 | -0.8 | 2.6 | 13 | -4.4 | -2.3 | -2.8 | 9.1 | 13 | 3.1 | 1.6 | 1.9 | -6.3 |
| 13(1) | 25.22 | 13 | -1.3 | -0.7 | -0.8 | 2.6 | 13 | -4.4 | -2.3 | -2.8 | 9.1 | 13 | 3.1 | 1.6 | 1.9 | -6.3 |
| 13(2) | 26.77 | 13 | -3.8 | -2.0 | -2.4 | 7.8 | 13 | -6.8 | -3.5 | -4.2 | 13.8 | 13 | 2.7 | 1.4 | 1.7 | -5.5 |
| 13(3) | 28.33 | 12 | -5.2 | -2.5 | -3.1 | 11.8 | 12 | -7.9 | -3.8 | -4.6 | 17.8 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 14(1) | 28.33 | 12 | -5.2 | -2.5 | -3.1 | 11.8 | 12 | -7.9 | -3.8 | -4.6 | 17.8 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 14(2) | 29.88 | 12 | -6.6 | -3.2 | -3.9 | 15.0 | 12 | -9.4 | -4.6 | -5.5 | 21.3 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 14(3) | 31.44 | 12 | -7.7 | -3.7 | -4.5 | 17.3 | 12 | -10.5 | -5.1 | -6.2 | 23.7 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 15(1) | 31.44 | 12 | -7.7 | -3.7 | -4.5 | 17.3 | 12 | -10.5 | -5.1 | -6.2 | 23.7 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 15(2) | 32.99 | 12 | -8.3 | -4.0 | -4.9 | 18.7 | 12 | -11.1 | -5.4 | -6.5 | 25.2 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 15(3) | 34.55 | 12 | -8.5 | -4.1 | -5.0 | 19.2 | 12 | -11.4 | -5.5 | -6.7 | 25.7 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 16(1) | 34.55 | 12 | -8.5 | -4.1 | -5.0 | 19.2 | 12 | -11.4 | -5.5 | -6.7 | 25.7 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 16(2) | 36.10 | 12 | -8.3 | -4.0 | -4.9 | 18.7 | 12 | -11.1 | -5.4 | -6.5 | 25.2 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 16(3) | 37.65 | 12 | -7.7 | -3.7 | -4.5 | 17.3 | 12 | -10.5 | -5.1 | -6.2 | 23.7 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 17(1) | 37.65 | 12 | -7.7 | -3.7 | -4.5 | 17.3 | 12 | -10.5 | -5.1 | -6.2 | 23.7 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 17(2) | 39.21 | 12 | -6.6 | -3.2 | -3.9 | 15.0 | 12 | -9.4 | -4.6 | -5.5 | 21.3 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 17(3) | 40.76 | 12 | -5.2 | -2.5 | -3.1 | 11.8 | 12 | -7.9 | -3.8 | -4.6 | 17.8 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 18(1) | 40.76 | 12 | -5.2 | -2.5 | -3.1 | 11.8 | 12 | -7.9 | -3.8 | -4.6 | 17.8 | 12 | 2.4 | 1.1 | 1.4 | -5.3 |
| 18(2) | 42.32 | 13 | -3.8 | -2.0 | -2.4 | 7.8 | 13 | -6.8 | -3.5 | -4.2 | 13.8 | 13 | 2.7 | 1.4 | 1.7 | -5.5 |
| 18(3) | 43.87 | 13 | -1.3 | -0.7 | -0.8 | 2.6 | 13 | -4.4 | -2.3 | -2.8 | 9.1 | 13 | 3.1 | 1.6 | 1.9 | -6.3 |
| 19(1) | 43.87 | 13 | -1.3 | -0.7 | -0.8 | 2.6 | 13 | -4.4 | -2.3 | -2.8 | 9.1 | 13 | 3.1 | 1.6 | 1.9 | -6.3 |
| 19(2) | 45.43 | 13 | 1.7 | 0.9 | 1.1 | -3.6 | 13 | -2.6 | -1.4 | -1.7 | 5.4 | 13 | 4.5 | 2.3 | 2.8 | -9.2 |
| 19(3) | 46.98 | 13 | 5.2 | 2.7 | 3.3 | -10.7 | 13 | -1.6 | -0.8 | -1.0 | 3.2 | 13 | 7.1 | 3.7 | 4.5 | -14.6 |
| 20(1) | 46.98 | 13 | 5.2 | 2.7 | 3.3 | -10.7 | 13 | -1.6 | -0.8 | -1.0 | 3.2 | 13 | 7.1 | 3.7 | 4.5 | -14.6 |
| 20(2) | 48.54 | 14 | 7.6 | 4.6 | 5.6 | -11.3 | 14 | -1.0 | -0.6 | -0.7 | 1.4 | 14 | 9.1 | 5.5 | 6.6 | -13.4 |
| 20(3) | 50.09 | 14 | 11.3 | 6.8 | 8.2 | -16.7 | 14 | -1.0 | -0.6 | -0.7 | 1.5 | 14 | 13.0 | 7.8 | 9.5 | -19.3 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | GRADIENTE | | | | | VP(POS) | | | | | VP(NEG) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 14 | -10.1 | -6.1 | -7.4 | 15.0 | 14 | -1.5 | -0.9 | -1.1 | 2.2 | 14 | 9.4 | 5.7 | 6.8 | -13.9 |
| 11(2) | 20.55 | 14 | -10.1 | -6.1 | -7.4 | 15.0 | 14 | -1.2 | -0.7 | -0.9 | 1.7 | 14 | 6.4 | 3.8 | 4.6 | -9.4 |
| 11(3) | 22.11 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -3.5 | -1.8 | -2.2 | 7.1 | 13 | 5.0 | 2.6 | 3.1 | -10.2 |
| 12(1) | 22.11 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -3.5 | -1.8 | -2.2 | 7.1 | 13 | 5.0 | 2.6 | 3.1 | -10.2 |
| 12(2) | 23.66 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -6.1 | -3.2 | -3.8 | 12.5 | 13 | 4.6 | 2.4 | 2.9 | -9.4 |
| 12(3) | 25.22 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -8.7 | -4.5 | -5.5 | 17.9 | 13 | 4.2 | 2.2 | 2.7 | -8.7 |
| 13(1) | 25.22 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -8.7 | -4.5 | -5.5 | 17.9 | 13 | 4.2 | 2.2 | 2.7 | -8.7 |
| 13(2) | 26.77 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -11.1 | -5.7 | -6.9 | 22.7 | 13 | 3.9 | 2.0 | 2.4 | -7.9 |
| 13(3) | 28.33 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -11.6 | -5.6 | -6.8 | 26.1 | 12 | 3.1 | 1.5 | 1.8 | -6.9 |
| 14(1) | 28.33 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -11.6 | -5.6 | -6.8 | 26.1 | 12 | 3.1 | 1.5 | 1.8 | -6.9 |
| 14(2) | 29.88 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -13.0 | -6.3 | -7.6 | 29.4 | 12 | 2.7 | 1.3 | 1.6 | -6.2 |
| 14(3) | 31.44 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -14.1 | -6.9 | -8.3 | 32.0 | 12 | 2.4 | 1.2 | 1.4 | -5.4 |
| 15(1) | 31.44 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -14.1 | -6.9 | -8.3 | 32.0 | 12 | 2.4 | 1.2 | 1.4 | -5.4 |
| 15(2) | 32.99 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -14.8 | -7.2 | -8.7 | 33.4 | 12 | 2.1 | 1.0 | 1.2 | -4.7 |
| 15(3) | 34.55 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -15.0 | -7.3 | -8.8 | 34.0 | 12 | 1.7 | 0.8 | 1.0 | -3.9 |
| 16(1) | 34.55 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -15.0 | -7.3 | -8.8 | 34.0 | 12 | 1.7 | 0.8 | 1.0 | -3.9 |
| 16(2) | 36.10 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -14.8 | -7.2 | -8.7 | 33.4 | 12 | 2.1 | 1.0 | 1.2 | -4.7 |
| 16(3) | 37.65 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -14.1 | -6.9 | -8.3 | 32.0 | 12 | 2.4 | 1.2 | 1.4 | -5.4 |
| 17(1) | 37.65 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -14.1 | -6.9 | -8.3 | 32.0 | 12 | 2.4 | 1.2 | 1.4 | -5.4 |
| 17(2) | 39.21 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -13.0 | -6.3 | -7.6 | 29.4 | 12 | 2.7 | 1.3 | 1.6 | -6.2 |
| 17(3) | 40.76 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -11.6 | -5.6 | -6.8 | 26.1 | 12 | 3.1 | 1.5 | 1.8 | -6.9 |
| 18(1) | 40.76 | 12 | -10.7 | -5.2 | -6.3 | 24.2 | 12 | -11.6 | -5.6 | -6.8 | 26.1 | 12 | 3.1 | 1.5 | 1.8 | -6.9 |
| 18(2) | 42.32 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -11.1 | -5.7 | -6.9 | 22.7 | 13 | 3.9 | 2.0 | 2.4 | -7.9 |
| 18(3) | 43.87 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -8.7 | -4.5 | -5.5 | 17.9 | 13 | 4.2 | 2.2 | 2.7 | -8.7 |
| 19(1) | 43.87 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -8.7 | -4.5 | -5.5 | 17.9 | 13 | 4.2 | 2.2 | 2.7 | -8.7 |
| 19(2) | 45.43 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -6.1 | -3.2 | -3.8 | 12.5 | 13 | 4.6 | 2.4 | 2.9 | -9.4 |
| 19(3) | 46.98 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -3.5 | -1.8 | -2.2 | 7.1 | 13 | 5.0 | 2.6 | 3.1 | -10.2 |
| 20(1) | 46.98 | 13 | -12.2 | -6.3 | -7.6 | 25.0 | 13 | -3.5 | -1.8 | -2.2 | 7.1 | 13 | 5.0 | 2.6 | 3.1 | -10.2 |
| 20(2) | 48.54 | 14 | -10.1 | -6.1 | -7.4 | 15.0 | 14 | -1.2 | -0.7 | -0.9 | 1.7 | 14 | 6.4 | 3.8 | 4.6 | -9.4 |
| 20(3) | 50.09 | 14 | -10.1 | -6.1 | -7.4 | 15.0 | 14 | -1.5 | -0.9 | -1.1 | 2.2 | 14 | 9.4 | 5.7 | 6.8 | -13.9 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0**

| | | GRADIENTE | | | | | VP(POS) | | | | | VP(NEG) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1(2) | 0.95 | 10 | -0.6 | -0.4 | -0.4 | 0.7 | 10 | -2.7 | -1.7 | -2.0 | 3.5 | 10 | 0.5 | 0.3 | 0.4 | -0.7 |
| 1(3) | 1.90 | 11 | -1.2 | -0.6 | -0.7 | 2.4 | 11 | -5.4 | -2.7 | -3.3 | 11.3 | 11 | 1.1 | 0.5 | 0.7 | -2.3 |
| 2(1) | 1.90 | 11 | -1.2 | -0.6 | -0.7 | 2.4 | 11 | -5.4 | -2.7 | -3.3 | 11.3 | 11 | 1.1 | 0.5 | 0.7 | -2.3 |
| 2(2) | 2.85 | 11 | -1.7 | -0.9 | -1.1 | 3.7 | 11 | -7.3 | -3.7 | -4.5 | 15.5 | 11 | 1.6 | 0.8 | 1.0 | -3.4 |
| 2(3) | 3.80 | 11 | -2.3 | -1.2 | -1.4 | 4.9 | 11 | -9.1 | -4.6 | -5.6 | 19.3 | 11 | 2.1 | 1.1 | 1.3 | -4.5 |
| 3(1) | 3.80 | 11 | -2.3 | -1.2 | -1.4 | 4.9 | 11 | -9.1 | -4.6 | -5.6 | 19.3 | 11 | 2.1 | 1.1 | 1.3 | -4.5 |
| 3(2) | 4.75 | 11 | -2.9 | -1.5 | -1.8 | 6.1 | 11 | -10.4 | -5.3 | -6.4 | 21.9 | 11 | 2.7 | 1.4 | 1.6 | -5.7 |
| 3(3) | 5.70 | 12 | -3.2 | -1.6 | -1.9 | 7.3 | 12 | -10.5 | -5.1 | -6.2 | 23.8 | 12 | 3.0 | 1.4 | 1.7 | -6.7 |
| 4(1) | 5.70 | 12 | -3.2 | -1.6 | -1.9 | 7.3 | 12 | -10.5 | -5.1 | -6.2 | 23.8 | 12 | 3.0 | 1.4 | 1.7 | -6.7 |
| 4(2) | 6.65 | 12 | -3.8 | -1.8 | -2.2 | 8.5 | 12 | -11.2 | -5.4 | -6.6 | 25.3 | 12 | 3.5 | 1.7 | 2.0 | -7.9 |
| 4(3) | 7.60 | 12 | -4.3 | -2.1 | -2.5 | 9.7 | 12 | -11.7 | -5.7 | -6.9 | 26.5 | 12 | 4.0 | 1.9 | 2.3 | -9.0 |
| 5(1) | 7.60 | 12 | -4.3 | -2.1 | -2.5 | 9.7 | 12 | -11.7 | -5.7 | -6.9 | 26.5 | 12 | 4.0 | 1.9 | 2.3 | -9.0 |
| 5(2) | 8.55 | 12 | -4.8 | -2.3 | -2.8 | 10.9 | 12 | -11.6 | -5.6 | -6.8 | 26.2 | 12 | 4.5 | 2.2 | 2.6 | -10.1 |
| 5(3) | 9.50 | 12 | -5.4 | -2.6 | -3.1 | 12.1 | 12 | -11.7 | -5.7 | -6.8 | 26.4 | 12 | 5.0 | 2.4 | 2.9 | -11.2 |
| 6(1) | 9.50 | 12 | -5.4 | -2.6 | -3.1 | 12.1 | 12 | -11.7 | -5.7 | -6.8 | 26.4 | 12 | 5.0 | 2.4 | 2.9 | -11.2 |
| 6(2) | 10.45 | 12 | -5.9 | -2.9 | -3.5 | 13.3 | 12 | -11.0 | -5.4 | -6.5 | 24.9 | 12 | 5.5 | 2.7 | 3.2 | -12.4 |
| 6(3) | 11.40 | 12 | -6.4 | -3.1 | -3.8 | 14.5 | 12 | -10.5 | -5.1 | -6.1 | 23.7 | 12 | 6.0 | 2.9 | 3.5 | -13.5 |
| 7(1) | 11.40 | 12 | -6.4 | -3.1 | -3.8 | 14.5 | 12 | -10.5 | -5.1 | -6.1 | 23.7 | 12 | 6.0 | 2.9 | 3.5 | -13.5 |
| 7(2) | 12.35 | 12 | -7.0 | -3.4 | -4.1 | 15.7 | 12 | -9.4 | -4.6 | -5.5 | 21.3 | 12 | 6.5 | 3.1 | 3.8 | -14.6 |
| 7(3) | 13.30 | 12 | -7.5 | -3.6 | -4.4 | 17.0 | 12 | -8.3 | -4.0 | -4.9 | 18.9 | 12 | 7.0 | 3.4 | 4.1 | -15.7 |
| 8(1) | 13.30 | 12 | -7.5 | -3.6 | -4.4 | 17.0 | 12 | -8.3 | -4.0 | -4.9 | 18.9 | 12 | 7.0 | 3.4 | 4.1 | -15.7 |
| 8(2) | 14.25 | 13 | -9.1 | -4.7 | -5.7 | 18.7 | 13 | -7.9 | -4.1 | -5.0 | 16.2 | 13 | 8.5 | 4.4 | 5.3 | -17.4 |
| 8(3) | 15.20 | 13 | -9.8 | -5.1 | -6.1 | 20.0 | 13 | -6.3 | -3.2 | -3.9 | 12.8 | 13 | 9.0 | 4.7 | 5.7 | -18.5 |
| 9(1) | 15.20 | 13 | -9.8 | -5.1 | -6.1 | 20.0 | 13 | -6.3 | -3.2 | -3.9 | 12.8 | 13 | 9.0 | 4.7 | 5.7 | -18.5 |
| 9(2) | 16.15 | 13 | -10.4 | -5.4 | -6.5 | 21.2 | 13 | -4.4 | -2.3 | -2.7 | 8.9 | 13 | 9.6 | 5.0 | 6.0 | -19.7 |
| 9(3) | 17.10 | 13 | -11.0 | -5.7 | -6.9 | 22.5 | 13 | -2.4 | -1.2 | -1.5 | 4.9 | 13 | 10.2 | 5.3 | 6.4 | -20.8 |
| 10(1) | 17.10 | 13 | -11.0 | -5.7 | -6.9 | 22.5 | 13 | -2.4 | -1.2 | -1.5 | 4.9 | 13 | 10.2 | 5.3 | 6.4 | -20.8 |
| 10(2) | 18.05 | 14 | -9.6 | -5.8 | -7.0 | 14.2 | 14 | -1.4 | -0.9 | -1.0 | 2.1 | 14 | 8.9 | 5.4 | 6.5 | -13.2 |
| 10(3) | 19.00 | 14 | -10.1 | -6.1 | -7.4 | 15.0 | 14 | -1.5 | -0.9 | -1.1 | 2.2 | 14 | 9.4 | 5.7 | 6.8 | -13.9 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF** — **ISOSTATICO PRETENSADO T=INF** — **FASE 1** — **FASE 2**

| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | **0.00** | 52 | 7.9 | 0.5 | 3.7 | -44.9 | 52 | 0.0 | 0.0 | 0.0 | 0.0 | 52 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1(2) | 0.95 | 52 | 7.9 | 0.5 | 3.7 | -44.9 | 52 | -1.4 | -0.9 | -1.5 | -2.0 | 52 | -0.5 | -0.3 | -0.6 | -0.8 |
| 1(3) | 1.90 | 51 | 7.5 | -4.8 | -4.2 | -82.4 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 2(1) | 1.90 | 51 | 10.4 | -5.5 | -3.5 | -106.5 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 2(2) | 2.85 | 51 | 10.4 | -5.5 | -3.5 | -106.5 | 51 | -3.4 | -1.7 | -3.6 | 8.3 | 51 | -1.3 | -0.6 | -1.4 | 3.2 |
| 2(3) | 3.80 | 51 | 10.4 | -5.5 | -3.5 | -106.5 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 3(1) | 3.80 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 3(2) | 4.75 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.0 | -2.5 | -5.3 | 12.2 | 51 | -1.9 | -1.0 | -2.0 | 4.7 |
| 3(3) | 5.70 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 4(1) | 5.70 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 4(2) | 6.65 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.0 | -3.0 | -6.5 | 14.8 | 51 | -2.3 | -1.2 | -2.5 | 5.6 |
| 4(3) | 7.60 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 5(1) | 7.60 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 5(2) | 8.55 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.5 | -3.3 | -7.0 | 16.1 | 51 | -2.5 | -1.3 | -2.7 | 6.1 |
| 5(3) | 9.50 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.6 | -3.3 | -7.1 | 16.2 | 51 | -2.5 | -1.3 | -2.7 | 6.2 |
| 6(1) | 9.50 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.6 | -3.3 | -7.1 | 16.2 | 51 | -2.5 | -1.3 | -2.7 | 6.2 |
| 6(2) | 10.45 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.5 | -3.3 | -7.0 | 16.1 | 51 | -2.5 | -1.3 | -2.7 | 6.1 |
| 6(3) | 11.40 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 7(1) | 11.40 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 7(2) | 12.35 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.0 | -3.0 | -6.5 | 14.8 | 51 | -2.3 | -1.2 | -2.5 | 5.6 |
| 7(3) | 13.30 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 8(1) | 13.30 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 8(2) | 14.25 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.0 | -2.5 | -5.3 | 12.2 | 51 | -1.9 | -1.0 | -2.0 | 4.7 |
| 8(3) | 15.20 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 9(1) | 15.20 | 51 | 7.5 | -4.8 | -3.7 | -106.3 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 9(2) | 16.15 | 51 | 7.5 | -4.8 | -3.7 | -106.3 | 51 | -3.4 | -1.7 | -3.6 | 8.3 | 51 | -1.3 | -0.6 | -1.4 | 3.2 |
| 9(3) | 17.10 | 51 | 7.5 | -4.8 | -4.2 | -82.4 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 10(1) | 17.10 | 51 | 9.7 | 2.1 | 4.9 | -44 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 10(2) | 18.05 | 53 | 9.7 | 2.1 | 4.9 | -44 | 53 | -1.2 | -0.7 | -1.3 | 2.0 | 53 | -0.5 | -0.3 | -0.5 | 0.8 |
| 10(3) | 19.00 | 53 | 9.7 | 2.1 | 4.9 | -44 | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 53 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=0** — **GRADIENTE** — **VP(POS)** — **VP(NEG)**

| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 50.09 | 14 | -10.1 | -6.1 | -7.4 | 15.0 | 14 | -1.5 | -0.9 | -1.1 | 2.2 | 14 | 9.4 | 5.7 | 6.8 | -13.9 |
| 21(2) | 51.04 | 14 | -9.6 | -5.8 | -7.0 | 14.2 | 14 | -1.4 | -0.9 | -1.0 | 2.1 | 14 | 8.9 | 5.4 | 6.5 | -13.2 |
| 21(3) | 51.99 | 13 | -11.0 | -5.7 | -6.9 | 22.5 | 13 | -2.4 | -1.2 | -1.5 | 4.9 | 13 | 10.2 | 5.3 | 6.4 | -20.8 |
| 22(1) | 51.99 | 13 | -11.0 | -5.7 | -6.9 | 22.5 | 13 | -2.4 | -1.2 | -1.5 | 4.9 | 13 | 10.2 | 5.3 | 6.4 | -20.8 |
| 22(2) | 52.94 | 13 | -10.4 | -5.4 | -6.5 | 21.2 | 13 | -4.4 | -2.3 | -2.7 | 8.9 | 13 | 9.6 | 5.0 | 6.0 | -19.7 |
| 22(3) | 53.89 | 13 | -9.8 | -5.1 | -6.1 | 20.0 | 13 | -6.3 | -3.2 | -3.9 | 12.8 | 13 | 9.0 | 4.7 | 5.7 | -18.5 |
| 23(1) | 53.89 | 13 | -9.8 | -5.1 | -6.1 | 20.0 | 13 | -6.3 | -3.2 | -3.9 | 12.8 | 13 | 9.0 | 4.7 | 5.7 | -18.5 |
| 23(2) | 54.84 | 13 | -9.1 | -4.7 | -5.7 | 18.7 | 13 | -7.9 | -4.1 | -5.0 | 16.2 | 13 | 8.5 | 4.4 | 5.3 | -17.4 |
| 23(3) | 55.79 | 12 | -7.5 | -3.6 | -4.4 | 17.0 | 12 | -8.3 | -4.0 | -4.9 | 18.9 | 12 | 7.0 | 3.4 | 4.1 | -15.7 |
| 24(1) | 55.79 | 12 | -7.5 | -3.6 | -4.4 | 17.0 | 12 | -8.3 | -4.0 | -4.9 | 18.9 | 12 | 7.0 | 3.4 | 4.1 | -15.7 |
| 24(2) | 56.74 | 12 | -7.0 | -3.4 | -4.1 | 15.7 | 12 | -9.4 | -4.6 | -5.5 | 21.3 | 12 | 6.5 | 3.1 | 3.8 | -14.6 |
| 24(3) | 57.69 | 12 | -6.4 | -3.1 | -3.8 | 14.5 | 12 | -10.5 | -5.1 | -6.1 | 23.7 | 12 | 6.0 | 2.9 | 3.5 | -13.5 |
| 25(1) | 57.69 | 12 | -6.4 | -3.1 | -3.8 | 14.5 | 12 | -10.5 | -5.1 | -6.1 | 23.7 | 12 | 6.0 | 2.9 | 3.5 | -13.5 |
| 25(2) | 58.64 | 12 | -5.9 | -2.9 | -3.5 | 13.3 | 12 | -11.0 | -5.4 | -6.5 | 24.9 | 12 | 5.5 | 2.7 | 3.2 | -12.4 |
| 25(3) | 59.59 | 12 | -5.4 | -2.6 | -3.1 | 12.1 | 12 | -11.7 | -5.7 | -6.8 | 26.4 | 12 | 5.0 | 2.4 | 2.9 | -11.2 |
| 26(1) | 59.59 | 12 | -5.4 | -2.6 | -3.1 | 12.1 | 12 | -11.7 | -5.7 | -6.8 | 26.4 | 12 | 5.0 | 2.4 | 2.9 | -11.2 |
| 26(2) | 60.54 | 12 | -4.8 | -2.3 | -2.8 | 10.9 | 12 | -11.6 | -5.6 | -6.8 | 26.2 | 12 | 4.5 | 2.2 | 2.6 | -10.1 |
| 26(3) | 61.49 | 12 | -4.3 | -2.1 | -2.5 | 9.7 | 12 | -11.7 | -5.7 | -6.9 | 26.5 | 12 | 4.0 | 1.9 | 2.3 | -9.0 |
| 27(1) | 61.49 | 12 | -4.3 | -2.1 | -2.5 | 9.7 | 12 | -11.7 | -5.7 | -6.9 | 26.5 | 12 | 4.0 | 1.9 | 2.3 | -9.0 |
| 27(2) | 62.44 | 12 | -3.8 | -1.8 | -2.2 | 8.5 | 12 | -11.2 | -5.4 | -6.6 | 25.3 | 12 | 3.5 | 1.7 | 2.0 | -7.9 |
| 27(3) | 63.39 | 12 | -3.2 | -1.6 | -1.9 | 7.3 | 12 | -10.5 | -5.1 | -6.2 | 23.8 | 12 | 3.0 | 1.4 | 1.7 | -6.7 |
| 28(1) | 63.39 | 12 | -3.2 | -1.6 | -1.9 | 7.3 | 12 | -10.5 | -5.1 | -6.2 | 23.8 | 12 | 3.0 | 1.4 | 1.7 | -6.7 |
| 28(2) | 64.34 | 11 | -2.9 | -1.5 | -1.8 | 6.1 | 11 | -10.4 | -5.3 | -6.4 | 21.9 | 11 | 2.7 | 1.4 | 1.6 | -5.7 |
| 28(3) | 65.29 | 11 | -2.3 | -1.2 | -1.4 | 4.9 | 11 | -9.1 | -4.6 | -5.6 | 19.3 | 11 | 2.1 | 1.1 | 1.3 | -4.5 |
| 29(1) | 65.29 | 11 | -2.3 | -1.2 | -1.4 | 4.9 | 11 | -9.1 | -4.6 | -5.6 | 19.3 | 11 | 2.1 | 1.1 | 1.3 | -4.5 |
| 29(2) | 66.24 | 11 | -1.7 | -0.9 | -1.1 | 3.7 | 11 | -7.3 | -3.7 | -4.5 | 15.5 | 11 | 1.6 | 0.8 | 1.0 | -3.4 |
| 29(3) | 67.19 | 11 | -1.2 | -0.6 | -0.7 | 2.4 | 11 | -5.4 | -2.7 | -3.3 | 11.3 | 11 | 1.1 | 0.5 | 0.7 | -2.3 |
| 30(1) | 67.19 | 11 | -1.2 | -0.6 | -0.7 | 2.4 | 11 | -5.4 | -2.7 | -3.3 | 11.3 | 11 | 1.1 | 0.5 | 0.7 | -2.3 |
| 30(2) | 68.14 | 10 | -0.6 | -0.4 | -0.4 | 0.7 | 10 | -2.7 | -1.7 | -2.0 | 3.5 | 10 | 0.5 | 0.3 | 0.4 | -0.7 |
| 30(3) | 69.09 | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF** — **ISOSTATICO PRETENSADO T=INF** — **FASE 1** — **FASE 2**

| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 50.09 | 53 | 9.7 | 2.1 | 4.9 | -44 | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 53 | 0.0 | 0.0 | 0.0 | 0.0 |
| 21(2) | 51.04 | 53 | 9.7 | 2.1 | 4.9 | -44 | 53 | -1.2 | -0.7 | -1.3 | 2.0 | 53 | -0.5 | -0.3 | -0.5 | 0.8 |
| 21(3) | 51.99 | 51 | 9.7 | 2.1 | 4.9 | -44 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 22(1) | 51.99 | 51 | 7.5 | -4.8 | -4.2 | -82.4 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 22(2) | 52.94 | 51 | 7.5 | -4.8 | -4.2 | -82.4 | 51 | -3.4 | -1.7 | -3.6 | 8.3 | 51 | -1.3 | -0.6 | -1.4 | 3.2 |
| 22(3) | 53.89 | 51 | 7.5 | -4.8 | -4.2 | -82.4 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 23(1) | 53.89 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 23(2) | 54.84 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.0 | -2.5 | -5.3 | 12.2 | 51 | -1.9 | -1.0 | -2.0 | 4.7 |
| 23(3) | 55.79 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 24(1) | 55.79 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 24(2) | 56.74 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.0 | -3.0 | -6.5 | 14.8 | 51 | -2.3 | -1.2 | -2.5 | 5.6 |
| 24(3) | 57.69 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 25(1) | 57.69 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 25(2) | 58.64 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.5 | -3.3 | -7.0 | 16.1 | 51 | -2.5 | -1.3 | -2.7 | 6.1 |
| 25(3) | 59.59 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.6 | -3.3 | -7.1 | 16.2 | 51 | -2.5 | -1.3 | -2.7 | 6.2 |
| 26(1) | 59.59 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.6 | -3.3 | -7.1 | 16.2 | 51 | -2.5 | -1.3 | -2.7 | 6.2 |
| 26(2) | 60.54 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.5 | -3.3 | -7.0 | 16.1 | 51 | -2.5 | -1.3 | -2.7 | 6.1 |
| 26(3) | 61.49 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 27(1) | 61.49 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.3 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 27(2) | 62.44 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -6.0 | -3.0 | -6.5 | 14.8 | 51 | -2.3 | -1.2 | -2.5 | 5.6 |
| 27(3) | 63.39 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 28(1) | 63.39 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.5 | -2.8 | -6.0 | 13.6 | 51 | -2.1 | -1.1 | -2.3 | 5.2 |
| 28(2) | 64.34 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -5.0 | -2.5 | -5.3 | 12.2 | 51 | -1.9 | -1.0 | -2.0 | 4.7 |
| 28(3) | 65.29 | 51 | 10.1 | -5.7 | -3.7 | -106.3 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 29(1) | 65.29 | 51 | 10.4 | -5.5 | -3.5 | -106.5 | 51 | -4.2 | -2.1 | -4.5 | 10.4 | 51 | -1.6 | -0.8 | -1.7 | 4.0 |
| 29(2) | 66.24 | 51 | 10.4 | -5.5 | -3.5 | -106.5 | 51 | -3.4 | -1.7 | -3.6 | 8.3 | 51 | -1.3 | -0.6 | -1.4 | 3.2 |
| 29(3) | 67.19 | 51 | 10.4 | -5.5 | -3.5 | -106.5 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 30(1) | 67.19 | 51 | 7.5 | -4.8 | -4.2 | -82.4 | 51 | -2.4 | -1.2 | -2.6 | 5.8 | 51 | -0.9 | -0.5 | -1.0 | 2.2 |
| 30(2) | 68.14 | 52 | 7.9 | 0.5 | 3.7 | -44.9 | 52 | -1.4 | -0.9 | -1.5 | -2.0 | 52 | -0.5 | -0.3 | -0.6 | -0.8 |
| 30(3) | 69.09 | 52 | 7.9 | 0.5 | 3.7 | -44.9 | 52 | 0.0 | 0.0 | 0.0 | 0.0 | 52 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF** — **ISOSTATICO PRETENSADO T=INF** — **FASE 1** — **FASE 2**

| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 19.00 | 53 | 11.9 | 2.8 | 6.6 | -52.5 | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 53 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11(2) | 20.55 | 53 | 11.9 | 2.8 | -2 | -162.2 | 53 | -3.2 | -1.9 | -3.5 | 5.4 | 53 | -1.2 | -0.7 | -1.3 | 2.1 |
| 11(3) | 22.11 | 51 | 11.9 | 2.8 | -2 | -162.2 | 51 | -6.4 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 12(1) | 22.11 | 51 | 16.5 | -7.2 | -2 | -162.2 | 51 | -6.4 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 12(2) | 23.66 | 51 | 16.5 | -7.2 | -2 | -162.2 | 51 | -9.0 | -4.5 | -9.7 | 22.2 | 51 | -3.5 | -1.7 | -3.7 | 8.5 |
| 12(3) | 25.22 | 51 | 16.5 | -7.2 | -2 | -162.2 | 51 | -11.3 | -5.7 | -12.1 | 27.8 | 51 | -4.3 | -2.2 | -4.6 | 10.6 |
| 13(1) | 25.22 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -11.3 | -5.7 | -12.1 | 27.8 | 51 | -4.3 | -2.2 | -4.6 | 10.6 |
| 13(2) | 26.77 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -13.3 | -6.7 | -14.2 | 32.6 | 51 | -5.1 | -2.6 | -5.4 | 12.5 |
| 13(3) | 28.33 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -14.9 | -7.5 | -15.9 | 36.5 | 51 | -5.7 | -2.9 | -6.1 | 14.0 |
| 14(1) | 28.33 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -14.9 | -7.5 | -15.9 | 36.5 | 51 | -5.7 | -2.9 | -6.1 | 14.0 |
| 14(2) | 29.88 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -16.1 | -8.1 | -17.3 | 39.5 | 51 | -6.2 | -3.1 | -6.6 | 15.1 |
| 14(3) | 31.44 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.0 | -8.5 | -18.2 | 41.7 | 51 | -6.5 | -3.3 | -7.0 | 16.0 |
| 15(1) | 31.44 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.0 | -8.5 | -18.2 | 41.7 | 51 | -6.5 | -3.3 | -7.0 | 16.0 |
| 15(2) | 32.99 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.5 | -8.8 | -18.8 | 43.0 | 51 | -6.7 | -3.4 | -7.2 | 16.5 |
| 15(3) | 34.55 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.7 | -8.9 | -19.0 | 43.5 | 51 | -6.8 | -3.4 | -7.3 | 16.6 |
| 16(1) | 34.55 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.7 | -8.9 | -19.0 | 43.5 | 51 | -6.8 | -3.4 | -7.3 | 16.6 |
| 16(2) | 36.10 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.5 | -8.8 | -18.8 | 43.0 | 51 | -6.7 | -3.4 | -7.2 | 16.5 |
| 16(3) | 37.65 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.0 | -8.5 | -18.2 | 41.7 | 51 | -6.5 | -3.3 | -7.0 | 16.0 |
| 17(1) | 37.65 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -17.0 | -8.5 | -18.2 | 41.7 | 51 | -6.5 | -3.3 | -7.0 | 16.0 |
| 17(2) | 39.21 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -16.1 | -8.1 | -17.3 | 39.5 | 51 | -6.2 | -3.1 | -6.6 | 15.1 |
| 17(3) | 40.76 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -14.9 | -7.5 | -15.9 | 36.5 | 51 | -5.7 | -2.9 | -6.1 | 14.0 |
| 18(1) | 40.76 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -14.9 | -7.5 | -15.9 | 36.5 | 51 | -5.7 | -2.9 | -6.1 | 14.0 |
| 18(2) | 42.32 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -13.3 | -6.7 | -14.2 | 32.6 | 51 | -5.1 | -2.6 | -5.4 | 12.5 |
| 18(3) | 43.87 | 51 | 18.9 | -9.5 | 0.5 | -206 | 51 | -11.3 | -5.7 | -12.1 | 27.8 | 51 | -4.3 | -2.2 | -4.6 | 10.6 |
| 19(1) | 43.87 | 51 | 16.5 | -7.2 | 0.5 | -206 | 51 | -11.3 | -5.7 | -12.1 | 27.8 | 51 | -4.3 | -2.2 | -4.6 | 10.6 |
| 19(2) | 45.43 | 51 | 16.5 | -7.2 | 0.5 | -206 | 51 | -9.0 | -4.5 | -9.7 | 22.2 | 51 | -3.5 | -1.7 | -3.7 | 8.5 |
| 19(3) | 46.98 | 51 | 16.5 | -7.2 | -2 | -162.2 | 51 | -6.4 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 20(1) | 46.98 | 51 | 11.9 | 2.8 | -2 | -162.2 | 51 | -6.4 | -3.2 | -6.8 | 15.6 | 51 | -2.4 | -1.2 | -2.6 | 6.0 |
| 20(2) | 48.54 | 53 | 11.9 | 2.8 | -2 | -162.2 | 53 | -3.2 | -1.9 | -3.5 | 5.4 | 53 | -1.2 | -0.7 | -1.3 | 2.1 |
| 20(3) | 50.09 | 53 | 11.9 | 2.8 | 6.6 | -52.5 | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 53 | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF**

| | | FASE 3 | | | | | FASE 5 | | | | | FASE 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 53 | 4.2 | 2.5 | 4.5 | -7.0 | 59 | 3.0 | 1.8 | 2.2 | -4.4 |
| 11(2) | 20.55 | 53 | -1.8 | -1.1 | -1.9 | 3.0 | 53 | 1.7 | 1.0 | 1.9 | -2.9 | 59 | 2.0 | 1.2 | 1.5 | -3.0 |
| 11(3) | 22.11 | 51 | -3.7 | -1.9 | -4.0 | 9.2 | 51 | -0.3 | -0.2 | -0.3 | 0.8 | 58 | 1.3 | 0.7 | 0.8 | -2.8 |
| 12(1) | 22.11 | 51 | -3.7 | -1.9 | -4.0 | 9.2 | 51 | -0.3 | -0.2 | -0.3 | 0.8 | 58 | 1.3 | 0.7 | 0.8 | -2.8 |
| 12(2) | 23.66 | 51 | -5.6 | -2.8 | -6.0 | 13.8 | 51 | -1.9 | -1.0 | -2.1 | 4.8 | 58 | 0.4 | 0.2 | 0.3 | -0.9 |
| 12(3) | 25.22 | 51 | -7.5 | -3.8 | -8.0 | 18.4 | 51 | -3.1 | -1.6 | -3.3 | 7.6 | 58 | -0.4 | -0.2 | -0.2 | 0.7 |
| 13(1) | 25.22 | 51 | -7.5 | -3.8 | -8.0 | 18.4 | 51 | -3.1 | -1.6 | -3.3 | 7.6 | 58 | -0.4 | -0.2 | -0.2 | 0.7 |
| 13(2) | 26.77 | 51 | -9.4 | -4.7 | -10.0 | 23.0 | 51 | -3.8 | -1.9 | -4.1 | 9.4 | 58 | -1.0 | -0.5 | -0.6 | 2.1 |
| 13(3) | 28.33 | 51 | -11.2 | -5.6 | -12.0 | 27.6 | 51 | -4.0 | -2.0 | -4.3 | 9.9 | 57 | -1.4 | -0.7 | -0.8 | 3.1 |
| 14(1) | 28.33 | 51 | -11.2 | -5.6 | -12.0 | 27.6 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -1.4 | -0.7 | -0.8 | 3.1 |
| 14(2) | 29.88 | 51 | -12.9 | -6.5 | -13.8 | 31.6 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -1.8 | -0.9 | -1.1 | 4.0 |
| 14(3) | 31.44 | 51 | -14.0 | -7.1 | -15.0 | 34.4 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.0 | -1.0 | -1.2 | 4.6 |
| 15(1) | 31.44 | 51 | -14.0 | -7.1 | -15.0 | 34.4 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.0 | -1.0 | -1.2 | 4.6 |
| 15(2) | 32.99 | 51 | -14.7 | -7.4 | -15.8 | 36.2 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.2 | -1.1 | -1.3 | 4.9 |
| 15(3) | 34.55 | 51 | -15.0 | -7.5 | -16.0 | 36.7 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.3 | -1.1 | -1.3 | 5.0 |
| 16(1) | 34.55 | 51 | -15.0 | -7.5 | -16.0 | 36.7 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.3 | -1.1 | -1.3 | 5.0 |
| 16(2) | 36.10 | 51 | -14.7 | -7.4 | -15.8 | 36.2 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.2 | -1.1 | -1.3 | 4.9 |
| 16(3) | 37.65 | 51 | -14.0 | -7.1 | -15.0 | 34.4 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.0 | -1.0 | -1.2 | 4.6 |
| 17(1) | 37.65 | 51 | -14.0 | -7.1 | -15.0 | 34.4 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -2.0 | -1.0 | -1.2 | 4.6 |
| 17(2) | 39.21 | 51 | -12.9 | -6.5 | -13.8 | 31.6 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -1.8 | -0.9 | -1.1 | 4.0 |
| 17(3) | 40.76 | 51 | -11.2 | -5.6 | -12.0 | 27.6 | 57 | -4.3 | -2.1 | -2.6 | 9.6 | 57 | -1.4 | -0.7 | -0.8 | 3.1 |
| 18(1) | 40.76 | 51 | -11.2 | -5.6 | -12.0 | 27.6 | 51 | -4.0 | -2.0 | -4.3 | 9.9 | 57 | -1.4 | -0.7 | -0.8 | 3.1 |
| 18(2) | 42.32 | 51 | -9.4 | -4.7 | -10.0 | 23.0 | 51 | -3.8 | -1.9 | -4.1 | 9.4 | 58 | -1.0 | -0.5 | -0.6 | 2.1 |
| 18(3) | 43.87 | 51 | -7.5 | -3.8 | -8.0 | 18.4 | 51 | -3.1 | -1.6 | -3.3 | 7.6 | 58 | -0.4 | -0.2 | -0.2 | 0.7 |
| 19(1) | 43.87 | 51 | -7.5 | -3.8 | -8.0 | 18.4 | 51 | -3.1 | -1.6 | -3.3 | 7.6 | 58 | -0.4 | -0.2 | -0.2 | 0.7 |
| 19(2) | 45.43 | 51 | -5.6 | -2.8 | -6.0 | 13.8 | 51 | -1.9 | -1.0 | -2.1 | 4.8 | 58 | 0.4 | 0.2 | 0.3 | -0.9 |
| 19(3) | 46.98 | 51 | -3.7 | -1.9 | -4.0 | 9.2 | 51 | -0.3 | -0.2 | -0.3 | 0.8 | 58 | 1.3 | 0.7 | 0.8 | -2.8 |
| 20(1) | 46.98 | 51 | -3.7 | -1.9 | -4.0 | 9.2 | 51 | -0.3 | -0.2 | -0.3 | 0.8 | 58 | 1.3 | 0.7 | 0.8 | -2.8 |
| 20(2) | 48.54 | 53 | -1.8 | -1.1 | -1.9 | 3.0 | 53 | 1.7 | 1.0 | 1.9 | -2.9 | 59 | 2.0 | 1.2 | 1.5 | -3.0 |
| 20(3) | 50.09 | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 53 | 4.2 | 2.5 | 4.5 | -7.0 | 59 | 3.0 | 1.8 | 2.2 | -4.4 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF**

| | | FASE 3 | | | | | FASE 5 | | | | | FASE 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | 52 | 0.0 | 0.0 | 0.0 | 0.0 | 55 | 0.0 | 0.0 | 0.0 | 0.0 | 55 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1(2) | 0.95 | 52 | -1.7 | -1.1 | -1.9 | -2.6 | 55 | 0.2 | 0.1 | 0.1 | -0.2 | 55 | -0.2 | -0.2 | -0.2 | 0.3 |
| 1(3) | 1.90 | 51 | -3.0 | -1.5 | -3.2 | 7.4 | 56 | 0.3 | 0.2 | 0.2 | -0.7 | 56 | -0.4 | -0.2 | -0.3 | 0.9 |
| 2(1) | 1.90 | 51 | -3.0 | -1.5 | -3.2 | 7.4 | 56 | 0.3 | 0.2 | 0.2 | -0.7 | 56 | -0.4 | -0.2 | -0.3 | 0.9 |
| 2(2) | 2.85 | 51 | -4.2 | -2.1 | -4.6 | 10.4 | 56 | 0.5 | 0.3 | 0.3 | -1.1 | 56 | -0.6 | -0.3 | -0.4 | 1.2 |
| 2(3) | 3.80 | 51 | -5.3 | -2.7 | -5.7 | 13.0 | 56 | 0.7 | 0.3 | 0.4 | -1.4 | 56 | -0.7 | -0.4 | -0.4 | 1.5 |
| 3(1) | 3.80 | 51 | -5.3 | -2.7 | -5.7 | 13.0 | 56 | 0.7 | 0.3 | 0.4 | -1.4 | 56 | -0.7 | -0.4 | -0.4 | 1.5 |
| 3(2) | 4.75 | 51 | -6.2 | -3.1 | -6.6 | 15.2 | 56 | 0.9 | 0.4 | 0.5 | -1.8 | 56 | -0.8 | -0.4 | -0.5 | 1.6 |
| 3(3) | 5.70 | 51 | -6.9 | -3.5 | -7.4 | 17.0 | 57 | 1.0 | 0.5 | 0.6 | -2.1 | 57 | -0.8 | -0.4 | -0.4 | 1.7 |
| 4(1) | 5.70 | 51 | -6.9 | -3.5 | -7.4 | 17.0 | 57 | 1.0 | 0.5 | 0.6 | -2.1 | 57 | -0.8 | -0.4 | -0.4 | 1.7 |
| 4(2) | 6.65 | 51 | -7.5 | -3.7 | -8.0 | 18.3 | 57 | 1.1 | 0.5 | 0.7 | -2.5 | 57 | -0.7 | -0.4 | -0.4 | 1.6 |
| 4(3) | 7.60 | 51 | -7.8 | -3.9 | -8.4 | 19.2 | 57 | 1.3 | 0.6 | 0.8 | -2.8 | 57 | -0.7 | -0.3 | -0.4 | 1.5 |
| 5(1) | 7.60 | 51 | -7.8 | -3.9 | -8.4 | 19.2 | 57 | 1.3 | 0.6 | 0.8 | -2.8 | 57 | -0.7 | -0.3 | -0.4 | 1.5 |
| 5(2) | 8.55 | 51 | -8.0 | -4.0 | -8.6 | 19.7 | 57 | 1.4 | 0.7 | 0.8 | -3.2 | 57 | -0.6 | -0.3 | -0.3 | 1.3 |
| 5(3) | 9.50 | 51 | -8.0 | -4.0 | -8.6 | 19.7 | 57 | 1.6 | 0.8 | 0.9 | -3.5 | 57 | -0.4 | -0.2 | -0.3 | 1.0 |
| 6(1) | 9.50 | 51 | -8.0 | -4.0 | -8.6 | 19.7 | 57 | 1.6 | 0.8 | 0.9 | -3.5 | 57 | -0.4 | -0.2 | -0.3 | 1.0 |
| 6(2) | 10.45 | 51 | -7.9 | -4.0 | -8.4 | 19.3 | 57 | 1.7 | 0.9 | 1.0 | -3.9 | 57 | -0.3 | -0.1 | -0.2 | 0.6 |
| 6(3) | 11.40 | 51 | -7.5 | -3.8 | -8.1 | 18.5 | 57 | 1.9 | 0.9 | 1.1 | -4.2 | 57 | -0.1 | 0.0 | 0.0 | 0.1 |
| 7(1) | 11.40 | 51 | -7.5 | -3.8 | -8.1 | 18.5 | 51 | 1.8 | 0.9 | 1.9 | -4.4 | 57 | -0.1 | 0.0 | 0.0 | 0.1 |
| 7(2) | 12.35 | 51 | -7.0 | -3.5 | -7.5 | 17.3 | 51 | 1.9 | 1.0 | 2.1 | -4.7 | 57 | 0.2 | 0.1 | 0.1 | -0.4 |
| 7(3) | 13.30 | 51 | -6.4 | -3.2 | -6.8 | 15.6 | 51 | 2.1 | 1.0 | 2.2 | -5.1 | 57 | 0.5 | 0.2 | 0.3 | -1.1 |
| 8(1) | 13.30 | 51 | -6.4 | -3.2 | -6.8 | 15.6 | 51 | 2.1 | 1.0 | 2.2 | -5.1 | 57 | 0.5 | 0.2 | 0.3 | -1.1 |
| 8(2) | 14.25 | 51 | -5.5 | -2.8 | -5.9 | 13.5 | 51 | 2.2 | 1.1 | 2.4 | -5.5 | 58 | 0.9 | 0.5 | 0.6 | -2.0 |
| 8(3) | 15.20 | 51 | -4.5 | -2.2 | -4.8 | 11.0 | 51 | 2.4 | 1.2 | 2.6 | -5.8 | 58 | 1.4 | 0.7 | 0.9 | -2.9 |
| 9(1) | 15.20 | 51 | -4.5 | -2.2 | -4.8 | 11.0 | 51 | 2.4 | 1.2 | 2.6 | -5.8 | 58 | 1.4 | 0.7 | 0.9 | -2.9 |
| 9(2) | 16.15 | 51 | -3.4 | -1.7 | -3.6 | 8.2 | 51 | 2.6 | 1.3 | 2.8 | -6.4 | 58 | 1.8 | 0.9 | 1.1 | -3.9 |
| 9(3) | 17.10 | 51 | -2.2 | -1.1 | -2.4 | 5.5 | 51 | 3.0 | 1.5 | 3.2 | -7.4 | 58 | 2.4 | 1.2 | 1.5 | -4.9 |
| 10(1) | 17.10 | 51 | -2.2 | -1.1 | -2.4 | 5.5 | 51 | 3.0 | 1.5 | 3.2 | -7.4 | 58 | 2.4 | 1.2 | 1.5 | -4.9 |
| 10(2) | 18.05 | 53 | -1.1 | -0.6 | -1.2 | 1.8 | 53 | 3.4 | 2.1 | 3.7 | -5.8 | 59 | 2.5 | 1.5 | 1.8 | -3.6 |
| 10(3) | 19.00 | 53 | 0.0 | 0.0 | 0.0 | 0.0 | 53 | 4.2 | 2.5 | 4.5 | -7.0 | 59 | 3.0 | 1.8 | 2.2 | -4.4 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF**

| | | CM | | | | | REDISTRIBUCIONES | | | | | RETRACCION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | **60** | 0.0 | 0.0 | 0.0 | 0.0 | **101** | 0.0 | 0.0 | 0.0 | 0.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 1(2) | 0.95 | **60** | -0.9 | -0.5 | -0.7 | 1.1 | **101** | -0.7 | -0.4 | -0.5 | 0.9 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 1(3) | 1.90 | **61** | -1.6 | -0.8 | -1.0 | 3.3 | **102** | -1.4 | -0.7 | -0.9 | 3.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 2(1) | 1.90 | **61** | -1.6 | -0.8 | -1.0 | 3.3 | **102** | -1.4 | -0.7 | -0.9 | 3.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 2(2) | 2.85 | **61** | -2.1 | -1.1 | -1.3 | 4.5 | **102** | -2.2 | -1.1 | -1.3 | 4.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 2(3) | 3.80 | **61** | -2.5 | -1.3 | -1.6 | 5.3 | **102** | -2.9 | -1.5 | -1.8 | 6.1 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 3(1) | 3.80 | **61** | -2.5 | -1.3 | -1.6 | 5.3 | **102** | -2.9 | -1.5 | -1.8 | 6.1 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 3(2) | 4.75 | **61** | -2.8 | -1.4 | -1.7 | 5.9 | **102** | -3.6 | -1.8 | -2.2 | 7.6 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 3(3) | 5.70 | **62** | -2.7 | -1.3 | -1.6 | 6.0 | **103** | -4.0 | -2.0 | -2.4 | 9.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 4(1) | 5.70 | **62** | -2.7 | -1.3 | -1.6 | 6.0 | **103** | -4.0 | -2.0 | -2.4 | 9.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 4(2) | 6.65 | **62** | -2.6 | -1.3 | -1.5 | 5.9 | **103** | -4.7 | -2.3 | -2.8 | 10.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 4(3) | 7.60 | **62** | -2.4 | -1.2 | -1.4 | 5.4 | **103** | -5.3 | -2.6 | -3.1 | 12.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 5(1) | 7.60 | **62** | -2.4 | -1.2 | -1.4 | 5.4 | **103** | -5.3 | -2.6 | -3.1 | 12.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 5(2) | 8.55 | **62** | -2.1 | -1.0 | -1.2 | 4.6 | **103** | -6.0 | -2.9 | -3.5 | 13.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 5(3) | 9.50 | **62** | -1.6 | -0.8 | -0.9 | 3.5 | **103** | -6.7 | -3.3 | -3.9 | 15.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 6(1) | 9.50 | **62** | -1.6 | -0.8 | -0.9 | 3.5 | **103** | -6.7 | -3.3 | -3.9 | 15.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 6(2) | 10.45 | **62** | -0.9 | -0.5 | -0.5 | 2.1 | **103** | -7.3 | -3.6 | -4.3 | 16.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 6(3) | 11.40 | **62** | -0.1 | -0.1 | -0.1 | 0.3 | **103** | -8.0 | -3.9 | -4.7 | 18.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 7(1) | 11.40 | **62** | -0.1 | -0.1 | -0.1 | 0.3 | **103** | -8.0 | -3.9 | -4.7 | 18.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 7(2) | 12.35 | **62** | 0.8 | 0.4 | 0.5 | -1.8 | **103** | -8.7 | -4.2 | -5.1 | 19.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 7(3) | 13.30 | **62** | 1.8 | 0.9 | 1.1 | -4.2 | **103** | -9.3 | -4.6 | -5.5 | 21.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 8(1) | 13.30 | **62** | 1.8 | 0.9 | 1.1 | -4.2 | **103** | -9.3 | -4.6 | -5.5 | 21.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 8(2) | 14.25 | **63** | 3.5 | 1.8 | 2.1 | -7.3 | **104** | -11.4 | -5.8 | -7.1 | 23.6 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 8(3) | 15.20 | **63** | 5.0 | 2.6 | 3.1 | -10.5 | **104** | -12.1 | -6.2 | -7.5 | 25.2 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 9(1) | 15.20 | **63** | 5.0 | 2.6 | 3.1 | -10.5 | **104** | -12.1 | -6.2 | -7.5 | 25.2 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 9(2) | 16.15 | **63** | 6.7 | 3.4 | 4.2 | -14.1 | **104** | -12.9 | -6.6 | -8.0 | 26.8 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 9(3) | 17.10 | **63** | 8.6 | 4.4 | 5.3 | -18.0 | **104** | -13.7 | -7.0 | -8.5 | 28.3 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 10(1) | 17.10 | **63** | 8.6 | 4.4 | 5.3 | -18.0 | **104** | -13.7 | -7.0 | -8.5 | 28.3 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 10(2) | 18.05 | **64** | 8.9 | 5.4 | 6.5 | -13.3 | **105** | -12.1 | -7.3 | -7.3 | 17.9 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 10(3) | 19.00 | **64** | 10.8 | 6.5 | 7.8 | -16.0 | **105** | -12.7 | -7.7 | -7.7 | 18.8 | | 0.6 | 6.7 | -27.7 | 8.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF**

| | | FASE 3 | | | | | FASE 5 | | | | | FASE 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | **53** | 0.0 | 0.0 | 0.0 | 0.0 | **53** | 4.2 | 2.5 | 4.5 | -7.0 | **59** | 3.0 | 1.8 | 2.2 | -4.4 |
| 21(2) | 51.04 | **53** | -1.1 | -0.6 | -1.2 | 1.8 | **53** | 3.4 | 2.1 | 3.7 | -5.8 | **59** | 2.5 | 1.5 | 1.8 | -3.6 |
| 21(3) | 51.99 | **51** | -2.2 | -1.1 | -2.4 | 5.5 | **51** | 3.0 | 1.5 | 3.2 | -7.4 | **58** | 2.4 | 1.2 | 1.5 | -4.9 |
| 22(1) | 51.99 | **51** | -2.2 | -1.1 | -2.4 | 5.5 | **51** | 3.0 | 1.5 | 3.2 | -7.4 | **58** | 2.4 | 1.2 | 1.5 | -4.9 |
| 22(2) | 52.94 | **51** | -3.4 | -1.7 | -3.6 | 8.2 | **51** | 2.6 | 1.3 | 2.8 | -6.4 | **58** | 1.8 | 0.9 | 1.1 | -3.9 |
| 22(3) | 53.89 | **51** | -4.5 | -2.2 | -4.8 | 11.0 | **51** | 2.4 | 1.2 | 2.6 | -5.8 | **58** | 1.4 | 0.7 | 0.9 | -2.9 |
| 23(1) | 53.89 | **51** | -4.5 | -2.2 | -4.8 | 11.0 | **51** | 2.4 | 1.2 | 2.6 | -5.8 | **58** | 1.4 | 0.7 | 0.9 | -2.9 |
| 23(2) | 54.84 | **51** | -5.5 | -2.8 | -5.9 | 13.5 | **51** | 2.2 | 1.1 | 2.4 | -5.5 | **58** | 0.9 | 0.5 | 0.6 | -2.0 |
| 23(3) | 55.79 | **51** | -6.4 | -3.2 | -6.8 | 15.6 | **51** | 2.1 | 1.0 | 2.2 | -5.1 | **57** | 0.5 | 0.2 | 0.3 | -1.1 |
| 24(1) | 55.79 | **51** | -6.4 | -3.2 | -6.8 | 15.6 | **51** | 2.1 | 1.0 | 2.2 | -5.1 | **57** | 0.5 | 0.2 | 0.3 | -1.1 |
| 24(2) | 56.74 | **51** | -7.0 | -3.5 | -7.5 | 17.3 | **51** | 1.9 | 1.0 | 2.1 | -4.7 | **57** | 0.2 | 0.1 | 0.1 | -0.4 |
| 24(3) | 57.69 | **51** | -7.5 | -3.8 | -8.1 | 18.5 | **51** | 1.8 | 0.9 | 1.9 | -4.4 | **57** | -0.1 | 0.0 | 0.0 | 0.1 |
| 25(1) | 57.69 | **51** | -7.5 | -3.8 | -8.1 | 18.5 | **57** | 1.9 | 0.9 | 1.1 | -4.2 | **57** | -0.1 | 0.0 | 0.0 | 0.1 |
| 25(2) | 58.64 | **51** | -7.9 | -4.0 | -8.4 | 19.3 | **57** | 1.7 | 0.9 | 1.0 | -3.9 | **57** | -0.3 | -0.1 | -0.2 | 0.6 |
| 25(3) | 59.59 | **51** | -8.0 | -4.0 | -8.6 | 19.7 | **57** | 1.6 | 0.8 | 0.9 | -3.5 | **57** | -0.4 | -0.2 | -0.3 | 1.0 |
| 26(1) | 59.59 | **51** | -8.0 | -4.0 | -8.6 | 19.7 | **57** | 1.6 | 0.8 | 0.9 | -3.5 | **57** | -0.4 | -0.2 | -0.3 | 1.0 |
| 26(2) | 60.54 | **51** | -8.0 | -4.0 | -8.6 | 19.7 | **57** | 1.4 | 0.7 | 0.8 | -3.2 | **57** | -0.6 | -0.3 | -0.3 | 1.3 |
| 26(3) | 61.49 | **51** | -7.8 | -3.9 | -8.4 | 19.2 | **57** | 1.3 | 0.6 | 0.8 | -2.8 | **57** | -0.7 | -0.3 | -0.4 | 1.5 |
| 27(1) | 61.49 | **51** | -7.8 | -3.9 | -8.4 | 19.2 | **57** | 1.3 | 0.6 | 0.8 | -2.8 | **57** | -0.7 | -0.3 | -0.4 | 1.5 |
| 27(2) | 62.44 | **51** | -7.5 | -3.7 | -8.0 | 18.3 | **57** | 1.1 | 0.5 | 0.7 | -2.5 | **57** | -0.7 | -0.4 | -0.4 | 1.6 |
| 27(3) | 63.39 | **51** | -6.9 | -3.5 | -7.4 | 17.0 | **57** | 1.0 | 0.5 | 0.6 | -2.1 | **57** | -0.8 | -0.4 | -0.4 | 1.7 |
| 28(1) | 63.39 | **51** | -6.9 | -3.5 | -7.4 | 17.0 | **57** | 1.0 | 0.5 | 0.6 | -2.1 | **57** | -0.8 | -0.4 | -0.4 | 1.7 |
| 28(2) | 64.34 | **51** | -6.2 | -3.1 | -6.6 | 15.2 | **56** | 0.9 | 0.4 | 0.5 | -1.8 | **56** | -0.8 | -0.4 | -0.5 | 1.6 |
| 28(3) | 65.29 | **51** | -5.3 | -2.7 | -5.7 | 13.0 | **56** | 0.7 | 0.3 | 0.4 | -1.4 | **56** | -0.7 | -0.4 | -0.4 | 1.5 |
| 29(1) | 65.29 | **51** | -5.3 | -2.7 | -5.7 | 13.0 | **56** | 0.7 | 0.3 | 0.4 | -1.4 | **56** | -0.7 | -0.4 | -0.4 | 1.5 |
| 29(2) | 66.24 | **51** | -4.2 | -2.1 | -4.6 | 10.4 | **56** | 0.5 | 0.3 | 0.3 | -1.1 | **56** | -0.6 | -0.3 | -0.4 | 1.2 |
| 29(3) | 67.19 | **51** | -3.0 | -1.5 | -3.2 | 7.4 | **56** | 0.3 | 0.2 | 0.2 | -0.7 | **56** | -0.4 | -0.2 | -0.3 | 0.9 |
| 30(1) | 67.19 | **51** | -3.0 | -1.5 | -3.2 | 7.4 | **56** | 0.3 | 0.2 | 0.2 | -0.7 | **56** | -0.4 | -0.2 | -0.3 | 0.9 |
| 30(2) | 68.14 | **52** | -1.7 | -1.1 | -1.9 | -2.6 | **55** | 0.2 | 0.1 | 0.1 | -0.2 | **55** | -0.2 | -0.2 | -0.2 | 0.3 |
| 30(3) | 69.09 | **52** | 0.0 | 0.0 | 0.0 | 0.0 | **55** | 0.0 | 0.0 | 0.0 | 0.0 | **55** | 0.0 | 0.0 | 0.0 | 0.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF**

| | | CM | | | | | REDISTRIBUCIONES | | | | | RETRACCION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | 64 | 10.8 | 6.5 | 7.8 | -16.0 | 105 | -12.7 | -7.7 | -7.7 | 18.8 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 21(2) | 51.04 | 64 | 8.9 | 5.4 | 6.5 | -13.3 | 105 | -12.1 | -7.3 | -7.3 | 17.9 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 21(3) | 51.99 | 63 | 8.6 | 4.4 | 5.3 | -18.0 | 104 | -13.7 | -7.0 | -8.5 | 28.3 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 22(1) | 51.99 | 63 | 8.6 | 4.4 | 5.3 | -18.0 | 104 | -13.7 | -7.0 | -8.5 | 28.3 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 22(2) | 52.94 | 63 | 6.7 | 3.4 | 4.2 | -14.1 | 104 | -12.9 | -6.6 | -8.0 | 26.8 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 22(3) | 53.89 | 63 | 5.0 | 2.6 | 3.1 | -10.5 | 104 | -12.1 | -6.2 | -7.5 | 25.2 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 23(1) | 53.89 | 63 | 5.0 | 2.6 | 3.1 | -10.5 | 104 | -12.1 | -6.2 | -7.5 | 25.2 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 23(2) | 54.84 | 63 | 3.5 | 1.8 | 2.1 | -7.3 | 104 | -11.4 | -5.8 | -7.1 | 23.6 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 23(3) | 55.79 | 62 | 1.8 | 0.9 | 1.1 | -4.2 | 103 | -9.3 | -4.6 | -5.5 | 21.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 24(1) | 55.79 | 62 | 1.8 | 0.9 | 1.1 | -4.2 | 103 | -9.3 | -4.6 | -5.5 | 21.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 24(2) | 56.74 | 62 | 0.8 | 0.4 | 0.5 | -1.8 | 103 | -8.7 | -4.2 | -5.1 | 19.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 24(3) | 57.69 | 62 | -0.1 | -0.1 | -0.1 | 0.3 | 103 | -8.0 | -3.9 | -4.7 | 18.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 25(1) | 57.69 | 62 | -0.1 | -0.1 | -0.1 | 0.3 | 103 | -8.0 | -3.9 | -4.7 | 18.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 25(2) | 58.64 | 62 | -0.9 | -0.5 | -0.5 | 2.1 | 103 | -7.3 | -3.6 | -4.3 | 16.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 25(3) | 59.59 | 62 | -1.6 | -0.8 | -0.9 | 3.5 | 103 | -6.7 | -3.3 | -3.9 | 15.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 26(1) | 59.59 | 62 | -1.6 | -0.8 | -0.9 | 3.5 | 103 | -6.7 | -3.3 | -3.9 | 15.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 26(2) | 60.54 | 62 | -2.1 | -1.0 | -1.2 | 4.6 | 103 | -6.0 | -2.9 | -3.5 | 13.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 26(3) | 61.49 | 62 | -2.4 | -1.2 | -1.4 | 5.4 | 103 | -5.3 | -2.6 | -3.1 | 12.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 27(1) | 61.49 | 62 | -2.4 | -1.2 | -1.4 | 5.4 | 103 | -5.3 | -2.6 | -3.1 | 12.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 27(2) | 62.44 | 62 | -2.6 | -1.3 | -1.5 | 5.9 | 103 | -4.7 | -2.3 | -2.8 | 10.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 27(3) | 63.39 | 62 | -2.7 | -1.3 | -1.6 | 6.0 | 103 | -4.0 | -2.0 | -2.4 | 9.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 28(1) | 63.39 | 62 | -2.7 | -1.3 | -1.6 | 6.0 | 103 | -4.0 | -2.0 | -2.4 | 9.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 28(2) | 64.34 | 61 | -2.8 | -1.4 | -1.7 | 5.9 | 102 | -3.6 | -1.8 | -2.2 | 7.6 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 28(3) | 65.29 | 61 | -2.5 | -1.3 | -1.6 | 5.3 | 102 | -2.9 | -1.5 | -1.8 | 6.1 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 29(1) | 65.29 | 61 | -2.5 | -1.3 | -1.6 | 5.3 | 102 | -2.9 | -1.5 | -1.8 | 6.1 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 29(2) | 66.24 | 61 | -2.1 | -1.1 | -1.3 | 4.5 | 102 | -2.2 | -1.1 | -1.3 | 4.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 29(3) | 67.19 | 61 | -1.6 | -0.8 | -1.0 | 3.3 | 102 | -1.4 | -0.7 | -0.9 | 3.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 30(1) | 67.19 | 61 | -1.6 | -0.8 | -1.0 | 3.3 | 102 | -1.4 | -0.7 | -0.9 | 3.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 30(2) | 68.14 | 60 | -0.9 | -0.5 | -0.7 | 1.1 | 101 | -0.7 | -0.4 | -0.5 | 0.9 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 30(3) | 69.09 | 60 | 0.0 | 0.0 | 0.0 | 0.0 | 101 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.6 | 6.7 | -27.7 | 8.0 |

***TENSIONES INDIVIDUALES***

**TIEMPO T=INF**

| | | CM | | | | | REDISTRIBUCIONES | | | | | RETRACCION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj | Stipo | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 64 | 10.8 | 6.5 | 7.8 | -16.0 | 105 | -12.7 | -7.7 | -7.7 | 18.8 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 11(2) | 20.55 | 64 | 7.3 | 4.4 | 5.3 | -10.8 | 105 | -12.7 | -7.6 | -7.6 | 18.8 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 11(3) | 22.11 | 63 | 4.9 | 2.5 | 3.0 | -10.3 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 12(1) | 22.11 | 63 | 4.9 | 2.5 | 3.0 | -10.3 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 12(2) | 23.66 | 63 | 1.6 | 0.8 | 1.0 | -3.4 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 12(3) | 25.22 | 63 | -1.2 | -0.6 | -0.7 | 2.5 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 13(1) | 25.22 | 63 | -1.2 | -0.6 | -0.7 | 2.5 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 13(2) | 26.77 | 63 | -3.6 | -1.8 | -2.2 | 7.6 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 13(3) | 28.33 | 62 | -4.9 | -2.4 | -2.9 | 11.1 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 14(1) | 28.33 | 62 | -4.9 | -2.4 | -2.9 | 11.1 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 14(2) | 29.88 | 62 | -6.3 | -3.1 | -3.7 | 14.1 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 14(3) | 31.44 | 62 | -7.2 | -3.5 | -4.3 | 16.3 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 15(1) | 31.44 | 62 | -7.2 | -3.5 | -4.3 | 16.3 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 15(2) | 32.99 | 62 | -7.8 | -3.8 | -4.6 | 17.6 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 15(3) | 34.55 | 62 | -8.0 | -3.9 | -4.7 | 18.0 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 16(1) | 34.55 | 62 | -8.0 | -3.9 | -4.7 | 18.0 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 16(2) | 36.10 | 62 | -7.8 | -3.8 | -4.6 | 17.6 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 16(3) | 37.65 | 62 | -7.2 | -3.5 | -4.3 | 16.3 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 17(1) | 37.65 | 62 | -7.2 | -3.5 | -4.3 | 16.3 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 17(2) | 39.21 | 62 | -6.3 | -3.1 | -3.7 | 14.1 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 17(3) | 40.76 | 62 | -4.9 | -2.4 | -2.9 | 11.1 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 18(1) | 40.76 | 62 | -4.9 | -2.4 | -2.9 | 11.1 | 103 | -13.4 | -6.5 | -7.9 | 30.0 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 18(2) | 42.32 | 63 | -3.6 | -1.8 | -2.2 | 7.6 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 18(3) | 43.87 | 63 | -1.2 | -0.6 | -0.7 | 2.5 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 19(1) | 43.87 | 63 | -1.2 | -0.6 | -0.7 | 2.5 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 19(2) | 45.43 | 63 | 1.6 | 0.8 | 1.0 | -3.4 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 19(3) | 46.98 | 63 | 4.9 | 2.5 | 3.0 | -10.3 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 20(1) | 46.98 | 63 | 4.9 | 2.5 | 3.0 | -10.3 | 104 | -15.2 | -7.8 | -9.4 | 31.5 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 20(2) | 48.54 | 64 | 7.3 | 4.4 | 5.3 | -10.8 | 105 | -12.7 | -7.6 | -7.6 | 18.8 | | 0.6 | 6.7 | -27.7 | 8.0 |
| 20(3) | 50.09 | 64 | 10.8 | 6.5 | 7.8 | -16.0 | 105 | -12.7 | -7.7 | -7.7 | 18.8 | | 0.6 | 6.7 | -27.7 | 8.0 |

***TENSIONES ACUMULADAS***

**TIEMPO T=0**

| | | TRAS COLOCAR VIGAS | | | | TRAS PRELOSAS | | | | TRAS BC LOSA EN CDV | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 0.0 | 0.0 | 34.7 | -70.5 | 0.0 | 0.0 | 34.7 | -70.5 | 0.0 | 0.0 | 34.7 | -70.5 |
| 11(2) | 20.55 | 0.0 | 0.0 | 28.4 | -183.6 | 0.0 | 0.0 | 20.2 | -179.0 | 0.0 | 0.0 | 8.2 | -172.2 |
| 11(3) | 22.11 | 0.0 | 0.0 | -5.4 | -166.5 | 0.0 | 0.0 | -26.6 | -155.3 | 0.0 | 0.0 | -59.1 | -138.1 |
| 12(1) | 22.11 | 0.0 | 0.0 | -5.4 | -166.5 | 0.0 | 0.0 | -26.6 | -155.3 | 0.0 | 0.0 | -59.1 | -138.1 |
| 12(2) | 23.66 | 0.0 | 0.0 | -7.1 | -227.4 | 0.0 | 0.0 | -37.1 | -211.5 | 0.0 | 0.0 | -85.8 | -185.7 |
| 12(3) | 25.22 | 0.0 | 0.0 | -27.1 | -216.8 | 0.0 | 0.0 | -64.7 | -196.9 | 0.0 | 0.0 | -129.7 | -162.5 |
| 13(1) | 25.22 | 0.0 | 0.0 | -27.1 | -216.8 | 0.0 | 0.0 | -64.7 | -196.9 | 0.0 | 0.0 | -129.7 | -162.5 |
| 13(2) | 26.77 | 0.0 | 0.0 | -44.0 | -207.9 | 0.0 | 0.0 | -88.1 | -184.6 | 0.0 | 0.0 | -169.4 | -141.6 |
| 13(3) | 28.33 | 0.0 | 0.0 | -57.8 | -200.6 | 0.0 | 0.0 | -107.2 | -174.4 | 0.0 | 0.0 | -204.7 | -122.9 |
| 14(1) | 28.33 | 0.0 | 0.0 | -57.8 | -200.6 | 0.0 | 0.0 | -107.2 | -174.4 | 0.0 | 0.0 | -204.7 | -122.9 |
| 14(2) | 29.88 | 0.0 | 0.0 | -68.6 | -194.9 | 0.0 | 0.0 | -122.1 | -166.6 | 0.0 | 0.0 | -233.9 | -107.5 |
| 14(3) | 31.44 | 0.0 | 0.0 | -76.3 | -190.8 | 0.0 | 0.0 | -132.7 | -160.9 | 0.0 | 0.0 | -254.7 | -96.5 |
| 15(1) | 31.44 | 0.0 | 0.0 | -76.3 | -190.8 | 0.0 | 0.0 | -132.7 | -160.9 | 0.0 | 0.0 | -254.7 | -96.5 |
| 15(2) | 32.99 | 0.0 | 0.0 | -80.9 | -188.4 | 0.0 | 0.0 | -139.1 | -157.6 | 0.0 | 0.0 | -267.1 | -89.9 |
| 15(3) | 34.55 | 0.0 | 0.0 | -82.4 | -187.5 | 0.0 | 0.0 | -141.3 | -156.4 | 0.0 | 0.0 | -271.3 | -87.7 |
| 16(1) | 34.55 | 0.0 | 0.0 | -82.4 | -187.5 | 0.0 | 0.0 | -141.3 | -156.4 | 0.0 | 0.0 | -271.3 | -87.7 |
| 16(2) | 36.10 | 0.0 | 0.0 | -80.9 | -188.4 | 0.0 | 0.0 | -139.1 | -157.6 | 0.0 | 0.0 | -267.1 | -89.9 |
| 16(3) | 37.65 | 0.0 | 0.0 | -76.3 | -190.8 | 0.0 | 0.0 | -132.7 | -160.9 | 0.0 | 0.0 | -254.7 | -96.5 |
| 17(1) | 37.65 | 0.0 | 0.0 | -76.3 | -190.8 | 0.0 | 0.0 | -132.7 | -160.9 | 0.0 | 0.0 | -254.7 | -96.5 |
| 17(2) | 39.21 | 0.0 | 0.0 | -68.6 | -194.9 | 0.0 | 0.0 | -122.1 | -166.6 | 0.0 | 0.0 | -233.9 | -107.5 |
| 17(3) | 40.76 | 0.0 | 0.0 | -57.8 | -200.6 | 0.0 | 0.0 | -107.2 | -174.4 | 0.0 | 0.0 | -204.7 | -122.9 |
| 18(1) | 40.76 | 0.0 | 0.0 | -57.8 | -200.6 | 0.0 | 0.0 | -107.2 | -174.4 | 0.0 | 0.0 | -204.7 | -122.9 |
| 18(2) | 42.32 | 0.0 | 0.0 | -44.0 | -207.9 | 0.0 | 0.0 | -88.1 | -184.6 | 0.0 | 0.0 | -169.4 | -141.6 |
| 18(3) | 43.87 | 0.0 | 0.0 | -27.1 | -216.8 | 0.0 | 0.0 | -64.7 | -196.9 | 0.0 | 0.0 | -129.7 | -162.5 |
| 19(1) | 43.87 | 0.0 | 0.0 | -27.1 | -216.8 | 0.0 | 0.0 | -64.7 | -196.9 | 0.0 | 0.0 | -129.7 | -162.5 |
| 19(2) | 45.43 | 0.0 | 0.0 | -7.1 | -227.4 | 0.0 | 0.0 | -37.1 | -211.5 | 0.0 | 0.0 | -85.8 | -185.7 |
| 19(3) | 46.98 | 0.0 | 0.0 | -5.4 | -166.5 | 0.0 | 0.0 | -26.6 | -155.3 | 0.0 | 0.0 | -59.1 | -138.1 |
| 20(1) | 46.98 | 0.0 | 0.0 | -5.4 | -166.5 | 0.0 | 0.0 | -26.6 | -155.3 | 0.0 | 0.0 | -59.1 | -138.1 |
| 20(2) | 48.54 | 0.0 | 0.0 | 28.4 | -183.6 | 0.0 | 0.0 | 20.2 | -179.0 | 0.0 | 0.0 | 8.2 | -172.2 |
| 20(3) | 50.09 | 0.0 | 0.0 | 34.7 | -70.5 | 0.0 | 0.0 | 34.7 | -70.5 | 0.0 | 0.0 | 34.7 | -70.5 |

***TENSIONES ACUMULADAS***

**TIEMPO T=0**

| | | TRAS COLOCAR VIGAS | | | | TRAS PRELOSAS | | | | TRAS BC LOSA EN CDV | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |
| 1(2) | 0.95 | 0.0 | 0.0 | 25.8 | -53.2 | 0.0 | 0.0 | 22.3 | -51.3 | 0.0 | 0.0 | 10.6 | -44.8 |
| 1(3) | 1.90 | 0.0 | 0.0 | -8.2 | -80.6 | 0.0 | 0.0 | -16.1 | -76.5 | 0.0 | 0.0 | -42.2 | -62.6 |
| 2(1) | 1.90 | 0.0 | 0.0 | 4.5 | -111.3 | 0.0 | 0.0 | -3.4 | -107.1 | 0.0 | 0.0 | -29.6 | -93.3 |
| 2(2) | 2.85 | 0.0 | 0.0 | -4.1 | -106.8 | 0.0 | 0.0 | -15.3 | -100.9 | 0.0 | 0.0 | -52.2 | -81.4 |
| 2(3) | 3.80 | 0.0 | 0.0 | -11.6 | -102.8 | 0.0 | 0.0 | -25.6 | -95.4 | 0.0 | 0.0 | -71.8 | -71.0 |
| 3(1) | 3.80 | 0.0 | 0.0 | -11.6 | -102.8 | 0.0 | 0.0 | -25.6 | -95.4 | 0.0 | 0.0 | -71.8 | -71.0 |
| 3(2) | 4.75 | 0.0 | 0.0 | -17.9 | -99.5 | 0.0 | 0.0 | -34.4 | -90.8 | 0.0 | 0.0 | -88.3 | -62.3 |
| 3(3) | 5.70 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -101.6 | -55.2 |
| 4(1) | 5.70 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -101.6 | -55.2 |
| 4(2) | 6.65 | 0.0 | 0.0 | -27.1 | -94.6 | 0.0 | 0.0 | -47.1 | -84.1 | 0.0 | 0.0 | -111.9 | -49.8 |
| 4(3) | 7.60 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -119.0 | -46.0 |
| 5(1) | 7.60 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -119.0 | -46.0 |
| 5(2) | 8.55 | 0.0 | 0.0 | -31.7 | -92.2 | 0.0 | 0.0 | -53.4 | -80.7 | 0.0 | 0.0 | -123.1 | -43.9 |
| 5(3) | 9.50 | 0.0 | 0.0 | -32.3 | -91.9 | 0.0 | 0.0 | -54.2 | -80.3 | 0.0 | 0.0 | -124.0 | -43.4 |
| 6(1) | 9.50 | 0.0 | 0.0 | -32.3 | -91.9 | 0.0 | 0.0 | -54.2 | -80.3 | 0.0 | 0.0 | -124.0 | -43.4 |
| 6(2) | 10.45 | 0.0 | 0.0 | -31.7 | -92.2 | 0.0 | 0.0 | -53.4 | -80.7 | 0.0 | 0.0 | -121.9 | -44.5 |
| 6(3) | 11.40 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -116.6 | -47.3 |
| 7(1) | 11.40 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -116.6 | -47.3 |
| 7(2) | 12.35 | 0.0 | 0.0 | -27.1 | -94.6 | 0.0 | 0.0 | -47.1 | -84.1 | 0.0 | 0.0 | -108.2 | -51.7 |
| 7(3) | 13.30 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -96.8 | -57.8 |
| 8(1) | 13.30 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -96.8 | -57.8 |
| 8(2) | 14.25 | 0.0 | 0.0 | -17.9 | -99.5 | 0.0 | 0.0 | -34.4 | -90.8 | 0.0 | 0.0 | -82.2 | -65.5 |
| 8(3) | 15.20 | 0.0 | 0.0 | -11.6 | -102.8 | 0.0 | 0.0 | -25.6 | -95.4 | 0.0 | 0.0 | -64.5 | -74.9 |
| 9(1) | 15.20 | 0.0 | 0.0 | -24.2 | -72.2 | 0.0 | 0.0 | -38.3 | -64.7 | 0.0 | 0.0 | -77.1 | -44.2 |
| 9(2) | 16.15 | 0.0 | 0.0 | -16.8 | -76.1 | 0.0 | 0.0 | -28.0 | -70.2 | 0.0 | 0.0 | -57.1 | -54.8 |
| 9(3) | 17.10 | 0.0 | 0.0 | -8.2 | -80.6 | 0.0 | 0.0 | -16.1 | -76.5 | 0.0 | 0.0 | -35.5 | -66.2 |
| 10(1) | 17.10 | 0.0 | 0.0 | 5.4 | -47.2 | 0.0 | 0.0 | -2.5 | -43.0 | 0.0 | 0.0 | -21.9 | -32.8 |
| 10(2) | 18.05 | 0.0 | 0.0 | 18.1 | -53.6 | 0.0 | 0.0 | 15.0 | -51.9 | 0.0 | 0.0 | 7.8 | -47.8 |
| 10(3) | 19.00 | 0.0 | 0.0 | 26.1 | -58.1 | 0.0 | 0.0 | 26.1 | -58.1 | 0.0 | 0.0 | 26.1 | -58.1 |

8.1.5. TENSIONES ACUMULADAS

***TENSIONES ACUMULADAS***

**IEMPO T=0**

| | | TRAS BC RESTO LOSA | | | | TRAS VOLADIZOS DE LOSA | | | | C.PERMANENTE A T0 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |
| 1(2) | 0.95 | 0.2 | 0.1 | 10.8 | -45.0 | -0.1 | -0.1 | 10.6 | -44.7 | -1.0 | -0.6 | 9.9 | -43.5 |
| 1(3) | 1.90 | 0.4 | 0.2 | -41.9 | -63.4 | -0.1 | -0.1 | -42.3 | -62.4 | -1.8 | -0.9 | -43.3 | -58.9 |
| 2(1) | 1.90 | 0.4 | 0.2 | -29.3 | -94.1 | -0.1 | -0.1 | -29.6 | -93.1 | -1.8 | -0.9 | -30.7 | -89.6 |
| 2(2) | 2.85 | 0.6 | 0.3 | -51.8 | -82.5 | -0.1 | -0.1 | -52.3 | -81.2 | -2.4 | -1.2 | -53.7 | -76.4 |
| 2(3) | 3.80 | 0.8 | 0.4 | -71.3 | -72.5 | 0.0 | 0.0 | -71.8 | -70.9 | -2.7 | -1.4 | -73.4 | -65.3 |
| 3(1) | 3.80 | 0.8 | 0.4 | -71.3 | -72.5 | 0.0 | 0.0 | -71.8 | -70.9 | -2.7 | -1.4 | -73.4 | -65.3 |
| 3(2) | 4.75 | 1.0 | 0.5 | -87.6 | -64.2 | 0.1 | 0.0 | -88.2 | -62.4 | -2.9 | -1.5 | -90.0 | -56.2 |
| 3(3) | 5.70 | 1.2 | 0.6 | -100.9 | -57.5 | 0.3 | 0.1 | -101.5 | -55.7 | -2.6 | -1.2 | -103.1 | -49.3 |
| 4(1) | 5.70 | 1.2 | 0.6 | -100.9 | -57.5 | 0.3 | 0.1 | -101.5 | -55.7 | -2.6 | -1.2 | -103.1 | -49.3 |
| 4(2) | 6.65 | 1.4 | 0.7 | -111.0 | -52.5 | 0.5 | 0.2 | -111.6 | -50.7 | -2.3 | -1.1 | -113.2 | -44.5 |
| 4(3) | 7.60 | 1.6 | 0.8 | -118.0 | -49.1 | 0.7 | 0.4 | -118.5 | -47.5 | -1.8 | -0.8 | -120.0 | -41.7 |
| 5(1) | 7.60 | 1.6 | 0.8 | -118.0 | -49.1 | 0.7 | 0.4 | -118.5 | -47.5 | -1.8 | -0.8 | -120.0 | -41.7 |
| 5(2) | 8.55 | 1.8 | 1.0 | -121.9 | -47.3 | 1.1 | 0.6 | -122.4 | -45.9 | -1.1 | -0.5 | -123.7 | -41.0 |
| 5(3) | 9.50 | 2.0 | 1.1 | -122.7 | -47.2 | 1.4 | 0.8 | -123.1 | -46.1 | -0.2 | 0.0 | -124.1 | -42.4 |
| 6(1) | 9.50 | 2.0 | 1.1 | -122.7 | -47.2 | 1.4 | 0.8 | -123.1 | -46.1 | -0.2 | 0.0 | -124.1 | -42.4 |
| 6(2) | 10.45 | 2.2 | 1.2 | -120.5 | -48.8 | 1.8 | 1.0 | -120.7 | -48.1 | 0.9 | 0.5 | -121.2 | -45.9 |
| 6(3) | 11.40 | 2.4 | 1.3 | -115.1 | -51.9 | 2.3 | 1.2 | -115.1 | -51.8 | 2.2 | 1.2 | -115.2 | -51.4 |
| 7(1) | 11.40 | 0.0 | 0.0 | -101.1 | -55.5 | -0.1 | 0.0 | -101.2 | -55.4 | -0.2 | -0.1 | -101.3 | -55.0 |
| 7(2) | 12.35 | 0.0 | 0.0 | -91.4 | -60.6 | 0.3 | 0.1 | -91.3 | -61.1 | 1.1 | 0.5 | -90.8 | -63.0 |
| 7(3) | 13.30 | 0.0 | 0.0 | -78.7 | -67.3 | 0.6 | 0.3 | -78.3 | -68.6 | 2.6 | 1.3 | -77.1 | -73.0 |
| 8(1) | 13.30 | 0.0 | 0.0 | -78.7 | -67.3 | 0.6 | 0.3 | -78.3 | -68.6 | 2.6 | 1.3 | -77.1 | -73.0 |
| 8(2) | 14.25 | 0.0 | 0.0 | -62.8 | -75.7 | 1.1 | 0.6 | -62.1 | -77.8 | 4.8 | 2.5 | -59.8 | -85.4 |
| 8(3) | 15.20 | 0.0 | 0.0 | -43.8 | -85.8 | 1.6 | 0.9 | -42.8 | -88.8 | 6.9 | 3.6 | -39.4 | -99.7 |
| 9(1) | 15.20 | 0.0 | 0.0 | -56.4 | -55.1 | 1.6 | 0.9 | -55.4 | -58.1 | 6.9 | 3.6 | -52.1 | -69.0 |
| 9(2) | 16.15 | 0.0 | 0.0 | -34.4 | -66.8 | 2.1 | 1.2 | -33.0 | -70.8 | 9.3 | 4.9 | -28.5 | -85.4 |
| 9(3) | 17.10 | 0.0 | 0.0 | -9.2 | -80.1 | 2.7 | 1.5 | -7.4 | -85.3 | 11.9 | 6.2 | -1.7 | -103.9 |
| 10(1) | 17.10 | 0.0 | 0.0 | 4.4 | -46.7 | 2.7 | 1.5 | 6.2 | -51.8 | 11.9 | 6.2 | 11.9 | -70.5 |
| 10(2) | 18.05 | 0.0 | 0.0 | 30.9 | -60.9 | 2.8 | 1.7 | 33.0 | -64.8 | 12.2 | 7.4 | 39.9 | -78.7 |
| 10(3) | 19.00 | 0.0 | 0.0 | 54.1 | -74.0 | 3.4 | 2.1 | 56.6 | -78.7 | 14.7 | 8.9 | 64.9 | -95.4 |

***TENSIONES ACUMULADAS***

**IEMPO T=0**

| | | TRAS COLOCAR VIGAS | | | | TRAS PRELOSAS | | | | TRAS BC LOSA EN CDV | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | 0.0 | 0.0 | 26.1 | -58.1 | 0.0 | 0.0 | 26.1 | -58.1 | 0.0 | 0.0 | 26.1 | -58.1 |
| 21(2) | 51.04 | 0.0 | 0.0 | 18.1 | -53.6 | 0.0 | 0.0 | 15.0 | -51.9 | 0.0 | 0.0 | 7.8 | -47.8 |
| 21(3) | 51.99 | 0.0 | 0.0 | 5.4 | -47.2 | 0.0 | 0.0 | -2.5 | -43.0 | 0.0 | 0.0 | -21.9 | -32.8 |
| 22(1) | 51.99 | 0.0 | 0.0 | -8.2 | -80.6 | 0.0 | 0.0 | -16.1 | -76.5 | 0.0 | 0.0 | -35.5 | -66.2 |
| 22(2) | 52.94 | 0.0 | 0.0 | -16.8 | -76.1 | 0.0 | 0.0 | -28.0 | -70.2 | 0.0 | 0.0 | -57.1 | -54.8 |
| 22(3) | 53.89 | 0.0 | 0.0 | -24.2 | -72.2 | 0.0 | 0.0 | -38.3 | -64.7 | 0.0 | 0.0 | -77.1 | -44.2 |
| 23(1) | 53.89 | 0.0 | 0.0 | -11.6 | -102.8 | 0.0 | 0.0 | -25.6 | -95.4 | 0.0 | 0.0 | -64.5 | -74.9 |
| 23(2) | 54.84 | 0.0 | 0.0 | -17.9 | -99.5 | 0.0 | 0.0 | -34.4 | -90.8 | 0.0 | 0.0 | -82.2 | -65.5 |
| 23(3) | 55.79 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -96.8 | -57.8 |
| 24(1) | 55.79 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -96.8 | -57.8 |
| 24(2) | 56.74 | 0.0 | 0.0 | -27.1 | -94.6 | 0.0 | 0.0 | -47.1 | -84.1 | 0.0 | 0.0 | -108.2 | -51.7 |
| 24(3) | 57.69 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -116.6 | -47.3 |
| 25(1) | 57.69 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -116.6 | -47.3 |
| 25(2) | 58.64 | 0.0 | 0.0 | -31.7 | -92.2 | 0.0 | 0.0 | -53.4 | -80.7 | 0.0 | 0.0 | -121.9 | -44.5 |
| 25(3) | 59.59 | 0.0 | 0.0 | -32.3 | -91.9 | 0.0 | 0.0 | -54.2 | -80.3 | 0.0 | 0.0 | -124.0 | -43.4 |
| 26(1) | 59.59 | 0.0 | 0.0 | -32.3 | -91.9 | 0.0 | 0.0 | -54.2 | -80.3 | 0.0 | 0.0 | -124.0 | -43.4 |
| 26(2) | 60.54 | 0.0 | 0.0 | -31.7 | -92.2 | 0.0 | 0.0 | -53.4 | -80.7 | 0.0 | 0.0 | -123.1 | -43.9 |
| 26(3) | 61.49 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -119.0 | -46.0 |
| 27(1) | 61.49 | 0.0 | 0.0 | -29.9 | -93.1 | 0.0 | 0.0 | -51.0 | -82.0 | 0.0 | 0.0 | -119.0 | -46.0 |
| 27(2) | 62.44 | 0.0 | 0.0 | -27.1 | -94.6 | 0.0 | 0.0 | -47.1 | -84.1 | 0.0 | 0.0 | -111.9 | -49.8 |
| 27(3) | 63.39 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -101.6 | -55.2 |
| 28(1) | 63.39 | 0.0 | 0.0 | -23.1 | -96.8 | 0.0 | 0.0 | -41.5 | -87.0 | 0.0 | 0.0 | -101.6 | -55.2 |
| 28(2) | 64.34 | 0.0 | 0.0 | -17.9 | -99.5 | 0.0 | 0.0 | -34.4 | -90.8 | 0.0 | 0.0 | -88.3 | -62.3 |
| 28(3) | 65.29 | 0.0 | 0.0 | -11.6 | -102.8 | 0.0 | 0.0 | -25.6 | -95.4 | 0.0 | 0.0 | -71.8 | -71.0 |
| 29(1) | 65.29 | 0.0 | 0.0 | -11.6 | -102.8 | 0.0 | 0.0 | -25.6 | -95.4 | 0.0 | 0.0 | -71.8 | -71.0 |
| 29(2) | 66.24 | 0.0 | 0.0 | -4.1 | -106.8 | 0.0 | 0.0 | -15.3 | -100.9 | 0.0 | 0.0 | -52.2 | -81.4 |
| 29(3) | 67.19 | 0.0 | 0.0 | 4.5 | -111.3 | 0.0 | 0.0 | -3.4 | -107.1 | 0.0 | 0.0 | -29.6 | -93.3 |
| 30(1) | 67.19 | 0.0 | 0.0 | -8.2 | -80.6 | 0.0 | 0.0 | -16.1 | -76.5 | 0.0 | 0.0 | -42.2 | -62.6 |
| 30(2) | 68.14 | 0.0 | 0.0 | 25.8 | -53.2 | 0.0 | 0.0 | 22.3 | -51.3 | 0.0 | 0.0 | 10.6 | -44.8 |
| 30(3) | 69.09 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |

***TENSIONES ACUMULADAS***

**IEMPO T=0**

| | | TRAS BC RESTO LOSA | | | | TRAS VOLADIZOS DE LOSA | | | | C.PERMANENTE A T0 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | 0.0 | 0.0 | 54.1 | -74.0 | 3.4 | 2.1 | 56.6 | -78.7 | 14.7 | 8.9 | 64.9 | -95.4 |
| 21(2) | 51.04 | 0.0 | 0.0 | 30.9 | -60.9 | 2.8 | 1.7 | 33.0 | -64.8 | 12.2 | 7.4 | 39.9 | -78.7 |
| 21(3) | 51.99 | 0.0 | 0.0 | 4.4 | -46.7 | 2.7 | 1.5 | 6.2 | -51.8 | 11.9 | 6.2 | 11.9 | -70.5 |
| 22(1) | 51.99 | 0.0 | 0.0 | -9.2 | -80.1 | 2.7 | 1.5 | -7.4 | -85.3 | 11.9 | 6.2 | -1.7 | -103.9 |
| 22(2) | 52.94 | 0.0 | 0.0 | -34.4 | -66.8 | 2.1 | 1.2 | -33.0 | -70.8 | 9.3 | 4.9 | -28.5 | -85.4 |
| 22(3) | 53.89 | 0.0 | 0.0 | -56.4 | -55.1 | 1.6 | 0.9 | -55.4 | -58.1 | 6.9 | 3.6 | -52.1 | -69.0 |
| 23(1) | 53.89 | 0.0 | 0.0 | -43.8 | -85.8 | 1.6 | 0.9 | -42.8 | -88.8 | 6.9 | 3.6 | -39.4 | -99.7 |
| 23(2) | 54.84 | 0.0 | 0.0 | -62.8 | -75.7 | 1.1 | 0.6 | -62.1 | -77.8 | 4.8 | 2.5 | -59.8 | -85.4 |
| 23(3) | 55.79 | 0.0 | 0.0 | -78.7 | -67.3 | 0.6 | 0.3 | -78.3 | -68.6 | 2.6 | 1.3 | -77.1 | -73.0 |
| 24(1) | 55.79 | 0.0 | 0.0 | -78.7 | -67.3 | 0.6 | 0.3 | -78.3 | -68.6 | 2.6 | 1.3 | -77.1 | -73.0 |
| 24(2) | 56.74 | 0.0 | 0.0 | -91.4 | -60.6 | 0.3 | 0.1 | -91.3 | -61.1 | 1.1 | 0.5 | -90.8 | -63.0 |
| 24(3) | 57.69 | 0.0 | 0.0 | -101.1 | -55.5 | -0.1 | 0.0 | -101.2 | -55.4 | -0.2 | -0.1 | -101.3 | -55.0 |
| 25(1) | 57.69 | 2.4 | 1.3 | -115.1 | -51.9 | 2.3 | 1.2 | -115.1 | -51.8 | 2.2 | 1.2 | -115.2 | -51.4 |
| 25(2) | 58.64 | 2.2 | 1.2 | -120.5 | -48.8 | 1.8 | 1.0 | -120.7 | -48.1 | 0.9 | 0.5 | -121.2 | -45.9 |
| 25(3) | 59.59 | 2.0 | 1.1 | -122.7 | -47.2 | 1.4 | 0.8 | -123.1 | -46.1 | -0.2 | 0.0 | -124.1 | -42.4 |
| 26(1) | 59.59 | 2.0 | 1.1 | -122.7 | -47.2 | 1.4 | 0.8 | -123.1 | -46.1 | -0.2 | 0.0 | -124.1 | -42.4 |
| 26(2) | 60.54 | 1.8 | 1.0 | -121.9 | -47.3 | 1.1 | 0.6 | -122.4 | -45.9 | -1.1 | -0.5 | -123.7 | -41.0 |
| 26(3) | 61.49 | 1.6 | 0.8 | -118.0 | -49.1 | 0.7 | 0.4 | -118.5 | -47.5 | -1.8 | -0.8 | -120.0 | -41.7 |
| 27(1) | 61.49 | 1.6 | 0.8 | -118.0 | -49.1 | 0.7 | 0.4 | -118.5 | -47.5 | -1.8 | -0.8 | -120.0 | -41.7 |
| 27(2) | 62.44 | 1.4 | 0.7 | -111.0 | -52.5 | 0.5 | 0.2 | -111.6 | -50.7 | -2.3 | -1.1 | -113.2 | -44.5 |
| 27(3) | 63.39 | 1.2 | 0.6 | -100.9 | -57.5 | 0.3 | 0.1 | -101.5 | -55.7 | -2.6 | -1.2 | -103.1 | -49.3 |
| 28(1) | 63.39 | 1.2 | 0.6 | -100.9 | -57.5 | 0.3 | 0.1 | -101.5 | -55.7 | -2.6 | -1.2 | -103.1 | -49.3 |
| 28(2) | 64.34 | 1.0 | 0.5 | -87.6 | -64.2 | 0.1 | 0.0 | -88.2 | -62.4 | -2.9 | -1.5 | -90.0 | -56.2 |
| 28(3) | 65.29 | 0.8 | 0.4 | -71.3 | -72.5 | 0.0 | 0.0 | -71.8 | -70.9 | -2.7 | -1.4 | -73.4 | -65.3 |
| 29(1) | 65.29 | 0.8 | 0.4 | -71.3 | -72.5 | 0.0 | 0.0 | -71.8 | -70.9 | -2.7 | -1.4 | -73.4 | -65.3 |
| 29(2) | 66.24 | 0.6 | 0.3 | -51.8 | -82.5 | -0.1 | -0.1 | -52.3 | -81.2 | -2.4 | -1.2 | -53.7 | -76.4 |
| 29(3) | 67.19 | 0.4 | 0.2 | -29.3 | -94.1 | -0.1 | -0.1 | -29.6 | -93.1 | -1.8 | -0.9 | -30.7 | -89.6 |
| 30(1) | 67.19 | 0.4 | 0.2 | -41.9 | -63.4 | -0.1 | -0.1 | -42.3 | -62.4 | -1.8 | -0.9 | -43.3 | -58.9 |
| 30(2) | 68.14 | 0.2 | 0.1 | 10.8 | -45.0 | -0.1 | -0.1 | 10.6 | -44.7 | -1.0 | -0.6 | 9.9 | -43.5 |
| 30(3) | 69.09 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |

***TENSIONES ACUMULADAS***

**IEMPO T=0**

| | | TRAS BC RESTO LOSA | | | | TRAS VOLADIZOS DE LOSA | | | | C.PERMANENTE A T0 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 0.0 | 0.0 | 62.7 | -86.3 | 3.4 | 2.1 | 65.2 | -91.0 | 14.7 | 8.9 | 73.4 | -107.8 |
| 11(2) | 20.55 | 0.0 | 0.0 | 19.7 | -178.7 | 2.3 | 1.4 | 21.4 | -181.9 | 9.9 | 6.0 | 27.0 | -193.2 |
| 11(3) | 22.11 | 0.0 | 0.0 | -61.7 | -136.7 | 1.6 | 0.8 | -60.7 | -139.7 | 6.8 | 3.6 | -57.4 | -150.4 |
| 12(1) | 22.11 | 0.0 | 0.0 | -61.7 | -136.7 | 1.6 | 0.8 | -60.7 | -139.7 | 6.8 | 3.6 | -57.4 | -150.4 |
| 12(2) | 23.66 | 0.0 | 0.0 | -102.7 | -176.8 | 0.5 | 0.3 | -102.4 | -177.8 | 2.2 | 1.2 | -101.3 | -181.3 |
| 12(3) | 25.22 | 0.0 | 0.0 | -156.8 | -148.3 | -0.4 | -0.2 | -157.0 | -147.5 | -1.7 | -0.9 | -157.8 | -144.8 |
| 13(1) | 25.22 | 0.0 | 0.0 | -156.8 | -148.3 | -0.4 | -0.2 | -157.0 | -147.5 | -1.7 | -0.9 | -157.8 | -144.8 |
| 13(2) | 26.77 | 0.0 | 0.0 | -202.5 | -124.1 | -1.2 | -0.6 | -203.3 | -121.8 | -5.0 | -2.6 | -205.7 | -114.0 |
| 13(3) | 28.33 | 0.0 | 0.0 | -239.9 | -104.3 | -1.7 | -0.9 | -241.0 | -100.9 | -6.9 | -3.5 | -244.1 | -89.1 |
| 14(1) | 28.33 | -5.4 | -2.9 | -208.2 | -112.4 | -7.1 | -3.8 | -209.3 | -109.0 | -12.3 | -6.3 | -212.4 | -97.3 |
| 14(2) | 29.88 | -5.4 | -2.9 | -237.3 | -97.0 | -7.6 | -4.1 | -238.8 | -92.7 | -14.2 | -7.3 | -242.7 | -77.7 |
| 14(3) | 31.44 | -5.4 | -2.9 | -258.1 | -86.0 | -7.9 | -4.2 | -259.8 | -81.1 | -15.6 | -8.0 | -264.3 | -63.8 |
| 15(1) | 31.44 | -5.4 | -2.9 | -258.1 | -86.0 | -7.9 | -4.2 | -259.8 | -81.1 | -15.6 | -8.0 | -264.3 | -63.8 |
| 15(2) | 32.99 | -5.4 | -2.9 | -270.6 | -79.4 | -8.1 | -4.3 | -272.4 | -74.1 | -16.4 | -8.4 | -277.2 | -55.4 |
| 15(3) | 34.55 | -5.4 | -2.9 | -274.8 | -77.2 | -8.2 | -4.4 | -276.6 | -71.8 | -16.7 | -8.5 | -281.6 | -52.6 |
| 16(1) | 34.55 | -5.4 | -2.9 | -274.8 | -77.2 | -8.2 | -4.4 | -276.6 | -71.8 | -16.7 | -8.5 | -281.6 | -52.6 |
| 16(2) | 36.10 | -5.4 | -2.9 | -270.6 | -79.4 | -8.1 | -4.3 | -272.4 | -74.1 | -16.4 | -8.4 | -277.2 | -55.4 |
| 16(3) | 37.65 | -5.4 | -2.9 | -258.1 | -86.0 | -7.9 | -4.2 | -259.8 | -81.1 | -15.6 | -8.0 | -264.3 | -63.8 |
| 17(1) | 37.65 | -5.4 | -2.9 | -258.1 | -86.0 | -7.9 | -4.2 | -259.8 | -81.1 | -15.6 | -8.0 | -264.3 | -63.8 |
| 17(2) | 39.21 | -5.4 | -2.9 | -237.3 | -97.0 | -7.6 | -4.1 | -238.8 | -92.7 | -14.2 | -7.3 | -242.7 | -77.7 |
| 17(3) | 40.76 | -5.4 | -2.9 | -208.2 | -112.4 | -7.1 | -3.8 | -209.3 | -109.0 | -12.3 | -6.3 | -212.4 | -97.3 |
| 18(1) | 40.76 | 0.0 | 0.0 | -239.9 | -104.3 | -1.7 | -0.9 | -241.0 | -100.9 | -6.9 | -3.5 | -244.1 | -89.1 |
| 18(2) | 42.32 | 0.0 | 0.0 | -202.5 | -124.1 | -1.2 | -0.6 | -203.3 | -121.8 | -5.0 | -2.6 | -205.7 | -114.0 |
| 18(3) | 43.87 | 0.0 | 0.0 | -156.8 | -148.3 | -0.4 | -0.2 | -157.0 | -147.5 | -1.7 | -0.9 | -157.8 | -144.8 |
| 19(1) | 43.87 | 0.0 | 0.0 | -156.8 | -148.3 | -0.4 | -0.2 | -157.0 | -147.5 | -1.7 | -0.9 | -157.8 | -144.8 |
| 19(2) | 45.43 | 0.0 | 0.0 | -102.7 | -176.8 | 0.5 | 0.3 | -102.4 | -177.8 | 2.2 | 1.2 | -101.3 | -181.3 |
| 19(3) | 46.98 | 0.0 | 0.0 | -61.7 | -136.7 | 1.6 | 0.8 | -60.7 | -139.7 | 6.8 | 3.6 | -57.4 | -150.4 |
| 20(1) | 46.98 | 0.0 | 0.0 | -61.7 | -136.7 | 1.6 | 0.8 | -60.7 | -139.7 | 6.8 | 3.6 | -57.4 | -150.4 |
| 20(2) | 48.54 | 0.0 | 0.0 | 19.7 | -178.7 | 2.3 | 1.4 | 21.4 | -181.9 | 9.9 | 6.0 | 27.0 | -193.2 |
| 20(3) | 50.09 | 0.0 | 0.0 | 62.7 | -86.3 | 3.4 | 2.1 | 65.2 | -91.0 | 14.7 | 8.9 | 73.4 | -107.8 |

***TENSIONES ACUMULADAS***

**IEMPO T=0**

| BARRA | X(m) | C.CUASIPERMANENTE CPT0+.2(SCUPOS+VPPOS+GRADIENTE) suplosa | inflosa | supcaj | infcaj | C.PERMANENTE CPT0+.5(SCUPOS+VPPOS)+.2GRAD. suplosa | inflosa | supcaj | infcaj | C.PERMANENTE CPT0+.2(SCUPOS+VPPOS)+.5GRAD. suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 19.00 | 12.2 | 7.4 | 71.6 | -104.0 | 11.4 | 6.9 | 71.0 | -102.9 | 9.1 | 5.6 | 69.4 | -99.5 |
| 11(2) | 20.55 | 7.5 | 4.5 | 25.2 | -189.6 | 6.8 | 4.1 | 24.7 | -188.6 | 4.4 | 2.7 | 23.0 | -185.1 |
| 11(3) | 22.11 | 3.3 | 1.8 | -59.6 | -143.3 | 1.8 | 1.0 | -60.6 | -140.2 | -0.3 | -0.1 | -61.9 | -135.8 |
| 12(1) | 22.11 | 3.3 | 1.8 | -59.6 | -143.3 | 1.8 | 1.0 | -60.6 | -140.2 | -0.3 | -0.1 | -61.9 | -135.8 |
| 12(2) | 23.66 | -2.0 | -1.0 | -103.9 | -172.8 | -4.6 | -2.4 | -105.6 | -167.4 | -5.6 | -2.9 | -106.2 | -165.3 |
| 12(3) | 25.22 | -6.8 | -3.5 | -161.0 | -134.5 | -10.7 | -5.6 | -163.5 | -126.4 | -10.4 | -5.4 | -163.3 | -127.0 |
| 13(1) | 25.22 | -6.8 | -3.5 | -161.0 | -134.5 | -10.7 | -5.6 | -163.5 | -126.4 | -10.4 | -5.4 | -163.3 | -127.0 |
| 13(2) | 26.77 | -11.0 | -5.7 | -209.4 | -101.7 | -16.4 | -8.5 | -212.8 | -90.7 | -14.7 | -7.6 | -211.7 | -94.2 |
| 13(3) | 28.33 | -13.0 | -6.4 | -247.6 | -75.5 | -18.8 | -9.2 | -251.0 | -62.3 | -16.2 | -7.9 | -249.5 | -68.2 |
| 14(1) | 28.33 | -18.4 | -9.3 | -215.9 | -83.6 | -24.2 | -12.1 | -219.3 | -70.4 | -21.6 | -10.8 | -217.8 | -76.4 |
| 14(2) | 29.88 | -20.9 | -10.5 | -246.5 | -62.7 | -27.6 | -13.8 | -250.5 | -47.5 | -24.1 | -12.1 | -248.4 | -55.5 |
| 14(3) | 31.44 | -22.7 | -11.4 | -268.4 | -47.8 | -30.0 | -15.0 | -272.7 | -31.1 | -25.9 | -12.9 | -270.3 | -40.5 |
| 15(1) | 31.44 | -22.7 | -11.4 | -268.4 | -47.8 | -30.0 | -15.0 | -272.7 | -31.1 | -25.9 | -12.9 | -270.3 | -40.5 |
| 15(2) | 32.99 | -23.7 | -11.9 | -281.5 | -38.8 | -31.5 | -15.7 | -286.1 | -21.3 | -26.9 | -13.5 | -283.4 | -31.6 |
| 15(3) | 34.55 | -24.1 | -12.1 | -285.9 | -35.8 | -32.0 | -15.9 | -290.6 | -17.9 | -27.3 | -13.7 | -287.8 | -28.6 |
| 16(1) | 34.55 | -24.1 | -12.1 | -285.9 | -35.8 | -32.0 | -15.9 | -290.6 | -17.9 | -27.3 | -13.7 | -287.8 | -28.6 |
| 16(2) | 36.10 | -23.7 | -11.9 | -281.5 | -38.8 | -31.5 | -15.7 | -286.1 | -21.3 | -26.9 | -13.5 | -283.4 | -31.6 |
| 16(3) | 37.65 | -22.7 | -11.4 | -268.4 | -47.8 | -30.0 | -15.0 | -272.7 | -31.1 | -25.9 | -12.9 | -270.3 | -40.5 |
| 17(1) | 37.65 | -22.7 | -11.4 | -268.4 | -47.8 | -30.0 | -15.0 | -272.7 | -31.1 | -25.9 | -12.9 | -270.3 | -40.5 |
| 17(2) | 39.21 | -20.9 | -10.5 | -246.5 | -62.7 | -27.6 | -13.8 | -250.5 | -47.5 | -24.1 | -12.1 | -248.4 | -55.5 |
| 17(3) | 40.76 | -18.4 | -9.3 | -215.9 | -83.6 | -24.2 | -12.1 | -219.3 | -70.4 | -21.6 | -10.8 | -217.8 | -76.4 |
| 18(1) | 40.76 | -13.0 | -6.4 | -247.6 | -75.5 | -18.8 | -9.2 | -251.0 | -62.3 | -16.2 | -7.9 | -249.5 | -68.2 |
| 18(2) | 42.32 | -11.0 | -5.7 | -209.4 | -101.7 | -16.4 | -8.5 | -212.8 | -90.7 | -14.7 | -7.6 | -211.7 | -94.2 |
| 18(3) | 43.87 | -6.8 | -3.5 | -161.0 | -134.5 | -10.7 | -5.6 | -163.5 | -126.4 | -10.4 | -5.4 | -163.3 | -127.0 |
| 19(1) | 43.87 | -6.8 | -3.5 | -161.0 | -134.5 | -10.7 | -5.6 | -163.5 | -126.4 | -10.4 | -5.4 | -163.3 | -127.0 |
| 19(2) | 45.43 | -2.0 | -1.0 | -103.9 | -172.8 | -4.6 | -2.4 | -105.6 | -167.4 | -5.6 | -2.9 | -106.2 | -165.3 |
| 19(3) | 46.98 | 3.3 | 1.8 | -59.6 | -143.3 | 1.8 | 1.0 | -60.6 | -140.2 | -0.3 | -0.1 | -61.9 | -135.8 |
| 20(1) | 46.98 | 3.3 | 1.8 | -59.6 | -143.3 | 1.8 | 1.0 | -60.6 | -140.2 | -0.3 | -0.1 | -61.9 | -135.8 |
| 20(2) | 48.54 | 7.5 | 4.5 | 25.2 | -189.6 | 6.8 | 4.1 | 24.7 | -188.6 | 4.4 | 2.7 | 23.0 | -185.1 |
| 20(3) | 50.09 | 12.2 | 7.4 | 71.6 | -104.0 | 11.4 | 6.9 | 71.0 | -102.9 | 9.1 | 5.6 | 69.4 | -99.5 |

***TENSIONES ACUMULADAS***

**IEMPO T=0**

| BARRA | X(m) | C.CUASIPERMANENTE CPT0+.2(SCUPOS+VPPOS+GRADIENTE) suplosa | inflosa | supcaj | infcaj | C.PERMANENTE CPT0+.5(SCUPOS+VPPOS)+.2GRAD. suplosa | inflosa | supcaj | infcaj | C.PERMANENTE CPT0+.2(SCUPOS+VPPOS)+.5GRAD. suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | **0.00** | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |
| 1(2) | 0.95 | -2.0 | -1.2 | 9.2 | -42.3 | -3.2 | -2.0 | 8.2 | -40.6 | -2.1 | -1.3 | 9.0 | -42.0 |
| 1(3) | 1.90 | -3.7 | -1.9 | -44.5 | -54.9 | -6.2 | -3.1 | -46.0 | -49.7 | -4.0 | -2.1 | -44.7 | -54.2 |
| 2(1) | 1.90 | -3.7 | -1.9 | -31.8 | -85.6 | -6.2 | -3.1 | -33.3 | -80.3 | -4.0 | -2.1 | -32.0 | -84.8 |
| 2(2) | 2.85 | -5.0 | -2.6 | -55.3 | -70.8 | -8.4 | -4.3 | -57.4 | -63.6 | -5.5 | -2.8 | -55.6 | -69.7 |
| 2(3) | 3.80 | -6.0 | -3.1 | -75.5 | -58.3 | -10.3 | -5.2 | -78.1 | -49.3 | -6.7 | -3.4 | -75.9 | -56.8 |
| 3(1) | 3.80 | -6.0 | -3.1 | -75.5 | -58.3 | -10.3 | -5.2 | -78.1 | -49.3 | -6.7 | -3.4 | -75.9 | -56.8 |
| 3(2) | 4.75 | -6.7 | -3.4 | -92.4 | -48.1 | -11.6 | -5.9 | -95.4 | -37.7 | -7.6 | -3.9 | -92.9 | -46.3 |
| 3(3) | 5.70 | -6.5 | -3.2 | -105.5 | -40.3 | -11.5 | -5.6 | -108.4 | -29.1 | -7.5 | -3.6 | -106.0 | -38.2 |
| 4(1) | 5.70 | -6.5 | -3.2 | -105.5 | -40.3 | -11.5 | -5.6 | -108.4 | -29.1 | -7.5 | -3.6 | -106.0 | -38.2 |
| 4(2) | 6.65 | -6.6 | -3.2 | -115.7 | -34.8 | -11.9 | -5.8 | -118.8 | -22.7 | -7.7 | -3.7 | -116.4 | -32.2 |
| 4(3) | 7.60 | -6.4 | -3.1 | -122.7 | -31.4 | -12.0 | -5.8 | -126.0 | -18.8 | -7.7 | -3.7 | -123.5 | -28.5 |
| 5(1) | 7.60 | -6.4 | -3.1 | -122.7 | -31.4 | -12.0 | -5.8 | -126.0 | -18.8 | -7.7 | -3.7 | -123.5 | -28.5 |
| 5(2) | 8.55 | -5.8 | -2.8 | -126.4 | -30.4 | -11.4 | -5.5 | -129.7 | -17.9 | -7.2 | -3.5 | -127.2 | -27.2 |
| 5(3) | 9.50 | -5.0 | -2.4 | -126.9 | -31.6 | -10.6 | -5.1 | -130.2 | -18.9 | -6.6 | -3.2 | -127.8 | -27.9 |
| 6(1) | 9.50 | -5.0 | -2.4 | -126.9 | -31.6 | -10.6 | -5.1 | -130.2 | -18.9 | -6.6 | -3.2 | -127.8 | -27.9 |
| 6(2) | 10.45 | -3.9 | -1.8 | -124.0 | -35.2 | -9.2 | -4.4 | -127.1 | -23.2 | -5.6 | -2.6 | -125.1 | -31.2 |
| 6(3) | 11.40 | -2.5 | -1.1 | -117.9 | -40.9 | -7.6 | -3.6 | -120.9 | -29.5 | -4.4 | -2.0 | -119.1 | -36.5 |
| 7(1) | 11.40 | -4.9 | -2.4 | -104.0 | -44.5 | -9.9 | -4.8 | -106.9 | -33.1 | -6.8 | -3.3 | -105.1 | -40.1 |
| 7(2) | 12.35 | -3.4 | -1.6 | -93.4 | -52.9 | -7.9 | -3.8 | -96.1 | -42.6 | -5.5 | -2.6 | -94.6 | -48.2 |
| 7(3) | 13.30 | -1.6 | -0.8 | -79.6 | -63.5 | -5.7 | -2.7 | -82.0 | -54.3 | -3.9 | -1.8 | -80.9 | -58.4 |
| 8(1) | 13.30 | -1.6 | -0.8 | -79.6 | -63.5 | -5.7 | -2.7 | -82.0 | -54.3 | -3.9 | -1.8 | -80.9 | -58.4 |
| 8(2) | 14.25 | 0.4 | 0.2 | -62.5 | -76.4 | -3.5 | -1.8 | -65.0 | -68.5 | -2.4 | -1.2 | -64.3 | -70.8 |
| 8(3) | 15.20 | 3.0 | 1.6 | -41.9 | -91.6 | 0.0 | 0.0 | -43.8 | -85.5 | 0.0 | 0.1 | -43.7 | -85.6 |
| 9(1) | 15.20 | 3.0 | 1.6 | -54.5 | -60.9 | 0.0 | 0.0 | -56.4 | -54.8 | 0.0 | 0.1 | -56.4 | -54.9 |
| 9(2) | 16.15 | 5.8 | 3.1 | -30.7 | -78.4 | 3.8 | 2.0 | -32.0 | -74.1 | 2.7 | 1.5 | -32.6 | -72.0 |
| 9(3) | 17.10 | 8.8 | 4.6 | -3.6 | -97.8 | 7.6 | 4.0 | -4.3 | -95.3 | 5.6 | 2.9 | -5.6 | -91.0 |
| 10(1) | 17.10 | 8.8 | 4.6 | 10.0 | -64.3 | 7.6 | 4.0 | 9.2 | -61.8 | 5.6 | 2.9 | 7.9 | -57.6 |
| 10(2) | 18.05 | 9.8 | 5.9 | 38.1 | -75.1 | 9.0 | 5.5 | 37.6 | -74.0 | 6.9 | 4.2 | 36.0 | -70.8 |
| 10(3) | 19.00 | 12.2 | 7.4 | 63.0 | -91.7 | 11.4 | 6.9 | 62.5 | -90.6 | 9.1 | 5.6 | 60.8 | -87.2 |

***TENSIONES ACUMULADAS***
**IEMPO T=0**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|
| | | C.CARACTRÍSTICA CPT0+1(SCUPOS+VPPOS)+.6GRAD. | | | | C.CARACTRÍSTICA CPT0+.6(SCUPOS+VPPOS)+1.0GRAD. | | | |
| 1(1) | **0.00** | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |
| 1(2) | 0.95 | -5.6 | -3.5 | 6.4 | -37.6 | -4.1 | -2.6 | 7.5 | -39.5 |
| 1(3) | 1.90 | -10.8 | -5.5 | -48.8 | -40.0 | -7.9 | -4.0 | -47.1 | -46.0 |
| 2(1) | 1.90 | -10.8 | -5.5 | -36.2 | -70.6 | -7.9 | -4.0 | -34.4 | -76.6 |
| 2(2) | 2.85 | -14.8 | -7.6 | -61.3 | -50.0 | -11.0 | -5.6 | -58.9 | -58.2 |
| 2(3) | 3.80 | -18.3 | -9.3 | -83.0 | -32.3 | -13.6 | -6.9 | -80.1 | -42.3 |
| 3(1) | 3.80 | -18.3 | -9.3 | -83.0 | -32.3 | -13.6 | -6.9 | -80.1 | -42.3 |
| 3(2) | 4.75 | -20.9 | -10.7 | -101.1 | -18.1 | -15.6 | -7.9 | -97.8 | -29.4 |
| 3(3) | 5.70 | -21.1 | -10.2 | -114.0 | -7.4 | -15.8 | -7.6 | -110.9 | -19.5 |
| 4(1) | 5.70 | -21.1 | -10.2 | -114.0 | -7.4 | -15.8 | -7.6 | -110.9 | -19.5 |
| 4(2) | 6.65 | -22.3 | -10.8 | -124.9 | 0.7 | -16.7 | -8.1 | -121.6 | -11.9 |
| 4(3) | 7.60 | -23.0 | -11.1 | -132.4 | 6.1 | -17.2 | -8.3 | -129.1 | -6.8 |
| 5(1) | 7.60 | -23.0 | -11.1 | -132.4 | 6.1 | -17.2 | -8.3 | -129.1 | -6.8 |
| 5(2) | 8.55 | -22.6 | -10.9 | -136.2 | 7.5 | -17.1 | -8.2 | -133.0 | -5.0 |
| 5(3) | 9.50 | -22.1 | -10.6 | -136.9 | 6.9 | -16.8 | -8.1 | -133.8 | -5.0 |
| 6(1) | 9.50 | -22.1 | -10.6 | -136.9 | 6.9 | -16.8 | -8.1 | -133.8 | -5.0 |
| 6(2) | 10.45 | -20.4 | -9.8 | -133.7 | 2.2 | -15.7 | -7.5 | -130.9 | -8.5 |
| 6(3) | 11.40 | -18.6 | -8.9 | -127.4 | -4.6 | -14.4 | -6.9 | -124.9 | -14.0 |
| 7(1) | 11.40 | -20.9 | -10.2 | -113.4 | -8.2 | -16.8 | -8.1 | -111.0 | -17.6 |
| 7(2) | 12.35 | -18.4 | -8.9 | -102.2 | -19.0 | -15.0 | -7.3 | -100.2 | -26.5 |
| 7(3) | 13.30 | -15.4 | -7.5 | -87.7 | -32.3 | -13.0 | -6.3 | -86.3 | -37.7 |
| 8(1) | 13.30 | -15.4 | -7.5 | -87.7 | -32.3 | -13.0 | -6.3 | -86.3 | -37.7 |
| 8(2) | 14.25 | -13.5 | -7.0 | -71.3 | -47.9 | -12.1 | -6.2 | -70.3 | -50.9 |
| 8(3) | 15.20 | -9.0 | -4.6 | -49.4 | -67.2 | -8.9 | -4.6 | -49.3 | -67.4 |
| 9(1) | 15.20 | -9.0 | -4.6 | -62.0 | -36.5 | -8.9 | -4.6 | -61.9 | -36.8 |
| 9(2) | 16.15 | -3.8 | -1.9 | -36.7 | -58.6 | -5.2 | -2.7 | -37.6 | -55.8 |
| 9(3) | 17.10 | 1.2 | 0.7 | -8.4 | -82.1 | -1.6 | -0.7 | -10.1 | -76.5 |
| 10(1) | 17.10 | 1.2 | 0.7 | 5.2 | -48.7 | -1.6 | -0.7 | 3.5 | -43.0 |
| 10(2) | 18.05 | 3.9 | 2.4 | 33.8 | -66.4 | 1.1 | 0.7 | 31.8 | -62.2 |
| 10(3) | 19.00 | 6.1 | 3.7 | 58.6 | -82.7 | 3.1 | 1.9 | 56.4 | -78.2 |

***TENSIONES ACUMULADAS***
**IEMPO T=0**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C.CUASIPERMANENTE CPT0+.2(SCUPOS+VPPOS+GRADIENTE) | | | | C.PERMANENTE CPT0+.5(SCUPOS+VPPOS)+.2GRAD. | | | | C.PERMANENTE CPT0+.2(SCUPOS+VPPOS)+.5GRAD. | | | |
| 21(1) | 50.09 | 12.2 | 7.4 | 63.0 | -91.7 | 11.4 | 6.9 | 62.5 | -90.6 | 9.1 | 5.6 | 60.8 | -87.2 |
| 21(2) | 51.04 | 9.8 | 5.9 | 38.1 | -75.1 | 9.0 | 5.5 | 37.6 | -74.0 | 6.9 | 4.2 | 36.0 | -70.8 |
| 21(3) | 51.99 | 8.8 | 4.6 | 10.0 | -64.3 | 7.6 | 4.0 | 9.2 | -61.8 | 5.6 | 2.9 | 7.9 | -57.6 |
| 22(1) | 51.99 | 8.8 | 4.6 | -3.6 | -97.8 | 7.6 | 4.0 | -4.3 | -95.3 | 5.6 | 2.9 | -5.6 | -91.0 |
| 22(2) | 52.94 | 5.8 | 3.1 | -30.7 | -78.4 | 3.8 | 2.0 | -32.0 | -74.1 | 2.7 | 1.5 | -32.6 | -72.0 |
| 22(3) | 53.89 | 3.0 | 1.6 | -54.5 | -60.9 | 0.0 | 0.0 | -56.4 | -54.8 | 0.0 | 0.1 | -56.4 | -54.9 |
| 23(1) | 53.89 | 3.0 | 1.6 | -41.9 | -91.6 | 0.0 | 0.0 | -43.8 | -85.5 | 0.0 | 0.1 | -43.7 | -85.6 |
| 23(2) | 54.84 | 0.4 | 0.2 | -62.5 | -76.4 | -3.5 | -1.8 | -65.0 | -68.5 | -2.4 | -1.2 | -64.3 | -70.8 |
| 23(3) | 55.79 | -1.6 | -0.8 | -79.6 | -63.5 | -5.7 | -2.7 | -82.0 | -54.3 | -3.9 | -1.8 | -80.9 | -58.4 |
| 24(1) | 55.79 | -1.6 | -0.8 | -79.6 | -63.5 | -5.7 | -2.7 | -82.0 | -54.3 | -3.9 | -1.8 | -80.9 | -58.4 |
| 24(2) | 56.74 | -3.4 | -1.6 | -93.4 | -52.9 | -7.9 | -3.8 | -96.1 | -42.6 | -5.5 | -2.6 | -94.6 | -48.2 |
| 24(3) | 57.69 | -4.9 | -2.4 | -104.0 | -44.5 | -9.9 | -4.8 | -106.9 | -33.1 | -6.8 | -3.3 | -105.1 | -40.1 |
| 25(1) | 57.69 | -2.5 | -1.1 | -117.9 | -40.9 | -7.6 | -3.6 | -120.9 | -29.5 | -4.4 | -2.0 | -119.1 | -36.5 |
| 25(2) | 58.64 | -3.9 | -1.8 | -124.0 | -35.2 | -9.2 | -4.4 | -127.1 | -23.2 | -5.6 | -2.6 | -125.1 | -31.2 |
| 25(3) | 59.59 | -5.0 | -2.4 | -126.9 | -31.6 | -10.6 | -5.1 | -130.2 | -18.9 | -6.6 | -3.2 | -127.8 | -27.9 |
| 26(1) | 59.59 | -5.0 | -2.4 | -126.9 | -31.6 | -10.6 | -5.1 | -130.2 | -18.9 | -6.6 | -3.2 | -127.8 | -27.9 |
| 26(2) | 60.54 | -5.8 | -2.8 | -126.4 | -30.4 | -11.4 | -5.5 | -129.7 | -17.9 | -7.2 | -3.5 | -127.2 | -27.2 |
| 26(3) | 61.49 | -6.4 | -3.1 | -122.7 | -31.4 | -12.0 | -5.8 | -126.0 | -18.8 | -7.7 | -3.7 | -123.5 | -28.5 |
| 27(1) | 61.49 | -6.4 | -3.1 | -122.7 | -31.4 | -12.0 | -5.8 | -126.0 | -18.8 | -7.7 | -3.7 | -123.5 | -28.5 |
| 27(2) | 62.44 | -6.6 | -3.2 | -115.7 | -34.8 | -11.9 | -5.8 | -118.8 | -22.7 | -7.7 | -3.7 | -116.4 | -32.2 |
| 27(3) | 63.39 | -6.5 | -3.2 | -105.5 | -40.3 | -11.5 | -5.6 | -108.4 | -29.1 | -7.5 | -3.6 | -106.0 | -38.2 |
| 28(1) | 63.39 | -6.5 | -3.2 | -105.5 | -40.3 | -11.5 | -5.6 | -108.4 | -29.1 | -7.5 | -3.6 | -106.0 | -38.2 |
| 28(2) | 64.34 | -6.7 | -3.4 | -92.4 | -48.1 | -11.6 | -5.9 | -95.4 | -37.7 | -7.6 | -3.9 | -92.9 | -46.3 |
| 28(3) | 65.29 | -6.0 | -3.1 | -75.5 | -58.3 | -10.3 | -5.2 | -78.1 | -49.3 | -6.7 | -3.4 | -75.9 | -56.8 |
| 29(1) | 65.29 | -6.0 | -3.1 | -75.5 | -58.3 | -10.3 | -5.2 | -78.1 | -49.3 | -6.7 | -3.4 | -75.9 | -56.8 |
| 29(2) | 66.24 | -5.0 | -2.6 | -55.3 | -70.8 | -8.4 | -4.3 | -57.4 | -63.6 | -5.5 | -2.8 | -55.6 | -69.7 |
| 29(3) | 67.19 | -3.7 | -1.9 | -31.8 | -85.6 | -6.2 | -3.1 | -33.3 | -80.3 | -4.0 | -2.1 | -32.0 | -84.8 |
| 30(1) | 67.19 | -3.7 | -1.9 | -44.5 | -54.9 | -6.2 | -3.1 | -46.0 | -49.7 | -4.0 | -2.1 | -44.7 | -54.2 |
| 30(2) | 68.14 | -2.0 | -1.2 | 9.2 | -42.3 | -3.2 | -2.0 | 8.2 | -40.6 | -2.1 | -1.3 | 9.0 | -42.0 |
| 30(3) | 69.09 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |

***TENSIONES ACUMULADAS***
**TIEMPO T=0**

| BARRA | X(m) | C.CARACTRÍSTICA CPT0+1(SCUPOS+VPPOS)+.6GRAD. suplosa | inflosa | supcaj | infcaj | C.CARACTRÍSTICA CPT0+.6(SCUPOS+VPPOS)+1.0GRAD. suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 50.09 | 6.1 | 3.7 | 58.6 | -82.7 | 3.1 | 1.9 | 56.4 | -78.2 |
| 21(2) | 51.04 | 3.9 | 2.4 | 33.8 | -66.4 | 1.1 | 0.7 | 31.8 | -62.2 |
| 21(3) | 51.99 | 1.2 | 0.7 | 5.2 | -48.7 | -1.6 | -0.7 | 3.5 | -43.0 |
| 22(1) | 51.99 | 1.2 | 0.7 | -8.4 | -82.1 | -1.6 | -0.7 | -10.1 | -76.5 |
| 22(2) | 52.94 | -3.8 | -1.9 | -36.7 | -58.6 | -5.2 | -2.7 | -37.6 | -55.8 |
| 22(3) | 53.89 | -9.0 | -4.6 | -62.0 | -36.5 | -8.9 | -4.6 | -61.9 | -36.8 |
| 23(1) | 53.89 | -9.0 | -4.6 | -49.4 | -67.2 | -8.9 | -4.6 | -49.3 | -67.4 |
| 23(2) | 54.84 | -13.5 | -7.0 | -71.3 | -47.9 | -12.1 | -6.2 | -70.3 | -50.9 |
| 23(3) | 55.79 | -15.4 | -7.5 | -87.7 | -32.3 | -13.0 | -6.3 | -86.3 | -37.7 |
| 24(1) | 55.79 | -15.4 | -7.5 | -87.7 | -32.3 | -13.0 | -6.3 | -86.3 | -37.7 |
| 24(2) | 56.74 | -18.4 | -8.9 | -102.2 | -19.0 | -15.0 | -7.3 | -100.2 | -26.5 |
| 24(3) | 57.69 | -20.9 | -10.2 | -113.4 | -8.2 | -16.8 | -8.1 | -111.0 | -17.6 |
| 25(1) | 57.69 | -18.6 | -8.9 | -127.4 | -4.6 | -14.4 | -6.9 | -124.9 | -14.0 |
| 25(2) | 58.64 | -20.4 | -9.8 | -133.7 | 2.2 | -15.7 | -7.5 | -130.9 | -8.5 |
| 25(3) | 59.59 | -22.1 | -10.6 | -136.9 | 6.9 | -16.8 | -8.1 | -133.8 | -5.0 |
| 26(1) | 59.59 | -22.1 | -10.6 | -136.9 | 6.9 | -16.8 | -8.1 | -133.8 | -5.0 |
| 26(2) | 60.54 | -22.6 | -10.9 | -136.2 | 7.5 | -17.1 | -8.2 | -133.0 | -5.0 |
| 26(3) | 61.49 | -23.0 | -11.1 | -132.4 | 6.1 | -17.2 | -8.3 | -129.1 | -6.8 |
| 27(1) | 61.49 | -23.0 | -11.1 | -132.4 | 6.1 | -17.2 | -8.3 | -129.1 | -6.8 |
| 27(2) | 62.44 | -22.3 | -10.8 | -124.9 | 0.7 | -16.7 | -8.1 | -121.6 | -11.9 |
| 27(3) | 63.39 | -21.1 | -10.2 | -114.0 | -7.4 | -15.8 | -7.6 | -110.9 | -19.5 |
| 28(1) | 63.39 | -21.1 | -10.2 | -114.0 | -7.4 | -15.8 | -7.6 | -110.9 | -19.5 |
| 28(2) | 64.34 | -20.9 | -10.7 | -101.1 | -18.1 | -15.6 | -7.9 | -97.8 | -29.4 |
| 28(3) | 65.29 | -18.3 | -9.3 | -83.0 | -32.3 | -13.6 | -6.9 | -80.1 | -42.3 |
| 29(1) | 65.29 | -18.3 | -9.3 | -83.0 | -32.3 | -13.6 | -6.9 | -80.1 | -42.3 |
| 29(2) | 66.24 | -14.8 | -7.6 | -61.3 | -50.0 | -11.0 | -5.6 | -58.9 | -58.2 |
| 29(3) | 67.19 | -10.8 | -5.5 | -36.2 | -70.6 | -7.9 | -4.0 | -34.4 | -76.6 |
| 30(1) | 67.19 | -10.8 | -5.5 | -48.8 | -40.0 | -7.9 | -4.0 | -47.1 | -46.0 |
| 30(2) | 68.14 | -5.6 | -3.5 | 6.4 | -37.6 | -4.1 | -2.6 | 7.5 | -39.5 |
| 30(3) | 69.09 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |

***TENSIONES ACUMULADAS***
**TIEMPO T=0**

| BARRA | X(m) | C.CARACTRÍSTICA CPT0+1(SCUPOS+VPPOS)+.6GRAD. suplosa | inflosa | supcaj | infcaj | C.CARACTRÍSTICA CPT0+.6(SCUPOS+VPPOS)+1.0GRAD. suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 19.00 | 6.1 | 3.7 | 67.2 | -95.1 | 3.1 | 1.9 | 65.0 | -90.6 |
| 11(2) | 20.55 | 1.7 | 1.1 | 21.0 | -181.0 | -1.5 | -0.9 | 18.7 | -176.3 |
| 11(3) | 22.11 | -5.6 | -2.9 | -65.2 | -125.0 | -8.5 | -4.3 | -67.0 | -119.2 |
| 12(1) | 22.11 | -5.6 | -2.9 | -65.2 | -125.0 | -8.5 | -4.3 | -67.0 | -119.2 |
| 12(2) | 23.66 | -13.9 | -7.2 | -111.4 | -148.4 | -15.2 | -7.9 | -112.2 | -145.6 |
| 12(3) | 25.22 | -22.2 | -11.5 | -170.6 | -102.9 | -21.8 | -11.3 | -170.4 | -103.7 |
| 13(1) | 25.22 | -22.2 | -11.5 | -170.6 | -102.9 | -21.8 | -11.3 | -170.4 | -103.7 |
| 13(2) | 26.77 | -30.2 | -15.7 | -221.4 | -62.5 | -27.9 | -14.5 | -220.0 | -67.1 |
| 13(3) | 28.33 | -32.8 | -16.0 | -259.2 | -30.6 | -29.3 | -14.3 | -257.2 | -38.5 |
| 14(1) | 28.33 | -38.2 | -18.9 | -227.6 | -38.8 | -34.7 | -17.2 | -225.5 | -46.7 |
| 14(2) | 29.88 | -43.1 | -21.3 | -259.6 | -12.5 | -38.4 | -19.0 | -256.8 | -23.1 |
| 14(3) | 31.44 | -46.6 | -23.0 | -282.5 | 6.5 | -41.1 | -20.3 | -279.2 | -6.1 |
| 15(1) | 31.44 | -46.6 | -23.0 | -282.5 | 6.5 | -41.1 | -20.3 | -279.2 | -6.1 |
| 15(2) | 32.99 | -48.7 | -24.1 | -296.2 | 17.7 | -42.7 | -21.1 | -292.6 | 4.0 |
| 15(3) | 34.55 | -49.5 | -24.4 | -300.8 | 21.6 | -43.2 | -21.4 | -297.1 | 7.4 |
| 16(1) | 34.55 | -49.5 | -24.4 | -300.8 | 21.6 | -43.2 | -21.4 | -297.1 | 7.4 |
| 16(2) | 36.10 | -48.7 | -24.1 | -296.2 | 17.7 | -42.7 | -21.1 | -292.6 | 4.0 |
| 16(3) | 37.65 | -46.6 | -23.0 | -282.5 | 6.5 | -41.1 | -20.3 | -279.2 | -6.1 |
| 17(1) | 37.65 | -46.6 | -23.0 | -282.5 | 6.5 | -41.1 | -20.3 | -279.2 | -6.1 |
| 17(2) | 39.21 | -43.1 | -21.3 | -259.6 | -12.5 | -38.4 | -19.0 | -256.8 | -23.1 |
| 17(3) | 40.76 | -38.2 | -18.9 | -227.6 | -38.8 | -34.7 | -17.2 | -225.5 | -46.7 |
| 18(1) | 40.76 | -32.8 | -16.0 | -259.2 | -30.6 | -29.3 | -14.3 | -257.2 | -38.5 |
| 18(2) | 42.32 | -30.2 | -15.7 | -221.4 | -62.5 | -27.9 | -14.5 | -220.0 | -67.1 |
| 18(3) | 43.87 | -22.2 | -11.5 | -170.6 | -102.9 | -21.8 | -11.3 | -170.4 | -103.7 |
| 19(1) | 43.87 | -22.2 | -11.5 | -170.6 | -102.9 | -21.8 | -11.3 | -170.4 | -103.7 |
| 19(2) | 45.43 | -13.9 | -7.2 | -111.4 | -148.4 | -15.2 | -7.9 | -112.2 | -145.6 |
| 19(3) | 46.98 | -5.6 | -2.9 | -65.2 | -125.0 | -8.5 | -4.3 | -67.0 | -119.2 |
| 20(1) | 46.98 | -5.6 | -2.9 | -65.2 | -125.0 | -8.5 | -4.3 | -67.0 | -119.2 |
| 20(2) | 48.54 | 1.7 | 1.1 | 21.0 | -181.0 | -1.5 | -0.9 | 18.7 | -176.3 |
| 20(3) | 50.09 | 6.1 | 3.7 | 67.2 | -95.1 | 3.1 | 1.9 | 65.0 | -90.6 |

***TENSIONES ACUMULADAS***
**TIEMPO T=0**

| BARRA | X(m) | C.CUASIPERMANENTE CPT0+.2(SCUNEG+VPNEG) | | | | C.PERMANENTE CPT0+.5(SCUNEG+VPNEG) | | | | C.CARACTRÍSTICA CPT0+1.0(SCUNEG+VPNEG) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 11(1) | 19.00 | 19.2 | 11.6 | 76.7 | -114.4 | 25.9 | 15.7 | 81.6 | -124.4 | 37.2 | 22.4 | 89.8 | -141.0 |
| 11(2) | 20.55 | 13.0 | 7.9 | 29.2 | -197.8 | 17.7 | 10.7 | 32.6 | -204.6 | 25.4 | 15.3 | 38.2 | -216.1 |
| 11(3) | 22.11 | 9.2 | 4.8 | -55.9 | -155.4 | 12.9 | 6.7 | -53.6 | -162.8 | 18.9 | 9.8 | -49.9 | -175.2 |
| 12(1) | 22.11 | 9.2 | 4.8 | -55.9 | -155.4 | 12.9 | 6.7 | -53.6 | -162.8 | 18.9 | 9.8 | -49.9 | -175.2 |
| 12(2) | 23.66 | 4.1 | 2.1 | -100.2 | -185.1 | 6.8 | 3.5 | -98.4 | -190.7 | 11.4 | 5.9 | -95.6 | -200.0 |
| 12(3) | 25.22 | -0.2 | -0.1 | -156.9 | -147.8 | 2.0 | 1.0 | -155.5 | -152.3 | 5.6 | 2.9 | -153.3 | -159.8 |
| 13(1) | 25.22 | -0.2 | -0.1 | -156.9 | -147.8 | 2.0 | 1.0 | -155.5 | -152.3 | 5.6 | 2.9 | -153.3 | -159.8 |
| 13(2) | 26.77 | -3.7 | -2.0 | -204.9 | -116.6 | -1.8 | -0.9 | -203.6 | -120.7 | 1.5 | 0.8 | -201.6 | -127.3 |
| 13(3) | 28.33 | -5.9 | -2.9 | -243.4 | -91.6 | -4.2 | -2.1 | -242.5 | -95.3 | -1.5 | -0.8 | -240.9 | -101.4 |
| 14(1) | 28.33 | -11.2 | -5.8 | -211.8 | -99.7 | -9.6 | -5.0 | -210.8 | -103.4 | -6.9 | -3.7 | -209.2 | -109.5 |
| 14(2) | 29.88 | -13.2 | -6.8 | -242.1 | -80.0 | -11.7 | -6.0 | -241.2 | -83.5 | -9.2 | -4.8 | -239.7 | -89.2 |
| 14(3) | 31.44 | -14.6 | -7.5 | -263.7 | -65.9 | -13.2 | -6.8 | -262.9 | -69.1 | -10.8 | -5.7 | -261.5 | -74.5 |
| 15(1) | 31.44 | -14.6 | -7.5 | -263.7 | -65.9 | -13.2 | -6.8 | -262.9 | -69.1 | -10.8 | -5.7 | -261.5 | -74.5 |
| 15(2) | 32.99 | -15.5 | -7.9 | -276.7 | -57.4 | -14.2 | -7.3 | -275.9 | -60.4 | -12.0 | -6.2 | -274.6 | -65.4 |
| 15(3) | 34.55 | -15.9 | -8.1 | -281.1 | -54.4 | -14.6 | -7.5 | -280.4 | -57.2 | -12.6 | -6.5 | -279.2 | -61.8 |
| 16(1) | 34.55 | -15.9 | -8.1 | -281.1 | -54.4 | -14.6 | -7.5 | -280.4 | -57.2 | -12.6 | -6.5 | -279.2 | -61.8 |
| 16(2) | 36.10 | -15.5 | -7.9 | -276.7 | -57.4 | -14.2 | -7.3 | -275.9 | -60.4 | -12.0 | -6.2 | -274.6 | -65.4 |
| 16(3) | 37.65 | -14.6 | -7.5 | -263.7 | -65.9 | -13.2 | -6.8 | -262.9 | -69.1 | -10.8 | -5.7 | -261.5 | -74.5 |
| 17(1) | 37.65 | -14.6 | -7.5 | -263.7 | -65.9 | -13.2 | -6.8 | -262.9 | -69.1 | -10.8 | -5.7 | -261.5 | -74.5 |
| 17(2) | 39.21 | -13.2 | -6.8 | -242.1 | -80.0 | -11.7 | -6.0 | -241.2 | -83.5 | -9.2 | -4.8 | -239.7 | -89.2 |
| 17(3) | 40.76 | -11.2 | -5.8 | -211.8 | -99.7 | -9.6 | -5.0 | -210.8 | -103.4 | -6.9 | -3.7 | -209.2 | -109.5 |
| 18(1) | 40.76 | -5.9 | -2.9 | -243.4 | -91.6 | -4.2 | -2.1 | -242.5 | -95.3 | -1.5 | -0.8 | -240.9 | -101.4 |
| 18(2) | 42.32 | -3.7 | -2.0 | -204.9 | -116.6 | -1.8 | -0.9 | -203.6 | -120.7 | 1.5 | 0.8 | -201.6 | -127.3 |
| 18(3) | 43.87 | -0.2 | -0.1 | -156.9 | -147.8 | 2.0 | 1.0 | -155.5 | -152.3 | 5.6 | 2.9 | -153.3 | -159.8 |
| 19(1) | 43.87 | -0.2 | -0.1 | -156.9 | -147.8 | 2.0 | 1.0 | -155.5 | -152.3 | 5.6 | 2.9 | -153.3 | -159.8 |
| 19(2) | 45.43 | 4.1 | 2.1 | -100.2 | -185.1 | 6.8 | 3.5 | -98.4 | -190.7 | 11.4 | 5.9 | -95.6 | -200.0 |
| 19(3) | 46.98 | 9.2 | 4.8 | -55.9 | -155.4 | 12.9 | 6.7 | -53.6 | -162.8 | 18.9 | 9.8 | -49.9 | -175.2 |
| 20(1) | 46.98 | 9.2 | 4.8 | -55.9 | -155.4 | 12.9 | 6.7 | -53.6 | -162.8 | 18.9 | 9.8 | -49.9 | -175.2 |
| 20(2) | 48.54 | 13.0 | 7.9 | 29.2 | -197.8 | 17.7 | 10.7 | 32.6 | -204.6 | 25.4 | 15.3 | 38.2 | -216.1 |
| 20(3) | 50.09 | 19.2 | 11.6 | 76.7 | -114.4 | 25.9 | 15.7 | 81.6 | -124.4 | 37.2 | 22.4 | 89.8 | -141.0 |

***TENSIONES ACUMULADAS***
**TIEMPO T=0**

| BARRA | X(m) | C.CUASIPERMANENTE CPT0+.2(SCUNEG+VPNEG) | | | | C.PERMANENTE CPT0+.5(SCUNEG+VPNEG) | | | | C.CARACTRÍSTICA CPT0+1.0(SCUNEG+VPNEG) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 1(1) | **0.00** | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |
| 1(2) | 0.95 | -0.8 | -0.5 | 10.1 | -43.8 | -0.5 | -0.3 | 10.3 | -44.2 | 0.1 | 0.1 | 10.7 | -44.9 |
| 1(3) | 1.90 | -1.4 | -0.7 | -43.0 | -59.8 | -0.7 | -0.4 | -42.6 | -61.2 | 0.4 | 0.2 | -42.0 | -63.5 |
| 2(1) | 1.90 | -1.4 | -0.7 | -30.4 | -90.5 | -0.7 | -0.4 | -30.0 | -91.9 | 0.4 | 0.2 | -29.3 | -94.2 |
| 2(2) | 2.85 | -1.7 | -0.9 | -53.2 | -77.8 | -0.7 | -0.4 | -52.6 | -79.8 | 0.9 | 0.5 | -51.6 | -83.3 |
| 2(3) | 3.80 | -1.9 | -0.9 | -72.9 | -67.1 | -0.5 | -0.3 | -72.1 | -69.9 | 1.6 | 0.8 | -70.8 | -74.5 |
| 3(1) | 3.80 | -1.9 | -0.9 | -72.9 | -67.1 | -0.5 | -0.3 | -72.1 | -69.9 | 1.6 | 0.8 | -70.8 | -74.5 |
| 3(2) | 4.75 | -1.8 | -0.9 | -89.3 | -58.5 | -0.1 | -0.1 | -88.3 | -62.0 | 2.6 | 1.3 | -86.7 | -67.8 |
| 3(3) | 5.70 | -1.4 | -0.6 | -102.4 | -52.1 | 0.5 | 0.2 | -101.3 | -56.2 | 3.5 | 1.7 | -99.6 | -63.1 |
| 4(1) | 5.70 | -1.4 | -0.6 | -102.4 | -52.1 | 0.5 | 0.2 | -101.3 | -56.2 | 3.5 | 1.7 | -99.6 | -63.1 |
| 4(2) | 6.65 | -0.9 | -0.4 | -112.4 | -47.7 | 1.3 | 0.6 | -111.1 | -52.5 | 4.8 | 2.4 | -109.0 | -60.5 |
| 4(3) | 7.60 | -0.2 | -0.1 | -119.1 | -45.4 | 2.2 | 1.1 | -117.7 | -50.9 | 6.3 | 3.1 | -115.3 | -60.0 |
| 5(1) | 7.60 | -0.2 | -0.1 | -119.1 | -45.4 | 2.2 | 1.1 | -117.7 | -50.9 | 6.3 | 3.1 | -115.3 | -60.0 |
| 5(2) | 8.55 | 0.7 | 0.4 | -122.6 | -45.1 | 3.4 | 1.7 | -121.0 | -51.3 | 8.0 | 3.9 | -118.3 | -61.6 |
| 5(3) | 9.50 | 1.8 | 0.9 | -122.9 | -47.0 | 4.8 | 2.4 | -121.1 | -53.9 | 9.9 | 4.9 | -118.1 | -65.3 |
| 6(1) | 9.50 | 1.8 | 0.9 | -122.9 | -47.0 | 4.8 | 2.4 | -121.1 | -53.9 | 9.9 | 4.9 | -118.1 | -65.3 |
| 6(2) | 10.45 | 3.1 | 1.6 | -119.9 | -50.9 | 6.4 | 3.2 | -118.0 | -58.5 | 12.0 | 5.9 | -114.7 | -71.1 |
| 6(3) | 11.40 | 4.6 | 2.3 | -113.8 | -56.9 | 8.2 | 4.1 | -111.6 | -65.2 | 14.3 | 7.1 | -108.1 | -78.9 |
| 7(1) | 11.40 | 2.2 | 1.1 | -99.8 | -60.5 | 5.9 | 2.8 | -97.7 | -68.8 | 11.9 | 5.8 | -94.1 | -82.5 |
| 7(2) | 12.35 | 3.7 | 1.8 | -89.2 | -68.9 | 7.7 | 3.7 | -86.9 | -77.9 | 14.2 | 6.9 | -83.1 | -92.7 |
| 7(3) | 13.30 | 5.4 | 2.7 | -75.5 | -79.4 | 9.7 | 4.7 | -73.0 | -89.0 | 16.8 | 8.2 | -68.8 | -105.1 |
| 8(1) | 13.30 | 5.4 | 2.7 | -75.5 | -79.4 | 9.7 | 4.7 | -73.0 | -89.0 | 16.8 | 8.2 | -68.8 | -105.1 |
| 8(2) | 14.25 | 8.3 | 4.3 | -57.6 | -92.5 | 13.4 | 7.0 | -54.4 | -103.1 | 22.1 | 11.5 | -49.0 | -120.8 |
| 8(3) | 15.20 | 10.6 | 5.5 | -37.1 | -107.3 | 16.1 | 8.4 | -33.7 | -118.6 | 25.4 | 13.2 | -27.9 | -137.5 |
| 9(1) | 15.20 | 10.6 | 5.5 | -49.8 | -76.6 | 16.1 | 8.4 | -46.3 | -87.9 | 25.4 | 13.2 | -40.5 | -106.8 |
| 9(2) | 16.15 | 13.2 | 6.9 | -26.0 | -93.5 | 19.1 | 10.0 | -22.3 | -105.6 | 29.0 | 15.1 | -16.2 | -125.7 |
| 9(3) | 17.10 | 16.2 | 8.4 | 1.0 | -112.8 | 22.6 | 11.8 | 5.1 | -126.0 | 33.4 | 17.4 | 11.8 | -148.0 |
| 10(1) | 17.10 | 16.2 | 8.4 | 14.6 | -79.3 | 22.6 | 11.8 | 18.6 | -92.5 | 33.4 | 17.4 | 25.4 | -114.6 |
| 10(2) | 18.05 | 16.2 | 9.8 | 42.8 | -84.6 | 22.2 | 13.4 | 47.1 | -93.4 | 32.2 | 19.4 | 54.4 | -108.2 |
| 10(3) | 19.00 | 19.2 | 11.6 | 68.2 | -102.1 | 25.9 | 15.7 | 73.1 | -112.0 | 37.2 | 22.4 | 81.2 | -128.6 |

***TENSIONES ACUMULADAS***

**TIEMPO T=INF**

| | | CARGA PERMANETE T=INF | | | | C.CUASIPERMANENTE CPTINF+.2(SCUPOS+VPPOS+GRADIENTE) | | | | C.PERMANENTE CPTINF+.2(SCUPOS+VPPOS)+.5GRAD. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 1(1) | 1(1) | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 |
| 1(2) | 1(2) | 2.8 | 3.9 | -29.5 | -37.9 | 1.9 | 3.2 | -30.2 | -36.6 | 1.7 | 3.1 | -30.3 | -36.4 |
| 1(3) | 1(3) | -1.8 | -2.7 | -40.4 | -48.2 | -3.6 | -3.6 | -41.6 | -44.2 | -4.0 | -3.8 | -41.8 | -43.5 |
| 2(1) | 2(1) | 1.0 | -3.3 | -39.8 | -71.1 | -0.9 | -4.3 | -40.9 | -67.1 | -1.2 | -4.5 | -41.1 | -66.4 |
| 2(2) | 2(2) | -2.9 | -5.3 | -43.4 | -62.0 | -5.5 | -6.7 | -45.0 | -56.4 | -6.1 | -6.9 | -45.3 | -55.3 |
| 2(3) | 2(3) | -6.2 | -7.0 | -46.4 | -54.2 | -9.6 | -8.7 | -48.5 | -47.2 | -10.3 | -9.0 | -48.9 | -45.8 |
| 3(1) | 3(1) | -6.5 | -7.2 | -46.6 | -54.0 | -9.8 | -8.9 | -48.7 | -47.0 | -10.5 | -9.2 | -49.1 | -45.6 |
| 3(2) | 3(2) | -9.3 | -8.6 | -49.2 | -47.5 | -13.1 | -10.6 | -51.6 | -39.4 | -14.0 | -11.0 | -52.1 | -37.6 |
| 3(3) | 3(3) | -11.1 | -9.3 | -50.8 | -42.5 | -15.0 | -11.3 | -53.2 | -33.5 | -16.0 | -11.7 | -53.7 | -31.3 |
| 4(1) | 4(1) | -11.1 | -9.3 | -50.8 | -42.5 | -15.0 | -11.3 | -53.2 | -33.5 | -16.0 | -11.7 | -53.7 | -31.3 |
| 4(2) | 4(2) | -12.7 | -10.1 | -52.4 | -38.6 | -17.0 | -12.2 | -54.9 | -28.9 | -18.1 | -12.8 | -55.5 | -26.3 |
| 4(3) | 4(3) | -13.7 | -10.7 | -53.4 | -36.0 | -18.3 | -12.9 | -56.1 | -25.7 | -19.6 | -13.5 | -56.8 | -22.8 |
| 5(1) | 5(1) | -13.7 | -10.7 | -53.4 | -36.0 | -18.3 | -12.9 | -56.1 | -25.7 | -19.6 | -13.5 | -56.8 | -22.8 |
| 5(2) | 5(2) | -14.2 | -10.9 | -53.9 | -34.7 | -18.9 | -13.2 | -56.6 | -24.1 | -20.3 | -13.9 | -57.5 | -20.9 |
| 5(3) | 5(3) | -14.2 | -10.9 | -53.9 | -34.7 | -19.0 | -13.2 | -56.7 | -23.9 | -20.6 | -14.0 | -57.7 | -20.3 |
| 6(1) | 6(1) | -14.2 | -10.9 | -53.9 | -34.7 | -19.0 | -13.2 | -56.7 | -23.9 | -20.6 | -14.0 | -57.7 | -20.3 |
| 6(2) | 6(2) | -13.6 | -10.6 | -53.4 | -36.1 | -18.3 | -12.9 | -56.2 | -25.4 | -20.1 | -13.7 | -57.2 | -21.4 |
| 6(3) | 6(3) | -12.4 | -10.0 | -52.4 | -38.7 | -17.1 | -12.3 | -55.2 | -28.2 | -19.0 | -13.2 | -56.3 | -23.8 |
| 7(1) | 7(1) | -12.6 | -10.0 | -51.7 | -38.8 | -17.2 | -12.3 | -54.4 | -28.3 | -19.1 | -13.2 | -55.5 | -23.9 |
| 7(2) | 7(2) | -10.9 | -9.2 | -50.1 | -42.7 | -15.3 | -11.4 | -52.7 | -32.7 | -17.4 | -12.4 | -53.9 | -28.0 |
| 7(3) | 7(3) | -8.6 | -8.1 | -48.0 | -48.0 | -12.8 | -10.1 | -50.5 | -38.5 | -15.1 | -11.2 | -51.8 | -33.4 |
| 8(1) | 8(1) | -8.6 | -8.1 | -48.0 | -48.0 | -12.8 | -10.1 | -50.5 | -38.5 | -15.1 | -11.2 | -51.8 | -33.4 |
| 8(2) | 8(2) | -6.7 | -7.3 | -46.3 | -53.9 | -11.1 | -9.6 | -49.0 | -44.9 | -13.9 | -11.0 | -50.7 | -39.3 |
| 8(3) | 8(3) | -3.3 | -5.5 | -43.1 | -61.8 | -7.2 | -7.6 | -45.6 | -53.7 | -10.2 | -9.1 | -47.4 | -47.7 |
| 9(1) | 9(1) | -5.7 | -4.7 | -43.1 | -61.8 | -9.7 | -6.7 | -45.6 | -53.7 | -12.6 | -8.2 | -47.4 | -47.7 |
| 9(2) | 9(2) | -1.7 | -2.6 | -39.5 | -71.1 | -5.2 | -4.4 | -41.6 | -64.0 | -8.3 | -6.0 | -43.6 | -57.7 |
| 9(3) | 9(3) | 2.9 | -0.3 | -35.8 | -59.0 | -0.1 | -1.8 | -37.6 | -52.8 | -3.4 | -3.5 | -39.7 | -46.1 |
| 10(1) | 10(1) | 5.0 | 6.3 | -27.1 | -22.5 | 2.0 | 4.7 | -29.0 | -16.4 | -1.3 | 3.0 | -31.1 | -9.6 |
| 10(2) | 10(2) | 10.2 | 9.0 | -20.9 | -34.3 | 7.8 | 7.5 | -22.7 | -30.7 | 4.9 | 5.8 | -24.8 | -26.5 |
| 10(3) | 10(3) | 15.5 | 12.2 | -15.8 | -42.7 | 12.9 | 10.6 | -17.6 | -39.0 | 9.9 | 8.8 | -19.9 | -34.5 |

***TENSIONES ACUMULADAS***

**IEMPO T=0**

| | | C.CUASIPERMANENTE CPT0+.2(SCUNEG+VPNEG) | | | | C.PERMANENTE CPT0+.5(SCUNEG+VPNEG) | | | | C.CARACTRÍSTICA CPT0+1.0(SCUNEG+VPNEG) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BARRA** | **X(m)** | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
| 21(1) | 50.09 | 19.2 | 11.6 | 68.2 | -102.1 | 25.9 | 15.7 | 73.1 | -112.0 | 37.2 | 22.4 | 81.2 | -128.6 |
| 21(2) | 51.04 | 16.2 | 9.8 | 42.8 | -84.6 | 22.2 | 13.4 | 47.1 | -93.4 | 32.2 | 19.4 | 54.4 | -108.2 |
| 21(3) | 51.99 | 16.2 | 8.4 | 14.6 | -79.3 | 22.6 | 11.8 | 18.6 | -92.5 | 33.4 | 17.4 | 25.4 | -114.6 |
| 22(1) | 51.99 | 16.2 | 8.4 | 1.0 | -112.8 | 22.6 | 11.8 | 5.1 | -126.0 | 33.4 | 17.4 | 11.8 | -148.0 |
| 22(2) | 52.94 | 13.2 | 6.9 | -26.0 | -93.5 | 19.1 | 10.0 | -22.3 | -105.6 | 29.0 | 15.1 | -16.2 | -125.7 |
| 22(3) | 53.89 | 10.6 | 5.5 | -49.8 | -76.6 | 16.1 | 8.4 | -46.3 | -87.9 | 25.4 | 13.2 | -40.5 | -106.8 |
| 23(1) | 53.89 | 10.6 | 5.5 | -37.1 | -107.3 | 16.1 | 8.4 | -33.7 | -118.6 | 25.4 | 13.2 | -27.9 | -137.5 |
| 23(2) | 54.84 | 8.3 | 4.3 | -57.6 | -92.5 | 13.4 | 7.0 | -54.4 | -103.1 | 22.1 | 11.5 | -49.0 | -120.8 |
| 23(3) | 55.79 | 5.4 | 2.7 | -75.5 | -79.4 | 9.7 | 4.7 | -73.0 | -89.0 | 16.8 | 8.2 | -68.8 | -105.1 |
| 24(1) | 55.79 | 5.4 | 2.7 | -75.5 | -79.4 | 9.7 | 4.7 | -73.0 | -89.0 | 16.8 | 8.2 | -68.8 | -105.1 |
| 24(2) | 56.74 | 3.7 | 1.8 | -89.2 | -68.9 | 7.7 | 3.7 | -86.9 | -77.9 | 14.2 | 6.9 | -83.1 | -92.7 |
| 24(3) | 57.69 | 2.2 | 1.1 | -99.8 | -60.5 | 5.9 | 2.8 | -97.7 | -68.8 | 11.9 | 5.8 | -94.1 | -82.5 |
| 25(1) | 57.69 | 4.6 | 2.3 | -113.8 | -56.9 | 8.2 | 4.1 | -111.6 | -65.2 | 14.3 | 7.1 | -108.1 | -78.9 |
| 25(2) | 58.64 | 3.1 | 1.6 | -119.9 | -50.9 | 6.4 | 3.2 | -118.0 | -58.5 | 12.0 | 5.9 | -114.7 | -71.1 |
| 25(3) | 59.59 | 1.8 | 0.9 | -122.9 | -47.0 | 4.8 | 2.4 | -121.1 | -53.9 | 9.9 | 4.9 | -118.1 | -65.3 |
| 26(1) | 59.59 | 1.8 | 0.9 | -122.9 | -47.0 | 4.8 | 2.4 | -121.1 | -53.9 | 9.9 | 4.9 | -118.1 | -65.3 |
| 26(2) | 60.54 | 0.7 | 0.4 | -122.6 | -45.1 | 3.4 | 1.7 | -121.0 | -51.3 | 8.0 | 3.9 | -118.3 | -61.6 |
| 26(3) | 61.49 | -0.2 | -0.1 | -119.1 | -45.4 | 2.2 | 1.1 | -117.7 | -50.9 | 6.3 | 3.1 | -115.3 | -60.0 |
| 27(1) | 61.49 | -0.2 | -0.1 | -119.1 | -45.4 | 2.2 | 1.1 | -117.7 | -50.9 | 6.3 | 3.1 | -115.3 | -60.0 |
| 27(2) | 62.44 | -0.9 | -0.4 | -112.4 | -47.7 | 1.3 | 0.6 | -111.1 | -52.5 | 4.8 | 2.4 | -109.0 | -60.5 |
| 27(3) | 63.39 | -1.4 | -0.6 | -102.4 | -52.1 | 0.5 | 0.2 | -101.3 | -56.2 | 3.5 | 1.7 | -99.6 | -63.1 |
| 28(1) | 63.39 | -1.4 | -0.6 | -102.4 | -52.1 | 0.5 | 0.2 | -101.3 | -56.2 | 3.5 | 1.7 | -99.6 | -63.1 |
| 28(2) | 64.34 | -1.8 | -0.9 | -89.3 | -58.5 | -0.1 | -0.1 | -88.3 | -62.0 | 2.6 | 1.3 | -86.7 | -67.8 |
| 28(3) | 65.29 | -1.9 | -0.9 | -72.9 | -67.1 | -0.5 | -0.3 | -72.1 | -69.9 | 1.6 | 0.8 | -70.8 | -74.5 |
| 29(1) | 65.29 | -1.9 | -0.9 | -72.9 | -67.1 | -0.5 | -0.3 | -72.1 | -69.9 | 1.6 | 0.8 | -70.8 | -74.5 |
| 29(2) | 66.24 | -1.7 | -0.9 | -53.2 | -77.8 | -0.7 | -0.4 | -52.6 | -79.8 | 0.9 | 0.5 | -51.6 | -83.3 |
| 29(3) | 67.19 | -1.4 | -0.7 | -30.4 | -90.5 | -0.7 | -0.4 | -30.0 | -91.9 | 0.4 | 0.2 | -29.3 | -94.2 |
| 30(1) | 67.19 | -1.4 | -0.7 | -43.0 | -59.8 | -0.7 | -0.4 | -42.6 | -61.2 | 0.4 | 0.2 | -42.0 | -63.5 |
| 30(2) | 68.14 | -0.8 | -0.5 | 10.1 | -43.8 | -0.5 | -0.3 | 10.3 | -44.2 | 0.1 | 0.1 | 10.7 | -44.9 |
| 30(3) | 69.09 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 | 0.0 | 0.0 | 35.1 | -58.3 |

***TENSIONES***
***ACUMULADAS***
**TIEMPO T=INF**

CARGA PERMANETE T=INF

C.CUASIPERMANENTE
**CPTINF+.2(SCUPOS+VPPOS+GRADIENTE)**

C.PERMANENTE
**CPTINF+.2(SCUPOS+VPPOS)+.5GRAD.**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 21(1) | 15.5 | 12.2 | -15.8 | -42.7 | 12.9 | 10.6 | -17.6 | -39.0 | 9.9 | 8.8 | -19.9 | -34.5 |
| 21(2) | 21(2) | 10.2 | 9.0 | -20.9 | -34.3 | 7.8 | 7.5 | -22.7 | -30.7 | 4.9 | 5.8 | -24.8 | -26.5 |
| 21(3) | 21(3) | 5.0 | 6.3 | -27.1 | -22.5 | 2.0 | 4.7 | -29.0 | -16.4 | -1.3 | 3.0 | -31.1 | -9.6 |
| 22(1) | 22(1) | 2.9 | -0.3 | -35.8 | -59.0 | -0.1 | -1.8 | -37.6 | -52.8 | -3.4 | -3.5 | -39.7 | -46.1 |
| 22(2) | 22(2) | -1.7 | -2.6 | -39.9 | -48.4 | -5.2 | -4.4 | -42.1 | -41.3 | -8.3 | -6.0 | -44.0 | -35.0 |
| 22(3) | 22(3) | -5.7 | -4.7 | -43.6 | -39.1 | -9.7 | -6.7 | -46.1 | -31.0 | -12.6 | -8.2 | -47.9 | -25.0 |
| 23(1) | 23(1) | -3.3 | -5.5 | -43.1 | -61.8 | -7.2 | -7.6 | -45.6 | -53.7 | -10.2 | -9.1 | -47.4 | -47.7 |
| 23(2) | 23(2) | -6.7 | -7.3 | -46.3 | -53.9 | -11.1 | -9.6 | -49.0 | -44.9 | -13.9 | -11.0 | -50.7 | -39.3 |
| 23(3) | 23(3) | -8.6 | -8.1 | -48.0 | -48.0 | -12.8 | -10.1 | -50.5 | -38.5 | -15.1 | -11.2 | -51.8 | -33.4 |
| 24(1) | 24(1) | -8.6 | -8.1 | -48.0 | -48.0 | -12.8 | -10.1 | -50.5 | -38.5 | -15.1 | -11.2 | -51.8 | -33.4 |
| 24(2) | 24(2) | -10.9 | -9.2 | -50.1 | -42.7 | -15.3 | -11.4 | -52.7 | -32.7 | -17.4 | -12.4 | -53.9 | -28.0 |
| 24(3) | 24(3) | -12.6 | -10.0 | -51.7 | -38.8 | -17.2 | -12.3 | -54.4 | -28.3 | -19.1 | -13.2 | -55.5 | -23.9 |
| 25(1) | 25(1) | -12.4 | -10.0 | -52.4 | -38.7 | -17.1 | -12.3 | -55.2 | -28.2 | -19.0 | -13.2 | -56.3 | -23.8 |
| 25(2) | 25(2) | -13.6 | -10.6 | -53.4 | -36.1 | -18.3 | -12.9 | -56.2 | -25.4 | -20.1 | -13.7 | -57.2 | -21.4 |
| 25(3) | 25(3) | -14.2 | -10.9 | -53.9 | -34.7 | -19.0 | -13.2 | -56.7 | -23.9 | -20.6 | -14.0 | -57.7 | -20.3 |
| 26(1) | 26(1) | -14.2 | -10.9 | -53.9 | -34.7 | -19.0 | -13.2 | -56.7 | -23.9 | -20.6 | -14.0 | -57.7 | -20.3 |
| 26(2) | 26(2) | -14.2 | -10.9 | -53.9 | -34.7 | -18.9 | -13.2 | -56.6 | -24.1 | -20.3 | -13.9 | -57.5 | -20.9 |
| 26(3) | 26(3) | -13.7 | -10.7 | -53.4 | -36.0 | -18.3 | -12.9 | -56.1 | -25.7 | -19.6 | -13.5 | -56.8 | -22.8 |
| 27(1) | 27(1) | -13.7 | -10.7 | -53.4 | -36.0 | -18.3 | -12.9 | -56.1 | -25.7 | -19.6 | -13.5 | -56.8 | -22.8 |
| 27(2) | 27(2) | -12.7 | -10.1 | -52.4 | -38.6 | -17.0 | -12.2 | -54.9 | -28.9 | -18.1 | -12.8 | -55.5 | -26.3 |
| 27(3) | 27(3) | -11.1 | -9.3 | -50.8 | -42.5 | -15.0 | -11.3 | -53.2 | -33.5 | -16.0 | -11.7 | -53.7 | -31.3 |
| 28(1) | 28(1) | -11.1 | -9.3 | -50.8 | -42.5 | -15.0 | -11.3 | -53.2 | -33.5 | -16.0 | -11.7 | -53.7 | -31.3 |
| 28(2) | 28(2) | -9.3 | -8.6 | -49.2 | -47.5 | -13.1 | -10.6 | -51.6 | -39.4 | -14.0 | -11.0 | -52.1 | -37.6 |
| 28(3) | 28(3) | -6.5 | -7.2 | -46.6 | -54.0 | -9.8 | -8.9 | -48.7 | -47.0 | -10.5 | -9.2 | -49.1 | -45.6 |
| 29(1) | 29(1) | -6.2 | -7.0 | -46.4 | -54.2 | -9.6 | -8.7 | -48.5 | -47.2 | -10.3 | -9.0 | -48.9 | -45.8 |
| 29(2) | 29(2) | -2.9 | -5.3 | -43.4 | -62.0 | -5.5 | -6.7 | -45.0 | -56.4 | -6.1 | -6.9 | -45.3 | -55.3 |
| 29(3) | 29(3) | 1.0 | -3.3 | -39.8 | -71.1 | -0.9 | -4.3 | -40.9 | -67.1 | -1.2 | -4.5 | -41.1 | -66.4 |
| 30(1) | 30(1) | -1.8 | -2.7 | -40.4 | -48.2 | -3.6 | -3.6 | -41.6 | -44.2 | -4.0 | -3.8 | -41.8 | -43.5 |
| 30(2) | 30(2) | 2.8 | 3.9 | -29.5 | -37.9 | 1.9 | 3.2 | -30.2 | -36.6 | 1.7 | 3.1 | -30.3 | -36.4 |
| 30(3) | 30(3) | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 |

***TENSIONES***
***ACUMULADAS***
**TIEMPO T=INF**

CARGA PERMANETE T=INF

C.CUASIPERMANENTE
**CPTINF+.2(SCUPOS+VPPOS+GRADIENTE)**

C.PERMANENTE
**CPTINF+.2(SCUPOS+VPPOS)+.5GRAD.**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 11(1) | 17.6 | 12.8 | -14.2 | -50.8 | 15.0 | 11.3 | -16.0 | -47.0 | 12.0 | 9.5 | -18.2 | -42.5 |
| 11(2) | 11(2) | 4.3 | 4.8 | -35.2 | -133.7 | 1.8 | 3.3 | -37.0 | -130.1 | -1.2 | 1.5 | -39.2 | -125.6 |
| 11(3) | 11(3) | -9.6 | -1.5 | -48.7 | -96.3 | -13.1 | -3.3 | -50.9 | -89.3 | -16.7 | -5.2 | -53.2 | -81.8 |
| 12(1) | 12(1) | -5.3 | -11.0 | -48.7 | -96.3 | -8.7 | -12.8 | -50.9 | -89.3 | -12.4 | -14.7 | -53.2 | -81.8 |
| 12(2) | 12(2) | -16.8 | -16.9 | -59.2 | -69.8 | -21.0 | -19.1 | -61.8 | -61.2 | -24.6 | -21.0 | -64.1 | -53.7 |
| 12(3) | 12(3) | -26.8 | -22.0 | -68.2 | -46.8 | -31.8 | -24.6 | -71.4 | -36.5 | -35.5 | -26.5 | -73.7 | -29.0 |
| 13(1) | 13(1) | -24.5 | -24.2 | -65.8 | -88.4 | -29.6 | -26.8 | -69.0 | -78.1 | -33.2 | -28.7 | -71.3 | -70.6 |
| 13(2) | 13(2) | -32.9 | -28.5 | -73.4 | -69.0 | -38.9 | -31.6 | -77.2 | -56.7 | -42.6 | -33.5 | -79.5 | -49.2 |
| 13(3) | 13(3) | -37.3 | -30.2 | -77.5 | -55.3 | -43.3 | -33.1 | -81.1 | -41.6 | -46.5 | -34.7 | -83.0 | -34.4 |
| 14(1) | 14(1) | -37.6 | -30.3 | -75.8 | -55.6 | -43.6 | -33.2 | -79.3 | -42.0 | -46.8 | -34.8 | -81.2 | -34.7 |
| 14(2) | 14(2) | -42.7 | -32.9 | -80.5 | -43.4 | -49.3 | -36.1 | -84.4 | -28.4 | -52.6 | -37.7 | -86.2 | -21.2 |
| 14(3) | 14(3) | -46.4 | -34.8 | -83.8 | -34.7 | -53.5 | -38.2 | -88.0 | -18.7 | -56.7 | -39.7 | -89.9 | -11.5 |
| 15(1) | 15(1) | -46.4 | -34.8 | -83.8 | -34.7 | -53.5 | -38.2 | -88.0 | -18.7 | -56.7 | -39.7 | -89.9 | -11.5 |
| 15(2) | 15(2) | -48.6 | -35.9 | -85.8 | -29.5 | -56.0 | -39.4 | -90.1 | -12.9 | -59.2 | -41.0 | -92.0 | -5.7 |
| 15(3) | 15(3) | -49.4 | -36.2 | -86.5 | -27.8 | -56.8 | -39.8 | -90.9 | -11.0 | -60.0 | -41.4 | -92.7 | -3.7 |
| 16(1) | 16(1) | -49.4 | -36.2 | -86.5 | -27.8 | -56.8 | -39.8 | -90.9 | -11.0 | -60.0 | -41.4 | -92.7 | -3.7 |
| 16(2) | 16(2) | -48.6 | -35.9 | -85.8 | -29.5 | -56.0 | -39.4 | -90.1 | -12.9 | -59.2 | -41.0 | -92.0 | -5.7 |
| 16(3) | 16(3) | -46.4 | -34.8 | -83.8 | -34.7 | -53.5 | -38.2 | -88.0 | -18.7 | -56.7 | -39.7 | -89.9 | -11.5 |
| 17(1) | 17(1) | -46.4 | -34.8 | -83.8 | -34.7 | -53.5 | -38.2 | -88.0 | -18.7 | -56.7 | -39.7 | -89.9 | -11.5 |
| 17(2) | 17(2) | -42.7 | -32.9 | -80.5 | -43.4 | -49.3 | -36.1 | -84.4 | -28.4 | -52.6 | -37.7 | -86.2 | -21.2 |
| 17(3) | 17(3) | -37.6 | -30.3 | -75.8 | -55.6 | -43.6 | -33.2 | -79.3 | -42.0 | -46.8 | -34.8 | -81.2 | -34.7 |
| 18(1) | 18(1) | -37.3 | -30.2 | -77.5 | -55.3 | -43.3 | -33.1 | -81.1 | -41.6 | -46.5 | -34.7 | -83.0 | -34.4 |
| 18(2) | 18(2) | -32.9 | -28.5 | -73.4 | -69.0 | -38.9 | -31.6 | -77.2 | -56.7 | -42.6 | -33.5 | -79.5 | -49.2 |
| 18(3) | 18(3) | -24.5 | -24.2 | -65.8 | -88.4 | -29.6 | -26.8 | -69.0 | -78.1 | -33.2 | -28.7 | -71.3 | -70.6 |
| 19(1) | 19(1) | -26.8 | -22.0 | -65.8 | -88.4 | -31.8 | -24.6 | -69.0 | -78.1 | -35.5 | -26.5 | -71.3 | -70.6 |
| 19(2) | 19(2) | -16.8 | -16.9 | -56.8 | -111.4 | -21.0 | -19.1 | -59.4 | -102.8 | -24.6 | -21.0 | -61.7 | -95.4 |
| 19(3) | 19(3) | -5.3 | -11.0 | -48.7 | -96.3 | -8.7 | -12.8 | -50.9 | -89.3 | -12.4 | -14.7 | -53.2 | -81.8 |
| 20(1) | 20(1) | -9.6 | -1.5 | -48.7 | -96.3 | -13.1 | -3.3 | -50.9 | -89.3 | -16.7 | -5.2 | -53.2 | -81.8 |
| 20(2) | 20(2) | 4.3 | 4.8 | -35.2 | -133.7 | 1.8 | 3.3 | -37.0 | -130.1 | -1.2 | 1.5 | -39.2 | -125.6 |
| 20(3) | 20(3) | 17.6 | 12.8 | -14.2 | -50.8 | 15.0 | 11.3 | -16.0 | -47.0 | 12.0 | 9.5 | -18.2 | -42.5 |

***TENSIONES ACUMULADAS***
**TIEMPO T=INF**

C.PERMANENTE
**CPTINF+.5(SCUPOS+VPPOS)+.2GRAD.**

C.CARACTRÍSTICA
**CPTINF+1(SCUPOS+VPPOS)+0.6GRAD.**

C.CARACTRÍSTICA
**CPTINF+.6(SCUPOS+VPPOS)+1.0GRA**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 11(1) | 14.3 | 10.8 | -16.6 | -45.9 | 9.0 | 7.7 | -20.4 | -38.1 | 5.9 | 5.8 | -22.7 | -33.6 |
| 11(2) | 11(2) | 1.2 | 2.9 | -37.4 | -129.1 | -4.0 | -0.2 | -41.2 | -121.6 | -7.2 | -2.1 | -43.5 | -116.8 |
| 11(3) | 11(3) | -14.6 | -4.1 | -51.9 | -86.1 | -22.0 | -8.0 | -56.5 | -71.0 | -24.9 | -9.4 | -58.3 | -65.1 |
| 12(1) | 12(1) | -10.2 | -13.6 | -51.9 | -86.1 | -17.6 | -17.5 | -56.5 | -71.0 | -20.5 | -18.9 | -58.3 | -65.1 |
| 12(2) | 12(2) | -23.6 | -20.4 | -63.4 | -55.8 | -32.9 | -25.2 | -69.2 | -36.9 | -34.2 | -26.0 | -70.1 | -34.1 |
| 12(3) | 12(3) | -35.8 | -26.7 | -73.8 | -28.4 | -47.2 | -32.6 | -81.0 | -4.9 | -46.9 | -32.4 | -80.8 | -5.7 |
| 13(1) | 13(1) | -33.5 | -28.8 | -71.5 | -70.0 | -45.0 | -34.8 | -78.6 | -46.5 | -44.6 | -34.6 | -78.4 | -47.3 |
| 13(2) | 13(2) | -44.3 | -34.4 | -80.6 | -45.8 | -58.1 | -41.5 | -89.2 | -17.5 | -55.8 | -40.3 | -87.8 | -22.2 |
| 13(3) | 13(3) | -49.1 | -36.0 | -84.5 | -28.5 | -63.1 | -42.8 | -92.7 | 3.2 | -59.6 | -41.1 | -90.7 | -4.7 |
| 14(1) | 14(1) | -49.4 | -36.1 | -82.7 | -28.8 | -63.4 | -42.9 | -90.9 | 2.9 | -59.9 | -41.2 | -88.9 | -5.0 |
| 14(2) | 14(2) | -56.1 | -39.4 | -88.3 | -13.2 | -71.6 | -46.9 | -97.4 | 21.8 | -66.9 | -44.6 | -94.6 | 11.2 |
| 14(3) | 14(3) | -60.9 | -41.8 | -92.3 | -2.0 | -77.5 | -49.8 | -102.0 | 35.5 | -71.9 | -47.1 | -98.8 | 22.9 |
| 15(1) | 15(1) | -60.9 | -41.8 | -92.3 | -2.0 | -77.5 | -49.8 | -102.0 | 35.5 | -71.9 | -47.1 | -98.8 | 22.9 |
| 15(2) | 15(2) | -63.7 | -43.2 | -94.7 | 4.6 | -81.0 | -51.6 | -104.8 | 43.6 | -74.9 | -48.6 | -101.2 | 29.9 |
| 15(3) | 15(3) | -64.7 | -43.7 | -95.5 | 6.9 | -82.2 | -52.2 | -105.8 | 46.4 | -75.9 | -49.1 | -102.1 | 32.2 |
| 16(1) | 16(1) | -64.7 | -43.7 | -95.5 | 6.9 | -82.2 | -52.2 | -105.8 | 46.4 | -75.9 | -49.1 | -102.1 | 32.2 |
| 16(2) | 16(2) | -63.7 | -43.2 | -94.7 | 4.6 | -81.0 | -51.6 | -104.8 | 43.6 | -74.9 | -48.6 | -101.2 | 29.9 |
| 16(3) | 16(3) | -60.9 | -41.8 | -92.3 | -2.0 | -77.5 | -49.8 | -102.0 | 35.5 | -71.9 | -47.1 | -98.8 | 22.9 |
| 17(1) | 17(1) | -60.9 | -41.8 | -92.3 | -2.0 | -77.5 | -49.8 | -102.0 | 35.5 | -71.9 | -47.1 | -98.8 | 22.9 |
| 17(2) | 17(2) | -56.1 | -39.4 | -88.3 | -13.2 | -71.6 | -46.9 | -97.4 | 21.8 | -66.9 | -44.6 | -94.6 | 11.2 |
| 17(3) | 17(3) | -49.4 | -36.1 | -82.7 | -28.8 | -63.4 | -42.9 | -90.9 | 2.9 | -59.9 | -41.2 | -88.9 | -5.0 |
| 18(1) | 18(1) | -49.1 | -36.0 | -84.5 | -28.5 | -63.1 | -42.8 | -92.7 | 3.2 | -59.6 | -41.1 | -90.7 | -4.7 |
| 18(2) | 18(2) | -44.3 | -34.4 | -80.6 | -45.8 | -58.1 | -41.5 | -89.2 | -17.5 | -55.8 | -40.3 | -87.8 | -22.2 |
| 18(3) | 18(3) | -33.5 | -28.8 | -71.5 | -70.0 | -45.0 | -34.8 | -78.6 | -46.5 | -44.6 | -34.6 | -78.4 | -47.3 |
| 19(1) | 19(1) | -35.8 | -26.7 | -71.5 | -70.0 | -47.2 | -32.6 | -78.6 | -46.5 | -46.9 | -32.4 | -78.4 | -47.3 |
| 19(2) | 19(2) | -23.6 | -20.4 | -61.1 | -97.5 | -32.9 | -25.2 | -66.9 | -78.5 | -34.2 | -26.0 | -67.7 | -75.7 |
| 19(3) | 19(3) | -10.2 | -13.6 | -51.9 | -86.1 | -17.6 | -17.5 | -56.5 | -71.0 | -20.5 | -18.9 | -58.3 | -65.1 |
| 20(1) | 20(1) | -14.6 | -4.1 | -51.9 | -86.1 | -22.0 | -8.0 | -56.5 | -71.0 | -24.9 | -9.4 | -58.3 | -65.1 |
| 20(2) | 20(2) | 1.2 | 2.9 | -37.4 | -129.1 | -4.0 | -0.2 | -41.2 | -121.6 | -7.2 | -2.1 | -43.5 | -116.8 |
| 20(3) | 20(3) | 14.3 | 10.8 | -16.6 | -45.9 | 9.0 | 7.7 | -20.4 | -38.1 | 5.9 | 5.8 | -22.7 | -33.6 |

***TENSIONES ACUMULADAS***
**TIEMPO T=INF**

C.PERMANENTE
**CPTINF+.5(SCUPOS+VPPOS)+.2GRAD.**

C.CARACTRÍSTICA
**CPTINF+1(SCUPOS+VPPOS)+0.6GRAD.**

C.CARACTRÍSTICA
**CPTINF+.6(SCUPOS+VPPOS)+1.0GRA**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 1(1) | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 |
| 1(2) | 1(2) | 0.6 | 2.5 | -31.1 | -35.0 | -1.7 | 1.0 | -32.9 | -31.9 | -0.3 | 1.9 | -31.8 | -33.8 |
| 1(3) | 1(3) | -6.1 | -4.9 | -43.1 | -39.0 | -10.7 | -7.2 | -45.9 | -29.3 | -7.9 | -5.8 | -44.2 | -35.3 |
| 2(1) | 2(1) | -3.4 | -5.6 | -42.4 | -61.9 | -8.0 | -7.9 | -45.3 | -52.2 | -5.1 | -6.4 | -43.5 | -58.2 |
| 2(2) | 2(2) | -9.0 | -8.4 | -47.1 | -49.2 | -15.4 | -11.7 | -51.0 | -35.6 | -11.5 | -9.7 | -48.6 | -43.8 |
| 2(3) | 2(3) | -13.8 | -10.9 | -51.1 | -38.2 | -21.9 | -14.9 | -56.0 | -21.2 | -17.1 | -12.5 | -53.1 | -31.3 |
| 3(1) | 3(1) | -14.1 | -11.0 | -51.3 | -38.0 | -22.1 | -15.1 | -56.2 | -21.1 | -17.4 | -12.7 | -53.3 | -31.1 |
| 3(2) | 3(2) | -18.0 | -13.0 | -54.6 | -29.1 | -27.4 | -17.8 | -60.3 | -9.4 | -22.0 | -15.1 | -57.0 | -20.7 |
| 3(3) | 3(3) | -20.0 | -13.7 | -56.1 | -22.2 | -29.6 | -18.4 | -61.7 | -0.5 | -24.2 | -15.7 | -58.6 | -12.6 |
| 4(1) | 4(1) | -20.0 | -13.7 | -56.1 | -22.2 | -29.6 | -18.4 | -61.7 | -0.5 | -24.2 | -15.7 | -58.6 | -12.6 |
| 4(2) | 4(2) | -22.3 | -14.8 | -58.0 | -16.8 | -32.6 | -19.9 | -64.1 | 6.6 | -27.1 | -17.1 | -60.8 | -6.0 |
| 4(3) | 4(3) | -23.9 | -15.6 | -59.3 | -13.1 | -34.9 | -20.9 | -65.8 | 11.8 | -29.1 | -18.2 | -62.4 | -1.1 |
| 5(1) | 5(1) | -23.9 | -15.6 | -59.3 | -13.1 | -34.9 | -20.9 | -65.8 | 11.8 | -29.1 | -18.2 | -62.4 | -1.1 |
| 5(2) | 5(2) | -24.5 | -15.9 | -59.9 | -11.6 | -35.7 | -21.3 | -66.5 | 13.8 | -30.2 | -18.7 | -63.2 | 1.3 |
| 5(3) | 5(3) | -24.6 | -15.9 | -60.0 | -11.3 | -36.0 | -21.5 | -66.7 | 14.6 | -30.7 | -18.9 | -63.6 | 2.6 |
| 6(1) | 6(1) | -24.6 | -15.9 | -60.0 | -11.3 | -36.0 | -21.5 | -66.7 | 14.6 | -30.7 | -18.9 | -63.6 | 2.6 |
| 6(2) | 6(2) | -23.6 | -15.5 | -59.3 | -13.3 | -34.9 | -20.9 | -65.9 | 12.1 | -30.1 | -18.6 | -63.1 | 1.3 |
| 6(3) | 6(3) | -22.1 | -14.7 | -58.1 | -16.7 | -33.1 | -20.1 | -64.6 | 8.1 | -29.0 | -18.0 | -62.1 | -1.3 |
| 7(1) | 7(1) | -22.3 | -14.8 | -57.3 | -16.9 | -33.3 | -20.1 | -63.8 | 8.0 | -29.1 | -18.1 | -61.4 | -1.4 |
| 7(2) | 7(2) | -19.9 | -13.6 | -55.4 | -22.3 | -30.3 | -18.6 | -61.5 | 1.2 | -27.0 | -17.0 | -59.6 | -6.3 |
| 7(3) | 7(3) | -16.9 | -12.1 | -52.9 | -29.3 | -26.6 | -16.8 | -58.6 | -7.3 | -24.2 | -15.6 | -57.2 | -12.7 |
| 8(1) | 8(1) | -16.9 | -12.1 | -52.9 | -29.3 | -26.6 | -16.8 | -58.6 | -7.3 | -24.2 | -15.6 | -57.2 | -12.7 |
| 8(2) | 8(2) | -15.0 | -11.6 | -51.4 | -37.0 | -25.1 | -16.8 | -57.7 | -16.4 | -23.6 | -16.0 | -56.8 | -19.4 |
| 8(3) | 8(3) | -10.2 | -9.1 | -47.5 | -47.6 | -19.1 | -13.7 | -53.1 | -29.4 | -19.0 | -13.7 | -53.0 | -29.6 |
| 9(1) | 9(1) | -12.7 | -8.3 | -47.5 | -47.6 | -21.6 | -12.9 | -53.1 | -29.4 | -21.5 | -12.8 | -53.0 | -29.6 |
| 9(2) | 9(2) | -7.2 | -5.5 | -42.9 | -59.8 | -14.8 | -9.4 | -47.7 | -44.3 | -16.2 | -10.1 | -48.5 | -41.4 |
| 9(3) | 9(3) | -1.3 | -2.5 | -38.4 | -50.3 | -7.8 | -5.8 | -42.4 | -37.2 | -10.5 | -7.2 | -44.2 | -31.5 |
| 10(1) | 10(1) | 0.8 | 4.1 | -29.8 | -13.9 | -5.7 | 0.8 | -33.8 | -0.7 | -8.4 | -0.7 | -35.5 | 4.9 |
| 10(2) | 10(2) | 7.1 | 7.1 | -23.3 | -29.6 | 2.0 | 4.0 | -27.0 | -22.1 | -0.9 | 2.3 | -29.0 | -17.9 |
| 10(3) | 10(3) | 12.2 | 10.2 | -18.2 | -37.9 | 6.9 | 7.0 | -22.1 | -30.0 | 3.8 | 5.1 | -24.3 | -25.5 |

***TENSIONES***
***ACUMULADAS***
**TIEMPO T=INF**

C.CUASIPERMANENTE
**CPTINF+.2(SCUNEG+VPNEG)**

C.PERMANENTE
**CPTINF+.5(SCUNEG+VPNEG)**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 1(1) | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 |
| 1(2) | 1(2) | 3.0 | 4.0 | -29.3 | -38.1 | 3.4 | 4.2 | -29.1 | -38.6 |
| 1(3) | 1(3) | -1.3 | -2.4 | -40.2 | -49.1 | -0.7 | -2.1 | -39.8 | -50.5 |
| 2(1) | 2(1) | 1.4 | -3.1 | -39.5 | -72.0 | 2.1 | -2.8 | -39.1 | -73.4 |
| 2(2) | 2(2) | -2.3 | -5.0 | -43.0 | -63.4 | -1.3 | -4.5 | -42.4 | -65.5 |
| 2(3) | 2(3) | -5.4 | -6.6 | -45.9 | -56.1 | -4.1 | -5.9 | -45.1 | -58.8 |
| 3(1) | 3(1) | -5.7 | -6.7 | -46.1 | -55.9 | -4.3 | -6.1 | -45.3 | -58.6 |
| 3(2) | 3(2) | -8.2 | -8.0 | -48.5 | -49.8 | -6.6 | -7.2 | -47.5 | -53.3 |
| 3(3) | 3(3) | -9.8 | -8.8 | -50.1 | -45.2 | -8.0 | -7.9 | -49.1 | -49.3 |
| 4(1) | 4(1) | -9.8 | -8.8 | -50.1 | -45.2 | -8.0 | -7.9 | -49.1 | -49.3 |
| 4(2) | 4(2) | -11.2 | -9.5 | -51.5 | -41.8 | -9.1 | -8.4 | -50.3 | -46.6 |
| 4(3) | 4(3) | -12.1 | -9.9 | -52.4 | -39.7 | -9.7 | -8.7 | -51.0 | -45.2 |
| 5(1) | 5(1) | -12.1 | -9.9 | -52.4 | -39.7 | -9.7 | -8.7 | -51.0 | -45.2 |
| 5(2) | 5(2) | -12.4 | -10.0 | -52.8 | -38.8 | -9.7 | -8.7 | -51.2 | -45.0 |
| 5(3) | 5(3) | -12.2 | -9.9 | -52.7 | -39.3 | -9.1 | -8.4 | -50.9 | -46.2 |
| 6(1) | 6(1) | -12.2 | -9.9 | -52.7 | -39.3 | -9.1 | -8.4 | -50.9 | -46.2 |
| 6(2) | 6(2) | -11.4 | -9.5 | -52.1 | -41.1 | -8.0 | -7.9 | -50.2 | -48.7 |
| 6(3) | 6(3) | -10.0 | -8.8 | -51.0 | -44.2 | -6.4 | -7.1 | -48.9 | -52.4 |
| 7(1) | 7(1) | -10.1 | -8.9 | -50.2 | -44.3 | -6.5 | -7.1 | -48.1 | -52.6 |
| 7(2) | 7(2) | -8.2 | -7.9 | -48.6 | -48.7 | -4.3 | -6.0 | -46.2 | -57.6 |
| 7(3) | 7(3) | -5.8 | -6.7 | -46.4 | -54.4 | -1.5 | -4.6 | -43.9 | -64.0 |
| 8(1) | 8(1) | -5.8 | -6.7 | -46.4 | -54.4 | -1.5 | -4.6 | -43.9 | -64.0 |
| 8(2) | 8(2) | -3.3 | -5.5 | -44.1 | -61.0 | 1.9 | -2.8 | -40.9 | -71.6 |
| 8(3) | 8(3) | 0.4 | -3.6 | -40.8 | -69.4 | 6.0 | -0.7 | -37.4 | -80.7 |
| 9(1) | 9(1) | -2.1 | -2.8 | -40.8 | -69.4 | 3.5 | 0.1 | -37.4 | -80.7 |
| 9(2) | 9(2) | 2.2 | -0.6 | -37.0 | -79.2 | 8.1 | 2.5 | -33.3 | -91.3 |
| 9(3) | 9(3) | 7.2 | 2.0 | -33.1 | -67.8 | 13.7 | 5.3 | -29.0 | -81.0 |
| 10(1) | 10(1) | 9.3 | 8.5 | -24.4 | -31.3 | 15.8 | 11.9 | -20.4 | -44.6 |
| 10(2) | 10(2) | 14.2 | 11.4 | -18.0 | -40.2 | 20.2 | 15.0 | -13.7 | -49.1 |
| 10(3) | 10(3) | 20.0 | 14.9 | -12.5 | -49.3 | 26.7 | 18.9 | -7.6 | -59.3 |

***TENSIONES***
***ACUMULADAS***
**TIEMPO T=INF**

C.PERMANENTE
**CPTINF+.5(SCUPOS+VPPOS)+.2GRAD.**

C.CARACTRÍSTICA
**CPTINF+1(SCUPOS+VPPOS)+0.6GRAD.**

C.CARACTRÍSTICA
**CPTINF+.6(SCUPOS+VPPOS)+1.0GRA**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 21(1) | 12.2 | 10.2 | -18.2 | -37.9 | 6.9 | 7.0 | -22.1 | -30.0 | 3.8 | 5.1 | -24.3 | -25.5 |
| 21(2) | 21(2) | 7.1 | 7.1 | -23.3 | -29.6 | 2.0 | 4.0 | -27.0 | -22.1 | -0.9 | 2.3 | -29.0 | -17.9 |
| 21(3) | 21(3) | 0.8 | 4.1 | -29.8 | -13.9 | -5.7 | 0.8 | -33.8 | -0.7 | -8.4 | -0.7 | -35.5 | 4.9 |
| 22(1) | 22(1) | -1.3 | -2.5 | -38.4 | -50.3 | -7.8 | -5.8 | -42.4 | -37.2 | -10.5 | -7.2 | -44.2 | -31.5 |
| 22(2) | 22(2) | -7.2 | -5.5 | -43.4 | -37.1 | -14.8 | -9.4 | -48.1 | -21.6 | -16.2 | -10.1 | -49.0 | -18.7 |
| 22(3) | 22(3) | -12.7 | -8.3 | -48.0 | -24.9 | -21.6 | -12.9 | -53.5 | -6.7 | -21.5 | -12.8 | -53.5 | -6.9 |
| 23(1) | 23(1) | -10.2 | -9.1 | -47.5 | -47.6 | -19.1 | -13.7 | -53.1 | -29.4 | -19.0 | -13.7 | -53.0 | -29.6 |
| 23(2) | 23(2) | -15.0 | -11.6 | -51.4 | -37.0 | -25.1 | -16.8 | -57.7 | -16.4 | -23.6 | -16.0 | -56.8 | -19.4 |
| 23(3) | 23(3) | -16.9 | -12.1 | -52.9 | -29.3 | -26.6 | -16.8 | -58.6 | -7.3 | -24.2 | -15.6 | -57.2 | -12.7 |
| 24(1) | 24(1) | -16.9 | -12.1 | -52.9 | -29.3 | -26.6 | -16.8 | -58.6 | -7.3 | -24.2 | -15.6 | -57.2 | -12.7 |
| 24(2) | 24(2) | -19.9 | -13.6 | -55.4 | -22.3 | -30.3 | -18.6 | -61.5 | 1.2 | -27.0 | -17.0 | -59.6 | -6.3 |
| 24(3) | 24(3) | -22.3 | -14.8 | -57.3 | -16.9 | -33.3 | -20.1 | -63.8 | 8.0 | -29.1 | -18.1 | -61.4 | -1.4 |
| 25(1) | 25(1) | -22.1 | -14.7 | -58.1 | -16.7 | -33.1 | -20.1 | -64.6 | 8.1 | -29.0 | -18.0 | -62.1 | -1.3 |
| 25(2) | 25(2) | -23.6 | -15.5 | -59.3 | -13.3 | -34.9 | -20.9 | -65.9 | 12.1 | -30.1 | -18.6 | -63.1 | 1.3 |
| 25(3) | 25(3) | -24.6 | -15.9 | -60.0 | -11.3 | -36.0 | -21.5 | -66.7 | 14.6 | -30.7 | -18.9 | -63.6 | 2.6 |
| 26(1) | 26(1) | -24.6 | -15.9 | -60.0 | -11.3 | -36.0 | -21.5 | -66.7 | 14.6 | -30.7 | -18.9 | -63.6 | 2.6 |
| 26(2) | 26(2) | -24.5 | -15.9 | -59.9 | -11.6 | -35.7 | -21.3 | -66.5 | 13.8 | -30.2 | -18.7 | -63.2 | 1.3 |
| 26(3) | 26(3) | -23.9 | -15.6 | -59.3 | -13.1 | -34.9 | -20.9 | -65.8 | 11.8 | -29.1 | -18.2 | -62.4 | -1.1 |
| 27(1) | 27(1) | -23.9 | -15.6 | -59.3 | -13.1 | -34.9 | -20.9 | -65.8 | 11.8 | -29.1 | -18.2 | -62.4 | -1.1 |
| 27(2) | 27(2) | -22.3 | -14.8 | -58.0 | -16.8 | -32.6 | -19.9 | -64.1 | 6.6 | -27.1 | -17.1 | -60.8 | -6.0 |
| 27(3) | 27(3) | -20.0 | -13.7 | -56.1 | -22.2 | -29.6 | -18.4 | -61.7 | -0.5 | -24.2 | -15.7 | -58.6 | -12.6 |
| 28(1) | 28(1) | -20.0 | -13.7 | -56.1 | -22.2 | -29.6 | -18.4 | -61.7 | -0.5 | -24.2 | -15.7 | -58.6 | -12.6 |
| 28(2) | 28(2) | -18.0 | -13.0 | -54.6 | -29.1 | -27.4 | -17.8 | -60.3 | -9.4 | -22.0 | -15.1 | -57.0 | -20.7 |
| 28(3) | 28(3) | -14.1 | -11.0 | -51.3 | -38.0 | -22.1 | -15.1 | -56.2 | -21.1 | -17.4 | -12.7 | -53.3 | -31.1 |
| 29(1) | 29(1) | -13.8 | -10.9 | -51.1 | -38.2 | -21.9 | -14.9 | -56.0 | -21.2 | -17.1 | -12.5 | -53.1 | -31.3 |
| 29(2) | 29(2) | -9.0 | -8.4 | -47.1 | -49.2 | -15.4 | -11.7 | -51.0 | -35.6 | -11.5 | -9.7 | -48.6 | -43.8 |
| 29(3) | 29(3) | -3.4 | -5.6 | -42.4 | -61.9 | -8.0 | -7.9 | -45.3 | -52.2 | -5.1 | -6.4 | -43.5 | -58.2 |
| 30(1) | 30(1) | -6.1 | -4.9 | -43.1 | -39.0 | -10.7 | -7.2 | -45.9 | -29.3 | -7.9 | -5.8 | -44.2 | -35.3 |
| 30(2) | 30(2) | 0.6 | 2.5 | -31.1 | -35.0 | -1.7 | 1.0 | -32.9 | -31.9 | -0.3 | 1.9 | -31.8 | -33.8 |
| 30(3) | 30(3) | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 |

***TENSIONES***
***ACUMULADAS***
**TIEMPO T=INF**

C.CUASIPERMANENTE
**CPTINF+.2(SCUNEG+VPNEG)**

C.PERMANENTE
**CPTINF+.5(SCUNEG+VPNEG)**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 21(1) | 20.0 | 14.9 | -12.5 | -49.3 | 26.7 | 18.9 | -7.6 | -59.3 |
| 21(2) | 21(2) | 14.2 | 11.4 | -18.0 | -40.2 | 20.2 | 15.0 | -13.7 | -49.1 |
| 21(3) | 21(3) | 9.3 | 8.5 | -24.4 | -31.3 | 15.8 | 11.9 | -20.4 | -44.6 |
| 22(1) | 22(1) | 7.2 | 2.0 | -33.1 | -67.8 | 13.7 | 5.3 | -29.0 | -81.0 |
| 22(2) | 22(2) | 2.2 | -0.6 | -37.5 | -56.5 | 8.1 | 2.5 | -33.8 | -68.5 |
| 22(3) | 22(3) | -2.1 | -2.8 | -41.3 | -46.7 | 3.5 | 0.1 | -37.8 | -58.0 |
| 23(1) | 23(1) | 0.4 | -3.6 | -40.8 | -69.4 | 6.0 | -0.7 | -37.4 | -80.7 |
| 23(2) | 23(2) | -3.3 | -5.5 | -44.1 | -61.0 | 1.9 | -2.8 | -40.9 | -71.6 |
| 23(3) | 23(3) | -5.8 | -6.7 | -46.4 | -54.4 | -1.5 | -4.6 | -43.9 | -64.0 |
| 24(1) | 24(1) | -5.8 | -6.7 | -46.4 | -54.4 | -1.5 | -4.6 | -43.9 | -64.0 |
| 24(2) | 24(2) | -8.2 | -7.9 | -48.6 | -48.7 | -4.3 | -6.0 | -46.2 | -57.6 |
| 24(3) | 24(3) | -10.1 | -8.9 | -50.2 | -44.3 | -6.5 | -7.1 | -48.1 | -52.6 |
| 25(1) | 25(1) | -10.0 | -8.8 | -51.0 | -44.2 | -6.4 | -7.1 | -48.9 | -52.4 |
| 25(2) | 25(2) | -11.4 | -9.5 | -52.1 | -41.1 | -8.0 | -7.9 | -50.2 | -48.7 |
| 25(3) | 25(3) | -12.2 | -9.9 | -52.7 | -39.3 | -9.1 | -8.4 | -50.9 | -46.2 |
| 26(1) | 26(1) | -12.2 | -9.9 | -52.7 | -39.3 | -9.1 | -8.4 | -50.9 | -46.2 |
| 26(2) | 26(2) | -12.4 | -10.0 | -52.8 | -38.8 | -9.7 | -8.7 | -51.2 | -45.0 |
| 26(3) | 26(3) | -12.1 | -9.9 | -52.4 | -39.7 | -9.7 | -8.7 | -51.0 | -45.2 |
| 27(1) | 27(1) | -12.1 | -9.9 | -52.4 | -39.7 | -9.7 | -8.7 | -51.0 | -45.2 |
| 27(2) | 27(2) | -11.2 | -9.5 | -51.5 | -41.8 | -9.1 | -8.4 | -50.3 | -46.6 |
| 27(3) | 27(3) | -9.8 | -8.8 | -50.1 | -45.2 | -8.0 | -7.9 | -49.1 | -49.3 |
| 28(1) | 28(1) | -9.8 | -8.8 | -50.1 | -45.2 | -8.0 | -7.9 | -49.1 | -49.3 |
| 28(2) | 28(2) | -8.2 | -8.0 | -48.5 | -49.8 | -6.6 | -7.2 | -47.5 | -53.3 |
| 28(3) | 28(3) | -5.7 | -6.7 | -46.1 | -55.9 | -4.3 | -6.1 | -45.3 | -58.6 |
| 29(1) | 29(1) | -5.4 | -6.6 | -45.9 | -56.1 | -4.1 | -5.9 | -45.1 | -58.8 |
| 29(2) | 29(2) | -2.3 | -5.0 | -43.0 | -63.4 | -1.3 | -4.5 | -42.4 | -65.5 |
| 29(3) | 29(3) | 1.4 | -3.1 | -39.5 | -72.0 | 2.1 | -2.8 | -39.1 | -73.4 |
| 30(1) | 30(1) | -1.3 | -2.4 | -40.2 | -49.1 | -0.7 | -2.1 | -39.8 | -50.5 |
| 30(2) | 30(2) | 3.0 | 4.0 | -29.3 | -38.1 | 3.4 | 4.2 | -29.1 | -38.6 |
| 30(3) | 30(3) | 8.1 | 7.2 | -24.2 | -34.7 | 8.1 | 7.2 | -24.2 | -34.7 |

***TENSIONES***
***ACUMULADAS***
**TIEMPO T=INF**

C.CUASIPERMANENTE
**CPTINF+.2(SCUNEG+VPNEG)**

C.PERMANENTE
**CPTINF+.5(SCUNEG+VPNEG)**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 11(1) | 22.0 | 15.5 | -10.9 | -57.4 | 28.8 | 19.6 | -6.0 | -67.4 |
| 11(2) | 11(2) | 7.4 | 6.6 | -32.9 | -138.3 | 12.0 | 9.4 | -29.5 | -145.2 |
| 11(3) | 11(3) | -7.2 | -0.3 | -47.2 | -101.3 | -3.6 | 1.6 | -44.9 | -108.7 |
| 12(1) | 12(1) | -2.8 | -9.8 | -47.2 | -101.3 | 0.8 | -7.9 | -44.9 | -108.7 |
| 12(2) | 12(2) | -15.0 | -16.0 | -58.0 | -73.5 | -12.2 | -14.5 | -56.3 | -79.1 |
| 12(3) | 12(3) | -25.3 | -21.2 | -67.3 | -49.8 | -23.1 | -20.1 | -65.9 | -54.3 |
| 13(1) | 13(1) | -23.0 | -23.4 | -64.9 | -91.4 | -20.8 | -22.3 | -63.5 | -95.9 |
| 13(2) | 13(2) | -31.6 | -27.8 | -72.6 | -71.7 | -29.7 | -26.8 | -71.4 | -75.7 |
| 13(3) | 13(3) | -36.2 | -29.7 | -76.9 | -57.7 | -34.6 | -28.9 | -76.0 | -61.4 |
| 14(1) | 14(1) | -36.5 | -29.8 | -75.1 | -58.1 | -34.8 | -29.0 | -74.2 | -61.7 |
| 14(2) | 14(2) | -41.7 | -32.4 | -79.9 | -45.7 | -40.2 | -31.7 | -79.0 | -49.2 |
| 14(3) | 14(3) | -45.5 | -34.3 | -83.3 | -36.9 | -44.0 | -33.6 | -82.4 | -40.1 |
| 15(1) | 15(1) | -45.5 | -34.3 | -83.3 | -36.9 | -44.0 | -33.6 | -82.4 | -40.1 |
| 15(2) | 15(2) | -47.8 | -35.4 | -85.3 | -31.5 | -46.4 | -34.8 | -84.5 | -34.5 |
| 15(3) | 15(3) | -48.6 | -35.8 | -86.0 | -29.6 | -47.3 | -35.2 | -85.3 | -32.4 |
| 16(1) | 16(1) | -48.6 | -35.8 | -86.0 | -29.6 | -47.3 | -35.2 | -85.3 | -32.4 |
| 16(2) | 16(2) | -47.8 | -35.4 | -85.3 | -31.5 | -46.4 | -34.8 | -84.5 | -34.5 |
| 16(3) | 16(3) | -45.5 | -34.3 | -83.3 | -36.9 | -44.0 | -33.6 | -82.4 | -40.1 |
| 17(1) | 17(1) | -45.5 | -34.3 | -83.3 | -36.9 | -44.0 | -33.6 | -82.4 | -40.1 |
| 17(2) | 17(2) | -41.7 | -32.4 | -79.9 | -45.7 | -40.2 | -31.7 | -79.0 | -49.2 |
| 17(3) | 17(3) | -36.5 | -29.8 | -75.1 | -58.1 | -34.8 | -29.0 | -74.2 | -61.7 |
| 18(1) | 18(1) | -36.2 | -29.7 | -76.9 | -57.7 | -34.6 | -28.9 | -76.0 | -61.4 |
| 18(2) | 18(2) | -31.6 | -27.8 | -72.6 | -71.7 | -29.7 | -26.8 | -71.4 | -75.7 |
| 18(3) | 18(3) | -23.0 | -23.4 | -64.9 | -91.4 | -20.8 | -22.3 | -63.5 | -95.9 |
| 19(1) | 19(1) | -25.3 | -21.2 | -64.9 | -91.4 | -23.1 | -20.1 | -63.5 | -95.9 |
| 19(2) | 19(2) | -15.0 | -16.0 | -55.6 | -115.1 | -12.2 | -14.5 | -53.9 | -120.7 |
| 19(3) | 19(3) | -2.8 | -9.8 | -47.2 | -101.3 | 0.8 | -7.9 | -44.9 | -108.7 |
| 20(1) | 20(1) | -7.2 | -0.3 | -47.2 | -101.3 | -3.6 | 1.6 | -44.9 | -108.7 |
| 20(2) | 20(2) | 7.4 | 6.6 | -32.9 | -138.3 | 12.0 | 9.4 | -29.5 | -145.2 |
| 20(3) | 20(3) | 22.0 | 15.5 | -10.9 | -57.4 | 28.8 | 19.6 | -6.0 | -67.4 |

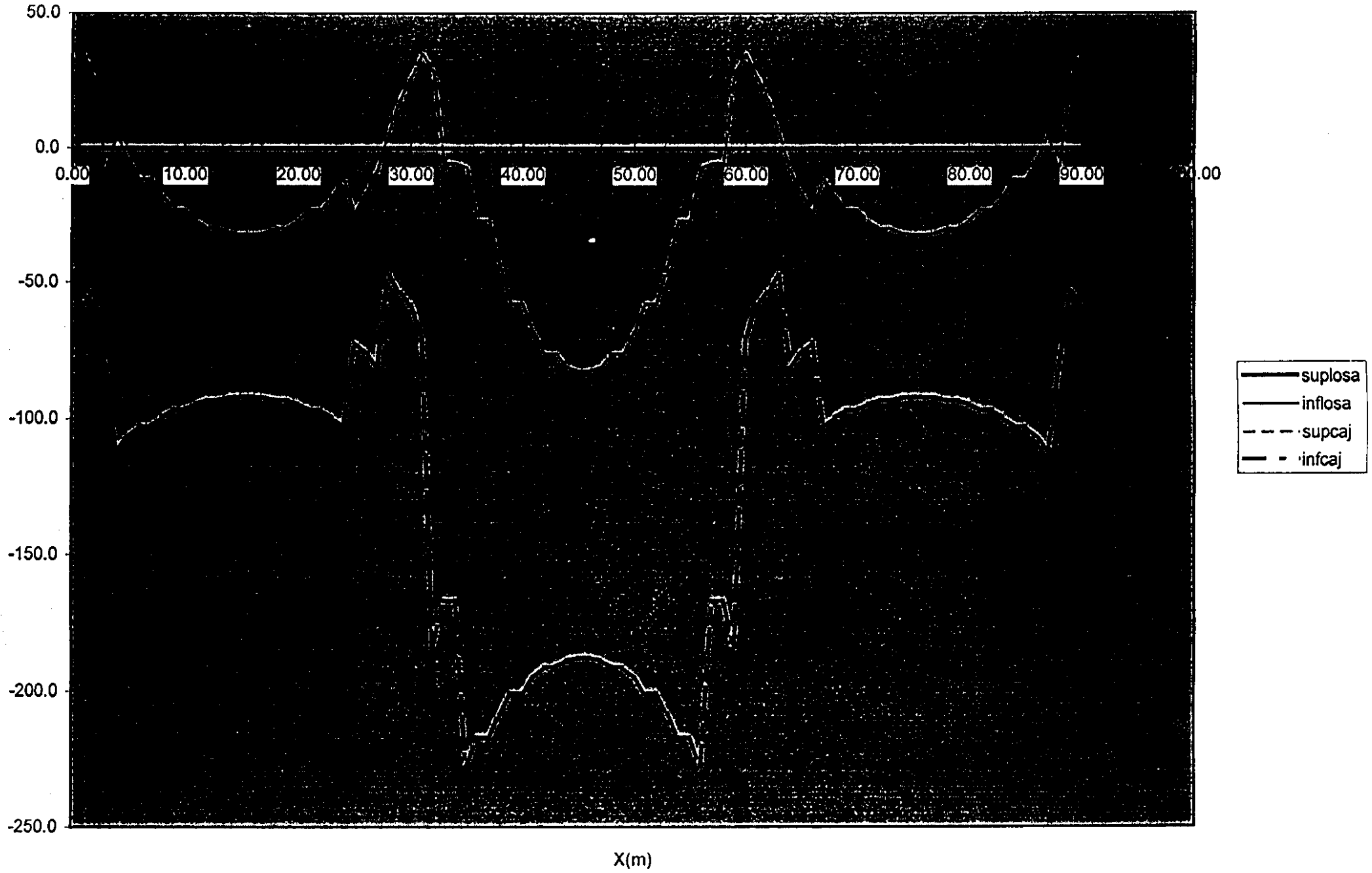
***TENSIONES***
***ACUMULADAS*** C.CARACTRÍSTICA
**TIEMPO T=INF** **CPTINF+1.0(SCUNEG+VPNEG)**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 11(1) | 40.0 | 26.3 | 2.1 | -84.0 | | | | | | | | |
| 11(2) | 11(2) | 19.7 | 14.1 | -23.9 | -156.6 | | | | | | | | |
| 11(3) | 11(3) | 2.5 | 4.7 | -41.2 | -121.1 | | | | | | | | |
| 12(1) | 12(1) | 6.9 | -4.8 | -41.2 | -121.1 | | | | | | | | |
| 12(2) | 12(2) | -7.7 | -12.2 | -53.5 | -88.4 | | | | | | | | |
| 12(3) | 12(3) | -19.5 | -18.2 | -63.6 | -61.8 | | | | | | | | |
| 13(1) | 13(1) | -17.2 | -20.4 | -61.2 | -103.4 | | | | | | | | |
| 13(2) | 13(2) | -26.4 | -25.1 | -69.4 | -82.4 | | | | | | | | |
| 13(3) | 13(3) | -31.9 | -27.6 | -74.4 | -67.5 | | | | | | | | |
| 14(1) | 14(1) | -32.1 | -27.7 | -72.6 | -67.8 | | | | | | | | |
| 14(2) | 14(2) | -37.6 | -30.4 | -77.5 | -54.9 | | | | | | | | |
| 14(3) | 14(3) | -41.7 | -32.4 | -81.0 | -45.5 | | | | | | | | |
| 15(1) | 15(1) | -41.7 | -32.4 | -81.0 | -45.5 | | | | | | | | |
| 15(2) | 15(2) | -44.2 | -33.7 | -83.2 | -39.5 | | | | | | | | |
| 15(3) | 15(3) | -45.3 | -34.2 | -84.1 | -37.0 | | | | | | | | |
| 16(1) | 16(1) | -45.3 | -34.2 | -84.1 | -37.0 | | | | | | | | |
| 16(2) | 16(2) | -44.2 | -33.7 | -83.2 | -39.5 | | | | | | | | |
| 16(3) | 16(3) | -41.7 | -32.4 | -81.0 | -45.5 | | | | | | | | |
| 17(1) | 17(1) | -41.7 | -32.4 | -81.0 | -45.5 | | | | | | | | |
| 17(2) | 17(2) | -37.6 | -30.4 | -77.5 | -54.9 | | | | | | | | |
| 17(3) | 17(3) | -32.1 | -27.7 | -72.6 | -67.8 | | | | | | | | |
| 18(1) | 18(1) | -31.9 | -27.6 | -74.4 | -67.5 | | | | | | | | |
| 18(2) | 18(2) | -26.4 | -25.1 | -69.4 | -82.4 | | | | | | | | |
| 18(3) | 18(3) | -17.2 | -20.4 | -61.2 | -103.4 | | | | | | | | |
| 19(1) | 19(1) | -19.5 | -18.2 | -61.2 | -103.4 | | | | | | | | |
| 19(2) | 19(2) | -7.7 | -12.2 | -51.1 | -130.1 | | | | | | | | |
| 19(3) | 19(3) | 6.9 | -4.8 | -41.2 | -121.1 | | | | | | | | |
| 20(1) | 20(1) | 2.5 | 4.7 | -41.2 | -121.1 | | | | | | | | |
| 20(2) | 20(2) | 19.7 | 14.1 | -23.9 | -156.6 | | | | | | | | |
| 20(3) | 20(3) | 40.0 | 26.3 | 2.1 | -84.0 | | | | | | | | |

***TENSIONES***
***ACUMULADAS*** C.CARACTRÍSTICA
**TIEMPO T=INF** **CPTINF+1.0(SCUNEG+VPNEG)**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 1(1) | 8.1 | 7.2 | -24.2 | -34.7 | | | | | | | | |
| 1(2) | 1(2) | 3.9 | 4.5 | -28.6 | -39.3 | | | | | | | | |
| 1(3) | 1(3) | 0.4 | -1.6 | -39.1 | -52.8 | | | | | | | | |
| 2(1) | 2(1) | 3.2 | -2.2 | -38.4 | -75.7 | | | | | | | | |
| 2(2) | 2(2) | 0.4 | -3.6 | -41.3 | -68.9 | | | | | | | | |
| 2(3) | 2(3) | -1.9 | -4.8 | -43.8 | -63.4 | | | | | | | | |
| 3(1) | 3(1) | -2.2 | -5.0 | -43.9 | -63.3 | | | | | | | | |
| 3(2) | 3(2) | -3.8 | -5.8 | -45.9 | -59.1 | | | | | | | | |
| 3(3) | 3(3) | -5.0 | -6.4 | -47.3 | -56.2 | | | | | | | | |
| 4(1) | 4(1) | -5.0 | -6.4 | -47.3 | -56.2 | | | | | | | | |
| 4(2) | 4(2) | -5.6 | -6.7 | -48.2 | -54.6 | | | | | | | | |
| 4(3) | 4(3) | -5.6 | -6.7 | -48.6 | -54.3 | | | | | | | | |
| 5(1) | 5(1) | -5.6 | -6.7 | -48.6 | -54.3 | | | | | | | | |
| 5(2) | 5(2) | -5.1 | -6.5 | -48.5 | -55.3 | | | | | | | | |
| 5(3) | 5(3) | -4.1 | -6.0 | -48.0 | -57.7 | | | | | | | | |
| 6(1) | 6(1) | -4.1 | -6.0 | -48.0 | -57.7 | | | | | | | | |
| 6(2) | 6(2) | -2.4 | -5.2 | -46.9 | -61.3 | | | | | | | | |
| 6(3) | 6(3) | -0.3 | -4.1 | -45.3 | -66.2 | | | | | | | | |
| 7(1) | 7(1) | -0.4 | -4.1 | -44.5 | -66.3 | | | | | | | | |
| 7(2) | 7(2) | 2.3 | -2.8 | -42.4 | -72.5 | | | | | | | | |
| 7(3) | 7(3) | 5.6 | -1.2 | -39.7 | -80.1 | | | | | | | | |
| 8(1) | 8(1) | 5.6 | -1.2 | -39.7 | -80.1 | | | | | | | | |
| 8(2) | 8(2) | 10.6 | 1.7 | -35.4 | -89.3 | | | | | | | | |
| 8(3) | 8(3) | 15.2 | 4.0 | -31.6 | -99.6 | | | | | | | | |
| 9(1) | 9(1) | 12.7 | 4.9 | -31.6 | -99.6 | | | | | | | | |
| 9(2) | 9(2) | 18.0 | 7.6 | -27.1 | -111.4 | | | | | | | | |
| 9(3) | 9(3) | 24.5 | 10.9 | -22.3 | -103.1 | | | | | | | | |
| 10(1) | 10(1) | 26.5 | 17.5 | -13.6 | -66.6 | | | | | | | | |
| 10(2) | 10(2) | 30.2 | 21.0 | -6.4 | -63.8 | | | | | | | | |
| 10(3) | 10(3) | 37.9 | 25.7 | 0.5 | -75.9 | | | | | | | | |

TRAS COLOCAR VIGAS

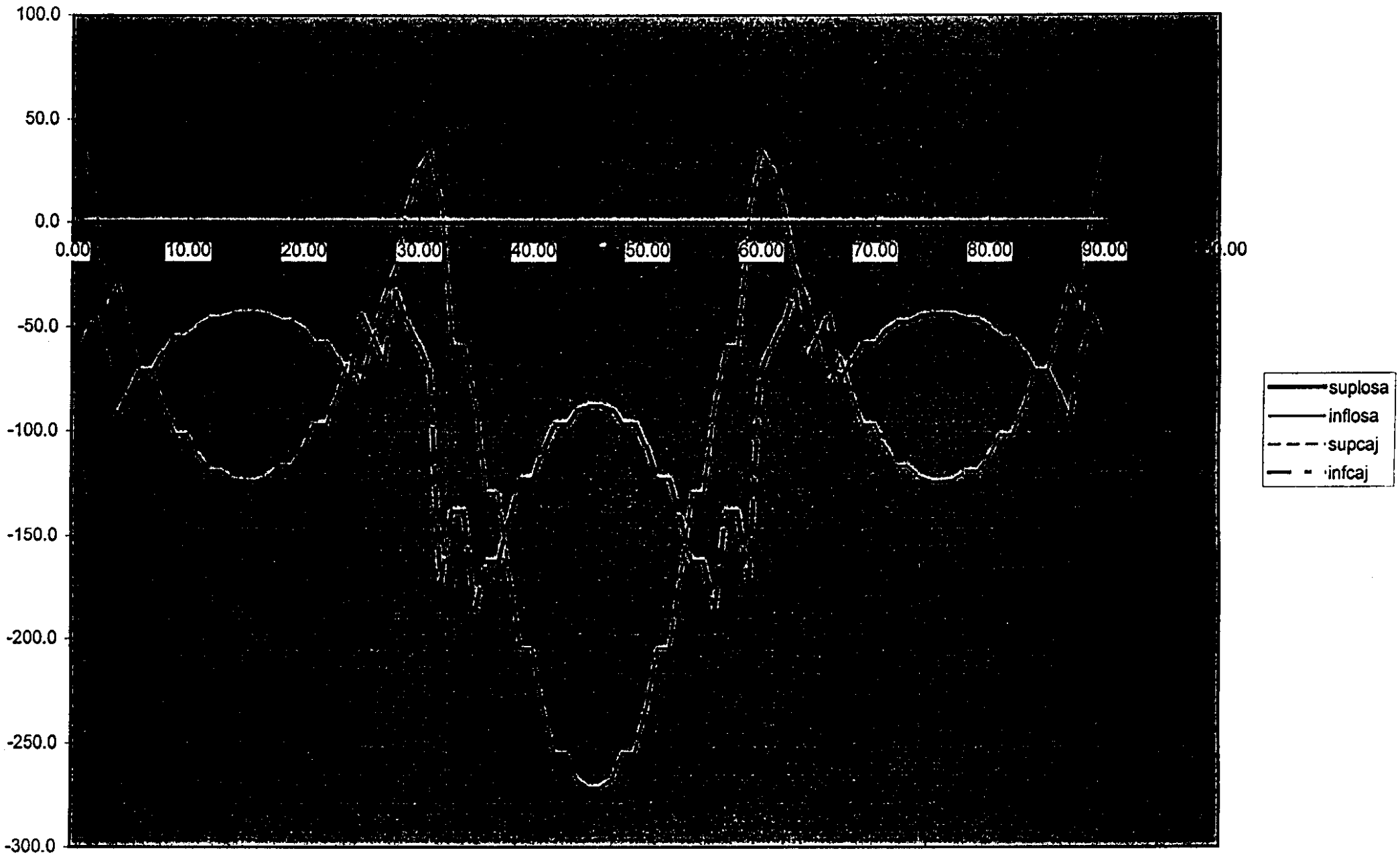



P.A.6 GRAFICOS

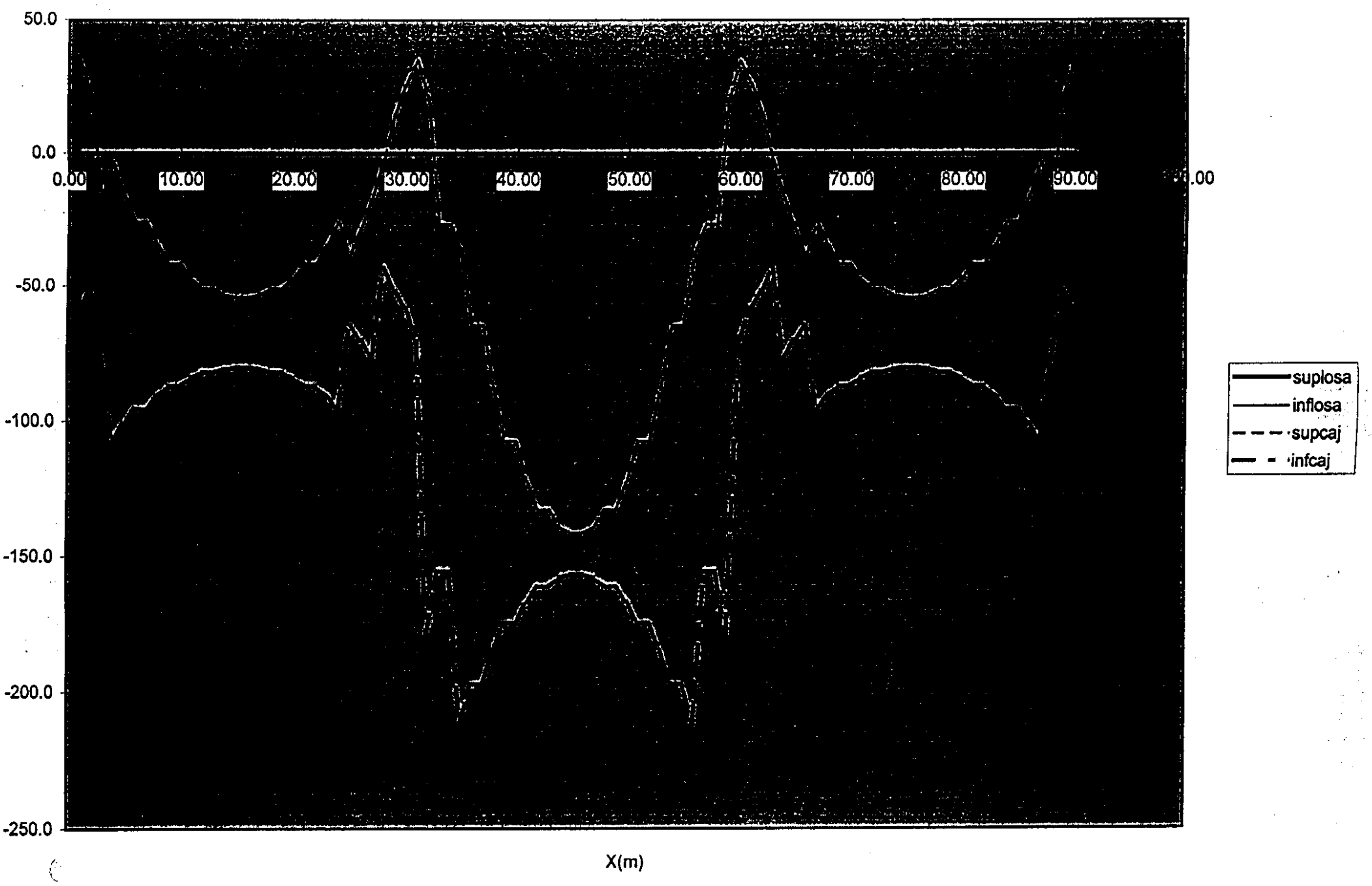
***TENSIONES***
***ACUMULADAS*** C.CARACTRÍSTICA
**TIEMPO T=INF** **CPTINF+1.0(SCUNEG+VPNEG)**

| BARRA | X(m) | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj | suplosa | inflosa | supcaj | infcaj |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 21(1) | 37.9 | 25.7 | 0.5 | -75.9 | | | | | | | | |
| 21(2) | 21(2) | 30.2 | 21.0 | -6.4 | -63.8 | | | | | | | | |
| 21(3) | 21(3) | 26.5 | 17.5 | -13.6 | -66.6 | | | | | | | | |
| 22(1) | 22(1) | 24.5 | 10.9 | -22.3 | -103.1 | | | | | | | | |
| 22(2) | 22(2) | 18.0 | 7.6 | -27.6 | -88.7 | | | | | | | | |
| 22(3) | 22(3) | 12.7 | 4.9 | -32.0 | -76.9 | | | | | | | | |
| 23(1) | 23(1) | 15.2 | 4.0 | -31.6 | -99.6 | | | | | | | | |
| 23(2) | 23(2) | 10.6 | 1.7 | -35.4 | -89.3 | | | | | | | | |
| 23(3) | 23(3) | 5.6 | -1.2 | -39.7 | -80.1 | | | | | | | | |
| 24(1) | 24(1) | 5.6 | -1.2 | -39.7 | -80.1 | | | | | | | | |
| 24(2) | 24(2) | 2.3 | -2.8 | -42.4 | -72.5 | | | | | | | | |
| 24(3) | 24(3) | -0.4 | -4.1 | -44.5 | -66.3 | | | | | | | | |
| 25(1) | 25(1) | -0.3 | -4.1 | -45.3 | -66.2 | | | | | | | | |
| 25(2) | 25(2) | -2.4 | -5.2 | -46.9 | -61.3 | | | | | | | | |
| 25(3) | 25(3) | -4.1 | -6.0 | -48.0 | -57.7 | | | | | | | | |
| 26(1) | 26(1) | -4.1 | -6.0 | -48.0 | -57.7 | | | | | | | | |
| 26(2) | 26(2) | -5.1 | -6.5 | -48.5 | -55.3 | | | | | | | | |
| 26(3) | 26(3) | -5.6 | -6.7 | -48.6 | -54.3 | | | | | | | | |
| 27(1) | 27(1) | -5.6 | -6.7 | -48.6 | -54.3 | | | | | | | | |
| 27(2) | 27(2) | -5.6 | -6.7 | -48.2 | -54.6 | | | | | | | | |
| 27(3) | 27(3) | -5.0 | -6.4 | -47.3 | -56.2 | | | | | | | | |
| 28(1) | 28(1) | -5.0 | -6.4 | -47.3 | -56.2 | | | | | | | | |
| 28(2) | 28(2) | -3.8 | -5.8 | -45.9 | -59.1 | | | | | | | | |
| 28(3) | 28(3) | -2.2 | -5.0 | -43.9 | -63.3 | | | | | | | | |
| 29(1) | 29(1) | -1.9 | -4.8 | -43.8 | -63.4 | | | | | | | | |
| 29(2) | 29(2) | 0.4 | -3.6 | -41.3 | -68.9 | | | | | | | | |
| 29(3) | 29(3) | 3.2 | -2.2 | -38.4 | -75.7 | | | | | | | | |
| 30(1) | 30(1) | 0.4 | -1.6 | -39.1 | -52.8 | | | | | | | | |
| 30(2) | 30(2) | 3.9 | 4.5 | -28.6 | -39.3 | | | | | | | | |
| 30(3) | 30(3) | 8.1 | 7.2 | -24.2 | -34.7 | | | | | | | | |

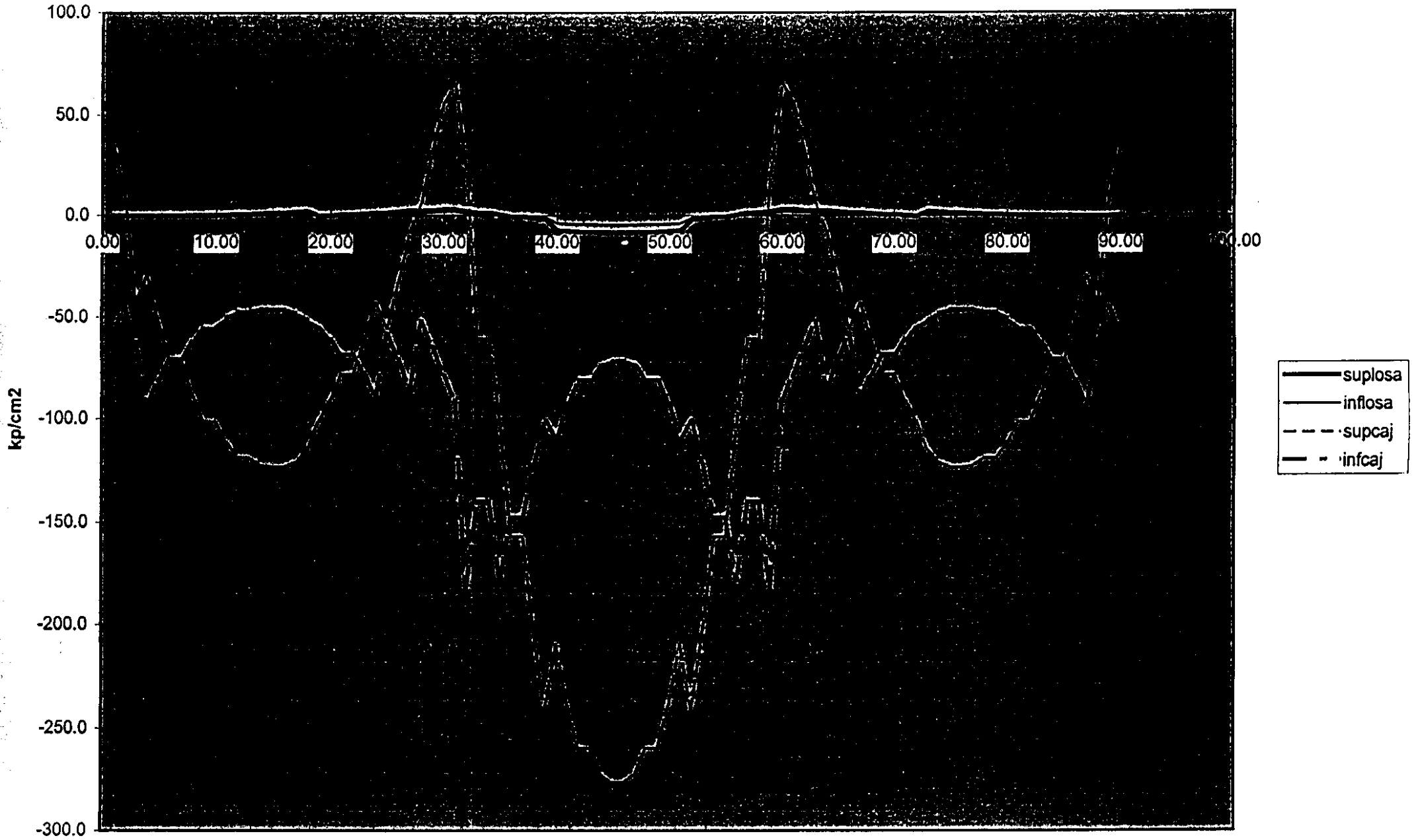
TRAS BC LOSA EN CDV



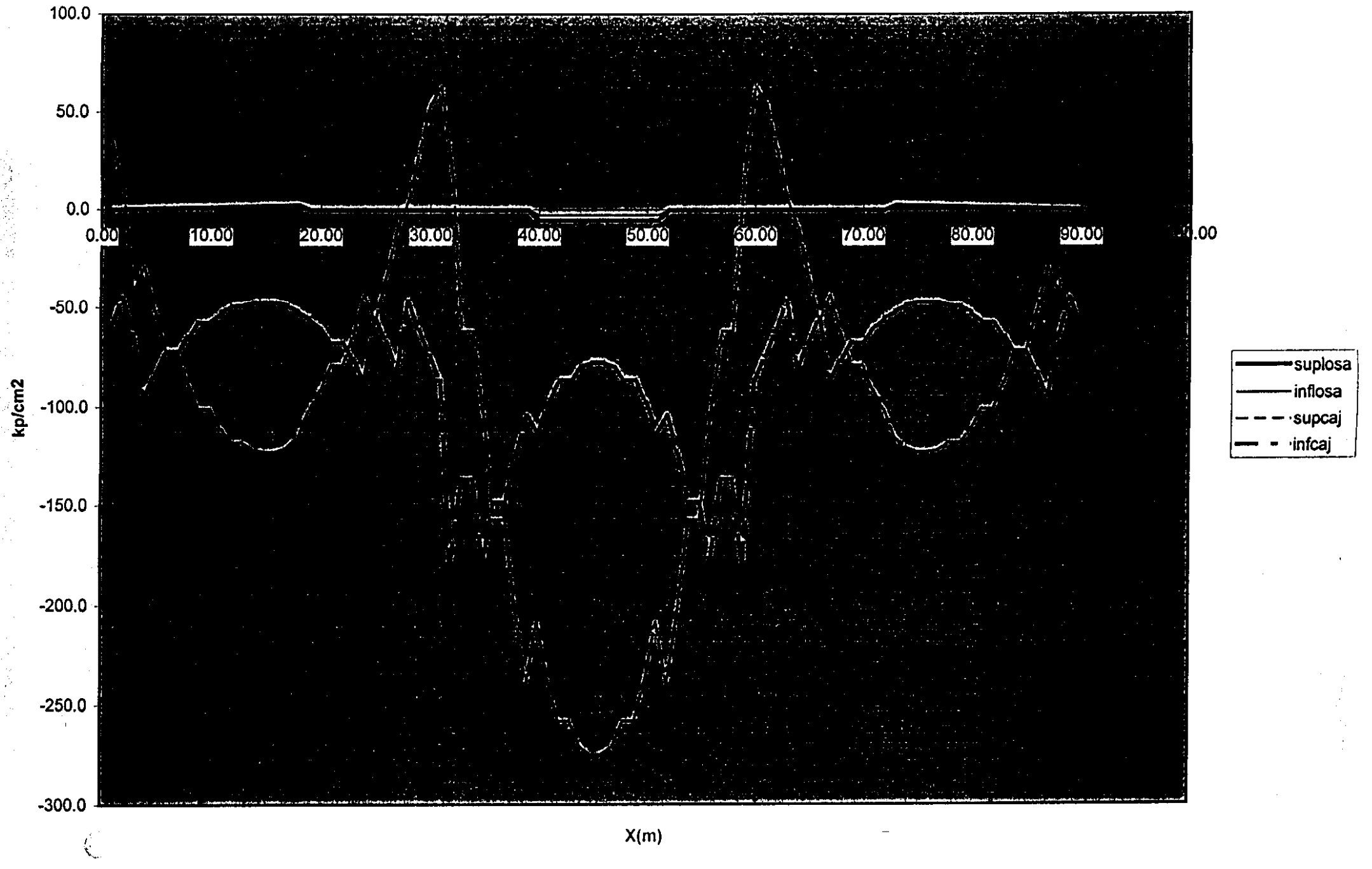

TRAS PRELOSAS



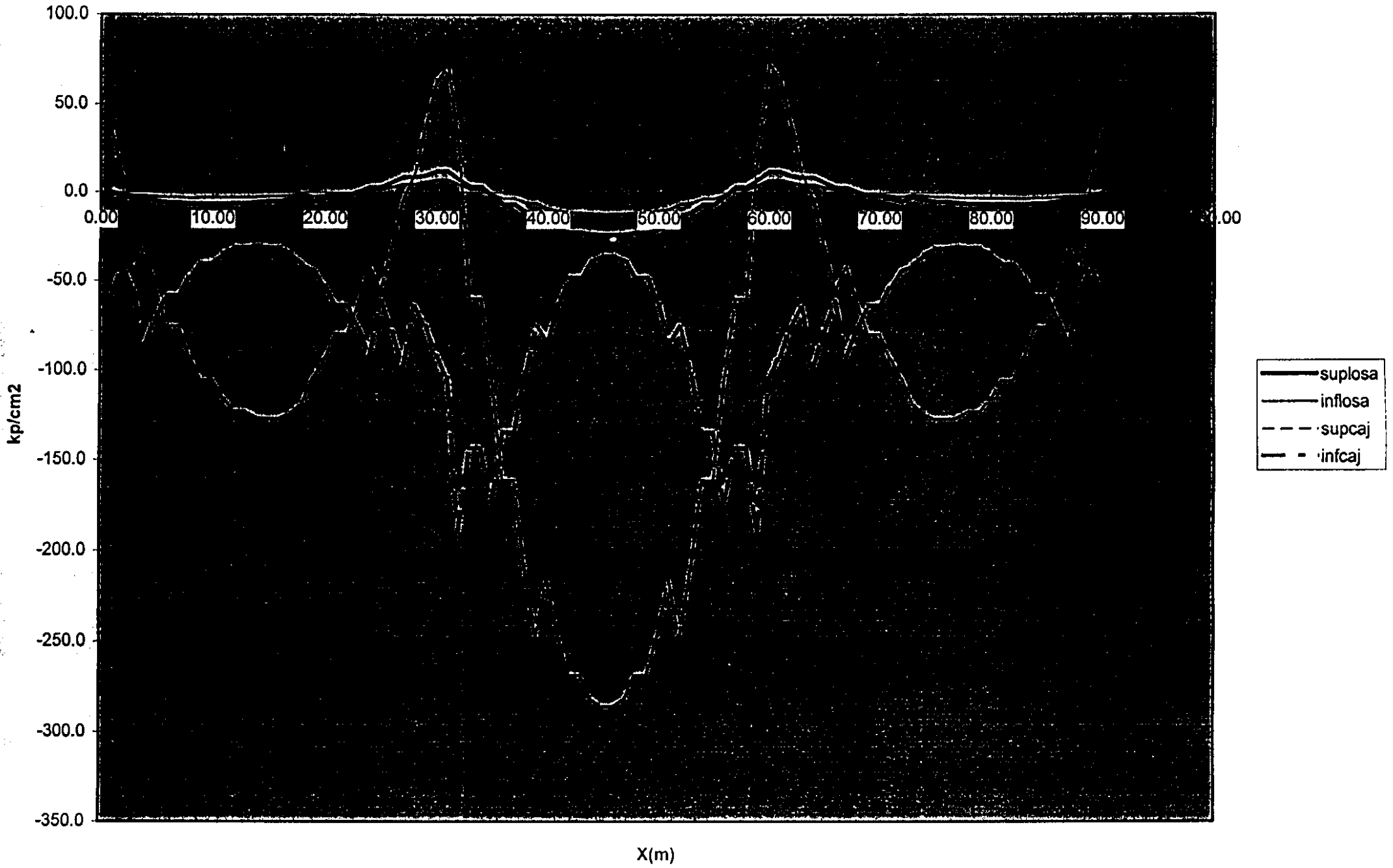
TRAS VOLADIZOS DE LOSA




TRAS BC RESTO LOSA

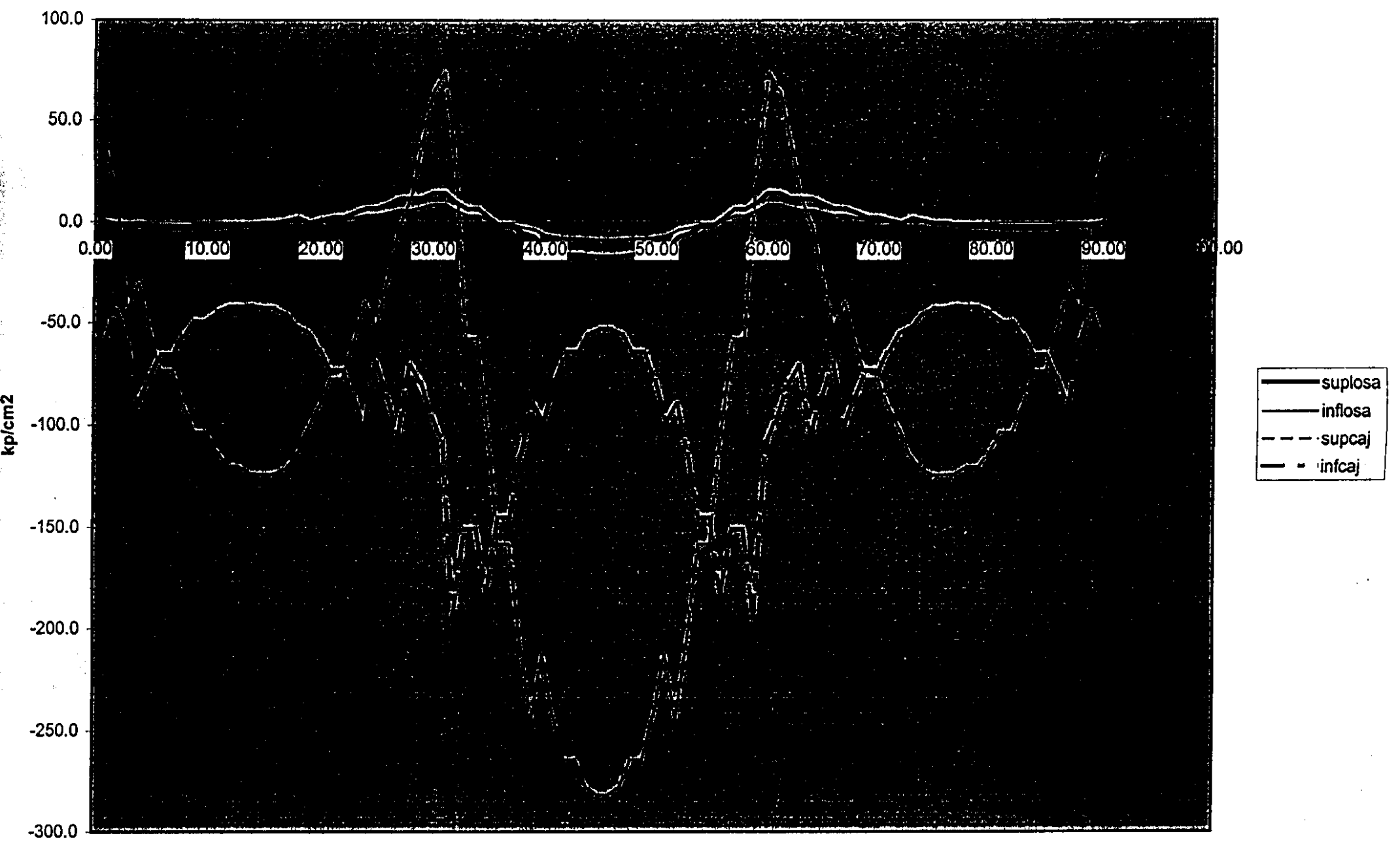


CPT0+.2(SCUPOS+VPPOS+GRADIENTE)



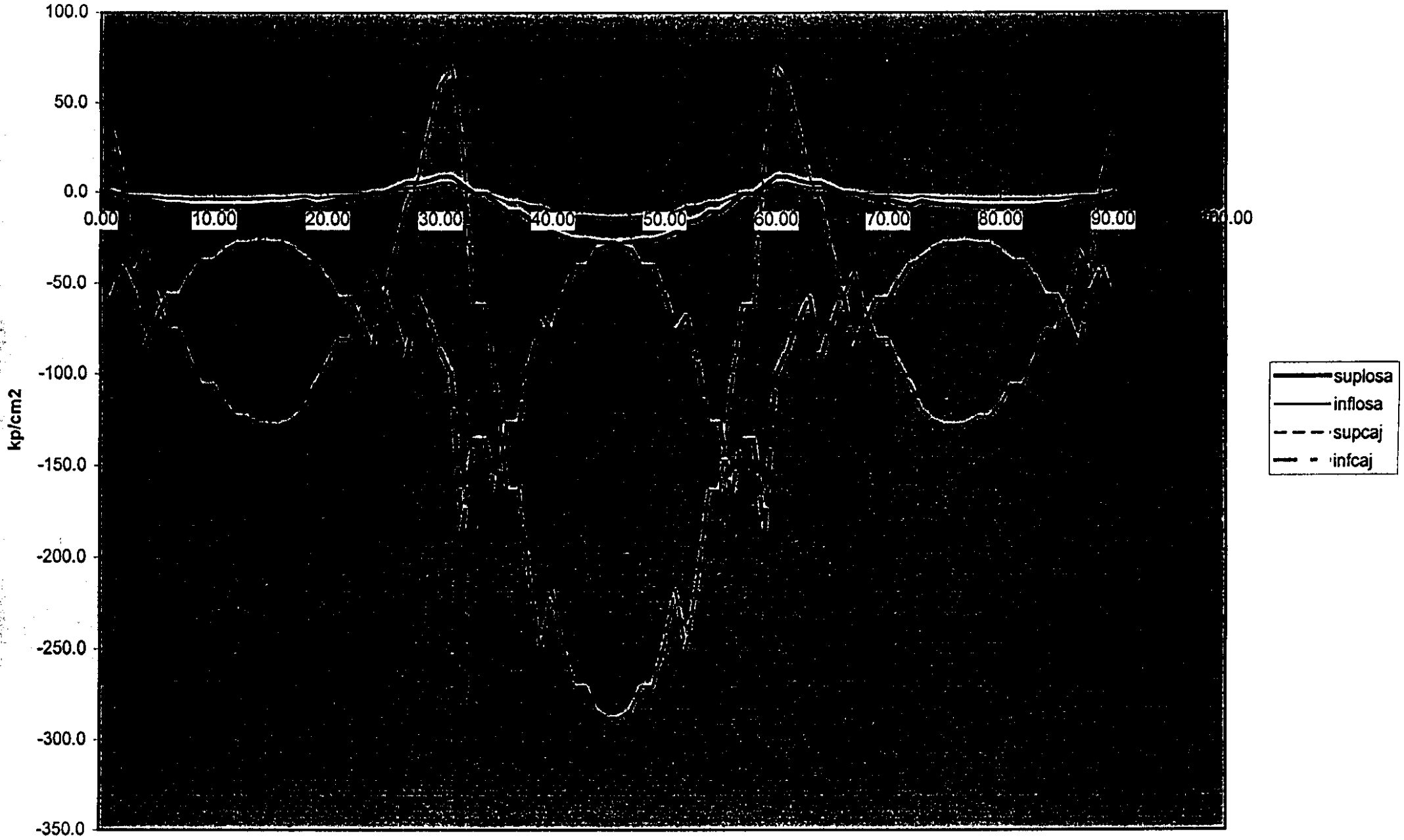

X(m)

C.PERMANENTE A T0

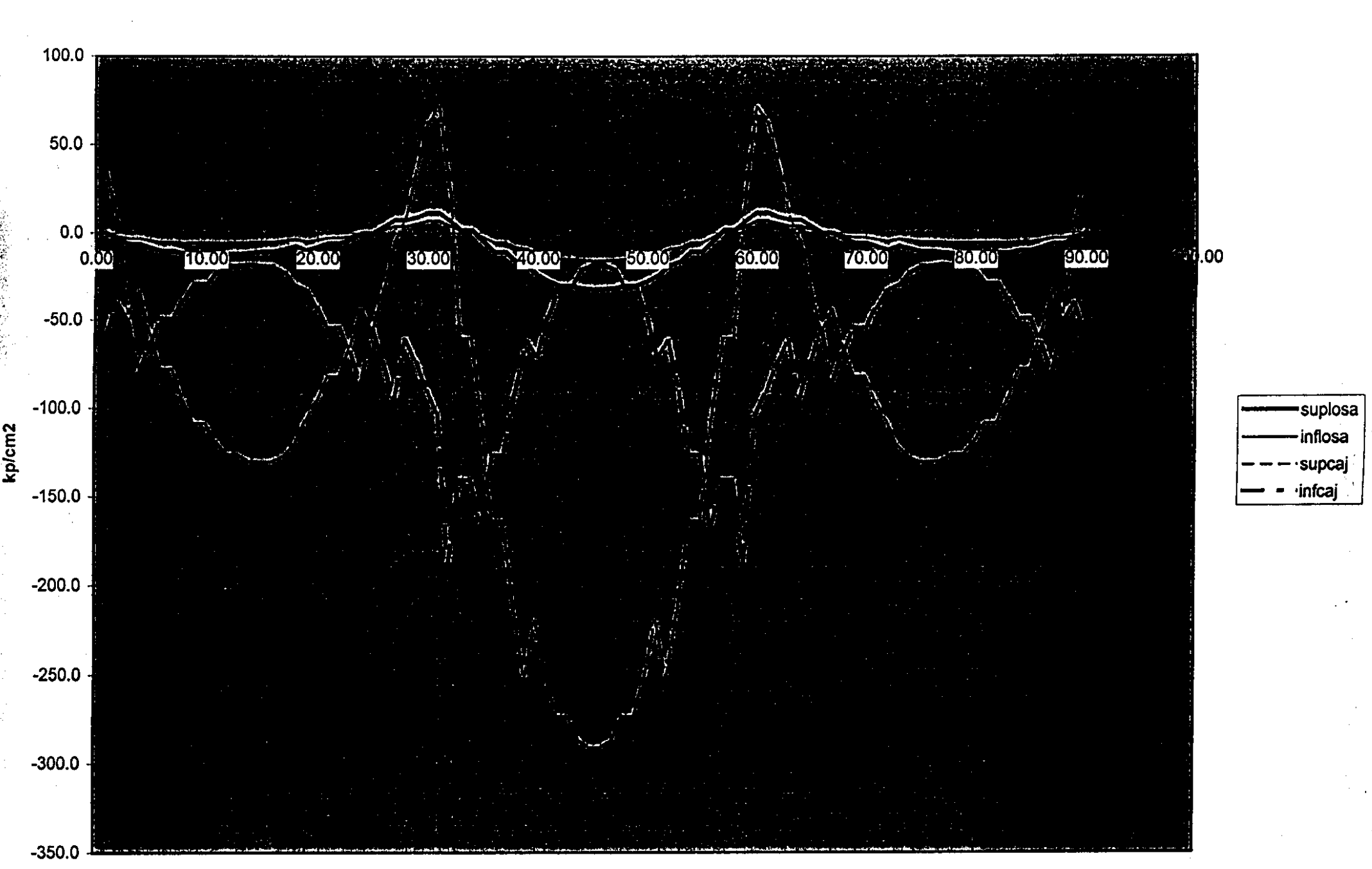



X(m)

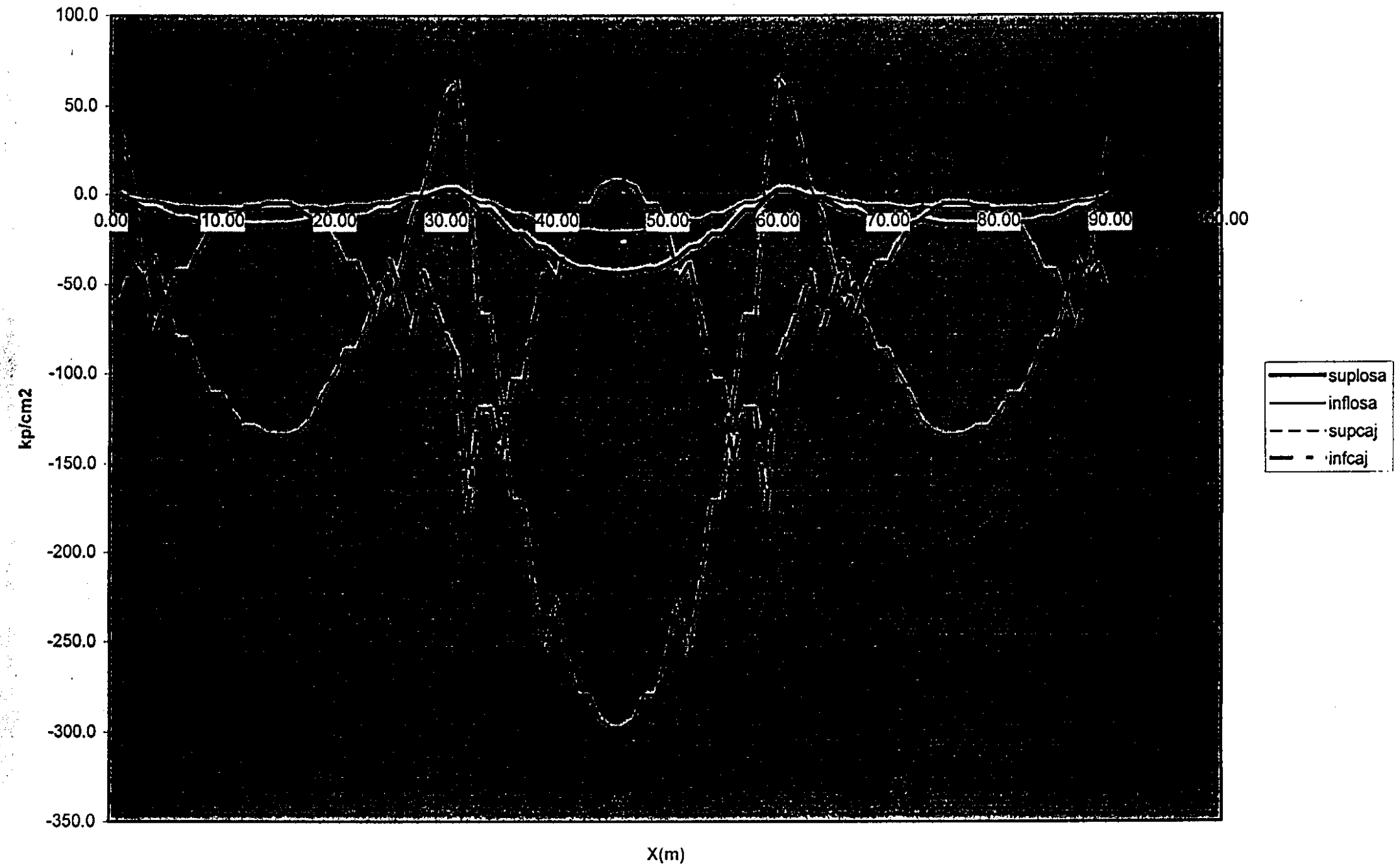
CPT0+.2(SCUPOS+VPPOS)+.5GRAD.



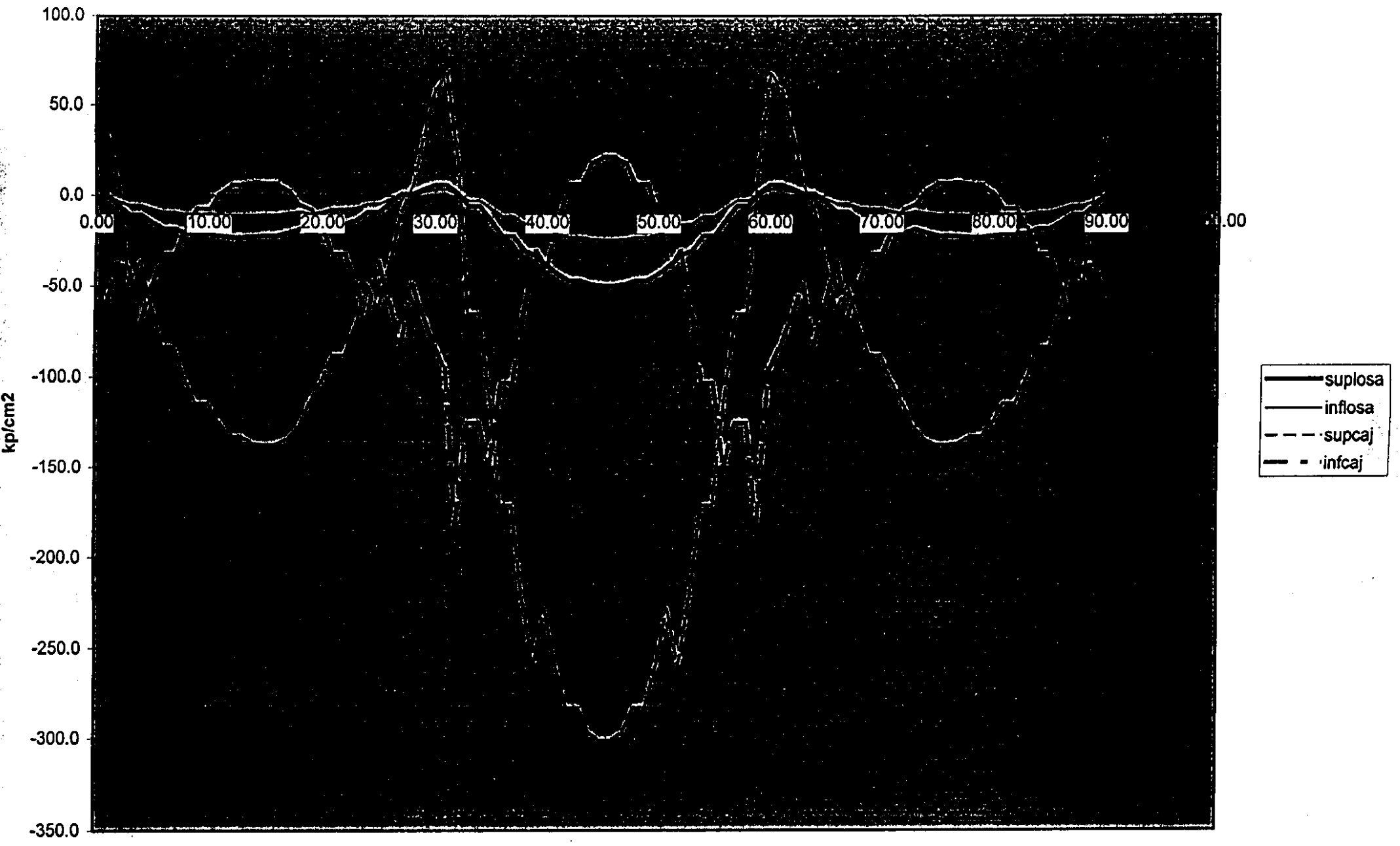

CPT0+.5(SCUPOS+VPPOS)+.2GRAD.



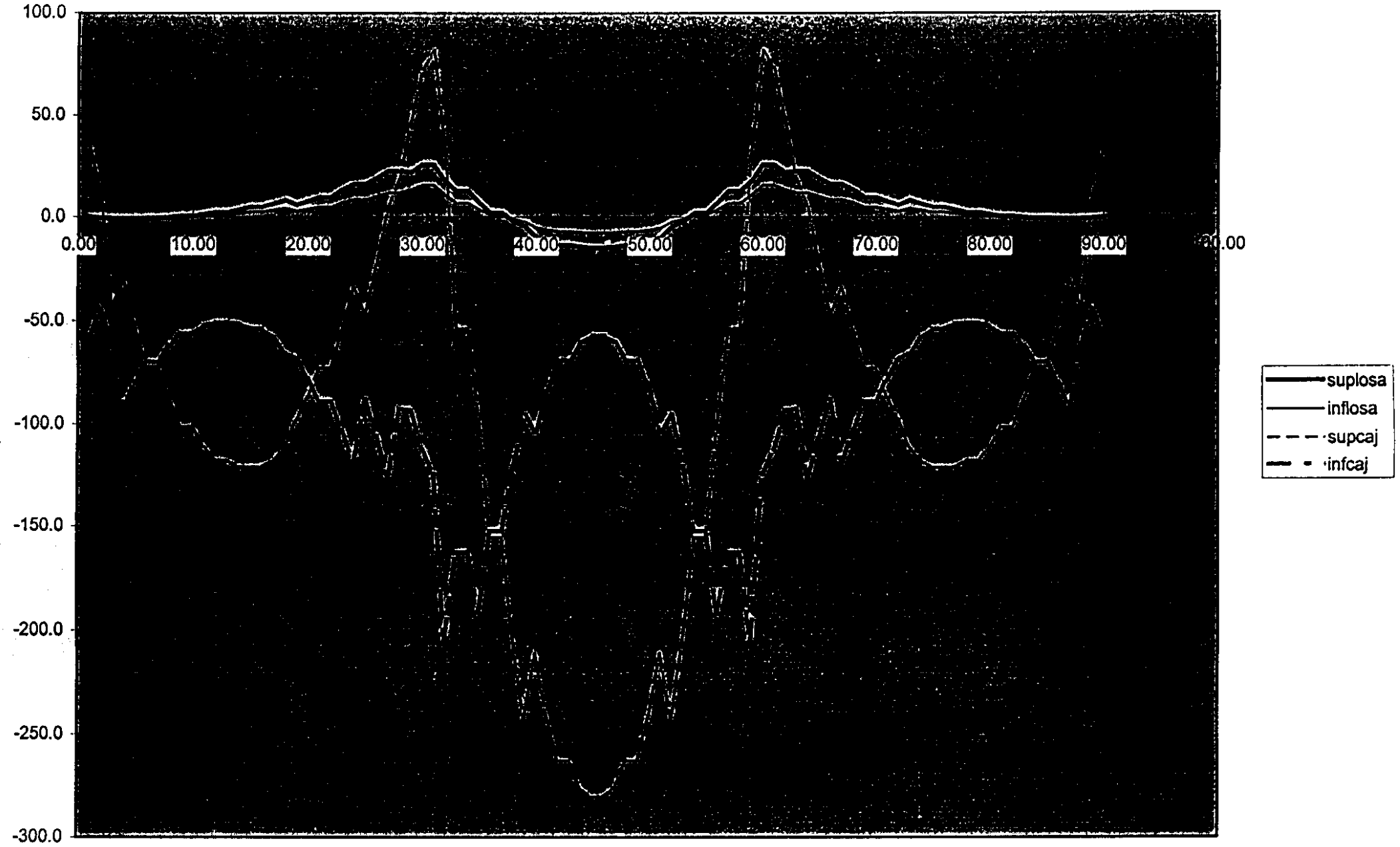
CPT0+.6(SCUPOS+VPPOS)+1.0GRAD.




CPT0+1(SCUPOS+VPPOS)+.6GRAD.

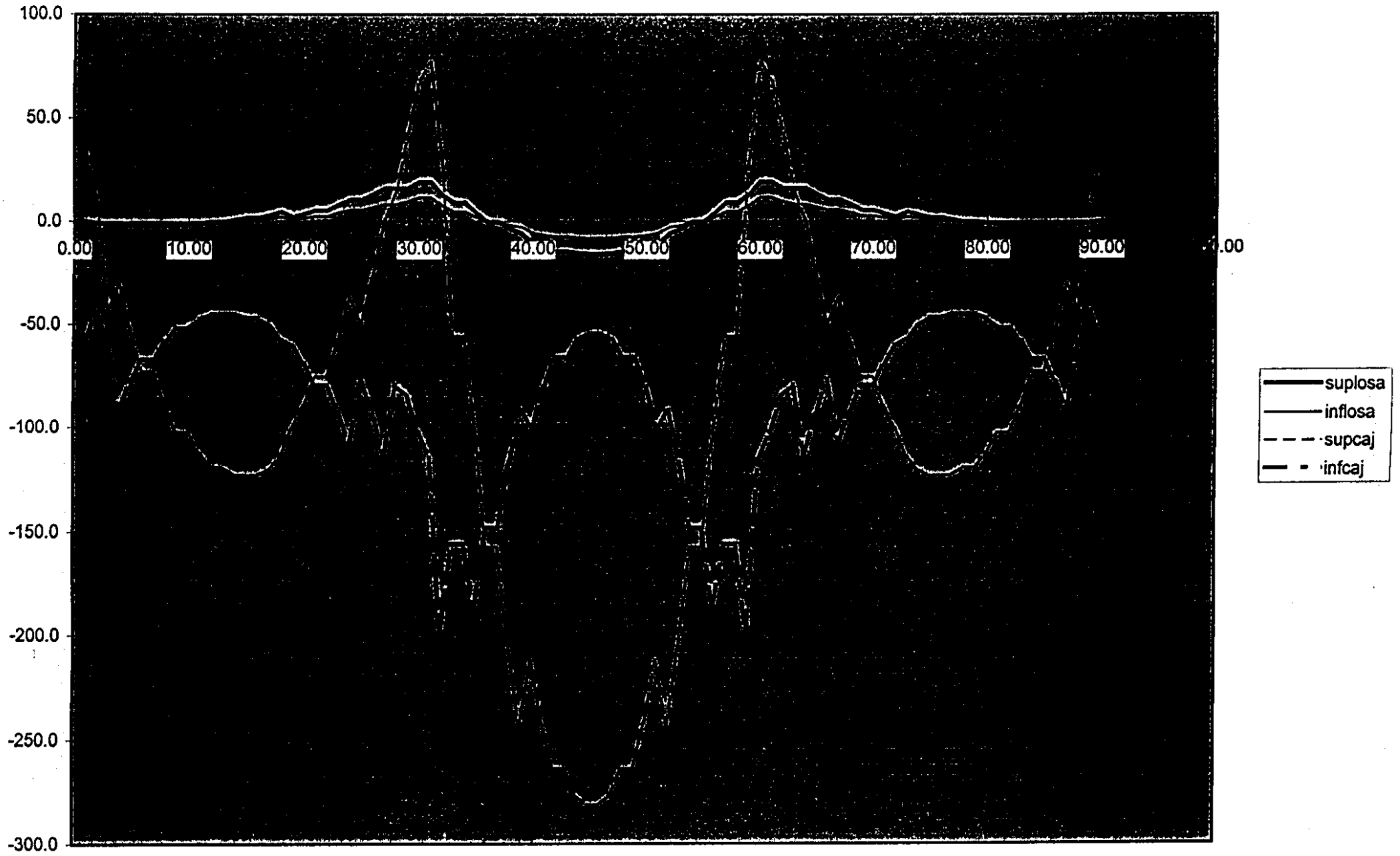


CPT0+.5(SCUNEG+VPNEG)



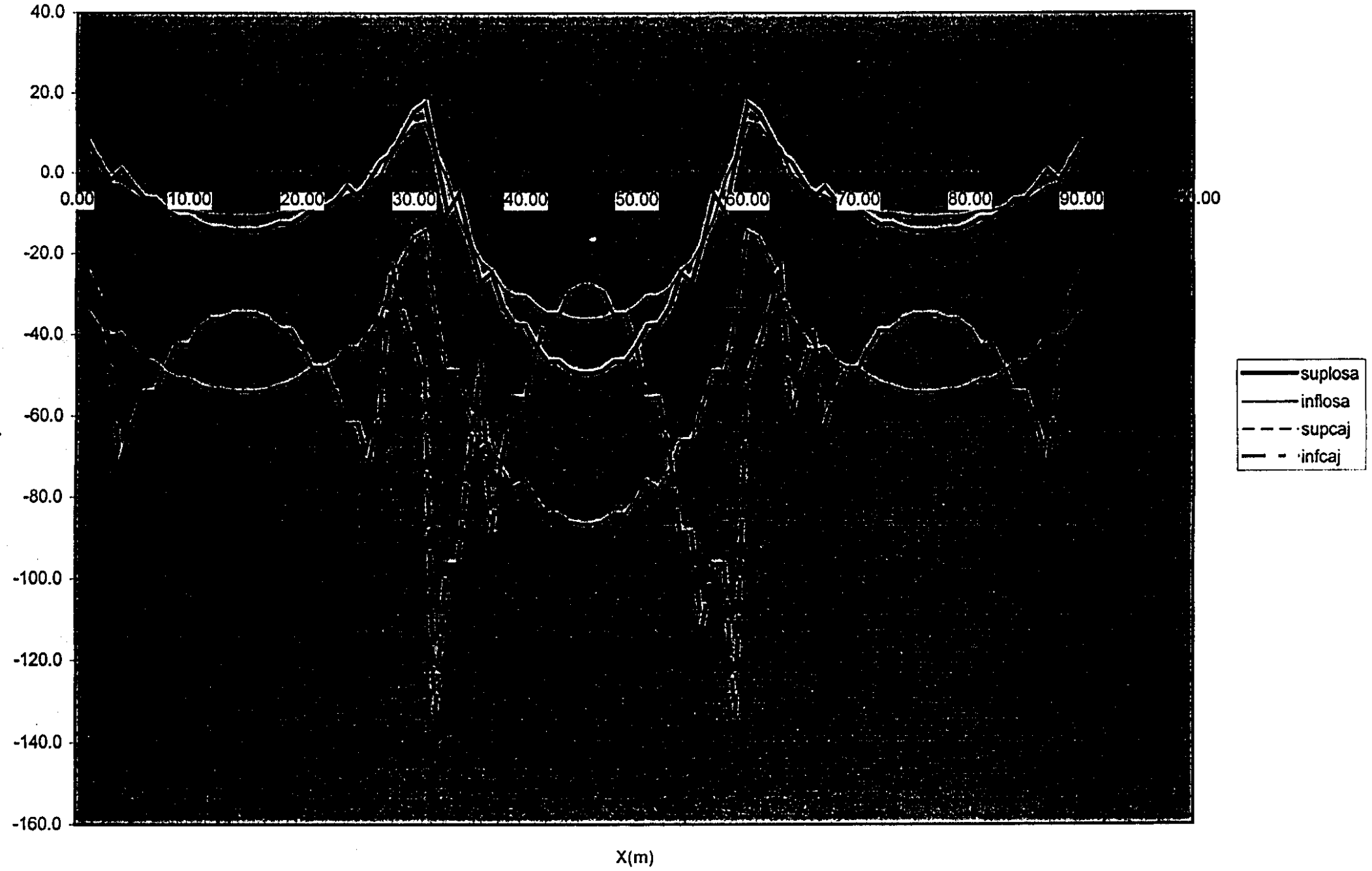

X(m)

CPT0+.2(SCUNEG+VPNEG)

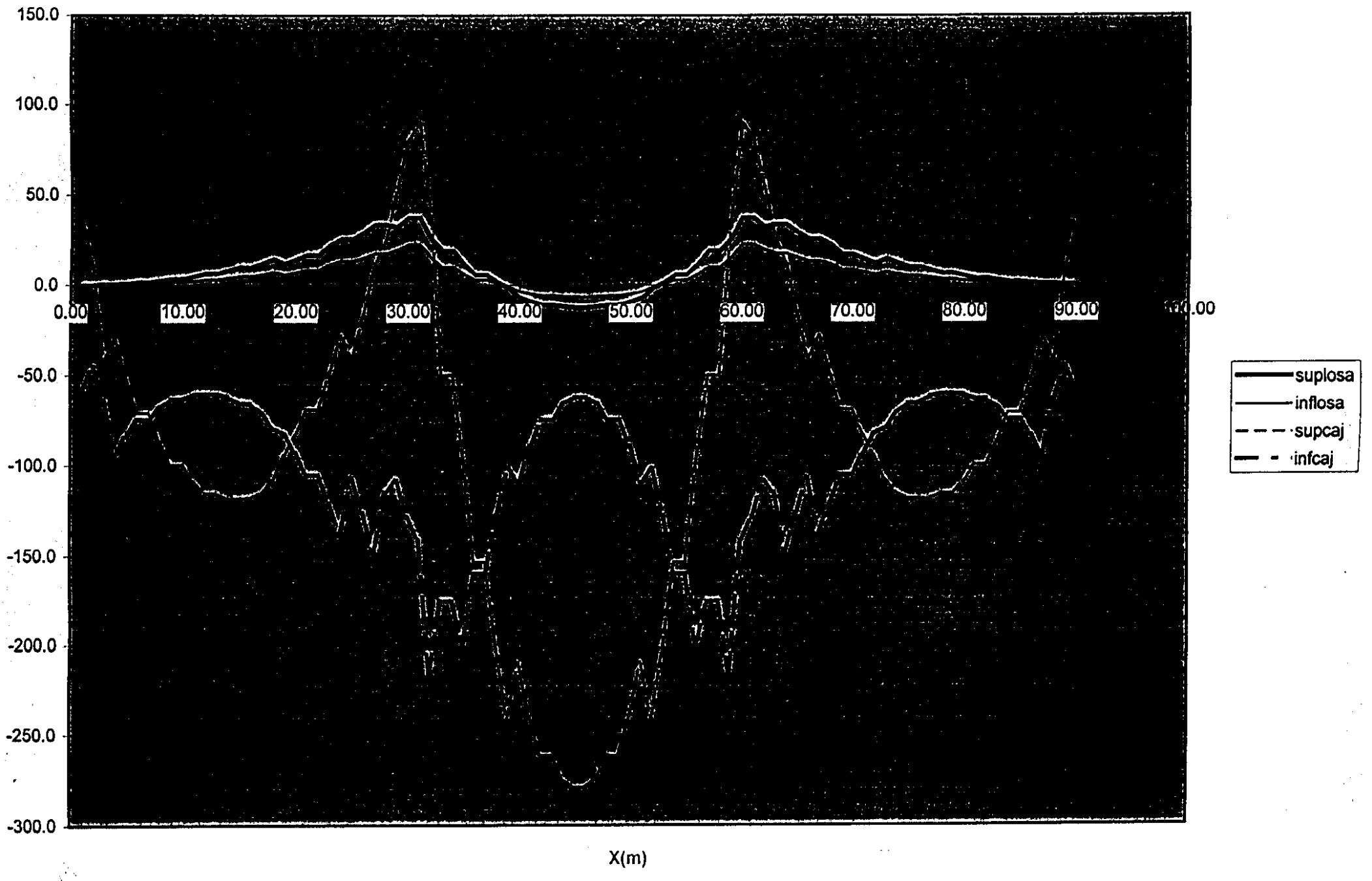



X(m)

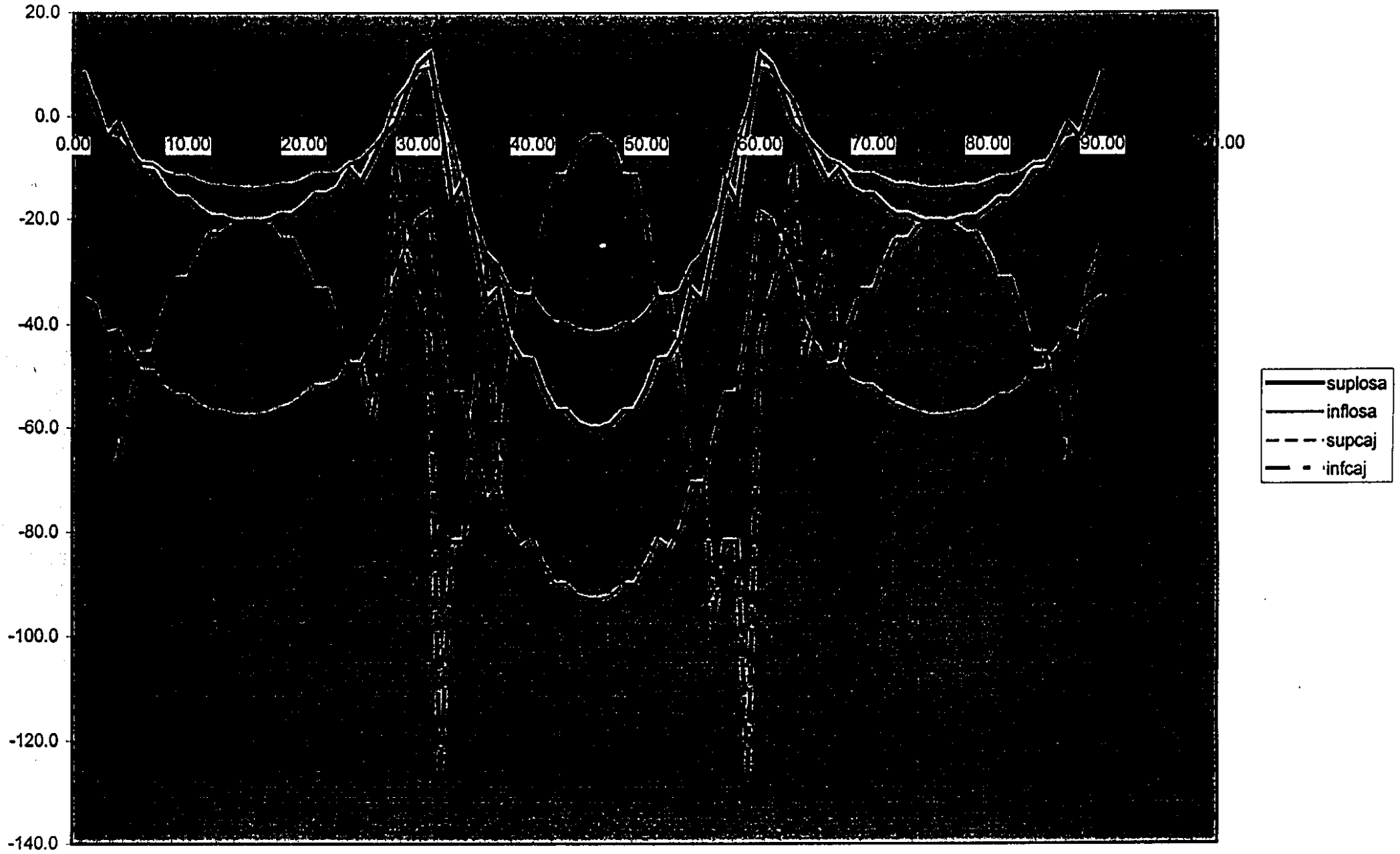
CARGA PERMANETE T=INF



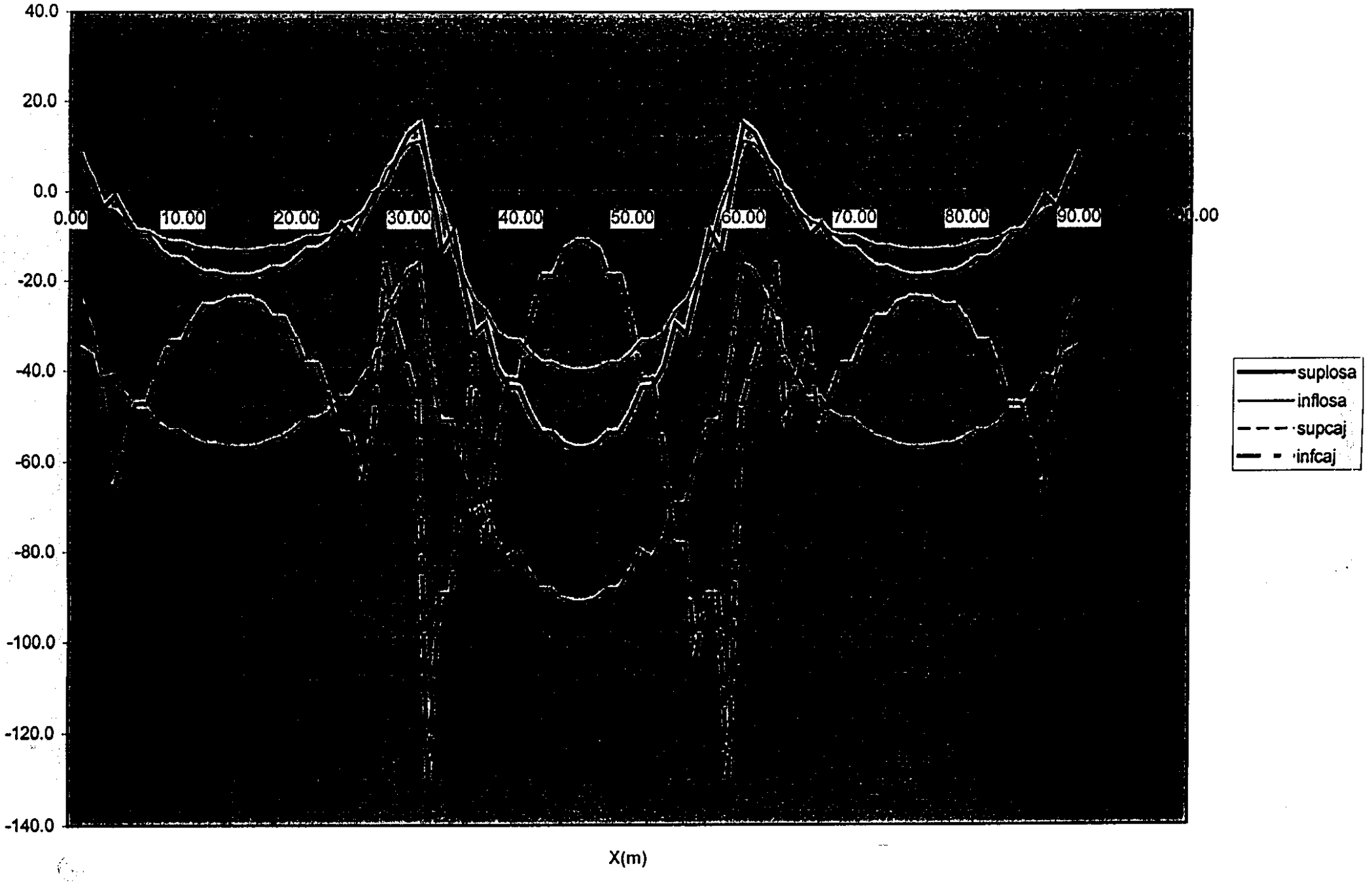

CPT0+1.0(SCUNEG+VPNEG)



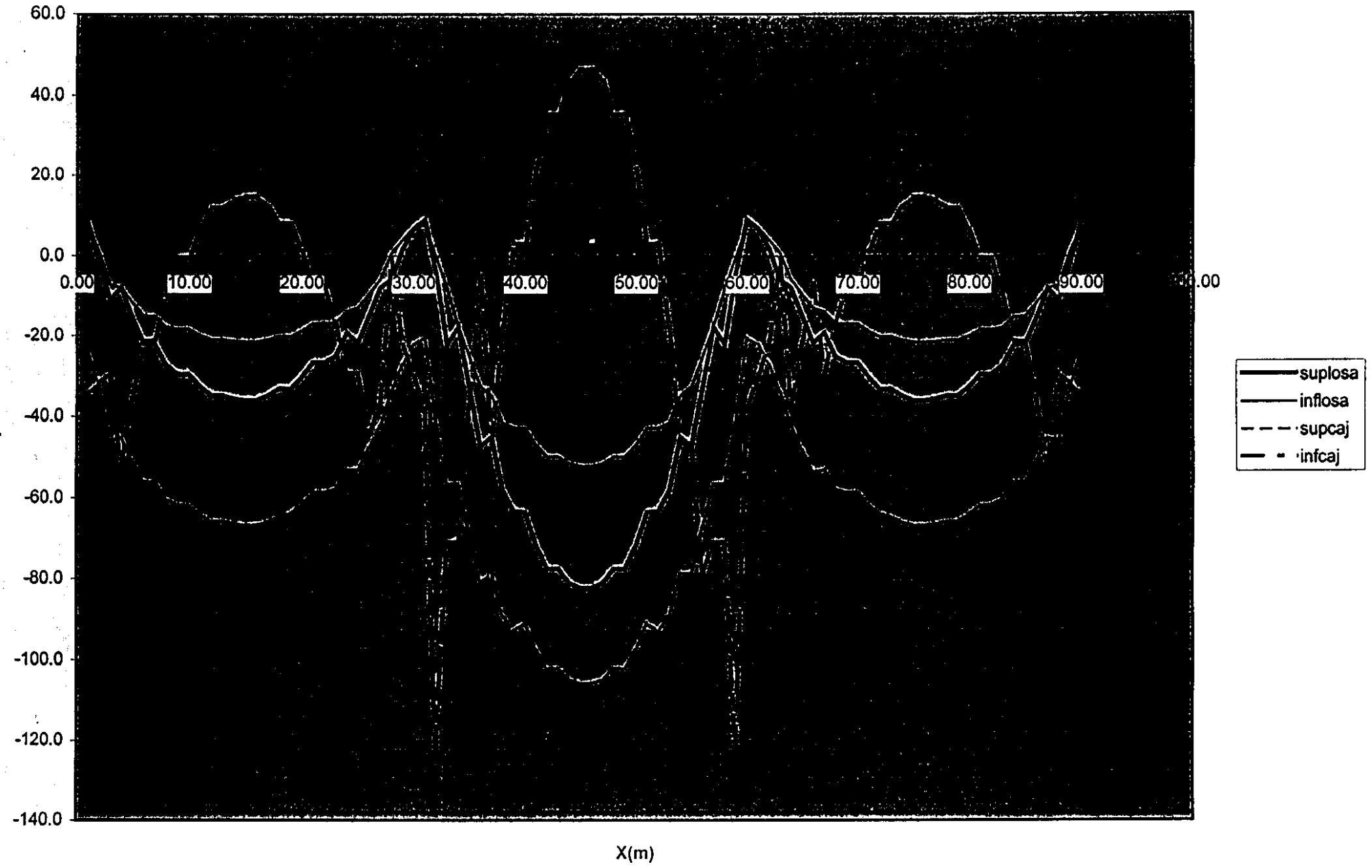
CPTINF+.2(SCUPOS+VPPOS)+.5GRAD.



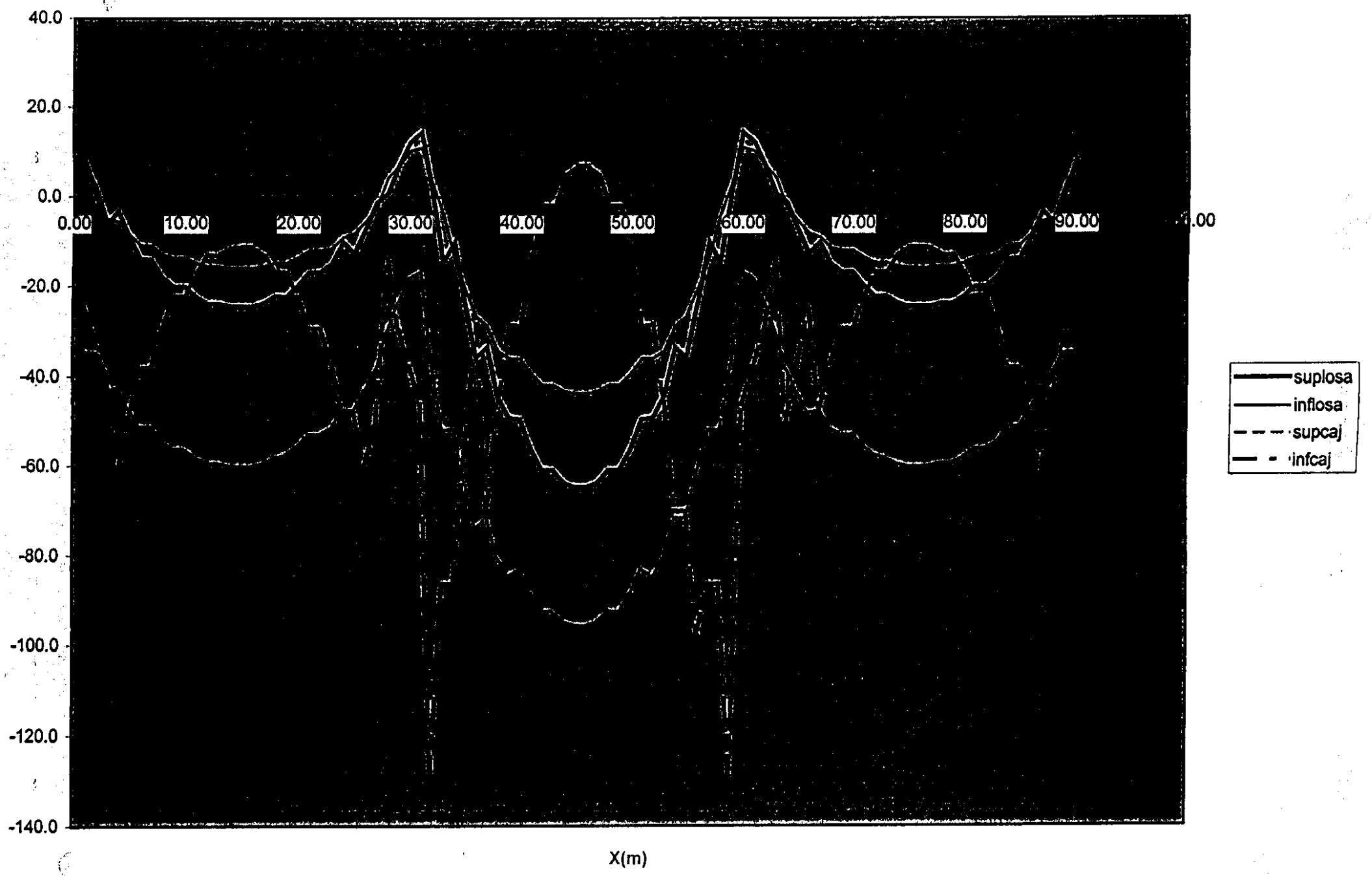

CPTINF+.2(SCUPOS+VPPOS+GRADIENTE)



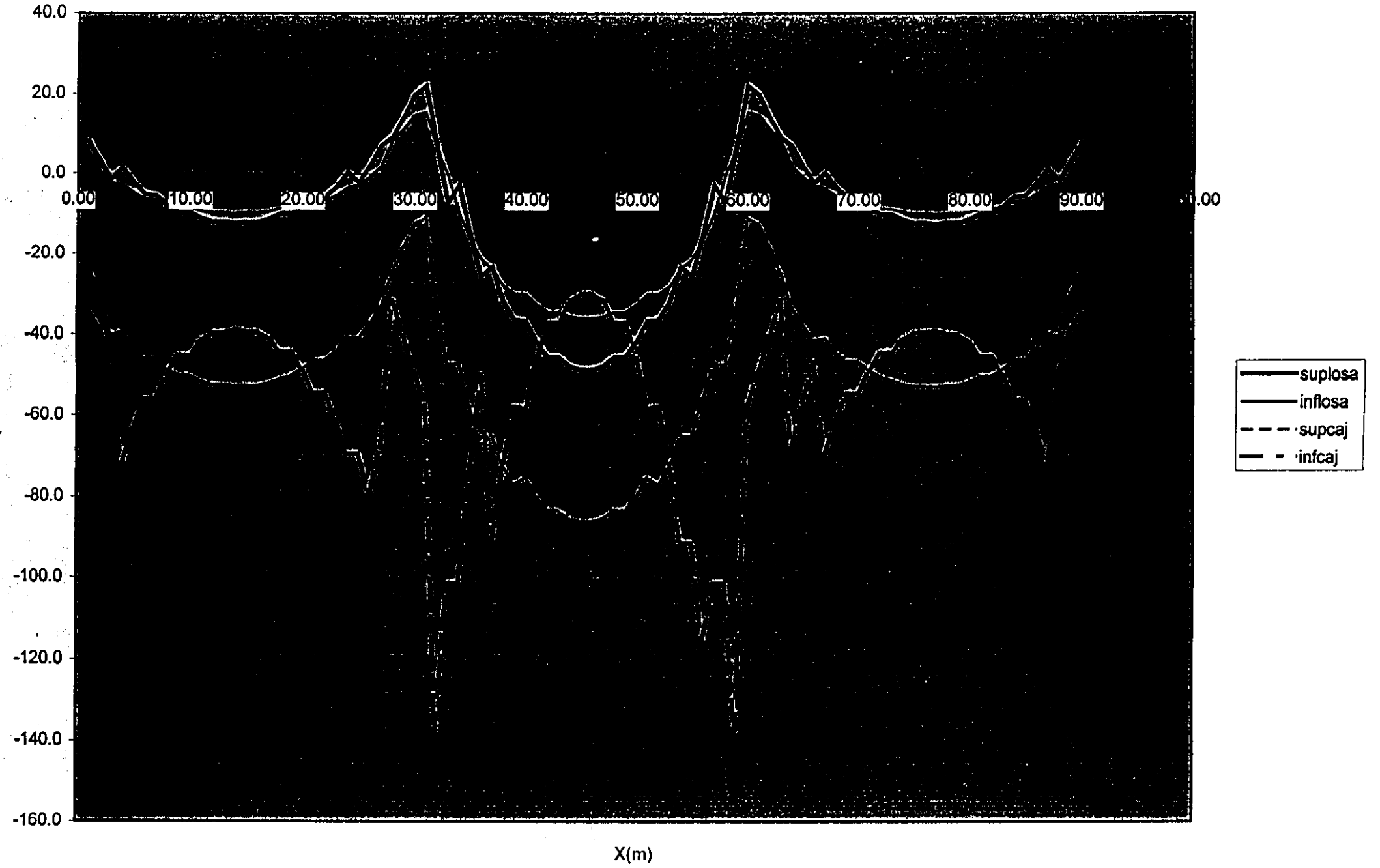
CPTINF+1(SCUPOS+VPPOS)+0.6GRAD.



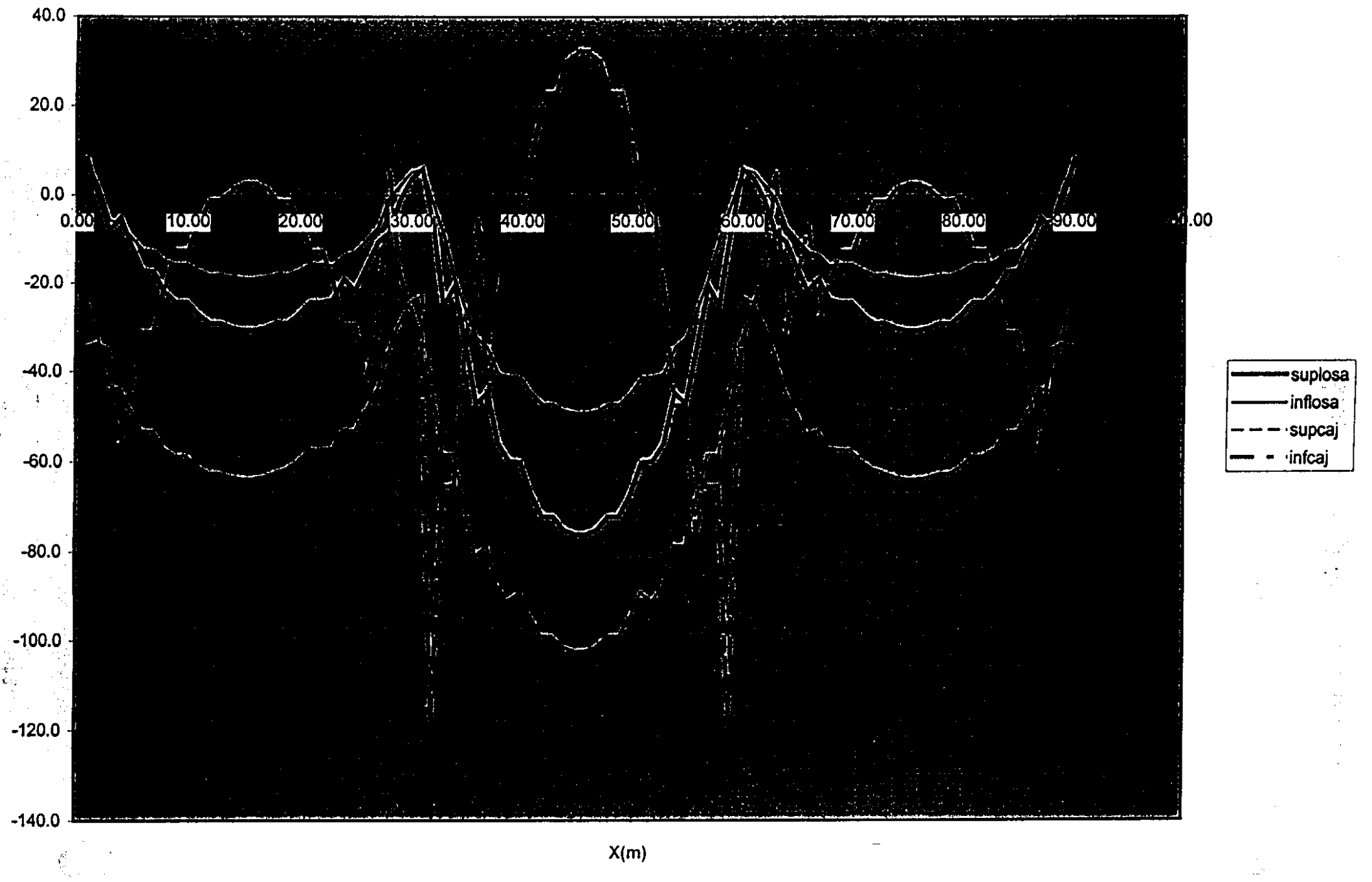

CPTINF+.5(SCUPOS+VPPOS)+.2GRAD.



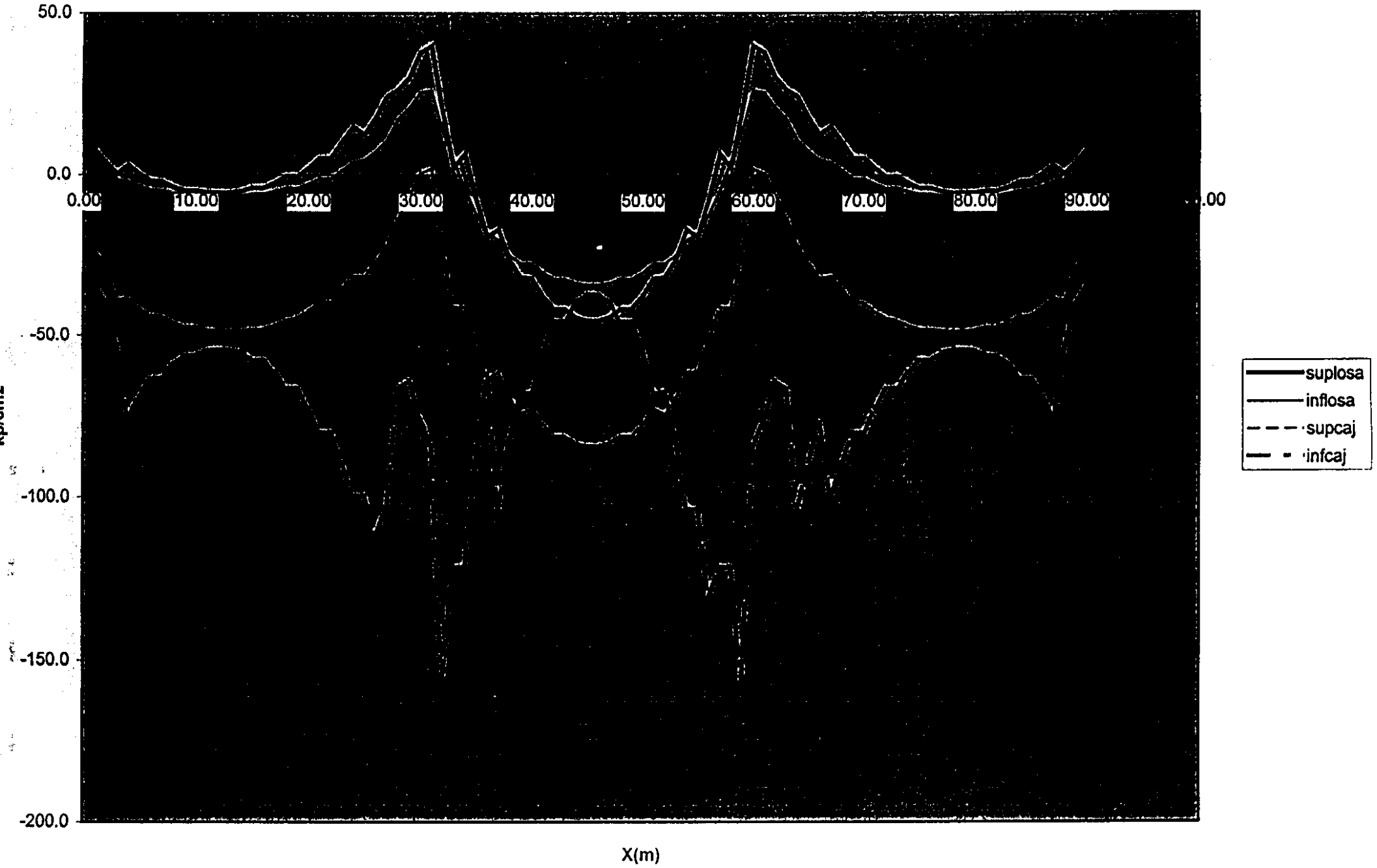
CPTINF+.2(SCUNEG+VPNEG)



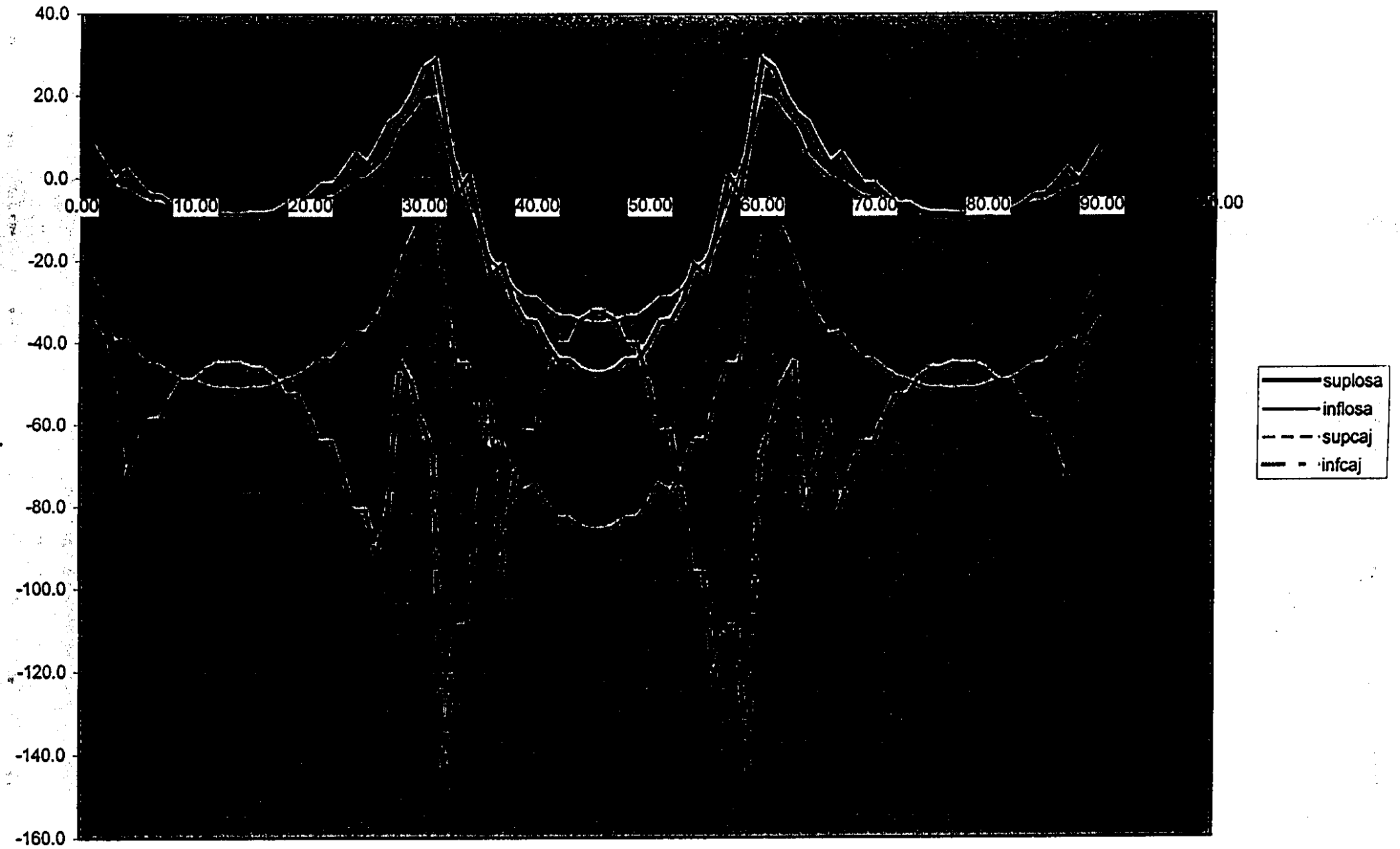

CPTINF+.6(SCUPOS+VPPOS)+1.0GRAD.



CPTINF+1.0(SCUNEG+VPNEG)




CPTINF+.5(SCUNEG+VPNEG)



# 9.CONTROL EN ROTURA

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 9-1 |

## 9. CONTROL EN ROTURA

### 9.1. Control en Rotura para estructura completa

| Envolvente de rotura a T=0 | $\gamma_{fav}$ | $\gamma_{desfav}$ |
|---|---|---|
| Fase 1 (coloc. vigas) | 0.90 | 1.35 |
| Fase 2 (Coloc. prelosas) | 0.90 | 1.35 |
| Fase 3 (BC losa en cdv) | 0.90 | 1.35 |
| Fase 5 (BC resto de losa) | 0.90 | 1.35 |
| Fase 6 (losa realizada) | 0.90 | 1.35 |
| Carga Muerta | 0.90 | 1.35 |
| Sobrecarga uniforme | 0.00 | 1.35 |
| Vehículo pesado | 0.00 | 1.35 |
| Gradiente térmico | 0.00 | 1.50 |

| Envolvente de rotura a T = inf | $\gamma_{fav}$ | $\gamma_{desfav}$ |
|---|---|---|
| (se añaden a las anteriores las ctes. estados): | | |
| Redistribución de cargas exteriores | 1.00 | 1.35 |
| Redistribución de pretensado + pérdidas | 1.00 | 1.00 |

Combinación de acciones

Sobrecarga de uso dominante

$$\Sigma \gamma_{Gi} \cdot G_{ki} + \Sigma \gamma_{Qi}^{*} \cdot G_{ki}^{*} + \gamma_Q \times (sc_{uso} + vp) + 0.60 \times \gamma_Q \times (gradiente)$$

Gradiente térmico dominante

$$\Sigma \gamma_{Gi} \cdot G_{ki} + \Sigma \gamma_{Qi}^{*} \cdot G_{ki}^{*} + \gamma_Q \times (gradiente) + 0.60 \times \gamma_Q \times (sc_{uso} + vp)$$

9.1.1 Esfuerzos de cálculo

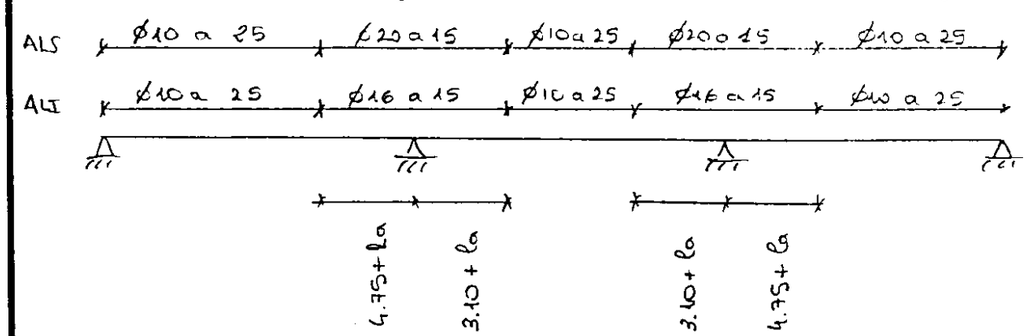
Se obtienen las envolventes anteriores decalando la ley de momentos un canto en el sentido más desfavorable. Se considerará una redistribución de las leyes de momentos de cálculo del 9%, debido a la previsible fisuración de la losa en la sección sobre pilar, lo que supone un aumento de los momentos positivos de este valor (5%) y un decremento análogo de los momentos negativos que no se tendrá en cuenta.

9.1.2 Esfuerzos últimos

Se obtienen con el programa "CSEC".

En aquellas secciones donde $|Md| < |Mu|$ se dimensionará una armadura pasiva de refuerzo dispuesta en la tabla inferior de la viga para positivos o en la losa para negativos.

Se dispondrá refuerzo de rotura en la losa para negativos:






la = long. anclaje 1Ø25 en posición II:

$1.4 \times m\phi^2 \;\&\; \frac{fak}{400}\phi \;\&\; 15cm$

$1.4 \times 15 \times 2^2 \;\&\; \frac{5100}{400} \cdot 2 \;\&\; 15$

54 cm & 25,5 & 15

Tomaremos la = 85 cm

4.75 + la = 5.60 m

3.10 + la = 4.00 m

No se precisa armadura de rotura en viga.

*SUBTRAMO XV AVE / E-1505.0*

*MOMENTOS CARACTERÍSTICOS*

*MOMENTOS DE CÁLCULO*

| BARRA | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Redistr.cext | Redistr.pret | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradient | T=0 Md- | T=0 Md+ | T=INF Md- | T=INF Md+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | 0.00 | 0.00 | 0.00 | -88.30 | -59.20 | -405.79 | 655.03 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 193.30 | -1131.72 | 6.00 | -1024.51 | 255.24 |
| 11(2) | 67.90 | 26.00 | 37.80 | -36.30 | -39.90 | -405.88 | 655.03 | -145.70 | 18.40 | -173.10 | 22.50 | -121.60 | 193.30 | -623.09 | 304.85 | -515.99 | 554.00 |
| 11(3) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | -405.88 | 655.03 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 193.30 | -197.09 | 617.82 | -89.99 | 866.98 |
| 12(1) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | -405.88 | 655.03 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 193.30 | -197.09 | 617.82 | -89.99 | 866.98 |
| 12(2) | 182.30 | 69.70 | 113.30 | 39.20 | -7.20 | -405.79 | 655.03 | -27.70 | 41.90 | -71.30 | 97.20 | -73.00 | 193.30 | 100.49 | 929.81 | 207.70 | 1179.05 |
| 12(3) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | -405.79 | 655.03 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 193.30 | 327.06 | 1238.01 | 434.27 | 1487.25 |
| 13(1) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | -405.79 | 655.03 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 193.30 | 327.06 | 1238.01 | 434.27 | 1487.25 |
| 13(2) | 268.00 | 102.50 | 188.90 | 77.00 | 17.20 | -405.71 | 655.03 | 60.80 | 107.10 | -42.50 | 175.60 | -61.10 | 193.30 | 487.56 | 1562.46 | 594.89 | 1811.79 |
| 13(3) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | -405.79 | 655.03 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 193.30 | 612.93 | 1839.32 | 720.14 | 2088.56 |
| 14(1) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | -405.79 | 655.03 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 193.30 | 612.93 | 1839.32 | 720.14 | 2088.56 |
| 14(2) | 325.20 | 124.40 | 259.70 | 81.70 | 33.60 | -405.88 | 655.03 | 119.80 | 169.70 | -42.50 | 235.00 | -49.20 | 193.30 | 712.41 | 2055.96 | 819.51 | 2305.12 |
| 14(3) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | -405.88 | 655.03 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 193.30 | 786.12 | 2212.58 | 893.22 | 2461.73 |
| 15(1) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | -405.88 | 655.03 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 193.30 | 786.12 | 2212.58 | 893.22 | 2461.73 |
| 15(2) | 353.80 | 135.30 | 297.50 | 81.70 | 41.70 | -405.79 | 655.03 | 149.30 | 201.00 | -42.50 | 266.70 | -37.20 | 193.30 | 833.82 | 2305.58 | 941.03 | 2554.82 |
| 15(3) | 357.40 | 136.70 | 302.20 | 81.70 | 42.70 | -405.79 | 655.03 | 153.00 | 204.90 | -42.50 | 271.20 | -31.30 | 193.30 | 855.63 | 2337.62 | 962.84 | 2586.86 |
| 16(1) | 357.40 | 136.70 | 302.20 | 81.70 | 42.70 | -405.79 | 655.03 | 153.00 | 204.90 | -42.50 | 271.20 | -31.30 | 193.30 | 855.63 | 2337.62 | 962.84 | 2586.86 |
| 16(2) | 353.80 | 135.30 | 297.50 | 81.70 | 41.70 | -405.79 | 655.03 | 149.30 | 201.00 | -42.50 | 266.70 | -37.20 | 193.30 | 833.82 | 2305.58 | 941.03 | 2554.82 |
| 16(3) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | -405.88 | 655.03 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 193.30 | 786.12 | 2212.58 | 893.22 | 2461.73 |
| 17(1) | 343.10 | 131.20 | 283.30 | 81.70 | 38.70 | -405.88 | 655.03 | 138.30 | 189.30 | -42.50 | 255.10 | -43.20 | 193.30 | 786.12 | 2212.58 | 893.22 | 2461.73 |
| 17(2) | 325.20 | 124.40 | 259.70 | 81.70 | 33.60 | -405.88 | 655.03 | 119.80 | 169.70 | -42.50 | 235.00 | -49.20 | 193.30 | 712.41 | 2055.96 | 819.51 | 2305.12 |
| 17(3) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | -405.79 | 655.03 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 193.30 | 612.93 | 1839.32 | 720.14 | 2088.56 |
| 18(1) | 300.20 | 114.80 | 226.60 | 81.70 | 26.40 | -405.79 | 655.03 | 94.00 | 142.30 | -42.50 | 208.60 | -55.10 | 193.30 | 612.93 | 1839.32 | 720.14 | 2088.56 |
| 18(2) | 268.00 | 102.50 | 188.90 | 77.00 | 17.20 | -405.71 | 655.03 | 60.80 | 107.10 | -42.50 | 175.60 | -61.10 | 193.30 | 487.56 | 1562.46 | 594.89 | 1811.79 |
| 18(3) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | -405.79 | 655.03 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 193.30 | 327.06 | 1238.01 | 434.27 | 1487.25 |
| 19(1) | 228.70 | 87.50 | 151.10 | 62.80 | 6.00 | -405.79 | 655.03 | 20.30 | 70.30 | -48.70 | 138.30 | -67.10 | 193.30 | 327.06 | 1238.01 | 434.27 | 1487.25 |
| 19(2) | 182.30 | 69.70 | 113.30 | 39.20 | -7.20 | -405.79 | 655.03 | -27.70 | 41.90 | -71.30 | 97.20 | -73.00 | 193.30 | 100.49 | 929.81 | 207.70 | 1179.05 |
| 19(3) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | -405.88 | 655.03 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 193.30 | -197.09 | 617.82 | -89.99 | 866.98 |
| 20(1) | 128.70 | 49.20 | 75.50 | 6.20 | -22.50 | -405.88 | 655.03 | -83.00 | 25.10 | -113.20 | 55.30 | -79.00 | 193.30 | -197.09 | 617.82 | -89.99 | 866.98 |
| 20(2) | 67.90 | 26.00 | 37.80 | -36.30 | -39.90 | -405.88 | 655.03 | -145.70 | 18.40 | -173.10 | 22.50 | -121.60 | 193.30 | -623.09 | 304.85 | -515.99 | 554.00 |
| 20(3) | 0.00 | 0.00 | 0.00 | -88.30 | -59.20 | -405.79 | 655.03 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 193.30 | -1131.72 | 6.00 | -1024.51 | 255.24 |

*SUBTRAMO XV AVE / E-1505.0*

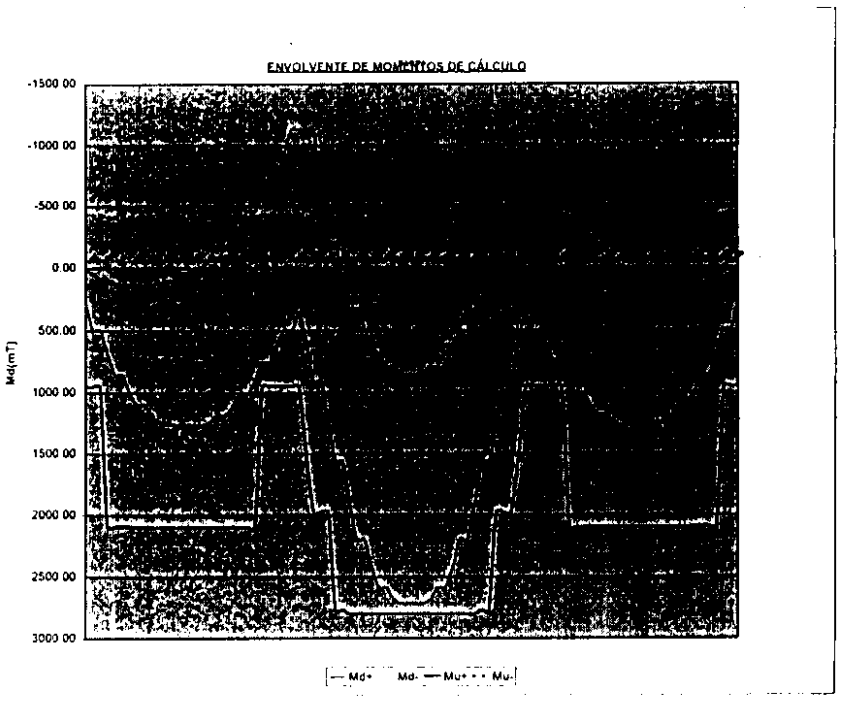
*MOMENTOS CARACTERÍSTICOS*

*MOMENTOS DE CÁLCULO*

| BARRA | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Redistr.cext | Redistr.pret | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradient | T=0 Md- | T=0 Md+ | T=INF Md- | T=INF Md+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1(2) | 25.40 | 9.70 | 32.10 | -3.00 | 4.30 | -20.40 | 32.74 | 15.40 | 25.70 | -9.30 | 45.70 | -9.00 | 9.70 | 46.71 | 230.45 | 51.91 | 242.78 |
| 1(3) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | -40.72 | 65.47 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 19.30 | 83.70 | 438.87 | 94.21 | 463.63 |
| 2(1) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | -40.72 | 65.47 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 19.30 | 83.70 | 438.87 | 94.21 | 463.63 |
| 2(2) | 68.10 | 26.00 | 85.70 | -9.00 | 10.50 | -60.86 | 98.27 | 37.90 | 68.20 | -28.00 | 122.70 | -26.90 | 29.00 | 110.88 | 612.42 | 126.99 | 649.83 |
| 2(3) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | -81.18 | 131.01 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 38.70 | 128.67 | 761.76 | 150.09 | 811.59 |
| 3(1) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | -81.18 | 131.01 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 38.70 | 128.67 | 761.76 | 150.09 | 811.59 |
| 3(2) | 100.10 | 38.30 | 125.20 | -15.00 | 13.80 | -101.58 | 163.74 | 49.40 | 99.00 | -46.60 | 173.40 | -44.80 | 48.30 | 136.77 | 879.75 | 163.39 | 941.92 |
| 3(3) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | -121.81 | 196.48 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 58.00 | 134.91 | 972.02 | 166.95 | 1046.69 |
| 4(1) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | -121.81 | 196.48 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 58.00 | 134.91 | 972.02 | 166.95 | 1046.69 |
| 4(2) | 121.50 | 46.40 | 150.60 | -21.00 | 13.90 | -142.04 | 229.28 | 49.80 | 118.20 | -65.30 | 201.90 | -62.70 | 67.70 | 123.63 | 1038.15 | 161.16 | 1125.39 |
| 4(3) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | -162.35 | 262.01 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 77.30 | 102.66 | 1082.54 | 145.50 | 1182.20 |
| 5(1) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | -162.35 | 262.01 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 77.30 | 102.66 | 1082.54 | 145.50 | 1182.20 |
| 5(2) | 132.10 | 50.50 | 161.90 | -27.00 | 11.00 | -182.50 | 294.75 | 39.30 | 125.60 | -83.90 | 209.00 | -80.70 | 87.00 | 71.97 | 1088.88 | 120.35 | 1201.13 |
| 5(3) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | -202.90 | 327.48 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 96.70 | 31.74 | 1083.47 | 85.32 | 1208.05 |
| 6(1) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | -202.90 | 327.48 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 96.70 | 31.74 | 1083.47 | 85.32 | 1208.05 |
| 6(2) | 132.10 | 50.50 | 159.10 | -33.00 | 5.10 | -223.21 | 360.28 | 17.70 | 121.40 | -102.60 | 198.90 | -98.60 | 106.30 | -18.30 | 1038.50 | 40.65 | 1175.57 |
| 6(3) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | -243.53 | 393.02 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 116.00 | -77.73 | 978.11 | -13.47 | 1127.60 |
| 7(1) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | -243.53 | 393.02 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 116.00 | -77.73 | 978.11 | -13.47 | 1127.60 |
| 7(2) | 121.50 | 46.40 | 142.10 | -39.00 | -3.80 | -263.76 | 425.75 | -14.90 | 105.40 | -121.20 | 170.20 | -116.50 | 125.60 | -155.45 | 893.01 | -85.76 | 1055.01 |
| 7(3) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | -284.07 | 458.49 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 135.30 | -246.27 | 791.64 | -171.27 | 966.06 |
| 8(1) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | -284.07 | 458.49 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 135.30 | -246.27 | 791.64 | -171.27 | 966.06 |
| 8(2) | 100.10 | 38.30 | 111.10 | -45.00 | -15.90 | -304.39 | 491.23 | -58.50 | 77.80 | -139.90 | 125.70 | -134.40 | 145.00 | -348.09 | 665.12 | -267.78 | 851.96 |
| 8(3) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | -324.62 | 524.02 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 154.60 | -461.27 | 518.58 | -375.47 | 717.99 |
| 9(1) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | -324.62 | 524.02 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 154.60 | -461.27 | 518.58 | -375.47 | 717.99 |
| 9(2) | 68.10 | 26.00 | 67.70 | -52.80 | -30.90 | -344.93 | 556.76 | -113.10 | 39.80 | -159.90 | 69.10 | -152.40 | 164.30 | -588.51 | 385.77 | -497.41 | 597.60 |
| 9(3) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | -365.25 | 589.50 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 174.00 | -743.12 | 248.94 | -646.70 | 473.19 |
| 10(1) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | -365.25 | 589.50 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 174.00 | -743.12 | 248.94 | -646.70 | 473.19 |
| 10(2) | 25.40 | 9.70 | 22.60 | -72.90 | -49.00 | -385.65 | 622.23 | -178.80 | 20.30 | -210.10 | 27.00 | -170.30 | 183.60 | -924.62 | 125.24 | -823.00 | 361.82 |
| 10(3) | 0.00 | 0.00 | 0.00 | -88.30 | -59.20 | -405.79 | 655.03 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 193.30 | -1131.72 | 6.00 | -1024.51 | 255.24 |

LEYES DE CÁLCULO DECALADAS + REDISTR.DE M° 5% / Mu SIN REFUERZO

| BARRA | Md+ | Md- | Mu+ | Mu- | | | | |
|---|---|---|---|---|---|---|---|---|
| 1(1) | 254.92 | 0.00 | 949.90 | -429.80 | | OK | | OK |
| 1(2) | 486.81 | 46.71 | 949.90 | -429.80 | | OK | | OK |
| 1(3) | 486.81 | 83.70 | 949.90 | -428.80 | | OK | | OK |
| 2(1) | 682.32 | 83.70 | 2087.70 | -409.40 | | OK | | OK |
| 2(2) | 852.17 | 110.88 | 2087.70 | -409.40 | | OK | | OK |
| 2(3) | 852.17 | 128.67 | 2087.70 | -409.40 | | OK | | OK |
| 3(1) | 989.01 | 128.67 | 2087.70 | -409.40 | | OK | | OK |
| 3(2) | 1099.02 | 136.77 | 2097.20 | -409.40 | | OK | | OK |
| 3(3) | 1099.02 | 134.91 | 2097.20 | -409.40 | | OK | | OK |
| 4(1) | 1181.66 | 134.91 | 2097.20 | -409.40 | | OK | | OK |
| 4(2) | 1241.31 | 123.63 | 2097.20 | -409.40 | | OK | | OK |
| 4(3) | 1241.31 | 102.66 | 2097.20 | -409.40 | | OK | | OK |
| 5(1) | 1261.19 | 102.66 | 2097.20 | -409.40 | | OK | | OK |
| 5(2) | 1268.46 | 71.97 | 2097.20 | -409.40 | | OK | | OK |
| 5(3) | 1268.46 | 31.74 | 2097.20 | -409.40 | | OK | | OK |
| 6(1) | 1268.46 | 31.74 | 2097.20 | -409.40 | | OK | | OK |
| 6(2) | 1268.46 | -18.30 | 2097.20 | -409.40 | | OK | | OK |
| 6(3) | 1234.35 | -77.73 | 2097.20 | -409.40 | | OK | | OK |
| 7(1) | 1183.98 | -77.73 | 2097.20 | -409.40 | | OK | | OK |
| 7(2) | 1183.98 | -155.45 | 2097.20 | -409.40 | | OK | | OK |
| 7(3) | 1107.76 | -246.27 | 2097.20 | -409.40 | | OK | | OK |
| 8(1) | 1014.36 | -348.09 | 2097.20 | -409.40 | | OK | | OK |
| 8(2) | 1014.36 | -461.27 | 2097.20 | -409.40 | | OK | | Md-<Mu- |
| 8(3) | 894.55 | -461.27 | 2097.20 | -409.40 | | OK | | Md-<Mu- |
| 9(1) | 753.89 | -588.51 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 9(2) | 753.89 | -743.12 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 9(3) | 627.48 | -743.12 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 10(1) | 496.85 | -924.62 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 10(2) | 496.85 | -1131.72 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 10(3) | 379.91 | -1131.72 | 949.80 | -429.50 | | OK | | Md-<Mu- |
| 11(1) | 581.70 | -1131.72 | 1514.40 | -410.60 | | OK | | Md-<Mu- |
| 11(2) | 910.32 | -1131.72 | 1972.90 | -410.60 | | OK | | Md-<Mu- |
| 11(3) | 910.32 | -623.09 | 1972.90 | -410.60 | | OK | | Md-<Mu- |
| 12(1) | 1238.00 | -197.09 | 1972.90 | -410.60 | | OK | | OK |
| 12(2) | 1561.61 | -197.09 | 2765.80 | -399.30 | | OK | | OK |
| 12(3) | 1561.61 | 100.49 | 2765.80 | -399.30 | | OK | | OK |
| 13(1) | 1902.37 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 13(2) | 2192.98 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 13(3) | 2192.98 | 487.56 | 2797.00 | -399.30 | | OK | | OK |
| 14(1) | 2420.37 | 612.93 | 2797.00 | -399.30 | | OK | | OK |
| 14(2) | 2584.82 | 712.41 | 2797.00 | -399.30 | | OK | | OK |
| 14(3) | 2584.82 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 15(1) | 2682.56 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 15(2) | 2716.20 | 833.82 | 2797.00 | -399.30 | | OK | | OK |
| 15(3) | 2716.20 | 855.63 | 2797.00 | -399.30 | | OK | | OK |
| 16(1) | 2716.20 | 855.63 | 2797.00 | -399.30 | | OK | | OK |
| 16(2) | 2716.20 | 833.82 | 2797.00 | -399.30 | | OK | | OK |
| 16(3) | 2682.56 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 17(1) | 2584.82 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 17(2) | 2584.82 | 612.93 | 2797.00 | -399.30 | | OK | | OK |
| 17(3) | 2420.37 | 612.93 | 2797.00 | -399.30 | | OK | | OK |
| 18(1) | 2192.98 | 487.56 | 2797.00 | -399.30 | | OK | | OK |
| 18(2) | 2192.98 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 18(3) | 1902.37 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 19(1) | 1561.61 | 100.49 | 2765.80 | -399.30 | | OK | | OK |
| 19(2) | 1561.61 | -197.09 | 2765.80 | -399.30 | | OK | | OK |
| 19(3) | 1238.00 | -197.09 | 1972.90 | -410.60 | | OK | | OK |
| 20(1) | 910.32 | -623.09 | 1972.90 | -410.60 | | OK | | Md-<Mu- |




*SUBTRAMO XV AVE / E-1505.0*

*MOMENTOS CARACTERÍSTICOS*

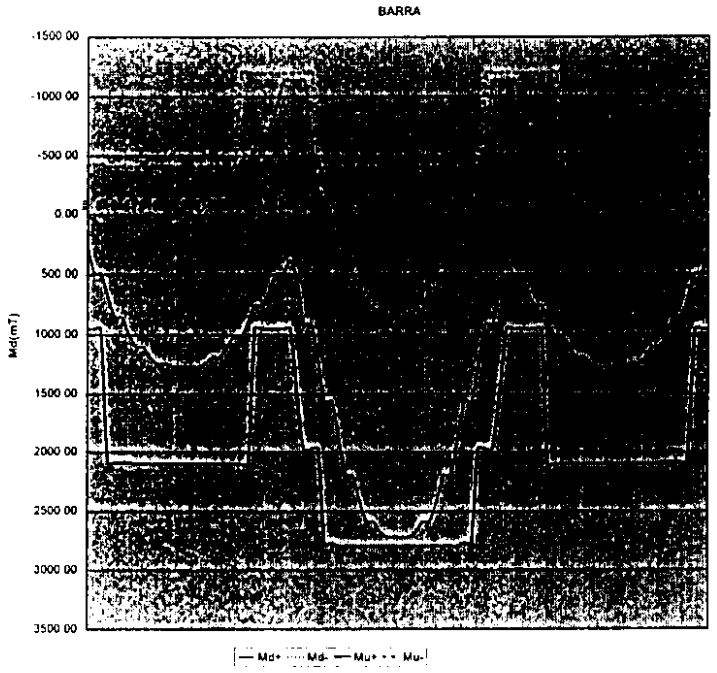
*MOMENTOS DE CÁLCULO*

| BARRA | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Redistr.cext | Redistr.pret | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradient | T=0 Md- | T=0 Md+ | T=INF Md- | T=INF Md+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | 0.00 | 0.00 | 0.00 | -88.30 | -59.20 | -405.79 | 655.03 | -215.70 | 19.30 | -248.40 | 28.40 | -179.20 | 193.30 | -1131.72 | 6.00 | -1024.51 | 255.24 |
| 21(2) | 25.40 | 9.70 | 22.60 | -72.90 | -49.00 | -385.65 | 622.23 | -178.80 | 20.30 | -210.10 | 27.00 | -170.30 | 183.60 | -924.62 | 125.24 | -823.00 | 361.82 |
| 21(3) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | -365.25 | 589.50 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 174.00 | -743.12 | 248.94 | -646.70 | 473.19 |
| 22(1) | 48.10 | 18.40 | 45.10 | -61.10 | -39.60 | -365.25 | 589.50 | -144.60 | 26.80 | -180.30 | 37.70 | -161.30 | 174.00 | -743.12 | 248.94 | -646.70 | 473.19 |
| 22(2) | 68.10 | 26.00 | 67.70 | -52.80 | -30.90 | -344.93 | 556.76 | -113.10 | 39.80 | -159.90 | 69.10 | -152.40 | 164.30 | -588.51 | 385.77 | -497.41 | 597.60 |
| 22(3) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | -324.62 | 524.02 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 154.60 | -461.27 | 518.58 | -375.47 | 717.99 |
| 23(1) | 85.40 | 32.70 | 90.30 | -48.10 | -23.00 | -324.62 | 524.02 | -84.40 | 59.60 | -149.20 | 99.10 | -143.40 | 154.60 | -461.27 | 518.58 | -375.47 | 717.99 |
| 23(2) | 100.10 | 38.30 | 111.10 | -45.00 | -15.90 | -304.39 | 491.23 | -58.50 | 77.80 | -139.90 | 125.70 | -134.40 | 145.00 | -348.09 | 665.12 | -267.78 | 851.96 |
| 23(3) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | -284.07 | 458.49 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 135.30 | -246.27 | 791.64 | -171.27 | 966.06 |
| 24(1) | 112.10 | 42.90 | 128.40 | -42.00 | -9.50 | -284.07 | 458.49 | -35.30 | 93.10 | -130.60 | 150.50 | -125.50 | 135.30 | -246.27 | 791.64 | -171.27 | 966.06 |
| 24(2) | 121.50 | 46.40 | 142.10 | -39.00 | -3.80 | -263.76 | 425.75 | -14.90 | 105.40 | -121.20 | 170.20 | -116.50 | 125.60 | -155.45 | 893.01 | -85.76 | 1055.01 |
| 24(3) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | -243.53 | 393.02 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 116.00 | -77.73 | 978.11 | -13.47 | 1127.60 |
| 25(1) | 128.10 | 49.00 | 152.40 | -36.00 | 1.00 | -243.53 | 393.02 | 2.80 | 114.90 | -111.90 | 189.20 | -107.50 | 116.00 | -77.73 | 978.11 | -13.47 | 1127.60 |
| 25(2) | 132.10 | 50.50 | 159.10 | -33.00 | 5.10 | -223.21 | 360.28 | 17.70 | 121.40 | -102.60 | 198.90 | -98.60 | 106.30 | -18.30 | 1038.50 | 40.65 | 1175.57 |
| 25(3) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | -202.90 | 327.48 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 96.70 | 31.74 | 1083.47 | 85.32 | 1208.05 |
| 26(1) | 133.50 | 51.00 | 162.20 | -30.00 | 8.50 | -202.90 | 327.48 | 29.90 | 125.00 | -93.30 | 210.70 | -89.60 | 96.70 | 31.74 | 1083.47 | 85.32 | 1208.05 |
| 26(2) | 132.10 | 50.50 | 161.90 | -27.00 | 11.00 | -182.50 | 294.75 | 39.30 | 125.60 | -83.90 | 209.00 | -80.70 | 87.00 | 71.97 | 1088.88 | 120.35 | 1201.13 |
| 26(3) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | -162.35 | 262.01 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 77.30 | 102.66 | 1082.54 | 145.50 | 1182.20 |
| 27(1) | 128.10 | 49.00 | 158.00 | -24.00 | 12.90 | -162.35 | 262.01 | 45.90 | 123.40 | -74.60 | 211.80 | -71.70 | 77.30 | 102.66 | 1082.54 | 145.50 | 1182.20 |
| 27(2) | 121.50 | 46.40 | 150.60 | -21.00 | 13.90 | -142.04 | 229.28 | 49.80 | 118.20 | -65.30 | 201.90 | -62.70 | 67.70 | 123.63 | 1038.15 | 161.16 | 1125.39 |
| 27(3) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | -121.81 | 196.48 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 58.00 | 134.91 | 972.02 | 166.95 | 1046.69 |
| 28(1) | 112.10 | 42.90 | 139.70 | -18.00 | 14.20 | -121.81 | 196.48 | 51.00 | 110.10 | -56.00 | 190.00 | -53.80 | 58.00 | 134.91 | 972.02 | 166.95 | 1046.69 |
| 28(2) | 100.10 | 38.30 | 125.20 | -15.00 | 13.80 | -101.58 | 163.74 | 49.40 | 99.00 | -46.60 | 173.40 | -44.80 | 48.30 | 136.77 | 879.75 | 163.39 | 941.92 |
| 28(3) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | -81.18 | 131.01 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 38.70 | 128.67 | 761.76 | 150.09 | 811.59 |
| 29(1) | 85.40 | 32.70 | 107.20 | -12.00 | 12.50 | -81.18 | 131.01 | 45.00 | 85.10 | -37.30 | 152.20 | -35.80 | 38.70 | 128.67 | 761.76 | 150.09 | 811.59 |
| 29(2) | 68.10 | 26.00 | 85.70 | -9.00 | 10.50 | -60.86 | 98.27 | 37.90 | 68.20 | -28.00 | 122.70 | -26.90 | 29.00 | 110.88 | 612.42 | 126.99 | 649.83 |
| 29(3) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | -40.72 | 65.47 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 19.30 | 83.70 | 438.87 | 94.21 | 463.63 |
| 30(1) | 48.10 | 18.40 | 60.70 | -6.00 | 7.80 | -40.72 | 65.47 | 28.00 | 48.40 | -18.70 | 89.50 | -17.90 | 19.30 | 83.70 | 438.87 | 94.21 | 463.63 |
| 30(2) | 25.40 | 9.70 | 32.10 | -3.00 | 4.30 | -20.40 | 32.74 | 15.40 | 25.70 | -9.30 | 45.70 | -9.00 | 9.70 | 46.71 | 230.45 | 51.91 | 242.78 |
| 30(3) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

LEYES DE CÁLCULO DECALADAS + REDISTR.DE M° 5% / Mu CON REFUERZO

| BARRA | Md+ | Md- | Mu+ | Mu- | | | | |
|---|---|---|---|---|---|---|---|---|
| 1(1) | 254.92 | 0.00 | 949.90 | -429.80 | | OK | | OK |
| 1(2) | 486.81 | 46.71 | 949.90 | -429.80 | | OK | | OK |
| 1(3) | 486.81 | 83.70 | 949.90 | -428.80 | | OK | | OK |
| 2(1) | 682.32 | 83.70 | 2087.70 | -409.40 | | OK | | OK |
| 2(2) | 852.17 | 110.88 | 2087.70 | -409.40 | | OK | | OK |
| 2(3) | 852.17 | 128.67 | 2087.70 | -409.40 | | OK | | OK |
| 3(1) | 989.01 | 128.67 | 2087.70 | -409.40 | | OK | | OK |
| 3(2) | 1099.02 | 136.77 | 2097.20 | -409.40 | | OK | | OK |
| 3(3) | 1099.02 | 134.91 | 2097.20 | -409.40 | | OK | | OK |
| 4(1) | 1181.66 | 134.91 | 2097.20 | -409.40 | | OK | | OK |
| 4(2) | 1241.31 | 123.63 | 2097.20 | -409.40 | | OK | | OK |
| 4(3) | 1241.31 | 102.66 | 2097.20 | -409.40 | | OK | | OK |
| 5(1) | 1261.19 | 102.66 | 2097.20 | -409.40 | | OK | | OK |
| 5(2) | 1268.46 | 71.97 | 2097.20 | -409.40 | | OK | | OK |
| 5(3) | 1268.46 | 31.74 | 2097.20 | -409.40 | | OK | | OK |
| 6(1) | 1268.46 | 31.74 | 2097.20 | -409.40 | | OK | | OK |
| 6(2) | 1268.46 | -18.30 | 2097.20 | -409.40 | | OK | | OK |
| 6(3) | 1234.35 | -77.73 | 2097.20 | -409.40 | | OK | | OK |
| 7(1) | 1183.98 | -77.73 | 2097.20 | -409.40 | | OK | | OK |
| 7(2) | 1183.98 | -155.45 | 2097.20 | -409.40 | | OK | | OK |
| 7(3) | 1107.76 | -246.27 | 2097.20 | -409.40 | | OK | | OK |
| 8(1) | 1014.36 | -348.09 | 2097.20 | -409.40 | | OK | | OK |
| 8(2) | 1014.36 | -461.27 | 2097.20 | -1199.30 | | OK | | OK |
| 8(3) | 894.55 | -461.27 | 2097.20 | -1199.30 | | OK | | OK |
| 9(1) | 753.89 | -588.51 | 948.20 | -1199.30 | | OK | | OK |
| 9(2) | 753.89 | -743.12 | 948.20 | -1199.30 | | OK | | OK |
| 9(3) | 627.48 | -743.12 | 948.20 | -1199.30 | | OK | | OK |
| 10(1) | 496.85 | -924.62 | 948.20 | -1199.30 | | OK | | OK |
| 10(2) | 496.85 | -1131.72 | 948.20 | -1199.30 | | OK | | OK |
| 10(3) | 379.91 | -1131.72 | 949.80 | -1199.30 | | OK | | OK |
| 11(1) | 581.70 | -1131.72 | 1514.40 | -1199.30 | | OK | | OK |
| 11(2) | 910.32 | -1131.72 | 1972.90 | -1199.30 | | OK | | OK |
| 11(3) | 910.32 | -623.09 | 1972.90 | -1199.30 | | OK | | OK |
| 12(1) | 1238.00 | -197.09 | 1972.90 | -410.60 | | OK | | OK |
| 12(2) | 1561.61 | -197.09 | 2765.80 | -399.30 | | OK | | OK |
| 12(3) | 1561.61 | 100.49 | 2765.80 | -399.30 | | OK | | OK |
| 13(1) | 1902.37 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 13(2) | 2192.98 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 13(3) | 2192.98 | 487.56 | 2797.00 | -399.30 | | OK | | OK |
| 14(1) | 2420.37 | 612.93 | 2797.00 | -399.30 | | OK | | OK |
| 14(2) | 2584.82 | 712.41 | 2797.00 | -399.30 | | OK | | OK |
| 14(3) | 2584.82 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 15(1) | 2682.56 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 15(2) | 2716.20 | 833.82 | 2797.00 | -399.30 | | OK | | OK |
| 15(3) | 2716.20 | 855.63 | 2797.00 | -399.30 | | OK | | OK |
| 16(1) | 2716.20 | 855.63 | 2797.00 | -399.30 | | OK | | OK |
| 16(2) | 2716.20 | 833.82 | 2797.00 | -399.30 | | OK | | OK |
| 16(3) | 2682.56 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 17(1) | 2584.82 | 786.12 | 2797.00 | -399.30 | | OK | | OK |
| 17(2) | 2584.82 | 612.93 | 2797.00 | -399.30 | | OK | | OK |
| 17(3) | 2420.37 | 612.93 | 2797.00 | -399.30 | | OK | | OK |
| 18(1) | 2192.98 | 487.56 | 2797.00 | -399.30 | | OK | | OK |
| 18(2) | 2192.98 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 18(3) | 1902.37 | 327.06 | 2797.00 | -399.30 | | OK | | OK |
| 19(1) | 1561.61 | 100.49 | 2765.80 | -399.30 | | OK | | OK |
| 19(2) | 1561.61 | -197.09 | 2765.80 | -399.30 | | OK | | OK |
| 19(3) | 1238.00 | -197.09 | 1972.90 | -410.60 | | OK | | OK |
| 20(1) | 910.32 | -623.09 | 1972.90 | -1199.30 | | OK | | OK |
| 20(2) | 910.32 | -1131.72 | 1972.90 | -410.60 | | OK | | Md-<Mu- |
| 20(3) | 581.70 | -1131.72 | 1514.40 | -410.60 | | OK | | Md-<Mu- |
| 21(1) | 379.91 | -1131.72 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 21(2) | 496.85 | -1131.72 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 21(3) | 496.85 | -924.62 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 22(1) | 627.48 | -743.12 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 22(2) | 753.89 | -743.12 | 948.20 | -428.80 | | OK | | Md-<Mu- |
| 22(3) | 753.89 | -588.51 | 949.80 | -429.50 | | OK | | Md-<Mu- |
| 23(1) | 894.55 | -461.27 | 2097.20 | -409.40 | | OK | | Md-<Mu- |
| 23(2) | 1014.36 | -461.27 | 2097.20 | -409.40 | | OK | | Md-<Mu- |
| 23(3) | 1014.36 | -246.27 | 2097.20 | -409.40 | | OK | | OK |
| 24(1) | 1107.76 | -246.27 | 2097.20 | -409.40 | | OK | | OK |
| 24(2) | 1183.98 | -155.45 | 2097.20 | -409.40 | | OK | | OK |
| 24(3) | 1183.98 | -77.73 | 2097.20 | -409.40 | | OK | | OK |
| 25(1) | 1234.35 | -77.73 | 2097.20 | -409.40 | | OK | | OK |
| 25(2) | 1268.46 | -18.30 | 2097.20 | -409.40 | | OK | | OK |
| 25(3) | 1268.46 | 31.74 | 2097.20 | -409.40 | | OK | | OK |
| 26(1) | 1261.19 | 31.74 | 2097.20 | -409.40 | | OK | | OK |
| 26(2) | 1261.19 | 71.97 | 2097.20 | -409.40 | | OK | | OK |
| 26(3) | 1261.19 | 102.66 | 2097.20 | -409.40 | | OK | | OK |
| 27(1) | 1241.31 | 102.66 | 2097.20 | -409.40 | | OK | | OK |
| 27(2) | 1241.31 | 123.63 | 2097.20 | -409.40 | | OK | | OK |
| 27(3) | 1181.66 | 134.91 | 2097.20 | -409.40 | | OK | | OK |
| 28(1) | 1099.02 | 134.91 | 2097.20 | -409.40 | | OK | | OK |
| 28(2) | 1099.02 | 136.77 | 2097.20 | -409.40 | | OK | | OK |
| 28(3) | 989.01 | 128.67 | 2087.70 | -409.40 | | OK | | OK |
| 29(1) | 852.17 | 128.67 | 2087.70 | -409.40 | | OK | | OK |
| 29(2) | 852.17 | 110.88 | 2087.70 | -409.40 | | OK | | OK |
| 29(3) | 682.32 | 83.70 | 2087.70 | -409.40 | | OK | | OK |
| 30(1) | 486.81 | 83.70 | 949.90 | -429.80 | | OK | | OK |
| 30(2) | 486.81 | 46.71 | 949.90 | -429.80 | | OK | | OK |
| 30(3) | 254.92 | 0.00 | 949.90 | -428.80 | | OK | | OK |

ENVOLVENTE DE MOMENTOS DE CÁLCULO



| | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16(2) | 353.80 | 482.49 | 1078.80 | OK | 660.29 | 900.50 | 1078.80 | OK | 786.60 | 1075.01 | 1078.80 | OK |
| 16(3) | 343.10 | 477.63 | 1078.80 | OK | 660.29 | 891.38 | 1078.80 | OK | 757.60 | 1061.91 | 1078.80 | OK |
| 17(1) | 343.10 | 463.19 | 1078.80 | OK | 640.31 | 891.38 | 1078.80 | OK | 757.60 | 1022.76 | 1078.80 | OK |
| 17(2) | 325.20 | 463.19 | 1078.80 | OK | 640.31 | 864.41 | 1078.80 | OK | 709.30 | 1022.76 | 1078.80 | OK |
| 17(3) | 300.20 | 439.02 | 1078.80 | OK | 606.96 | 864.41 | 1078.80 | OK | 641.60 | 957.56 | 1078.80 | OK |
| 18(1) | 300.20 | 405.27 | 1078.80 | OK | 560.25 | 819.40 | 1078.80 | OK | 641.60 | 866.16 | 1078.80 | OK |
| 18(2) | 268.00 | 405.27 | 1078.80 | OK | 560.25 | 756.34 | 1078.80 | OK | 559.40 | 866.16 | 1078.80 | OK |
| 18(3) | 228.70 | 361.80 | 1078.90 | OK | 500.18 | 756.34 | 1078.90 | OK | 467.30 | 755.19 | 1078.90 | OK |
| 19(1) | 228.70 | 308.75 | 1078.90 | OK | 426.87 | 675.24 | 1078.90 | OK | 467.30 | 630.86 | 1078.90 | OK |
| 19(2) | 182.30 | 308.75 | 1078.90 | OK | 426.87 | 576.27 | 1078.90 | OK | 365.30 | 630.86 | 1078.90 | OK |
| 19(3) | 128.70 | 246.11 | 1003.40 | OK | 340.20 | 576.27 | 1003.40 | OK | 253.40 | 493.16 | 1003.40 | OK |
| 20(1) | 128.70 | 173.75 | 1003.40 | OK | 240.17 | 459.27 | 1003.40 | OK | 253.40 | 342.09 | 1003.40 | OK |
| 20(2) | 67.90 | 173.75 | 1003.40 | OK | 240.17 | 324.22 | 1003.40 | OK | 131.70 | 342.09 | 1003.40 | OK |
| 20(3) | 0.00 | 91.67 | 808.80 | OK | 126.77 | 324.22 | 808.80 | OK | 0.00 | 177.80 | 808.80 | OK |
| 21(1) | 0.00 | 34.29 | 697.20 | OK | 47.39 | 121.20 | 697.20 | OK | 0.00 | 77.90 | 697.20 | OK |
| 21(2) | 25.40 | 64.94 | 653.40 | OK | 89.78 | 121.20 | 653.40 | OK | 57.70 | 150.66 | 653.40 | OK |
| 21(3) | 48.10 | 64.94 | 653.40 | OK | 89.78 | 171.50 | 653.40 | OK | 111.60 | 150.66 | 653.40 | OK |
| 22(1) | 48.10 | 91.94 | 653.40 | OK | 127.04 | 215.24 | 653.40 | OK | 111.60 | 218.43 | 653.40 | OK |
| 22(2) | 68.10 | 115.29 | 653.40 | OK | 159.44 | 215.24 | 653.40 | OK | 161.80 | 281.34 | 653.40 | OK |
| 22(3) | 85.40 | 115.29 | 653.40 | OK | 159.44 | 252.23 | 653.40 | OK | 208.40 | 281.34 | 653.40 | OK |
| 23(1) | 85.40 | 135.14 | 1020.30 | OK | 186.84 | 282.49 | 1020.30 | OK | 208.40 | 336.83 | 1020.30 | OK |
| 23(2) | 100.10 | 151.34 | 1020.30 | OK | 209.25 | 282.49 | 1020.30 | OK | 249.50 | 382.59 | 1020.30 | OK |
| 23(3) | 112.10 | 151.34 | 1020.30 | OK | 209.25 | 306.00 | 1020.30 | OK | 283.40 | 382.59 | 1020.30 | OK |
| 24(1) | 112.10 | 164.03 | 1020.30 | OK | 226.67 | 322.76 | 1020.30 | OK | 283.40 | 418.50 | 1020.30 | OK |
| 24(2) | 121.50 | 172.94 | 1020.30 | OK | 239.09 | 322.76 | 1020.30 | OK | 310.00 | 444.83 | 1020.30 | OK |
| 24(3) | 128.10 | 172.94 | 1020.30 | OK | 239.09 | 332.79 | 1020.30 | OK | 329.50 | 444.83 | 1020.30 | OK |
| 25(1) | 128.10 | 178.34 | 1020.30 | OK | 246.51 | 332.79 | 1020.30 | OK | 329.50 | 461.30 | 1020.30 | OK |
| 25(2) | 132.10 | 180.23 | 1020.30 | OK | 246.51 | 332.79 | 1020.30 | OK | 341.70 | 468.05 | 1020.30 | OK |
| 25(3) | 133.50 | 180.23 | 1020.30 | OK | 246.51 | 332.79 | 1020.30 | OK | 346.70 | 468.05 | 1020.30 | OK |
| 26(1) | 133.50 | 180.23 | 1020.30 | OK | 249.08 | 336.25 | 1020.30 | OK | 346.70 | 468.05 | 1020.30 | OK |
| 26(2) | 132.10 | 180.23 | 1020.30 | OK | 249.08 | 336.25 | 1020.30 | OK | 344.50 | 468.05 | 1020.30 | OK |
| 26(3) | 128.10 | 178.34 | 1020.30 | OK | 246.51 | 336.25 | 1020.30 | OK | 335.10 | 465.08 | 1020.30 | OK |
| 27(1) | 128.10 | 172.94 | 1020.30 | OK | 239.09 | 332.79 | 1020.30 | OK | 335.10 | 452.39 | 1020.30 | OK |
| 27(2) | 121.50 | 172.94 | 1020.30 | OK | 239.09 | 322.76 | 1020.30 | OK | 318.50 | 452.39 | 1020.30 | OK |
| 27(3) | 112.10 | 164.03 | 1020.30 | OK | 226.67 | 322.76 | 1020.30 | OK | 294.70 | 429.98 | 1020.30 | OK |
| 28(1) | 112.10 | 151.34 | 1020.30 | OK | 209.25 | 306.00 | 1020.30 | OK | 294.70 | 397.85 | 1020.30 | OK |
| 28(2) | 100.10 | 151.34 | 1020.30 | OK | 209.25 | 282.49 | 1020.30 | OK | 263.60 | 397.85 | 1020.30 | OK |
| 28(3) | 85.40 | 135.14 | 1020.30 | OK | 186.84 | 282.49 | 1020.30 | OK | 225.30 | 355.86 | 1020.30 | OK |
| 29(1) | 85.40 | 115.29 | 1020.30 | OK | 159.44 | 252.23 | 1020.30 | OK | 225.30 | 304.16 | 1020.30 | OK |
| 29(2) | 68.10 | 115.29 | 1020.30 | OK | 159.44 | 215.24 | 1020.30 | OK | 179.80 | 304.16 | 1020.30 | OK |
| 29(3) | 48.10 | 91.94 | 1020.30 | OK | 127.04 | 215.24 | 1020.30 | OK | 127.20 | 242.73 | 1020.30 | OK |
| 30(1) | 48.10 | 64.94 | 1020.30 | OK | 89.78 | 171.50 | 1020.30 | OK | 127.20 | 171.72 | 1020.30 | OK |
| 30(2) | 25.40 | 64.94 | 653.40 | OK | 89.78 | 121.20 | 653.40 | OK | 67.20 | 171.72 | 653.40 | OK |
| 30(3) | 0.00 | 34.29 | 653.40 | OK | 47.39 | 121.20 | 653.40 | OK | 0.00 | 90.72 | 653.40 | OK |

*CONTROL A ROTURA EN FLEXION PARA FASES DE MONTAJE (Idecalaje=1canto)*

| BARRA | Fase 1 | Md* | Mu+ | control+ | Fase 1+2 | Md* | Mu+ | control+ | 1+2+3 | Md* | Mu+ | control+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 0.00 | 34.29 | 653.40 | OK | 47.39 | 121.20 | 653.40 | OK | 0.00 | 90.72 | 653.40 | OK |
| 1(2) | 25.40 | 64.94 | 653.40 | OK | 89.78 | 121.20 | 653.40 | OK | 67.20 | 171.72 | 653.40 | OK |
| 1(3) | 48.10 | 64.94 | 1020.30 | OK | 89.78 | 171.50 | 1020.30 | OK | 127.20 | 171.72 | 1020.30 | OK |
| 2(1) | 48.10 | 91.94 | 1020.30 | OK | 127.04 | 215.24 | 1020.30 | OK | 127.20 | 242.73 | 1020.30 | OK |
| 2(2) | 68.10 | 115.29 | 1020.30 | OK | 159.44 | 215.24 | 1020.30 | OK | 179.80 | 304.16 | 1020.30 | OK |
| 2(3) | 85.40 | 115.29 | 1020.30 | OK | 159.44 | 252.23 | 1020.30 | OK | 225.30 | 304.16 | 1020.30 | OK |
| 3(1) | 85.40 | 135.14 | 1020.30 | OK | 186.84 | 282.49 | 1020.30 | OK | 225.30 | 355.86 | 1020.30 | OK |
| 3(2) | 100.10 | 151.34 | 1020.30 | OK | 209.25 | 282.49 | 1020.30 | OK | 263.60 | 397.85 | 1020.30 | OK |
| 3(3) | 112.10 | 151.34 | 1020.30 | OK | 209.25 | 306.00 | 1020.30 | OK | 294.70 | 397.85 | 1020.30 | OK |
| 4(1) | 112.10 | 164.03 | 1020.30 | OK | 226.67 | 322.76 | 1020.30 | OK | 294.70 | 429.98 | 1020.30 | OK |
| 4(2) | 121.50 | 172.94 | 1020.30 | OK | 239.09 | 322.76 | 1020.30 | OK | 318.50 | 452.39 | 1020.30 | OK |
| 4(3) | 128.10 | 172.94 | 1020.30 | OK | 239.09 | 332.79 | 1020.30 | OK | 335.10 | 452.39 | 1020.30 | OK |
| 5(1) | 128.10 | 178.34 | 1020.30 | OK | 246.51 | 336.25 | 1020.30 | OK | 335.10 | 465.08 | 1020.30 | OK |
| 5(2) | 132.10 | 180.23 | 1020.30 | OK | 249.08 | 336.25 | 1020.30 | OK | 344.50 | 468.05 | 1020.30 | OK |
| 5(3) | 133.50 | 180.23 | 1020.30 | OK | 249.08 | 336.25 | 1020.30 | OK | 346.70 | 468.05 | 1020.30 | OK |
| 6(1) | 133.50 | 180.23 | 1020.30 | OK | 246.51 | 332.79 | 1020.30 | OK | 346.70 | 468.05 | 1020.30 | OK |
| 6(2) | 132.10 | 180.23 | 1020.30 | OK | 246.51 | 332.79 | 1020.30 | OK | 341.70 | 468.05 | 1020.30 | OK |
| 6(3) | 128.10 | 178.34 | 1020.30 | OK | 246.51 | 332.79 | 1020.30 | OK | 329.50 | 461.30 | 1020.30 | OK |
| 7(1) | 128.10 | 172.94 | 1020.30 | OK | 239.09 | 332.79 | 1020.30 | OK | 329.50 | 444.83 | 1020.30 | OK |
| 7(2) | 121.50 | 172.94 | 1020.30 | OK | 239.09 | 322.76 | 1020.30 | OK | 310.00 | 444.83 | 1020.30 | OK |
| 7(3) | 112.10 | 164.03 | 1020.30 | OK | 226.67 | 322.76 | 1020.30 | OK | 283.40 | 418.50 | 1020.30 | OK |
| 8(1) | 112.10 | 151.34 | 1020.30 | OK | 209.25 | 306.00 | 1020.30 | OK | 283.40 | 382.59 | 1020.30 | OK |
| 8(2) | 100.10 | 151.34 | 1020.30 | OK | 209.25 | 282.49 | 1020.30 | OK | 249.50 | 382.59 | 1020.30 | OK |
| 8(3) | 85.40 | 135.14 | 1020.30 | OK | 186.84 | 282.49 | 1020.30 | OK | 208.40 | 336.83 | 1020.30 | OK |
| 9(1) | 85.40 | 115.29 | 653.40 | OK | 159.44 | 252.23 | 653.40 | OK | 208.40 | 281.34 | 653.40 | OK |
| 9(2) | 68.10 | 115.29 | 653.40 | OK | 159.44 | 215.24 | 653.40 | OK | 161.80 | 281.34 | 653.40 | OK |
| 9(3) | 48.10 | 91.94 | 653.40 | OK | 127.04 | 215.24 | 653.40 | OK | 111.60 | 218.43 | 653.40 | OK |
| 10(1) | 48.10 | 64.94 | 653.40 | OK | 89.78 | 171.50 | 653.40 | OK | 111.60 | 150.66 | 653.40 | OK |
| 10(2) | 25.40 | 64.94 | 653.40 | OK | 89.78 | 121.20 | 653.40 | OK | 57.70 | 150.66 | 653.40 | OK |
| 10(3) | 0.00 | 34.29 | 697.20 | OK | 47.39 | 121.20 | 697.20 | OK | 0.00 | 77.90 | 697.20 | OK |
| 11(1) | 0.00 | 91.67 | 808.80 | OK | 126.77 | 324.22 | 808.80 | OK | 0.00 | 177.80 | 808.80 | OK |
| 11(2) | 67.90 | 173.75 | 1003.40 | OK | 240.17 | 324.22 | 1003.40 | OK | 131.70 | 342.09 | 1003.40 | OK |
| 11(3) | 128.70 | 173.75 | 1003.40 | OK | 240.17 | 459.27 | 1003.40 | OK | 253.40 | 342.09 | 1003.40 | OK |
| 12(1) | 128.70 | 246.11 | 1003.40 | OK | 340.20 | 576.27 | 1003.40 | OK | 253.40 | 493.16 | 1003.40 | OK |
| 12(2) | 182.30 | 308.75 | 1078.90 | OK | 426.87 | 576.27 | 1078.90 | OK | 365.30 | 630.86 | 1078.90 | OK |
| 12(3) | 228.70 | 308.75 | 1078.90 | OK | 426.87 | 675.24 | 1078.90 | OK | 467.30 | 630.86 | 1078.90 | OK |
| 13(1) | 228.70 | 361.80 | 1078.90 | OK | 500.18 | 756.34 | 1078.90 | OK | 467.30 | 755.19 | 1078.90 | OK |
| 13(2) | 268.00 | 405.27 | 1078.80 | OK | 560.25 | 756.34 | 1078.80 | OK | 559.40 | 866.16 | 1078.80 | OK |
| 13(3) | 300.20 | 405.27 | 1078.80 | OK | 560.25 | 819.40 | 1078.80 | OK | 641.60 | 866.16 | 1078.80 | OK |
| 14(1) | 300.20 | 439.02 | 1078.80 | OK | 606.96 | 864.41 | 1078.80 | OK | 641.60 | 957.56 | 1078.80 | OK |
| 14(2) | 325.20 | 463.19 | 1078.80 | OK | 640.31 | 864.41 | 1078.80 | OK | 709.30 | 1022.76 | 1078.80 | OK |
| 14(3) | 343.10 | 463.19 | 1078.80 | OK | 640.31 | 891.38 | 1078.80 | OK | 757.60 | 1022.76 | 1078.80 | OK |
| 15(1) | 343.10 | 477.63 | 1078.80 | OK | 660.29 | 900.50 | 1078.80 | OK | 757.60 | 1061.91 | 1078.80 | OK |
| 15(2) | 353.80 | 482.49 | 1078.80 | OK | 667.04 | 900.50 | 1078.80 | OK | 786.60 | 1075.01 | 1078.80 | OK |
| 15(3) | 357.40 | 482.49 | 1078.80 | OK | 667.04 | 900.50 | 1078.80 | OK | 796.30 | 1075.01 | 1078.80 | OK |
| 6(1) | 357.40 | 482.49 | 1078.80 | OK | 667.04 | 900.50 | 1078.80 | OK | 796.30 | 1075.01 | 1078.80 | OK |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16(2) | 868.30 | 1185.30 | 755.37 | 2740.50 | -399.30 | OK | OK | 910.00 | 1228.50 | 790.20 | 2753.70 | -399.30 | OK |
| 16(3) | 839.30 | 1172.21 | 755.37 | 2740.50 | -399.30 | OK | OK | 878.00 | 1185.30 | 790.20 | 2753.70 | -399.30 | OK |
| 17(1) | 839.30 | 1133.06 | 711.90 | 2740.50 | -399.30 | OK | OK | 878.00 | 1185.30 | 742.14 | 2753.70 | -399.30 | OK |
| 17(2) | 791.00 | 1133.06 | 650.97 | 2740.50 | -399.30 | OK | OK | 824.60 | 1113.21 | 674.73 | 2753.70 | -399.30 | OK |
| 17(3) | 723.30 | 1067.85 | 650.97 | 2740.50 | -399.30 | OK | OK | 749.70 | 1012.10 | 674.73 | 2753.70 | -399.30 | OK |
| 18(1) | 723.30 | 976.46 | 572.76 | 1078.80 | -77.00 | OK | OK | 749.70 | 1012.10 | 588.24 | 2753.70 | -399.30 | OK |
| 18(2) | 636.40 | 976.46 | 477.09 | 1078.80 | -77.00 | OK | OK | 653.60 | 882.36 | 482.49 | 2753.70 | -399.30 | OK |
| 18(3) | 530.10 | 859.14 | 477.09 | 1078.90 | -77.00 | OK | OK | 536.10 | 723.74 | 482.49 | 2740.50 | -399.30 | OK |
| 19(1) | 530.10 | 715.64 | 364.05 | 1078.90 | -77.00 | OK | OK | 536.10 | 723.74 | 354.33 | 2740.50 | -399.30 | OK |
| 19(2) | 404.50 | 715.64 | 233.64 | 1078.90 | -77.00 | OK | OK | 397.30 | 539.60 | 203.27 | 1961.60 | -410.60 | OK |
| 19(3) | 259.60 | 546.08 | 233.64 | 1003.40 | -77.00 | OK | OK | 237.10 | 330.21 | 203.27 | 1961.60 | -410.60 | OK |
| 20(1) | 259.60 | 350.46 | 69.53 | 1003.40 | -77.00 | OK | OK | 237.10 | 330.21 | 15.66 | 1961.60 | -410.60 | OK |
| 20(2) | 95.40 | 350.46 | -119.21 | 1003.40 | -84.70 | OK | MAL | 55.50 | 141.89 | -199.13 | 1961.60 | -410.60 | OK |
| 20(3) | -88.30 | 145.13 | -119.21 | 808.80 | -90.50 | OK | MAL | -147.50 | -53.28 | -199.13 | 1138.50 | -1216.20 | OK |
| 21(1) | -88.30 | 12.29 | -119.21 | 697.20 | -92.40 | OK | MAL | -147.50 | 33.80 | -199.13 | 946.20 | -429.50 | OK |
| 21(2) | -15.20 | 95.67 | -119.21 | 653.40 | -92.10 | OK | MAL | -64.20 | 115.02 | -199.13 | 945.10 | -428.80 | OK |
| 21(3) | 50.50 | 95.67 | -46.49 | 653.40 | -92.10 | OK | OK | 10.90 | 115.02 | -112.64 | 945.10 | -428.80 | OK |
| 22(1) | 50.50 | 170.91 | 17.96 | 653.40 | -92.10 | OK | OK | 10.90 | 190.62 | -35.51 | 945.10 | -428.80 | OK |
| 22(2) | 109.00 | 238.05 | 74.34 | 653.40 | -92.10 | OK | OK | 78.10 | 260.64 | -35.51 | 945.10 | -428.80 | OK |
| 22(3) | 160.30 | 238.05 | 122.63 | 653.40 | -92.10 | OK | OK | 137.30 | 260.64 | 32.63 | 945.10 | -428.80 | OK |
| 23(1) | 160.30 | 296.33 | 122.63 | 1020.30 | -84.00 | OK | OK | 137.30 | 322.52 | 91.58 | 2074.80 | -409.40 | OK |
| 23(2) | 204.50 | 344.79 | 163.80 | 1020.30 | -84.00 | OK | OK | 188.60 | 374.04 | 91.58 | 2074.80 | -409.40 | OK |
| 23(3) | 241.40 | 344.79 | 198.36 | 1020.30 | -84.00 | OK | OK | 231.90 | 374.04 | 185.54 | 2074.80 | -409.40 | OK |
| 24(1) | 241.40 | 383.40 | 198.36 | 1020.30 | -84.00 | OK | OK | 231.90 | 415.08 | 185.54 | 2074.80 | -409.40 | OK |
| 24(2) | 271.00 | 412.43 | 226.35 | 1020.30 | -84.00 | OK | OK | 267.20 | 446.18 | 221.22 | 2074.80 | -409.40 | OK |
| 24(3) | 293.50 | 412.43 | 247.95 | 1020.30 | -84.00 | OK | OK | 294.50 | 446.18 | 248.85 | 2074.80 | -409.40 | OK |
| 25(1) | 293.50 | 431.60 | 247.95 | 2074.80 | -409.40 | OK | OK | 294.50 | 468.18 | 248.85 | 2074.80 | -409.40 | OK |
| 25(2) | 308.70 | 441.05 | 262.98 | 2074.80 | -409.40 | OK | OK | 313.80 | 479.52 | 267.57 | 2074.80 | -409.40 | OK |
| 25(3) | 316.70 | 441.05 | 271.53 | 2074.80 | -409.40 | OK | OK | 325.20 | 479.52 | 279.18 | 2074.80 | -409.40 | OK |
| 26(1) | 316.70 | 368.06 | 271.53 | 2074.80 | -409.40 | OK | OK | 325.20 | 479.52 | 279.18 | 2074.80 | -409.40 | OK |
| 26(2) | 317.50 | 368.06 | 273.60 | 2074.80 | -409.40 | OK | OK | 328.50 | 479.52 | 283.50 | 2074.80 | -409.40 | OK |
| 26(3) | 311.10 | 367.92 | 269.19 | 2074.80 | -409.40 | OK | OK | 324.00 | 479.93 | 280.80 | 2074.80 | -409.40 | OK |
| 27(1) | 311.10 | 359.69 | 269.19 | 2074.80 | -409.40 | OK | OK | 324.00 | 469.80 | 280.80 | 2074.80 | -409.40 | OK |
| 27(2) | 297.50 | 359.69 | 258.30 | 2074.80 | -409.40 | OK | OK | 311.40 | 469.80 | 270.81 | 2074.80 | -409.40 | OK |
| 27(3) | 276.70 | 343.31 | 240.93 | 2074.80 | -409.40 | OK | OK | 290.90 | 448.74 | 253.71 | 2074.80 | -409.40 | OK |
| 28(1) | 276.70 | 318.78 | 240.93 | 2074.80 | -409.40 | OK | OK | 290.90 | 417.02 | 253.71 | 2074.80 | -409.40 | OK |
| 28(2) | 248.60 | 318.78 | 216.99 | 2074.80 | -409.40 | OK | OK | 262.40 | 417.02 | 229.41 | 2074.80 | -409.40 | OK |
| 28(3) | 213.30 | 286.02 | 186.57 | 2073.00 | -409.40 | OK | OK | 225.80 | 374.49 | 197.82 | 2073.00 | -409.40 | OK |
| 29(1) | 213.30 | 245.12 | 186.57 | 2073.00 | -409.40 | OK | OK | 225.80 | 321.03 | 197.82 | 2073.00 | -409.40 | OK |
| 29(2) | 170.80 | 245.12 | 149.67 | 2073.00 | -409.40 | OK | OK | 181.30 | 321.03 | 159.12 | 2073.00 | -409.40 | OK |
| 29(3) | 121.20 | 196.07 | 106.38 | 2073.00 | -409.40 | OK | OK | 129.00 | 256.91 | 113.40 | 2073.00 | -409.40 | OK |
| 30(1) | 121.20 | 139.01 | 106.38 | 946.20 | -428.80 | OK | OK | 129.00 | 182.25 | 113.40 | 946.20 | -428.80 | OK |
| 30(2) | 64.20 | 139.01 | 56.43 | 946.20 | -429.80 | OK | OK | 68.50 | 182.25 | 60.30 | 946.20 | -429.80 | OK |
| 30(3) | 0.00 | 73.58 | 0.00 | 946.20 | -429.80 | OK | OK | 0.00 | 96.53 | 0.00 | 946.20 | -429.80 | OK |

***CONTROL A CONTROL A ROTURA EN FLEXION PARA FASES DE MONTAJE (Idecalaje=1canto)***

| BARRA | 1+2+3+5 | Md+ | Md- | Mu+ | Mu- | control+ | control- | 1+2+3+5+6 | Md+ | Md- | Mu+ | Mu- | control+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | 0.00 | 88.02 | 0.00 | 946.20 | -429.80 | OK | OK | 0.00 | 96.53 | 0.00 | 946.20 | -429.80 | OK |
| 1(2) | 64.20 | 166.32 | 56.43 | 946.20 | -429.80 | OK | OK | 68.50 | 182.25 | 60.30 | 946.20 | -429.80 | OK |
| 1(3) | 121.20 | 166.32 | 106.38 | 946.20 | -428.80 | OK | OK | 129.00 | 182.25 | 113.40 | 946.20 | -428.80 | OK |
| 2(1) | 121.20 | 234.63 | 106.38 | 2073.00 | -409.40 | OK | OK | 129.00 | 256.91 | 113.40 | 2073.00 | -409.40 | OK |
| 2(2) | 170.80 | 293.36 | 149.67 | 2073.00 | -409.40 | OK | OK | 181.30 | 321.03 | 159.12 | 2073.00 | -409.40 | OK |
| 2(3) | 213.30 | 293.36 | 186.57 | 2073.00 | -409.40 | OK | OK | 225.80 | 321.03 | 197.82 | 2073.00 | -409.40 | OK |
| 3(1) | 213.30 | 342.36 | 186.57 | 2073.00 | -409.40 | OK | OK | 225.80 | 374.49 | 197.82 | 2073.00 | -409.40 | OK |
| 3(2) | 248.60 | 381.65 | 216.99 | 2074.80 | -409.40 | OK | OK | 262.40 | 417.02 | 229.41 | 2074.80 | -409.40 | OK |
| 3(3) | 276.70 | 381.65 | 240.93 | 2074.80 | -409.40 | OK | OK | 290.90 | 417.02 | 253.71 | 2074.80 | -409.40 | OK |
| 4(1) | 276.70 | 411.08 | 240.93 | 2074.80 | -409.40 | OK | OK | 290.90 | 448.74 | 253.71 | 2074.80 | -409.40 | OK |
| 4(2) | 297.50 | 430.79 | 258.30 | 2074.80 | -409.40 | OK | OK | 311.40 | 469.80 | 270.81 | 2074.80 | -409.40 | OK |
| 4(3) | 311.10 | 430.79 | 269.19 | 2074.80 | -409.40 | OK | OK | 324.00 | 469.80 | 280.80 | 2074.80 | -409.40 | OK |
| 5(1) | 311.10 | 440.78 | 269.19 | 2074.80 | -409.40 | OK | OK | 324.00 | 479.93 | 280.80 | 2074.80 | -409.40 | OK |
| 5(2) | 317.50 | 441.05 | 273.60 | 2074.80 | -409.40 | OK | OK | 328.50 | 479.52 | 283.50 | 2074.80 | -409.40 | OK |
| 5(3) | 316.70 | 441.05 | 271.53 | 2074.80 | -409.40 | OK | OK | 325.20 | 479.52 | 279.18 | 2074.80 | -409.40 | OK |
| 6(1) | 316.70 | 441.05 | 271.53 | 2074.80 | -409.40 | OK | OK | 325.20 | 479.52 | 279.18 | 2074.80 | -409.40 | OK |
| 6(2) | 308.70 | 441.05 | 262.98 | 2074.80 | -409.40 | OK | OK | 313.80 | 468.18 | 267.57 | 2074.80 | -409.40 | OK |
| 6(3) | 293.50 | 431.60 | 247.95 | 2074.80 | -409.40 | OK | OK | 294.50 | 446.18 | 248.85 | 2074.80 | -409.40 | OK |
| 7(1) | 293.50 | 412.43 | 247.95 | 1020.30 | -84.00 | OK | OK | 294.50 | 446.18 | 248.85 | 2074.80 | -409.40 | OK |
| 7(2) | 271.00 | 412.43 | 226.35 | 1020.30 | -84.00 | OK | OK | 267.20 | 415.08 | 221.22 | 2074.80 | -409.40 | OK |
| 7(3) | 241.40 | 383.40 | 198.36 | 1020.30 | -84.00 | OK | OK | 231.90 | 374.04 | 185.54 | 2074.80 | -409.40 | OK |
| 8(1) | 241.40 | 344.79 | 198.36 | 1020.30 | -84.00 | OK | OK | 231.90 | 374.04 | 185.54 | 2074.80 | -409.40 | OK |
| 8(2) | 204.50 | 344.79 | 163.80 | 1020.30 | -84.00 | OK | OK | 188.60 | 322.52 | 142.34 | 2074.80 | -409.40 | OK |
| 8(3) | 160.30 | 296.33 | 122.63 | 1020.30 | -84.00 | OK | OK | 137.30 | 260.64 | 91.58 | 2074.80 | -409.40 | OK |
| 9(1) | 160.30 | 238.05 | 122.63 | 653.40 | -92.10 | OK | OK | 137.30 | 260.64 | 91.58 | 945.10 | -428.80 | OK |
| 9(2) | 109.00 | 238.05 | 74.34 | 653.40 | -92.10 | OK | OK | 78.10 | 190.62 | -35.51 | 945.10 | -428.80 | OK |
| 9(3) | 50.50 | 170.91 | 17.96 | 653.40 | -92.10 | OK | OK | 10.90 | 115.02 | -35.51 | 945.10 | -428.80 | OK |
| 10(1) | 50.50 | 95.67 | -46.49 | 653.40 | -92.10 | OK | OK | 10.90 | 115.02 | -112.64 | 945.10 | -428.80 | OK |
| 10(2) | -15.20 | 95.67 | -119.21 | 653.40 | -92.10 | OK | MAL | -64.20 | 33.80 | -199.13 | 945.10 | -428.80 | OK |
| 10(3) | -88.30 | 12.29 | -119.21 | 697.20 | -92.40 | OK | MAL | -147.50 | -53.28 | -199.13 | 946.20 | -429.50 | OK |
| 11(1) | -88.30 | 145.13 | -119.21 | 808.80 | -90.50 | OK | MAL | -147.50 | 141.89 | -199.13 | 1138.50 | -1216.20 | OK |
| 11(2) | 95.40 | 350.46 | -119.21 | 1003.40 | -84.70 | OK | MAL | 55.50 | 330.21 | -199.13 | 1961.60 | -410.60 | OK |
| 11(3) | 259.60 | 350.46 | 69.53 | 1003.40 | -77.00 | OK | OK | 237.10 | 330.21 | 15.66 | 1961.60 | -410.60 | OK |
| 12(1) | 259.60 | 546.08 | 233.64 | 1003.40 | -77.00 | OK | OK | 237.10 | 539.60 | 203.27 | 1961.60 | -410.60 | OK |
| 12(2) | 404.50 | 715.64 | 233.64 | 1078.90 | -77.00 | OK | OK | 397.30 | 723.74 | 203.27 | 1961.60 | -410.60 | OK |
| 12(3) | 530.10 | 715.64 | 364.05 | 1078.90 | -77.00 | OK | OK | 536.10 | 723.74 | 354.33 | 2740.50 | -399.30 | OK |
| 13(1) | 530.10 | 859.14 | 477.09 | 1078.90 | -77.00 | OK | OK | 536.10 | 882.36 | 482.49 | 2740.50 | -399.30 | OK |
| 13(2) | 636.40 | 976.46 | 572.76 | 1078.80 | -77.00 | OK | OK | 653.60 | 1012.10 | 482.49 | 2753.70 | -399.30 | OK |
| 13(3) | 723.30 | 976.46 | 650.97 | 1078.80 | -77.00 | OK | OK | 749.70 | 1012.10 | 588.24 | 2753.70 | -399.30 | OK |
| 14(1) | 723.30 | 1067.85 | 650.97 | 2740.50 | -399.30 | OK | OK | 749.70 | 1113.21 | 674.73 | 2753.70 | -399.30 | OK |
| 14(2) | 791.00 | 1133.06 | 711.90 | 2740.50 | -399.30 | OK | OK | 824.60 | 1185.30 | 674.73 | 2753.70 | -399.30 | OK |
| 14(3) | 839.30 | 1133.06 | 755.37 | 2740.50 | -399.30 | OK | OK | 878.00 | 1185.30 | 742.14 | 2753.70 | -399.30 | OK |
| 15(1) | 839.30 | 1172.21 | 755.37 | 2740.50 | -399.30 | OK | OK | 878.00 | 1228.50 | 790.20 | 2753.70 | -399.30 | OK |
| 15(2) | 868.30 | 1185.30 | 781.47 | 2740.50 | -399.30 | OK | OK | 910.00 | 1242.95 | 790.20 | 2753.70 | -399.30 | OK |
| 15(3) | 878.00 | 1185.30 | 790.20 | 2740.50 | -399.30 | OK | OK | 920.70 | 1242.95 | 819.00 | 2753.70 | -399.30 | OK |
| 6(1) | 878.00 | 1185.30 | 781.47 | 2740.50 | -399.30 | OK | OK | 920.70 | 1242.95 | 819.00 | 2753.70 | -399.30 | OK |

# 10.ANALISIS TRANSVERSAL DE ESFUERZOS

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 10-1 |

## 10. ANALISIS TRANSVERSAL DE ESFUERZOS

El cálculo del tablero frente a esfuerzos transversales se realiza siguiendo las prescripciones marcadas en la Instrucción española EHE, basado en el método de la celosía de inclinación variable.

### 10.1. Parametros de cálculo a cortante

Agotamiento por compresión oblicua:

$$V_{rd} \leq V_{u1} = K \cdot f_{1cd} \cdot b_o \cdot d \cdot \frac{ctg\theta + ctg\alpha}{1 + ctg^2\theta}$$ , donde

$f_{1cd} = 0.60 f_{cd} = 3000\ T/m^2$

$\theta$: ángulo de inclinación de las bielas de compresión variable entre $1 \leq ctg\theta \leq 1.50$

Agotamiento por tracción

$V_{rd} \leq V_{u2} = V_{cu} + V_{su}$

$V_{cu} = [0.10 \cdot \xi \cdot (100\rho_1 \cdot f_{ck})^{1/3} - 0.15\sigma_{cd}] \cdot b_o \cdot d\ \beta$

$V_{su} = A_\alpha \cdot f_{yad} \cdot z \cdot \sin\alpha \cdot (ctg\alpha + ctg\theta)$

de donde se deduce para $\alpha = 90°$

$A_\alpha = (V_{rd} - V_{cu}) / f_{yad} \cdot z \cdot ctg\theta$ armadura necesaria

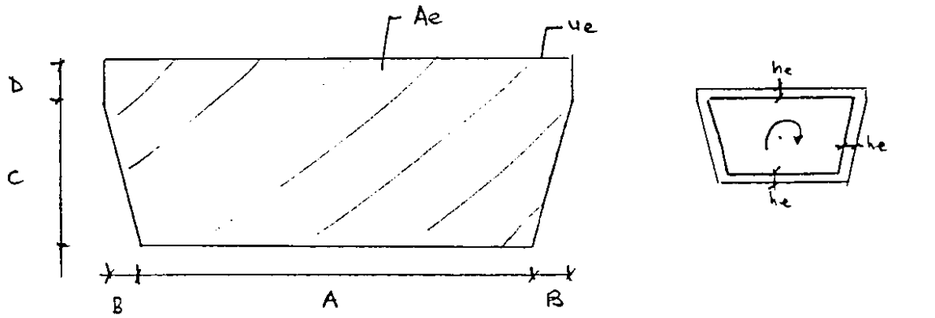
Armadura mínima de cortante

$A_\alpha \geq 0.02 \cdot f_{cd} \cdot b_o / f_{yad}$ para $\alpha = 90°$

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 10-2 |

## 10.2 Parametros de cálculo a torsión

Sección de cálculo




| A | B | C | D | Ae (m²) | ue (m) | he (m) |
|---|---|---|---|---|---|---|
| 3.145 | 0.265 | 1,060 | 0.125 | 4,0739 | 9,255 | 0.10 |

Agotamiento por compresión oblicua del hormigón

$Td \leq Tu1 = \alpha \cdot fred \cdot Ae \cdot he \cdot \frac{ctg\theta}{1+ctg^2\theta}$

$fred = 0.60\ fcd$

$\alpha = 1.50$

$0.40 \leq ctg\theta \leq 2.50$

Agotamiento de la armadura transversal

$Td \leq Tu2 = 2\,Ae \cdot Aat \cdot fyat \cdot ctg\theta$

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 10-3 |

Agotamiento de la armadura longitudinal

$Td \leq Tu3 = 2 \cdot \frac{Ae}{ue} \cdot Al \cdot fyld \cdot tg\theta$ donde

$fyld = 5100/1.10 = 4636\ kp/cm^2$

## 10.3 Interacción cortante - torsor

$\left(\frac{Td}{Tu1}\right)^\beta + \left(\frac{Vd}{Vu1}\right)^\beta \leq 1$ donde

$\beta = 2 \times \left(1 - \frac{he}{b}\right) = 1,00$

$b = 2 \times he$

Se sumarán las armaduras transversales debidas a cortante y a torsión individualmente.

## 10.4 Interacción flexión - axil - torsor

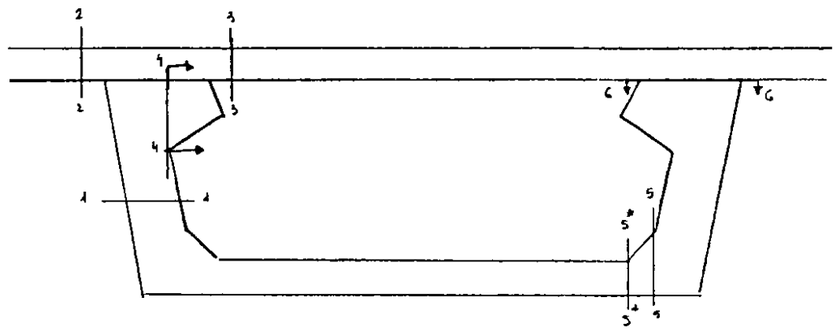
Se sumarán las armaduras longitudinales por concepto de flexión y de torsión.

## 10.5 Resumen cuantías por cortante y torsión

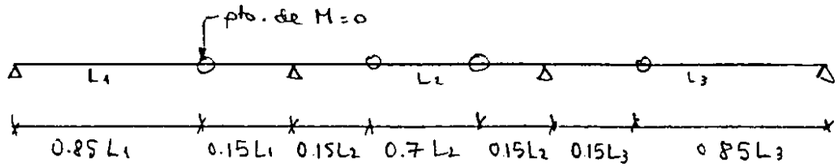
Cortante: $Rbv = \frac{1}{8} \times Acercido/Atotal$

Torsor: $Rbt = \frac{1}{2Ae}$

## 10.6. Secciones tipo y fibras de cálculo




- La fibra 4 controla la armadura transversal de la cabeza superior de viga para cargas en sección simple.
- La fibra 5 controla la armadura transversal de tabla inferior de viga, considerando que el cuanto de dicha fibra es igual al de la fibra 5*, para evitar un doble control de ambas fibras
- La fibra 6 controla el rasante entre hormigones de viga y losa y se realiza en el apt 10.10.
- Para las fibras 2 y 3 se adoptarán los siguientes valores de $\theta$ como control indirecto de fisuración:




Zona de $M^-$ : $\operatorname{ctg}\theta = 1{,}25$

Zona de $M^+$ : $\operatorname{ctg}\theta = 2{,}00$



- Tan sólo se considera colaboración del hormigón a cortante ("Vcu") en la fibra 4.
- La distribución de la armadura tanto activa como pasiva se realiza de forma simétrica y uniforme a cada lado de las almas lo que permite adoptar un único valor de $A_{cos}/A_{tot}$ tanto para compresiones como para tracciones.

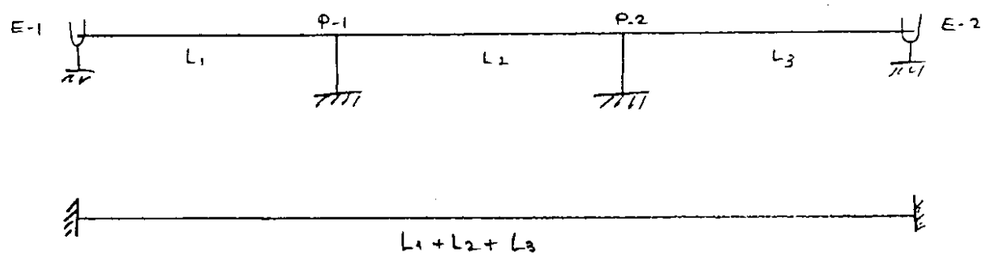
## 10.7. Esfuerzos de cálculo

Esfuerzos cortantes:

Se obtienen directamente del cuadro adjunto a continuación.

Momentos torsores:

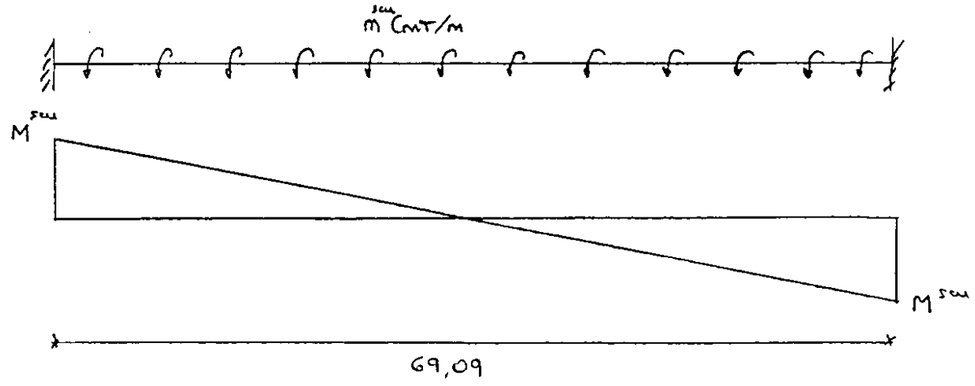
Obtenemos las leyes de torsores actuantes en el tablero:




Viga biempotrada a torsión

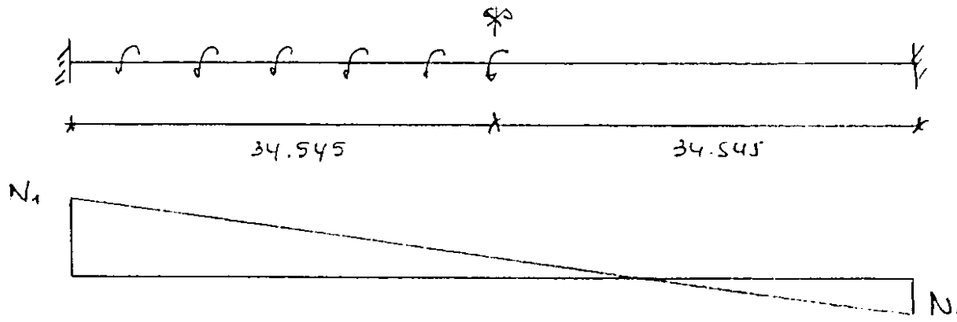
Se considera torsión uniforme por tratarse de sección cerrada y por tanto de alabeo despreciable.

• Torsor debido a S.C.U.




$m^{scu} = 3{,}28$ mT/m

$M^{scu} = 3{,}28 \text{ mT/m} \times 69{,}09 \text{ m} \times \frac{1}{2} = 49{,}38 \text{ mT} \quad (= m \cdot L/2)$



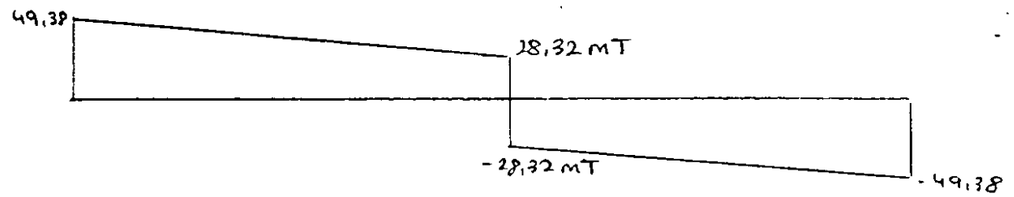

$N_1 = \frac{3}{4} \times m \times \left(\frac{L}{2}\right) = \frac{3}{4} \times 3{,}28 \times \frac{69{,}09}{2} = 84{,}98$ mT

$N_2 = \frac{1}{4} \times m \times \left(\frac{L}{2}\right) = \frac{1}{4} \times 3{,}28 \times \frac{69{,}09}{2} = 28{,}33$ mT

$M(L/2) = \frac{(84{,}98 + 28{,}33)}{69{,}09} \times \frac{69{,}09}{2} - 28{,}33 = 28{,}32$ mT



Envolvente de torsores de S.C.U :




(NOTA: Valores sin mayorar)

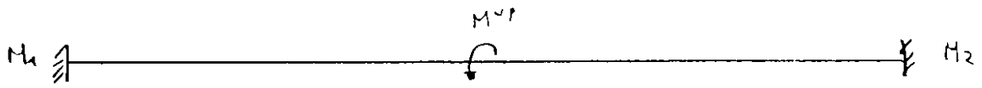
• Torsor debido a V.P.

$30 \text{ mT/eje} \times 3 \text{ ejes} = 90 \text{ mT}$



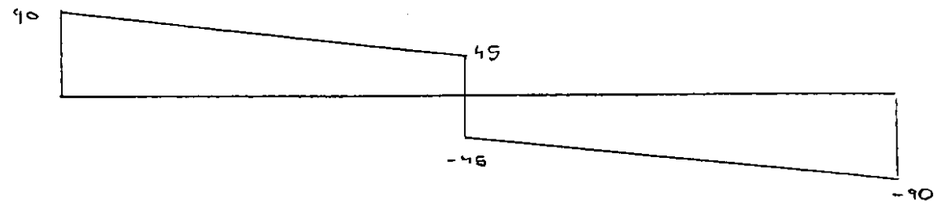

$M_1 = M^{VP} = 90$ mT

$M_2 = 0$ mT




$M_1 = M_{VP}/2 = 45$ mT

Envolvente de torsores de V.P. :




(NOTA: Valores sin mayorar)

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 10 - 8 |

Combinaciones V-T :

1ª Combinación : Vmáximo - Tconcomitante

Se obtiene con el cortante total de cálculo y el torsor de cálculo del vehículo pesado.

2ª Combinación : Tmáximo - Vconcomitante

Se obtiene con el torsor total de cálculo (vehículo + sobrecarga uniforme) y el cortante de cálculo obtenido con la mitad de la sobrecarga (en un solo lado del tablero). Se dimensionará con los resultados pésimos de las dos combinaciones.

A la vista de los resultados obtenidos seguidamente resulta desfavorable la 1ª Combinación (Vmax - Tconc) para toda la vida del puente.

**SUB.XV.AVE MADRID-BARCELONA / E-1505.0**

**CORTANTES SOBRE ESTRUCTURA IDEAL**

| BARRA | p vigas tin | pp losa tinf | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | suma + | suma - |
|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | -17.10 | -34.00 | -17.60 | 9.80 | -28.50 | 9.40 | -54.30 | -10.20 | -59.70 | -151.50 |
| 1(2) | -14.30 | -28.40 | -14.70 | 9.80 | -25.50 | 9.40 | -47.10 | -10.20 | -48.40 | -130.00 |
| 1(3) | -11.50 | -22.80 | -11.80 | 10.20 | -22.80 | 9.40 | -47.10 | -10.20 | -36.70 | -116.00 |
| 2(1) | -11.50 | -22.80 | -11.80 | 10.20 | -22.80 | 9.40 | -47.10 | -10.20 | -36.70 | -116.00 |
| 2(2) | -8.70 | -17.20 | -8.90 | 10.20 | -19.70 | 9.40 | -40.00 | -10.20 | -25.40 | -94.50 |
| 2(3) | -5.90 | -11.60 | -6.00 | 11.30 | -17.70 | 9.40 | -40.00 | -10.20 | -13.00 | -81.20 |
| 3(1) | -5.90 | -11.60 | -6.00 | 11.30 | -17.70 | 9.40 | -40.00 | -10.20 | -13.00 | -81.20 |
| 3(2) | -3.00 | -6.10 | -3.10 | 11.30 | -14.60 | 9.40 | -33.20 | -10.20 | -1.70 | -60.00 |
| 3(3) | -0.20 | -0.50 | -0.20 | 13.10 | -13.40 | 15.90 | -33.20 | -10.20 | 17.90 | -47.50 |
| 4(1) | -0.20 | -0.50 | -0.20 | 13.10 | -10.30 | 15.90 | -26.70 | -10.20 | 17.90 | -47.50 |
| 4(2) | 2.60 | 5.10 | 2.70 | 13.10 | -9.80 | 22.90 | -26.70 | -10.20 | 50.10 | -26.60 |
| 4(3) | 5.40 | 10.70 | 5.60 | 15.70 | -9.80 | 22.90 | -26.70 | -10.20 | 50.10 | -14.80 |
| 5(1) | 5.40 | 10.70 | 5.60 | 15.70 | -6.90 | 22.90 | -20.50 | -10.20 | 61.60 | -5.60 |
| 5(2) | 8.20 | 16.30 | 8.50 | 15.90 | -6.90 | 29.60 | -20.50 | -10.20 | 82.60 | 16.90 |
| 5(3) | 11.00 | 21.90 | 11.40 | 18.90 | -6.90 | 29.60 | -20.50 | -10.20 | 82.60 | 16.90 |
| 6(1) | 11.00 | 21.90 | 11.40 | 18.90 | -4.60 | 36.00 | -14.70 | -10.20 | 94.70 | 36.30 |
| 6(2) | 13.80 | 27.50 | 14.30 | 19.70 | -4.60 | 36.00 | -14.70 | -10.20 | 115.50 | 47.60 |
| 6(3) | 16.60 | 33.10 | 17.20 | 22.80 | -4.60 | 36.00 | -14.70 | -10.20 | 115.50 | 47.60 |
| 7(1) | 16.60 | 33.10 | 17.20 | 22.80 | -2.90 | 36.00 | -9.50 | -10.20 | 128.20 | 65.80 |
| 7(2) | 19.40 | 38.70 | 20.10 | 24.20 | -2.90 | 42.00 | -9.50 | -10.20 | 148.50 | 77.00 |
| 7(3) | 22.20 | 44.20 | 23.00 | 27.30 | -2.90 | 42.00 | -9.50 | -10.20 | 148.50 | 77.00 |
| 8(1) | 22.20 | 44.20 | 23.00 | 27.30 | -1.80 | 42.00 | -4.80 | -10.20 | 161.90 | 94.20 |
| 8(2) | 25.10 | 49.80 | 25.90 | 29.30 | -1.80 | 47.60 | -4.80 | -10.20 | 181.80 | 105.50 |
| 8(3) | 27.90 | 55.40 | 28.80 | 32.30 | -1.80 | 47.60 | -4.80 | -10.20 | 181.80 | 105.50 |
| 9(1) | 27.90 | 55.40 | 28.80 | 32.30 | -1.20 | 47.60 | -1.50 | -10.20 | 195.60 | 120.70 |
| 9(2) | 30.70 | 61.00 | 31.70 | 34.80 | -1.20 | 52.50 | -1.50 | -10.20 | 214.80 | 131.90 |
| 9(3) | 33.50 | 66.60 | 34.50 | 37.90 | -1.20 | 52.50 | -1.50 | -10.20 | 214.80 | 131.90 |
| 10(1) | 33.50 | 66.60 | 34.50 | 37.90 | -1.00 | 52.50 | -1.50 | -10.20 | 229.00 | 143.40 |
| 10(2) | 36.30 | 72.20 | 37.40 | 40.80 | -1.00 | 56.90 | -1.50 | -10.20 | 247.80 | 154.70 |
| 10(3) | 39.10 | 77.80 | 40.30 | 43.90 | | | | | | |

*CORTANTES SOBRE ESTRUCTURA IDEAL*

| BARRA | p vigas tin | pp losa tinf | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | suma + | suma - |
|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | -39.10 | -77.80 | -40.30 | 1.00 | -43.90 | 1.50 | -56.90 | 10.20 | -144.50 | -258.00 |
| 21(2) | -36.30 | -72.20 | -37.40 | 1.00 | -40.80 | 1.50 | -52.50 | 10.20 | -133.20 | -239.20 |
| 21(3) | -33.50 | -66.60 | -34.50 | 1.20 | -37.90 | 1.50 | -52.50 | 10.20 | -121.70 | -225.00 |
| 22(1) | -33.50 | -66.60 | -34.50 | 1.20 | -37.90 | 1.50 | -52.50 | 10.20 | -121.70 | -225.00 |
| 22(2) | -30.70 | -61.00 | -31.70 | 1.20 | -34.80 | 1.50 | -47.60 | 10.20 | -110.50 | -205.80 |
| 22(3) | -27.90 | -55.40 | -28.80 | 1.80 | -32.30 | 4.80 | -47.60 | 10.20 | -95.30 | -192.00 |
| 23(1) | -27.90 | -55.40 | -28.80 | 1.80 | -32.30 | 4.80 | -47.60 | 10.20 | -95.30 | -192.00 |
| 23(2) | -25.10 | -49.80 | -25.90 | 1.80 | -29.30 | 4.80 | -42.00 | 10.20 | -84.00 | -172.10 |
| 23(3) | -22.20 | -44.20 | -23.00 | 2.90 | -27.30 | 9.50 | -42.00 | 10.20 | -66.80 | -158.70 |
| 24(1) | -22.20 | -44.20 | -23.00 | 2.90 | -27.30 | 9.50 | -42.00 | 10.20 | -66.80 | -158.70 |
| 24(2) | -19.40 | -38.70 | -20.10 | 2.90 | -24.20 | 9.50 | -36.00 | 10.20 | -55.60 | -138.40 |
| 24(3) | -16.60 | -33.10 | -17.20 | 4.60 | -22.80 | 14.70 | -36.00 | 10.20 | -37.40 | -125.70 |
| 25(1) | -16.60 | -33.10 | -17.20 | 4.60 | -22.80 | 14.70 | -36.00 | 10.20 | -37.40 | -125.70 |
| 25(2) | -13.80 | -27.50 | -14.30 | 4.60 | -19.70 | 14.70 | -29.60 | 10.20 | -26.10 | -104.90 |
| 25(3) | -11.00 | -21.90 | -11.40 | 6.90 | -18.90 | 20.50 | -29.60 | 10.20 | -6.70 | -92.80 |
| 26(1) | -11.00 | -21.90 | -11.40 | 6.90 | -18.90 | 20.50 | -29.60 | 10.20 | -6.70 | -92.80 |
| 26(2) | -8.20 | -16.30 | -8.50 | 6.90 | -15.90 | 20.50 | -22.90 | 10.20 | 4.60 | -71.80 |
| 26(3) | -5.40 | -10.70 | -5.60 | 9.80 | -15.70 | 26.70 | -22.90 | 10.20 | 25.00 | -60.30 |
| 27(1) | -5.40 | -10.70 | -5.60 | 9.80 | -15.70 | 26.70 | -22.90 | 10.20 | 25.00 | -60.30 |
| 27(2) | -2.60 | -5.10 | -2.70 | 10.30 | -13.10 | 26.70 | -15.90 | 10.20 | 36.80 | -39.40 |
| 27(3) | 0.20 | 0.50 | 0.20 | 13.40 | -13.10 | 33.20 | -15.90 | 10.20 | 57.70 | -28.10 |
| 28(1) | 0.20 | 0.50 | 0.20 | 13.40 | -13.10 | 33.20 | -15.90 | 10.20 | 57.70 | -28.10 |
| 28(2) | 3.00 | 6.10 | 3.10 | 14.60 | -11.30 | 33.20 | -9.40 | 10.20 | 70.20 | -8.50 |
| 28(3) | 5.90 | 11.60 | 6.00 | 17.70 | -11.30 | 40.00 | -9.40 | 10.20 | 91.40 | 2.80 |
| 29(1) | 5.90 | 11.60 | 6.00 | 17.70 | -11.30 | 40.00 | -9.40 | 10.20 | 91.40 | 2.80 |
| 29(2) | 8.70 | 17.20 | 8.90 | 19.70 | -10.20 | 40.00 | -9.40 | 10.20 | 104.70 | 15.20 |
| 29(3) | 11.50 | 22.80 | 11.80 | 22.80 | -10.20 | 47.10 | -9.40 | 10.20 | 126.20 | 26.50 |
| 30(1) | 11.50 | 22.80 | 11.80 | 22.80 | -10.20 | 47.10 | -9.40 | 10.20 | 126.20 | 26.50 |
| 30(2) | 14.30 | 28.40 | 14.70 | 25.50 | -9.80 | 47.10 | -9.40 | 10.20 | 140.20 | 38.20 |
| 30(3) | 17.10 | 34.00 | 17.60 | 28.50 | -9.80 | 54.30 | -9.40 | 10.20 | 161.70 | 49.50 |

*CORTANTES SOBRE ESTRUCTURA IDEAL*

| BARRA | p vigas tin | pp losa tinf | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | suma + | suma - |
|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | -46.00 | -91.50 | -47.40 | 2.60 | -53.00 | 3.80 | -58.10 | 0.00 | -178.50 | -296.00 |
| 11(2) | -41.40 | -82.30 | -42.70 | 2.60 | -47.90 | 3.80 | -55.90 | 0.00 | -160.00 | -270.20 |
| 11(3) | -36.80 | -73.20 | -38.00 | 2.90 | -43.20 | 3.80 | -53.50 | 0.00 | -141.30 | -244.70 |
| 12(1) | -36.80 | -73.20 | -38.00 | 2.90 | -43.20 | 3.80 | -53.50 | 0.00 | -141.30 | -244.70 |
| 12(2) | -32.20 | -64.00 | -33.20 | 2.90 | -38.20 | 4.10 | -50.60 | 0.00 | -122.40 | -218.20 |
| 12(3) | -27.60 | -54.90 | -28.50 | 4.00 | -34.30 | 6.70 | -47.60 | 0.00 | -100.30 | -192.90 |
| 13(1) | -27.60 | -54.90 | -28.50 | 4.00 | -34.30 | 6.70 | -47.60 | 0.00 | -100.30 | -192.90 |
| 13(2) | -23.00 | -45.70 | -23.70 | 4.00 | -29.20 | 9.40 | -44.30 | 0.00 | -79.00 | -165.90 |
| 13(3) | -18.40 | -36.60 | -19.00 | 6.10 | -26.30 | 12.60 | -41.00 | 0.00 | -55.30 | -141.30 |
| 14(1) | -18.40 | -36.60 | -19.00 | 6.10 | -26.30 | 12.60 | -41.00 | 0.00 | -55.30 | -141.30 |
| 14(2) | -13.80 | -27.40 | -14.20 | 6.10 | -21.20 | 15.70 | -37.30 | 0.00 | -33.60 | -113.90 |
| 14(3) | -9.20 | -18.30 | -9.50 | 9.30 | -19.40 | 19.30 | -33.80 | 0.00 | -8.40 | -90.20 |
| 15(1) | -9.20 | -18.30 | -9.50 | 9.30 | -19.40 | 19.30 | -33.80 | 0.00 | -8.40 | -90.20 |
| 15(2) | -4.60 | -9.10 | -4.70 | 9.30 | -14.40 | 22.70 | -30.00 | 0.00 | 13.60 | -62.80 |
| 15(3) | 0.00 | 0.00 | 0.00 | 13.80 | -13.80 | 26.50 | -26.50 | 0.00 | 40.30 | -40.30 |
| 16(1) | 0.00 | 0.00 | 0.00 | 13.80 | -13.80 | 26.50 | -26.50 | 0.00 | 40.30 | -40.30 |
| 16(2) | 4.60 | 9.10 | 4.70 | 14.40 | -9.30 | 30.00 | -22.70 | 0.00 | 62.80 | -13.60 |
| 16(3) | 9.20 | 18.30 | 9.50 | 19.40 | -9.30 | 33.80 | -19.30 | 0.00 | 90.20 | 8.40 |
| 17(1) | 9.20 | 18.30 | 9.50 | 19.40 | -9.30 | 33.80 | -19.30 | 0.00 | 90.20 | 8.40 |
| 17(2) | 13.80 | 27.40 | 14.20 | 21.20 | -6.10 | 37.30 | -15.70 | 0.00 | 113.90 | 33.60 |
| 17(3) | 18.40 | 36.60 | 19.00 | 26.30 | -6.10 | 41.00 | -12.60 | 0.00 | 141.30 | 55.30 |
| 18(1) | 18.40 | 36.60 | 19.00 | 26.30 | -6.10 | 41.00 | -12.60 | 0.00 | 141.30 | 55.30 |
| 18(2) | 23.00 | 45.70 | 23.70 | 29.20 | -4.00 | 44.30 | -9.40 | 0.00 | 165.90 | 79.00 |
| 18(3) | 27.60 | 54.90 | 28.50 | 34.30 | -4.00 | 47.60 | -6.70 | 0.00 | 192.90 | 100.30 |
| 19(1) | 27.60 | 54.90 | 28.50 | 34.30 | -4.00 | 47.60 | -6.70 | 0.00 | 192.90 | 100.30 |
| 19(2) | 32.20 | 64.00 | 33.20 | 38.20 | -2.90 | 50.60 | -4.10 | 0.00 | 218.20 | 122.40 |
| 19(3) | 36.80 | 73.20 | 38.00 | 43.20 | -2.90 | 53.50 | -3.80 | 0.00 | 244.70 | 141.30 |
| 20(1) | 36.80 | 73.20 | 38.00 | 43.20 | -2.90 | 53.50 | -3.80 | 0.00 | 244.70 | 141.30 |
| 20(2) | 41.40 | 82.30 | 42.70 | 47.90 | -2.60 | 55.90 | -3.80 | 0.00 | 270.20 | 160.00 |
| 20(3) | 46.00 | 91.50 | 47.40 | 53.00 | -2.60 | 58.10 | -3.80 | 0.00 | 296.00 | 178.50 |

***CORTANTES LONGITUDINALES***

| BARR | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Hip.pret. | Red.ppviga | Redpplosa | Redpret+perd | Red.total | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | BARR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | -46.00 | -17.60 | -24.30 | -36.40 | -13.10 | 0.00 | 0.00 | -0.08 | 0.00 | -0.08 | -47.40 | 2.60 | -53.00 | 3.80 | -58.10 | 0.00 | 11(1) |
| 11(2) | -41.40 | -15.80 | -24.30 | -30.40 | -11.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -42.70 | 2.60 | -47.90 | 3.80 | -55.90 | 0.00 | 11(2) |
| 11(3) | -36.80 | -14.10 | -24.30 | -24.30 | -10.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -38.00 | 2.90 | -43.20 | 3.80 | -53.50 | 0.00 | 11(3) |
| 12(1) | -36.80 | -14.10 | -24.30 | -24.30 | -10.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -38.00 | 2.90 | -43.20 | 3.80 | -53.50 | 0.00 | 12(1) |
| 12(2) | -32.20 | -12.30 | -24.30 | -18.20 | -9.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -33.20 | 2.90 | -38.20 | 4.10 | -50.60 | 0.00 | 12(2) |
| 12(3) | -27.60 | -10.50 | -24.30 | -12.10 | -7.90 | 0.00 | 0.00 | -0.09 | 0.00 | -0.09 | -28.50 | 4.00 | -34.30 | 6.70 | -47.60 | 0.00 | 12(3) |
| 13(1) | -27.60 | -10.50 | -24.30 | -12.10 | -7.90 | 0.00 | 0.00 | -0.09 | 0.00 | -0.09 | -28.50 | 4.00 | -34.30 | 6.70 | -47.60 | 0.00 | 13(1) |
| 13(2) | -23.00 | -8.80 | -24.30 | -6.10 | -6.60 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | -23.70 | 4.00 | -29.20 | 9.40 | -44.30 | 0.00 | 13(2) |
| 13(3) | -18.40 | -7.00 | -24.30 | 0.00 | -5.20 | 0.00 | 0.00 | -0.09 | 0.00 | -0.09 | -19.00 | 6.10 | -26.30 | 12.60 | -41.00 | 0.00 | 13(3) |
| 14(1) | -18.40 | -7.00 | -24.30 | 0.00 | -5.20 | 0.00 | 0.00 | -0.09 | 0.00 | -0.09 | -19.00 | 6.10 | -26.30 | 12.60 | -41.00 | 0.00 | 14(1) |
| 14(2) | -13.80 | -5.30 | -18.20 | 0.00 | -3.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -14.20 | 6.10 | -21.20 | 15.70 | -37.30 | 0.00 | 14(2) |
| 14(3) | -9.20 | -3.50 | -12.10 | 0.00 | -2.60 | 0.00 | 0.00 | -0.09 | 0.00 | -0.09 | -9.50 | 9.30 | -19.40 | 19.30 | -33.80 | 0.00 | 14(3) |
| 15(1) | -9.20 | -3.50 | -12.10 | 0.00 | -2.60 | 0.00 | 0.00 | -0.09 | 0.00 | -0.09 | -9.50 | 9.30 | -19.40 | 19.30 | -33.80 | 0.00 | 15(1) |
| 15(2) | -4.60 | -1.80 | -6.10 | 0.00 | -1.30 | 0.00 | 0.00 | 0.08 | 0.00 | 0.08 | -4.70 | 9.30 | -14.40 | 22.70 | -30.00 | 0.00 | 15(2) |
| 15(3) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.80 | -13.80 | 26.50 | -26.50 | 0.00 | 15(3) |
| 16(1) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.80 | -13.80 | 26.50 | -26.50 | 0.00 | 16(1) |
| 16(2) | 4.60 | 1.80 | 6.10 | 0.00 | 1.30 | 0.00 | 0.00 | -0.08 | 0.00 | -0.08 | 4.70 | 14.40 | -9.30 | 30.00 | -22.70 | 0.00 | 16(2) |
| 16(3) | 9.20 | 3.50 | 12.10 | 0.00 | 2.60 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | 9.50 | 19.40 | -9.30 | 33.80 | -19.30 | 0.00 | 16(3) |
| 17(1) | 9.20 | 3.50 | 12.10 | 0.00 | 2.60 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | 9.50 | 19.40 | -9.30 | 33.80 | -19.30 | 0.00 | 17(1) |
| 17(2) | 13.80 | 5.30 | 18.20 | 0.00 | 3.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.20 | 21.20 | -6.10 | 37.30 | -15.70 | 0.00 | 17(2) |
| 17(3) | 18.40 | 7.00 | 24.30 | 0.00 | 5.20 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | 19.00 | 26.30 | -6.10 | 41.00 | -12.60 | 0.00 | 17(3) |
| 18(1) | 18.40 | 7.00 | 24.30 | 0.00 | 5.20 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | 19.00 | 26.30 | -6.10 | 41.00 | -12.60 | 0.00 | 18(1) |
| 18(2) | 23.00 | 8.80 | 24.30 | 6.10 | 6.60 | 0.00 | 0.00 | -0.09 | 0.00 | -0.09 | 23.70 | 29.20 | -4.00 | 44.30 | -9.40 | 0.00 | 18(2) |
| 18(3) | 27.60 | 10.50 | 24.30 | 12.10 | 7.90 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | 28.50 | 34.30 | -4.00 | 47.60 | -6.70 | 0.00 | 18(3) |
| 19(1) | 27.60 | 10.50 | 24.30 | 12.10 | 7.90 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | 28.50 | 34.30 | -4.00 | 47.60 | -6.70 | 0.00 | 19(1) |
| 19(2) | 32.20 | 12.30 | 24.30 | 18.20 | 9.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 33.20 | 38.20 | -2.90 | 50.60 | -4.10 | 0.00 | 19(2) |
| 19(3) | 36.80 | 14.10 | 24.30 | 24.30 | 10.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 38.00 | 43.20 | -2.90 | 53.50 | -3.80 | 0.00 | 19(3) |
| 20(1) | 36.80 | 14.10 | 24.30 | 24.30 | 10.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 38.00 | 43.20 | -2.90 | 53.50 | -3.80 | 0.00 | 20(1) |
| 20(2) | 41.40 | 15.80 | 24.30 | 30.40 | 11.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 42.70 | 47.90 | -2.60 | 55.90 | -3.80 | 0.00 | 20(2) |
| 20(3) | 46.00 | 17.60 | 24.30 | 36.40 | 13.10 | 0.00 | 0.00 | 0.08 | 0.00 | 0.08 | 47.40 | 53.00 | -2.60 | 58.10 | -3.80 | 0.00 | 20(3) |

***SUB.XV AVE MADRID-BARCELONA / E-1505.0***

***CORTANTES LONGITUDINALES***

| BARR | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Hip.pret. | Red.ppviga | Redpplosa | Redpret+perd | Red.total | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | BARR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | -28.10 | -10.70 | -31.20 | -0.30 | -4.90 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | -17.60 | 9.80 | -28.50 | 9.40 | -54.30 | -10.20 | 1(1) |
| 1(2) | -25.30 | -9.70 | -27.50 | -0.30 | -4.10 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | -14.70 | 9.80 | -25.50 | 9.40 | -47.10 | -10.20 | 1(2) |
| 1(3) | -22.50 | -8.60 | -23.80 | -0.30 | -3.30 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | -11.80 | 10.20 | -22.80 | 9.40 | -47.10 | -10.20 | 1(3) |
| 2(1) | -22.50 | -8.60 | -23.80 | -0.30 | -3.30 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | -11.80 | 10.20 | -22.80 | 9.40 | -47.10 | -10.20 | 2(1) |
| 2(2) | -19.70 | -7.50 | -20.00 | -0.30 | -2.50 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | -8.90 | 10.20 | -19.70 | 9.40 | -40.00 | -10.20 | 2(2) |
| 2(3) | -16.90 | -6.40 | -16.30 | -0.30 | -1.70 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | -6.00 | 11.30 | -17.70 | 9.40 | -40.00 | -10.20 | 2(3) |
| 3(1) | -16.90 | -6.40 | -16.30 | -0.30 | -1.70 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | -6.00 | 11.30 | -17.70 | 9.40 | -40.00 | -10.20 | 3(1) |
| 3(2) | -14.10 | -5.40 | -12.60 | -0.30 | -0.90 | -55.60 | 9.44 | 11.14 | -34.47 | -13.90 | -3.10 | 11.30 | -14.60 | 9.40 | -33.20 | -10.20 | 3(2) |
| 3(3) | -11.20 | -4.30 | -8.90 | -0.30 | -0.10 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | -0.20 | 13.10 | -13.40 | 15.90 | -33.20 | -10.20 | 3(3) |
| 4(1) | -11.20 | -4.30 | -8.90 | -0.30 | -0.10 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | -0.20 | 13.10 | -13.40 | 15.90 | -33.20 | -10.20 | 4(1) |
| 4(2) | -8.40 | -3.20 | -5.20 | -0.30 | 0.70 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | 2.70 | 13.10 | -10.30 | 15.90 | -26.70 | -10.20 | 4(2) |
| 4(3) | -5.60 | -2.10 | -1.50 | -0.30 | 1.50 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | 5.60 | 15.70 | -9.80 | 22.90 | -26.70 | -10.20 | 4(3) |
| 5(1) | -5.60 | -2.10 | -1.50 | -0.30 | 1.50 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | 5.60 | 15.70 | -9.80 | 22.90 | -26.70 | -10.20 | 5(1) |
| 5(2) | -2.80 | -1.10 | 2.20 | -0.30 | 2.30 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 8.50 | 15.90 | -6.90 | 22.90 | -20.50 | -10.20 | 5(2) |
| 5(3) | 0.00 | 0.00 | 5.90 | -0.30 | 3.10 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 11.40 | 18.90 | -6.90 | 29.60 | -20.50 | -10.20 | 5(3) |
| 6(1) | 0.00 | 0.00 | 5.90 | -0.30 | 3.10 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 11.40 | 18.90 | -6.90 | 29.60 | -20.50 | -10.20 | 6(1) |
| 6(2) | 2.80 | 1.10 | 9.70 | -0.30 | 3.90 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | 14.30 | 19.70 | -4.60 | 29.60 | -14.70 | -10.20 | 6(2) |
| 6(3) | 5.60 | 2.10 | 13.40 | -0.30 | 4.70 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 17.20 | 22.80 | -4.60 | 36.00 | -14.70 | -10.20 | 6(3) |
| 7(1) | 5.60 | 2.10 | 13.40 | -0.30 | 4.70 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 17.20 | 22.80 | -4.60 | 36.00 | -14.70 | -10.20 | 7(1) |
| 7(2) | 8.40 | 3.20 | 13.40 | 3.40 | 5.50 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 20.10 | 24.20 | -2.90 | 36.00 | -9.50 | -10.20 | 7(2) |
| 7(3) | 11.20 | 4.30 | 13.40 | 7.10 | 6.30 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | 23.00 | 27.30 | -2.90 | 42.00 | -9.50 | -10.20 | 7(3) |
| 8(1) | 11.20 | 4.30 | 13.40 | 7.10 | 6.30 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | 23.00 | 27.30 | -2.90 | 42.00 | -9.50 | -10.20 | 8(1) |
| 8(2) | 14.10 | 5.40 | 13.40 | 10.80 | 7.10 | -55.60 | 9.35 | 11.14 | -34.47 | -13.99 | 25.90 | 29.30 | -1.80 | 42.00 | -4.80 | -10.20 | 8(2) |
| 8(3) | 16.90 | 6.40 | 13.40 | 14.50 | 7.90 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 28.80 | 32.30 | -1.80 | 47.60 | -4.80 | -10.20 | 8(3) |
| 9(1) | 16.90 | 6.40 | 13.40 | 14.50 | 7.90 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 28.80 | 32.30 | -1.80 | 47.60 | -4.80 | -10.20 | 9(1) |
| 9(2) | 19.70 | 7.50 | 13.40 | 18.20 | 8.70 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 31.70 | 34.80 | -1.20 | 47.60 | -1.50 | -10.20 | 9(2) |
| 9(3) | 22.50 | 8.60 | 13.40 | 21.90 | 9.50 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 34.50 | 37.90 | -1.20 | 52.50 | -1.50 | -10.20 | 9(3) |
| 10(1) | 22.50 | 8.60 | 13.40 | 21.90 | 9.50 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 34.50 | 37.90 | -1.20 | 52.50 | -1.50 | -10.20 | 10(1) |
| 10(2) | 25.30 | 9.70 | 13.40 | 25.60 | 10.30 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 37.40 | 40.80 | -1.00 | 52.50 | -1.50 | -10.20 | 10(2) |
| 10(3) | 28.10 | 10.70 | 13.40 | 29.40 | 11.10 | -55.60 | 9.35 | 11.22 | -34.47 | -13.90 | 40.30 | 43.90 | -1.00 | 56.90 | -1.50 | -10.20 | 10(3) |

***SUBTRAMO XV DEL AVE / E-1505.0***

***CORTANTES CARACTERÍSTICOS***

***CORTANTES DE CÁLCULO***

| BARRA | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Redistr. | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | T=0 Vd- | T=0 Vd+ | T=INF Vd- | T=INF Vd+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1(1) | -28.10 | -10.70 | -31.20 | -0.30 | -4.90 | -13.99 | -17.60 | 9.80 | -28.50 | 9.40 | -54.30 | -10.20 | -249.48 | -66.96 | -268.36 | -80.95 |
| 1(2) | -25.30 | -9.70 | -27.50 | -0.30 | -4.10 | -13.90 | -14.70 | 9.80 | -25.50 | 9.40 | -47.10 | -10.20 | -219.06 | -56.88 | -237.83 | -70.78 |
| 1(3) | -22.50 | -8.60 | -23.80 | -0.30 | -3.30 | -13.90 | -11.80 | 10.20 | -22.80 | 9.40 | -47.10 | -10.20 | -199.76 | -46.11 | -218.52 | -60.01 |
| 2(1) | -22.50 | -8.60 | -23.80 | -0.30 | -3.30 | -13.90 | -11.80 | 10.20 | -22.80 | 9.40 | -47.10 | -10.20 | -199.76 | -46.11 | -218.52 | -60.01 |
| 2(2) | -19.70 | -7.50 | -20.00 | -0.30 | -2.50 | -13.99 | -8.90 | 10.20 | -19.70 | 9.40 | -40.00 | -10.20 | -169.07 | -35.85 | -187.95 | -49.84 |
| 2(3) | -16.90 | -6.40 | -16.30 | -0.30 | -1.70 | -13.99 | -6.00 | 11.30 | -17.70 | 9.40 | -40.00 | -10.20 | -150.81 | -24.03 | -169.69 | -38.02 |
| 3(1) | -16.90 | -6.40 | -16.30 | -0.30 | -1.70 | -13.99 | -6.00 | 11.30 | -17.70 | 9.40 | -40.00 | -10.20 | -150.81 | -24.03 | -169.69 | -38.02 |
| 3(2) | -14.10 | -5.40 | -12.60 | -0.30 | -0.90 | -13.90 | -3.10 | 11.30 | -14.60 | 9.40 | -33.20 | -10.20 | -120.84 | -13.95 | -139.61 | -27.85 |
| 3(3) | -11.20 | -4.30 | -8.90 | -0.30 | -0.10 | -13.99 | -0.20 | 13.10 | -13.40 | 15.90 | -33.20 | -10.20 | -103.65 | 8.76 | -122.53 | -5.23 |
| 4(1) | -11.20 | -4.30 | -8.90 | -0.30 | -0.10 | -13.99 | -0.20 | 13.10 | -13.40 | 15.90 | -33.20 | -10.20 | -103.65 | 8.76 | -122.53 | -5.23 |
| 4(2) | -8.40 | -3.20 | -5.20 | -0.30 | 0.70 | -13.99 | 2.70 | 13.10 | -10.30 | 15.90 | -26.70 | -10.20 | -75.53 | 20.46 | -94.41 | 6.47 |
| 4(3) | -5.60 | -2.10 | -1.50 | -0.30 | 1.50 | -13.99 | 5.60 | 15.70 | -9.80 | 22.90 | -26.70 | -10.20 | -61.19 | 46.70 | -80.07 | 32.71 |
| 5(1) | -5.60 | -2.10 | -1.50 | -0.30 | 1.50 | -13.99 | 5.60 | 15.70 | -9.80 | 22.90 | -26.70 | -10.20 | -61.19 | 46.70 | -80.07 | 32.71 |
| 5(2) | -2.80 | -1.10 | 2.20 | -0.30 | 2.30 | -13.90 | 8.50 | 15.90 | -6.90 | 22.90 | -20.50 | -10.20 | -35.07 | 59.73 | -53.84 | 45.83 |
| 5(3) | 0.00 | 0.00 | 5.90 | -0.30 | 3.10 | -13.90 | 11.40 | 18.90 | -6.90 | 29.60 | -20.50 | -10.20 | -23.15 | 87.78 | -41.91 | 73.88 |
| 6(1) | 0.00 | 0.00 | 5.90 | -0.30 | 3.10 | -13.90 | 11.40 | 18.90 | -6.90 | 29.60 | -20.50 | -10.20 | -23.15 | 87.78 | -41.91 | 73.88 |
| 6(2) | 2.80 | 1.10 | 9.70 | -0.30 | 3.90 | -13.99 | 14.30 | 19.70 | -4.60 | 29.60 | -14.70 | -10.20 | -0.73 | 104.37 | -19.62 | 90.38 |
| 6(3) | 5.60 | 2.10 | 13.40 | -0.30 | 4.70 | -13.90 | 17.20 | 22.80 | -4.60 | 36.00 | -14.70 | -10.20 | 9.35 | 133.74 | -9.42 | 119.84 |
| 7(1) | 5.60 | 2.10 | 13.40 | -0.30 | 4.70 | -13.90 | 17.20 | 22.80 | -4.60 | 36.00 | -14.70 | -10.20 | 9.35 | 133.74 | -9.42 | 119.84 |
| 7(2) | 8.40 | 3.20 | 13.40 | 3.40 | 5.50 | -13.90 | 20.10 | 24.20 | -2.90 | 36.00 | -9.50 | -10.20 | 30.00 | 150.96 | 11.23 | 137.06 |
| 7(3) | 11.20 | 4.30 | 13.40 | 7.10 | 6.30 | -13.99 | 23.00 | 27.30 | -2.90 | 42.00 | -9.50 | -10.20 | 40.17 | 179.87 | 21.29 | 165.88 |
| 8(1) | 11.20 | 4.30 | 13.40 | 7.10 | 6.30 | -13.99 | 23.00 | 27.30 | -2.90 | 42.00 | -9.50 | -10.20 | 40.17 | 179.87 | 21.29 | 165.88 |
| 8(2) | 14.10 | 5.40 | 13.40 | 10.80 | 7.10 | -13.99 | 25.90 | 29.30 | -1.80 | 42.00 | -4.80 | -10.20 | 59.13 | 198.26 | 40.25 | 184.27 |
| 8(3) | 16.90 | 6.40 | 13.40 | 14.50 | 7.90 | -13.90 | 28.80 | 32.30 | -1.80 | 47.60 | -4.80 | -10.20 | 69.21 | 226.28 | 50.44 | 212.37 |
| 9(1) | 16.90 | 6.40 | 13.40 | 14.50 | 7.90 | -13.90 | 28.80 | 32.30 | -1.80 | 47.60 | -4.80 | -10.20 | 69.21 | 226.28 | 50.44 | 212.37 |
| 9(2) | 19.70 | 7.50 | 13.40 | 18.20 | 8.70 | -13.90 | 31.70 | 34.80 | -1.20 | 47.60 | -1.50 | -10.20 | 85.23 | 245.28 | 66.46 | 231.38 |
| 9(3) | 22.50 | 8.60 | 13.40 | 21.90 | 9.50 | -13.90 | 34.50 | 37.90 | -1.20 | 52.50 | -1.50 | -10.20 | 95.31 | 272.40 | 76.54 | 258.50 |
| 10(1) | 22.50 | 8.60 | 13.40 | 21.90 | 9.50 | -13.90 | 34.50 | 37.90 | -1.20 | 52.50 | -1.50 | -10.20 | 95.31 | 272.40 | 76.54 | 258.50 |
| 10(2) | 25.30 | 9.70 | 13.40 | 25.60 | 10.30 | -13.90 | 37.40 | 40.80 | -1.00 | 52.50 | -1.50 | -10.20 | 105.78 | 292.01 | 87.01 | 278.10 |
| 10(3) | 28.10 | 10.70 | 13.40 | 29.40 | 11.10 | -13.90 | 40.30 | 43.90 | -1.00 | 56.90 | -1.50 | -10.20 | 115.95 | 318.51 | 97.18 | 304.61 |

***CORTANTES LONGITUDINALES***

| BARR | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Hip.pret. | Red.ppviga | Redpplosa | Redpret+perd | Red.total | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | BARR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | -28.10 | -10.70 | -13.40 | -29.40 | -11.10 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -40.30 | 1.00 | -43.90 | 1.50 | -56.90 | 10.20 | 21(1) |
| 21(2) | -25.30 | -9.70 | -13.40 | -25.60 | -10.30 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -37.40 | 1.00 | -40.80 | 1.50 | -52.50 | 10.20 | 21(2) |
| 21(3) | -22.50 | -8.60 | -13.40 | -21.90 | -9.50 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -34.50 | 1.20 | -37.90 | 1.50 | -52.50 | 10.20 | 21(3) |
| 22(1) | -22.50 | -8.60 | -13.40 | -21.90 | -9.50 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -34.50 | 1.20 | -37.90 | 1.50 | -52.50 | 10.20 | 22(1) |
| 22(2) | -19.70 | -7.50 | -13.40 | -18.20 | -8.70 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -31.70 | 1.20 | -34.80 | 1.50 | -47.60 | 10.20 | 22(2) |
| 22(3) | -16.90 | -6.40 | -13.40 | -14.50 | -7.90 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -28.80 | 1.80 | -32.30 | 4.80 | -47.60 | 10.20 | 22(3) |
| 23(1) | -16.90 | -6.40 | -13.40 | -14.50 | -7.90 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -28.80 | 1.80 | -32.30 | 4.80 | -47.60 | 10.20 | 23(1) |
| 23(2) | -14.10 | -5.40 | -13.40 | -10.80 | -7.10 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | -25.90 | 1.80 | -29.30 | 4.80 | -42.00 | 10.20 | 23(2) |
| 23(3) | -11.20 | -4.30 | -13.40 | -7.10 | -6.30 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | -23.00 | 2.90 | -27.30 | 9.50 | -42.00 | 10.20 | 23(3) |
| 24(1) | -11.20 | -4.30 | -13.40 | -7.10 | -6.30 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | -23.00 | 2.90 | -27.30 | 9.50 | -42.00 | 10.20 | 24(1) |
| 24(2) | -8.40 | -3.20 | -13.40 | -3.40 | -5.50 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -20.10 | 2.90 | -24.20 | 9.50 | -36.00 | 10.20 | 24(2) |
| 24(3) | -5.60 | -2.10 | -13.40 | 0.30 | -4.70 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -17.20 | 4.60 | -22.80 | 14.70 | -36.00 | 10.20 | 24(3) |
| 25(1) | -5.60 | -2.10 | -13.40 | 0.30 | -4.70 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -17.20 | 4.60 | -22.80 | 14.70 | -36.00 | 10.20 | 25(1) |
| 25(2) | -2.80 | -1.10 | -9.70 | 0.30 | -3.90 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | -14.30 | 4.60 | -19.70 | 14.70 | -29.60 | 10.20 | 25(2) |
| 25(3) | 0.00 | 0.00 | -5.90 | 0.30 | -3.10 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -11.40 | 6.90 | -18.90 | 20.50 | -29.60 | 10.20 | 25(3) |
| 26(1) | 0.00 | 0.00 | -5.90 | 0.30 | -3.10 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -11.40 | 6.90 | -18.90 | 20.50 | -29.60 | 10.20 | 26(1) |
| 26(2) | 2.80 | 1.10 | -2.20 | 0.30 | -2.30 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | -8.50 | 6.90 | -15.90 | 20.50 | -22.90 | 10.20 | 26(2) |
| 26(3) | 5.60 | 2.10 | 1.50 | 0.30 | -1.50 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | -5.60 | 9.80 | -15.70 | 26.70 | -22.90 | 10.20 | 26(3) |
| 27(1) | 5.60 | 2.10 | 1.50 | 0.30 | -1.50 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | -5.60 | 9.80 | -15.70 | 26.70 | -22.90 | 10.20 | 27(1) |
| 27(2) | 8.40 | 3.20 | 5.20 | 0.30 | -0.70 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | -2.70 | 10.30 | -13.10 | 26.70 | -15.90 | 10.20 | 27(2) |
| 27(3) | 11.20 | 4.30 | 8.90 | 0.30 | 0.10 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | 0.20 | 13.40 | -13.10 | 33.20 | -15.90 | 10.20 | 27(3) |
| 28(1) | 11.20 | 4.30 | 8.90 | 0.30 | 0.10 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | 0.20 | 13.40 | -13.10 | 33.20 | -15.90 | 10.20 | 28(1) |
| 28(2) | 14.10 | 5.40 | 12.60 | 0.30 | 0.90 | 55.60 | -9.44 | -11.14 | 34.47 | 13.90 | 3.10 | 14.60 | -11.30 | 33.20 | -9.40 | 10.20 | 28(2) |
| 28(3) | 16.90 | 6.40 | 16.30 | 0.30 | 1.70 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | 6.00 | 17.70 | -11.30 | 40.00 | -9.40 | 10.20 | 28(3) |
| 29(1) | 16.90 | 6.40 | 16.30 | 0.30 | 1.70 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | 6.00 | 17.70 | -11.30 | 40.00 | -9.40 | 10.20 | 29(1) |
| 29(2) | 19.70 | 7.50 | 20.00 | 0.30 | 2.50 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | 8.90 | 19.70 | -10.20 | 40.00 | -9.40 | 10.20 | 29(2) |
| 29(3) | 22.50 | 8.60 | 23.80 | 0.30 | 3.30 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | 11.80 | 22.80 | -10.20 | 47.10 | -9.40 | 10.20 | 29(3) |
| 30(1) | 22.50 | 8.60 | 23.80 | 0.30 | 3.30 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | 11.80 | 22.80 | -10.20 | 47.10 | -9.40 | 10.20 | 30(1) |
| 30(2) | 25.30 | 9.70 | 27.50 | 0.30 | 4.10 | 55.60 | -9.35 | -11.22 | 34.47 | 13.90 | 14.70 | 25.50 | -9.80 | 47.10 | -9.40 | 10.20 | 30(2) |
| 30(3) | 28.10 | 10.70 | 31.20 | 0.30 | 4.90 | 55.60 | -9.35 | -11.14 | 34.47 | 13.99 | 17.60 | 28.50 | -9.80 | 54.30 | -9.40 | 10.20 | 30(3) |

*CORTANTES CARACTERÍSTICOS*

*CORTANTES DE CÁLCULO*

| BARRA | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Redistr. | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | T=0 Vd- | T=0 Vd+ | T=INF Vd- | T=INF Vd+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21(1) | -28.10 | -10.70 | -13.40 | -29.40 | -11.10 | 13.90 | -40.30 | 1.00 | -43.90 | 1.50 | -56.90 | 10.20 | -330.75 | -103.71 | -316.85 | -84.94 |
| 21(2) | -25.30 | -9.70 | -13.40 | -25.60 | -10.30 | 13.90 | -37.40 | 1.00 | -40.80 | 1.50 | -52.50 | 10.20 | -304.25 | -93.54 | -290.34 | -74.77 |
| 21(3) | -22.50 | -8.60 | -13.40 | -21.90 | -9.50 | 13.90 | -34.50 | 1.20 | -37.90 | 1.50 | -52.50 | 10.20 | -284.64 | -83.07 | -270.74 | -64.30 |
| 22(1) | -22.50 | -8.60 | -13.40 | -21.90 | -9.50 | 13.90 | -34.50 | 1.20 | -37.90 | 1.50 | -52.50 | 10.20 | -284.64 | -83.07 | -270.74 | -64.30 |
| 22(2) | -19.70 | -7.50 | -13.40 | -18.20 | -8.70 | 13.90 | -31.70 | 1.20 | -34.80 | 1.50 | -47.60 | 10.20 | -257.52 | -72.99 | -243.62 | -54.22 |
| 22(3) | -16.90 | -6.40 | -13.40 | -14.50 | -7.90 | 13.90 | -28.80 | 1.80 | -32.30 | 4.80 | -47.60 | 10.20 | -238.52 | -56.97 | -224.61 | -38.20 |
| 23(1) | -16.90 | -6.40 | -13.40 | -14.50 | -7.90 | 13.90 | -28.80 | 1.80 | -32.30 | 4.80 | -47.60 | 10.20 | -238.52 | -56.97 | -224.61 | -38.20 |
| 23(2) | -14.10 | -5.40 | -13.40 | -10.80 | -7.10 | 13.99 | -25.90 | 1.80 | -29.30 | 4.80 | -42.00 | 10.20 | -210.50 | -46.89 | -196.51 | -28.01 |
| 23(3) | -11.20 | -4.30 | -13.40 | -7.10 | -6.30 | 13.99 | -23.00 | 2.90 | -27.30 | 9.50 | -42.00 | 10.20 | -192.11 | -27.93 | -178.12 | -9.05 |
| 24(1) | -11.20 | -4.30 | -13.40 | -7.10 | -6.30 | 13.99 | -23.00 | 2.90 | -27.30 | 9.50 | -42.00 | 10.20 | -192.11 | -27.93 | -178.12 | -9.05 |
| 24(2) | -8.40 | -3.20 | -13.40 | -3.40 | -5.50 | 13.90 | -20.10 | 2.90 | -24.20 | 9.50 | -36.00 | 10.20 | -163.20 | -17.76 | -149.30 | 1.01 |
| 24(3) | -5.60 | -2.10 | -13.40 | 0.30 | -4.70 | 13.90 | -17.20 | 4.60 | -22.80 | 14.70 | -36.00 | 10.20 | -145.98 | 2.89 | -132.08 | 21.66 |
| 25(1) | -5.60 | -2.10 | -13.40 | 0.30 | -4.70 | 13.90 | -17.20 | 4.60 | -22.80 | 14.70 | -36.00 | 10.20 | -145.98 | 2.89 | -132.08 | 21.66 |
| 25(2) | -2.80 | -1.10 | -9.70 | 0.30 | -3.90 | 13.99 | -14.30 | 4.60 | -19.70 | 14.70 | -29.60 | 10.20 | -116.61 | 12.98 | -102.62 | 31.86 |
| 25(3) | 0.00 | 0.00 | -5.90 | 0.30 | -3.10 | 13.90 | -11.40 | 6.90 | -18.90 | 20.50 | -29.60 | 10.20 | -100.02 | 35.39 | -86.12 | 54.15 |
| 26(1) | 0.00 | 0.00 | -5.90 | 0.30 | -3.10 | 13.90 | -11.40 | 6.90 | -18.90 | 20.50 | -29.60 | 10.20 | -100.02 | 35.39 | -86.12 | 54.15 |
| 26(2) | 2.80 | 1.10 | -2.20 | 0.30 | -2.30 | 13.90 | -8.50 | 6.90 | -15.90 | 20.50 | -22.90 | 10.20 | -71.97 | 47.31 | -58.07 | 66.08 |
| 26(3) | 5.60 | 2.10 | 1.50 | 0.30 | -1.50 | 13.99 | -5.60 | 9.80 | -15.70 | 26.70 | -22.90 | 10.20 | -58.94 | 73.43 | -44.95 | 92.31 |
| 27(1) | 5.60 | 2.10 | 1.50 | 0.30 | -1.50 | 13.99 | -5.60 | 9.80 | -15.70 | 26.70 | -22.90 | 10.20 | -58.94 | 73.43 | -44.95 | 92.31 |
| 27(2) | 8.40 | 3.20 | 5.20 | 0.30 | -0.70 | 13.99 | -2.70 | 10.30 | -13.10 | 26.70 | -15.90 | 10.20 | -32.70 | 87.77 | -18.71 | 106.65 |
| 27(3) | 11.20 | 4.30 | 8.90 | 0.30 | 0.10 | 13.99 | 0.20 | 13.40 | -13.10 | 33.20 | -15.90 | 10.20 | -21.00 | 115.89 | -7.01 | 134.77 |
| 28(1) | 11.20 | 4.30 | 8.90 | 0.30 | 0.10 | 13.99 | 0.20 | 13.40 | -13.10 | 33.20 | -15.90 | 10.20 | -21.00 | 115.89 | -7.01 | 134.77 |
| 28(2) | 14.10 | 5.40 | 12.60 | 0.30 | 0.90 | 13.90 | 3.10 | 14.60 | -11.30 | 33.20 | -9.40 | 10.20 | 1.71 | 133.08 | 15.61 | 151.85 |
| 28(3) | 16.90 | 6.40 | 16.30 | 0.30 | 1.70 | 13.99 | 6.00 | 17.70 | -11.30 | 40.00 | -9.40 | 10.20 | 11.79 | 163.05 | 25.78 | 181.93 |
| 29(1) | 16.90 | 6.40 | 16.30 | 0.30 | 1.70 | 13.99 | 6.00 | 17.70 | -11.30 | 40.00 | -9.40 | 10.20 | 11.79 | 163.05 | 25.78 | 181.93 |
| 29(2) | 19.70 | 7.50 | 20.00 | 0.30 | 2.50 | 13.99 | 8.90 | 19.70 | -10.20 | 40.00 | -9.40 | 10.20 | 23.61 | 181.31 | 37.60 | 200.19 |
| 29(3) | 22.50 | 8.60 | 23.80 | 0.30 | 3.30 | 13.90 | 11.80 | 22.80 | -10.20 | 47.10 | -9.40 | 10.20 | 33.87 | 212.00 | 47.77 | 230.76 |
| 30(1) | 22.50 | 8.60 | 23.80 | 0.30 | 3.30 | 13.90 | 11.80 | 22.80 | -10.20 | 47.10 | -9.40 | 10.20 | 33.87 | 212.00 | 47.77 | 230.76 |
| 30(2) | 25.30 | 9.70 | 27.50 | 0.30 | 4.10 | 13.90 | 14.70 | 25.50 | -9.80 | 47.10 | -9.40 | 10.20 | 44.64 | 231.30 | 58.54 | 250.07 |
| 30(3) | 28.10 | 10.70 | 31.20 | 0.30 | 4.90 | 13.99 | 17.60 | 28.50 | -9.80 | 54.30 | -9.40 | 10.20 | 54.72 | 261.72 | 68.71 | 280.60 |

*CORTANTES CARACTERÍSTICOS*

*CORTANTES DE CÁLCULO*

| BARRA | Fase 1 | Fase 2 | Fase 3 | Fase 5 | Fase 6 | Redistr. | cm | scu(pos) | scu(neg) | vp(pos) | vp(neg) | gradiente | T=0 Vd- | T=0 Vd+ | T=INF Vd- | T=INF Vd+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11(1) | -46.00 | -17.60 | -24.30 | -36.40 | -13.10 | -0.08 | -47.40 | 2.60 | -53.00 | 3.80 | -58.10 | 0.00 | -416.13 | -156.72 | -416.24 | -156.81 |
| 11(2) | -41.40 | -15.80 | -24.30 | -30.40 | -11.80 | 0.00 | -42.70 | 2.60 | -47.90 | 3.80 | -55.90 | 0.00 | -380.34 | -140.16 | -380.34 | -140.16 |
| 11(3) | -36.80 | -14.10 | -24.30 | -24.30 | -10.50 | 0.00 | -38.00 | 2.90 | -43.20 | 3.80 | -53.50 | 0.00 | -344.85 | -123.15 | -344.85 | -123.15 |
| 12(1) | -36.80 | -14.10 | -24.30 | -24.30 | -10.50 | 0.00 | -38.00 | 2.90 | -43.20 | 3.80 | -53.50 | 0.00 | -344.85 | -123.15 | -344.85 | -123.15 |
| 12(2) | -32.20 | -12.30 | -24.30 | -18.20 | -9.20 | 0.00 | -33.20 | 2.90 | -38.20 | 4.10 | -50.60 | 0.00 | -307.89 | -105.96 | -307.89 | -105.96 |
| 12(3) | -27.60 | -10.50 | -24.30 | -12.10 | -7.90 | -0.09 | -28.50 | 4.00 | -34.30 | 6.70 | -47.60 | 0.00 | -272.57 | -83.76 | -272.68 | -83.85 |
| 13(1) | -27.60 | -10.50 | -24.30 | -12.10 | -7.90 | -0.09 | -28.50 | 4.00 | -34.30 | 6.70 | -47.60 | 0.00 | -272.57 | -83.76 | -272.68 | -83.85 |
| 13(2) | -23.00 | -8.80 | -24.30 | -6.10 | -6.60 | 0.09 | -23.70 | 4.00 | -29.20 | 9.40 | -44.30 | 0.00 | -235.13 | -63.15 | -235.04 | -63.04 |
| 13(3) | -18.40 | -7.00 | -24.30 | 0.00 | -5.20 | -0.09 | -19.00 | 6.10 | -26.30 | 12.60 | -41.00 | 0.00 | -200.72 | -38.46 | -200.83 | -38.55 |
| 14(1) | -18.40 | -7.00 | -24.30 | 0.00 | -5.20 | -0.09 | -19.00 | 6.10 | -26.30 | 12.60 | -41.00 | 0.00 | -200.72 | -38.46 | -200.83 | -38.55 |
| 14(2) | -13.80 | -5.30 | -18.20 | 0.00 | -3.90 | 0.00 | -14.20 | 6.10 | -21.20 | 15.70 | -37.30 | 0.00 | -162.54 | -17.16 | -162.54 | -17.16 |
| 14(3) | -9.20 | -3.50 | -12.10 | 0.00 | -2.60 | -0.09 | -9.50 | 9.30 | -19.40 | 19.30 | -33.80 | 0.00 | -129.62 | 9.69 | -129.73 | 9.61 |
| 15(1) | -9.20 | -3.50 | -12.10 | 0.00 | -2.60 | -0.09 | -9.50 | 9.30 | -19.40 | 19.30 | -33.80 | 0.00 | -129.62 | 9.69 | -129.73 | 9.61 |
| 15(2) | -4.60 | -1.80 | -6.10 | 0.00 | -1.30 | 0.08 | -4.70 | 9.30 | -14.40 | 22.70 | -30.00 | 0.00 | -91.58 | 31.35 | -91.49 | 31.46 |
| 15(3) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.80 | -13.80 | 26.50 | -26.50 | 0.00 | -60.45 | 60.45 | -60.45 | 60.45 |
| 16(1) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.80 | -13.80 | 26.50 | -26.50 | 0.00 | -60.45 | 60.45 | -60.45 | 60.45 |
| 16(2) | 4.60 | 1.80 | 6.10 | 0.00 | 1.30 | -0.08 | 4.70 | 14.40 | -9.30 | 30.00 | -22.70 | 0.00 | -31.35 | 91.58 | -31.46 | 91.49 |
| 16(3) | 9.20 | 3.50 | 12.10 | 0.00 | 2.60 | 0.09 | 9.50 | 19.40 | -9.30 | 33.80 | -19.30 | 0.00 | -9.69 | 129.62 | -9.61 | 129.73 |
| 17(1) | 9.20 | 3.50 | 12.10 | 0.00 | 2.60 | 0.09 | 9.50 | 19.40 | -9.30 | 33.80 | -19.30 | 0.00 | -9.69 | 129.62 | -9.61 | 129.73 |
| 17(2) | 13.80 | 5.30 | 18.20 | 0.00 | 3.90 | 0.00 | 14.20 | 21.20 | -6.10 | 37.30 | -15.70 | 0.00 | 17.16 | 162.54 | 17.16 | 162.54 |
| 17(3) | 18.40 | 7.00 | 24.30 | 0.00 | 5.20 | 0.09 | 19.00 | 26.30 | -6.10 | 41.00 | -12.60 | 0.00 | 38.46 | 200.72 | 38.55 | 200.83 |
| 18(1) | 18.40 | 7.00 | 24.30 | 0.00 | 5.20 | 0.09 | 19.00 | 26.30 | -6.10 | 41.00 | -12.60 | 0.00 | 38.46 | 200.72 | 38.55 | 200.83 |
| 18(2) | 23.00 | 8.80 | 24.30 | 6.10 | 6.60 | -0.09 | 23.70 | 29.20 | -4.00 | 44.30 | -9.40 | 0.00 | 63.15 | 235.13 | 63.04 | 235.04 |
| 18(3) | 27.60 | 10.50 | 24.30 | 12.10 | 7.90 | 0.09 | 28.50 | 34.30 | -4.00 | 47.60 | -6.70 | 0.00 | 83.76 | 272.57 | 83.85 | 272.68 |
| 19(1) | 27.60 | 10.50 | 24.30 | 12.10 | 7.90 | 0.09 | 28.50 | 34.30 | -4.00 | 47.60 | -6.70 | 0.00 | 83.76 | 272.57 | 83.85 | 272.68 |
| 19(2) | 32.20 | 12.30 | 24.30 | 18.20 | 9.20 | 0.00 | 33.20 | 38.20 | -2.90 | 50.60 | -4.10 | 0.00 | 105.96 | 307.89 | 105.96 | 307.89 |
| 19(3) | 36.80 | 14.10 | 24.30 | 24.30 | 10.50 | 0.00 | 38.00 | 43.20 | -2.90 | 53.50 | -3.80 | 0.00 | 123.15 | 344.85 | 123.15 | 344.85 |
| 20(1) | 36.80 | 14.10 | 24.30 | 24.30 | 10.50 | 0.00 | 38.00 | 43.20 | -2.90 | 53.50 | -3.80 | 0.00 | 123.15 | 344.85 | 123.15 | 344.85 |
| 20(2) | 41.40 | 15.80 | 24.30 | 30.40 | 11.80 | 0.00 | 42.70 | 47.90 | -2.60 | 55.90 | -3.80 | 0.00 | 140.16 | 380.34 | 140.16 | 380.34 |
| 20(3) | 46.00 | 17.60 | 24.30 | 36.40 | 13.10 | 0.08 | 47.40 | 53.00 | -2.60 | 58.10 | -3.80 | 0.00 | 156.72 | 416.13 | 156.81 | 416.24 |

***SUB.XV AVE MADRID-BARCELONA / E-1505.0***

| ***TORSORES SOBRE ESTRUCTURA IDEAL*** | | | | | | Vdmax-Tdconc | | Tdmax-Vdconc | |
|---|---|---|---|---|---|---|---|---|---|
| BARRA | **X(m)** | $T_{SCU}$ | $T_{VP}$ | $Td_{SCU}$ | $Td_{VP}$ | Vd | Td | Vd | Td |
| 1(1) | **0.00** | 49.38 | 90.00 | 74.07 | 135.00 | 268.36 | 135.00 | 246.99 | 139.38 |
| 1(2) | 0.95 | 48.80 | 88.76 | 73.20 | 133.14 | 237.83 | 133.14 | 218.70 | 137.56 |
| 1(3) | 1.90 | 48.22 | 87.52 | 72.33 | 131.29 | 218.52 | 131.29 | 201.42 | 135.75 |
| 2(1) | 1.90 | 48.22 | 87.52 | 72.33 | 131.29 | 218.52 | 131.29 | 201.42 | 135.75 |
| 2(2) | 2.85 | 47.64 | 86.29 | 71.46 | 129.43 | 187.95 | 129.43 | 173.17 | 133.93 |
| 2(3) | 3.80 | 47.06 | 85.05 | 70.60 | 127.57 | 169.69 | 127.57 | 156.42 | 132.11 |
| 3(1) | 3.80 | 47.06 | 85.05 | 70.60 | 127.57 | 169.69 | 127.57 | 156.42 | 132.11 |
| 3(2) | 4.75 | 46.48 | 83.81 | 69.73 | 125.71 | 139.61 | 125.71 | 128.66 | 130.29 |
| 3(3) | 5.70 | 45.91 | 82.57 | 68.86 | 123.86 | 122.53 | 123.86 | 112.48 | 128.48 |
| 4(1) | 5.70 | 45.91 | 82.57 | 68.86 | 123.86 | 122.53 | 123.86 | 112.48 | 128.48 |
| 4(2) | 6.65 | 45.33 | 81.33 | 67.99 | 122.00 | 94.41 | 122.00 | 86.68 | 126.66 |
| 4(3) | 7.60 | 44.75 | 80.10 | 67.12 | 120.14 | 80.07 | 120.14 | 72.72 | 124.84 |
| 5(1) | 7.60 | 44.75 | 80.10 | 67.12 | 120.14 | 80.07 | 120.14 | 72.72 | 124.84 |
| 5(2) | 8.55 | 44.17 | 78.86 | 66.25 | 118.29 | 59.73 | 118.29 | 48.66 | 123.03 |
| 5(3) | 9.50 | 43.59 | 77.62 | 65.38 | 116.43 | 87.78 | 116.43 | 73.61 | 121.21 |
| 6(1) | 9.50 | 43.59 | 77.62 | 65.38 | 116.43 | 87.78 | 116.43 | 73.61 | 121.21 |
| 6(2) | 10.45 | 43.01 | 76.38 | 64.51 | 114.57 | 104.37 | 114.57 | 89.60 | 119.39 |
| 6(3) | 11.40 | 42.43 | 75.14 | 63.65 | 112.72 | 133.74 | 112.72 | 116.64 | 117.57 |
| 7(1) | 11.40 | 42.43 | 75.14 | 63.65 | 112.72 | 133.74 | 112.72 | 116.64 | 117.57 |
| 7(2) | 12.35 | 41.85 | 73.91 | 62.78 | 110.86 | 150.96 | 110.86 | 132.81 | 115.76 |
| 7(3) | 13.30 | 41.27 | 72.67 | 61.91 | 109.00 | 179.87 | 109.00 | 159.39 | 113.94 |
| 8(1) | 13.30 | 41.27 | 72.67 | 61.91 | 109.00 | 179.87 | 109.00 | 159.39 | 113.94 |
| 8(2) | 14.25 | 40.69 | 71.43 | 61.04 | 107.14 | 198.26 | 107.14 | 176.28 | 112.12 |
| 8(3) | 15.20 | 40.11 | 70.19 | 60.17 | 105.29 | 226.28 | 105.29 | 202.05 | 110.31 |
| 9(1) | 15.20 | 40.11 | 70.19 | 60.17 | 105.29 | 226.28 | 105.29 | 202.05 | 110.31 |
| 9(2) | 16.15 | 39.53 | 68.95 | 59.30 | 103.43 | 245.28 | 103.43 | 219.18 | 108.49 |
| 9(3) | 17.10 | 38.96 | 67.72 | 58.43 | 101.57 | 272.40 | 101.57 | 243.98 | 106.67 |
| 10(1) | 17.10 | 38.96 | 67.72 | 58.43 | 101.57 | 272.40 | 101.57 | 243.98 | 106.67 |
| 10(2) | 18.05 | 38.38 | 66.48 | 57.57 | 99.72 | 292.01 | 99.72 | 261.41 | 104.85 |
| 10(3) | 19.00 | 37.80 | 65.24 | 56.70 | 97.86 | 318.51 | 97.86 | 285.59 | 103.04 |

| ***TORSORES SOBRE ESTRUCTURA IDEAL*** | | | | | | Vdmax-Tdconc | | Tdmax-Vdconc | |
|---|---|---|---|---|---|---|---|---|---|
| BARRA | **X(m)** | $T_{SCU}$ | $T_{VP}$ | $Td_{SCU}$ | $Td_{VP}$ | Vd | Td | Vd | Td |
| 11(1) | 19.00 | 37.80 | 65.24 | 56.70 | 97.86 | 416.24 | 97.86 | 376.49 | 103.04 |
| 11(2) | 20.55 | 36.85 | 63.21 | 55.27 | 94.82 | 380.34 | 94.82 | 344.42 | 100.06 |
| 11(3) | 22.11 | 35.90 | 61.19 | 53.85 | 91.78 | 344.85 | 91.78 | 312.45 | 97.09 |
| 12(1) | 22.11 | 35.90 | 61.19 | 53.85 | 91.78 | 344.85 | 91.78 | 312.45 | 97.09 |
| 12(2) | 23.66 | 34.95 | 59.16 | 52.43 | 88.74 | 307.89 | 88.74 | 279.24 | 94.12 |
| 12(3) | 25.22 | 34.01 | 57.14 | 51.01 | 85.70 | 272.68 | 85.70 | 246.95 | 91.14 |
| 13(1) | 25.22 | 34.01 | 57.14 | 51.01 | 85.70 | 272.68 | 85.70 | 246.95 | 91.14 |
| 13(2) | 26.77 | 33.06 | 55.11 | 49.59 | 82.67 | 235.13 | 82.67 | 213.23 | 88.17 |
| 13(3) | 28.33 | 32.11 | 53.08 | 48.17 | 79.63 | 200.83 | 79.63 | 181.10 | 85.20 |
| 14(1) | 28.33 | 32.11 | 53.08 | 48.17 | 79.63 | 200.83 | 79.63 | 181.10 | 85.20 |
| 14(2) | 29.88 | 31.16 | 51.06 | 46.75 | 76.59 | 162.54 | 76.59 | 146.64 | 82.22 |
| 14(3) | 31.44 | 30.22 | 49.03 | 45.32 | 73.55 | 129.73 | 73.55 | 115.18 | 79.25 |
| 15(1) | 31.44 | 30.22 | 49.03 | 45.32 | 73.55 | 129.73 | 73.55 | 115.18 | 79.25 |
| 15(2) | 32.99 | 29.27 | 47.01 | 43.90 | 70.51 | 91.58 | 70.51 | 80.78 | 76.28 |
| 15(3) | 34.55 | 28.32 | 44.98 | 42.48 | 67.47 | 60.45 | 67.47 | 50.10 | 73.30 |
| 16(1) | 34.55 | -28.32 | -44.98 | -42.48 | -67.47 | 60.45 | 67.47 | 50.10 | 73.30 |
| 16(2) | 36.10 | -28.90 | -46.22 | -43.35 | -69.33 | 91.58 | 69.33 | 80.78 | 75.12 |
| 16(3) | 37.65 | -29.48 | -47.46 | -44.22 | -71.18 | 129.73 | 71.18 | 115.18 | 76.93 |
| 17(1) | 37.65 | -29.48 | -47.46 | -44.22 | -71.18 | 129.73 | 71.18 | 115.18 | 76.93 |
| 17(2) | 39.21 | -30.06 | -48.69 | -45.09 | -73.04 | 162.54 | 73.04 | 146.64 | 78.75 |
| 17(3) | 40.76 | -30.64 | -49.93 | -45.95 | -74.90 | 200.83 | 74.90 | 181.10 | 80.57 |
| 18(1) | 40.76 | -30.64 | -49.93 | -45.95 | -74.90 | 200.83 | 74.90 | 181.10 | 80.57 |
| 18(2) | 42.32 | -31.22 | -51.17 | -46.82 | -76.76 | 235.13 | 76.76 | 213.23 | 82.39 |
| 18(3) | 43.87 | -31.79 | -52.41 | -47.69 | -78.61 | 272.68 | 78.61 | 246.95 | 84.20 |
| 19(1) | 43.87 | -31.79 | -52.41 | -47.69 | -78.61 | 272.68 | 78.61 | 246.95 | 84.20 |
| 19(2) | 45.43 | -32.37 | -53.65 | -48.56 | -80.47 | 307.89 | 80.47 | 279.24 | 86.02 |
| 19(3) | 46.98 | -32.95 | -54.88 | -49.43 | -82.33 | 344.85 | 82.33 | 312.45 | 87.84 |
| 20(1) | 46.98 | -32.95 | -54.88 | -49.43 | -82.33 | 344.85 | 82.33 | 312.45 | 87.84 |
| 20(2) | 48.54 | -33.53 | -56.12 | -50.30 | -84.18 | 380.34 | 84.18 | 344.42 | 89.65 |
| 20(3) | 50.09 | -34.11 | -57.36 | -51.17 | -86.04 | 416.24 | 86.04 | 376.49 | 91.47 |

## CARACTERISTICAS DE LAS SECCIONES TIPO

### SECCIONES TIPO

| | | TEM | TE | T | TP | TPM | CA | CME | CMP |
|---|---|---|---|---|---|---|---|---|---|
| Canto | (m.) | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.15 | 1.15 | 1.15 |
| z | (m.) | 1.215 | 1.215 | 1.215 | 1.148 | 1.148 | 0.990 | 0.990 | 0.990 |
| fck viga | (kp/cm2.) | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| fck losa | (kp/cm2.) | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| Ae | (m2.) | 4.074 | 4.074 | 4.074 | 4.074 | 4.074 | 0.000 | 0.000 | 0.000 |
| Ue | (m) | 9.255 | 9.255 | 9.255 | 9.255 | 9.255 | 0.000 | 0.000 | 0.000 |
| Area | (m2.) | 4.145 | 2.669 | 2.834 | 2.565 | 5.534 | 1.156 | 2.633 | 2.387 |
| Inercia | (m2.) | 0.641 | 0.554 | 0.585 | 0.534 | 0.856 | 0.170 | 0.198 | 0.227 |
| ycdg | (m) | 0.650 | 0.608 | 0.602 | 0.613 | 0.544 | 0.750 | 0.736 | 0.731 |
| FIBRA 1 | ycdg | 0.880 | 0.880 | 0.880 | 0.880 | 0.880 | 0.880 | 0.880 | 0.880 |
| | bw,v(m.) | 0.200 | 0.200 | 0.200 | 0.200 | 0.200 | 0.000 | 0.000 | 0.000 |
| | Acosido/Atotal | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.000 | 0.000 | 0.000 |
| | bw,t(m.) | 0.200 | 0.200 | 0.200 | 0.200 | 0.200 | 0.000 | 0.000 | 0.000 |
| FIBRA 2 | ycdg | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.000 | 0.000 | 0.000 |
| | bw,v(m.) | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.000 | 0.000 | 0.000 |
| | Acosido/Atotal | 0.235 | 0.235 | 0.235 | 0.235 | 0.235 | 0.000 | 0.000 | 0.000 |
| | bw,t(m.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| FIBRA 3 | ycdg | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 | 0.000 | 0.000 | 0.000 |
| | bw,v(m.) | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.000 | 0.000 | 0.000 |
| | Acosido/Atotal | 0.290 | 0.290 | 0.290 | 0.290 | 0.290 | 0.000 | 0.000 | 0.000 |
| | bw,t(m.) | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.000 | 0.000 | 0.000 |
| FIBRA 4 | ycdg | 0.453 | 0.453 | 0.453 | 0.453 | 0.453 | 0.203 | 0.203 | 0.203 |
| | bw,v(m.) | 0.406 | 0.406 | 0.406 | 0.406 | 0.406 | 0.406 | 0.406 | 0.406 |
| | Acosido/Atotal | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.169 | 0.169 | 0.169 |
| | bw,t(m.) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| FIBRA 5 | ycdg | 1.310 | 1.310 | 1.310 | 1.310 | 1.310 | 0.000 | 0.000 | 0.000 |
| | bw,v(m.) | 0.180 | 0.180 | 0.180 | 0.180 | 0.180 | 0.000 | 0.000 | 0.000 |
| | Acosido/Atotal | 0.462 | 0.462 | 0.462 | 0.462 | 0.462 | 0.000 | 0.000 | 0.000 |
| | bw,t(m.) | 0.180 | 0.180 | 0.180 | 0.180 | 0.180 | 0.000 | 0.000 | 0.000 |

***TORSORES SOBRE ESTRUCTURA IDEAL***

| | | | | | | Vdmax-Tdconc | | Tdmax-Vdconc | |
|---|---|---|---|---|---|---|---|---|---|
| BARRA | X(m) | $T_{SCU}$ | $T_{VP}$ | $Td_{SCU}$ | $Td_{VP}$ | Vd | Td | Vd | Td |
| 21(1) | 50.09 | -34.11 | -57.36 | -51.17 | -86.04 | 330.75 | 86.04 | 297.83 | 91.47 |
| 21(2) | 51.04 | -34.69 | -58.60 | -52.04 | -87.90 | 304.25 | 87.90 | 273.65 | 93.29 |
| 21(3) | 51.99 | -35.27 | -59.84 | -52.90 | -89.75 | 284.64 | 89.75 | 256.22 | 95.11 |
| 22(1) | 51.99 | -35.27 | -59.84 | -52.90 | -89.75 | 284.64 | 89.75 | 256.22 | 95.11 |
| 22(2) | 52.94 | -35.85 | -61.07 | -53.77 | -91.61 | 257.52 | 91.61 | 231.42 | 96.92 |
| 22(3) | 53.89 | -36.43 | -62.31 | -54.64 | -93.47 | 238.52 | 93.47 | 214.29 | 98.74 |
| 23(1) | 53.89 | -36.43 | -62.31 | -54.64 | -93.47 | 238.52 | 93.47 | 214.29 | 98.74 |
| 23(2) | 54.84 | -37.01 | -63.55 | -55.51 | -95.33 | 210.50 | 95.33 | 188.52 | 100.56 |
| 23(3) | 55.79 | -37.59 | -64.79 | -56.38 | -97.18 | 192.11 | 97.18 | 171.63 | 102.37 |
| 24(1) | 55.79 | -37.59 | -64.79 | -56.38 | -97.18 | 192.11 | 97.18 | 171.63 | 102.37 |
| 24(2) | 56.74 | -38.17 | -66.03 | -57.25 | -99.04 | 163.20 | 99.04 | 145.05 | 104.19 |
| 24(3) | 57.69 | -38.74 | -67.26 | -58.12 | -100.90 | 145.98 | 100.90 | 128.88 | 106.01 |
| 25(1) | 57.69 | -38.74 | -67.26 | -58.12 | -100.90 | 145.98 | 100.90 | 128.88 | 106.01 |
| 25(2) | 58.64 | -39.32 | -68.50 | -58.98 | -102.75 | 116.61 | 102.75 | 101.84 | 107.83 |
| 25(3) | 59.59 | -39.90 | -69.74 | -59.85 | -104.61 | 100.02 | 104.61 | 85.85 | 109.64 |
| 26(1) | 59.59 | -39.90 | -69.74 | -59.85 | -104.61 | 100.02 | 104.61 | 85.85 | 109.64 |
| 26(2) | 60.54 | -40.85 | -71.77 | -61.28 | -107.65 | 71.97 | 107.65 | 60.90 | 112.62 |
| 26(3) | 61.49 | -41.80 | -73.79 | -62.70 | -110.69 | 92.31 | 110.69 | 84.96 | 115.59 |
| 27(1) | 61.49 | -41.80 | -73.79 | -62.70 | -110.69 | 92.31 | 110.69 | 84.96 | 115.59 |
| 27(2) | 62.44 | -42.75 | -75.82 | -64.12 | -113.73 | 106.65 | 113.73 | 98.92 | 118.56 |
| 27(3) | 63.39 | -43.69 | -77.84 | -65.54 | -116.77 | 134.77 | 116.77 | 124.72 | 121.54 |
| 28(1) | 63.39 | -43.69 | -77.84 | -65.54 | -116.77 | 134.77 | 116.77 | 124.72 | 121.54 |
| 28(2) | 64.34 | -44.64 | -79.87 | -66.96 | -119.80 | 151.85 | 119.80 | 140.90 | 124.51 |
| 28(3) | 65.29 | -45.59 | -81.90 | -68.38 | -122.84 | 181.93 | 122.84 | 168.66 | 127.48 |
| 29(1) | 65.29 | -45.59 | -81.90 | -68.38 | -122.84 | 181.93 | 122.84 | 168.66 | 127.48 |
| 29(2) | 66.24 | -46.54 | -83.92 | -69.80 | -125.88 | 200.19 | 125.88 | 185.41 | 130.46 |
| 29(3) | 67.19 | -47.48 | -85.95 | -71.23 | -128.92 | 230.76 | 128.92 | 213.66 | 133.43 |
| 30(1) | 67.19 | -47.48 | -85.95 | -71.23 | -128.92 | 230.76 | 128.92 | 213.66 | 133.43 |
| 30(2) | 68.14 | -48.43 | -87.97 | -72.65 | -131.96 | 250.07 | 131.96 | 230.94 | 136.40 |
| 30(3) | 69.09 | -49.38 | -90.00 | -74.07 | -135.00 | 280.60 | 135.00 | 259.23 | 139.38 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *13*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 201.42 | 135.75 | 596.74 | -225.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 745.92 | -389.45 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 11 | 0 48 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 469 | 2.00 | 0 18 | 0 00 | 0 18 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 426 | 2.00 | 0 22 | 0 10 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 920 | 1.00 | 0 38 | 0 12 | 0 50 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 52 82 | 0 77 | 15 29 | 4 17 | 34 77 | 3 57 | 19 45 |
| 2 | 0 00 | 0 00 | | 4 86 | 0 00 | | 2 23 | 4 86 |
| 3 | 0 00 | 0 00 | | 6 00 | 2 08 | | 2 23 | 8 09 |
| 4 | 0 00 | 0 00 | | 6 93 | 0 00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0 00 | | 19 14 | 4 17 | | 3 21 | 23 30 |

***BARRA*** *21*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 201.42 | 135.75 | 1,392.38 | -782.51 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 1,740.48 | -1,085.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 11 | 0 48 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 18 | 0 00 | 0 18 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 22 | 0 10 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 38 | 0 12 | 0 50 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 84 | 12 80 | 4 17 | 34 77 | 3 57 | 16 97 |
| 2 | 0 00 | 0 00 | | 4 86 | 0 00 | | 2 23 | 4 86 |
| 3 | 0 00 | 0 00 | | 6 00 | 2 08 | | 2 23 | 8 09 |
| 4 | 0 00 | 0 00 | | 6 93 | 0 00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0 00 | | 19 14 | 4 17 | | 3 21 | 23 30 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *11*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 246.99 | 139.38 | 0.00 | 0.00 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 70.00 | 0.00 | 0.00 | 76.28 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 46 | 0 11 | 0 57 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 27 | 0 11 | 0 37 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 47 | 0 12 | 0 59 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 34 71 | 0 69 | 21 84 | 4 28 | 35 70 | 3 57 | 26 12 |
| 2 | 0 00 | 0 00 | | 5 96 | 0 00 | | 2 23 | 5 96 |
| 3 | 0 00 | 0 00 | | 7 36 | 2 14 | | 2 23 | 9 50 |
| 4 | 0 00 | 0 00 | | 8 84 | 0 00 | | 6 90 | 8 84 |
| 5 | 0 00 | 0 00 | | 23 47 | 4 28 | | 3 21 | 27 75 |

***BARRA*** *12*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 218.70 | 137.56 | 596.74 | -311.96 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 62.50 | 0.00 | 745.92 | -452.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 41 | 0 11 | 0 52 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 450 | 2.00 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 408 | 2.00 | 0 23 | 0 11 | 0 34 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 751 | 1.00 | 0 42 | 0 12 | 0 53 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 46 37 | 0 74 | 17 73 | 4 22 | 35 23 | 3 57 | 21 95 |
| 2 | 0 00 | 0 00 | | 5 28 | 0 00 | | 2 23 | 5 28 |
| 3 | 0 00 | 0 00 | | 6 52 | 2 11 | | 2 23 | 8 63 |
| 4 | 0 00 | 0 00 | | 7 89 | 0 00 | | 6 90 | 7 89 |
| 5 | 0 00 | 0 00 | | 20 78 | 4 22 | | 3 21 | 25 00 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *31*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 156.42 | 132.11 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 29 | 0 11 | 0 40 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 011 | 2.00 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 926 | 2.00 | 0 17 | 0 10 | 0 27 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 452 | 1.00 | 0 30 | 0 11 | 0 41 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 91 | 8 17 | 4 05 | 33 84 | 3 57 | 12 23 |
| 2 | 0 00 | 0 00 | | 3 78 | 0 00 | | 2 23 | 3 78 |
| 3 | 0 00 | 0 00 | | 4 66 | 2 03 | | 2 23 | 6 69 |
| 4 | 0 00 | 0 00 | | 5 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 14 86 | 4 05 | | 3 21 | 18 92 |

***BARRA*** *32*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 128.66 | 130.29 | 1,392.38 | -638.96 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.10 | 0.00 | 1,740.48 | -943.54 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 24 | 0 11 | 0 34 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 947 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 867 | 2.00 | 0 14 | 0 10 | 0 24 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 554 | 1.00 | 0 24 | 0 11 | 0 36 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 96 | 5 57 | 4 00 | 33 37 | 3 57 | 9 57 |
| 2 | 0 00 | 0 00 | | 3 11 | 0 00 | | 2 23 | 3 11 |
| 3 | 0 00 | 0 00 | | 3 83 | 2 00 | | 2 23 | 5 83 |
| 4 | 0 00 | 0 00 | | 4 05 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 23 | 4 00 | | 3 21 | 16 22 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *22*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 173.17 | 133.93 | 1,392.38 | -715.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 47.20 | 0.00 | 1,740.48 | -1,030.81 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 32 | 0 11 | 0 43 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 039 | 2.00 | 0 15 | 0 00 | 0 15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 953 | 2.00 | 0 19 | 0 10 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 234 | 1.00 | 0 33 | 0 11 | 0 44 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin /cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 88 | 9 90 | 4 11 | 34 30 | 3 57 | 14 01 |
| 2 | 0 00 | 0 00 | | 4 18 | 0 00 | | 2 23 | 4 18 |
| 3 | 0 00 | 0 00 | | 5 16 | 2 05 | | 2 23 | 7 22 |
| 4 | 0 00 | 0 00 | | 5 96 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 16 45 | 4 11 | | 3 21 | 20 56 |

***BARRA*** *23*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 156.42 | 132.11 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 29 | 0 11 | 0 40 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 011 | 2.00 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 926 | 2.00 | 0 17 | 0 10 | 0 27 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 452 | 1.00 | 0 30 | 0 11 | 0 41 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 91 | 8 17 | 4 05 | 33 84 | 3 57 | 12 23 |
| 2 | 0 00 | 0 00 | | 3 78 | 0 00 | | 2 23 | 3 78 |
| 3 | 0 00 | 0 00 | | 4 66 | 2 03 | | 2 23 | 6 69 |
| 4 | 0 00 | 0 00 | | 5 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 14 86 | 4 05 | | 3 21 | 18 92 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *42*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 86.68 | 126.66 | 1,392.38 | -640.17 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 16.80 | 0.00 | 1,740.48 | -886.51 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 16 | 0 10 | 0 26 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 948 | 2.00 | 0 08 | 0 00 | 0 08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 868 | 2.00 | 0 09 | 0 10 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 551 | 1.00 | 0 16 | 0 11 | 0 27 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 13 | 1 25 | 3 89 | 32 44 | 3 57 | 5 14 |
| 2 | 0 00 | 0 00 | | 2 09 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 58 | 1 94 | | 2 23 | 4 53 |
| 4 | 0 00 | 0 00 | | 2 12 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 24 | 3 89 | | 3 21 | 12 12 |

***BARRA*** *43*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 72.72 | 124.84 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 13 | 0 10 | 0 24 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 965 | 2.00 | 0 06 | 0 00 | 0 06 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 884 | 2.00 | 0 08 | 0 10 | 0 17 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 465 | 1.00 | 0 14 | 0 11 | 0 24 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 23 | -0 18 | 3 83 | 31 98 | 3 57 | 3 65 |
| 2 | 0 00 | 0 00 | | 1 76 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 17 | 1 92 | | 2 23 | 4 08 |
| 4 | 0 00 | 0 00 | | 1 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 6 91 | 3 83 | | 3 21 | 10 74 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *33*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 112.48 | 128.48 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 21 | 0 11 | 0 31 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 12 | 0 10 | 0 22 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 21 | 0 11 | 0 32 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 01 | 3 91 | 3 94 | 32 91 | 3 57 | 7 85 |
| 2 | 0 00 | 0 00 | | 2 71 | 0 00 | | 2 23 | 2 71 |
| 3 | 0 00 | 0 00 | | 3 35 | 1 97 | | 2 23 | 5 32 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 10 69 | 3 94 | | 3 21 | 14 63 |

***BARRA*** *41*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 112.48 | 128.48 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 21 | 0 11 | 0 31 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 12 | 0 10 | 0 22 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 21 | 0 11 | 0 32 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 01 | 3 91 | 3 94 | 32 91 | 3 57 | 7 85 |
| 2 | 0 00 | 0 00 | | 2 71 | 0 00 | | 2 23 | 2 71 |
| 3 | 0 00 | 0 00 | | 3 35 | 1 97 | | 2 23 | 5 32 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 10 69 | 3 94 | | 3 21 | 14 63 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *53*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 73.61 | 121.21 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 14 | 0 10 | 0 24 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 030 | 2.00 | 0 06 | 0 00 | 0 06 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 945 | 2.00 | 0 08 | 0 09 | 0 17 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 14 | 0 10 | 0 24 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 22 | -0 09 | 3 72 | 31 05 | 3 57 | 3 63 |
| 2 | 0 00 | 0 00 | | 1 78 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 19 | 1 86 | | 2 23 | 4 05 |
| 4 | 0 00 | 0 00 | | 0 74 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 6 99 | 3 72 | | 3 21 | 10 71 |

***BARRA*** *61*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 73.61 | 121.21 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 14 | 0 10 | 0 24 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 030 | 2.00 | 0 06 | 0 00 | 0 06 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 945 | 2.00 | 0 08 | 0 09 | 0 17 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 14 | 0 10 | 0 24 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 22 | -0 09 | 3 72 | 31 05 | 3 57 | 3 63 |
| 2 | 0 00 | 0 00 | | 1 78 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 19 | 1 86 | | 2 23 | 4 05 |
| 4 | 0 00 | 0 00 | | 0 74 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 6 99 | 3 72 | | 3 21 | 10 71 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *51*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 72.72 | 124.84 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 13 | 0 10 | 0 24 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 965 | 2.00 | 0 06 | 0 00 | 0 06 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 884 | 2.00 | 0 08 | 0 10 | 0 17 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 465 | 1.00 | 0 14 | 0 11 | 0 24 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 23 | -0 18 | 3 83 | 31 98 | 3 57 | 3 65 |
| 2 | 0 00 | 0 00 | | 1 76 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 17 | 1 92 | | 2 23 | 4 08 |
| 4 | 0 00 | 0 00 | | 1 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 6 91 | 3 83 | | 3 21 | 10 74 |

***BARRA*** *52*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 48.66 | 123.03 | 1,392.38 | -718.48 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 1.70 | 0.00 | 1,740.48 | -859.72 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 09 | 0 10 | 0 19 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 992 | 2.00 | 0 04 | 0 00 | 0 04 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 909 | 2.00 | 0 05 | 0 09 | 0 15 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 267 | 1.00 | 0 09 | 0 10 | 0 20 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 54 | -2 66 | 3 77 | 31 51 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 17 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 1 45 | 1 89 | | 2 23 | 3 34 |
| 4 | 0 00 | 0 00 | | 0 21 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 4 62 | 3 77 | | 3 21 | 8 40 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *71*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 116.64 | 117.57 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -1,218.34 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 22 | 0 10 | 0 31 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 13 | 0 09 | 0 21 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 22 | 0 10 | 0 32 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 00 | 4 33 | 3 61 | 30 11 | 3 57 | 7 94 |
| 2 | 0 00 | 0 00 | | 2 82 | 0 00 | | 2 23 | 2 82 |
| 3 | 0 00 | 0 00 | | 3 48 | 1 80 | | 2 23 | 5 28 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 08 | 3 61 | | 3 21 | 14 69 |

***BARRA*** *72*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 132.81 | 115.76 | 1,392.38 | -1,123.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 25.00 | 0.00 | 1,740.48 | -1,152.28 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 25 | 0 09 | 0 34 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 209 | 2.00 | 0 12 | 0 00 | 0 12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 111 | 2.00 | 0 14 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 25 | 0 10 | 0 35 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 95 | 6 00 | 3 55 | 29 65 | 3 57 | 9 55 |
| 2 | 0 00 | 0 00 | | 3 21 | 0 00 | | 2 23 | 3 21 |
| 3 | 0 00 | 0 00 | | 3 96 | 1 78 | | 2 23 | 5 73 |
| 4 | 0 00 | 0 00 | | 3 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 62 | 3 55 | | 3 21 | 16 17 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *62*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 89.60 | 119.39 | 1,392.38 | -874.20 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 13.60 | 0.00 | 1,740.48 | -863.08 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 17 | 0 10 | 0 26 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 08 | 0 00 | 0 08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 10 | 0 09 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 17 | 0 10 | 0 27 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 11 | 1 55 | 3 66 | 30 58 | 3 57 | 5 22 |
| 2 | 0 00 | 0 00 | | 2 16 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 67 | 1 83 | | 2 23 | 4 50 |
| 4 | 0 00 | 0 00 | | 1 72 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 51 | 3 66 | | 3 21 | 12 18 |

***BARRA*** *63*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 116.64 | 117.57 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -876.07 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 22 | 0 10 | 0 31 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 13 | 0 09 | 0 21 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 22 | 0 10 | 0 32 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 74 51 | 1 00 | 4 33 | 3 61 | 30 11 | 3 57 | 7 94 |
| 2 | 0 00 | 0 00 | | 2 82 | 0 00 | | 2 23 | 2 82 |
| 3 | 0 00 | 0 00 | | 3 48 | 1 80 | | 2 23 | 5 28 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 08 | 3 61 | | 3 21 | 14 69 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *82*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 176.28 | 112.12 | 1,392.38 | -1,484.01 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.90 | 0.00 | 1,740.48 | -1,042.96 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 33 | 0 09 | 0 42 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 385 | 2.00 | 0 15 | 0 00 | 0 15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 276 | 2.00 | 0 19 | 0 09 | 0 27 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 34 | 0 10 | 0 43 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 86 | 10 47 | 3 44 | 28 72 | 3 57 | 13 91 |
| 2 | 0 00 | 0 00 | | 4 25 | 0 00 | | 2 23 | 4 25 |
| 3 | 0 00 | 0 00 | | 5 25 | 1 72 | | 2 23 | 6 97 |
| 4 | 0 00 | 0 00 | | 4 15 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 16 75 | 3 44 | | 3 21 | 20 19 |

***BARRA*** *83*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 202.05 | 110.31 | 1,392.38 | -1,697.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 1,740.48 | -999.61 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 40 | 0 09 | 0 49 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 603 | 1.25 | 0 15 | 0 00 | 0 15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 479 | 1.25 | 0 19 | 0 07 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 41 | 0 09 | 0 50 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 57 | 0 79 | 13 11 | 3 38 | 28 25 | 3 57 | 16 50 |
| 2 | 0 00 | 0 00 | | 8 26 | 0 00 | | 2 23 | 8 26 |
| 3 | 0 00 | 0 00 | | 10 20 | 2 71 | | 2 23 | 12 91 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 20 33 | 3 38 | | 3 21 | 23 71 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *73*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 159.39 | 113.94 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -1,093.75 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 30 | 0 09 | 0 39 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 17 | 0 09 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 30 | 0 10 | 0 40 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 89 | 8 73 | 3 50 | 29 18 | 3 57 | 12 23 |
| 2 | 0 00 | 0 00 | | 3 85 | 0 00 | | 2 23 | 3 85 |
| 3 | 0 00 | 0 00 | | 4 75 | 1 75 | | 2 23 | 6 50 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 15 15 | 3 50 | | 3 21 | 18 64 |

***BARRA*** *81*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 159.39 | 113.94 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -1,093.75 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 30 | 0 09 | 0 39 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 17 | 0 09 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 30 | 0 10 | 0 40 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 89 | 8 73 | 3 50 | 29 18 | 3 57 | 12 23 |
| 2 | 0 00 | 0 00 | | 3 85 | 0 00 | | 2 23 | 3 85 |
| 3 | 0 00 | 0 00 | | 4 75 | 1 75 | | 2 23 | 6 50 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 15 15 | 3 50 | | 3 21 | 18 64 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *93*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 243.98 | 106.67 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | -239.30 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 09 | 0 57 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 18 | 0.00 | 0 18 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 23 | 0 07 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 49 | 0 09 | 0 58 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmín (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 69 | 19 87 | 3 27 | 27 32 | 3 57 | 23 14 |
| 2 | 0 00 | 0 00 | | 9 98 | 0 00 | | 2 23 | 9 98 |
| 3 | 0 00 | 0 00 | | 12 32 | 2 62 | | 2 23 | 14 94 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 24 55 | 3 27 | | 3 21 | 27 82 |

***BARRA*** *101*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 243.98 | 106.67 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | -239.30 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 09 | 0 57 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 18 | 0 00 | 0 18 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 23 | 0 07 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 49 | 0 09 | 0 58 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmín (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 69 | 19 87 | 3 27 | 27 32 | 3 57 | 23 14 |
| 2 | 0 00 | 0 00 | | 9 98 | 0 00 | | 2 23 | 9 98 |
| 3 | 0 00 | 0 00 | | 12 32 | 2 62 | | 2 23 | 14 94 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 24 55 | 3 27 | | 3 21 | 27 82 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *91*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 202.05 | 110.31 | 596.74 | -1,140.84 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 745.92 | -303.41 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 40 | 0 09 | 0 49 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 125 | 1.25 | 0 15 | 0 00 | 0 15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 033 | 1.25 | 0 19 | 0 07 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 41 | 0 09 | 0 50 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmín (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 72 | 15 56 | 3 38 | 28 25 | 3 57 | 18 94 |
| 2 | 0 00 | 0 00 | | 8 26 | 0 00 | | 2 23 | 8 26 |
| 3 | 0 00 | 0 00 | | 10 20 | 2 71 | | 2 23 | 12 91 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 20 33 | 3 38 | | 3 21 | 23 71 |

***BARRA*** *92*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 219.18 | 108.49 | 596.74 | -1,382.91 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 40.60 | 0.00 | 745.92 | -267.59 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 43 | 0 09 | 0 52 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 264 | 1.25 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 162 | 1.25 | 0 20 | 0 07 | 0 27 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 44 | 0 09 | 0 53 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmín (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 71 | 17 32 | 3 33 | 27 79 | 3 57 | 20 65 |
| 2 | 0 00 | 0 00 | | 8 96 | 0 00 | | 2 23 | 8 96 |
| 3 | 0 00 | 0 00 | | 11 07 | 2 66 | | 2 23 | 13 73 |
| 4 | 0 00 | 0 00 | | 5 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 22 05 | 3 33 | | 3 21 | 25 38 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *111*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 376.49 | 103.04 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 87.90 | 0.00 | 0.00 | 364.41 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 74 | 0 08 | 0 82 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 28 | 0 00 | 0 28 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0 35 | 0 06 | 0 42 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 76 | 0 09 | 0 85 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 168 99 | 33 05 | 0 62 | 35 33 | 3 16 | 26 39 | 3 57 | 38 50 |
| 2 | 0 00 | 0 00 | | 15 39 | 0 00 | | 2 23 | 15 39 |
| 3 | 0 00 | 0 00 | | 19 01 | 2 53 | | 2 23 | 21 54 |
| 4 | 0 00 | 0 00 | | 11 10 | 0 00 | | 6 90 | 11 10 |
| 5 | 0 00 | 0 00 | | 37 88 | 3 16 | | 3 21 | 41 04 |

***BARRA*** *112*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 344.42 | 100.06 | 1,312.82 | -1,915.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 81.50 | 0.00 | 1,641.02 | -826.55 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 68 | 0 08 | 0 76 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 690 | 1.25 | 0 26 | 0 00 | 0 26 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 561 | 1.25 | 0 32 | 0 06 | 0 38 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 69 | 0 08 | 0 78 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 69 | 28 01 | 3 07 | 25 63 | 3 57 | 31 08 |
| 2 | 0 00 | 0 00 | | 14 08 | 0 00 | | 2 23 | 14 08 |
| 3 | 0 00 | 0 00 | | 17 39 | 2 46 | | 2 23 | 19 85 |
| 4 | 0 00 | 0 00 | | 10 29 | 0 00 | | 6 90 | 10 29 |
| 5 | 0 00 | 0 00 | | 34 65 | 3 07 | | 3 21 | 37 72 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *102*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 261.41 | 104.85 | 596.74 | -2,030.36 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 48.40 | 0.00 | 745.92 | -218.66 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 51 | 0 09 | 0 60 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 599 | 1.25 | 0 20 | 0 00 | 0 20 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 476 | 1.25 | 0 24 | 0 07 | 0 31 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 53 | 0 09 | 0 61 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 69 | 21 66 | 3 22 | 26 86 | 3 57 | 24 88 |
| 2 | 0 00 | 0 00 | | 10 69 | 0 00 | | 2 23 | 10 69 |
| 3 | 0 00 | 0 00 | | 13 20 | 2 57 | | 2 23 | 15 77 |
| 4 | 0 00 | 0 00 | | 6 11 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 26 30 | 3 22 | | 3 21 | 29 52 |

***BARRA*** *103*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 285.59 | 103.04 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 52.20 | 0.00 | 0.00 | 359.69 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 56 | 0 08 | 0 64 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 22 | 0 00 | 0 22 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0 27 | 0 06 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 57 | 0 09 | 0 66 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 33 05 | 0 64 | 25 98 | 3 16 | 26 39 | 3 57 | 29 14 |
| 2 | 0 00 | 0 00 | | 11 68 | 0 00 | | 2 23 | 11 68 |
| 3 | 0 00 | 0 00 | | 14 42 | 2 53 | | 2 23 | 16 95 |
| 4 | 0 00 | 0 00 | | 6 59 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 28 73 | 3 16 | | 3 21 | 31 89 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** *122*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 279.24 | 94.12 | 1,312.82 | -468.76 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 68.80 | 0.00 | 1,641.02 | -838.01 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 55 | 0 08 | 0 62 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 895 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 819 | 1.25 | 0 26 | 0 06 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 0 869 | 1.00 | 0 56 | 0 08 | 0 64 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 72 | 21 30 | 2 89 | 24 11 | 3 57 | 24 19 |
| 2 | 0 00 | 0 00 | | 11 42 | 0 00 | | 2 23 | 11 42 |
| 3 | 0 00 | 0 00 | | 14 10 | 2 31 | | 2 23 | 16 41 |
| 4 | 0 00 | 0 00 | | 8 69 | 0 00 | | 6 90 | 8 69 |
| 5 | 0 00 | 0 00 | | 28 09 | 2 89 | | 3 21 | 30 98 |

***BARRA*** *123*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 246.95 | 91.14 | 1,312.82 | 713.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 1,641.02 | -855.05 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 07 | 0 56 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 0 783 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 0 810 | 1.25 | 0 23 | 0 06 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 268 | 0.180 | 0 082 | 2 132 | 1.50 | 0 54 | 0 08 | 0 62 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 74 | 17 98 | 2 80 | 23 34 | 3 57 | 20 78 |
| 2 | 0 00 | 0 00 | | 10 10 | 0 00 | | 2 23 | 10 10 |
| 3 | 0 00 | 0 00 | | 12 47 | 2 24 | | 2 23 | 14 71 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 16 56 | 1 86 | | 3 21 | 18 43 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** *113*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 312.45 | 97.09 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -828.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 61 | 0 08 | 0 69 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 24 | 0 00 | 0 24 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 29 | 0 06 | 0 35 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 63 | 0 08 | 0 71 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 71 | 24 72 | 2 98 | 24 87 | 3 57 | 27 70 |
| 2 | 0 00 | 0 00 | | 12 78 | 0 00 | | 2 23 | 12 78 |
| 3 | 0 00 | 0 00 | | 15 78 | 2 38 | | 2 23 | 18 16 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 31 44 | 2 98 | | 3 21 | 34 41 |

***BARRA*** *121*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 312.45 | 97.09 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -828.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 61 | 0 08 | 0 69 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 24 | 0 00 | 0 24 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 29 | 0 06 | 0 35 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 63 | 0 08 | 0 71 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 71 | 24 72 | 2 98 | 24 87 | 3 57 | 27 70 |
| 2 | 0 00 | 0 00 | | 12 78 | 0 00 | | 2 23 | 12 78 |
| 3 | 0 00 | 0 00 | | 15 78 | 2 38 | | 2 23 | 18 16 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 31 44 | 2 98 | | 3 21 | 34 41 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *133*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 181.10 | 85.20 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,025.44 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 34 | 0 07 | 0 41 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 19 | 0 07 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 37 | 0 08 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 91 | 9 45 | 2 61 | 21 82 | 3 57 | 12 06 |
| 2 | 0 00 | 0 00 | | 4 37 | 0 00 | | 2 23 | 4 37 |
| 3 | 0 00 | 0 00 | | 5 40 | 1 31 | | 2 23 | 6 70 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 47 | 1 74 | | 3 21 | 13 22 |

***BARRA*** *141*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 181.10 | 85.20 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,025.44 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 34 | 0 07 | 0 41 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 19 | 0 07 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 37 | 0 08 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 91 | 9 45 | 2 61 | 21 82 | 3 57 | 12 06 |
| 2 | 0 00 | 0 00 | | 4 37 | 0 00 | | 2 23 | 4 37 |
| 3 | 0 00 | 0 00 | | 5 40 | 1 31 | | 2 23 | 6 70 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 47 | 1 74 | | 3 21 | 13 22 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *131*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 246.95 | 91.14 | 1,909.56 | -433.33 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 2,386.94 | -1,377.19 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 07 | 0 56 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 036 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 950 | 1.25 | 0 23 | 0 06 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 335 | 0.180 | 0 102 | 1 200 | 1.20 | 0 51 | 0 08 | 0 58 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 90 00 | 0 78 | 16 15 | 2 80 | 23 34 | 3 57 | 18 94 |
| 2 | 0 00 | 0 00 | | 10 10 | 0 00 | | 2 23 | 10 10 |
| 3 | 0 00 | 0 00 | | 12 47 | 2 24 | | 2 23 | 14 71 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 20 71 | 2 33 | | 3 21 | 23 04 |

***BARRA*** *132*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 213.23 | 88.17 | 1,909.56 | 620.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 56.10 | 0.00 | 2,386.94 | -1,110.73 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 39 | 0 07 | 0 47 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 210 | 2.00 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 189 | 2.00 | 0 23 | 0 07 | 0 30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 121 | 1.50 | 0 44 | 0 08 | 0 52 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 86 | 12 75 | 2 71 | 22 58 | 3 57 | 15 46 |
| 2 | 0 00 | 0 00 | | 5 15 | 0 00 | | 2 23 | 5 15 |
| 3 | 0 00 | 0 00 | | 6 36 | 1 35 | | 2 23 | 7 71 |
| 4 | 0 00 | 0 00 | | 7 08 | 0 00 | | 6 90 | 7 08 |
| 5 | 0 00 | 0 00 | | 13 51 | 1 80 | | 3 21 | 15 31 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *151*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 115.18 | 79.25 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 21 | 0 06 | 0 28 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 12 | 0 06 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 24 | 0 07 | 0 31 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 08 | 2 66 | 2 43 | 20 30 | 3 57 | 5 10 |
| 2 | 0 00 | 0 00 | | 2 78 | 0 00 | | 2 23 | 2 78 |
| 3 | 0 00 | 0 00 | | 3 43 | 1 22 | | 2 23 | 4 65 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 7 30 | 1 62 | | 3 21 | 8 92 |

***BARRA*** *152*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 80.78 | 76.28 | 1,909.56 | 1,363.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 12.50 | 0.00 | 2,386.94 | -873.67 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 15 | 0 06 | 0 21 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 07 | 0 00 | 0 07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 09 | 0 06 | 0 14 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 590 | 1.50 | 0 17 | 0 07 | 0 24 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 28 | -0 88 | 2 34 | 19 54 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 95 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 41 | 1 17 | | 2 23 | 3 58 |
| 4 | 0 00 | 0 00 | | 1 58 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 5 12 | 1 56 | | 3 21 | 6 68 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *142*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 146.64 | 82.22 | 1,909.56 | 1,113.62 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 37.30 | 0.00 | 2,386.94 | -954.58 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 27 | 0 07 | 0 34 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 595 | 2.00 | 0 13 | 0 00 | 0 13 | |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 652 | 2.00 | 0 16 | 0 06 | 0 22 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 442 | 1.50 | 0 30 | 0 08 | 0 38 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 98 | 5 90 | 2 52 | 21 06 | 3 57 | 8 42 |
| 2 | 0 00 | 0 00 | | 3 54 | 0 00 | | 2 23 | 3 54 |
| 3 | 0 00 | 0 00 | | 4 37 | 1 26 | | 2 23 | 5 63 |
| 4 | 0 00 | 0 00 | | 4 71 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 9 29 | 1 68 | | 3 21 | 10 97 |

***BARRA*** *143*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 115.18 | 79.25 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 21 | 0 06 | 0 28 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 12 | 0 06 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 24 | 0 07 | 0 31 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 08 | 2 66 | 2 43 | 20 30 | 3 57 | 5 10 |
| 2 | 0 00 | 0 00 | | 2 78 | 0 00 | | 2 23 | 2 78 |
| 3 | 0 00 | 0 00 | | 3 43 | 1 22 | | 2 23 | 4 65 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 7 30 | 1 62 | | 3 21 | 8 92 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***162***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 80.78 | 75.12 | 1,909.56 | 1,363.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 12.50 | 0.00 | 2,386.94 | -873.67 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 15 | 0 06 | 0 21 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 07 | 0 00 | 0 07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 09 | 0 06 | 0 14 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 590 | 1.50 | 0 17 | 0 07 | 0 24 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 28 | -0 88 | 2 30 | 19 24 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 95 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 41 | 1 15 | | 2 23 | 3 56 |
| 4 | 0 00 | 0 00 | | 1 58 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 5 12 | 1 54 | | 3 21 | 6 65 |

***BARRA*** ***163***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 115.18 | 76.93 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 21 | 0 06 | 0 28 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 12 | 0 06 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 24 | 0 07 | 0 31 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 08 | 2 66 | 2 36 | 19 71 | 3 57 | 5 02 |
| 2 | 0 00 | 0 00 | | 2 78 | 0 00 | | 2 23 | 2 78 |
| 3 | 0 00 | 0 00 | | 3 43 | 1 18 | | 2 23 | 4 61 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 7 30 | 1 57 | | 3 21 | 8 87 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***153***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0,602 | 50.10 | 73.30 | 1,909.56 | 1,395.39 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 0.00 | 0.00 | 2,386.94 | -863.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 09 | 0 06 | 0 15 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 04 | 0 00 | 0 04 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 05 | 0 06 | 0 11 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 608 | 1.50 | 0 10 | 0 07 | 0 17 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 69 | -4 03 | 2 25 | 18 78 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 21 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 1 49 | 1 12 | | 2 23 | 2 62 |
| 4 | 0 00 | 0 00 | | 0 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 3 17 | 1 50 | | 3 21 | 4 67 |

***BARRA*** ***161***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 50.10 | 73.30 | 1,909.56 | 1,395.39 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 0.00 | 0.00 | 2,386.94 | -863.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 09 | 0 06 | 0 15 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 04 | 0 00 | 0 04 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 05 | 0 06 | 0 11 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 608 | 1.50 | 0 10 | 0 07 | 0 17 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 69 | -4 03 | 2 25 | 18 77 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 21 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 1 49 | 1 12 | | 2 23 | 2 62 |
| 4 | 0 00 | 0 00 | | 0 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 3 17 | 1 50 | | 3 21 | 4 67 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *173*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 181.10 | 80.57 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,025.44 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 34 | 0 07 | 0 40 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 19 | 0 06 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 37 | 0 07 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 91 | 9 45 | 2 47 | 20 64 | 3 57 | 11 92 |
| 2 | 0 00 | 0 00 | | 4 37 | 0 00 | | 2 23 | 4 37 |
| 3 | 0 00 | 0 00 | | 5 40 | 1 24 | | 2 23 | 6 63 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 47 | 1 65 | | 3 21 | 13 12 |

***BARRA*** *181*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 181.10 | 80.57 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,414.57 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 34 | 0 07 | 0 40 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 19 | 0 06 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 37 | 0 07 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 91 | 9 45 | 2 47 | 20 64 | 3 57 | 11 92 |
| 2 | 0 00 | 0 00 | | 4 37 | 0 00 | | 2 23 | 4 37 |
| 3 | 0 00 | 0 00 | | 5 40 | 1 24 | | 2 23 | 6 63 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 47 | 1 65 | | 3 21 | 13 12 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *171*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 115.18 | 76.93 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 21 | 0 06 | 0 28 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 12 | 0 06 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 24 | 0 07 | 0 31 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 08 | 2 66 | 2 36 | 19 71 | 3 57 | 5 02 |
| 2 | 0 00 | 0 00 | | 2 78 | 0 00 | | 2 23 | 2 78 |
| 3 | 0 00 | 0 00 | | 3 43 | 1 18 | | 2 23 | 4 61 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 7 30 | 1 57 | | 3 21 | 8 87 |

***BARRA*** *172*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 146.64 | 78.75 | 1,909.56 | 1,113.62 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 37.30 | 0.00 | 2,386.94 | -954.58 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 27 | 0 06 | 0 34 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 595 | 2.00 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 652 | 2.00 | 0 16 | 0 06 | 0 22 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 442 | 1.50 | 0 30 | 0 07 | 0 37 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 98 | 5 90 | 2 42 | 20 17 | 3 57 | 8 32 |
| 2 | 0 00 | 0 00 | | 3 54 | 0 00 | | 2 23 | 3 54 |
| 3 | 0 00 | 0 00 | | 4 37 | 1 21 | | 2 23 | 5 58 |
| 4 | 0 00 | 0 00 | | 4 71 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 9 29 | 1 61 | | 3 21 | 10 90 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *191*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 246.95 | 84.20 | 1,312.82 | 713.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 1,641.02 | -626.30 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 07 | 0 55 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 0 783 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 0 810 | 1.25 | 0 23 | 0 05 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 268 | 0.180 | 0 082 | 2 132 | 1.50 | 0 54 | 0 08 | 0 62 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 74 | 17 98 | 2 58 | 21 57 | 3 57 | 20 56 |
| 2 | 0 00 | 0 00 | | 10 10 | 0 00 | | 2 23 | 10 10 |
| 3 | 0 00 | 0 00 | | 12 47 | 2 07 | | 2 23 | 14 54 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 16 56 | 1 72 | | 3 21 | 18 29 |

***BARRA*** *192*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 279.24 | 86.02 | 1,312.82 | -468.76 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 68.80 | 0.00 | 1,641.02 | -519.29 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 55 | 0 07 | 0 62 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 895 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 819 | 1.25 | 0 26 | 0 05 | 0 31 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 0 869 | 1.00 | 0 56 | 0 07 | 0 63 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 72 | 21 30 | 2 64 | 22 03 | 3 57 | 23 94 |
| 2 | 0 00 | 0 00 | | 11 42 | 0 00 | | 2 23 | 11 42 |
| 3 | 0 00 | 0 00 | | 14 10 | 2 11 | | 2 23 | 16 21 |
| 4 | 0 00 | 0 00 | | 8 69 | 0 00 | | 6 90 | 8 69 |
| 5 | 0 00 | 0 00 | | 28 09 | 2 64 | | 3 21 | 30 73 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *182*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 213.23 | 82.39 | 1,909.56 | 620.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 56.10 | 0.00 | 2,386.94 | -1,414.57 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 39 | 0 07 | 0 46 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 210 | 2.00 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 189 | 2.00 | 0 23 | 0 06 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 121 | 1.50 | 0 44 | 0 08 | 0 51 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 86 | 12 75 | 2 53 | 21 10 | 3 57 | 15 28 |
| 2 | 0 00 | 0 00 | | 5 15 | 0 00 | | 2 23 | 5 15 |
| 3 | 0 00 | 0 00 | | 6 36 | 1 26 | | 2 23 | 7 62 |
| 4 | 0 00 | 0 00 | | 7 08 | 0 00 | | 6 90 | 7 08 |
| 5 | 0 00 | 0 00 | | 13 51 | 1 69 | | 3 21 | 15 19 |

***BARRA*** *183*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 246.95 | 84.20 | 1,909.56 | -433.33 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 2,386.94 | -1,272.82 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 07 | 0 55 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 036 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 950 | 1.25 | 0 23 | 0 05 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 335 | 0.180 | 0 102 | 1 200 | 1.20 | 0 51 | 0 07 | 0 58 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 90 00 | 0 78 | 16 15 | 2 58 | 21 57 | 3 57 | 18 73 |
| 2 | 0 00 | 0 00 | | 10 10 | 0 00 | | 2 23 | 10 10 |
| 3 | 0 00 | 0 00 | | 12 47 | 2 07 | | 2 23 | 14 54 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 20 71 | 2 15 | | 3 21 | 22 86 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***202***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 344.42 | 89.65 | 1,312.82 | -1,915.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 81.50 | 0.00 | 1,641.02 | -358.91 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 68 | 0 07 | 0 75 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 690 | 1.25 | 0 26 | 0 00 | 0 26 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 561 | 1.25 | 0 32 | 0 06 | 0 38 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 69 | 0 08 | 0 77 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 69 | 28 01 | 2 75 | 22 96 | 3 57 | 30 76 |
| 2 | 0 00 | 0 00 | | 14 08 | 0 00 | | 2 23 | 14 08 |
| 3 | 0 00 | 0 00 | | 17 39 | 2 20 | | 2 23 | 19 59 |
| 4 | 0 00 | 0 00 | | 10 29 | 0 00 | | 6 90 | 10 29 |
| 5 | 0 00 | 0 00 | | 34 65 | 2 75 | | 3 21 | 37 40 |

***BARRA*** ***203***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 376.49 | 91.47 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 87.90 | 0.00 | 0.00 | 1,005.57 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 74 | 0 07 | 0 81 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 28 | 0 00 | 0 28 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0 35 | 0 06 | 0 41 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 76 | 0 08 | 0 84 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 168 99 | 33 05 | 0 62 | 35 33 | 2 81 | 23 43 | 3 57 | 38 14 |
| 2 | 0 00 | 0 00 | | 15 39 | 0 00 | | 2 23 | 15 39 |
| 3 | 0 00 | 0 00 | | 19 01 | 2 25 | | 2 23 | 21 26 |
| 4 | 0 00 | 0 00 | | 11 10 | 0 00 | | 6 90 | 11 10 |
| 5 | 0 00 | 0 00 | | 37 88 | 2 81 | | 3 21 | 40 69 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***193***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 312.45 | 87.84 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -429.77 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 61 | 0 07 | 0 68 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 24 | 0 00 | 0 24 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 29 | 0 06 | 0 35 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 63 | 0 07 | 0 70 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 71 | 24 72 | 2 70 | 22 50 | 3 57 | 27 41 |
| 2 | 0 00 | 0 00 | | 12 78 | 0 00 | | 2 23 | 12 78 |
| 3 | 0 00 | 0 00 | | 15 78 | 2 16 | | 2 23 | 17 93 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 31 44 | 2 70 | | 3 21 | 34 13 |

***BARRA*** ***201***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 312.45 | 87.84 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -429.77 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 61 | 0 07 | 0 68 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 24 | 0 00 | 0 24 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 29 | 0 06 | 0 35 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 63 | 0 07 | 0 70 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 71 | 24 72 | 2 70 | 22 50 | 3 57 | 27 41 |
| 2 | 0 00 | 0 00 | | 12 78 | 0 00 | | 2 23 | 12 78 |
| 3 | 0 00 | 0 00 | | 15 78 | 2 16 | | 2 23 | 17 93 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 31 44 | 2 70 | | 3 21 | 34 13 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *211*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 297.83 | 91.47 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 52.20 | 0.00 | 0.00 | 1,038.33 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 58 | 0.07 | 0 66 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 22 | 0.00 | 0 22 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0 28 | 0 06 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 60 | 0 08 | 0 68 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 33 05 | 0 64 | 27 24 | 2 81 | 23 43 | 3 57 | 30 05 |
| 2 | 0 00 | 0 00 | | 12 18 | 0 00 | | 2 23 | 12 18 |
| 3 | 0 00 | 0 00 | | 15 04 | 2 25 | | 2 23 | 17 28 |
| 4 | 0 00 | 0 00 | | 6 59 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 29 96 | 2 81 | | 3 21 | 32 77 |

***BARRA*** *212*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 273.65 | 93.29 | 596.74 | -2,030.36 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 48.40 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 54 | 0 08 | 0 61 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 599 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 476 | 1.25 | 0 25 | 0 06 | 0 31 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 55 | 0 08 | 0 63 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 68 | 22 92 | 2 86 | 23 89 | 3 57 | 25 78 |
| 2 | 0 00 | 0 00 | | 11 19 | 0 00 | | 2 23 | 11 19 |
| 3 | 0 00 | 0 00 | | 13 82 | 2 29 | | 2 23 | 16 11 |
| 4 | 0 00 | 0 00 | | 6 11 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 27 53 | 2 86 | | 3 21 | 30 39 |



SUBTRAMO XV DEL AVE
E-1505-0

ANÁLISIS TRANSVERSAL DE ESFUERZOS
BARRA 211

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 297.83 | 91.47 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 52.20 | 0.00 | 0.00 | 1,038.33 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 58 | 0 07 | 0 66 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 22 | 0 00 | 0 22 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0 28 | 0 06 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 60 | 0 08 | 0 68 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 33 05 | 0 64 | 27 24 | 2 81 | 23 43 | 3 57 | 30 05 |
| 2 | 0 00 | 0 00 | | 12 18 | 0 00 | | 2 23 | 12 18 |
| 3 | 0 00 | 0 00 | | 15 04 | 2 25 | | 2 23 | 17 28 |
| 4 | 0 00 | 0 00 | | 6 59 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 29 96 | 2 81 | | 3 21 | 32 77 |

BARRA 212

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 273.65 | 93.29 | 596.74 | -2,030.36 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 48.40 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 54 | 0 08 | 0 61 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 599 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 476 | 1.25 | 0 25 | 0 06 | 0 31 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 55 | 0 08 | 0 63 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 68 | 22 92 | 2 86 | 23 89 | 3 57 | 25 78 |
| 2 | 0 00 | 0 00 | | 11 19 | 0 00 | | 2 23 | 11 19 |
| 3 | 0 00 | 0 00 | | 13 82 | 2 29 | | 2 23 | 16 11 |
| 4 | 0 00 | 0 00 | | 6 11 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 27 53 | 2 86 | | 3 21 | 30 39 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *222*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 231.42 | 96.92 | 596.74 | -1,382.91 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 40.60 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 45 | 0 08 | 0 53 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 264 | 1.25 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 162 | 1.25 | 0 22 | 0 06 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 47 | 0 08 | 0 55 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 70 | 18 58 | 2 97 | 24 83 | 3 57 | 21 55 |
| 2 | 0 00 | 0 00 | | 9 46 | 0 00 | | 2 23 | 9 46 |
| 3 | 0 00 | 0 00 | | 11 68 | 2 38 | | 2 23 | 14 06 |
| 4 | 0 00 | 0 00 | | 5 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 23 28 | 2 97 | | 3 21 | 26 26 |

***BARRA*** *223*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 214.29 | 98.74 | 596.74 | -1,140.84 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 745.92 | 516.19 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 42 | 0 08 | 0 50 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 125 | 1.25 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 033 | 1.25 | 0 20 | 0 06 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 43 | 0 08 | 0 51 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 71 | 16 82 | 3 03 | 25 29 | 3 57 | 19 84 |
| 2 | 0 00 | 0 00 | | 8 76 | 0 00 | | 2 23 | 8 76 |
| 3 | 0 00 | 0 00 | | 10 82 | 2 42 | | 2 23 | 13 24 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 21 56 | 3 03 | | 3 21 | 24 59 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *213*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 256.22 | 95.11 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 50 | 0 08 | 0 58 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 24 | 0 06 | 0 30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 52 | 0 08 | 0 60 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 69 | 21 13 | 2 92 | 24 36 | 3 57 | 24 05 |
| 2 | 0 00 | 0 00 | | 10 48 | 0 00 | | 2 23 | 10 48 |
| 3 | 0 00 | 0 00 | | 12 94 | 2 33 | | 2 23 | 15 27 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 25 78 | 2 92 | | 3 21 | 28 70 |

***BARRA*** *221*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 256.22 | 95.11 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 50 | 0 08 | 0 58 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 24 | 0 06 | 0 30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 52 | 0 08 | 0 60 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 69 | 21 13 | 2 92 | 24 36 | 3 57 | 24 05 |
| 2 | 0 00 | 0 00 | | 10 48 | 0 00 | | 2 23 | 10 48 |
| 3 | 0 00 | 0 00 | | 12 94 | 2 33 | | 2 23 | 15 27 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 25 78 | 2 92 | | 3 21 | 28 70 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *233*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 171.63 | 102.37 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -499.39 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 32 | 0 08 | 0 40 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 15 | 0 00 | 0 15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 18 | 0 08 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 33 | 0 09 | 0 41 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 87 | 9 99 | 3 14 | 26 22 | 3 57 | 13 13 |
| 2 | 0 00 | 0 00 | | 4 14 | 0 00 | | 2 23 | 4 14 |
| 3 | 0 00 | 0 00 | | 5 12 | 1 57 | | 2 23 | 6 69 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 16 31 | 3 14 | | 3 21 | 19 45 |

***BARRA*** *241*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 171.63 | 102.37 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -499.39 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 32 | 0 08 | 0 40 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 15 | 0 00 | 0 15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 18 | 0 08 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 33 | 0 09 | 0 41 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 87 | 9 99 | 3 14 | 26 22 | 3 57 | 13 13 |
| 2 | 0 00 | 0 00 | | 4 14 | 0 00 | | 2 23 | 4 14 |
| 3 | 0 00 | 0 00 | | 5 12 | 1 57 | | 2 23 | 6 69 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 16 31 | 3 14 | | 3 21 | 19 45 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *231*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 214.29 | 98.74 | 1,392.38 | -1,697.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 1,740.48 | -377.98 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 42 | 0 08 | 0 50 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 603 | 1.25 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 479 | 1.25 | 0 20 | 0 06 | 0 26 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 43 | 0 08 | 0 51 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 57 | 0 77 | 14 37 | 3 03 | 25 29 | 3 57 | 17 40 |
| 2 | 0 00 | 0 00 | | 8 76 | 0 00 | | 2 23 | 8 76 |
| 3 | 0 00 | 0 00 | | 10 82 | 2 42 | | 2 23 | 13 24 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 21 56 | 3 03 | | 3 21 | 24 59 |

***BARRA*** *232*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 188.52 | 100.56 | 1,392.38 | -1,484.01 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.90 | 0.00 | 1,740.48 | -428.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 35 | 0 08 | 0 43 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 385 | 2.00 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 276 | 2.00 | 0 20 | 0 08 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 36 | 0 09 | 0 44 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 85 | 11 73 | 3 09 | 25 76 | 3 57 | 14 82 |
| 2 | 0 00 | 0 00 | | 4 55 | 0 00 | | 2 23 | 4 55 |
| 3 | 0 00 | 0 00 | | 5 62 | 1 54 | | 2 23 | 7 16 |
| 4 | 0 00 | 0 00 | | 4 15 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 17 91 | 3 09 | | 3 21 | 21 00 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***251***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 128.88 | 106.01 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -876.07 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 24 | 0 09 | 0 33 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 14 | 0 08 | 0 22 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 24 | 0 09 | 0 33 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 96 | 5 59 | 3 25 | 27 15 | 3 57 | 8 85 |
| 2 | 0 00 | 0 00 | | 3 11 | 0 00 | | 2 23 | 3 11 |
| 3 | 0 00 | 0 00 | | 3 84 | 1 63 | | 2 23 | 5 47 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 25 | 3 25 | | 3 21 | 15 50 |

***BARRA*** ***252***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 101.84 | 107.83 | 1,392.38 | -874.20 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 13.60 | 0.00 | 1,740.48 | -863.08 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 19 | 0 09 | 0 28 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 09 | 0 00 | 0 09 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 11 | 0 08 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 19 | 0 09 | 0 29 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 05 | 2 81 | 3 31 | 27 62 | 3 57 | 6 12 |
| 2 | 0 00 | 0 00 | | 2 46 | 0 00 | | 2 23 | 2 46 |
| 3 | 0 00 | 0 00 | | 3 04 | 1 65 | | 2 23 | 4 69 |
| 4 | 0 00 | 0 00 | | 1 72 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 9 68 | 3 31 | | 3 21 | 12 98 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***242***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 145.05 | 104.19 | 1,392.38 | -1,123.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 25.00 | 0.00 | 1,740.48 | -695.92 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 27 | 0 09 | 0 35 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 209 | 2.00 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 111 | 2.00 | 0 16 | 0 08 | 0 24 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 28 | 0 09 | 0 36 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 92 | 7 26 | 3 20 | 26 69 | 3 57 | 10 45 |
| 2 | 0 00 | 0 00 | | 3 50 | 0 00 | | 2 23 | 3 50 |
| 3 | 0 00 | 0 00 | | 4 32 | 1 60 | | 2 23 | 5 92 |
| 4 | 0 00 | 0 00 | | 3 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 13 78 | 3 20 | | 3 21 | 16 98 |

***BARRA*** ***243***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 128.88 | 106.01 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -695.92 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 24 | 0 09 | 0 33 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 14 | 0 08 | 0 22 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 24 | 0 09 | 0 33 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 96 | 5 59 | 3 25 | 27 15 | 3 57 | 8 85 |
| 2 | 0 00 | 0 00 | | 3 11 | 0 00 | | 2 23 | 3 11 |
| 3 | 0 00 | 0 00 | | 3 84 | 1 63 | | 2 23 | 5 47 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 25 | 3 25 | | 3 21 | 15 50 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***262***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 60.90 | 112.62 | 1,392.38 | -718.48 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 1.70 | 0.00 | 1,740.48 | -859.72 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.11 | 0.09 | 0.20 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 1.992 | 2.00 | 0.05 | 0.00 | 0.05 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.909 | 2.00 | 0.07 | 0.09 | 0.15 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.267 | 1.00 | 0.12 | 0.10 | 0.21 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 74.51 | 1.35 | -1.40 | 3.46 | 28.84 | 3.57 | 3.57 |
| 2 | 0.00 | 0.00 | | 1.47 | 0.00 | | 2.23 | 2.23 |
| 3 | 0.00 | 0.00 | | 1.82 | 1.73 | | 2.23 | 3.54 |
| 4 | 0.00 | 0.00 | | 0.21 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 5.79 | 3.46 | | 3.21 | 9.24 |

***BARRA*** ***263***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 84.96 | 115.59 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.16 | 0.09 | 0.25 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 1.965 | 2.00 | 0.07 | 0.00 | 0.07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.884 | 2.00 | 0.09 | 0.09 | 0.18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.465 | 1.00 | 0.16 | 0.10 | 0.26 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 74.51 | 1.14 | 1.08 | 3.55 | 29.61 | 3.57 | 4.62 |
| 2 | 0.00 | 0.00 | | 2.05 | 0.00 | | 2.23 | 2.23 |
| 3 | 0.00 | 0.00 | | 2.53 | 1.77 | | 2.23 | 4.31 |
| 4 | 0.00 | 0.00 | | 1.16 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 8.07 | 3.55 | | 3.21 | 11.62 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***253***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 85.85 | 109.64 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.16 | 0.09 | 0.25 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 2.030 | 2.00 | 0.07 | 0.00 | 0.07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.945 | 2.00 | 0.09 | 0.08 | 0.18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 1.000 | 1.00 | 0.16 | 0.09 | 0.26 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 74.51 | 1.13 | 1.17 | 3.36 | 28.08 | 3.57 | 4.53 |
| 2 | 0.00 | 0.00 | | 2.07 | 0.00 | | 2.23 | 2.23 |
| 3 | 0.00 | 0.00 | | 2.56 | 1.68 | | 2.23 | 4.24 |
| 4 | 0.00 | 0.00 | | 0.74 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 8.16 | 3.36 | | 3.21 | 11.52 |

***BARRA*** ***261***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 85.85 | 109.64 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.16 | 0.09 | 0.25 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 2.030 | 2.00 | 0.07 | 0.00 | 0.07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.945 | 2.00 | 0.09 | 0.08 | 0.18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 1.000 | 1.00 | 0.16 | 0.09 | 0.26 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 74.51 | 1.13 | 1.17 | 3.36 | 28.08 | 3.57 | 4.53 |
| 2 | 0.00 | 0.00 | | 2.07 | 0.00 | | 2.23 | 2.23 |
| 3 | 0.00 | 0.00 | | 2.56 | 1.68 | | 2.23 | 4.24 |
| 4 | 0.00 | 0.00 | | 0.74 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 8.16 | 3.36 | | 3.21 | 11.52 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *273*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 124.72 | 121.54 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 23 | 0 10 | 0 33 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 11 | 0.00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 13 | 0.09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 24 | 0 10 | 0 34 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 97 | 5 17 | 3 73 | 31 13 | 3 57 | 8 90 |
| 2 | 0 00 | 0 00 | | 3 01 | 0 00 | | 2 23 | 3 01 |
| 3 | 0 00 | 0 00 | | 3 72 | 1 86 | | 2 23 | 5 58 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 85 | 3 73 | | 3 21 | 15 58 |

***BARRA*** *281*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 124.72 | 121.54 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 23 | 0 10 | 0 33 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 11 | 0.00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 13 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0.00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 24 | 0 10 | 0 34 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 97 | 5 17 | 3 73 | 31 13 | 3 57 | 8 90 |
| 2 | 0 00 | 0 00 | | 3 01 | 0 00 | | 2 23 | 3 01 |
| 3 | 0 00 | 0 00 | | 3 72 | 1 86 | | 2 23 | 5 58 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 85 | 3 73 | | 3 21 | 15 58 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *271*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 84.96 | 115.59 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 16 | 0 09 | 0 25 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 965 | 2.00 | 0 07 | 0.00 | 0 07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 884 | 2.00 | 0 09 | 0 09 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 465 | 1.00 | 0 16 | 0 10 | 0 26 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1.14 | 1 08 | 3 55 | 29 61 | 3 57 | 4 62 |
| 2 | 0 00 | 0 00 | | 2 05 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 53 | 1 77 | | 2 23 | 4 31 |
| 4 | 0 00 | 0 00 | | 1 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 07 | 3 55 | | 3 21 | 11 62 |

***BARRA*** *272*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 98.92 | 118.56 | 1,392.38 | -640.17 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 16.80 | 0.00 | 1,740.48 | -886.51 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 18 | 0 10 | 0 28 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 948 | 2.00 | 0 09 | 0.00 | 0 09 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 868 | 2.00 | 0 11 | 0 09 | 0 20 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 551 | 1.00 | 0 19 | 0 10 | 0 29 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 07 | 2 51 | 3 64 | 30 37 | 3 57 | 6 15 |
| 2 | 0 00 | 0 00 | | 2 39 | 0 00 | | 2 23 | 2 39 |
| 3 | 0 00 | 0 00 | | 2 95 | 1 82 | | 2 23 | 4 77 |
| 4 | 0 00 | 0 00 | | 2 12 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 9 40 | 3 64 | | 3 21 | 13 04 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***291***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 168.66 | 127.48 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.31 | 0.10 | 0.42 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.154 | 0.000 | 0.000 | 2.011 | 1.25 | 0.12 | 0.00 | 0.12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.191 | 0.250 | 0.098 | 1.926 | 1.25 | 0.15 | 0.08 | 0.23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.01 | 0.00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.452 | 1.00 | 0.32 | 0.11 | 0.43 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0.88 | 9.43 | 3.91 | 32.65 | 3.57 | 13.34 |
| 2 | 0.00 | 0.00 | | 6.51 | 0.00 | | 2.23 | 6.51 |
| 3 | 0.00 | 0.00 | | 8.04 | 3.13 | | 2.23 | 11.17 |
| 4 | 0.00 | 0.00 | | 5.00 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 16.03 | 3.91 | | 3.21 | 19.94 |

***BARRA*** ***292***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 185.41 | 130.46 | 1,392.38 | -715.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 47.20 | 0.00 | 1,740.48 | -1,030.81 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.34 | 0.11 | 0.45 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.154 | 0.000 | 0.000 | 2.039 | 1.25 | 0.13 | 0.00 | 0.13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.191 | 0.250 | 0.098 | 1.953 | 1.25 | 0.16 | 0.08 | 0.24 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.02 | 0.00 | 0.02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.234 | 1.00 | 0.35 | 0.11 | 0.46 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0.86 | 11.16 | 4.00 | 33.41 | 3.57 | 15.16 |
| 2 | 0.00 | 0.00 | | 7.16 | 0.00 | | 2.23 | 7.16 |
| 3 | 0.00 | 0.00 | | 8.84 | 3.20 | | 2.23 | 12.04 |
| 4 | 0.00 | 0.00 | | 5.96 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 17.62 | 4.00 | | 3.21 | 21.62 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***282***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 140.90 | 124.51 | 1,392.38 | -638.96 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.10 | 0.00 | 1,740.48 | -943.54 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.26 | 0.10 | 0.36 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 1.947 | 2.00 | 0.12 | 0.00 | 0.12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.867 | 2.00 | 0.15 | 0.10 | 0.25 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.01 | 0.00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.554 | 1.00 | 0.27 | 0.11 | 0.37 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 74.51 | 0.93 | 6.83 | 3.82 | 31.89 | 3.57 | 10.65 |
| 2 | 0.00 | 0.00 | | 3.40 | 0.00 | | 2.23 | 3.40 |
| 3 | 0.00 | 0.00 | | 4.20 | 1.91 | | 2.23 | 6.11 |
| 4 | 0.00 | 0.00 | | 4.05 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 13.39 | 3.82 | | 3.21 | 17.21 |

***BARRA*** ***283***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 168.66 | 127.48 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m) | bw,t (m) | Tbt (t/m) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.31 | 0.10 | 0.42 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.154 | 0.000 | 0.000 | 2.011 | 1.25 | 0.12 | 0.00 | 0.12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.191 | 0.250 | 0.098 | 1.926 | 1.25 | 0.15 | 0.08 | 0.23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.01 | 0.00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.452 | 1.00 | 0.32 | 0.11 | 0.43 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0.88 | 9.43 | 3.91 | 32.65 | 3.57 | 13.34 |
| 2 | 0.00 | 0.00 | | 6.51 | 0.00 | | 2.23 | 6.51 |
| 3 | 0.00 | 0.00 | | 8.04 | 3.13 | | 2.23 | 11.17 |
| 4 | 0.00 | 0.00 | | 5.00 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 16.03 | 3.91 | | 3.21 | 19.94 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***302***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 230.94 | 136.40 | 596.74 | -311.96 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 62.50 | 0.00 | 745.92 | -452.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 43 | 0 11 | 0 54 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 450 | 2.00 | 0 20 | 0 00 | 0 20 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 408 | 2.00 | 0 25 | 0 10 | 0 35 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 751 | 1.00 | 0 44 | 0 12 | 0 55 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 46 37 | 0 73 | 18 99 | 4 19 | 34 94 | 3 57 | 23 17 |
| 2 | 0 00 | 0 00 | | 5 57 | 0 00 | | 2 23 | 5 57 |
| 3 | 0 00 | 0 00 | | 6 88 | 2 09 | | 2 23 | 8 98 |
| 4 | 0 00 | 0 00 | | 7 89 | 0 00 | | 6 90 | 7 89 |
| 5 | 0 00 | 0 00 | | 21 94 | 4 19 | | 3 21 | 26 13 |

***BARRA*** ***303***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 259.23 | 139.38 | 0.00 | 0.00 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 70.00 | 0.00 | 0.00 | 76.28 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 11 | 0 59 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 23 | 0 00 | 0 23 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 28 | 0 11 | 0 38 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 49 | 0 12 | 0 61 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 34 71 | 0 69 | 23 10 | 4 28 | 35 70 | 3 57 | 27 37 |
| 2 | 0 00 | 0 00 | | 6 26 | 0 00 | | 2 23 | 6 26 |
| 3 | 0 00 | 0 00 | | 7 73 | 2 14 | | 2 23 | 9 86 |
| 4 | 0 00 | 0 00 | | 8 84 | 0 00 | | 6 90 | 8 84 |
| 5 | 0 00 | 0 00 | | 24 63 | 4 28 | | 3 21 | 28 91 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***293***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 213.66 | 133.43 | 1,392.38 | -782.51 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 1,740.48 | -1,085.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 40 | 0 11 | 0 50 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 23 | 0 10 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 41 | 0 11 | 0 52 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 83 | 14 06 | 4 09 | 34 18 | 3 57 | 18 16 |
| 2 | 0 00 | 0 00 | | 5 16 | 0 00 | | 2 23 | 5 16 |
| 3 | 0 00 | 0 00 | | 6 37 | 2 05 | | 2 23 | 8 42 |
| 4 | 0 00 | 0 00 | | 6 93 | 0 00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0 00 | | 20 30 | 4 09 | | 3 21 | 24 40 |

***BARRA*** ***301***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 213.66 | 133.43 | 596.74 | -225.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 4.074 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 745.92 | -389.45 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 40 | 0 11 | 0 50 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 469 | 2.00 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 426 | 2.00 | 0 23 | 0 10 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 920 | 1.00 | 0 41 | 0 11 | 0 52 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin (cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 52 82 | 0 76 | 16 55 | 4 09 | 34 18 | 3 57 | 20 64 |
| 2 | 0 00 | 0 00 | | 5 16 | 0 00 | | 2 23 | 5 16 |
| 3 | 0 00 | 0 00 | | 6 37 | 2 05 | | 2 23 | 8 42 |
| 4 | 0 00 | 0 00 | | 6 93 | 0 00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0 00 | | 20 30 | 4 09 | | 3 21 | 24 40 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *13*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 218.52 | 131.29 | 596.74 | -225.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 745.92 | -389.45 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 40 | 0 11 | 0 51 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 469 | 2.00 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 426 | 2.00 | 0 23 | 0 10 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 920 | 1.00 | 0 42 | 0 11 | 0 53 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 52 82 | 0.75 | 17 05 | 4 03 | 33 63 | 3 57 | 21 08 |
| 2 | 0 00 | 0 00 | | 5 27 | 0 00 | | 2 23 | 5 27 |
| 3 | 0 00 | 0 00 | | 6 51 | 2 01 | | 2 23 | 8 53 |
| 4 | 0 00 | 0 00 | | 6 93 | 0 00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0 00 | | 20 76 | 4 03 | | 3 21 | 24 79 |

***BARRA*** *21*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 218.52 | 131.29 | 1,392.38 | -782.51 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 1,740.48 | -1,085.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 40 | 0 11 | 0 51 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 23 | 0 10 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 42 | 0 11 | 0 53 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 82 | 14 56 | 4 03 | 33 63 | 3 57 | 18 59 |
| 2 | 0 00 | 0 00 | | 5 27 | 0 00 | | 2 23 | 5 27 |
| 3 | 0 00 | 0 00 | | 6 51 | 2 01 | | 2 23 | 8 53 |
| 4 | 0 00 | 0 00 | | 6 93 | 0 00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0 00 | | 20 76 | 4 03 | | 3 21 | 24 79 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *11*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 268.36 | 135.00 | 0.00 | 0.00 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 70.00 | 0.00 | 0.00 | 76.28 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 50 | 0 11 | 0 61 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 23 | 0 00 | 0 23 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 29 | 0 10 | 0 39 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 51 | 0 11 | 0 62 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 34 71 | 0 69 | 24 04 | 4 14 | 34 58 | 3 57 | 28 18 |
| 2 | 0 00 | 0 00 | | 6 48 | 0 00 | | 2 23 | 6 48 |
| 3 | 0 00 | 0 00 | | 8 00 | 2 07 | | 2 23 | 10 07 |
| 4 | 0 00 | 0 00 | | 8 84 | 0 00 | | 6 90 | 8 84 |
| 5 | 0 00 | 0 00 | | 25 50 | 4 14 | | 3 21 | 29 64 |

***BARRA*** *12*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 237.83 | 133.14 | 596.74 | -311.96 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 62.50 | 0.00 | 745.92 | -452.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 44 | 0 11 | 0 55 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 450 | 2.00 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 408 | 2.00 | 0 26 | 0 10 | 0 36 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 751 | 1.00 | 0 45 | 0 11 | 0 56 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 46 37 | 0 73 | 19 70 | 4 09 | 34 10 | 3 57 | 23 78 |
| 2 | 0 00 | 0 00 | | 5 74 | 0 00 | | 2 23 | 5 74 |
| 3 | 0 00 | 0 00 | | 7 09 | 2 04 | | 2 23 | 9 13 |
| 4 | 0 00 | 0 00 | | 7 89 | 0 00 | | 6 90 | 7 89 |
| 5 | 0 00 | 0 00 | | 22 60 | 4 09 | | 3 21 | 26 68 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *31*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 169.69 | 127.57 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.31 | 0.10 | 0.42 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 2.011 | 2.00 | 0.15 | 0.00 | 0.15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.926 | 2.00 | 0.18 | 0.10 | 0.28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.01 | 0.00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.452 | 1.00 | 0.32 | 0.11 | 0.43 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0.88 | 9.54 | 3.91 | 32.68 | 3.57 | 13.45 |
| 2 | 0.00 | 0.00 | | 4.10 | 0.00 | | 2.23 | 4.10 |
| 3 | 0.00 | 0.00 | | 5.06 | 1.96 | | 2.23 | 7.01 |
| 4 | 0.00 | 0.00 | | 5.00 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 16.12 | 3.91 | | 3.21 | 20.04 |

***BARRA*** *32*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 139.61 | 125.71 | 1,392.38 | -638.96 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.10 | 0.00 | 1,740.48 | -943.54 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.26 | 0.10 | 0.36 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 1.947 | 2.00 | 0.12 | 0.00 | 0.12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.867 | 2.00 | 0.15 | 0.10 | 0.25 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.01 | 0.00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.554 | 1.00 | 0.27 | 0.11 | 0.37 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 74.51 | 0.93 | 6.70 | 3.86 | 32.20 | 3.57 | 10.55 |
| 2 | 0.00 | 0.00 | | 3.37 | 0.00 | | 2.23 | 3.37 |
| 3 | 0.00 | 0.00 | | 4.16 | 1.93 | | 2.23 | 6.09 |
| 4 | 0.00 | 0.00 | | 4.05 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 13.27 | 3.86 | | 3.21 | 17.12 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *22*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 187.95 | 129.43 | 1,392.38 | -715.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 47.20 | 0.00 | 1,740.48 | -1,030.81 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.35 | 0.11 | 0.45 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 2.039 | 2.00 | 0.16 | 0.00 | 0.16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.953 | 2.00 | 0.20 | 0.10 | 0.30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.02 | 0.00 | 0.02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.234 | 1.00 | 0.36 | 0.11 | 0.47 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0.86 | 11.42 | 3.97 | 33.15 | 3.57 | 15.39 |
| 2 | 0.00 | 0.00 | | 4.54 | 0.00 | | 2.23 | 4.54 |
| 3 | 0.00 | 0.00 | | 5.60 | 1.99 | | 2.23 | 7.59 |
| 4 | 0.00 | 0.00 | | 5.96 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 17.86 | 3.97 | | 3.21 | 21.83 |

***BARRA*** *23*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 169.69 | 127.57 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m.) | bw,t (m.) | Tbt (t/m.) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante (Vd/Vr) | γ2 torsión (Td/Tr) | γ INTERACCION (γ1+γ2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0.123 | 1.000 | 1.00 | 0.31 | 0.10 | 0.42 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0.000 | 2.011 | 2.00 | 0.15 | 0.00 | 0.15 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0.119 | 0.250 | 0.061 | 1.926 | 2.00 | 0.18 | 0.10 | 0.28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0.505 | 0.000 | 0.000 | 0.704 | 1.00 | 0.01 | 0.00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0.380 | 0.180 | 0.123 | 0.452 | 1.00 | 0.32 | 0.11 | 0.43 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra) | Ast (cm2/m/fibra) | Asl (cm2) | Asmin cm2/m/fibra | Astotal (Asv + Ast) (cm2/m/fibra) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0.88 | 9.54 | 3.91 | 32.68 | 3.57 | 13.45 |
| 2 | 0.00 | 0.00 | | 4.10 | 0.00 | | 2.23 | 4.10 |
| 3 | 0.00 | 0.00 | | 5.06 | 1.96 | | 2.23 | 7.01 |
| 4 | 0.00 | 0.00 | | 5.00 | 0.00 | | 6.90 | 6.90 |
| 5 | 0.00 | 0.00 | | 16.12 | 3.91 | | 3.21 | 20.04 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *42*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 94.41 | 122.00 | 1,392.38 | -640.17 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 16.80 | 0.00 | 1,740.48 | -886.51 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 17 | 0 10 | 0 27 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 948 | 2.00 | 0 08 | 0 00 | 0 08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 868 | 2.00 | 0 10 | 0 09 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 551 | 1.00 | 0 18 | 0 10 | 0 28 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 09 | 2 05 | 3 74 | 31 25 | 3 57 | 5 79 |
| 2 | 0 00 | 0 00 | | 2 28 | 0 00 | | 2 23 | 2 28 |
| 3 | 0 00 | 0 00 | | 2 81 | 1 87 | | 2 23 | 4 69 |
| 4 | 0 00 | 0 00 | | 2 12 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 97 | 3 74 | | 3 21 | 12 71 |

***BARRA*** *43*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 80.07 | 120.14 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 15 | 0 10 | 0 25 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 965 | 2.00 | 0 07 | 0 00 | 0 07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 884 | 2.00 | 0 09 | 0 09 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 465 | 1.00 | 0 15 | 0 10 | 0 25 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 17 | 0 57 | 3 69 | 30 77 | 3 57 | 4 26 |
| 2 | 0 00 | 0 00 | | 1 93 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 39 | 1 84 | | 2 23 | 4 23 |
| 4 | 0 00 | 0 00 | | 1 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 7 61 | 3 69 | | 3 21 | 11 29 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *33*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 122.53 | 123.86 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 23 | 0 10 | 0 33 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 13 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 23 | 0 11 | 0 34 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 98 | 4 94 | 3 80 | 31 72 | 3 57 | 8 74 |
| 2 | 0 00 | 0 00 | | 2 96 | 0 00 | | 2 23 | 2 96 |
| 3 | 0 00 | 0 00 | | 3 65 | 1 90 | | 2 23 | 5 55 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 64 | 3 80 | | 3 21 | 15 44 |

***BARRA*** *41*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 122.53 | 123.86 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 23 | 0 10 | 0 33 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 13 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 23 | 0 11 | 0 34 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 98 | 4 94 | 3 80 | 31 72 | 3 57 | 8 74 |
| 2 | 0 00 | 0 00 | | 2 96 | 0 00 | | 2 23 | 2 96 |
| 3 | 0 00 | 0 00 | | 3 65 | 1 90 | | 2 23 | 5 55 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 64 | 3 80 | | 3 21 | 15 44 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *53*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 87.78 | 116.43 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 16 | 0 10 | 0 26 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 030 | 2.00 | 0 08 | 0 00 | 0 08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 945 | 2.00 | 0 09 | 0 09 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 17 | 0 10 | 0 27 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 12 | 1 37 | 3 57 | 29 82 | 3 57 | 4 94 |
| 2 | 0 00 | 0 00 | | 2 12 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 62 | 1 79 | | 2 23 | 4 40 |
| 4 | 0 00 | 0 00 | | 0 74 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 34 | 3 57 | | 3 21 | 11 91 |

***BARRA*** *61*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 87.78 | 116.43 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 16 | 0 10 | 0 26 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 030 | 2.00 | 0 08 | 0 00 | 0 08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 945 | 2.00 | 0 09 | 0 09 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 17 | 0 10 | 0 27 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 12 | 1 37 | 3 57 | 29 82 | 3 57 | 4 94 |
| 2 | 0 00 | 0 00 | | 2 12 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 62 | 1 79 | | 2 23 | 4 40 |
| 4 | 0 00 | 0 00 | | 0 74 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 34 | 3 57 | | 3 21 | 11 91 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *51*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 80.07 | 120.14 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 15 | 0 10 | 0 25 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 965 | 2.00 | 0 07 | 0 00 | 0 07 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 884 | 2.00 | 0 09 | 0 09 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 465 | 1.00 | 0 15 | 0 10 | 0 25 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 17 | 0 57 | 3 69 | 30 77 | 3 57 | 4 26 |
| 2 | 0 00 | 0 00 | | 1 93 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 39 | 1 84 | | 2 23 | 4 23 |
| 4 | 0 00 | 0 00 | | 1 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 7 61 | 3 69 | | 3 21 | 11 29 |

***BARRA*** *52*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 59.73 | 118.29 | 1,392.38 | -718.48 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 1.70 | 0.00 | 1,740.48 | -859.72 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 11 | 0 10 | 0 21 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 992 | 2.00 | 0 05 | 0 00 | 0 05 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 909 | 2.00 | 0 06 | 0 09 | 0 15 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 267 | 1.00 | 0 11 | 0 10 | 0 21 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 37 | -1 52 | 3 63 | 30 30 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 44 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 1 78 | 1 81 | | 2 23 | 3 59 |
| 4 | 0 00 | 0 00 | | 0 21 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 5 68 | 3 63 | | 3 21 | 9 30 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *71*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 133.74 | 112.72 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -1,218.34 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 25 | 0 09 | 0 34 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 12 | 0 00 | 0 12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 14 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 25 | 0 10 | 0 35 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 95 | 6 09 | 3 46 | 28 87 | 3 57 | 9 55 |
| 2 | 0 00 | 0 00 | | 3 23 | 0 00 | | 2 23 | 3 23 |
| 3 | 0 00 | 0 00 | | 3 99 | 1 73 | | 2 23 | 5 72 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 71 | 3 46 | | 3 21 | 16 17 |

***BARRA*** *72*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 150.96 | 110.86 | 1,392.38 | -1,123.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 25.00 | 0.00 | 1,740.48 | -1,152.28 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 28 | 0 09 | 0 37 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 209 | 2.00 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 111 | 2.00 | 0 16 | 0 08 | 0 25 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 29 | 0 09 | 0 38 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 91 | 7 87 | 3 40 | 28 39 | 3 57 | 11 27 |
| 2 | 0 00 | 0 00 | | 3 64 | 0 00 | | 2 23 | 3 64 |
| 3 | 0 00 | 0 00 | | 4 50 | 1 70 | | 2 23 | 6 20 |
| 4 | 0 00 | 0 00 | | 3 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 14 34 | 3 40 | | 3 21 | 17 75 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *62*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 104.37 | 114.57 | 1,392.38 | -874.20 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 13.60 | 0.00 | 1,740.48 | -863.08 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 19 | 0 09 | 0 29 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 09 | 0 00 | 0 09 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 11 | 0 09 | 0 20 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 20 | 0 10 | 0 30 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 04 | 3 07 | 3 52 | 29 35 | 3 57 | 6 59 |
| 2 | 0 00 | 0 00 | | 2 52 | 0 00 | | 2 23 | 2 52 |
| 3 | 0 00 | 0 00 | | 3 11 | 1 76 | | 2 23 | 4 87 |
| 4 | 0 00 | 0 00 | | 1 72 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 9 92 | 3 52 | | 3 21 | 13 43 |

***BARRA*** *63*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 133.74 | 112.72 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -876.07 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 25 | 0 09 | 0 34 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 12 | 0 00 | 0 12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 14 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 25 | 0 10 | 0 35 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 95 | 6 09 | 3 46 | 28 87 | 3 57 | 9 55 |
| 2 | 0 00 | 0 00 | | 3 23 | 0 00 | | 2 23 | 3 23 |
| 3 | 0 00 | 0 00 | | 3 99 | 1 73 | | 2 23 | 5 72 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 71 | 3 46 | | 3 21 | 16 17 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** *82*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 198.26 | 107.14 | 1,392.38 | -1,484.01 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.90 | 0.00 | 1,740.48 | -1,042.96 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 09 | 0 45 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 385 | 2.00 | 0 17 | 0.00 | 0.17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 276 | 2.00 | 0 21 | 0 08 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 38 | 0 09 | 0 47 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 84 | 12 73 | 3 29 | 27 44 | 3 57 | 16 02 |
| 2 | 0 00 | 0 00 | | 4 79 | 0 00 | | 2 23 | 4 79 |
| 3 | 0 00 | 0 00 | | 5 91 | 1 64 | | 2 23 | 7 55 |
| 4 | 0 00 | 0 00 | | 4 15 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 18 84 | 3 29 | | 3 21 | 22 13 |

***BARRA*** *83*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 226.28 | 105.29 | 1,392.38 | -1,697.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 1,740.48 | -999.61 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 44 | 0 09 | 0 53 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 603 | 1.25 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 479 | 1.25 | 0 21 | 0 07 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 46 | 0 09 | 0 54 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 57 | 0 76 | 15 61 | 3 23 | 26 97 | 3 57 | 18 84 |
| 2 | 0 00 | 0 00 | | 9 25 | 0 00 | | 2 23 | 9 25 |
| 3 | 0 00 | 0 00 | | 11 43 | 2 58 | | 2 23 | 14 01 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 22 77 | 3 23 | | 3 21 | 26 00 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** *73*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 179.87 | 109.00 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -1,093.75 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 33 | 0.09 | 0 42 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 19 | 0 08 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 34 | 0 09 | 0 43 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 86 | 10 84 | 3 34 | 27 92 | 3 57 | 14 18 |
| 2 | 0 00 | 0 00 | | 4 34 | 0 00 | | 2 23 | 4 34 |
| 3 | 0 00 | 0 00 | | 5 36 | 1 67 | | 2 23 | 7 03 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 17 09 | 3 34 | | 3 21 | 20 44 |

***BARRA*** *81*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 179.87 | 109.00 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -1,093.75 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 33 | 0.09 | 0 42 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 16 | 0 00 | 0 16 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 19 | 0 08 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 34 | 0 09 | 0 43 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 86 | 10 84 | 3 34 | 27 92 | 3 57 | 14 18 |
| 2 | 0 00 | 0 00 | | 4 34 | 0 00 | | 2 23 | 4 34 |
| 3 | 0 00 | 0 00 | | 5 36 | 1 67 | | 2 23 | 7 03 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 17 09 | 3 34 | | 3 21 | 20 44 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *93*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 272.40 | 101.57 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | -239.30 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 53 | 0 08 | 0 62 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 25 | 0 06 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 55 | 0 09 | 0 63 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 68 | 22 79 | 3 12 | 26 02 | 3 57 | 25 91 |
| 2 | 0 00 | 0 00 | | 11 14 | 0 00 | | 2 23 | 11 14 |
| 3 | 0 00 | 0 00 | | 13 75 | 2 49 | | 2 23 | 16 25 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 27 41 | 3 12 | | 3 21 | 30 52 |

***BARRA*** *101*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 272.40 | 101.57 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | -239.30 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 53 | 0 08 | 0 62 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 25 | 0 06 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 55 | 0 09 | 0 63 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 68 | 22 79 | 3 12 | 26 02 | 3 57 | 25 91 |
| 2 | 0 00 | 0 00 | | 11 14 | 0 00 | | 2 23 | 11 14 |
| 3 | 0 00 | 0 00 | | 13 75 | 2 49 | | 2 23 | 16 25 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 27 41 | 3 12 | | 3 21 | 30 52 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *91*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 226.28 | 105.29 | 596.74 | -1,140.84 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 745.92 | -303.41 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 44 | 0 09 | 0 53 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 125 | 1.25 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 033 | 1.25 | 0 21 | 0 07 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 46 | 0 09 | 0 54 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 70 | 18 05 | 3 23 | 26 97 | 3 57 | 21 28 |
| 2 | 0 00 | 0 00 | | 9 25 | 0 00 | | 2 23 | 9 25 |
| 3 | 0 00 | 0 00 | | 11 43 | 2 58 | | 2 23 | 14 01 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 22 77 | 3 23 | | 3 21 | 26 00 |

***BARRA*** *92*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 245.28 | 103.43 | 596.74 | -1,382.91 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 40.60 | 0.00 | 745.92 | -267.59 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 48 | 0 08 | 0 57 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 264 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 162 | 1.25 | 0 23 | 0 06 | 0 29 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 49 | 0 09 | 0 58 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 69 | 20 00 | 3 17 | 26 49 | 3 57 | 23 18 |
| 2 | 0 00 | 0 00 | | 10 03 | 0 00 | | 2 23 | 10 03 |
| 3 | 0 00 | 0 00 | | 12 38 | 2 54 | | 2 23 | 14 92 |
| 4 | 0 00 | 0 00 | | 5 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 24 68 | 3 17 | | 3 21 | 27 85 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** *111*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 416.24 | 97.86 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 87.90 | 0.00 | 0.00 | 364.41 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 82 | 0 08 | 0 90 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 31 | 0 00 | 0.31 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0.39 | 0 06 | 0 45 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0.03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 84 | 0 08 | 0 92 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 168 99 | 33 05 | 0 62 | 39 42 | 3 00 | 25 06 | 3 57 | 42 43 |
| 2 | 0 00 | 0 00 | | 17 02 | 0 00 | | 2 23 | 17 02 |
| 3 | 0 00 | 0 00 | | 21 02 | 2 40 | | 2 23 | 23 42 |
| 4 | 0 00 | 0 00 | | 11 10 | 0 00 | | 6 90 | 11 10 |
| 5 | 0 00 | 0 00 | | 41 88 | 3 00 | | 3 21 | 44 88 |

***BARRA*** *112*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 380.34 | 94.82 | 1,312.82 | -1,915.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 81.50 | 0.00 | 1,641.02 | -826.55 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 75 | 0 08 | 0.82 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 690 | 1.25 | 0.29 | 0 00 | 0 29 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 561 | 1.25 | 0 35 | 0 06 | 0.41 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0.000 | 0 704 | 1.00 | 0 03 | 0 00 | 0.03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 77 | 0 08 | 0 85 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 68 | 31 70 | 2 91 | 24 29 | 3 57 | 34 61 |
| 2 | 0 00 | 0 00 | | 15 55 | 0 00 | | 2 23 | 15 55 |
| 3 | 0 00 | 0 00 | | 19 20 | 2 33 | | 2 23 | 21 53 |
| 4 | 0 00 | 0 00 | | 10 29 | 0 00 | | 6 90 | 10 29 |
| 5 | 0 00 | 0 00 | | 38 27 | 2 91 | | 3 21 | 41 18 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** *102*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 292.01 | 99.72 | 596.74 | -2,030.36 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 48.40 | 0.00 | 745.92 | -218.66 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 57 | 0 08 | 0 65 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 599 | 1.25 | 0 22 | 0 00 | 0.22 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 476 | 1.25 | 0 27 | 0 06 | 0 33 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 59 | 0 08 | 0 67 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 67 | 24 81 | 3 06 | 25 54 | 3 57 | 27 87 |
| 2 | 0 00 | 0 00 | | 11 94 | 0 00 | | 2 23 | 11 94 |
| 3 | 0 00 | 0 00 | | 14 74 | 2 45 | | 2 23 | 17 19 |
| 4 | 0 00 | 0 00 | | 6 11 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 29 38 | 3 06 | | 3 21 | 32 44 |

***BARRA*** *103*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 318.51 | 97.86 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 52.20 | 0.00 | 0.00 | 359.69 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 62 | 0 08 | 0 70 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 24 | 0 00 | 0 24 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0 30 | 0 06 | 0 36 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 64 | 0 08 | 0 72 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 33 05 | 0 63 | 29 37 | 3 00 | 25 06 | 3 57 | 32 37 |
| 2 | 0 00 | 0 00 | | 13 02 | 0 00 | | 2 23 | 13 02 |
| 3 | 0 00 | 0 00 | | 16 08 | 2 40 | | 2 23 | 18 48 |
| 4 | 0 00 | 0 00 | | 6 59 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 32 05 | 3 00 | | 3 21 | 35 05 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *122*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 307.89 | 88.74 | 1,312.82 | -468.76 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 68.80 | 0.00 | 1,641.02 | -838.01 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 60 | 0 07 | 0 68 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 895 | 1.25 | 0 23 | 0 00 | 0 23 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 819 | 1.25 | 0 29 | 0 06 | 0 34 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 407 | 0.180 | 0 123 | 0 869 | 1.00 | 0 62 | 0 08 | 0 69 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309.81 | 72 20 | 0 71 | 24 25 | 2 72 | 22 73 | 3 57 | 26 97 |
| 2 | 0 00 | 0 00 | | 12 59 | 0 00 | | 2 23 | 12 59 |
| 3 | 0 00 | 0 00 | | 15 55 | 2 18 | | 2 23 | 17 72 |
| 4 | 0 00 | 0 00 | | 8 69 | 0 00 | | 6 90 | 8 69 |
| 5 | 0 00 | 0 00 | | 30 98 | 2 72 | | 3 21 | 33 70 |

***BARRA*** *123*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 272.68 | 85.70 | 1,312.82 | 713.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 1,641.02 | -855.05 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 53 | 0.07 | 0 60 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 0 783 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 0 810 | 1.25 | 0 25 | 0 05 | 0 31 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 268 | 0.180 | 0 082 | 2 132 | 1.50 | 0 59 | 0 08 | 0 67 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309.81 | 72 20 | 0.73 | 20 63 | 2 63 | 21 95 | 3 57 | 23 25 |
| 2 | 0 00 | 0 00 | | 11 15 | 0 00 | | 2 23 | 11 15 |
| 3 | 0 00 | 0 00 | | 13 77 | 2 10 | | 2 23 | 15 87 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 18 29 | 1 75 | | 3 21 | 20 04 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *113*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 344.85 | 91.78 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -828.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 68 | 0 08 | 0 75 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 26 | 0 00 | 0 26 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 32 | 0 06 | 0 38 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 69 | 0 08 | 0 77 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309.81 | 72 20 | 0 69 | 28 05 | 2 82 | 23 51 | 3 57 | 30 87 |
| 2 | 0 00 | 0 00 | | 14 10 | 0 00 | | 2 23 | 14 10 |
| 3 | 0 00 | 0 00 | | 17 41 | 2 25 | | 2 23 | 19 67 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 34 70 | 2 82 | | 3 21 | 37 51 |

***BARRA*** *121*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 344.85 | 91.78 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -828.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 68 | 0 08 | 0 75 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 26 | 0 00 | 0 26 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 32 | 0 06 | 0 38 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 69 | 0 08 | 0 77 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309.81 | 72 20 | 0 69 | 28 05 | 2 82 | 23 51 | 3 57 | 30 87 |
| 2 | 0 00 | 0 00 | | 14 10 | 0 00 | | 2 23 | 14 10 |
| 3 | 0 00 | 0 00 | | 17 41 | 2 25 | | 2 23 | 19 67 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 34 70 | 2 82 | | 3 21 | 37 51 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *133*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 200.83 | 79.63 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,025.44 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 07 | 0 44 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 22 | 0 06 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 41 | 0 07 | 0 49 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 88 | 11 48 | 2 44 | 20 39 | 3 57 | 13 92 |
| 2 | 0 00 | 0 00 | | 4 85 | 0 00 | | 2 23 | 4 85 |
| 3 | 0 00 | 0 00 | | 5 99 | 1 22 | | 2 23 | 7 21 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 72 | 1 63 | | 3 21 | 14 35 |

***BARRA*** *141*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 200.83 | 79.63 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,025.44 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 07 | 0 44 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 22 | 0 06 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 41 | 0 07 | 0 49 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 88 | 11 48 | 2 44 | 20 39 | 3 57 | 13 92 |
| 2 | 0 00 | 0 00 | | 4 85 | 0 00 | | 2 23 | 4 85 |
| 3 | 0 00 | 0 00 | | 5 99 | 1 22 | | 2 23 | 7 21 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 72 | 1 63 | | 3 21 | 14 35 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *131*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 272.68 | 85.70 | 1,909.56 | -433.33 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 2,386.94 | -1,377.19 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 53 | 0 07 | 0 60 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 036 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 950 | 1.25 | 0 25 | 0 05 | 0 31 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 335 | 0.180 | 0 102 | 1 200 | 1.20 | 0 56 | 0 07 | 0 63 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 90 00 | 0 76 | 18 79 | 2 63 | 21 95 | 3 57 | 21 42 |
| 2 | 0 00 | 0 00 | | 11 15 | 0 00 | | 2 23 | 11 15 |
| 3 | 0 00 | 0 00 | | 13 77 | 2 10 | | 2 23 | 15 87 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 22 87 | 2 19 | | 3 21 | 25 06 |

***BARRA*** *132*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 235.13 | 82.67 | 1,909.56 | 620.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 56.10 | 0.00 | 2,386.94 | -1,110.73 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 44 | 0 07 | 0 50 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 210 | 2.00 | 0 20 | 0 00 | 0 20 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 189 | 2.00 | 0 25 | 0 06 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 121 | 1.50 | 0 48 | 0 08 | 0 56 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 84 | 15 00 | 2 54 | 21 17 | 3 57 | 17 54 |
| 2 | 0 00 | 0 00 | | 5 67 | 0 00 | | 2 23 | 5 67 |
| 3 | 0 00 | 0 00 | | 7 01 | 1 27 | | 2 23 | 8 28 |
| 4 | 0 00 | 0 00 | | 7 08 | 0 00 | | 6 90 | 7 08 |
| 5 | 0 00 | 0 00 | | 14 89 | 1 69 | | 3 21 | 16 59 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *151*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 129.73 | 73.55 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 24 | 0 06 | 0 30 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 14 | 0 06 | 0 20 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 27 | 0 07 | 0 33 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 03 | 4 16 | 2 26 | 18 84 | 3 57 | 6 42 |
| 2 | 0 00 | 0 00 | | 3 13 | 0 00 | | 2 23 | 3 13 |
| 3 | 0 00 | 0 00 | | 3 87 | 1 13 | | 2 23 | 4 99 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 22 | 1 50 | | 3 21 | 9 72 |

***BARRA*** *152*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 91.58 | 70.51 | 1,909.56 | 1,363.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 12.50 | 0.00 | 2,386.94 | -873.67 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 17 | 0 06 | 0 23 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 08 | 0 00 | 0 08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 10 | 0 05 | 0 15 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 590 | 1.50 | 0 19 | 0 06 | 0 25 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 20 | 0 24 | 2 16 | 18 06 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 2 21 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 73 | 1 08 | | 2 23 | 3 81 |
| 4 | 0 00 | 0 00 | | 1 58 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 5 80 | 1 44 | | 3 21 | 7 24 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *142*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 162.54 | 76.59 | 1,909.56 | 1,113.62 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 37.30 | 0.00 | 2,386.94 | -954.58 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 30 | 0 06 | 0 36 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 595 | 2.00 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 652 | 2.00 | 0 17 | 0 06 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 442 | 1.50 | 0 33 | 0 07 | 0 41 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 94 | 7 54 | 2 35 | 19 62 | 3 57 | 9 89 |
| 2 | 0 00 | 0 00 | | 3 92 | 0 00 | | 2 23 | 3 92 |
| 3 | 0 00 | 0 00 | | 4 84 | 1 17 | | 2 23 | 6 02 |
| 4 | 0 00 | 0 00 | | 4 71 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 10 30 | 1 57 | | 3 21 | 11 86 |

***BARRA*** *143*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 129.73 | 73.55 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0.24 | 0.06 | 0 30 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 14 | 0 06 | 0 20 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 27 | 0 07 | 0 33 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 03 | 4 16 | 2 26 | 18 84 | 3 57 | 6 42 |
| 2 | 0 00 | 0 00 | | 3 13 | 0 00 | | 2 23 | 3 13 |
| 3 | 0 00 | 0 00 | | 3 87 | 1 13 | | 2 23 | 4 99 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 22 | 1 50 | | 3 21 | 9 72 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *162*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 91.58 | 69.33 | 1,909.56 | 1,363.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 12.50 | 0.00 | 2,386.94 | -873.67 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 17 | 0 06 | 0 23 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 08 | 0 00 | 0 08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 10 | 0 05 | 0 15 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 590 | 1.50 | 0 19 | 0 06 | 0 25 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 20 | 0 24 | 2 13 | 17 76 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 2 21 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 73 | 1 06 | | 2 23 | 3 79 |
| 4 | 0 00 | 0 00 | | 1 58 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 5 80 | 1 42 | | 3 21 | 7 22 |

***BARRA*** *163*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 129.73 | 71.18 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 24 | 0 06 | 0 30 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 14 | 0 05 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 27 | 0 07 | 0 33 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 03 | 4 16 | 2 18 | 18 23 | 3 57 | 6 34 |
| 2 | 0 00 | 0 00 | | 3 13 | 0 00 | | 2 23 | 3 13 |
| 3 | 0 00 | 0 00 | | 3 87 | 1 09 | | 2 23 | 4 96 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 22 | 1 46 | | 3 21 | 9 67 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *153*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 60.45 | 67.47 | 1,909.56 | 1,395.39 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 0.00 | 0.00 | 2,386.94 | -863.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 11 | 0 06 | 0 17 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 05 | 0 00 | 0 05 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 06 | 0 05 | 0 12 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 608 | 1.50 | 0 12 | 0 06 | 0 19 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 50 | -2 97 | 2 07 | 17 28 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 46 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 1 80 | 1 04 | | 2 23 | 2 84 |
| 4 | 0 00 | 0 00 | | 0 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 3 83 | 1 38 | | 3 21 | 5 21 |

***BARRA*** *161*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 60.45 | 67.47 | 1,909.56 | 1,395.39 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 0.00 | 0.00 | 2,386.94 | -863.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 11 | 0 06 | 0 17 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 000 | 2.00 | 0 05 | 0 00 | 0 05 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 000 | 2.00 | 0 06 | 0 05 | 0 12 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 608 | 1.50 | 0 12 | 0 06 | 0 19 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 1 50 | -2 97 | 2 07 | 17 28 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 46 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 1 80 | 1 04 | | 2 23 | 2 84 |
| 4 | 0 00 | 0 00 | | 0 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 3 83 | 1 38 | | 3 21 | 5 21 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *173*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 200.83 | 74.90 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,025.44 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 06 | 0 43 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 22 | 0 06 | 0 27 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 41 | 0 07 | 0 48 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 88 | 11 48 | 2 30 | 19 18 | 3 57 | 13 77 |
| 2 | 0 00 | 0 00 | | 4 85 | 0 00 | | 2 23 | 4 85 |
| 3 | 0 00 | 0 00 | | 5 99 | 1 15 | | 2 23 | 7 13 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 72 | 1 53 | | 3 21 | 14 25 |

***BARRA*** *181*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 200.83 | 74.90 | 1,909.56 | 897.09 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 49.70 | 0.00 | 2,386.94 | -1,414.57 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 06 | 0 43 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 917 | 2.00 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 926 | 2.00 | 0 22 | 0 06 | 0 27 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 307 | 1.50 | 0 41 | 0 07 | 0 48 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 88 | 11 48 | 2 30 | 19 18 | 3 57 | 13 77 |
| 2 | 0 00 | 0 00 | | 4 85 | 0 00 | | 2 23 | 4 85 |
| 3 | 0 00 | 0 00 | | 5 99 | 1 15 | | 2 23 | 7 13 |
| 4 | 0 00 | 0 00 | | 6 28 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 72 | 1 53 | | 3 21 | 14 25 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *171*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 129.73 | 71.18 | 1,909.56 | 1,270.24 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.80 | 0.00 | 2,386.94 | -904.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 24 | 0 06 | 0 30 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 047 | 2.00 | 0 11 | 0 00 | 0 11 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 333 | 2.00 | 0 14 | 0 05 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 536 | 1.50 | 0 27 | 0 07 | 0 33 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450.64 | 89.29 | 1 03 | 4 16 | 2 18 | 18 23 | 3 57 | 6 34 |
| 2 | 0 00 | 0 00 | | 3 13 | 0 00 | | 2 23 | 3 13 |
| 3 | 0 00 | 0 00 | | 3 87 | 1 09 | | 2 23 | 4 96 |
| 4 | 0 00 | 0 00 | | 3 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 22 | 1 46 | | 3 21 | 9 67 |

***BARRA*** *172*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 162.54 | 73.04 | 1,909.56 | 1,113.62 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 37.30 | 0.00 | 2,386.94 | -954.58 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 30 | 0 06 | 0 36 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 0 595 | 2.00 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 0 652 | 2.00 | 0 17 | 0 06 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 442 | 1.50 | 0 33 | 0 07 | 0 40 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450.64 | 89.29 | 0 94 | 7 54 | 2 24 | 18 71 | 3 57 | 9 78 |
| 2 | 0 00 | 0 00 | | 3 92 | 0 00 | | 2 23 | 3 92 |
| 3 | 0 00 | 0 00 | | 4 84 | 1 12 | | 2 23 | 5 96 |
| 4 | 0 00 | 0 00 | | 4 71 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 10 30 | 1 49 | | 3 21 | 11 79 |

## ANÁLISIS TRANSVERSAL DE ESFUERZOS

***BARRA*** ***191***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 272.68 | 78.61 | 1,312.82 | 713.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 1,641.02 | -626.30 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 53 | 0 06 | 0 60 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 0 783 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 0 810 | 1.25 | 0 25 | 0 05 | 0 30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 268 | 0.180 | 0 082 | 2 132 | 1.50 | 0 59 | 0 07 | 0 67 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309.81 | 72 20 | 0.73 | 20 63 | 2 41 | 20.14 | 3 57 | 23 04 |
| 2 | 0.00 | 0.00 | | 11 15 | 0 00 | | 2 23 | 11 15 |
| 3 | 0 00 | 0 00 | | 13 77 | 1 93 | | 2 23 | 15 70 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 18 29 | 1 61 | | 3 21 | 19 90 |

***BARRA*** ***192***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 307.89 | 80.47 | 1,312.82 | -468.76 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 68.80 | 0.00 | 1,641.02 | -519.29 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 60 | 0 07 | 0 67 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 895 | 1.25 | 0 23 | 0 00 | 0 23 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 819 | 1.25 | 0 29 | 0 05 | 0 34 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 0 869 | 1.00 | 0 62 | 0 07 | 0 69 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309.81 | 72 20 | 0 71 | 24 25 | 2 47 | 20 61 | 3 57 | 26 72 |
| 2 | 0.00 | 0 00 | | 12 59 | 0 00 | | 2 23 | 12 59 |
| 3 | 0.00 | 0.00 | | 15 55 | 1 98 | | 2 23 | 17 52 |
| 4 | 0.00 | 0 00 | | 8 69 | 0 00 | | 6 90 | 8 69 |
| 5 | 0 00 | 0 00 | | 30 98 | 2 47 | | 3 21 | 33 45 |





## ANÁLISIS TRANSVERSAL DE ESFUERZOS

***BARRA*** ***182***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 235.13 | 76.76 | 1,909.56 | 620.35 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 56.10 | 0.00 | 2,386.94 | -1,414.57 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 44 | 0 06 | 0 50 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 210 | 2.00 | 0 20 | 0 00 | 0 20 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 189 | 2.00 | 0 25 | 0 06 | 0 31 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 253 | 0.180 | 0 082 | 2 121 | 1.50 | 0 48 | 0 07 | 0 55 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 89 29 | 0 84 | 15 00 | 2 36 | 19 66 | 3 57 | 17 36 |
| 2 | 0 00 | 0.00 | | 5 67 | 0 00 | | 2 23 | 5 67 |
| 3 | 0 00 | 0 00 | | 7 01 | 1 18 | | 2 23 | 8 19 |
| 4 | 0.00 | 0.00 | | 7 08 | 0 00 | | 6 90 | 7 08 |
| 5 | 0 00 | 0 00 | | 14 89 | 1 57 | | 3 21 | 16 46 |

***BARRA*** ***183***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 272.68 | 78.61 | 1,909.56 | -433.33 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 62.40 | 0.00 | 2,386.94 | -1,272.82 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 53 | 0 06 | 0 60 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 036 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 950 | 1.25 | 0 25 | 0 05 | 0 30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 335 | 0.180 | 0 102 | 1 200 | 1.20 | 0 56 | 0 07 | 0 63 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 450 64 | 90 00 | 0 76 | 18 79 | 2 41 | 20 14 | 3 57 | 21 21 |
| 2 | 0 00 | 0 00 | | 11 15 | 0 00 | | 2 23 | 11 15 |
| 3 | 0.00 | 0.00 | | 13 77 | 1 93 | | 2 23 | 15 70 |
| 4 | 0 00 | 0 00 | | 7 88 | 0 00 | | 6 90 | 7 88 |
| 5 | 0 00 | 0 00 | | 22 87 | 2 01 | | 3 21 | 24 88 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***202***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 380.34 | 84.18 | 1,312.82 | -1,915.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 81.50 | 0.00 | 1,641.02 | -358.91 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 75 | 0.07 | 0 81 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 690 | 1.25 | 0 29 | 0.00 | 0 29 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 561 | 1.25 | 0 35 | 0.05 | 0 41 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0.00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 77 | 0 07 | 0 84 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 68 | 31 70 | 2 58 | 21 56 | 3 57 | 34 28 |
| 2 | 0 00 | 0 00 | | 15 55 | 0 00 | | 2 23 | 15 55 |
| 3 | 0 00 | 0 00 | | 19 20 | 2 07 | | 2 23 | 21 27 |
| 4 | 0 00 | 0 00 | | 10 29 | 0 00 | | 6 90 | 10 29 |
| 5 | 0 00 | 0 00 | | 38 27 | 2 58 | | 3 21 | 40 85 |

***BARRA*** ***203***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 416.24 | 86.04 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 87.90 | 0.00 | 0.00 | 1,005.57 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 82 | 0.07 | 0 89 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 31 | 0 00 | 0 31 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 650 | 1.25 | 0 39 | 0 05 | 0 44 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 84 | 0 07 | 0 91 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 168 99 | 33 05 | 0 62 | 39 42 | 2 64 | 22 04 | 3 57 | 42 06 |
| 2 | 0 00 | 0 00 | | 17 02 | 0 00 | | 2 23 | 17 02 |
| 3 | 0 00 | 0 00 | | 21 02 | 2 11 | | 2 23 | 23 13 |
| 4 | 0 00 | 0 00 | | 11 10 | 0 00 | | 6 90 | 11 10 |
| 5 | 0 00 | 0 00 | | 41 88 | 2 64 | | 3 21 | 44 52 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***193***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 344.85 | 82.33 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -429.77 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 68 | 0 07 | 0 74 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 26 | 0 00 | 0 26 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 32 | 0 05 | 0 37 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 69 | 0 07 | 0 76 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72 20 | 0 69 | 28 05 | 2 53 | 21 09 | 3 57 | 30 58 |
| 2 | 0 00 | 0 00 | | 14 10 | 0 00 | | 2 23 | 14 10 |
| 3 | 0 00 | 0 00 | | 17 41 | 2 02 | | 2 23 | 19 43 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 34 70 | 2 53 | | 3 21 | 37 22 |

***BARRA*** ***201***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 344.85 | 82.33 | 1,312.82 | -1,063.99 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 75.20 | 0.00 | 1,641.02 | -429.77 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 68 | 0.07 | 0 74 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 256 | 1.25 | 0 26 | 0 00 | 0 26 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 155 | 1.25 | 0 32 | 0 05 | 0 37 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 69 | 0 07 | 0 76 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 309 81 | 72.20 | 0 69 | 28 05 | 2 53 | 21 09 | 3 57 | 30 58 |
| 2 | 0 00 | 0 00 | | 14 10 | 0 00 | | 2 23 | 14 10 |
| 3 | 0 00 | 0 00 | | 17 41 | 2 02 | | 2 23 | 19 43 |
| 4 | 0 00 | 0 00 | | 9 49 | 0 00 | | 6 90 | 9 49 |
| 5 | 0 00 | 0 00 | | 34 70 | 2 53 | | 3 21 | 37 22 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** ***213***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 284.64 | 89.75 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 56 | 0 07 | 0 63 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 27 | 0 06 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 57 | 0 08 | 0 65 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 68 | 24 05 | 2 75 | 22 99 | 3 57 | 26 81 |
| 2 | 0 00 | 0 00 | | 11 64 | 0 00 | | 2 23 | 11 64 |
| 3 | 0 00 | 0 00 | | 14 37 | 2 20 | | 2 23 | 16 58 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 28 64 | 2 75 | | 3 21 | 31 39 |

***BARRA*** ***221***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 284.64 | 89.75 | 596.74 | -1,679.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 44.50 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 56 | 0 07 | 0 63 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 423 | 1.25 | 0 21 | 0 00 | 0 21 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 311 | 1.25 | 0 27 | 0 06 | 0 32 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 57 | 0 08 | 0 65 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 68 | 24 05 | 2 75 | 22 99 | 3 57 | 26 81 |
| 2 | 0 00 | 0 00 | | 11 64 | 0 00 | | 2 23 | 11 64 |
| 3 | 0 00 | 0 00 | | 14 37 | 2 20 | | 2 23 | 16 58 |
| 4 | 0 00 | 0 00 | | 5 62 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 28 64 | 2 75 | | 3 21 | 31 39 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** ***211***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-E | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 5.534 | 0.856 | 0.544 | 330.75 | 86.04 | 0.00 | -2,014.20 | S.COMP. |
| H-H | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.387 | 0.227 | 0.731 | 52.20 | 0.00 | 0.00 | 1,038.33 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 65 | 0 07 | 0 72 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 1 928 | 1.25 | 0 25 | 0 00 | 0 25 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 1 850 | 1.25 | 0 31 | 0 05 | 0 36 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 67 | 0 07 | 0 74 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 33 05 | 0 63 | 30 63 | 2 64 | 22 04 | 3 57 | 33 27 |
| 2 | 0 00 | 0 00 | | 13 52 | 0 00 | | 2 23 | 13 52 |
| 3 | 0 00 | 0 00 | | 16 70 | 2 11 | | 2 23 | 18 81 |
| 4 | 0 00 | 0 00 | | 6 59 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 33 28 | 2 64 | | 3 21 | 35 92 |

***BARRA*** ***212***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 304.25 | 87.90 | 596.74 | -2,030.36 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 48.40 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 60 | 0 07 | 0 67 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 599 | 1.25 | 0 23 | 0 00 | 0 23 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 476 | 1.25 | 0 28 | 0 06 | 0 34 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 61 | 0 07 | 0 69 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 67 | 26 07 | 2 70 | 22 51 | 3 57 | 28 77 |
| 2 | 0 00 | 0 00 | | 12 44 | 0 00 | | 2 23 | 12 44 |
| 3 | 0 00 | 0 00 | | 15 36 | 2 16 | | 2 23 | 17 52 |
| 4 | 0 00 | 0 00 | | 6 11 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 30 61 | 2 70 | | 3 21 | 33 31 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***231***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 238.52 | 93.47 | 1,392.38 | -1,697.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 1,740.48 | -377.98 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 47 | 0 08 | 0 54 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 603 | 1.25 | 0 18 | 0 00 | 0 18 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 479 | 1.25 | 0 22 | 0 06 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 48 | 0 08 | 0 56 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 57 | 0 75 | 16 87 | 2 87 | 23 94 | 3 57 | 19 73 |
| 2 | 0 00 | 0 00 | | 9 75 | 0 00 | | 2 23 | 9 75 |
| 3 | 0 00 | 0 00 | | 12 04 | 2 29 | | 2 23 | 14 34 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 24 00 | 2 87 | | 3 21 | 26 86 |

***BARRA*** ***232***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 210.50 | 95.33 | 1,392.38 | -1,484.01 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.90 | 0.00 | 1,740.48 | -428.53 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 39 | 0 08 | 0 47 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 385 | 2.00 | 0 18 | 0 00 | 0 18 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 276 | 2.00 | 0 23 | 0 07 | 0 30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 40 | 0 08 | 0 48 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 82 | 13 99 | 2 92 | 24 42 | 3 57 | 16 92 |
| 2 | 0 00 | 0 00 | | 5 08 | 0 00 | | 2 23 | 5 08 |
| 3 | 0 00 | 0 00 | | 6 27 | 1 46 | | 2 23 | 7 74 |
| 4 | 0 00 | 0 00 | | 4 15 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 20 00 | 2 92 | | 3 21 | 22 93 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***222***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 257.52 | 91.61 | 596.74 | -1,382.91 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 40.60 | 0.00 | 745.92 | 527.17 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 50 | 0 07 | 0 58 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 264 | 1.25 | 0 19 | 0 00 | 0 19 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 162 | 1.25 | 0 24 | 0 06 | 0 30 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 52 | 0 08 | 0 60 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 50 85 | 0 69 | 21 26 | 2 81 | 23 46 | 3 57 | 24 07 |
| 2 | 0 00 | 0 00 | | 10 53 | 0 00 | | 2 23 | 10 53 |
| 3 | 0 00 | 0 00 | | 13 00 | 2 25 | | 2 23 | 15 25 |
| 4 | 0 00 | 0 00 | | 5 13 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 25 91 | 2 81 | | 3 21 | 28 72 |

***BARRA*** ***223***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-D | 1.400 | 1.148 | 500 | 250 | 4.074 | 9.255 | 2.565 | 0.534 | 0.613 | 238.52 | 93.47 | 596.74 | -1,140.84 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 36.70 | 0.00 | 745.92 | 516.19 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 47 | 0 08 | 0 54 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 164 | 0.000 | 0 000 | 2 125 | 1.25 | 0 18 | 0 00 | 0 18 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 202 | 0.250 | 0 098 | 2 033 | 1.25 | 0 22 | 0 06 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 402 | 0.180 | 0 123 | 1 000 | 1.00 | 0 48 | 0 08 | 0 56 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140.82 | 50.85 | 0 70 | 19 31 | 2 87 | 23 94 | 3 57 | 22 18 |
| 2 | 0 00 | 0 00 | | 9 75 | 0 00 | | 2 23 | 9 75 |
| 3 | 0 00 | 0 00 | | 12 04 | 2 29 | | 2 23 | 14 34 |
| 4 | 0 00 | 0 00 | | 4 63 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 24 00 | 2 87 | | 3 21 | 26 86 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** ***242***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 163.20 | 99.04 | 1,392.38 | -1,123.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 25.00 | 0.00 | 1,740.48 | -695.92 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 30 | 0 08 | 0 38 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 209 | 2.00 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 111 | 2.00 | 0 18 | 0 08 | 0 25 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 31 | 0 08 | 0 39 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 88 | 9 12 | 3 04 | 25 37 | 3 57 | 12 16 |
| 2 | 0 00 | 0 00 | | 3 94 | 0 00 | | 2 23 | 3 94 |
| 3 | 0 00 | 0 00 | | 4 86 | 1 52 | | 2 23 | 6 38 |
| 4 | 0 00 | 0 00 | | 3 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 15 51 | 3 04 | | 3 21 | 18 55 |

***BARRA*** ***243***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 145.98 | 100.90 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -695.92 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 27 | 0 08 | 0 35 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 16 | 0 08 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 28 | 0 09 | 0 36 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 92 | 7 35 | 3 10 | 25 84 | 3 57 | 10 45 |
| 2 | 0 00 | 0 00 | | 3 52 | 0 00 | | 2 23 | 3 52 |
| 3 | 0 00 | 0 00 | | 4 35 | 1 55 | | 2 23 | 5 90 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 13 87 | 3 10 | | 3 21 | 16 97 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**
***BARRA*** ***233***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 192.11 | 97.18 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -499.39 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 36 | 0 08 | 0 44 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 21 | 0 07 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 37 | 0 08 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 84 | 12 10 | 2 98 | 24 89 | 3 57 | 15 08 |
| 2 | 0 00 | 0 00 | | 4 64 | 0 00 | | 2 23 | 4 64 |
| 3 | 0 00 | 0 00 | | 5 73 | 1 49 | | 2 23 | 7 22 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 18 25 | 2 98 | | 3 21 | 21 24 |

***BARRA*** ***241***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 192.11 | 97.18 | 1,392.38 | -1,292.79 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 28.90 | 0.00 | 1,740.48 | -499.39 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 36 | 0 08 | 0 44 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 294 | 2.00 | 0 17 | 0 00 | 0 17 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 190 | 2.00 | 0 21 | 0 07 | 0 28 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 37 | 0 08 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmín cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 84 | 12 10 | 2 98 | 24 89 | 3 57 | 15 08 |
| 2 | 0 00 | 0 00 | | 4 64 | 0 00 | | 2 23 | 4 64 |
| 3 | 0 00 | 0 00 | | 5 73 | 1 49 | | 2 23 | 7 22 |
| 4 | 0 00 | 0 00 | | 3 65 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 18 25 | 2 98 | | 3 21 | 21 24 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***253***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 100.02 | 104.61 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 19 | 0 09 | 0 27 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 030 | 2.00 | 0 09 | 0 00 | 0 09 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 945 | 2.00 | 0 11 | 0 08 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 19 | 0 09 | 0 28 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 06 | 2 62 | 3 21 | 26 79 | 3 57 | 5 83 |
| 2 | 0 00 | 0 00 | | 2 41 | 0 00 | | 2 23 | 2 41 |
| 3 | 0 00 | 0 00 | | 2 98 | 1 60 | | 2 23 | 4 59 |
| 4 | 0 00 | 0 00 | | 0 74 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 9 50 | 3 21 | | 3 21 | 12 71 |

***BARRA*** ***261***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 100.02 | 104.61 | 1,392.38 | -786.60 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 5.90 | 0.00 | 1,740.48 | -857.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 19 | 0 09 | 0 27 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 030 | 2.00 | 0 09 | 0 00 | 0 09 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 945 | 2.00 | 0 11 | 0 08 | 0 19 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0 00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 19 | 0 09 | 0 28 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 06 | 2 62 | 3 21 | 26 79 | 3 57 | 5 83 |
| 2 | 0 00 | 0 00 | | 2 41 | 0 00 | | 2 23 | 2 41 |
| 3 | 0 00 | 0 00 | | 2 98 | 1 60 | | 2 23 | 4 59 |
| 4 | 0 00 | 0 00 | | 0 74 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 9 50 | 3 21 | | 3 21 | 12 71 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***251***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 145.98 | 100.90 | 1,392.38 | -980.64 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 21.10 | 0.00 | 1,740.48 | -876.07 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 27 | 0 08 | 0 35 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 135 | 2.00 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 2 042 | 2.00 | 0 16 | 0 08 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 28 | 0 09 | 0 36 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 92 | 7 35 | 3 10 | 25 84 | 3 57 | 10 45 |
| 2 | 0 00 | 0 00 | | 3 52 | 0 00 | | 2 23 | 3 52 |
| 3 | 0 00 | 0 00 | | 4 35 | 1 55 | | 2 23 | 5 90 |
| 4 | 0 00 | 0 00 | | 2 66 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 13 87 | 3 10 | | 3 21 | 16 97 |

***BARRA*** ***252***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 116.61 | 102.75 | 1,392.38 | -874.20 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 13.60 | 0.00 | 1,740.48 | -863.08 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 22 | 0 08 | 0 30 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 10 | 0 00 | 0 10 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 13 | 0 08 | 0 20 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 22 | 0 09 | 0 31 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 00 | 4 33 | 3 15 | 26 32 | 3 57 | 7 48 |
| 2 | 0 00 | 0 00 | | 2 81 | 0 00 | | 2 23 | 2 81 |
| 3 | 0 00 | 0 00 | | 3 48 | 1 58 | | 2 23 | 5 05 |
| 4 | 0 00 | 0 00 | | 1 72 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 11 08 | 3 15 | | 3 21 | 14 23 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***271***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 92.31 | 110.69 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0.17 | 0.09 | 0.26 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 965 | 2.00 | 0.08 | 0.00 | 0.08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 884 | 2.00 | 0 10 | 0.08 | 0.18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 465 | 1.00 | 0 18 | 0 09 | 0 27 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 10 | 1 83 | 3 40 | 28 35 | 3 57 | 5 23 |
| 2 | 0 00 | 0 00 | | 2 23 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 75 | 1 70 | | 2 23 | 4 45 |
| 4 | 0 00 | 0 00 | | 1 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 77 | 3 40 | | 3 21 | 12 17 |

***BARRA*** ***272***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 106.65 | 113.73 | 1,392.38 | -640.17 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 16.80 | 0.00 | 1,740.48 | -886.51 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 20 | 0.09 | 0 29 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 948 | 2.00 | 0.09 | 0.00 | 0.09 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 868 | 2.00 | 0 11 | 0.09 | 0 20 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0.01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 551 | 1.00 | 0.20 | 0 10 | 0 30 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 03 | 3 31 | 3 49 | 29 13 | 3 57 | 6 80 |
| 2 | 0 00 | 0 00 | | 2 57 | 0 00 | | 2 23 | 2 57 |
| 3 | 0 00 | 0 00 | | 3 18 | 1 74 | | 2 23 | 4 92 |
| 4 | 0 00 | 0 00 | | 2 12 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 10 13 | 3 49 | | 3 21 | 13 62 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***262***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 71.97 | 107.65 | 1,392.38 | -718.48 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 1.70 | 0.00 | 1,740.48 | -859.72 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 13 | 0.09 | 0 22 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 992 | 2.00 | 0 06 | 0.00 | 0.06 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 909 | 2.00 | 0.08 | 0.08 | 0 16 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 00 | 0 00 | 0.00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 267 | 1.00 | 0 14 | 0 09 | 0 23 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 24 | -0 26 | 3 30 | 27 57 | 3 57 | 3 57 |
| 2 | 0 00 | 0 00 | | 1 74 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 15 | 1 65 | | 2 23 | 3 80 |
| 4 | 0 00 | 0 00 | | 0 21 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 6 84 | 3 30 | | 3 21 | 10 14 |

***BARRA*** ***263***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 92.31 | 110.69 | 1,392.38 | -669.69 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 9.20 | 0.00 | 1,740.48 | -869.35 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0.17 | 0.09 | 0.26 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 965 | 2.00 | 0.08 | 0.00 | 0.08 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 884 | 2.00 | 0 10 | 0.08 | 0 18 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 465 | 1.00 | 0 18 | 0 09 | 0 27 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 1 10 | 1 83 | 3 40 | 28 35 | 3 57 | 5 23 |
| 2 | 0 00 | 0 00 | | 2 23 | 0 00 | | 2 23 | 2 23 |
| 3 | 0 00 | 0 00 | | 2 75 | 1 70 | | 2 23 | 4 45 |
| 4 | 0 00 | 0 00 | | 1 16 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 8 77 | 3 40 | | 3 21 | 12 17 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***282***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 151.85 | 119.80 | 1,392.38 | -638.96 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 32.10 | 0.00 | 1,740.48 | -943.54 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 28 | 0 10 | 0 38 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 947 | 2.00 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 867 | 2.00 | 0 16 | 0 09 | 0 25 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 554 | 1.00 | 0 29 | 0 10 | 0 39 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 91 | 7 96 | 3 68 | 30 69 | 3 57 | 11 63 |
| 2 | 0 00 | 0 00 | | 3 66 | 0 00 | | 2 23 | 3 66 |
| 3 | 0 00 | 0 00 | | 4 53 | 1 84 | | 2 23 | 6 36 |
| 4 | 0 00 | 0 00 | | 4 05 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 14 43 | 3 68 | | 3 21 | 18 10 |

***BARRA*** ***283***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 181.93 | 122.84 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 34 | 0 10 | 0 44 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 154 | 0.000 | 0 000 | 2 011 | 1.25 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 191 | 0.250 | 0 098 | 1 926 | 1.25 | 0 16 | 0 08 | 0 24 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 452 | 1.00 | 0 35 | 0 10 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 86 | 10 80 | 3 77 | 31 46 | 3 57 | 14 57 |
| 2 | 0 00 | 0 00 | | 7 03 | 0 00 | | 2 23 | 7 03 |
| 3 | 0 00 | 0 00 | | 8 68 | 3 02 | | 2 23 | 11 69 |
| 4 | 0 00 | 0 00 | | 5 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 17 29 | 3 77 | | 3 21 | 21 06 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***273***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 134.77 | 116.77 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 25 | 0 10 | 0 35 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 12 | 0 00 | 0 12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 14 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 26 | 0 10 | 0 36 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 94 | 6 20 | 3 58 | 29 91 | 3 57 | 9 78 |
| 2 | 0 00 | 0 00 | | 3 25 | 0 00 | | 2 23 | 3 25 |
| 3 | 0 00 | 0 00 | | 4 02 | 1 79 | | 2 23 | 5 81 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 81 | 3 58 | | 3 21 | 16 39 |

***BARRA*** ***281***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-C | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.834 | 0.585 | 0.602 | 134.77 | 116.77 | 1,392.38 | -630.18 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 24.40 | 0.00 | 1,740.48 | -911.20 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 25 | 0 10 | 0.35 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0 000 | 1 942 | 2.00 | 0 12 | 0 00 | 0.12 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 862 | 2.00 | 0 14 | 0 09 | 0 23 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 578 | 1.00 | 0 26 | 0 10 | 0 36 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 74 51 | 0 94 | 6 20 | 3 58 | 29 91 | 3 57 | 9 78 |
| 2 | 0 00 | 0 00 | | 3 25 | 0 00 | | 2 23 | 3 25 |
| 3 | 0 00 | 0 00 | | 4 02 | 1 79 | | 2 23 | 5 81 |
| 4 | 0 00 | 0 00 | | 3 08 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 12 81 | 3 58 | | 3 21 | 16 39 |

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***293***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 230.76 | 128.92 | 1,392.38 | -782.51 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 1,740.48 | -1,085.65 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 43 | 0.11 | 0 53 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 2 078 | 2.00 | 0 20 | 0.00 | 0 20 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 989 | 2.00 | 0 25 | 0.10 | 0 35 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0.00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 44 | 0.11 | 0 55 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0 81 | 15 82 | 3 96 | 33 02 | 3 57 | 19 78 |
| 2 | 0.00 | 0.00 | | 5 57 | 0 00 | | 2 23 | 5 57 |
| 3 | 0 00 | 0.00 | | 6 88 | 1 98 | | 2 23 | 8 86 |
| 4 | 0 00 | 0.00 | | 6 93 | 0 00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0.00 | | 21 93 | 3 96 | | 3 21 | 25 88 |

***BARRA*** ***301***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 230.76 | 128.92 | 596.74 | -225.56 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 54.90 | 0.00 | 745.92 | -389.45 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 43 | 0.11 | 0 53 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 469 | 2.00 | 0 20 | 0.00 | 0 20 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1 426 | 2.00 | 0 25 | 0.10 | 0 35 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0.00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 920 | 1.00 | 0 44 | 0 11 | 0 55 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 52 82 | 0 75 | 18 31 | 3 96 | 33 02 | 3 57 | 22 26 |
| 2 | 0.00 | 0.00 | | 5 57 | 0 00 | | 2 23 | 5 57 |
| 3 | 0.00 | 0.00 | | 6 88 | 1 98 | | 2 23 | 8 86 |
| 4 | 0.00 | 0 00 | | 6 93 | 0.00 | | 6 90 | 6 93 |
| 5 | 0 00 | 0 00 | | 21 93 | 3 96 | | 3 21 | 25 88 |





**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** ***291***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 181.93 | 122.84 | 1,392.38 | -667.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 39.60 | 0.00 | 1,740.48 | -983.41 | S.SIMPLE |

| Nº fibra | bw,v (m.) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 34 | 0 10 | 0 44 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 154 | 0.000 | 0 000 | 2 011 | 1.25 | 0 13 | 0 00 | 0 13 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 191 | 0.250 | 0 098 | 1 926 | 1.25 | 0 16 | 0 08 | 0 24 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 01 | 0 00 | 0 01 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 452 | 1.00 | 0 35 | 0 10 | 0 45 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328.59 | 76.97 | 0 86 | 10 80 | 3 77 | 31 46 | 3 57 | 14 57 |
| 2 | 0.00 | 0.00 | | 7 03 | 0 00 | | 2 23 | 7 03 |
| 3 | 0.00 | 0.00 | | 8 68 | 3 02 | | 2 23 | 11 69 |
| 4 | 0.00 | 0.00 | | 5 00 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0.00 | | 17 29 | 3 77 | | 3 21 | 21 06 |

***BARRA*** ***292***

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-B | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 2.669 | 0.554 | 0.608 | 200.19 | 125.88 | 1,392.38 | -715.50 | S.COMP. |
| F-F | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 1.156 | 0.170 | 0.750 | 47.20 | 0.00 | 1,740.48 | -1,030.81 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 37 | 0 10 | 0 47 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 154 | 0.000 | 0 000 | 2 039 | 1.25 | 0 14 | 0 00 | 0 14 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 191 | 0.250 | 0 098 | 1 953 | 1.25 | 0 18 | 0 08 | 0 25 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 234 | 1.00 | 0 38 | 0 11 | 0 49 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 328 59 | 76 97 | 0 84 | 12 68 | 3 86 | 32 24 | 3 57 | 16 54 |
| 2 | 0 00 | 0 00 | | 7 73 | 0 00 | | 2 23 | 7 73 |
| 3 | 0 00 | 0 00 | | 9 55 | 3 09 | | 2 23 | 12 64 |
| 4 | 0 00 | 0 00 | | 5 96 | 0 00 | | 6 90 | 6 90 |
| 5 | 0 00 | 0 00 | | 19 02 | 3 86 | | 3 21 | 22 88 |

FECHA: HOJA: 10-103

OBRA:

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## FIBRA 1

| Nudo | Anec cm² | nØ | Adisp cm² |
|---|---|---|---|
| 1(2) | 28,18 | Ø10+Ø12 a 12,5 | 3964 |
| 1(3) | 21,08 | Ø8+Ø12 a 15 | 21,79 |
| 2(2) | 15,39 | 2Ø10 a 20 | 15,70 |
| 3(2) | 10,55 | Ø12 a 20 | 11,30 |
| 3(3) | 8,74 | Ø12 a 25 | 9,04 |
| 4(2) | 5,79 | Ø10 a 25 | 6,28 |
| 6(2) | 6,59 | Ø12 a 20 | 11,30 |
| 7(3) | 14,18 | Ø16 a 25 | 16,08 |
| 8(3) | 18,84 | Ø6+Ø12 a 15 | 23,80 |
| 9(3) | 25,91 | Ø16 a 15 | 26,81 |
| 10(2) | 27,87 | Ø10+Ø12 a 11,5 | 30,64 |
| 11(2) | 34,61 | 2Ø12 a 12,5 | 36,16 |
| 11(3) | 30,87 | Ø16 a 12,5 | 32,16 |
| 12(3) | 23,25 | Ø16 + Ø12 a 25 | 25,12 |
| 13(2) | 17,54 | 2Ø12 a 25 | 18,08 |

## FIBRA 4

| Nudo | Anec cm² | nØ | Adisp cm² |
|---|---|---|---|
| 1(2) | 7,89 | Ø8 a 12,5 | 8,05 |
| 1(3) | 6,93 | Ø8 a 15 | 6,94 |
| 2(2) | 6,90 | Ø10 a 20 | 7,85 |
| 3(2) | 6,90 | Ø10 a 20 | 7,85 |
| 3(3) | 6,90 | Ø12 a 25 | 9,04 |
| 4(2) | 6,90 | Ø12 a 25 | 9,04 |
| 6(2) | 6,10 | Ø10 a 20 | 7,85 |
| 7(3) | 6,90 | Ø12 a 25 | 9,04 |
| 8(3) | 6,90 | Ø8 a 15 | 6,94 |
| 10(2) | 6,10 | Ø8 a 15 | 6,94 |
| 10(3) | 6,90 | Ø8 a 12,5 | 8,05 |
| 11(2) | 10,29 | Ø10 a 12,5 | 12,56 |
| 11(3) | 9,49 | Ø10 a 12,5 | 12,56 |
| 12(3) | 7,88 | Ø12 a 25 | 9,04 |
| 13(2) | 7,08 | Ø12 a 25 | 9,04 |

## FIBRA 5

| Nudo | Anec cm² | nØ | Adisp cm² |
|---|---|---|---|
| 1(2) | 26,68 | Ø10+Ø12 a 12,5 | 30,64 |
| 1(3) | 24,79 | Ø10+Ø12 a 15 | 25,55 |
| 2(2) | 21,89 | 2Ø12 a 20 | 22,60 |
| 3(2) | 17,12 | Ø10+Ø12 a 20 | 19,15 |
| 3(3) | 15,44 | Ø16 a 25 | 16,08 |
| 4(3) | 11,91 | 2Ø10 a 25 | 12,56 |
| 6(2) | 13,93 | Ø10+Ø12 a 25 | 19,15 |
| 7(3) | 20,44 | Ø16+Ø10 a 25 | 22,36 |
| 8(3) | 26,00 | 2Ø12 a 15 | 30,16 |
| 9(3) | 30,52 | Ø16+Ø8 a 15 | 32,52 |
| 10(2) | 32,44 | 2Ø12 a 12,5 | 36,16 |
| 11(2) | 41,18 | Ø16+Ø8 a 12,5 | 40,21 |
| 11(3) | 37,51 | " | 40,21 |
| 12(3) | 20,04 | Ø16+Ø8 a 25 | 20,10 |
| 13(2) | 16,59 | 2Ø12 a 25 | 18,08 |

SUBTRAMO XV DEL AVE
E-1505-0

**ANÁLISIS TRANSVERSAL DE ESFUERZOS**

***BARRA*** *302*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 250.07 | 131.96 | 596.74 | -311.96 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 62.50 | 0.00 | 745.92 | -452.03 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0 412 | 0.200 | 0 123 | 1 000 | 1.00 | 0 46 | 0 11 | 0 57 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0 097 | 0.000 | 0 000 | 1 450 | 2.00 | 0 22 | 0 00 | 0 22 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1.408 | 2.00 | 0 27 | 0.10 | 0 37 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 02 | 0 00 | 0 02 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 0 751 | 1.00 | 0 48 | 0 11 | 0 59 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140.82 | 46 37 | 0 72 | 20.96 | 4.05 | 33 80 | 3.57 | 25 01 |
| 2 | 0.00 | 0.00 | | 6 04 | 0 00 | | 2 23 | 6 04 |
| 3 | 0.00 | 0.00 | | 7 45 | 2 02 | | 2 23 | 9 48 |
| 4 | 0.00 | 0.00 | | 7 89 | 0 00 | | 6 90 | 7 89 |
| 5 | 0.00 | 0 00 | | 23 76 | 4 05 | | 3 21 | 27 81 |

***BARRA*** *303*

| SECCION TIPO | Canto (m.) | z (m.) | fck viga (kp/cm2.) | fck losa (kp/cm2.) | Ae (m2.) | Ue (m) | Area (m2.) | Inercia (m4.) | ycdg (m) | Vd (t.) | Td (mt.) | Nd (t.) | Md (mt.) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-A | 1.400 | 1.215 | 500 | 250 | 4.074 | 9.255 | 4.145 | 0.641 | 0.650 | 280.60 | 135.00 | 0.00 | 0.00 | S.COMP. |
| G-G | 1.150 | 0.990 | 500 | 250 | 0.000 | 0.000 | 2.633 | 0.198 | 0.736 | 70.00 | 0.00 | 0.00 | 76.28 | S.SIMPLE |

| Nº fibra | bw,v (m ) | Acosido/ Atotal | ycdg (m) | K | Tbv,c Tbv,t (t/m ) | bw,t (m ) | Tbt (t/m ) | cotg θ (calculada) | cotg θ (elegida) | γ1 cortante ( Vd/Vr ) | γ2 torsión ( Td/Tr ) | γ INTERACCION ( γ1+γ2 ) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.200 | 0.500 | 0.880 | 1.000 | 0.412 | 0.200 | 0 123 | 1.000 | 1.00 | 0.52 | 0 11 | 0 63 |
| 2 | 0.250 | 0.235 | 0.125 | 1.000 | 0.097 | 0.000 | 0 000 | 1.000 | 2.00 | 0.24 | 0 00 | 0 24 |
| 3 | 0.250 | 0.290 | 0.125 | 1.000 | 0 119 | 0.250 | 0 061 | 1.000 | 2.00 | 0.30 | 0.10 | 0.40 |
| 4 | 0.406 | 0.169 | 0.203 | 1.000 | 0 505 | 0.000 | 0 000 | 0 704 | 1.00 | 0 03 | 0 00 | 0 03 |
| 5 | 0.180 | 0.462 | 1.310 | 1.000 | 0 380 | 0.180 | 0 123 | 1 000 | 1.00 | 0 53 | 0 11 | 0 65 |

| Nº fibra | As long. traccion(cm2) | Vcu (Ton) | Sd (m) | Asv (cm2/m/fibra ) | Ast (cm2/m/fibra ) | Asl (cm2) | Asmin cm2/m/fibra | Astotal ( Asv + Ast ) (cm2/m/fibra ) |
|---|---|---|---|---|---|---|---|---|
| 1 | 140 82 | 34 71 | 0 68 | 25 30 | 4 14 | 34 58 | 3 57 | 29 44 |
| 2 | 0.00 | 0 00 | | 6 77 | 0 00 | | 2 23 | 6 77 |
| 3 | 0.00 | 0.00 | | 8 36 | 2 07 | | 2 23 | 10 43 |
| 4 | 0.00 | 0 00 | | 8 84 | 0 00 | | 6 90 | 8 84 |
| 5 | 0 00 | 0 00 | | 26 66 | 4 14 | | 3 21 | 30 81 |

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OBRA:

ESTUDIO:

PACADAR

Cercos ala superior: ϕ8a12.5 | ϕ8a15 | 1ϕ10a20 | ϕ10a20 | ϕ12a25 | ϕ12a25 | ϕ12a25 | ϕ8a15 | ϕ8a12.5 | ϕ8a12.5

1.90 | 1.90 | 3.80 | 3.80 | 3.80 | 2.75 | 2.85 | 1.125 | 1.045

Horquillas alma: 2ϕ16a12.5 | ϕ16+ϕ12a15 | 1ϕ10a20 | ϕ12a20 | ϕ10a25 | ϕ10a25 | ϕ16a25 | ϕ16a15 | ϕ10+ϕ12a12.5 | ϕ16a12.5

1.02 | 0.95 | 2.00 | 3.80 | 1.875 | 1.875 | 2.75 | 2.85 | 1.125 | 1.045

(V-1) y (V-3)

Horquillas tabla: ϕ16+ϕ12a12.5 | ϕ16+ϕ10a15 | 2ϕ12a20 | ϕ16+ϕ12a20 | 2ϕ10a25 | 1ϕ10a25 | ϕ16+ϕ10a25 | ϕ16+ϕ8a15 | 1ϕ12a12.5 | ϕ16+ϕ12a12.5

1.02 | 0.95 | 2.00 | 3.80 | 1.875 | 1.875 | 2.75 | 2.85 | 1.125 | 1.045

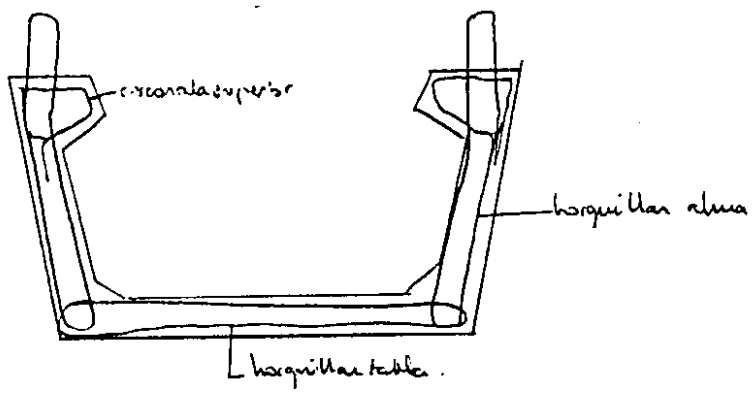
Cercos ala superior: ϕ10a12.5 | ϕ10a12.5 | ϕ12a25 | ϕ12a25 | ϕ8a15 | ϕ8a15

1.015 | 4.00 | 1.50 | 3.00 | 3.00 | 3.00

Horquillas alma: 1ϕ16a12.5 | ϕ16a12.5 | ϕ16+ϕ12a15 | 1ϕ12a25 | ϕ10a15 | ϕ8a15

(V-2)

Horquillas tabla: ϕ16+ϕ12a12.5 | ϕ16+ϕ8a12.5 | ϕ16+ϕ8a15 | 1ϕ12a25 | ϕ12a15 | ϕ10a15




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ESTUDIO:

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## FIBRA 1

| Nudo | Anec cm² | nϕ | Adisp cm² |
|---|---|---|---|
| 14(2) | 9,89 | ϕ10a15 | 10,47 |
| 14(3) | 6,43 | ϕ8a15 | 6,71 |
| 15(2) | " | " | " |

Resto de viga simétrica

## FIBRA 4

| Nudo | Anec cm² | nϕ | Adisp cm² |
|---|---|---|---|
| 14(2) | 6,20 | ϕ8a15 | 6,94 |
| 14(3) | 6,90 | ϕ8a15 | 6,94 |
| 15(2) | " | " | " |

Resto de viga simétrica

## FIBRA E

| Nudo | Anec cm² | nϕ | Adisp cm² |
|---|---|---|---|
| 14(2) | 11,86 | ϕ12a15 | 15,08 |
| 14(3) | 9,72 | ϕ10a15 | 9,47 |
| 15(2) | " | " | " |

Resto de viga simetrica.

10.8. Armado transversal de viga

Se controlan las siguientes fibras:

FIBRA 1 · Horquillas de alma

se calcula con el cortante a un canto del borde del apoyo por lo que la armadura a disponer no es la dada por ejemplo en el nudo 1(1), sino en el nudo 1(2) y así sucesivamente en los apoyos.

FIBRA 4 · Cercos de alas superiores

se calcula para las cargas que entran en sección simple

FIBRA 5 · Cercos de tabla inferior

ídem fibra 1.



10.9. Armadura transversal de losa

Se controlan las fibras 2 y 3.

Se dispondrá como armadura transversal de losa la mayor de las siguientes:

- cuantía por cortante de ala-alma (fibras 2 y 3)
- cuantía por flexión transversal de losa

10.10. Armadura longitudinal de torsión

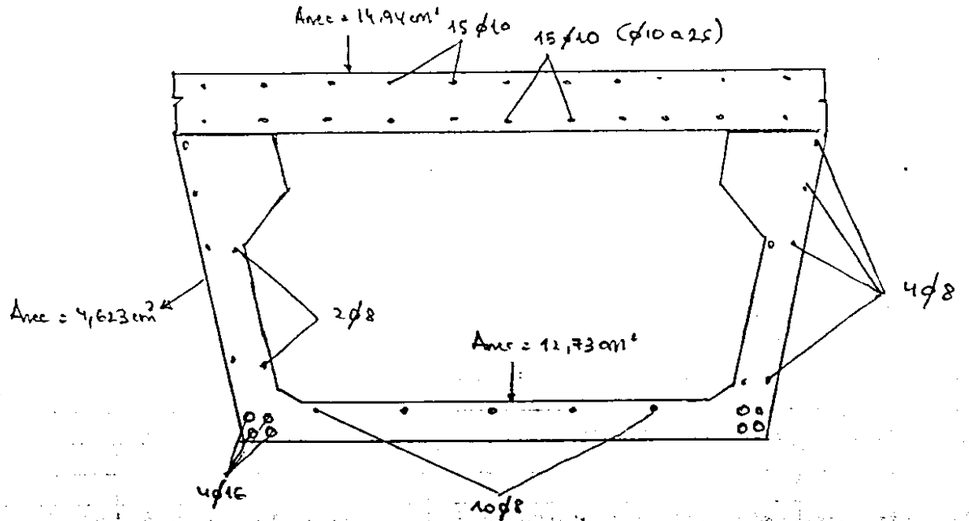
Se dispondrá cosida en toda la viga la máxima armadura necesaria por torsión:

$A_{sl}$ = 35,70 cm² Nudos 1(1) y 30(3) en la combinación $T_{d\,max} - V_{d\,conc}$

$A_{sl}/_{ue}$ = 35,70 cm² / 9,255 m = 3,857 cm²/m

Separados a no menos de 30 cm.

Se dispondrán:

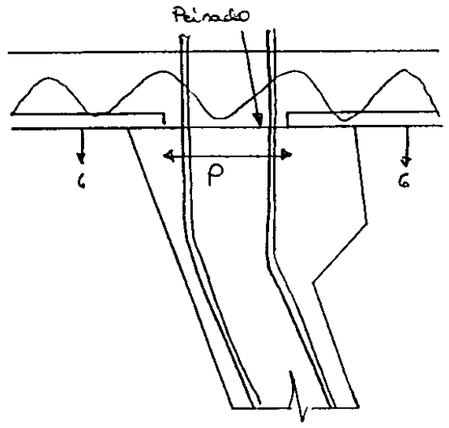


10.11 Esfuerzo rasante entre viga y losa

Se controla la FISURACIÓN conforme al artículo 47° de EHE.

La tensión rasante que solicita la junta debe cumplir:

$$\tau_d \le \beta \cdot f_{ct,d} + \mu \cdot \left( A_\alpha / p \cdot f_{yad} + \sigma_{cd} \right) \le 0{,}25\, f_{cd}$$




$p = 46{,}4 - 12 = 34{,}4 \text{ cm}^2/\text{m}$

$\tau_d$ = tensión rasante en la junta

$\beta$ = coef. rugosidad = 0.40 → Peinado cabeza viga

$\mu$ = coef. rozamiento = 0.90

$f_{ct,d} = f_{ct,k}/1.50$ (losa H-250) = 119 T/m²

$f_{cd}$ = (losa H-300) = $f_{ck}/1.50$ = 2000,00 T/m² → 0.25 fcd = 500 T/m²

$A_\alpha$ = armadura paralela p.m.l (cm²/m)

$f_{yad}$ = 4 T/cm²

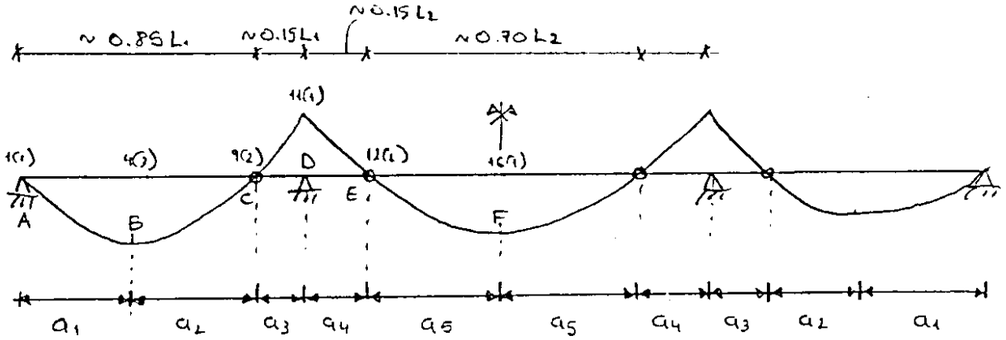
$\sigma_{cd} \sim 0$ (del lado de la seguridad)

$$A_{\alpha,min} \ge 0{,}38 \cdot p / f_{yad} = 0.38 \times 34{,}4 \times 10 / 400 = 0{,}326 \text{ cm}^2/\text{m}$$



$$A_\alpha \ge \left( \tau_d - \beta \cdot f_{ct,d} \right) \times p / \mu \times f_{yad}$$

Suponemos una redistribución plástica de esfuerzos tramificada en las siguientes zonas:




$a_1$ = 7.600 (≈ 3/8 $L_1$)

$a_2$ = 8,550

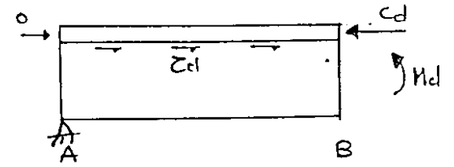
$a_3$ = 2.850

$a_4$ = 4.657

$a_5$ = 10,85

Redistribución plástica zona $a_1$ = 7,600 m

$C_d = M_d / 3 = 1082{,}20 / 1{,}215 = 890{,}70$ t




$\tau_d = C_d / p \cdot a \times A_{con} / A_{tot}$

$\tau_{d_m} = 890{,}70 / 0.244 \times 7.600 \times 0.50 = 170{,}34$ T/m² < 500 T/m² ✓

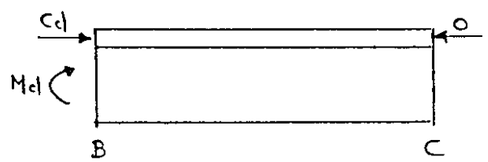
$A_\alpha \ge 11{,}73 \text{ cm}^2/\text{m} \times 7{,}600 \text{ m} = 89{,}14 \text{ cm}^2$ totales en $a_1$

| Aadisp (cm²/m) | d (m) | Total (cm²) |
|---|---|---|
| 30,64 | 0.95 | 29,10 |
| 21,79 | 0,95 | 20,70 |
| 15,70 | 0,95 | 14,91 |
| 11,30 | 1.90 | 21,47 |
| 9.04 | 0,95 | 8,58 |
| 6,28 | 1.90 | 11,93 |
| | | 106,40 cm² |

106,40 cm² > 89,14 cm² ✓

Zona $a_2$ = 8,550 m

Cd = 890,70 t




$Zdm = \frac{890,70}{0.344 \times 8.550} \times 0,50 = 151,41\ T/m^2 < 500\ T/m^2$ ✓

$Aa \geq 9,92\ cm^2/m \times 8,550 = 84,82\ cm^2$

| Aadisp | d | Total | |
|---|---|---|---|
| 5,79 | 2.85 | 16,50 | |
| 6,59 | 2.85 | 18,78 | Total = 80,11 cm² |
| 14,18 | 1.90 | 26,94 | |
| 18,84 | 0.95 | 17,89 | |



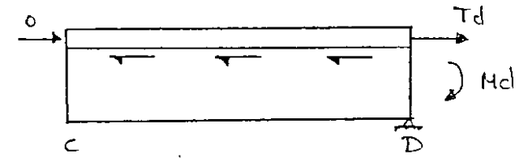
80,11 cm² < 84,82 cm² → Aarec = 4,71 cm²

Paramon de $\phi 6 + \phi 12$ a 15 → 1$\phi$16 a 15 en 0.95 = 25,43

Total = 87,65 cm² > 84,82 cm² ✓

Zona $a_3$ = 2.850 m

$Td = Md/3 = \frac{1024,5}{1.215} = -843,21\ t$




$Zd = \frac{843,22^t}{0.344 \times 2.850} \times 0.50 = 430,03\ T/m^2 < 500\ T/m^2$ ✓

$Aa \geq 36,54\ cm^2/m \times 2,85\ m = 104,15\ cm^2$

| Aadisp | d | Total | | | |
|---|---|---|---|---|---|
| 26,74 | 0.95 | 25.43 | | | |
| 25,91 | 0.95 | 24,61 | | | |
| 27,87 | 0.95 | 16,47 | 64,32 cm²/m | 0.95 m | 61,10 cm² |
| | | 68,98 | | | |

68,98 < 104,15 → Aarec = 35,17 cm²

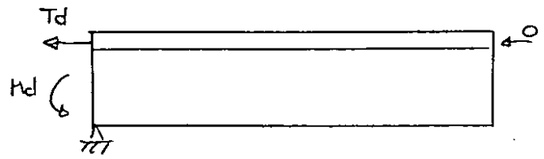
Paramon de $\phi 10 + \phi 12$ a 12,5 en 0.95 a 2$\phi$16 a 12,5 = 61,10

Total = 111,14 cm² > 104,17 cm² ✓

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|---|---|---|---|
| | | | HOJA: 10-112 |

Zona $a_4 = 4.657$ m

$Td = -843,22$ t




$Cd = \frac{843,22}{0.344 \times 4.567} \times 0.50 = 268,36\ T/m^2 < 500\ T/m^2$ ✓

$A_x \geq 21,09\ cm^2/m \times 4.567\ m = 96,34\ cm^2$

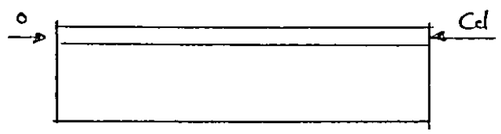
| Aadisp | d | Total |
|---|---|---|
| 34,61 | 0.95 | 32,87 |
| 30,87 | 3.617 | 111,65 |
| | | 144,52 |

$144,52 > 96,34\ cm^2$

Zona $a_5 = 10.86$ m

$Cd = \frac{Md}{3} = \frac{2586,86}{1.215}$

$= 2128,8$ t




$Cd = \frac{2128,8}{0.344 \times 10,86} \times 0.50 = 284,92\ T/m^2 < 500\ T/m^2$ ✓

$A_x \geq 22,67\ cm^2/m \times 10,86\ m = 246,28\ cm^2$

| Axdisp | d | Total |
|---|---|---|
| 34,61 | 1552 | 53,71 |
| 30,87 | 3.105 | 95,85 |
| 23,25 | 1.552 | 36,08 |

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 10-113 |

| Aadisp | d | Total |
|---|---|---|
| 17,54 | 3.105 | 54,46 |
| 9,89 | 1.552 | 15,34 |
| 6,43 | 4.657 | 29,94 |
| | | 263,14 |

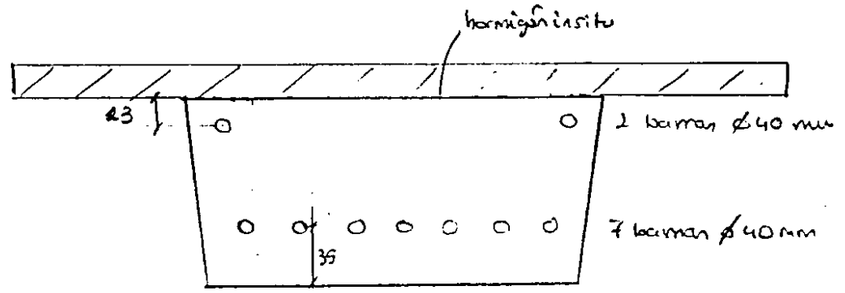
$263,14\ cm^2 > 246,28\ cm^2$ ✓

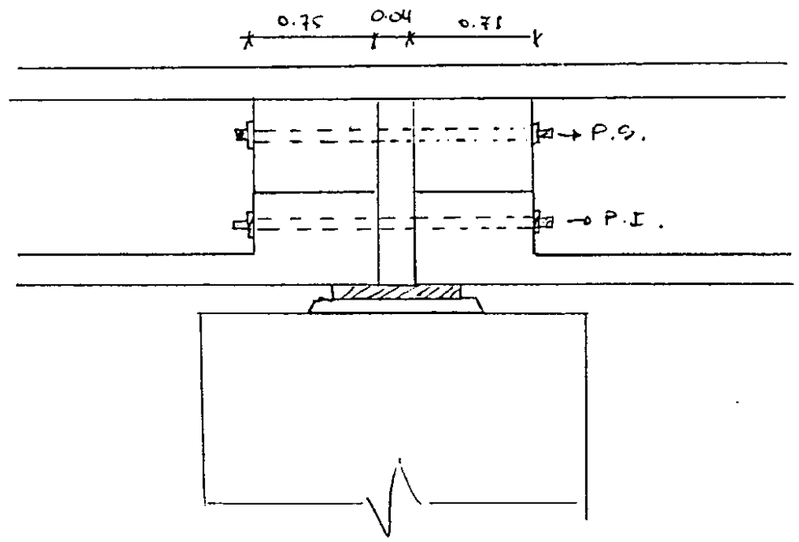
# 11.JUNTA HUMEDA

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 11 -1

## 11 JUNTA HUMEDA

### .1. Sección de calculo




### 11.2 Caracteristicas de barras de postesado

Barras ø40 mm → $A_{\phi 40} = 12{,}56$

Calidad 835/1030

Limite elástico = 835 MPa ~ 8520 kp/cm²

Coeficiente de seguridad = 1.10

Tensión de tesado = $0{,}7 \times f_{pu} = 0{,}7 \times 10.510 = 7357$ kp/cm²

Fuerza de tesado = 92,400 ton

Fuerza de tesado garantizada = 71,90 t

Relajación :

$$\rho(10^6) = \rho(10^3) \cdot \left(\frac{10^6}{10^3}\right)^K = 3{,}2 \times (10^3)^{0{,}1627} = 9{,}85\ \%$$

$$K = \log\left(\rho_{1000} / \rho_{100}\right) = \log\left(3{,}2 / 2{,}2\right) = 0{,}1627$$

(Valores según catálogo MK-4)

E = 1.650.000 kp/cm²

## 11.3 Control en rotura

Del capítulo 9 obtenemos :

$Md^+$ = 313,10 MT para estructura completa a t=inf

$Md^-$ = 1.35 x (-88,30) = -119,20 MT tras Fase 5 de montaje

Dimensionamiento a rotura con "CSEC" :

$Mu^+$ = 393,70 mT > $Md^+$ = 313,10 mT ✓

$Mu^-$ = -272,20 mT < $Md^-$ = -119,20 mT ✓

para PI = 36 ∅ 40 mm

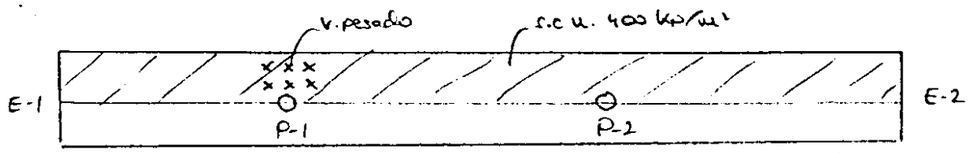
PS = 26 ∅ 40 mm



## 11.4 Dimensionamiento a torsión

Hipotesis 1 : Torsor máximo - Momento concomitante

& carga solo medio tablero con sobrecarga de 400 kp/m² :




$$T_{sw} = 3{,}28\ MT/M \times \frac{(19 \times 2 + 30{,}09)}{2} \times \frac{30{,}09/2}{30{,}09/2 + 19{,}00} = 49{,}38\ mT$$

$$T_{vp} = 30\ MT/eje \times 3\ ejes \times \frac{(19 + 31{,}09)}{2 \times 19 + 31{,}09} = 65{,}25\ MT$$

$$T_d = 1{,}50 \times (49{,}38 + 65{,}25) = 171{,}94\ mT$$

$Md^+$ = 313,10 − (19,30/2) x 1,50 = 298,62 mT muy similar al momento total por lo que se consideran concomitantes momento máximo y torsor máximo .

$$A_{sl} \geq T_d \cdot \frac{u_e}{A_e} \cdot \frac{1}{f_{yd}} = 171{,}94 \times \frac{9{,}255}{4{,}0739} \times \frac{1{,}10}{5{,}1} = 84{,}25\ cm^2$$

$A_e$ = 4,0739 m²

$u_e$ = 9,255 m

Se dispondrá la mitad de dicha cuantía en la losa y la otra mitad en la viga como barras de pretesado inferior :

84,25/2 = 42,12 cm² → Esta cuantía se sumará a la necesaria por flexión negativa sobre pila .

Barras de pretesado adicionales : 42,12 cm² / 12,56 cm²/barra → 4 ∅ 40mm

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 11 - 4 |

11.5 Control en tensiones

Se controla la sección bajo la combinación característica tanto para t=0 como para t=inf :

Combinaciones a t=0

POSTTO + FASES

Combinaciones a t=inf

CPTINF + 1 x (SCUADS + VPPAS) + 0,6 x GRADIENTE

Dichas combinaciones son las pésimas a negativos y a positivos respectivamente como puede deducirse rápidamente de los gráficos de tensiones del cap. 8.

Se controla la fibra superior de viga para la combinación a t=0 :

$\sigma_{SV} = +4,10 \text{ kp/cm}^2 < f_{ct,m} = 42,52 \text{ kp/cm}^2$ ✓

Se controla la fibra inferior de viga para la combinación a t= inf :

$\sigma_{IV} = 24,60 \text{ kp/cm}^2$ en tracción $< f_{ctm} = 0,68 \sqrt[3]{f_{ck}^2} =$

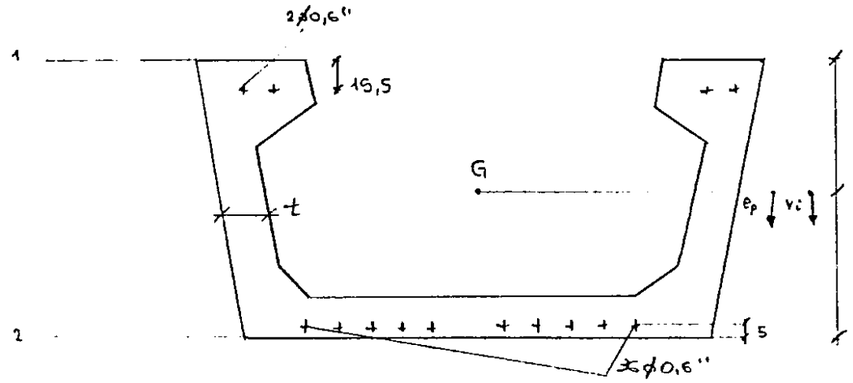
$= 42,52 \text{ kp/cm}^2$

No se fisura en combinación característica luego no se precisa comprobación a fisuración

# 12.ARMADURAS DE DIFUSION DEL PRETENSADO

## 12. ARMADURA DE DIFUSIÓN DEL PRETENSADO

### 12.1 Difusión para 36 ∅0,6" (pretensado taller)




A = 1.156 m²  W1 = -0,2267 m³  epi = 0.350 m

v1 = -0.750 m  W2 = 0,425 m³  eps = 0.595 m

v2 = 0.400 m  Atabla = 0.6021 m²  t = 0.20 m

I = 0.170 m  Acabezas = 0.3074 m²  - COMPRESIÓN

+ TRACCIÓN

σpi = tensión de tesado - pérdidas elásticas

D = diámetro torón = 0.0152 m

fbi = 0.80fpk = 0.80x450 = 360 kp/cm²

Tensión de tesado = 14800 kp/cm² x 20,72 T/torón

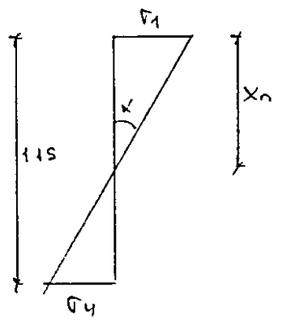


Tensiones debidas al pretensado

$$\sigma_1 = -(36+4) \times \frac{20,72}{1.156} - \frac{4 \times 20,72}{0,2267} \times 0,595 + \frac{36 \times 20,72}{0,2267} \times 0,350 =$$

$$= -716,99 - 217,53 + 1151,61 = 217,39 \ T/m^2$$

$$\sigma_2 = -716,95 + \frac{4 \times 20,72}{0,425} \times 0.400 - \frac{36 \times 20,72}{0,425} \times 0,350 = -1253,2 \ T/m^2$$




$$tg\alpha = \frac{\sigma_1 - \sigma_2}{1.15} = \frac{217,39 + 1253,2}{1.15} = 1278,80 \ T/m^3$$

$$x_n = \sigma_1 / tg\alpha = 217,39 / 340,13 = 0,628 \ m$$

Longitud de transmisión del pretensado

$$l_{td} = 13,2 \times D \times (\sigma_{pi} / f_{bi})^{1/2} \quad (m)$$

E,adim = 200.000 kp/cm²

n,adim ≈ 1.850.000 / 200.000 = 9,25

$$\sigma_{pi} = 14.800 \ kp/cm^2 - \frac{1}{10} \times (9,25 \times 1278,80 \ T/m^3 \times (1.15 - 0.628 - 0.05)) =$$

= 14.248 kp/cm²

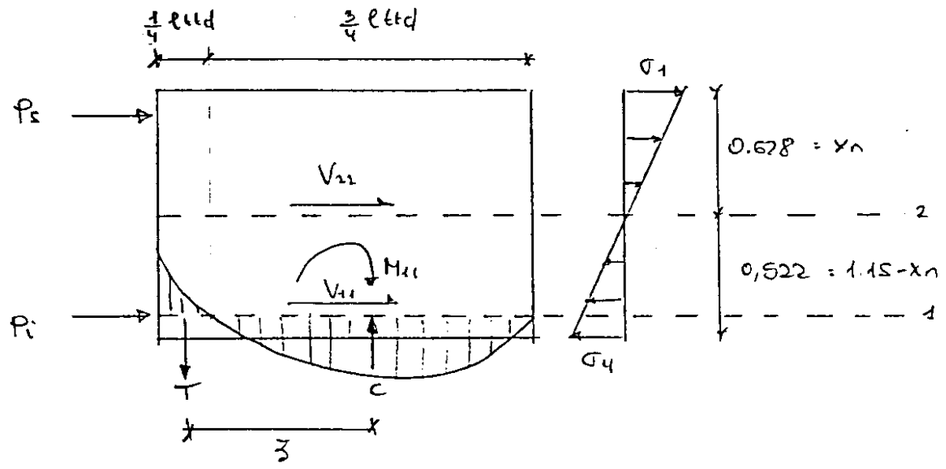
$$l_{td} = 13,2 \times 0.0152 \ m \times (14248 / 360)^{1/2} = 1,28 \ m$$

## Longitud de transferencia

$l_{ttd} = [h^2 + 0{,}36\, l_{td}^2]^{1/2} = 1{,}38$ m

($h$ = 1,15 m)

## Difusión en alzado




$z = 0.5 \times l_{ttd} = 0.69$ m

Se controlan las secciones 1-1 a flexión y corte y la 2-2 a corte exclusivamente:

$M_{11} = 4 \times 20{,}72^{t} \times 0{,}945^{m} + 2 \times 0{,}1537\,m^2 \times 147{,}12\,T/m^2 \times 0{,}897\,m + 2 \times 0{,}044\,m^2 \times 38{,}43\,T/m^3 \times 0{,}690\,m - 2 \times 0{,}208\,m^3 \times 626{,}06\,\frac{T}{m^3} \times 0{,}174^{m} = 76{,}65$ mT

$A_{s11} = M_{11} / z \times f_{sd} = 76{,}65$ mT $/ 0{,}69\,m \times 2\,T/cm^2 = 54{,}82\,cm^2$

$54{,}82\,cm^2 / 2$ alzas $= 27{,}41\,cm^2$ concentración en 0.50 m

$\rightarrow 2\phi 16$ a 12.5 : $32{,}16\,cm^2 > 27{,}41$

$V_{11} = 4 \times 20{,}72^{t} + 2 \times (0{,}1537\,m^2 \times 147{,}12\,T/m^2 + 0{,}044\,m^2 \times 38{,}43\,T/m^3 - 0.108 \times 626{,}06) = -128{,}95^{t}$



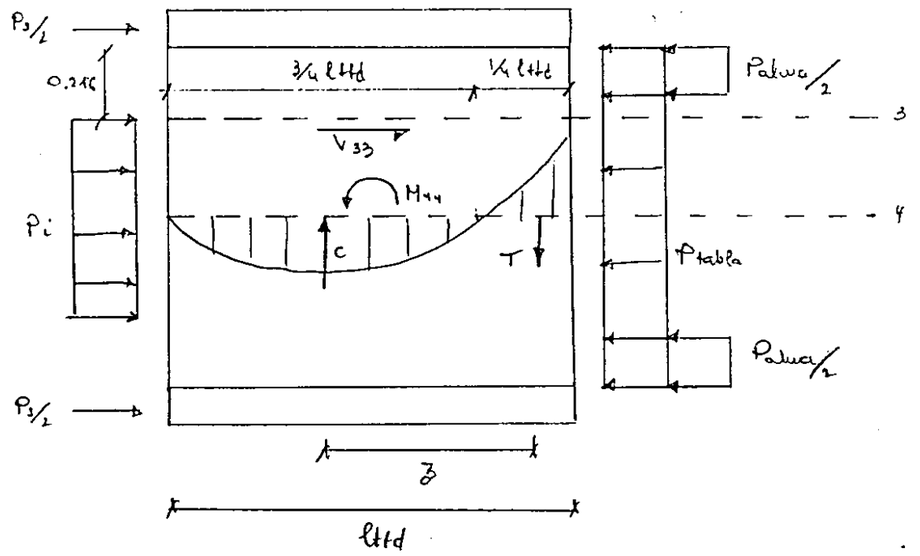
$A_{a11} = V_{11} / f_{yad} = 128{,}95 / 2\,t/cm^2 = 64{,}47\,cm^2 / 2$ alzas $= 32{,}33\,cm^2$

en 1.00 m $\rightarrow 2\phi 16$ a 12.5 $= 32{,}16\,cm^2 \approx 32{,}33$ ✓

$V_{22} = 131{,}51\,t$

$A_{s22} = 131{,}51 / 2 = 65{,}76\,cm^2 / 2$ alzas $= 32{,}88\,cm^2 \rightarrow 2\phi 16$ a 12.5 $= 32{,}16\,cm^2 \approx 32{,}88\,cm^2$

## Difusión en planta




$P_{tabla} = 0{,}6021\,m^2 \times (1253{,}2 + 1189{,}26)/2 = 735{,}30^{t} \approx 88{,}7\,\%\,(P_i + P_s)$

$P_{alma} = 11{,}3\,\%\,(P_i + P_s) = 93{,}65^{t}$

$V_{33} = 735{,}30^{t} \times \frac{0{,}55^{m}}{3.30^{m}} - 2 \times 20{,}72^{t} + \frac{93{,}65^{t}}{2} = 127{,}93^{t}$

$A_{33} = 127,93^{t} / 2^{t/cm^2} = 63,96\ cm^2$ en 1.00 m $\rightarrow$ 2 Ø16 a 12,5 = 64,32 cm

$M_{44} = 2 \times 20,72^{t} \times 2,115 - 93,69 \times \frac{1}{2} \times \frac{3.30}{2} - 735,30 \times \frac{1}{2} \times \frac{3.30}{4} +$

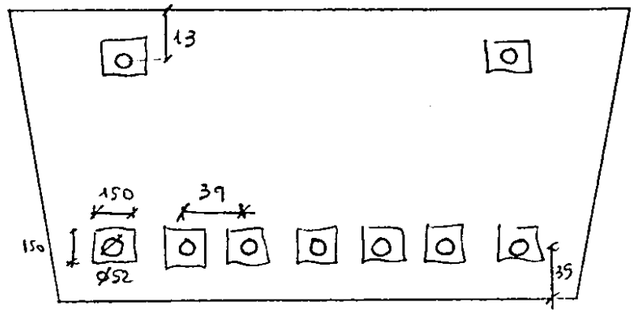
$+ 18 \times 20,72^{t} \times 0,717^{m} = 87,64 - 77,26 - 303,21 + 267,41 =$

$= -25,51\ MT$

$A_{44} = 25,51 / (0.69 \times 2) = 18,49\ cm^2$ en 0.50 m $\rightarrow$ Ø16+Ø12 a 12.5



## 12.2. Difusión del pretensado de barras

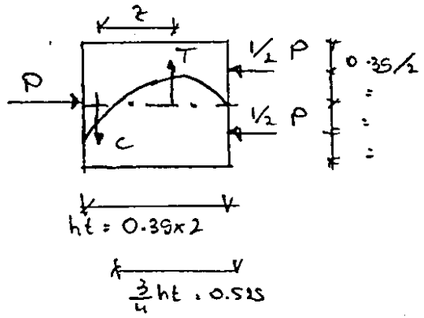



Barras Ø40 mm

Fuerza de tesado ≈ 92 t

### Armadura de difusión primaria ("bursting")

Barras inferiores:




$z = 0.5 \times ht = 0.35\ m$

$P = 92\ t$

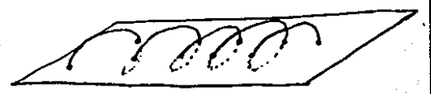
$M = \frac{1}{2} \times P \times \frac{1}{4} \times ht = \frac{P \times ht}{8} = 805\ mT$

$T = M/z = \frac{P \times ht}{8 \times \frac{1}{2} ht} = \frac{P}{4} = 23\ T$

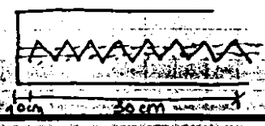
$\sigma_b = \frac{T}{\frac{1}{3} \times \frac{3}{4} \times ht \times b} = \frac{2 \times T}{1 \times ht} = 674\ T/m^2$

$As = 23^{t} / 3^{t/cm^2} = 7,66\ cm^2$

Ubicados desde 0.3ht hasta 0.8ht →



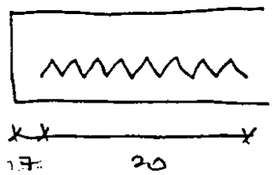
→ 8 pasos de hélice Ø8



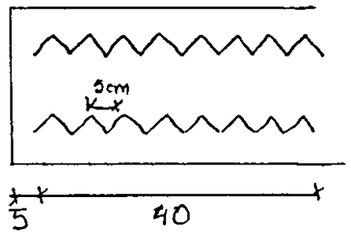
Barras superiores

ht = 0.13×2

8 pasos de hélice ø8



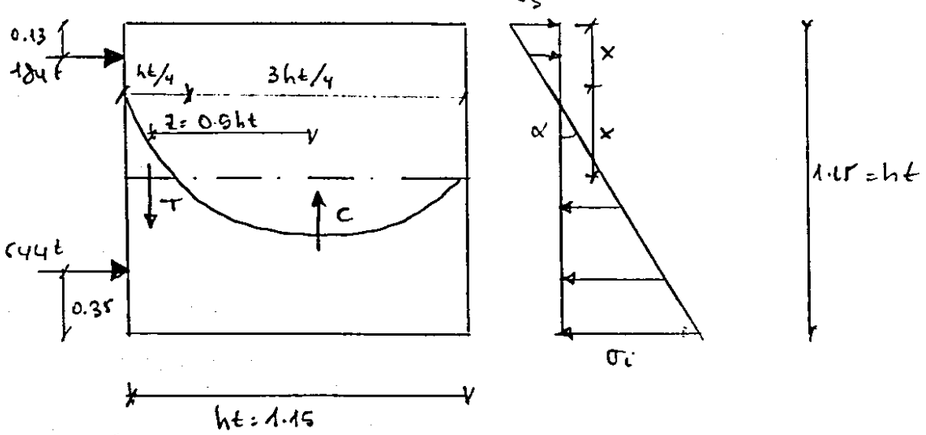

Disposición adoptada :




8 pasos de hélice ø8 mm

paso de hélice = 5 cm

° Armadura de difusión secundaria ("spalling")

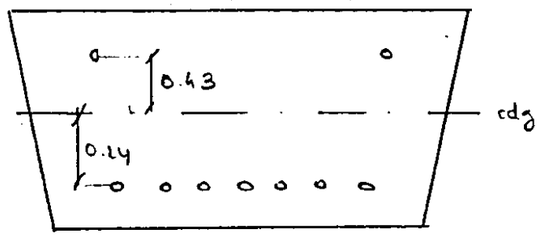



$W_S$ = 0.4537 / 0.5596 = 0.8108 m³

$W_I$ = 0.4537 m² / 0.5906 m = 0.7682 m³

A = 4.125 m²



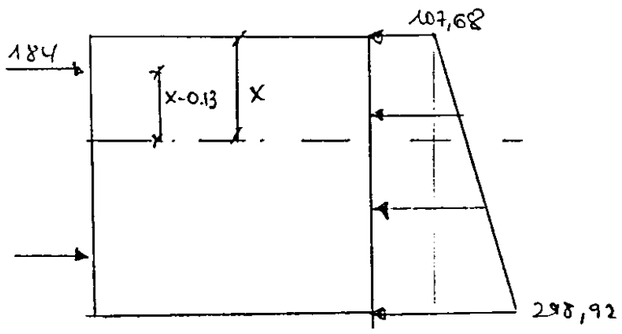



$\sigma_s = (644+184)^t/_{4.125\ m^1} + \frac{184\times0.43}{0.8108} - \frac{644\times0.24}{0.8108} = 200,72 + 97,58 -$

$- 190,62 = 107,68\ T/m^2$

$\sigma_i = 200,72 - \frac{184\times0.43}{0.7682} + \frac{644\times0.24}{0.7682} = 200,72 - 102,99 + 201,19 =$

$= 298,92\ T/m^2$ ; $tg\alpha = (\sigma_i - \sigma_s)/_{1.15} = 166,29$




bmed = (3.30 + 3.875)/2 = 3.587 m

$M(x) = 184 \cdot (x-0.13) - 107,68 \times 3.587 \times \frac{x^2}{2} - 166,29 \cdot x \cdot \frac{1}{2} \cdot 3.587 \times \frac{1}{3}x =$

$= 184x - 23,92 - 292,53\,x^2$

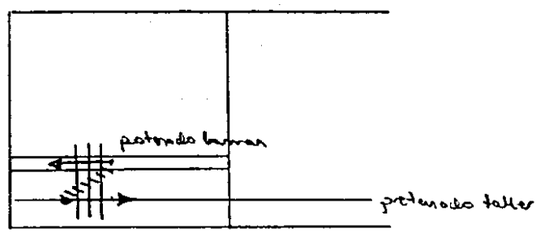
$M'(x) = 184 - 292,53x = 0 \rightarrow x = 0,629$

$M(0,629) = -23,92$ mT

$T = 23,92 / 0.50 \times 1.15 = 41,60$ t

$A_s = 41,60 / 1,5\ t/cm^2 = 27,73$ → se concentrarán en dos planos desde el extremo de una hacia el interior.

° Armadura de solape a distancia




$A_{st} = \frac{2}{3} A_{sl}$

Grupos de 1 barra:

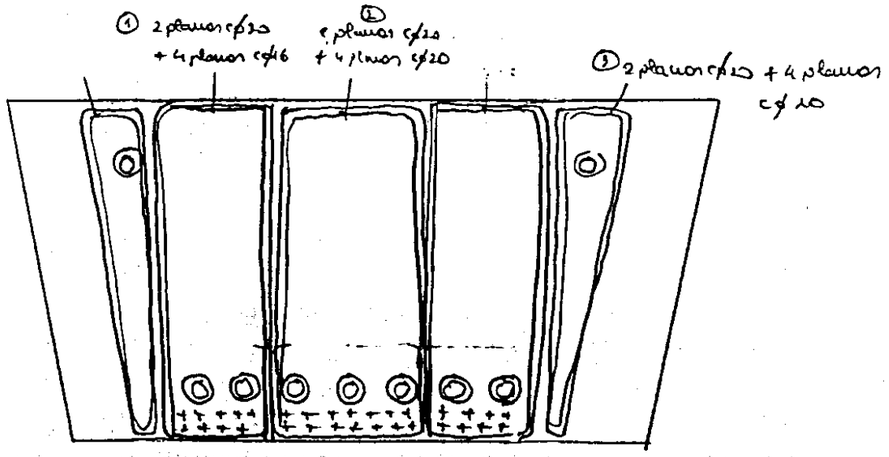
$A_{st} = \frac{2}{3} \times 12{,}56\ cm^2 = 8{,}37\ cm^2 \rightarrow$ 6 cϕ10

Grupos de 2 barras

$A_{st} = 16{,}74\ cm^2 \rightarrow$ 6 cϕ16

Grupos de 3 barras

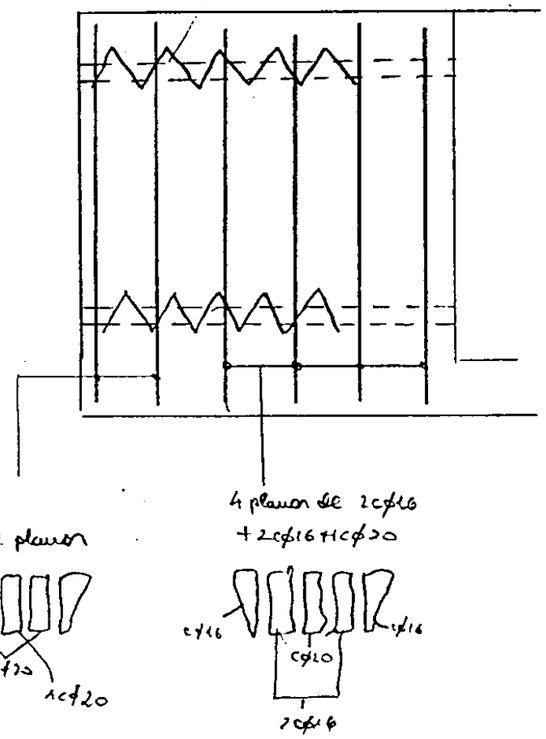
$A_{st} = 25{,}12\ cm^2 \rightarrow$ 6 cϕ20




Teniendo en cuenta que la armadura ③ deben ser cϕ16 según cap. 13 Armadura mínima), pasamos los cϕ20 a cϕ16 (en planos)



8 pares hélice ϕ8 (paso 5cm)




Estas cuantías x aumentarán para recoger el efecto del cortante del cap 13 (6 planos de 3 cϕ12 = 40,6 cm²), pasando los 2cϕ16 ▯ ▽ a 2cϕ20

# 13.MACIZADOS DE TALLER. RIOSTRA "IN SITU"

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 13-1

## 13. MACIZADOS DE TALLER. RIOSTRA 'IN SITU'

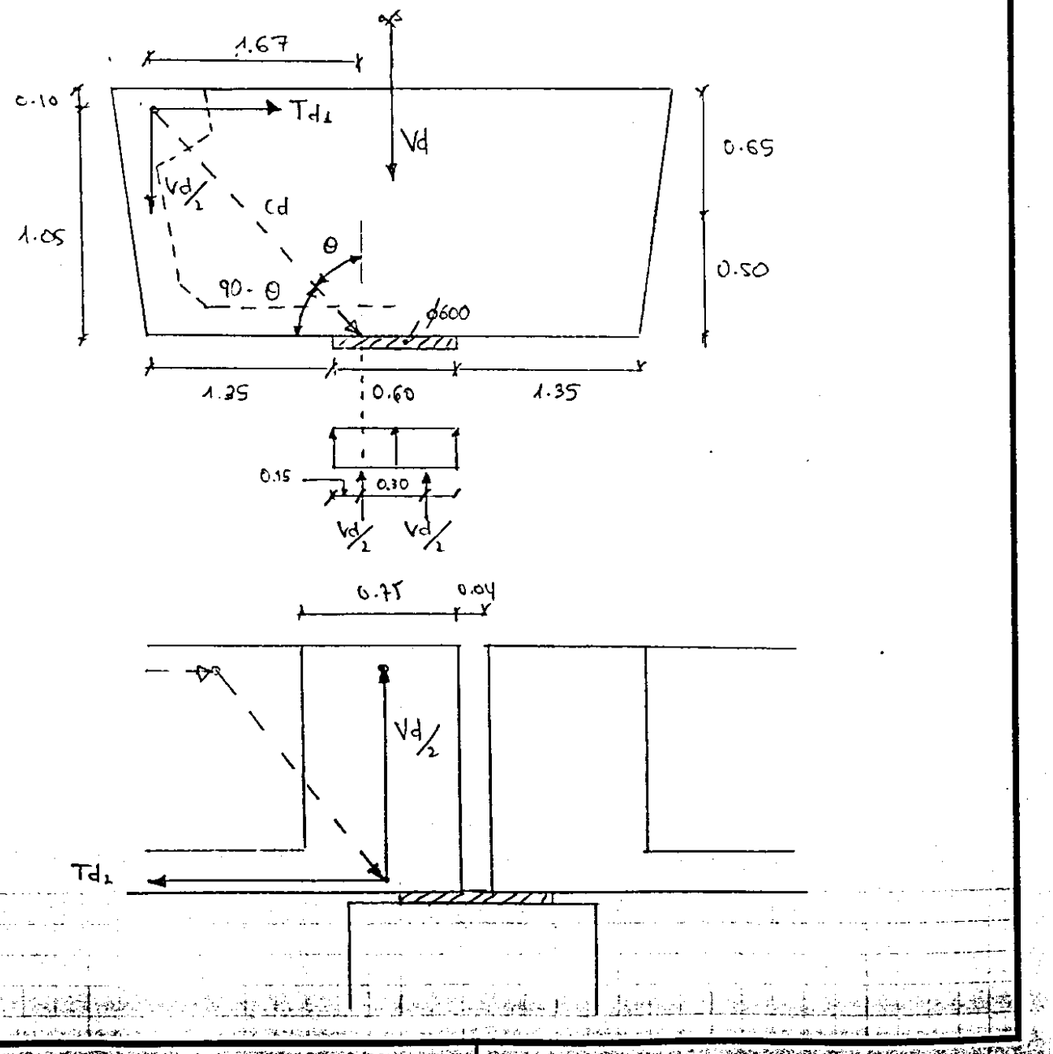
### 13.1. Macizado de taller sobre pilar

Macizado de taller en sección simple

(Fase 1 + Fase 2 + Fase 3 + Fase 5) montaje

$Vd = 1,35 \times (-46 - 17,60 - 24,30 - 36,40) = -167,81$ T  Lado V-2

$Vd = 1,35 \times (28,10 + 10,70 + 18,40 + 29,40) = 110,167$ T  Lado V-1 V-3



$1.67^m > 1.05^m$ No puede considerarse ménsula corta

Dimensionamiento a flexión:

$Md = \frac{Vd}{2} \times 1.67$

Para $Vd = 167,81\ T$

$Md = 140,12\ mT$

$\beta = 0,318$ (AEH-500 N)

$Uc = fcd \cdot b \cdot d = \frac{4500}{1.40} \times 0.75 \times (1.15-0.10) = 2531,25\ T$

$Mlim = \beta \cdot Uc \cdot d = 0,318 \times 2531,25 \times (1.15-0.10) = 845,18\ mT$

$Md < Mlim$

$x = 1,25 \times d \times \left[1 - \left[1 - 2,353 \times \frac{Md}{Uc \cdot d}\right]^{1/2}\right] = 0,084\ m$

$Us_1 = 0,68 \times fcd \times b \cdot x = 137,86\ ton$

$As_1 = \frac{Us}{fyd} = 137,86 \times \frac{1.10}{5.1} = 29,73\ cm^2$

→ 6 ϕ 25

Para $Vd = 110,16$ ton

$Md = 91,98\ mT$

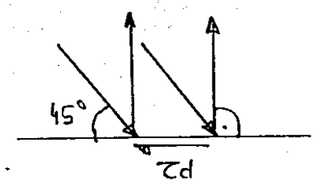
$x = 0,054\ m$

$Us = 59,46$ ton

$As = 19,29\ cm^2$ → 4 ϕ 25



Dimensionamiento a cortante




Para $Vd = 167,81\ t$

$Vd/_2 = 83,91\ t$

$Td = \frac{83,91}{0.75^m \times 0.90 \times (1.15-0.10)} =$ Regla Cordo

$= 118,38\ T/m^2$

Comprobación biela compresión:

$Td \leq 0.30\ fcd = 0.30 \times \frac{4500}{1.40} = 964,28\ T/m^2$

$118,38\ T/m^2 < 964,28\ T/m^2$

Armadura necesaria cortante:

$Vcu = 5 \cdot (fcd)^{1/2} \cdot b \cdot d = 5 \times \left(\frac{450}{1.40}\right)^{1/2} \times 0.75 \times (1.15-0.10) = 70,59$

$A\alpha \geq \frac{(83,91-70,59) \times 0.75}{0.90 \times (1.15-0.10) \times 4,2} = 2,52\ cm^2/m$

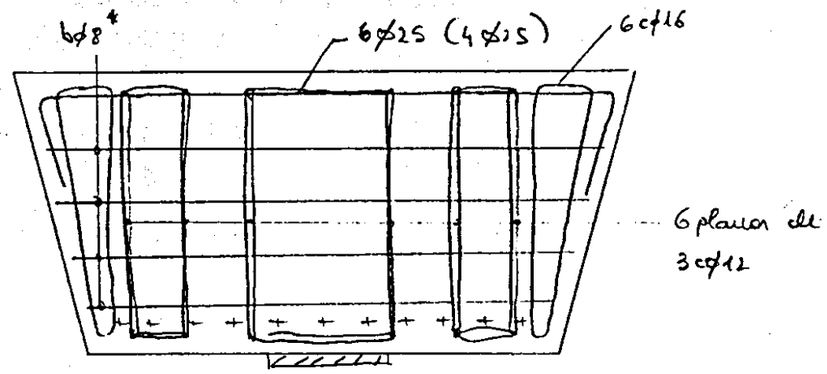
$A\alpha\ min \geq 0.02 \times \frac{fcd}{fyd} \times b = 11,47\ cm^2/m$

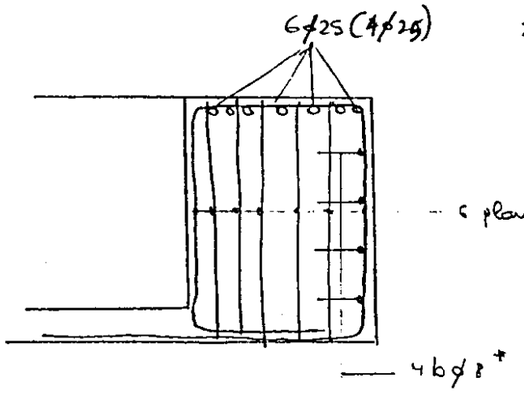
→ 3 c ϕ 16 a cada lado del neopreno

Idem para el cortante menor

Armadura de refuerzo: se resuelve todo el cortante en la sección de apoyo, en los 75 cm del macizado.

$A\alpha_2 = \frac{83,91\ t}{4,2\ t/cm^2} = 19,97\ cm^2$ → 6x3 ϕ 12 en 75 cm




* Acompañando las longitudinales de torsión.

Cuantía geométrica mínima:

$2{,}8/1000 \times 75^{cm} \times 115^{cm} = 24{,}15\ cm^2$ << armadura dispuesta en la cara de tracción

$0.30 \times 24{,}15\ cm^2 = 7{,}24\ cm^2$ << armadura de cercos de tabla inferior



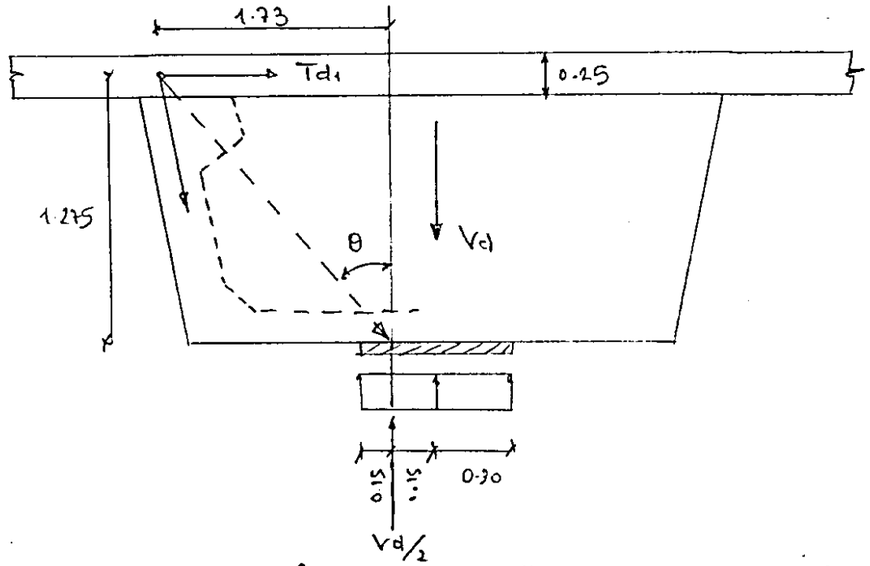
## Macizado en sección compuesta

Resto de cargas

$Vd = -416{,}13 - (-167{,}81) = -248{,}32\ t$ Lado V-2

$Vd = 318{,}51 - 110{,}16 = 208{,}35\ t$ Lado V-1 y V-3

Dimensiona $Vd = -248{,}32\ t$




El esquema es análogo al anterior salvo que la armadura de flexión As1 se ubicará en la losa entre las capas superior e inferior de su armadura transversal.

Armadura de flexión

$Md = 248{,}32 \times \frac{1}{2} \times 1.73 = 214{,}79\ mT$

$\beta = 0.318$

$Uc = 4500/1.40 \times 0.75 \times 1.275 = 3073{,}66\ T$

$Mlim = 0.318 \times 3073{,}66 \times 1.275 = 1246{,}21\ mT$

Md < Mlim

$$x = 1.25 \times 1.275 \times \left(1 - \left(1 - 2{,}353 \times 214{,}79 / 3073{,}66 \times 1.175\right)^{1/2}\right) = 0.106\,m$$

$$U_{s1} = 0{,}68 \times 4500/1.40 \times 0.75 \times 0.106 = 174{,}28\ T$$

$$A_{s1} = 174{,}28 \times 1.15/5{,}10 = 39{,}29\ cm^2$$ en 75 cm por cada viga

→ $\phi$25 a 12,5 A.T.S.

$\phi$16 a 12,5 A.T.I

NOTA. Esta cuantía se sumará a la dispuesta como armadura transversal de losa.

Armadura de cortante

$$\frac{Vd}{2} = 248{,}32/2 = 124{,}16\ t$$

$$\tau d = 124{,}16/0.75 \times 0.90 \times 1.275 = 144{,}26\ T/m^2 < 964{,}28\ T/m^2.\ \checkmark$$

$$V_{cu} = 5 \times \sqrt{\frac{450}{1.40}} \times 0.75 \times 1.275 = 89{,}72\ T$$

$$A_\alpha \geq (124{,}16 - 89{,}72) \times 0.75/0.90 \times 1.275 \times 4{,}2 = 5{,}98\ cm^2/m$$

$$A_{\alpha,min} \geq 0.02 \times 4500/1.40 \times 0.75 \times 1/4{,}2 = 11{,}48\ cm^2/m$$

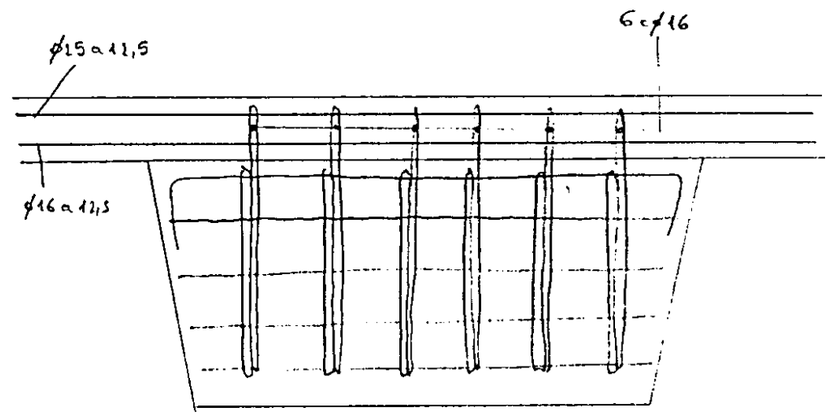
Se dispondrán 6c$\phi$16 adicionales, saliendo de la viga.



Armadura de vuelque: se cuenta el resto del cortante hasta la losa

$$A_{\alpha 2} \geq 124{,}16^t/4{,}2\ t/cm^2 = 29{,}56\ cm^2$$

Llevamos $6 \times 2\phi 16 = 48{,}24\ cm^2$ como armadura de disposición, que es claramente mayor que la necesaria.



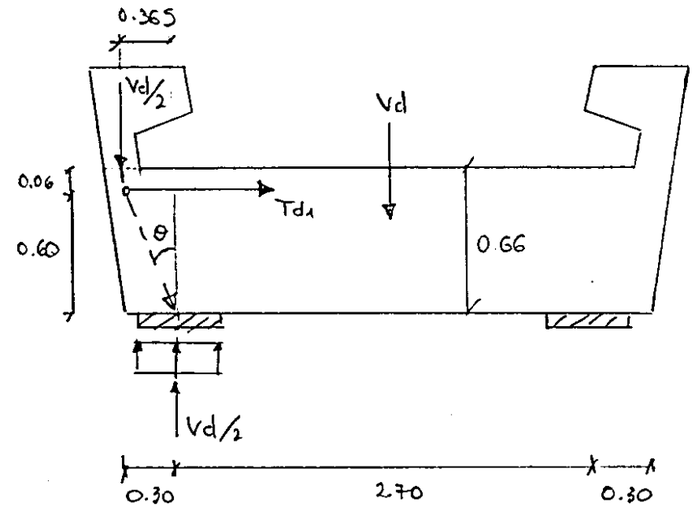
13.2. Macizado de estribo y riostra in situ

Macizado de taller

(Fase 1 + Fase 2) montaje

Se prevé no obstante que la fase 3 también se ejecute antes o durante el hormigonado de la riostra.

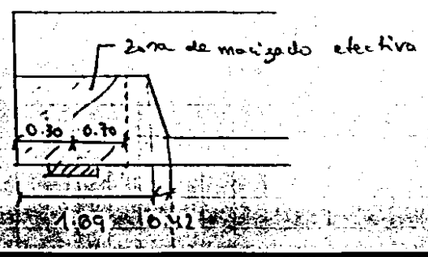
$Vd = 1.35 \times (28,10 + 10,70 + 31,20) = 94,5\ t$




$0.365 < 0.60$ m Se dimensiona como sección corta

$Md = 94,5^t \times \frac{1}{2} \times 0,365^m = 17,24\ MT$

$Vd = 94,5^t \times \frac{1}{2} = 47,25^t$






Armadura de flexión

$\beta = 0318$

$Uc = 4500/1.40 \times 1.00 \times 0.60 = 1928,57\ T$

$Mlim = 0.318 \times 1928,17 \times 0.60 = 367,97\ MT$

$Md < Mlim$

$x = 1,25 \times 0,60 \times (1 - (1 - 2,353 \times 17,24 / 1928,57 \times 0.60)^{1/2}) = 0.0123$

$Us1 = 0,68 \times 4500/1.40 \times 1,00 \times 0,0133 = 28,99\ T$

$As1 = 28,99 \times 1,10/5,10 = 6,25\ cm^2$ en 1 m

Armadura de cortante

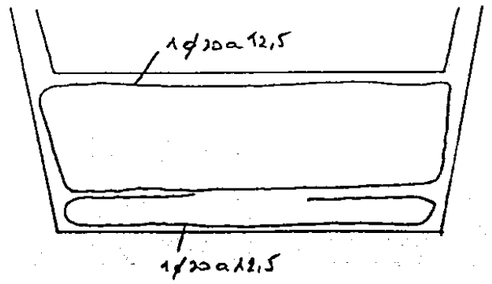
$Ax \geq 47,25^t / 4,2 \times 1.40 = 8,035\ cm^2/m = 8,035\ cm^2$ en 1 m

$1/3\ Ax = 5,35\ cm^2$

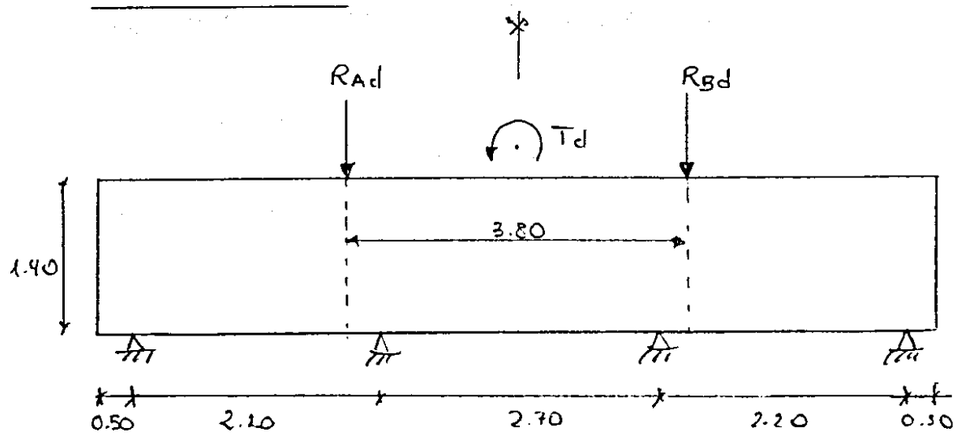
Se dispondrá como armadura principal $As = 6,25\ cm^2$

No obstante la cuantía dispuesta por difusión es

$\phi 20$ a 12,5 (1 rama) $= 25,13\ cm^2 >> 5,35\ cm^2$



## Riostra 'in situ'




Ancho riostra = 0.80 m .

El resto de cargas entran sobre la riostra .

Vd max = 168,36 − 1.35×(28,10 + 10,70) = 215,98 t

Td conc = 135 MT

RAd = RBd = 215,98/2 = 107,99

Cargas sobre la propia riostra :

peso propio riostra = 1.40 m × 0.80 m × 2,5 t/m³ = 2,80 T/m

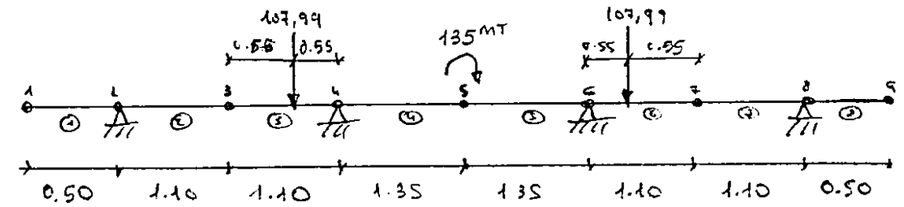
sobrecarga uniforme = 0.4 T/m² × 0.80 m = 0,32 T/m

vehículo pesado = 2 ejes de 10 t separados 2.00 m

Estas cargas producen esfuerzos prácticamente despreciables frente a los anteriores.



## Modelo de cálculo




Momentos de cálculo

M11 = 0 MT

M22 = 0 MT

M33 = 16.420 MT

M44 = -26.555 MT

M55 = 53.980 MT / 54.220 MT

M66 = -0.826 MT

M77 = 29.254 MT

M88 = 0,00 MT

M99 = 0,00 MT

Cortantes de cálculo

V22ⁱ = 0,00 t

V22ᵈ = 14.927 t

V44ⁱ = -93.063 t

V44ᵈ = 91.509 t

V66ⁱ = 59.507 t

V66ᵈ = 51.295 t

V88ⁱ = -26.595 t

V88ᵈ = 0.00 t

Dimensionamiento a flexión positiva (H-250 , AEH-500)

Md⁺ = 29.254 MT  d = 1.35 m

β = 0.318

Uc = 2500/1.50 × 0.80 × 1.35 = 1866,66 T

Mlim = 0,318 × 933,33 × 1.35 = 415,51

Md < Mlim

$$x = 1.25 \times 1.35 \times \left(1 - \left(1 - \frac{2{,}353 \times 29.254}{1866{,}66 \times 1.35}\right)^{1/2}\right) = 0.0331 \text{ m}$$

$$U_s^+ = 0.68 \times \frac{2500}{1.50} \times 0.80 \times 0.0331 = 21.041 \text{ T}$$

$$A_s^+ = 21.041 \times \frac{1.15}{5.10} = 4.744 \text{ cm}^2 \rightarrow 5\phi 12$$

Md = 53.780 mT  d = 0.70 m

Uc = 933,23 T

x = 0.0896 m

$U_s^+$ = 80.96 T

$A_s^+$ = 15.25 cm²  → (3 x 2 ϕ16) x 1

Dimensionamiento a flexión negativa

Md = -21.220 mT  d = 0.69 m

Uc = 920 T

x = 0.141

$U_s^-$ = 122,84 T

$A_s^-$ = 28,82 cm² en 80 cm → 5ϕ25 capa superior bona

5 ϕ 12 capa inferior bona



Dimensionamiento a cortante fuera del cajón

Vd = 93.063 t

$\tau d = \frac{83{,}682}{0.80 \times 0.90 \times 1.35} = 86.07 \text{ T/m}^2$

Biela : $\tau d \leq 0.30 f_{cd} = 0.30 \times \frac{2500}{1.50} = 500 \text{ T/m}^2$ ✓

Armadura necesaria :

$V_{cu} = 5 \sqrt{\frac{250}{1.50}} \times 0.80 \times 1.35 = 69.71 \text{ t}$

$A_w \geq \frac{(93{,}063 - 69{,}71) \times 0.80}{4.1 \times 0.90 \times 1.35} = 3{,}660 \text{ cm}^2/\text{m}$

$A_{w,min} = 0.02 \times \frac{2500}{1.50} \times 0.80 \times \frac{1.15}{5.1} = 6{,}013 \text{ cm}^2/\text{m}$

Armadura de cosido por rozamiento a distancia

$A_{sf} = \frac{2}{3} \cdot A_{sl} = \frac{2}{3} \times 18{,}25 \text{ cm}^2 = 12{,}16 \text{ cm}^2$

→ 2cϕ12 a 20

Dimensionamiento a cortante dentro del cajón

Vd = 59.507 t

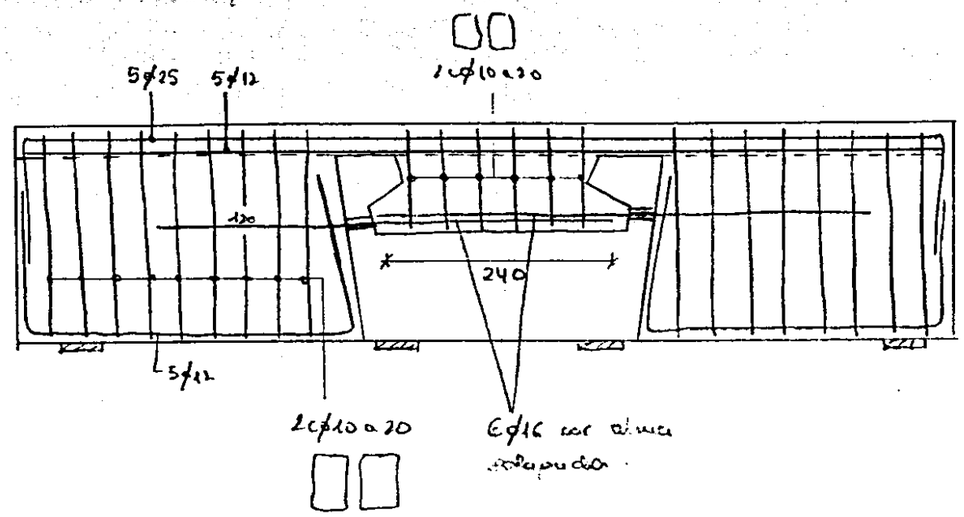
$\tau d = \frac{59.507}{0.80 \times 0.70 \times 0.70} = 118{,}07 \text{ T/m}^2 < 500 \text{ T/m}^2$ ✓

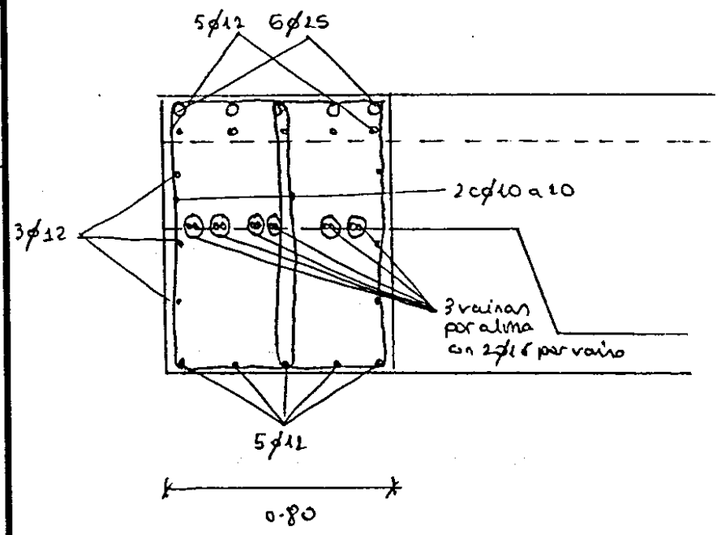
$V_{cu} = 5 \times \left(\frac{250}{1.50}\right)^{1/2} \times 0.80 \times 0.70 = 36.14 \text{ t}$

$A_w \geq \frac{(59.507 - 36.14) \times 0.80}{4.2 \times 0.9 \times 0.70} = 10{,}93 \text{ cm}^2/\text{m}$

→ 2cϕ10 a 20

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 13-14




La armadura superior de riostra se modificará en el cap 14 y en Cor placas si fuera preciso aumentar su cuantía.

## SALIDA DE ESFUERZOS EN RIOSTRA

STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.40

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13-15



F R A M E  E L E M E N T  F O R C E S

| ELT ID | LOAD COND | DIST ENDI | 1-2 PLANE SHEAR | 1-2 PLANE MOMENT | AXIAL FORCE | 1-3 PLANE SHEAR | 1-3 PLANE MOMENT | AXIAL TORQ |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | .250 | .000 | .000 | | .000 | .000 | |
| | | .500 | .000 | .000 | | .000 | .000 | |
| | | .500 | | | .000 | | | |
| 2 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 14.927 | .000 | |
| | | .550 | .000 | .000 | | 14.927 | 8.210 | |
| | | 1.100 | .000 | .000 | | 14.927 | 16.420 | |
| | | 1.100 | | | .000 | | | |
| 3 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 14.927 | 16.420 | |
| | | .550 | .000 | .000 | | -93.063 | 24.630 | |
| | | 1.100 | .000 | .000 | | -93.063 | -26.555 | |
| | | 1.100 | | | .000 | | | |
| 4 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 59.507 | -26.555 | |
| | | .675 | .000 | .000 | | 59.507 | 13.613 | |
| | | 1.350 | .000 | .000 | | 59.507 | 53.780 | |
| | | 1.350 | | | .000 | | | |
| 5 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 59.507 | -81.220 | |
| | | .675 | .000 | .000 | | 59.507 | -41.053 | |
| | | 1.350 | .000 | .000 | | 59.507 | -.886 | |
| | | 1.350 | | | .000 | | | |
| 6 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 81.395 | -.886 | |
| | | .550 | .000 | .000 | | 81.395 | 43.882 | |
| | | 1.100 | .000 | .000 | | -26.595 | 29.254 | |
| | | 1.100 | | | .000 | | | |
| 7 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | -26.595 | 29.254 | |
| | | .550 | .000 | .000 | | -26.595 | 14.627 | |
| | | 1.100 | .000 | .000 | | -26.595 | .000 | |
| | | 1.100 | | | .000 | | | |

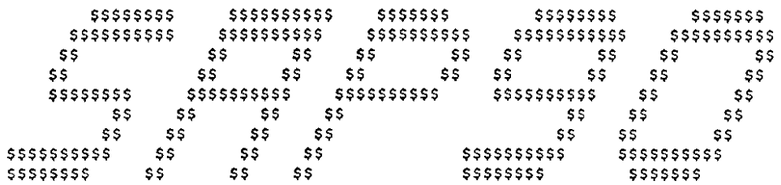
13-16



F R A M E  E L E M E N T  F O R C E S

| ELT ID | LOAD COND | DIST ENDI | 1-2 PLANE SHEAR | 1-2 PLANE MOMENT | AXIAL FORCE | 1-3 PLANE SHEAR | 1-3 PLANE MOMENT | AXIAL TORQ |
|---|---|---|---|---|---|---|---|---|
| 8 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | .250 | .000 | .000 | | .000 | .000 | |
| | | .500 | .000 | .000 | | .000 | .000 | |
| | | .500 | | | .000 | | | |

## RIOSTRA / REACCIONES



STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.40

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R E A C T I O N S  A N D  A P P L I E D  F O R C E S

LOAD CONDITION 1 - FORCES "F" AND MOMENTS "M"

| JOINT | F(Z) | M(Y) |
|---|---|---|
| 1 | .0000 | .0000 |
| 2 | 14.9272 | .0000 |
| 3 | .0000 | .0000 |
| 4 | 152.5698 | .0000 |
| 5 | .0000 | -135.0000 |
| 6 | 21.8880 | .0000 |
| 7 | .0000 | .0000 |
| 8 | 26.5949 | .0000 |
| 9 | .0000 | .0000 |
| TOTAL | .2160E+03 | -.1350E+03 |

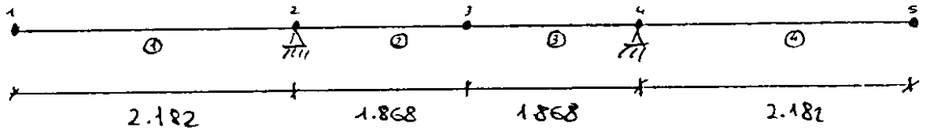
# 14.ANALISIS TRANSVERSAL DE LOSA

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 14-1 |

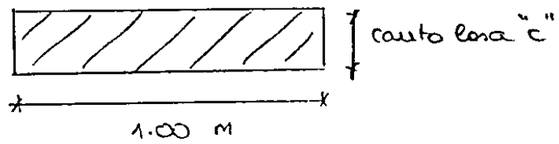
## 14. ANALISIS TRANSVERSAL DE LOSA

### 14.1 Modelo de cálculo

Programa de cálculo : "SAP90N"




| NUDO | X | CANTO LOSA (m) | A (m²) | I (m⁴) | J (m⁴) |
|---|---|---|---|---|---|
| 1 | 0 | 0.25 | 0.22 | 0.0013 | 0.0026 |
| 2 | 2.182 | 0.79 | 0.29 | 0.0020 | 0.0040 |
| 3 | 4.05 | 0.33 | 0.33 | 0.0030 | 0.0060 |
| 4 | 5.918 | 0.29 | 0.29 | 0.0020 | 0.0040 |
| 5 | 8100 | 0.25 | 0.25 | 0.0013 | 0.0026 |




$A = c \times 1{,}00$

$I = 1{,}00 \times c^3/12$

$J = 1{,}00 \times c^3/6$

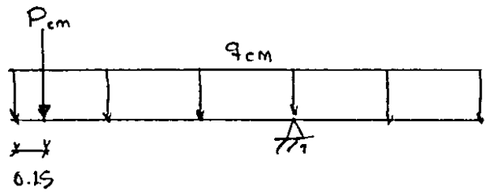
## 14.2. Acciones a considerar

1/ Peso propio losa

$\gamma = 2{,}50\ T/m^3$

se introduce automáticamente por el programa multiplicando $\gamma \times A_{barra}$.

2/ Carga muerta




$P_{cm}$ (impuesta ...) = 1.81 T/M.l.

$q_{cm} = 0.207\ T/m.l.$

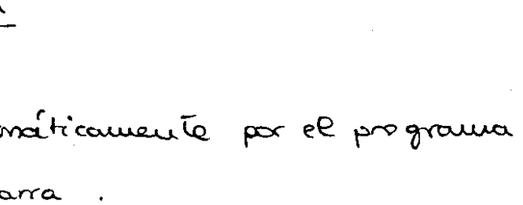
3/ Sobrecarga uniforme

$q_{sc} = 0.400\ T/m.l.$ en todo el tablero

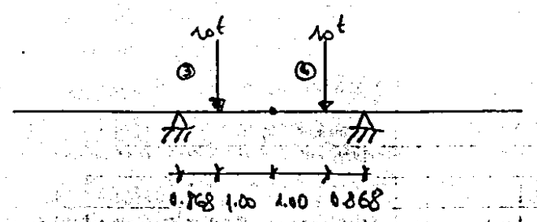
4/ Vehículo pesado

Posiciones adoptadas para máxima flexión y máximo cortante:

Posición nº 1 : (Cortante - flexión)



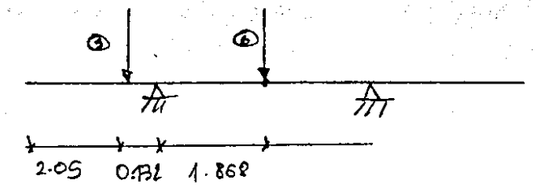

Posición nº 2 : (Cortante - flexión)






Posición nº 3

(solo Flexión)

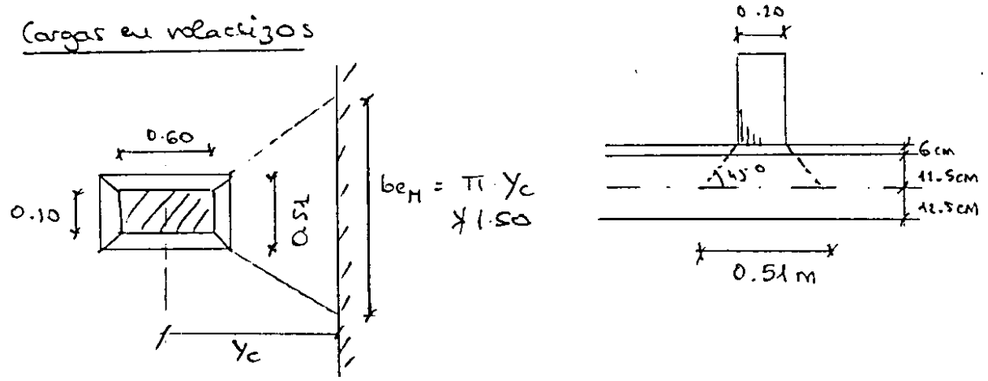



## 14.3. Ancho de reparto de la losa del carro

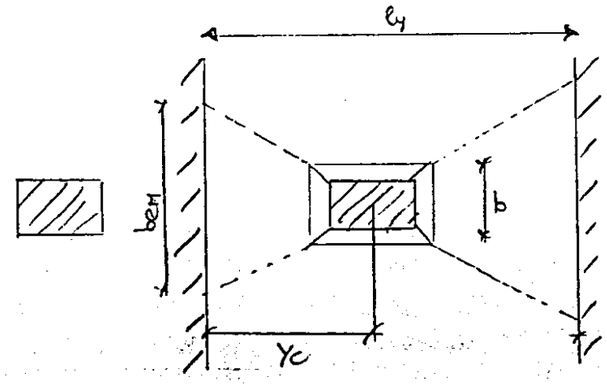
Se utilizan las fórmulas dadas en el Art.º 53.4 de EH-91

a/ Anchos de reparto a Flexión.

Cargas en voladizos




Cargas entre apoyos : cargas en vanos contiguos



$$b_1 = \frac{3}{4} \times b + \frac{3}{4} \times K \times l_y$$

$$be = b_1 - (b_1 - b) \times \left[1 - \frac{2 v_c}{l_y}\right]^2 \not> 1.50$$

$b = 0.51$ m

$l_y = 3.786$ m

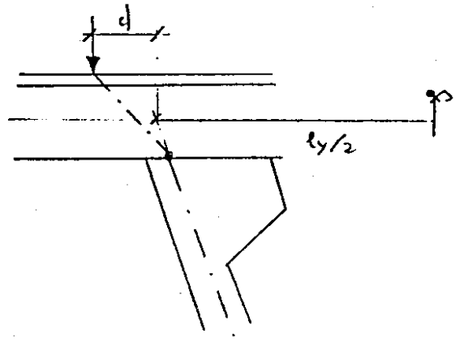
$K = 2/3$

Cargas en el mismo vano

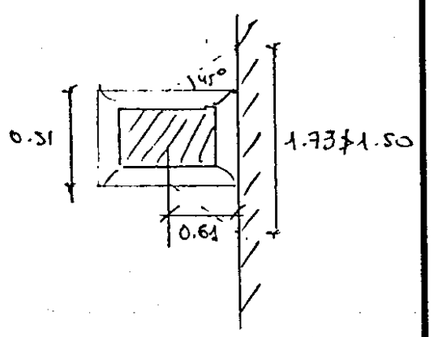
$K = 1$

b/ Anchos de reparto a cortante

Se arrimará la huella del vehículo lo mas cerca de (los apoyos Calzos de viga) y a no menos de d: 0.28m de cualquier apoyo.

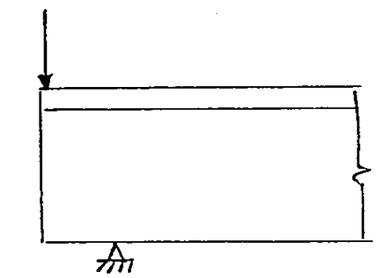


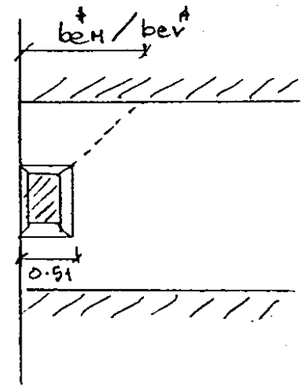

$bev = 1.50$ m






c/ Ancho en extremo de losa






$be_H^* = (be_H - 0.51)/2 + 0.51 = be_H - 0.51/2 = be_H - 0.255$ m

$be_v^* = be_v - 0.255$ m

d) Obtención de anchos eficaces

Eje nº ①

$be_{H_1} = 0.632 \times 2.14 = 1.984 \not> 1.50$ m

$be_{H_1}^* = 1.50 - 0.255 = 1.245$ m

$be_{v_1} = 1.50$ m

$be_{v_1}^* = 1.50 - 0.255 = 1.245$ m

Eje nº 2

$be_{H_2} = 2.125 \not> 1.50$ m

$be_{H_2}^* = 1.245$ m

$be_{v_2} = 1.50$ m

$be_{v_2}^* = 1.245$ m

FACADAR | ESTUDIO: | OBRA: | FECHA: HOJA: 14-6

Ej. nº 3

$bem_3 = 2.442 \times 1.50$

$bem_4^+ = 1.245$

$bev_3 = 1.50$

$bev_4^+ = 1.245$

Ej. nº 4

$bem_4 = 1.50$

$bem_4^+ = 1.245$

$bev_4 = 1.90$

$bev_4^+ = 1.245$

Ej. nº 5

$bem_5 = 0.444$ m

$bem_5^+ = 0.444 - 0.255 = 0.189$ m

$bev_5 = 1.50$ m

$bev_5^+ = 1.245$ m

Ej. nº 6

$bem_6 = 1.25 \times 1.50$ m

$bem_6^+ = 1.245$ m

$bev_6 = 1.50$ m

$bev_6^+ = 1.245$ m

Calculo de acciones:

Coeficiente de seguridad: $\gamma_f = 1.35$

Sobrecarga: $\gamma_{fav} = 0.00$ $\gamma_{desfav} = 1.50$

Se adopta valores de coeficiente de mayor.

14.11. Esfuerzos cortantes y momentos de calculo

| Nudo | CARGA | $N^+$ | $N^-$ | $V_i^+$ | $V_i^-$ | $V_d^+$ | $V_d^-$ | $bem^+$ | bem | bev | $bev^+$ | bev |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | P.P. LOSA | 0.00 | -1.45 | 0.00 | -1.39 | 1.45 | 0.00 | - | - | - | - | - |
| | C.M. | 0.00 | -3.99 | 0.00 | -2.26 | 0.38 | 0.00 | - | - | - | - | - |
| | S.C.U. | 0.00 | -0.95 | 0.00 | -0.87 | 0.25 | 0.00 | - | - | - | - | - |
| | EJE 1 | 0.00 | -6.32 | 0.00 | -10.00 | 1.69 | 0.00 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 2 | 0.00 | 0.00 | 0.00 | 0.00 | 6.34 | 0.00 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 3 | 0.00 | 0.00 | 0.00 | 0.00 | 7.67 | 0.00 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 4 | 0.00 | 0.00 | 0.00 | 0.00 | 2.32 | 0.00 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 5 | 0.00 | -1.32 | — | — | — | — | 1.245 | 0.444 | 1.50 | 1.245 | 1.245 |
| | EJE 6 | 0.00 | 0.00 | — | — | — | 0.00 | — | — | — | — | — |
| 3 | P.P. LOSA | 0.00 | -0.66 | 0.00 | 0.00 | 0.00 | 0.00 | — | — | — | — | — |
| | CM | 0.00 | -3.629 | 0.00 | 0.00 | 0.00 | 0.00 | — | — | — | — | — |
| | SCU | 0.00 | -0.254 | 0.00 | 0.00 | 0.00 | 0.00 | — | — | — | — | — |
| | EJE 1 | 0.00 | -3.46 | 1.69 | 0.00 | 1.69 | 0.00 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 2 | 6.84 | 0.00 | 0.00 | 0.00 | 0.00 | -3.66 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 3 | 4.34 | 0.00 | 0.00 | -2.32 | 0.00 | -2.32 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 4 | 4.34 | 0.00 | 2.32 | 0.00 | 2.32 | 0.00 | 1.245 | 1.50 | 1.50 | 1.245 | 1.245 |
| | EJE 5 | 0.00 | -0.66 | — | — | — | — | — | 0.159 | 1.50 | 1.245 | 1.245 |
| | EJE 6 | 9.34 | 0.00 | — | — | — | — | — | — | — | — | — |

FACADAR | ESTUDIO: | OBRA: | FECHA: HOJA: 14-4

Nudo 2 :

$Md^- = 1.35 \times (-1.45 - 3.99) + 1.50 \times (-0.95) + 1.50 \times \min\left[\left(\frac{-6.32}{1.50}\right); \left(\frac{-1.32}{0.414}\right)\right] = -7,344 - 1.425 - \min(-4,213; -3.188) = \underline{-12,98\ mT}$

$Vd^- = 1.35 \times (-1.39 - 2.26) + 1.50 \times (-0.87) + 1.50 \times \left(\frac{-10.00}{1.50}\right) =$

$= -6.10 - 1.305 - 10 = \underline{-17,405\ T}$

$Vd^+ = 1.35 \times (1.45 + 0.38) + 1.50 \times (0.75) + 1.50 \times \left(\frac{7.67}{1.50}\right) =$

$= 2.470 + 1.125 + 7.67 = 11,26\ T$

Nudo 3 :

$Md^+ = 1.50 \times 9.34/1.50 = \underline{9.34\ mT}$

Zuncho extremo de losa : (colaborizo en vuelo), b = 0.8 m

Peso propio losa = $(0.15 + 0.29) \times 2.5 \times 0.80 = 0.54\ T/m$

Carga muerta = $1.31 \times 0.80 = 1.448\ T$

$0.207 \times 0.80 = 0.165\ T/m$

Sobrecarga uniforme = $0.400 \times 0.80 = 0.32\ T/m$

Vehículo pesado = 1 eje de 10 T

$Md^- = 1.35 \times \left[(0.54 + 0.165) \times 2.182^2/2 + 1.448 \times 1.932\right] + 1.50 \times (0.32 \times 2.182^2/2 + 10 \times 0.632)] = -6,042 - 10,62 = -16,66\ mT$

$Vd = 1.35 \times \left[(0.54 + 0.165) \times 2.182 + 1.448)\right] + 1.50 \times \left[0.32 \times 2.182 + 10\right] =$

$= 20,02\ T$



## 15.4. Armado transversal de losa a flexión

Flexión positiva

$d = 0.33\ m - 0.06 - 0.03 = 0.24\ m$

$\beta = 0.318 \qquad Mlim = \beta \cdot Uc \cdot d = 36.68$

$Uc = fcd\ b \cdot d = 3000/1.50 \times 1.00 \times 0.24 = 480\ T$

Para $Md^+ = 9.34\ mT < Mlim$

$x = 1.25 \times 0.24 \times \left[1 - \left(1 - 2.353 \times 9.34 / 480 \times 0.24\right)^{1/2}\right] = 0.0301\ m$

$Us^+ = 0.68 \times 3000/1.50 \times 1 \times 0.0301 = 40.97\ T$

$As^+ = 40.97 \times 1.15/5.10 = 9.24\ cm^2/m$ → Ø16 a 0.20

(5Ø16 pnl)

Flexión negativa

$d = 0.29 - 0.03 = 0.26\ m$

$U_c = 520\ T$ ; $M_{lim} = 42,99\ mT$

$M_d^- = -12,98\ mT$ < $M_{lim}$

$x = 0.0391\ m$

$U_s^- = 53,11\ T$

$A_s^- = 11.97\ cm^2/m$ → $\phi 20$ a 25 (4$\phi$20 pmé)

$M_d^- = -16,66\ mT$ < $M_{lim}$

$x = 0.0511\ m$

$U_s^+ = 69,55\ T$

$A_s^+ = 15,68\ cm^2/m$ concentrados en 0.8m → 19,60 $cm^2$ →

→ 4$\phi$25



15.5. Comprobación a cortante

Para $V_d = -17,41\ T$ ; $d = 0.24\ m$

$\tau_d = 17,41 / (1.00 \times 0.90 \times 0.24) = 80,6\ T/m^2$

Comprobación biela

$\tau_d = 80,6 < 0.30 f_{cd} = 300\ T/m^2$

Necesidad de armadura

$V_{cu} = 5 \times \sqrt{300/1.50} \times 1.00 \times 0.24 = 16,97\ T$

$V_{u2,a} = 0.50 \times V_{cu} \times \xi \times (1+50\rho) = 14,55\ T$

$\xi = 1.60 - 0.24 = 1.36\ m$

$\rho = 4 \times 3.14\ cm^2 / (100 \times 24) = 0.0052$

se aumenta la cuantía de armadura transversal tipo nor de cono :

$(1+50\rho) \geq 17,41 / (0.50 \times 16,97 \times 1.36) = 1.508$

$\rho \geq (1.508 - 1)/50 = 0.0102$

$A_s \geq 0.0102 \times 100 \times 24 = 24,41\ cm^2/m$ → $\phi 20$ a 12.5 (8$\phi$20 pmé)

Para $V_d = -20,07$

$(1+50\rho) \geq 20,07 / (0.5 \times 16.97 \times 1.36) = 1.681$

$\rho \geq 0.0136$ → $A_s \geq 32,09\ cm^2/m$ → 40,87 $cm^2$ en 80 cm

→ 6$\phi$32

## 15.6. Comprobación E.L.S. Fisuración (Ca negativa)

Se comprueba para la combinación cuasipermanente de acciones : $g_{perm} + 0.20 \times$ sobrecargas

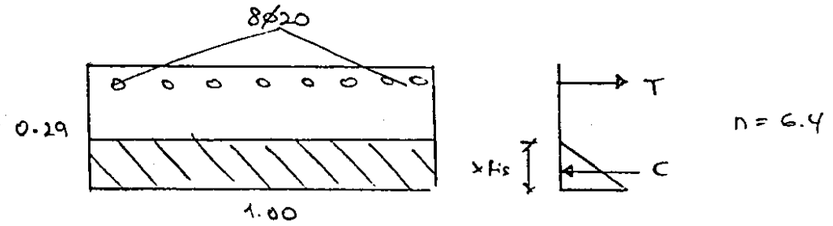
$f_{ct,m} = 0.63 \times 300^{2/3} = 30,47$ kp/cm²

$M_{servicio} = -1.45 - 3.99 - 0.20 \times (0.95 + 6.22/1.50) = -6.47$ MT

$M_{fis} : f_{ctm} = M_{fis} / W_{bruta}$

$M_{fis} = 304,7 \times 1.00 \times 0.29^2/6 = 4,27$ MT $< M_{servicio}$

Hay que comprobar fisuración




$x_{fis} = \dfrac{100 \cdot x_{fis} \cdot x_{fis}/2 + 25,12 \cdot 26}{100 \cdot x_{fis} + 25,12}$

$50 x_{fis}^2 + 25,12 x_{fis} - 653,12 = 0$

$x_{fis}^2 + 0.5024 x_{fis} - 13,062 = 0$

$x_{fis} = (-0.5024 \pm 7,245)/2 = \begin{cases} 3.37 \text{ cm} \\ - \end{cases}$

$I_{fis} = \frac{1}{3} \times 1.00 \times 0.0337^3 + 6.4 \times 25,12 \times 10^{-4} \times (0.26 - 0.0337)^2 = 0.0004 +$

$+ 0.0008 = 0.0012$ m⁴



$\sigma_{sr} = 4.27 \times (0.26 - 0.0337)/0.0012 = 805,25 \times 6,4 = 5153,6$ T/m²

$\sigma_s = 6,47/4.27 \times 5153,6 = 7808,8$ T/m² ≈ 781 kp/cm² << 2200

No precisa armadura adicional.

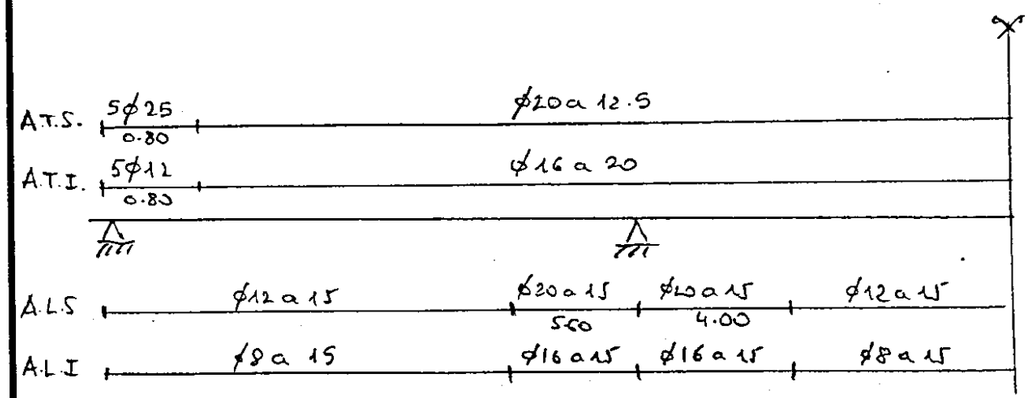
## 15.7. Armadura longitudinal de losa

Se dispondrá un 30 % de la armadura transversal de losa, salvo la zona sobre pilas donde se dispondrá la armadura dimensionada en el capítulo 9.

ATS = Ø20 a 12.5 → ALS = Ø12 a 15

ATI = Ø16 a 20 → ALI = Ø8 a 15

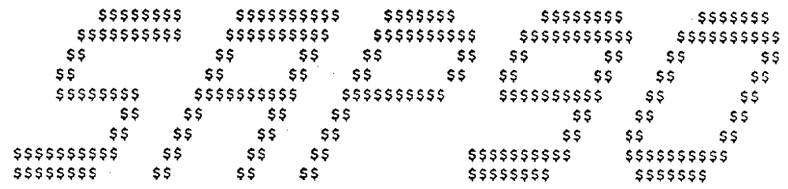
## 15.8 Esquema general de armado




Como armadura de piastra se dispuso el máximo entre el obtenido en el cap. 13 y el obtenido en el presente capítulo.

**ESFUERZOS LOCALES EN LOSA**

LC1 P.P.LOSA
LC2 C.M.
LC3 S.C.U.



STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.40

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F R A M E  E L E M E N T  F O R C E S

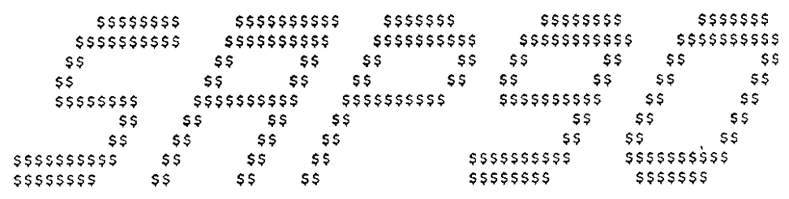
| ELT ID | LOAD COMB | DIST ENDI | 1-2 PLANE SHEAR | 1-2 PLANE MOMENT | AXIAL FORCE | 1-3 PLANE SHEAR | 1-3 PLANE MOMENT | AXIAL TORQ |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | -.648 | -.345 | |
| | | 2.182 | .000 | .000 | | -1.391 | -1.448 | |
| | | 2.182 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | -2.036 | -1.645 | |
| | | 2.182 | .000 | .000 | | -2.262 | -3.990 | |
| | | 2.182 | | | .000 | | | |
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | -.436 | -.238 | |
| | | 2.182 | .000 | .000 | | -.873 | -.952 | |
| | | 2.182 | | | .000 | | | |
| 2 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 1.448 | -1.448 | |
| | | .934 | .000 | .000 | | .747 | -.420 | |
| | | 1.868 | .000 | .000 | | .000 | -.067 | |
| | | 1.868 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .387 | -3.990 | |
| | | .934 | .000 | .000 | | .193 | -3.719 | |
| | | 1.868 | .000 | .000 | | .000 | -3.629 | |
| | | 1.868 | | | .000 | | | |
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .747 | -.952 | |
| | | .934 | .000 | .000 | | .374 | -.429 | |
| | | 1.868 | .000 | .000 | | .000 | -.254 | |
| | | 1.868 | | | .000 | | | |
| 3 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | -.067 | |
| | | .934 | .000 | .000 | | -.747 | -.420 | |
| | | 1.868 | .000 | .000 | | -1.448 | -1.448 | |
| | | 1.868 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | -3.629 | |
| | | .934 | .000 | .000 | | -.193 | -3.719 | |
| | | 1.868 | .000 | .000 | | -.387 | -3.990 | |
| | | 1.868 | | | .000 | | | |

F R A M E  E L E M E N T  F O R C E S

| ELT ID | LOAD COMB | DIST ENDI | 1-2 PLANE SHEAR | 1-2 PLANE MOMENT | AXIAL FORCE | 1-3 PLANE SHEAR | 1-3 PLANE MOMENT | AXIAL TORQ |
|---|---|---|---|---|---|---|---|---|
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | -.254 | |
| | | .934 | .000 | .000 | | -.374 | -.429 | |
| | | 1.868 | .000 | .000 | | -.747 | -.952 | |
| | | 1.868 | | | .000 | | | |
| 4 | ---------- | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 1.391 | -1.448 | |
| | | 1.091 | .000 | .000 | | .648 | -.345 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 2.262 | -3.990 | |
| | | 1.091 | .000 | .000 | | 2.036 | -1.645 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .873 | -.952 | |
| | | 1.091 | .000 | .000 | | .436 | -.238 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |

**ESFUERZOS LOCALES EN LOSA**

LC1 EJE 1
LC2 EJE 2
LC3 EJE 3
LC4 EJE 4
LC5 EJE 5
LC6 EJE 6



STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.40

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F R A M E  E L E M E N T  F O R C E S

| ELT ID | LOAD COND | DIST ENDI | 1-2 PLANE SHEAR | 1-2 PLANE MOMENT | AXIAL FORCE | 1-3 PLANE SHEAR | 1-3 PLANE MOMENT | AXIAL TORQ |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | -10.000 | -6.320 | |
| | | 2.182 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 4 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 5 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | -10.000 | -1.320 | |
| | | 2.182 | | | .000 | | | |
| | 6 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| 2 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 1.692 | -6.320 | |
| | | .934 | .000 | .000 | | 1.692 | -4.740 | |
| | | 1.868 | .000 | .000 | | 1.692 | -3.160 | |
| | | 1.868 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 6.338 | | |
| | | .934 | .000 | .000 | | 6.338 | 5.920 | |
| | | 1.868 | .000 | .000 | | -3.662 | 6.840 | |
| | | 1.868 | | | .000 | | | |



F R A M E  E L E M E N T  F O R C E S

| ELT ID | LOAD COND | DIST ENDI | 1-2 PLANE SHEAR | 1-2 PLANE MOMENT | AXIAL FORCE | 1-3 PLANE SHEAR | 1-3 PLANE MOMENT | AXIAL TORQ |
|---|---|---|---|---|---|---|---|---|
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 7.677 | .000 | |
| | | .934 | .000 | .000 | | -2.323 | 6.510 | |
| | | 1.868 | .000 | .000 | | -2.323 | 4.340 | |
| | | 1.868 | | | .000 | | | |
| | 4 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 2.323 | .000 | |
| | | .934 | .000 | .000 | | 2.323 | 2.170 | |
| | | 1.868 | .000 | .000 | | 2.323 | 4.340 | |
| | | 1.868 | | | .000 | | | |
| | 5 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .353 | -1.320 | |
| | | .934 | .000 | .000 | | .353 | -.990 | |
| | | 1.868 | .000 | .000 | | .353 | -.660 | |
| | | 1.868 | | | .000 | | | |
| | 6 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 5.000 | .000 | |
| | | .934 | .000 | .000 | | 5.000 | 4.670 | |
| | | 1.868 | .000 | .000 | | 5.000 | 9.340 | |
| | | 1.868 | | | .000 | | | |
| 3 | | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 1.692 | -3.160 | |
| | | .934 | .000 | .000 | | 1.692 | -1.580 | |
| | | 1.868 | .000 | .000 | | 1.692 | .000 | |
| | | 1.868 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | -3.662 | 6.840 | |
| | | .934 | .000 | .000 | | -3.662 | 3.420 | |
| | | 1.868 | .000 | .000 | | -3.662 | .000 | |
| | | 1.868 | | | .000 | | | |
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | -2.323 | 4.340 | |
| | | .934 | .000 | .000 | | -2.323 | 2.170 | |
| | | 1.868 | .000 | .000 | | -2.323 | .000 | |
| | | 1.868 | | | .000 | | | |
| | 4 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | 2.323 | 4.340 | |
| | | .934 | .000 | .000 | | 2.323 | 6.510 | |
| | | 1.868 | .000 | .000 | | -7.677 | .000 | |
| | | 1.868 | | | .000 | | | |
| | 5 | .000 | | | .000 | | | |

F R A M E  E L E M E N T  F O R C E S

| ELT ID | LOAD COND | DIST ENDI | 1-2 PLANE SHEAR | 1-2 PLANE MOMENT | AXIAL FORCE | 1-3 PLANE SHEAR | 1-3 PLANE MOMENT | AXIAL TORQ |
|---|---|---|---|---|---|---|---|---|
| | | .000 | .000 | .000 | | .353 | -.660 | |
| | | .934 | .000 | .000 | | .353 | -.330 | |
| | | 1.868 | .000 | .000 | | .353 | .000 | |
| | | 1.868 | | | .000 | | | |
| | 6 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | -5.000 | 9.340 | |
| | | .934 | .000 | .000 | | -5.000 | 4.670 | |
| | | 1.868 | .000 | .000 | | -5.000 | .000 | |
| | | 1.868 | | | .000 | | | |
| 4 | ---------- | | | | | | | |
| | 1 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 2 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 3 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 4 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 5 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |
| | 6 | .000 | | | .000 | | | |
| | | .000 | .000 | .000 | | .000 | .000 | |
| | | 1.091 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | .000 | .000 | | .000 | .000 | |
| | | 2.182 | | | .000 | | | |

# 15.CALCULO DE PRELOSAS DE ENCOFRADO PERDIDO

19.

# CALCULO DE PLACAS DE CELOSIA

PLACAS TIPO V-1

## Caracteristicas geometricas de la placa:

Placa de celosia con vuelos en ambos extremos

| | |
|---|---|
| Longitud total(cm): | 810 |
| Longitud del vuelo izquierdo(cm): | 211.2 |
| Longitud del apoyo izquierdo(cm): | 43.4 |
| Longitud del vano central(cm): | 300.8 |
| Longitud del apoyo derecho(cm): | 43.4 |
| Longitud del vuelo derecho(cm): | 211.2 |

| | |
|---|---|
| Canto de la celosia(cm): | 17 |
| Distancia entre senos de las diagonales(cm): | 20 |
| Distancia transversal entre celosias(cm): | 20 |
| Distancia entre los cordones inferiores de las celosias(cm) | 9 |
| Ancho de la placa(cm): | 120 |
| Espesor de la placa(cm): | 6 |
| Longitud de las entregas(cm): | 6 |

## Materiales empleados en la fabricacion de la placa

| | |
|---|---|
| Resistencia caracteristica del hormigon(kg/cm2): | 300 |
| Resistencia caracteristica del acero(kg/cm2): | 5100 |
| Coeficiente de minoracion del hormigon: | 1.4 |
| Coeficiente de minoracion del acero: | 1.1 |
| Coeficiente de mayoracion de las acciones: | 1.5 |
| Peso especifico del hormigon(kg/m3): | 2500 |

## Caracteristicas geometricas de la losa

| | |
|---|---|
| Espesor de la losa en el extremo del voladizo izquierdo(cm): | 25 |
| Espesor de la losa en el apoyo izquierdo(cm): | 30 |
| Espesor de la losa en el punto intermedio(cm): | 33 |
| Distancia del punto intermedio al apoyo izquierdo(cm): | 232.9 |
| Espesor de la losa en el apoyo derecho(cm): | 30 |
| Espesor de la losa en el extremo del voladizo derecho(cm): | 25 |

## Ejecucion del hormigonado

Hormigonado en dos fases:
Primera fase: hormigonado de:
- Vano central
- 132.2 cm del vuelo izquierdo
- 132.2 cm del vuelo derecho

Segunda fase: hormigonado del resto de la losa

## Acciones consideradas:

Peso propio, teniendo en cuenta las fases de hormigonado
Peso de un operario(kg/ml): 157 (incluido peto)

## Tipo de refuerzos utilizados

Celosias corridas

## Esfuerzos en la placa (sin mayorar y por metro):

Hipotesis 1:Vano central hormigonado y operario el punto pesimo para M+
Hipotesis 2:Fase intermedia de hormigonado y operario en punto pesimo para M-
Hipotesis 3:Segunda fase de hormigonado y operario en punto pesimo para M-
Hipotesis 4:Vano central hormigonado y operario el punto pesimo para Q
Hipotesis 5:Fase intermedia de hormigonado y operario en punto pesimo para Q

Voladizo izquierdo (x empezando en el apoyo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3345 | -.3168 | -1.2014 | -1.2798 | +0.0000 | +0.0000 | -.3345 | -.3168 | -.8699 | -1.1228 |
| +.2347 | -.2643 | -.2816 | -.9210 | -1.1024 | +0.0000 | +0.0000 | -.2643 | -.2816 | -.6262 | -.9454 |
| +.4693 | -.2024 | -.2464 | -.6827 | -.9246 | +0.0000 | +0.0000 | -.2024 | -.2464 | -.4248 | -.7676 |
| +.7040 | -.1487 | -.2112 | -.4866 | -.7462 | +0.0000 | +0.0000 | -.1487 | -.2112 | -.2655 | -.5892 |
| +.9387 | -.1033 | -.1760 | -.2875 | -.3330 | +0.0000 | +0.0000 | -.1033 | -.1760 | -.1033 | -.1760 |
| +1.1733 | -.0661 | -.1408 | -.2135 | -.2978 | +0.0000 | +0.0000 | -.0661 | -.1408 | -.0661 | -.1408 |
| +1.4080 | -.0372 | -.1056 | -.1477 | -.2626 | -.2688 | -.6117 | -.0372 | -.1056 | -.0372 | -.1056 |
| +1.6427 | -.0165 | -.0704 | -.0902 | -.2274 | -.1435 | -.4569 | -.0165 | -.0704 | -.0165 | -.0704 |
| +1.8773 | -.0041 | -.0352 | -.0410 | -.1922 | -.0542 | -.3053 | -.0041 | -.0352 | -.0041 | -.0352 |
| +2.1120 | +0.0000 | +0.0000 | +0.0000 | -.1570 | +0.0000 | -.1570 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

Tramo central (x empezando en el apoyo izquierdo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3345 | +1.2567 | -1.2014 | +1.1741 | +0.0000 | +0.0000 | -.3345 | +1.1741 | +0.0000 | +0.0000 |
| +.1543 | -.1493 | +1.1376 | -1.0250 | +1.0549 | +0.0000 | +0.0000 | -.1591 | +1.0543 | +0.0000 | +0.0000 |
| +.3166 | -.0230 | +1.0176 | -.8674 | +.9350 | +0.0000 | +0.0000 | -.0006 | +.9350 | +0.0000 | +0.0000 |
| +.4749 | +.1018 | +.8969 | -.7230 | +.8142 | +0.0000 | +0.0000 | +.1379 | +.8142 | +0.0000 | +0.0000 |
| +.6333 | +.2431 | +.7753 | -.6007 | +.6927 | +0.0000 | +0.0000 | +.2572 | +.6927 | +0.0000 | +0.0000 |
| +.7916 | +.4182 | +.6529 | -.5007 | +.5703 | +0.0000 | +0.0000 | +.3572 | +.5703 | +0.0000 | +0.0000 |
| +.9499 | +.6344 | +.5298 | -.4231 | +.4471 | +0.0000 | +0.0000 | +.4378 | +.4471 | +0.0000 | +0.0000 |
| +1.1082 | +.8918 | +.4058 | -.3682 | +.3232 | +0.0000 | +0.0000 | +.4987 | +.3232 | +0.0000 | +0.0000 |
| +1.2665 | +.9342 | +.2810 | -.3359 | +.1984 | +0.0000 | +0.0000 | +.5400 | +.1994 | +0.0000 | +0.0000 |
| +1.4248 | +.9670 | +.1554 | -.3054 | +.0728 | +0.0000 | +0.0000 | +.5615 | +.0728 | +0.0000 | +0.0000 |
| +1.5832 | +.9904 | +.1289 | -.3039 | -.0536 | +0.0000 | +0.0000 | +.5630 | -.0536 | +0.0000 | +0.0000 |
| +1.7415 | +.9401 | -.2552 | -.3224 | -.1808 | +0.0000 | +0.0000 | +.5445 | -.1808 | +0.0000 | +0.0000 |
| +1.8998 | +.5973 | -.3832 | -.3612 | -.3089 | +0.0000 | +0.0000 | +.5057 | -.3089 | +0.0000 | +0.0000 |
| +2.0581 | +.5251 | -.5121 | -.4203 | -.4377 | +0.0000 | +0.0000 | +.4466 | -.4377 | +0.0000 | +0.0000 |
| +2.2164 | +.4335 | -.6417 | -.4998 | -.5673 | +0.0000 | +0.0000 | +.3671 | -.5673 | +0.0000 | +0.0000 |
| +2.3747 | +.3193 | -.7720 | -.5999 | -.6976 | +0.0000 | +0.0000 | +.2670 | -.6976 | +0.0000 | +0.0000 |
| +2.5331 | +.1856 | -.9004 | -.7206 | -.8260 | +0.0000 | +0.0000 | +.1463 | -.8260 | +0.0000 | +0.0000 |
| +2.6914 | +.0317 | -1.0261 | -.8613 | -.9517 | +0.0000 | +0.0000 | +.0056 | -.9517 | +0.0000 | +0.0000 |
| +2.8497 | -.1418 | -1.1490 | -1.0218 | -1.0746 | +0.0000 | +0.0000 | -.1549 | -1.0746 | +0.0000 | +0.0000 |
| +3.0080 | -.3345 | -1.2691 | -1.2014 | -1.1947 | +0.0000 | +0.0000 | -.3345 | -1.3527 | +0.0000 | +0.0000 |

Voladizo derecho (x empezando en el apoyo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3345 | +.3168 | -1.2014 | -.3322 | +0.0000 | +0.0000 | -.3345 | +.3168 | -.8699 | -.4892 |
| +.2347 | -.2643 | +.2816 | -.9210 | -.2252 | +0.0000 | +0.0000 | -.2643 | +.2816 | -.6262 | -.3522 |
| +.4693 | -.2024 | +.2464 | -.6827 | -.1178 | +0.0000 | +0.0000 | -.2024 | +.2464 | -.4248 | -.2748 |
| +.7040 | -.1487 | +.2112 | -.4866 | -.0098 | +0.0000 | +0.0000 | -.1487 | +.2112 | -.2655 | -.1668 |
| +.9387 | -.1033 | +.1760 | -.2875 | +.3330 | +0.0000 | +0.0000 | -.1033 | +.1760 | -.1033 | +.1760 |
| +1.1733 | -.0661 | +.1408 | -.2135 | +.2978 | +0.0000 | +0.0000 | -.0661 | +.1408 | -.0661 | +.1408 |
| +1.4080 | -.0372 | +.1056 | -.1477 | +.2626 | -.2688 | +.6117 | -.0372 | +.1056 | -.0372 | +.1056 |
| +1.6427 | -.0165 | +.0704 | -.0902 | +.2274 | -.1435 | +.4569 | -.0165 | +.0704 | -.0165 | +.0704 |
| +1.8773 | -.0041 | +.0352 | -.0410 | +.1922 | -.0542 | +.3053 | -.0041 | +.0352 | -.0041 | +.0352 |
| +2.1120 | +0.0000 | +0.0000 | +0.0000 | +.1570 | +0.0000 | +.1570 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

**Esfuerzos en los elementos de la celosia(mayorados):**
Supuestas 6 celosias por pieza

A.- Compresiones en el cordon superior(T)
B.-Compresiones en el cordon inferior(T)
C.-Compresiones en las diagonales(T)

Voladizo izquierdo (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.1202 | .4608 |
| .2347 | 0.0000 | 1.6252 | .3969 |
| .4693 | 0.0000 | 1.2048 | .3329 |
| .7040 | 0.0000 | .8586 | .2687 |
| .9387 | 0.0000 | .5073 | .1199 |
| 1.1733 | 0.0000 | .3767 | .1072 |
| 1.4080 | 0.0000 | .4744 | .2202 |
| 1.6427 | 0.0000 | .2533 | .1645 |
| 1.8773 | 0.0000 | .0956 | .1099 |
| 2.1120 | 0.0000 | 0.0000 | .0565 |

Tramo central (x empezando en el apoyo izquierdo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.1202 | .4525 |
| .1583 | 0.0000 | 1.8088 | .4096 |
| .3166 | .0406 | 1.5308 | .3664 |
| .4749 | .3057 | 1.2864 | .3229 |
| .6333 | .5370 | 1.0759 | .2791 |
| .7916 | .7342 | .8994 | .2351 |
| .9499 | .8972 | .7573 | .1907 |
| 1.1082 | 1.0256 | .6497 | .1461 |
| 1.2665 | 1.1192 | .5768 | .1012 |
| 1.4248 | 1.1779 | .5389 | .0560 |
| 1.5832 | 1.2014 | .5362 | .0461 |
| 1.7415 | 1.1455 | .5690 | .0919 |
| 1.8998 | 1.0541 | .6374 | .1380 |
| 2.0581 | .9267 | .7416 | .1844 |
| 2.2164 | .7632 | .8820 | .2310 |
| 2.3747 | .5635 | 1.0587 | .2779 |
| 2.5331 | .3275 | 1.2716 | .3242 |
| 2.6914 | .0560 | 1.5200 | .3694 |
| 2.8497 | 0.0000 | 1.8031 | .4137 |
| 3.0080 | 0.0000 | 2.1202 | .4867 |

Voladizo derecho (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.1202 | .1761 |
| .2347 | 0.0000 | 1.6252 | .1376 |
| .4693 | 0.0000 | 1.2048 | .0989 |
| .7040 | 0.0000 | .8586 | .0760 |
| .9387 | 0.0000 | .5073 | .1199 |
| 1.1733 | 0.0000 | .3767 | .1072 |
| 1.4080 | 0.0000 | .4744 | .2202 |
| 1.6427 | 0.0000 | .2533 | .1645 |
| 1.8773 | 0.0000 | .0956 | .1099 |
| 2.1120 | 0.0000 | 0.0000 | .0565 |

**Dimensionamiento:**

Placas tipo (6 C-10.10.6) de 810 cm de longitud y canto 17 cms

| | Fi | w | Anec | Areal | Areal/Anec |
|---|---|---|---|---|---|
| Diagonales | 6 | 2.972 | 1.87 | 3.39 | 1.81 |
| Superior | 10 | 2.449 | 3.81 | 4.71 | 1.24 |
| Inferior | 10 | 2.449 | 6.72 | 9.42 | 1.40 |

(Cuantias en cm2/m)

**Flechas esperadas:**

Vuelo izquierdo: 1.54 cm. + $L/100 = 211.2/100 = 2.11$ cm
Vano biapoyado: 0 cm.
Vuelo derecho: 1.73 cm. + $L/100 = 2.11$ cm

**Precio:**

Precio unitario: 44216.28 pts. (C.V. 1.35)
Precio por metro cuadrado: 4549 pts.

# ALCULO DE PLACAS DE CELOSIA

PLACAS TIPO V-2 y V-2A

## a cteristicas geometricas de la placa:

Placa de celosia con vuelos en ambos extremos

| | |
|---|---|
| Longitud total(cm): | 810 |
| Longitud del vuelo izquierdo(cm): | 211.2 |
| Longitud del apoyo izquierdo(cm): | 46.4 |
| Longitud del vano central(cm): | 294.8 |
| Longitud del apoyo derecho(cm): | 46.4 |
| Longitud del vuelo derecho(cm): | 211.2 |

| | |
|---|---|
| Canto de la celosia(cm): | 17 |
| Distancia entre senos de las diagonales(cm): | 20 |
| Distancia transversal entre celosias(cm): | 20 |
| Distancia entre los cordones inferiores de las celosias(cm) | 9 |
| Ancho de la placa(cm): | 120 |
| Espesor de la placa(cm): | 6 |
| Longitud de las entregas(cm): | 6 |

## at riales empleados en la fabricacion de la placa

| | |
|---|---|
| Resistencia caracteristica del hormigon(kg/cm2): | 300 |
| Resistencia caracteristica del acero(kg/cm2): | 5100 |
| Coeficiente de minoracion del hormigon: | 1.4 |
| Coeficiente de minoracion del acero: | 1.1 |
| Coeficiente de mayoracion de las acciones: | 1.5 |
| Peso especifico del hormigon(kg/m3): | 2500 |

## aracteristicas geometricas de la losa

| | |
|---|---|
| Espesor de la losa en el extremo del voladizo izquierdo(cm): | 25 |
| Espesor de la losa en el apoyo izquierdo(cm): | 30 |
| Espesor de la losa en el punto intermedio(cm): | 33 |
| Distancia del punto intermedio al apoyo izquierdo(cm): | 232.9 |
| Espesor de la losa en el apoyo derecho(cm): | 30 |
| Espesor de la losa en el extremo del voladizo derecho(cm): | 25 |

## jecucion del hormigonado

Hormigonado en dos fases:
Primera fase: hormigonado de:
- Vano central
- 132.2 cm del vuelo izquierdo
- 132.2 cm del vuelo derecho

Segunda fase: hormigonado del resto de la losa

## cciones consideradas:

Peso propio, teniendo en cuenta las fases de hormigonado
Peso de un operario(kg/ml): 157

## ipo de refuerzos utilizados

Celosias corridas

## Esfuerzos en la placa (sin mayorar y por metro):

Hipotesis 1:Vano central hormigonado y operario el punto pesimo para M+
Hipotesis 2:Fase intermedia de hormigonado y operario en punto pesimo para M-
Hipotesis 3:Segunda fase de hormigonado y operario en punto pesimo para M-
Hipotesis 4:Vano central hormigonado y operario el punto pesimo para Q
Hipotesis 5:Fase intermedia de hormigonado y operario en punto pesimo para Q

Voladizo izquierdo (x empezando en el apoyo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3345 | -.3168 | -1.2014 | -1.2798 | +0.0000 | +0.0000 | -.3345 | -.3168 | -.8699 | -1.1228 |
| +.2347 | -.2643 | -.2816 | -.9210 | -1.1024 | +0.0000 | +0.0000 | -.2643 | -.2816 | -.6262 | -.9454 |
| +.4693 | -.2024 | -.2464 | -.6827 | -.9246 | +0.0000 | +0.0000 | -.2024 | -.2464 | -.4248 | -.7676 |
| +.7040 | -.1487 | -.2112 | -.4866 | -.7462 | +0.0000 | +0.0000 | -.1487 | -.2112 | -.2655 | -.5892 |
| +.9387 | -.1033 | -.1760 | -.2875 | -.3330 | +0.0000 | +0.0000 | -.1033 | -.1760 | -.1033 | -.1760 |
| +1.1733 | -.0661 | -.1408 | -.2135 | -.2978 | +0.0000 | +0.0000 | -.0661 | -.1408 | -.0661 | -.1408 |
| +1.4080 | -.0372 | -.1056 | -.1477 | -.2626 | -.2688 | -.6117 | -.0372 | -.1056 | -.0372 | -.1056 |
| +1.6427 | -.0165 | -.0704 | -.0902 | -.2274 | -.1435 | -.4569 | -.0165 | -.0704 | -.0165 | -.0704 |
| +1.8773 | -.0041 | -.0352 | -.0410 | -.1922 | -.0542 | -.3053 | -.0041 | -.0352 | -.0041 | -.0352 |
| +2.1120 | +0.0000 | +0.0000 | +0.0000 | -.1570 | +0.0000 | -.1570 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

Tramo central (x empezando en el apoyo izquierdo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3345 | +1.2327 | -1.2014 | +1.1501 | +0.0000 | +0.0000 | -.3345 | +1.1501 | +0.0000 | +0.0000 |
| +.1552 | -.1534 | +1.1160 | -1.0320 | +1.0333 | +0.0000 | +0.0000 | -.1651 | +1.0333 | +0.0000 | +0.0000 |
| +.3103 | +.0042 | +.9984 | -.8308 | +.9158 | +0.0000 | +0.0000 | -.0139 | +.9158 | +0.0000 | +0.0000 |
| +.4655 | +.1536 | +.8807 | -.7479 | +.7975 | +0.0000 | +0.0000 | -.1190 | +.7975 | +0.0000 | +0.0000 |
| +.6206 | +.2797 | +.7630 | -.6334 | +.6784 | +0.0000 | +0.0000 | -.2335 | +.6784 | +0.0000 | +0.0000 |
| +.7758 | +.3872 | +.6412 | -.5374 | +.5586 | +0.0000 | +0.0000 | -.3295 | +.5586 | +0.0000 | +0.0000 |
| +.9309 | +.4760 | +.5236 | -.4601 | +.4379 | +0.0000 | +0.0000 | -.4068 | +.4379 | +0.0000 | +0.0000 |
| +1.0861 | +.5461 | +.3931 | -.4016 | +.3165 | +0.0000 | +0.0000 | -.4653 | +.3165 | +0.0000 | +0.0000 |
| +1.2413 | +.5973 | +.2770 | -.3619 | +.1943 | +0.0000 | +0.0000 | -.5050 | +.1943 | +0.0000 | +0.0000 |
| +1.3964 | +.6296 | +.1543 | -.3413 | +.0714 | +0.0000 | +0.0000 | -.5256 | +.0714 | +0.0000 | +0.0000 |
| +1.5516 | +.6425 | -.1267 | -.3398 | -.0524 | +0.0000 | +0.0000 | -.5271 | -.0524 | +0.0000 | +0.0000 |
| +1.7067 | +.6119 | -.2512 | -.3576 | -.1769 | +0.0000 | +0.0000 | -.5093 | -.1769 | +0.0000 | +0.0000 |
| +1.8619 | +.5619 | -.3765 | -.3947 | -.3022 | +0.0000 | +0.0000 | -.4722 | -.3022 | +0.0000 | +0.0000 |
| +2.0171 | +.4924 | -.5026 | -.4514 | -.4282 | +0.0000 | +0.0000 | -.4155 | -.4282 | +0.0000 | +0.0000 |
| +2.1722 | +.4033 | -.6294 | -.5276 | -.5550 | +0.0000 | +0.0000 | -.3392 | -.5550 | +0.0000 | +0.0000 |
| +2.3274 | +.2945 | -.7570 | -.6237 | -.6827 | +0.0000 | +0.0000 | -.2432 | -.6827 | +0.0000 | +0.0000 |
| +2.4825 | +.1659 | -.8836 | -.7394 | -.8092 | +0.0000 | +0.0000 | -.1275 | -.8092 | +0.0000 | +0.0000 |
| +2.6377 | +.0179 | -1.0073 | -.8746 | -.9329 | +0.0000 | +0.0000 | -.0077 | -.9329 | +0.0000 | +0.0000 |
| +2.7928 | -.1491 | -1.1280 | -1.0288 | -1.0536 | +0.0000 | +0.0000 | -.1619 | -1.0536 | +0.0000 | +0.0000 |
| +2.9480 | -.3345 | -1.2458 | -1.2014 | -1.1715 | +0.0000 | +0.0000 | -.3345 | -1.1285 | +0.0000 | +0.0000 |

Voladizo derecho (x empezando en el apoyo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3345 | +.3168 | -1.2014 | -.3322 | +0.0000 | +0.0000 | -.3345 | +.3168 | -.8699 | -.4892 |
| +.2347 | -.2643 | +.2816 | -.9210 | -.2252 | +0.0000 | +0.0000 | -.2643 | +.2816 | -.6262 | -.3822 |
| +.4693 | -.2024 | +.2464 | -.6827 | -.1178 | +0.0000 | +0.0000 | -.2024 | +.2464 | -.4248 | -.2748 |
| +.7040 | -.1487 | +.2112 | -.4866 | -.0098 | +0.0000 | +0.0000 | -.1487 | +.2112 | -.2655 | -.1668 |
| +.9387 | -.1033 | +.1760 | -.2875 | +.3330 | +0.0000 | +0.0000 | -.1033 | +.1760 | -.1033 | +.1760 |
| +1.1733 | -.0661 | +.1408 | -.2135 | +.2978 | +0.0000 | +0.0000 | -.0661 | +.1408 | -.0661 | +.1408 |
| +1.4080 | -.0372 | +.1056 | -.1477 | +.2626 | -.2688 | +.6117 | -.0372 | +.1056 | -.0372 | +.1056 |
| +1.6427 | -.0165 | +.0704 | -.0902 | +.2274 | -.1435 | +.4569 | -.0165 | +.0704 | -.0165 | +.0704 |
| +1.8773 | -.0041 | +.0352 | -.0410 | +.1922 | -.0542 | +.3053 | -.0041 | +.0352 | -.0041 | +.0352 |
| +2.1120 | +0.0000 | +0.0000 | +0.0000 | +.1570 | +0.0000 | +.1570 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

**Esfuerzos en los elementos de la celosia(mayorados):**
Supuestas 6 celosias por pieza

A.- Compresiones en el cordon superior(T)
B.-Compresiones en el cordon inferior(T)
C.-Compresiones en las diagonales(T)

Voladizo izquierdo (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.1202 | .4608 |
| .2347 | 0.0000 | 1.6252 | .3969 |
| .4693 | 0.0000 | 1.2048 | .3329 |
| .7040 | 0.0000 | .8586 | .2687 |
| .9387 | 0.0000 | .5073 | .1199 |
| 1.1733 | 0.0000 | .3767 | .1072 |
| 1.4080 | 0.0000 | .4744 | .2202 |
| 1.6427 | 0.0000 | .2533 | .1645 |
| 1.8773 | 0.0000 | .0956 | .1099 |
| 2.1120 | 0.0000 | 0.0000 | .0565 |

Tramo central (x empezando en el apoyo izquierdo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.1202 | .4438 |
| .1552 | 0.0000 | 1.8212 | .4018 |
| .3103 | .0162 | 1.5544 | .3595 |
| .4655 | .2711 | 1.3198 | .3169 |
| .6206 | .4935 | 1.1177 | .2740 |
| .7758 | .6833 | .9484 | .2309 |
| .9309 | .8401 | .8119 | .1874 |
| 1.0861 | .9637 | .7086 | .1437 |
| 1.2413 | 1.0540 | .6387 | .0997 |
| 1.3964 | 1.1108 | .6023 | .0554 |
| 1.5516 | 1.1338 | .5997 | .0456 |
| 1.7067 | 1.0798 | .6310 | .0905 |
| 1.8619 | .9916 | .6966 | .1356 |
| 2.0171 | .8690 | .7966 | .1809 |
| 2.1722 | .7118 | .9311 | .2266 |
| 2.3274 | .5197 | 1.1006 | .2726 |
| 2.4825 | .2928 | 1.3049 | .3181 |
| 2.6377 | .0316 | 1.5435 | .3627 |
| 2.7928 | 0.0000 | 1.8155 | .4061 |
| 2.9480 | 0.0000 | 2.1202 | .4783 |

Voladizo derecho (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.1202 | .1761 |
| .2347 | 0.0000 | 1.6252 | .1376 |
| .4693 | 0.0000 | 1.2048 | .0989 |
| .7040 | 0.0000 | .8586 | .0760 |
| .9387 | 0.0000 | .5073 | .1199 |
| 1.1733 | 0.0000 | .3767 | .1072 |
| 1.4080 | 0.0000 | .4744 | .2202 |
| 1.6427 | 0.0000 | .2533 | .1645 |
| 1.8773 | 0.0000 | .0956 | .1099 |
| 2.1120 | 0.0000 | 0.0000 | .0565 |

**Dimensionamiento:**

Placas tipo 6 C-10.10.6 de 810 cm de longitud y canto 17 cms

| | Fi | w | Anec | Areal | Areal/Anec |
|---|---|---|---|---|---|
| Diagonales | 6 | 2.972 | 1.84 | 3.39 | 1.84 |
| Superior | 10 | 2.449 | 3.59 | 4.71 | 1.31 |
| Inferior | 10 | 2.449 | 6.72 | 9.42 | 1.40 |

(Cuantias en cm2/m)

**Flechas esperadas:**

Vuelo izquierdo: 1.6 cm. ≯ 2.11 cm
Vano biapoyado: 0 cm.
Vuelo derecho: 1.79 cm. ≯ 2.11 cm

**Precio:**

Precio unitario: 44216.28 pts. (C.V. 1.35)
Precio por metro cuadrado: 4549 pts.

## ALCULO DE PLACAS DE CELOSIA

PLACA TIPO VE-2

### acteristicas geometricas de la placa:

Placa de celosia con vuelos en ambos extremos

| | |
|---|---|
| Longitud total(cm): | 810 |
| Longitud del vuelo izquierdo(cm): | 211.2 |
| Longitud del apoyo izquierdo(cm): | 43.4 |
| Longitud del vano central(cm): | 300.8 |
| Longitud del apoyo derecho(cm): | 43.4 |
| Longitud del vuelo derecho(cm): | 211.2 |

| | |
|---|---|
| Canto de la celosia(cm): | 17 |
| Distancia entre senos de las diagonales(cm): | 20 |
| Distancia transversal entre celosias(cm): | 20 |
| Distancia entre los cordones inferiores de las celosias(cm) | 9 |
| Ancho de la placa(cm): | 69 |
| Espesor de la placa(cm): | 6 |
| Longitud de las entregas(cm): | 6 |

### ateriales empleados en la fabricacion de la placa

| | |
|---|---|
| Resistencia caracteristica del hormigon(kg/cm2): | 300 |
| Resistencia caracteristica del acero(kg/cm2): | 5100 |
| Coeficiente de minoracion del hormigon: | 1.4 |
| Coeficiente de minoracion del acero: | 1.1 |
| Coeficiente de mayoracion de las acciones: | 1.5 |
| Peso especifico del hormigon(kg/m3): | 2500 |

### aracteristicas geometricas de la losa

| | |
|---|---|
| Espesor de la losa en el extremo del voladizo izquierdo(cm): | 25 |
| Espesor de la losa en el apoyo izquierdo(cm): | 30 |
| Espesor de la losa en el punto intermedio(cm): | 33 |
| Distancia del punto intermedio al apoyo izquierdo(cm): | 232.9 |
| Espesor de la losa en el apoyo derecho(cm): | 30 |
| Espesor de la losa en el extremo del voladizo derecho(cm): | 25 |

### jecucion del hormigonado

Hormigonado en dos fases:
Primera fase: hormigonado de:
- Vano central
- 132.2 cm del vuelo izquierdo
- 132.2 cm del vuelo derecho

Segunda fase: hormigonado del resto de la losa

### cciones consideradas:

Peso propio, teniendo en cuenta las fases de hormigonado
Peso de un operario(kg/ml): 227.5 (incluso peto)

### ipo de refuerzos utilizados

elosias corridas

### Esfuerzos en la placa (sin mayorar y por metro):

Hipotesis 1:Vano central hormigonado y operario el punto pesimo para M-
Hipotesis 2:Fase intermedia de hormigonado y operario en punto pesimo para M-
Hipotesis 3:Segunda fase de hormigonado y operario en punto pesimo para M-
Hipotesis 4:Vano central hormigonado y operario el punto pesimo para Q
Hipotesis 5:Fase intermedia de hormigonado y operario en punto pesimo para Q

Voladizo izquierdo (X empezando en el apoyo)

| X | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | [illegible] | -.3168 | -1.3503 | -1.3503 | +0.0000 | +0.0000 | -.3345 | -.3168 | -.8699 | -1.1229 |
| +.2347 | -.2043 | -.2816 | -1.0533 | -1.1729 | +0.0000 | +0.0000 | -.2643 | -.2816 | -.6262 | -.9454 |
| +.4693 | -.0824 | -.2464 | -.7985 | -.9951 | +0.0000 | +0.0000 | -.2024 | -.2464 | -.4248 | -.7674 |
| +.7040 | -.1487 | -.2112 | -.5656 | -.8167 | +0.0000 | +0.0000 | -.1487 | -.2112 | -.2655 | -.5893 |
| +.9387 | -.1033 | -.1760 | -.3702 | -.6335 | +0.0000 | +0.0000 | -.1033 | -.1760 | -.1033 | -.4161 |
| +1.1733 | -.0661 | -.1408 | -.2796 | -.3683 | +0.0000 | +0.0000 | -.0661 | -.1408 | -.0661 | -.2408 |
| +1.4080 | -.0372 | -.1056 | -.1973 | -.1973 | +0.0000 | +0.0000 | -.0372 | -.1056 | -.0372 | -.1056 |
| +1.6427 | -.0165 | -.0704 | -.1233 | -.0425 | +0.0000 | +0.0000 | -.0165 | -.0704 | -.0165 | -.0704 |
| +1.8773 | -.0041 | -.0352 | -.0575 | -.0352 | +0.0000 | +0.0000 | -.0041 | -.0352 | -.0041 | -.0352 |
| +2.1120 | +0.0000 | +0.0000 | +0.0000 | -.2275 | +0.0000 | -.2275 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

Vano central (X empezando en el apoyo izquierdo

| X | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | [illegible] | +1.0334 | -1.3503 | +1.1741 | +0.0000 | +0.0000 | -.3345 | +1.1741 | +0.0000 | +0.0000 |
| +.1744 | [illegible] | +1.1747 | -1.1733 | +1.0343 | +0.0000 | +0.0000 | -.1965 | +1.0343 | [illegible] | [illegible] |
| +.3488 | [illegible] | +1.0347 | -1.0364 | +.8945 | +0.0000 | +0.0000 | -.0948 | +.8945 | [illegible] | [illegible] |
| +.5232 | [illegible] | +.8947 | -.8772 | +.7548 | +0.0000 | +0.0000 | -.0297 | +.7548 | [illegible] | [illegible] |
| +.6976 | [illegible] | +.7548 | -.7028 | +.6151 | +0.0000 | +0.0000 | -.0013 | +.6151 | [illegible] | [illegible] |
| +.8720 | [illegible] | +.6151 | -.5132 | +.4754 | +0.0000 | +0.0000 | -.0128 | +.4754 | [illegible] | [illegible] |
| +1.0464 | [illegible] | +.4754 | -.3784 | +.3357 | +0.0000 | +0.0000 | -.0592 | +.3357 | [illegible] | [illegible] |
| +1.2208 | [illegible] | +.3357 | -.2784 | +.1960 | +0.0000 | +0.0000 | -.1405 | +.1960 | [illegible] | [illegible] |
| +1.3952 | [illegible] | +.1960 | -.1932 | +.0563 | +0.0000 | +0.0000 | -.2567 | +.0563 | [illegible] | [illegible] |
| +1.5696 | [illegible] | +.0563 | -.1228 | -.0834 | +0.0000 | +0.0000 | -.3078 | -.0834 | [illegible] | [illegible] |
| +1.7440 | [illegible] | -.0834 | -.0672 | -.2231 | +0.0000 | +0.0000 | -.3938 | -.2231 | [illegible] | [illegible] |
| +1.9184 | [illegible] | -.2231 | -.0265 | -.3628 | +0.0000 | +0.0000 | -.4147 | -.3628 | [illegible] | [illegible] |
| +2.0928 | [illegible] | -.3628 | -.0009 | -.5025 | +0.0000 | +0.0000 | -.4705 | -.5025 | [illegible] | [illegible] |
| +2.2672 | [illegible] | -.5025 | -.0104 | -.6422 | +0.0000 | +0.0000 | -.5613 | -.6422 | [illegible] | [illegible] |
| +2.4416 | [illegible] | -.6422 | -.0549 | -.7819 | +0.0000 | +0.0000 | -.6870 | -.7819 | [illegible] | [illegible] |
| +2.6160 | [illegible] | -.7819 | -.1345 | -.9216 | +0.0000 | +0.0000 | -.8476 | -.9216 | [illegible] | [illegible] |
| +2.7904 | [illegible] | -.9216 | -.2490 | -1.0613 | +0.0000 | +0.0000 | -1.0433 | -1.0613 | [illegible] | [illegible] |
| +2.9648 | [illegible] | -1.0613 | -.3986 | -1.2010 | +0.0000 | +0.0000 | -1.2739 | -1.2010 | [illegible] | [illegible] |
| +3.1392 | [illegible] | -1.2010 | -.5832 | -1.3407 | +0.0000 | +0.0000 | -1.5394 | -1.3407 | [illegible] | [illegible] |

Voladizo derecho (X empezando en el apoyo)

| X | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3345 | -.3168 | -1.3503 | -.2617 | +0.0000 | +0.0000 | -.3345 | -.3168 | -.8699 | -.4892 |
| +.2347 | -.2643 | +.2816 | -1.0533 | -.1547 | +0.0000 | +0.0000 | -.2643 | -.2816 | -.6262 | -.3822 |
| +.4693 | -.2024 | +.2464 | -.7985 | -.0473 | +0.0000 | +0.0000 | -.2024 | +.2464 | -.4248 | -.2748 |
| +.7040 | -.1487 | +.2112 | -.5856 | +.0607 | +0.0000 | +0.0000 | -.1487 | +.2112 | -.2655 | -.1668 |
| +.9387 | -.1033 | +.1760 | -.3702 | +.4035 | +0.0000 | +0.0000 | -.1033 | +.1760 | -.1033 | +.1760 |
| +1.1733 | -.0661 | +.1408 | -.2796 | +.3683 | +0.0000 | +0.0000 | -.0661 | +.1408 | -.0661 | +.1408 |
| +1.4080 | -.0372 | +.1056 | -.1973 | +.3331 | -.3185 | +.6822 | -.0372 | +.1056 | -.0372 | +.1056 |
| +1.6427 | -.0165 | +.0704 | -.1233 | +.2979 | -.1766 | +.5274 | -.0165 | +.0704 | -.0165 | +.0704 |
| +1.8773 | -.0041 | +.0352 | -.0575 | +.2627 | -.0707 | +.3756 | -.0041 | +.0352 | -.0041 | +.0352 |
| +2.1120 | +0.0000 | +0.0000 | +0.0000 | +.2275 | +0.0000 | +.2275 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

**Esfuerzos en los elementos de la celosia(mayorados):**
Supuestas 3 celosias por pieza

A.-Compresiones en el cordon superior(T)
B.-Compresiones en el cordon inferior(T)
C.-Compresiones en las diagonales(T)

Voladizo izquierdo (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.7404 | .5591 |
| .2347 | 0.0000 | 2.1376 | .4856 |
| .4693 | 0.0000 | 1.6205 | .4120 |
| .7040 | 0.0000 | 1.1889 | .3382 |
| .9387 | 0.0000 | .7513 | .1671 |
| 1.1733 | 0.0000 | .5675 | .1525 |
| 1.4080 | 0.0000 | .6463 | .2824 |
| 1.6427 | 0.0000 | .3585 | .2183 |
| 1.8773 | 0.0000 | .1435 | .1556 |
| 2.1120 | 0.0000 | 0.0000 | .0942 |

Tramo central (x empezando en el apoyo izquierdo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.7404 | .5357 |
| .1583 | 0.0000 | 2.3823 | .4864 |
| .3166 | .0681 | 2.0626 | .4367 |
| .4749 | .3838 | 1.7816 | .3867 |
| .6333 | .6605 | 1.5395 | .3364 |
| .7916 | .8980 | 1.3365 | .2857 |
| .9499 | 1.0961 | 1.1731 | .2347 |
| 1.1082 | 1.2545 | 1.0493 | .1834 |
| 1.2665 | 1.3729 | .9655 | .1317 |
| 1.4248 | 1.4511 | .9219 | .0797 |
| 1.5832 | 1.4889 | .9188 | .0668 |
| 1.7415 | 1.4127 | .9565 | .1195 |
| 1.8998 | 1.2956 | 1.0351 | .1725 |
| 2.0581 | 1.1372 | 1.1550 | .2258 |
| 2.2164 | .9373 | 1.3165 | .2795 |
| 2.3747 | .6957 | 1.5197 | .3335 |
| 2.5331 | .4124 | 1.7645 | .3866 |
| 2.6914 | .0882 | 2.0502 | .4387 |
| 2.8497 | 0.0000 | 2.3758 | .4896 |
| 3.0080 | 0.0000 | 2.7404 | .5889 |

Voladizo derecho (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.7404 | .2025 |
| .2347 | 0.0000 | 2.1376 | .1583 |
| .4693 | 0.0000 | 1.6205 | .1138 |
| .7040 | 0.0000 | 1.1889 | .0874 |
| .9387 | 0.0000 | .7513 | .1671 |
| 1.1733 | 0.0000 | .5675 | .1525 |
| 1.4080 | 0.0000 | .6463 | .2824 |
| 1.6427 | 0.0000 | .3585 | .2183 |
| 1.8773 | 0.0000 | .1435 | .1556 |
| 2.1120 | 0.0000 | 0.0000 | .0942 |

**Dimensionamiento:**

Placas tipo 3 C-12.10.6 de 810 cm de longitud y canto 17 cms

| | Fi | w | Anec | Areal | Areal/Anec |
|---|---|---|---|---|---|
| Diagonales | 6 | 2.972 | 1.13 | 1.70 | 1.50 |
| Superior | 12 | 1.946 | 1.87 | 3.39 | 1.81 |
| Inferior | 10 | 2.449 | 4.34 | 4.71 | 1.09 |

(Cuantias en cm2/m)

**Flechas esperadas:**

Vuelo izquierdo: 1.38 cm. ≯ 2.41 cm
Vano biapoyado: 0 cm.
Vuelo derecho: 1.62 cm. ≯ 2.41 cm

**Precio:**

Precio unitario: 26296.245 pts. (C.V. 1.35)
Precio por metro cuadrado: 4705 pts.

## CALCULO DE PLACAS DE CELOSIA

PLACA Tipo VV-1

### Caracteristicas geometricas de la placa:

Placa de celosia con vuelos en ambos extremos

| | |
|---|---|
| Longitud total(cm): | 816 |
| Longitud del vuelo izquierdo(cm): | 211.2 |
| Longitud del apoyo izquierdo(cm): | 46.4 |
| Longitud del vano central(cm): | 300.8 |
| Longitud del apoyo derecho(cm): | 46.4 |
| Longitud del vuelo derecho(cm): | 211.2 |

| | |
|---|---|
| Canto de la celosia(cm): | 17 |
| Distancia entre senos de las diagonales(cm): | 20 |
| Distancia transversal entre celosias(cm): | 20 |
| Distancia entre los cordones inferiores de las celosias(cm) | 9 |
| Ancho de la placa(cm): | 80 |
| Espesor de la placa(cm): | 6 |
| Longitud de las entregas(cm): | 6 |

### Materiales empleados en la fabricacion de la placa

| | |
|---|---|
| Resistencia caracteristica del hormigon(kg/cm2): | 300 |
| Resistencia caracteristica del acero(kg/cm2): | 5100 |
| Coeficiente de minoracion del hormigon: | 1.4 |
| Coeficiente de minoracion del acero: | 1.1 |
| Coeficiente de mayoracion de las acciones: | 1.5 |
| Peso especifico del hormigon(kg/m3): | 2500 |

### Caracteristicas geometricas de la losa

| | |
|---|---|
| Espesor de la losa en el extremo del voladizo izquierdo(cm): | 25 |
| Espesor de la losa en el apoyo izquierdo(cm): | 30 |
| Espesor de la losa en el punto intermedio(cm): | 33 |
| Distancia del punto intermedio al apoyo izquierdo(cm): | 232.9 |
| Espesor de la losa en el apoyo derecho(cm): | 30 |
| Espesor de la losa en el extremo del voladizo derecho(cm): | 25 |

### Ejecucion del hormigonado

Hormigonado en dos fases:
Primera fase: hormigonado de:
- Vano central
- 132.2 cm del vuelo izquierdo
- 132.2 cm del vuelo derecho

Segunda fase: hormigonado del resto de la losa

### Acciones consideradas:

Peso propio, teniendo en cuenta las fases de hormigonado
Peso de un operario(kg/ml): 196.25 (incluye pelo)

### Tipo de refuerzos utilizados

Celosias corridas

### Esfuerzos en la placa (sin mayorar y por metro):

Hipotesis 1:Vano central hormigonado y operario el punto pesimo para M+
Hipotesis 2:Fase intermedia de hormigonado y operario en punto pesimo para M-
Hipotesis 3:Segunda fase de hormigonado y operario en punto pesimo para M-
Hipotesis 4:Vano central hormigonado y operario el punto pesimo para Q
Hipotesis 5:Fase intermedia de hormigonado y operario en punto pesimo para Q

Voladizo izquierdo (x empezando en el apoyo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3346 | -.3168 | -1.2843 | -1.3190 | +0.0000 | +0.0000 | -.3346 | -.3168 | -.6699 | -1.1228 |
| +.2347 | -.2643 | -.2816 | -.9946 | -1.1417 | +0.0000 | +0.0000 | -.2643 | -.2816 | -.6262 | -.9454 |
| +.4603 | -.2024 | -.2464 | -.7472 | -.9638 | +0.0000 | +0.0000 | -.2024 | -.2464 | -.4248 | -.7076 |
| +.7041 | -.1487 | -.2112 | -.5418 | -.7855 | +0.0000 | +0.0000 | -.1487 | -.2112 | -.2655 | -.5862 |
| +.9387 | -.1033 | -.1760 | -.3335 | -.3722 | +0.0000 | +0.0000 | -.1033 | -.1760 | -.1033 | -.1760 |
| +1.1733 | -.0661 | -.1408 | -.2503 | -.3371 | +0.0000 | +0.0000 | -.0661 | -.1408 | -.0661 | -.1408 |
| +1.4080 | -.0372 | -.1056 | -.1753 | -.3019 | -.2365 | +.6509 | -.0372 | -.1056 | -.0372 | -.1056 |
| +1.6427 | -.0165 | -.0704 | -.1086 | -.2666 | -.1620 | +.4961 | -.0165 | -.0704 | -.0165 | -.0704 |
| +1.8773 | -.0041 | -.0352 | -.0502 | -.2314 | -.0634 | +.3445 | -.0041 | -.0352 | -.0041 | -.0352 |
| +2.1120 | +0.0000 | -.0000 | +0.0000 | -.1963 | +0.0000 | -.1963 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

Tramo central (x empezando en el apoyo izquierdo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3346 | +.3168 | -1.2843 | +1.1741 | +0.0000 | +0.0000 | -.3346 | +1.1741 | -.6699 | +.9253 |
| +.2347 | -.2643 | +.2816 | -1.0379 | +1.0543 | +0.0000 | +0.0000 | -.2643 | +1.0543 | -.6262 | +.8111 |
| +.4603 | -.2024 | +.2464 | -.8053 | +.9365 | +0.0000 | +0.0000 | -.2024 | +.9365 | -.4248 | +.7021 |
| +.7041 | -.1487 | +.2112 | -.5918 | +.8142 | +0.0000 | +0.0000 | -.1487 | +.8142 | -.2655 | +.5922 |
| +.9387 | -.1033 | +.1760 | -.4007 | +.6927 | +0.0000 | +0.0000 | -.1033 | +.6927 | -.1033 | +.4824 |
| +1.1733 | -.0661 | +.1408 | -.2503 | +.5703 | +0.0000 | +0.0000 | -.0661 | +.5703 | -.0661 | +.3728 |
| +1.4080 | -.0372 | +.1056 | -.1753 | +.4471 | +0.0000 | +0.0000 | -.0372 | +.4471 | -.0372 | +.2633 |
| +1.6427 | -.0165 | +.0704 | -.1086 | +.3232 | +0.0000 | +0.0000 | -.0165 | +.3232 | -.0165 | +.1538 |
| +1.8773 | -.0041 | +.0352 | -.0502 | +.1981 | +0.0000 | +0.0000 | -.0041 | +.1981 | -.0041 | +.0443 |
| +2.1120 | +0.0000 | -.0000 | +0.0000 | -.1963 | +0.0000 | +0.0000 | +0.0000 | -.1963 | +0.0000 | -.1963 |

Voladizo derecho (x empezando en el apoyo)

| x | M1 | Q1 | M2 | Q2 | M3 | Q3 | M4 | Q4 | M5 | Q5 |
|---|---|---|---|---|---|---|---|---|---|---|
| +0.0000 | -.3346 | +.3168 | -1.2843 | -.2929 | +0.0000 | +0.0000 | -.3346 | +.3168 | -.6699 | -.4492 |
| +.2347 | -.2643 | +.2816 | -.9946 | -.1850 | +0.0000 | +0.0000 | -.2643 | +.2816 | -.6262 | -.3822 |
| +.4603 | -.2024 | +.2464 | -.7472 | -.0785 | +0.0000 | +0.0000 | -.2024 | +.2464 | -.4248 | -.2748 |
| +.7041 | -.1487 | +.2112 | -.5418 | +.0294 | +0.0000 | +0.0000 | -.1487 | +.2112 | -.2655 | -.1668 |
| +.9387 | -.1033 | +.1760 | -.3335 | +.3722 | +0.0000 | +0.0000 | -.1033 | +.1760 | -.1033 | +.1760 |
| +1.1733 | -.0661 | +.1408 | -.2503 | +.3371 | +0.0000 | +0.0000 | -.0661 | +.1408 | -.0661 | +.1408 |
| +1.4080 | -.0372 | +.1056 | -.1753 | +.3019 | -.2365 | +.6509 | -.0372 | +.1056 | -.0372 | +.1056 |
| +1.6427 | -.0165 | +.0704 | -.1086 | +.2666 | -.1620 | +.4961 | -.0165 | +.0704 | -.0165 | +.0704 |
| +1.8773 | -.0041 | +.0352 | -.0502 | +.2314 | -.0634 | +.3445 | -.0041 | +.0352 | -.0041 | +.0352 |
| +2.1120 | +0.0000 | -0.0000 | +0.0000 | +.1963 | +0.0000 | +.1963 | +0.0000 | +0.0000 | +0.0000 | +0.0000 |

**Esfuerzos en los elementos de la celosia(mayorados):**
Supuestas 4 celosias por pieza

A.-Compresiones en el cordon superior(T)
B.-Compresiones en el cordon inferior(T)
C.-Compresiones en las diagonales(T)

Voladizo izquierdo (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.2665 | .4749 |
| .2347 | 0.0000 | 1.7553 | .4110 |
| .4693 | 0.0000 | 1.3186 | .3470 |
| .7040 | 0.0000 | .9562 | .2828 |
| .9387 | 0.0000 | .5886 | .1340 |
| 1.1733 | 0.0000 | .4417 | .1214 |
| 1.4080 | 0.0000 | .5232 | .2344 |
| 1.6427 | 0.0000 | .2858 | .1786 |
| 1.8773 | 0.0000 | .1119 | .1241 |
| 2.1120 | 0.0000 | 0.0000 | .0707 |

Tramo central (x empezando en el apoyo izquierdo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.2665 | .4599 |
| .1583 | 0.0000 | 1.9551 | .4170 |
| .3166 | .0510 | 1.6771 | .3738 |
| .4749 | .3213 | 1.4327 | .3304 |
| .6333 | .5578 | 1.2222 | .2866 |
| .7916 | .7602 | 1.0457 | .2425 |
| .9499 | .9283 | .9036 | .1982 |
| 1.1082 | 1.0619 | .7960 | .1535 |
| 1.2665 | 1.1608 | .7231 | .1086 |
| 1.4248 | 1.2246 | .6852 | .0634 |
| 1.5832 | 1.2533 | .6825 | .0528 |
| 1.7415 | 1.1917 | .7152 | .0986 |
| 1.8998 | 1.0945 | .7836 | .1447 |
| 2.0581 | .9613 | .8879 | .1911 |
| 2.2164 | .7921 | 1.0283 | .2377 |
| 2.3747 | .5865 | 1.2050 | .2846 |
| 2.531 | .3448 | 1.4179 | .3309 |
| 2.6914 | .0675 | 1.6663 | .3761 |
| 2.8497 | 0.0000 | 1.9494 | .4204 |
| 3.0080 | 0.0000 | 2.2665 | .5008 |

Voladizo derecho (x empezando en el apoyo)

| x | A | B | C |
|---|---|---|---|
| 0.0000 | 0.0000 | 2.2665 | .1761 |
| .2347 | 0.0000 | 1.7553 | .1376 |
| .4693 | 0.0000 | 1.3186 | .0989 |
| .7040 | 0.0000 | .9562 | .0760 |
| .9387 | 0.0000 | .5886 | .1340 |
| 1.1733 | 0.0000 | .4417 | .1214 |
| 1.4080 | 0.0000 | .5232 | .2344 |
| 1.6427 | 0.0000 | .2858 | .1786 |
| 1.8773 | 0.0000 | .1119 | .1241 |
| 2.1120 | 0.0000 | 0.0000 | .0707 |

**Dimensionamiento:**

Placas tipo 4 C-10.10.6 de 810 cm de longitud y canto 17 cms

| | Fi | w | Anec | Areal | Areal/Anec |
|---|---|---|---|---|---|
| Diagonales | 6 | 2.972 | 1.28 | 2.26 | 1.76 |
| Superior | 10 | 2.449 | 2.65 | 3.14 | 1.19 |
| Inferior | 10 | 2.449 | 4.79 | 6.28 | 1.31 |

(Cuantias en cm2/m)

**Flechas esperadas:**

Vuelo izquierdo: 1.62 cm. ≯ 2.11 cm
Vano biapoyado: 0 cm.
Vuelo derecho: 1.86 cm. ≯ 2.11 cm

**Precio:**

Precio unitario: 29695.872 pts. (C.V. 1.35)
Precio por metro cuadrado: 4549 pts.

# 16.REACCIONES

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 16-1 |

## 16. REACCIONES

### 16.1 Reacciones a t=0

| | Rmax (T) | | Rmin (T) | |
|---|---|---|---|---|
| CARGA | ESTRIBO | PILA | ESTRIBO | PILA |
| FASE 1 | 22.101 | 74.023 | 28.101 | 74.023 |
| FASE 2 | 10.744 | 28.325 | 10.744 | 27.327 |
| FASE 3 | 39.341 | 49.060 | 39.641 | 49.060 |
| FASE 5 | -3.161 | 54.462 | -3.161 | 54.462 |
| FASE 6 | 4.900 | 24.256 | 4.900 | 24.256 |
| C.M | 17.640 | 97.791 | 17.640 | 97.791 |
| SCU | 29.543 | 96.828 | -9.817 | -3.629 |
| VP | 54.278 | 115.025 | -9.434 | -5.337 |
| GRADIENTE | 10.174 | -10.174 | 10.174 | -10.174 |
| TOTAL | 185.760 | 518.830 | 74.614 | 297.837 |

### 16.2 Reacciones a t=∞

Se añaden las siguientes hipótesis de carga:

| | | | | |
|---|---|---|---|---|
| REDISTR. C.EXTERIORES | -11.358 | 21.358 | -21.358 | 21.358 |
| REDISTR. HIP. PRETENSADO | 34.474 | -34.474 | 34.474 | -34.474 |
| TOTAL | 199.976 | 515.714 | 87.730 | 284.721 |

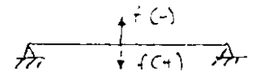
# 17.DEFORMACIONES

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 17-1

## 17. DEFORMACIONES

### 17.1 Flechas verticales

Flechas a t=0




| | INDIVIDUALES (mm) | | ACUMULADAS (mm) | |
|---|---|---|---|---|
| CARGA | VANO 1 | VANO 2 | VANO 1 | VANO 2 |
| PRETENSADO T=2 | -46.7 | -165.2 | -116.9 | -165.2 |
| P.P.VIGA T=2 | 14.7 | 105.6 | -32.0 | -59.6 |
| FLUENCIA T=2 a T=28 | -22.2 | -110.8 | -54.2 | -105.4 |
| FASE 2 | 2.9 | 20.3 | -51.3 | -97.6 |
| FASE 3 | 9.1 | 6.3 | -42.2 | -95.3 |
| FASE 5 | 1.3 | 4.9 | -40.9 | -90.4 |
| FASE 6 | 0.0 | 1.5 | -40.9 | -88.9 |
| C.M | 0.1 | 4.9 | -40.8 | -84.0 |
| S.C.U + V.P. | 4.8 | 15.1 | -36.0 | -68.9 |
| GRADIENTE | -1.4 | 1.3 | -37.4 | -67.6 |
| Flechas a t=inf | | | | |
| FLUENCIA PRET + P.P.VIGA DE T=28 a T=INF | -9.9 | -18.5 | -50.7 | -81.5 |
| FLUENCIA FASE 2 + FASE 3 DE T=28 a T=INF | 3.9 | 7.8 | -47.0 | -48.8 |
| FLUENCIA FASE 5 + FASE 6 DE T=28 a T=INF | 0.4 | 3.5 | -46.6 | -82.4 |

| | INDIVIDUALES (mm) | | ACUMULADAS (mm) | |
|---|---|---|---|---|
| CARGA | VANO 1 | VANO 2 | VANO 1 | VANO 2 |
| REDISTR. DE C EXT | -17.8 | -69.2 | -64.11 | -147.6 |
| REDISTR. DE PRET | 0.0 | +9.4 | -64.4 | -138.2 |
| SCHVP | 4.8 | 15.1 | -59.6 | -123.2 |
| FRADIENTE | -1.4 | +3 | -61.0 | -121.8 |

Las vigas se contraflechan en contraflecha durante toda la vida de la estructura.



* Hipotesis consideradas

- Instante de corte del pretensado: (2 días)

  $E_{0,2} = 200.000$ kp/cm²

- Resto de cargas (t = 28)

  $E_{0,28} = 357.000$ kp/cm²

- Inercia en sección simple

  $I_s = 0.17$ m⁴

- Inercia en sección compuesta

  $I_c = 0.525$ m⁴

- Fluencia transcurrida desde t=2 hasta t=28 días.

  $\varphi(2,28) = 1.347$

- Resto de fluencia

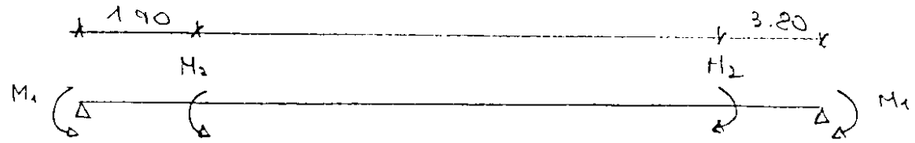
  $\varphi(28,\infty) = 2.065$

* Obtención de flechas iniciales (programa SAP 90)

Flechas a t=0

· Pretensado t: 2 días

1) Viga V-1 y V-3




$Hi = (ni \times FRI \times (Y_{gi} - Ei) - ns \times FRS \times (Y_{gs} - Es)) \times A\phi$

ni = nº torones sin enfundar en tabla inferior

$n_s$ = nº torones en cabezas superiores

FRI = tensión en los torones inferiores un instante después del corte de cables.

FRS = idem torones superiores

$Y_g$ = cdg sección simple

$E_i$ = recubrimiento vaciado del paramento inferior

$E_s$ = " " " " superior

$A_p$ = área de un torón 0,6" = 1,4 cm²

$M_1 = (30 \times 14,523 \times (0.40-0.05) - 4 \times 14,913 \times (0.75-0.155)) \times 1.4 =$

$= 163,85$ mT

$M_2 = (40 \times 14,116 \times (0.40-0.075) - 4 \times 14,824 \times (0.75-0.155)) \times 1.4 =$

$= 209,32$ mT

$f = -46,7$ mm

ii) Viga V-2




$M_1 = (36 \times 14,473 \times (0.40-0.05) - 4 \times 14,902 \times (0.75-0.155)) \times 1.4 =$

$= 205,65$ mT

$M_2 = (30 \times 13,878 \times (0.40-0.075) - 4 \times 14,880 \times (0.75-0.155)) \times 1.40 =$

$= 139,85$ mT

$M_3 = (30 \times 13,534 \times (0.40-0.08) - 4 \times 14,921 \times (0.75-0.155)) \times 1.4 =$



$M_3 = 132,180$ mT

$f = -165,2$ mm

• Peso propio de vigas $t = 2$ días

Del estado de esfuerzos y movimientos (FASE 1).

i) Vigas V-1 y V-3

$f = 7,6^{mm} \times E_{0,15}/E_{0,1} = 14,7$ mm

ii) Viga V-2

$f = 84,6 \times E_{0,28}/E_{0,1} = 165,6$ mm

• Viga en vacío de $t=2$ a $t=28$ días

i) Vigas V-1 y V-3

$f = (-46,7 + 111,7) \times \varphi_{(2,28)} \times E_{c,2}/E_{0,28} = -22,2$ mm

ii) Viga V-2

$f = (-165,2 + 105,6) \times \varphi_{(2,28)} \times E_{0,2}/E_{c,28} = -40,8$ mm

• Resto de cargas

Se obtienen con flechas directamente de los listados del programa BARRA.

Flechas a $t=\infty$

- Viga en vacío de $t=28$ a $t=\infty$

i) Viga V-1 y V-3

$f = (-46,7 + 14,7) \times \varphi(\infty,28) \times E_{0,2}/E_{0,28} \times I_s/I_c = -9,7$ mm

ii) Viga V-2

$f = (-163,2 + 105,6) \times 2,062 \times 200.000/284.000 \times 0,17/0,225 = -18,5$ mm

- Fases 2 y 3 de $t=28$ a $t=\infty$

i) Vigas V-1 y V-3

$f = (2,9 + 9,1) \times 2,065 \times 200.000/327.000 \times 0,17/0,225 = 5,2$ mm

ii) Vigas V-2

$f = (10,8 + 4,3) \times 2,065 \times 200.000/382.000 \times 0,17/0,225 = 7,7$ mm

- Fases 5, 6 y CM de $t=28$ a $t=\infty$

i) Vigas V-1 y V-3

$f = (1,3 + 0,0 + 0,1) \times 2,065 \times 200.000/382.000 \times 0,17/0,225 = 0,4$ mm

ii) Viga V-2

$f = (4,9 + 1,5 + 4,9) \times 2,065 \times 200.000/382.000 \times 0,17/0,225 = 2,7$ mm



- Redistribución de cargas exteriores

i) Viga V-1 y V-3

$f = 0,85 \times (\delta_{viga} - \delta_{1+\infty} - \text{fases 1 a 6}) =$

$= 0,85 \times [0,0 - (-1,6 + 1,9 + 9,1 + 1,3 + 0,0 + 0,1)] = -17,2$ mm

ii) Viga V-2

$f = 0,85 \times [(4,79 + 4,76) - (54,6 + 20,8 + 4,3 + 4,9 + 1,5 + 4,9)] =$

$= -69,2$ mm

- Redistribución de hiperestático de pretensado

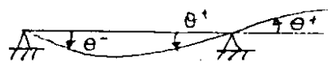
i) Viga V-1 y V-3

$f = 0,62 \times \text{Hip. ant } t=\infty = 0,62 \times 0,6 = 0,4$ mm

ii) Viga V-2

$f = 0,62 \times (-15,2) = -9,4$ mm

17.2 Giros




| Giros a t=0 | INDIVIDUALES (rad×10⁻³) | | ACUMULADAS (rad×10⁻³) | |
|---|---|---|---|---|
| | VANO 1 | VANO 2 | VANO 1 | VANO 2 |
| PRETENSADO T=2 | +9.10 | +11.10 | 9.10 | 11.10 |
| PP VIGA T=2 | -2.45 | -8.34 | 6.65 | 2.76 |
| FLUENCIA T=2 a T=28 | 4.63 | +1.92 | 11.28 | 4.68 |
| FASE 2 | -0.49 | -1.64 | 10.79 | 3.04 |
| FASE 3 | -1.55 | -2.73 | 9.24 | 0.31 |
| FASE 5 | -0.16 | -0.45 | 9.08 | -0.14 |
| FASE 6 | -0.00 | 0.00 | 9.08 | -0.14 |
| C.M | 0.00 | -0.22 | 9.08 | -0.36 |
| C.C.U +V.P. | 0.51/-0.84 | 0.64/-1.04 | 9.59/8.24 | 0.23/-1.40 |
| GRADIENTE | 0.44 | -0.17 | 10.03 | -1.57 |
| Giros a t=inf | | | | |
| FLUENCIA PRET + VIGA DE T=28 A T=INF | 2.06 | 0.85 | 11.14 | 0.49 |
| FLUENCIA FASE 2 + FASE 3 DE T=28 a T=INF | -1.22 | -2.56 | 9.92 | -2.07 |
| FLUENCIA FASE 5 + FASE 6 + CM DE T=28 a T=INF | -0.33 | -1.98 | 9.59 | -3.49 |
| REDISTR. C.EXT | 2.67 | 7.22 | 12.26 | 3.77 |
| REDISTR. PRET. | -0.46 | -0.48 | 11.80 | 3.29 |



* Obtención de giros individuales

° Fluencia de pretensado + pp viga de t=2 a t=28

VIGAS V-1 y V-3

$\theta = (9.10 - 2.45) \times 1.347 \times 200.000 / 387.000 = 4.63 \text{ rad} \times 10^{-3}$

VIGA V-2

$\theta = (11.10 - 8.34) \times 1.347 \times 200.000 / 387.000 = 1.92 \text{ rad} \times 10^{-3}$

° Fluencia de pretensado + pp viga de t=28 a t=inf

VIGAS V-1 y V-3

$\theta = (9.10 - 3.48) \times 2.065 \times 32.000 / \times 0.85 / = 2,06 \text{ rad} \times 10^{-3}$

VIGAS V-2

$\theta = 0.85 \text{ rad} \times 10^{-3}$

° Fluencia de fase 2 + fase 3 de t=28 a t=inf

VIGAS V-1 y V-3

$\theta = (-0.49 - 1.55) \times 2.065 \times 0.17 / 0.585 = -1.22 \text{ rad} \times 10^{-3}$

VIGA V-2

$\theta = -2,96 \text{ rad} \times 10^{-3}$

# ANEXO 1

# LISTADOS DE ESFUERZOS Y MOVIMIENTOS

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
FASE 1:COLOCACION DE VIGAS

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

DATOS DE LOS NUDOS

| | | | | Movimientos Impuestos | | |
|---|---|---|---|---|---|---|
| Nudo | Xi(m.) | Yi(m.) | Peso(Tn) | Ux | Vy | øz |
| 1 | 0.00 | 0.00 | | | | |
| 2 | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| 4 | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| 21 | 50.09 | 0.00 | | | | |
| 22 | 51.99 | 0.00 | | | | |
| 23 | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| 11 | | ****** | |
| 21 | | ****** | |
| 31 | | ****** | |
| 111 | ****** | ****** | |
| 121 | ****** | ****** | |

**Titulo:**
**COLOC.VIGAS**
**Tipo:** [ 1]Cargas Exteriores/Movimientos Apoyo

## DATOS DE SECCIONES TIPO

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

## DATOS DE LOS ELEMENTOS

| Nu.. | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 2 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 1 | 3 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 3 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 16 | 16 | 17 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 17 | 17 | 18 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| - | 18 | 19 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 1 | 19 | 20 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 1 | 3 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 3 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 1 | 2 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

Nota: En Elementos Curvos [Long] y [Alf]
corresponden a la Cuerda

## DATOS DE LOS ESTADOS DE CARGA

### ESTADO DE CARGA 1 :

## ACCIONES EN ELEMENTOS (m.;Tn;gsex.) :

| Nel | aj | Parametros de Carga: | |
|---|---|---|---|
| 1 | 1 | 2.958 | (Carga Repartida) |
| Misma Accion en Elementos : | | 2 <= j <= 30 | |

*** BARRA (RESULTADOS) ***

P ·ecto:
SU. .RAMO XV AVE / E-1505.0

Comentario:
FASE 1:COLOCACION DE VIGAS

Estado de Carga 1:
COLOC.VIGAS

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.001279 |
| 2 | 0.000000 | -.002387 | -.001212 |
| 3 | 0.000000 | -.004522 | -.001017 |
| 4 | 0.000000 | -.006194 | -.000729 |
| 5 | 0.000000 | -.007255 | -.000380 |
| . | 0.000000 | -.007618 | 0.000000 |
| 7 | 0.000000 | -.007253 | .000381 |
| 8 | 0.000000 | -.006191 | .000730 |
| 9 | 0.000000 | -.004518 | .001018 |
| 10 | 0.000000 | -.002382 | .001213 |
| 11 | 0.000000 | 0.000000 | .001275 |
| 12 | 0.000000 | -.017073 | -.005313 |
| 13 | 0.000000 | -.032385 | -.004458 |
| 14 | 0.000000 | -.044372 | -.003197 |
| 15 | 0.000000 | -.051984 | -.001666 |
| 16 | 0.000000 | -.054591 | -0.000000 |
| 17 | 0.000000 | -.051984 | .001666 |
| 18 | 0.000000 | -.044372 | .003197 |
| 19 | 0.000000 | -.032385 | .004458 |
| 20 | 0.000000 | -.017073 | .005313 |
| 21 | 0.000000 | 0.000000 | .005583 |
| 22 | 0.000000 | -.002382 | -.001213 |
| 23 | 0.000000 | -.004518 | -.001018 |
| 1 | 0.000000 | -.006191 | -.000730 |
| . | 0.000000 | -.007253 | -.000381 |
| 26 | 0.000000 | -.007618 | -0.000000 |
| 27 | 0.000000 | -.007255 | .000380 |
| 28 | 0.000000 | -.006194 | .000729 |
| 29 | 0.000000 | -.004522 | .001017 |
| 30 | 0.000000 | -.002387 | .001212 |
| 31 | 0.000000 | 0.000000 | .001279 |
| 111 | 0.000000 | 0.000000 | -.005583 |
| 121 | 0.000000 | 0.000000 | -.001275 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 | 1 2 | | | |
| S-izquierda | | 0.000 | -28.101 | 0.000 |
| S- centro | | 0.000 | -25.291 | 25.361 |
| S- derecha | | 0.000 | -22.481 | 48.053 |
| 2 | 2 3 | | | |
| S-izquierda | | 0.000 | -22.481 | 48.053 |
| S- centro | | 0.000 | -19.671 | 68.075 |
| S- derecha | | 0.000 | -16.861 | 85.427 |
| 3 | 3 4 | | | |
| S-izquierda | | 0.000 | -16.861 | 85.427 |
| S- centro | | 0.000 | -14.050 | 100.110 |
| S- derecha | | 0.000 | -11.240 | 112.123 |
| 4 | 4 5 | | | |
| S-izquierda | | 0.000 | -11.240 | 112.123 |
| S- centro | | 0.000 | -8.430 | 121.467 |
| S- derecha | | 0.000 | -5.620 | 128.141 |
| 5 | 5 6 | | | |
| S-izquierda | | 0.000 | -5.620 | 128.141 |
| S- centro | | 0.000 | -2.810 | 132.145 |
| S- derecha | | 0.000 | -0.000 | 133.480 |
| 6 | 6 7 | | | |
| S-izquierda | | 0.000 | 0.000 | 133.480 |
| S- centro | | 0.000 | 2.810 | 132.145 |
| S- derecha | | 0.000 | 5.620 | 128.141 |
| 7 | 7 8 | | | |
| S-izquierda | | 0.000 | 5.620 | 128.141 |
| S- centro | | 0.000 | 8.430 | 121.467 |
| S- derecha | | 0.000 | 11.240 | 112.123 |
| 8 | 8 9 | | | |
| S-izquierda | | 0.000 | 11.240 | 112.123 |
| S- centro | | 0.000 | 14.050 | 100.110 |
| S- derecha | | 0.000 | 16.861 | 85.427 |
| 9 | 9 10 | | | |
| S-izquierda | | 0.000 | 16.861 | 85.427 |
| S- centro | | 0.000 | 19.671 | 68.075 |
| S- derecha | | 0.000 | 22.481 | 48.053 |
| 10 | 10 11 | | | |
| S-izquierda | | 0.000 | 22.481 | 48.053 |
| S- centro | | 0.000 | 25.291 | 25.361 |
| S- derecha | | 0.000 | 28.101 | -0.000 |
| 11 | 111 12 | | | |
| S-izquierda | | 0.000 | -45.982 | 0.000 |
| S- centro | | 0.000 | -41.384 | 67.905 |
| S- derecha | | 0.000 | -36.786 | 128.663 |
| 12 | 12 13 | | | |
| S-izquierda | | 0.000 | -36.786 | 128.663 |
| S- centro | | 0.000 | -32.187 | 182.272 |
| S- derecha | | 0.000 | -27.589 | 228.733 |
| 13 | 13 14 | | | |
| S-izquierda | | 0.000 | -27.589 | 228.733 |
| S- centro | | 0.000 | -22.991 | 268.047 |
| S- derecha | | 0.000 | -18.393 | 300.213 |
| 14 | 14 15 | | | |
| S-izquierda | | 0.000 | -18.393 | 300.213 |
| S- centro | | 0.000 | -13.795 | 325.230 |
| S- derecha | | 0.000 | -9.196 | 343.100 |

| | | | |
|---|---|---|---|
| **15 15 16** | | | |
| **S-izquierda** | 0.000 | -9.196 | 343.100 |
| **S- centro** | 0.000 | -4.598 | 353.822 |
| **S derecha** | 0.000 | -0.000 | 357.396 |
| **16 16 17** | | | |
| **S-izquierda** | 0.000 | -0.000 | 357.396 |
| **S- centro** | 0.000 | 4.598 | 353.822 |
| **S- derecha** | 0.000 | 9.196 | 343.100 |
| **17 17 18** | | | |
| **S-izquierda** | 0.000 | 9.196 | 343.100 |
| **S- centro** | 0.000 | 13.795 | 325.230 |
| **S- derecha** | 0.000 | 18.393 | 300.213 |
| **18 18 19** | | | |
| **S-izquierda** | 0.000 | 18.393 | 300.213 |
| **S- centro** | 0.000 | 22.991 | 268.047 |
| **S- derecha** | 0.000 | 27.589 | 228.733 |
| **19 19 20** | | | |
| **S-izquierda** | 0.000 | 27.589 | 228.733 |
| **S centro** | 0.000 | 32.187 | 182.272 |
| **S- derecha** | 0.000 | 36.786 | 128.663 |
| **20 20 21** | | | |
| **S-izquierda** | 0.000 | 36.786 | 128.663 |
| **S- centro** | 0.000 | 41.384 | 67.905 |
| **S- derecha** | 0.000 | 45.982 | -0.000 |
| **21 121 22** | | | |
| **S-izquierda** | 0.000 | -28.101 | 0.000 |
| **S- centro** | 0.000 | -25.291 | 25.361 |
| **S- derecha** | 0.000 | -22.481 | 48.053 |
| **22 22 23** | | | |
| **S-izquierda** | 0.000 | -22.481 | 48.053 |
| **S- centro** | 0.000 | -19.671 | 68.075 |
| **S- derecha** | 0.000 | -16.861 | 85.427 |
| **23 23 24** | | | |
| **S zquierda** | 0.000 | -16.861 | 85.427 |
| **S- centro** | 0.000 | -14.050 | 100.110 |
| **S- derecha** | 0.000 | -11.240 | 112.123 |
| **24 24 25** | | | |
| **S-izquierda** | 0.000 | -11.240 | 112.123 |
| **S- centro** | 0.000 | -8.430 | 121.467 |
| **S- derecha** | 0.000 | -5.620 | 128.141 |
| **25 25 26** | | | |
| **S-izquierda** | 0.000 | -5.620 | 128.141 |
| **S- centro** | 0.000 | -2.810 | 132.145 |
| **S- derecha** | 0.000 | 0.000 | 133.480 |
| **26 26 27** | | | |
| **S-izquierda** | 0.000 | -0.000 | 133.480 |
| **S- centro** | 0.000 | 2.810 | 132.145 |
| **S- derecha** | 0.000 | 5.620 | 128.141 |
| **27 28** | | | |
| **S zquierda** | 0.000 | 5.620 | 128.141 |
| **S- centro** | 0.000 | 8.430 | 121.467 |
| **S- derecha** | 0.000 | 11.240 | 112.123 |

| | | | |
|---|---|---|---|
| **28 28 29** | | | |
| **S-izquierda** | 0.000 | 11.240 | 112.123 |
| **S- centro** | 0.000 | 14.050 | 100.110 |
| **S- derecha** | 0.000 | 16.861 | 85.427 |
| **29 29 30** | | | |
| **S-izquierda** | 0.000 | 16.861 | 85.427 |
| **S- centro** | 0.000 | 19.671 | 68.075 |
| **S- derecha** | 0.000 | 22.481 | 48.053 |
| **30 30 31** | | | |
| **S-izquierda** | 0.000 | 22.481 | 48.053 |
| **S- centro** | 0.000 | 25.291 | 25.361 |
| **S- derecha** | 0.000 | 28.101 | 0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 28.101 | 0.000 |
| 11 | 0.000 | 28.101 | 0.000 |
| 21 | 0.000 | 45.982 | 0.000 |
| 31 | 0.000 | 28.101 | 0.000 |
| 111 | 0.000 | 45.982 | 0.000 |
| 121 | 0.000 | 28.101 | 0.000 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0]) ... (<1%)

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Pr_ecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
FASE 2:COLOCACION DE PRELOSAS

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

DATOS DE LOS NUDOS

| Nudo | Xi(m.) | Yi(m.) | Peso(Tn) | Movimientos Impuestos Ux | Vy | øz |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | | | | |
| 2 | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| _ | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| 21 | 50.09 | 0.00 | | | | |
| 2 | 51.99 | 0.00 | | | | |
| | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| 11 | | ****** | |
| 1 | | ****** | |
| | | ****** | |
| 111 | ****** | ****** | |
| 121 | ****** | ****** | |

DATOS DE SECCIONES TIPO

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

DATOS DE LOS ELEMENTOS

| Num | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 2 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 1 | 3 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 3 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 16 | 16 | 17 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 17 | 17 | 18 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 18 | 18 | 19 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 19 | 19 | 20 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 1 | 3 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 3 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 1 | 2 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

Nota: En Elementos Curvos [Long] y [Alf]
corresponden a la Cuerda

DATOS DE LOS ESTADOS DE CARGA

ESTADO DE CARGA 1 :

**Titulo:**
**PRELOSAS**
**Tipo:** [ 1]Cargas Exteriores/Movimientos Apoyo

**ACCIONES EN ELEMENTOS (m.;Tn;gsex.) :**

| Nel | aj | Parametros de Carga: | |
|---|---|---|---|
| 1 | 1 | 1.131 | (Carga Repartida) |

Misma Accion en Elementos : 2 <= j <= 30

*** BARRA (RESULTADOS) ***

**Proyecto:**
**SUBTRAMO XV AVE / E-1505.0**

**Comentario:**
FASE 2:COLOCACION DE PRELOSAS

**Estado de Carga 1:**
**PRELOSAS**

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.000489 |
| 2 | 0.000000 | -.000913 | -.000464 |
| 3 | 0.000000 | -.001729 | -.000389 |
| 4 | 0.000000 | -.002368 | -.000279 |
| 5 | 0.000000 | -.002774 | -.000145 |
| 6 | 0.000000 | -.002913 | 0.000000 |
| 7 | 0.000000 | -.002773 | .000146 |
| 8 | 0.000000 | -.002367 | .000279 |
| 9 | 0.000000 | -.001728 | .000389 |
| 10 | 0.000000 | -.000911 | .000464 |
| 11 | 0.000000 | 0.000000 | .000487 |
| 12 | 0.000000 | -.006528 | -.002032 |
| 13 | 0.000000 | -.012383 | -.001704 |
| 14 | 0.000000 | -.016966 | -.001222 |
| 15 | 0.000000 | -.019876 | -.000637 |
| 16 | 0.000000 | -.020873 | -0.000000 |
| 17 | 0.000000 | -.019876 | .000637 |
| 18 | 0.000000 | -.016966 | .001222 |
| 19 | 0.000000 | -.012383 | .001704 |
| 20 | 0.000000 | -.006528 | .002032 |
| 21 | 0.000000 | 0.000000 | .002135 |
| 22 | 0.000000 | -.000911 | -.000464 |
| 23 | 0.000000 | -.001728 | -.000389 |
| 24 | 0.000000 | -.002367 | -.000279 |
| 25 | 0.000000 | -.002773 | -.000146 |
| 26 | 0.000000 | -.002913 | -0.000000 |
| 27 | 0.000000 | -.002774 | .000145 |
| 28 | 0.000000 | -.002368 | .000279 |
| 29 | 0.000000 | -.001729 | .000389 |
| 30 | 0.000000 | -.000913 | .000464 |
| 31 | 0.000000 | 0.000000 | .000489 |
| 111 | 0.000000 | 0.000000 | -.002135 |
| 121 | 0.000000 | 0.000000 | -.000487 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel | N-i | N-d | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|---|
| 1 | 1 | 2 | | | |
| S-izquierda | | | 0.000 | -10.744 | 0.000 |
| S- centro | | | 0.000 | -9.670 | 9.697 |
| S- derecha | | | 0.000 | -8.596 | 18.373 |
| 2 | 2 | 3 | | | |

| | | | |
|---|---|---|---|
| S-izquierda | 0.000 | -8.596 | 18.373 |
| S- centro | 0.000 | -7.521 | 26.029 |
| S- derecha | 0.000 | -6.447 | 32.663 |
| 3 4 | | | |
| S-izquierda | 0.000 | -6.447 | 32.663 |
| S- centro | 0.000 | -5.372 | 38.277 |
| S- derecha | 0.000 | -4.298 | 42.871 |
| 4 4 5 | | | |
| S-izquierda | 0.000 | -4.298 | 42.871 |
| S- centro | 0.000 | -3.223 | 46.443 |
| S- derecha | 0.000 | -2.149 | 48.995 |
| 5 5 6 | | | |
| S-izquierda | 0.000 | -2.149 | 48.995 |
| S- centro | 0.000 | -1.074 | 50.526 |
| S- derecha | 0.000 | 0.000 | 51.036 |
| 6 6 7 | | | |
| S-izquierda | 0.000 | 0.000 | 51.036 |
| S- centro | 0.000 | 1.074 | 50.526 |
| S derecha | 0.000 | 2.149 | 48.995 |
| 7 7 8 | | | |
| S-izquierda | 0.000 | 2.149 | 48.995 |
| S- centro | 0.000 | 3.223 | 46.443 |
| S- derecha | 0.000 | 4.298 | 42.871 |
| 8 8 9 | | | |
| S-izquierda | 0.000 | 4.298 | 42.871 |
| S- centro | 0.000 | 5.372 | 38.277 |
| S- derecha | 0.000 | 6.447 | 32.663 |
| 9 9 10 | | | |
| S-izquierda | 0.000 | 6.447 | 32.663 |
| S- centro | 0.000 | 7.521 | 26.029 |
| S- derecha | 0.000 | 8.596 | 18.373 |
| 10 10 11 | | | |
| S-izquierda | 0.000 | 8.596 | 18.373 |
| S centro | 0.000 | 9.670 | 9.697 |
| S- derecha | 0.000 | 10.744 | 0.000 |
| 11 111 12 | | | |
| S-izquierda | 0.000 | -17.581 | 0.000 |
| S- centro | 0.000 | -15.823 | 25.964 |
| S- derecha | 0.000 | -14.065 | 49.195 |
| 12 12 13 | | | |
| S-izquierda | 0.000 | -14.065 | 49.195 |
| S- centro | 0.000 | -12.307 | 69.692 |
| S- derecha | 0.000 | -10.549 | 87.457 |
| 13 13 14 | | | |
| S-izquierda | 0.000 | -10.549 | 87.457 |
| S- centro | 0.000 | -8.791 | 102.489 |
| S- derecha | 0.000 | -7.033 | 114.787 |
| 14 14 15 | | | |
| S zquierda | 0.000 | -7.033 | 114.787 |
| S- centro | 0.000 | -5.274 | 124.353 |
| S- derecha | 0.000 | -3.516 | 131.185 |
| 15 15 16 | | | |
| S-izquierda | 0.000 | -3.516 | 131.185 |
| S- centro | 0.000 | -1.758 | 135.285 |
| S- derecha | 0.000 | -0.000 | 136.651 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | -0.000 | 136.651 |
| S- centro | 0.000 | 1.758 | 135.285 |
| S- derecha | 0.000 | 3.516 | 131.185 |
| 17 17 18 | | | |
| S-izquierda | 0.000 | 3.516 | 131.185 |
| S- centro | 0.000 | 5.274 | 124.353 |
| S- derecha | 0.000 | 7.033 | 114.787 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | 7.033 | 114.787 |
| S- centro | 0.000 | 8.791 | 102.489 |
| S- derecha | 0.000 | 10.549 | 87.457 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | 10.549 | 87.457 |
| S- centro | 0.000 | 12.307 | 69.692 |
| S- derecha | 0.000 | 14.065 | 49.195 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | 14.065 | 49.195 |
| S- centro | 0.000 | 15.823 | 25.964 |
| S- derecha | 0.000 | 17.581 | 0.000 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | -10.744 | -0.000 |
| S- centro | 0.000 | -9.670 | 9.697 |
| S- derecha | 0.000 | -8.596 | 18.373 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | -8.596 | 18.373 |
| S- centro | 0.000 | -7.521 | 26.029 |
| S- derecha | 0.000 | -6.447 | 32.663 |
| 23 23 24 | | | |
| S-izquierda | 0.000 | -6.447 | 32.663 |
| S- centro | 0.000 | -5.372 | 38.277 |
| S- derecha | 0.000 | -4.298 | 42.871 |
| 24 24 25 | | | |
| S-izquierda | 0.000 | -4.298 | 42.871 |
| S- centro | 0.000 | -3.223 | 46.443 |
| S- derecha | 0.000 | -2.149 | 48.995 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | -2.149 | 48.995 |
| S- centro | 0.000 | -1.074 | 50.526 |
| S- derecha | 0.000 | 0.000 | 51.036 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | 0.000 | 51.036 |
| S- centro | 0.000 | 1.074 | 50.526 |
| S- derecha | 0.000 | 2.149 | 48.995 |
| 27 27 28 | | | |
| S-izquierda | 0.000 | 2.149 | 48.995 |
| S- centro | 0.000 | 3.223 | 46.443 |
| S- derecha | 0.000 | 4.298 | 42.871 |

| | | | |
|---|---|---|---|
| 28 28 29 | | | |
| S-izquierda | 0.000 | 4.298 | 42.871 |
| S centro | 0.000 | 5.372 | 38.277 |
| S- derecha | 0.000 | 6.447 | 32.663 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | 6.447 | 32.663 |
| S- centro | 0.000 | 7.521 | 26.029 |
| S- derecha | 0.000 | 8.596 | 18.373 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | 8.596 | 18.373 |
| S- centro | 0.000 | 9.670 | 9.697 |
| S- derecha | 0.000 | 10.744 | -0.000 |

Nota:Los esfuerzos se refieren a los extremos del elemento,excluyendo zonas rigidas en nudos de tamaño finito

** EACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 10.744 | 0.000 |
| 11 | 0.000 | 10.744 | 0.000 |
| 21 | 0.000 | 17.581 | 0.000 |
| 31 | 0.000 | 10.744 | 0.000 |
| 111 | 0.000 | 17.581 | 0.000 |
| 121 | 0.000 | 10.744 | 0.000 |

Nota:Se han controlado Errores de Cierre en Nudos y Reacciones(respecto a [0,0])...(<1%)

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
FASE 3:HORM.BC LOSA EN CDV

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

DATOS DE LOS NUDOS

| Nudo | Xi(m.) | Yi(m.) | Peso(Tn) | Movimientos Impuestos Ux | Vy | øz |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | | | | |
| 2 | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| 4 | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| 21 | 50.09 | 0.00 | | | | |
| 22 | 51.99 | 0.00 | | | | |
| 23 | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| 11 | | ****** | |
| 21 | | ****** | |
| 31 | | ****** | |
| 111 | ****** | ****** | |
| 121 | ****** | ****** | |

**Titulo:**
**3C LOSA CDV**
**Tipo:** [ 1]Cargas Exteriores/Movimientos Apoyo

**ACCIONES EN ELEMENTOS (m.;Tn;qsex.) :**

| Nel | aj | Parametros de Carga: | |
|---|---|---|---|
| 1 | 1 | 3.908 | (Carga Repartida) |
| | Misma Accion en Elementos : | 2 <= j <= 8 | |
| 14 | 1 | 3.908 | (Carga Repartida) |
| | Misma Accion en Elementos : | 15 <= j <= 17 | |
| 23 | 1 | 3.908 | (Carga Repartida) |
| | Misma Accion en Elementos : | 24 <= j <= 30 | |

**DATOS DE SECCIONES TIPO**

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

**DATOS DE LOS ELEMENTOS**

| Nu | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 2 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 1 | 3 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 3 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 16 | 16 | 17 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 17 | 17 | 18 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| [illegible] | 18 | 19 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 1 | 19 | 20 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 1 | 3 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 3 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 1 | 2 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

**Nota:** En Elementos Curvos [Long] y [Alf]
corresponden a la Cuerda

**DATOS DE LOS ESTADOS DE CARGA**

**ESTADO DE CARGA 1 :**

** BARRA (RESULTADOS) ***

Proyecto:
RAMO XV AVE / E-1505.0

Comentario:
FASE 3:HORM.BC Llosa EN CDV

Estado de Carga 1:
HC LOSA CDV

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.001557 |
| 2 | 0.000000 | -.002904 | -.001473 |
| 3 | 0.000000 | -.005491 | -.001227 |
| 4 | 0.000000 | -.007496 | -.000867 |
| 5 | 0.000000 | -.008741 | -.000434 |
| | 0.000000 | -.009126 | .000031 |
| 7 | 0.000000 | -.008627 | .000489 |
| 8 | 0.000000 | -.007298 | .000898 |
| 9 | 0.000000 | -.005272 | .001217 |
| 10 | 0.000000 | -.002754 | .001412 |
| 11 | 0.000000 | 0.000000 | .001468 |
| 12 | 0.000000 | -.012893 | -.004045 |
| 13 | 0.000000 | -.024730 | -.003510 |
| 14 | 0.000000 | -.034348 | -.002618 |
| 15 | 0.000000 | -.040659 | -.001398 |
| 16 | 0.000000 | -.042856 | -0.000000 |
| 17 | 0.000000 | -.040659 | .001398 |
| 18 | 0.000000 | -.034348 | .002618 |
| 19 | 0.000000 | -.024730 | .003510 |
| 20 | 0.000000 | -.012893 | .004045 |
| 21 | 0.000000 | 0.000000 | .004198 |
| 22 | 0.000000 | -.002754 | -.001412 |
| 23 | 0.000000 | -.005272 | -.001217 |
| 24 | 0.000000 | -.007298 | -.000898 |
| | 0.000000 | -.008627 | -.000489 |
| 26 | 0.000000 | -.009126 | -.000031 |
| 27 | 0.000000 | -.008741 | .000434 |
| 28 | 0.000000 | -.007496 | .000867 |
| 29 | 0.000000 | -.005491 | .001227 |
| 30 | 0.000000 | -.002904 | .001473 |
| 31 | 0.000000 | 0.000000 | .001557 |
| 111 | 0.000000 | 0.000000 | -.004198 |
| 121 | 0.000000 | 0.000000 | -.001468 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 | 1 2 | | | |
| S-izquierda | | 0.000 | -35.641 | 0.000 |
| S- centro | | 0.000 | -31.928 | 32.095 |
| S- derecha | | 0.000 | -28.216 | 60.664 |
| 2 | 2 3 | | | |
| S-izquierda | | 0.000 | -28.216 | 60.664 |
| S- centro | | 0.000 | -24.503 | 85.705 |
| S- derecha | | 0.000 | -20.791 | 107.220 |
| 3 | 3 4 | | | |
| S-izquierda | | 0.000 | -20.791 | 107.220 |
| S- centro | | 0.000 | -17.078 | 125.207 |
| S- derecha | | 0.000 | -13.365 | 139.668 |
| 4 | 4 5 | | | |
| S-izquierda | | 0.000 | -13.365 | 139.668 |
| S- centro | | 0.000 | -9.653 | 150.602 |
| S- derecha | | 0.000 | -5.940 | 158.008 |
| 5 | 5 6 | | | |
| S-izquierda | | 0.000 | -5.940 | 158.008 |
| S- centro | | 0.000 | -2.228 | 161.888 |
| S- derecha | | 0.000 | 1.485 | 162.241 |
| 6 | 6 7 | | | |
| S-izquierda | | 0.000 | 1.485 | 162.241 |
| S- centro | | 0.000 | 5.198 | 159.066 |
| S- derecha | | 0.000 | 8.910 | 152.365 |
| 7 | 7 8 | | | |
| S-izquierda | | 0.000 | 8.910 | 152.365 |
| S- centro | | 0.000 | 12.623 | 142.137 |
| S- derecha | | 0.000 | 16.335 | 128.382 |
| 8 | 8 9 | | | |
| S-izquierda | | 0.000 | 16.335 | 128.382 |
| S- centro | | 0.000 | 20.048 | 111.100 |
| S- derecha | | 0.000 | 23.761 | 90.290 |
| 9 | 9 10 | | | |
| S-izquierda | | 0.000 | 23.761 | 90.290 |
| S- centro | | 0.000 | 23.761 | 67.718 |
| S- derecha | | 0.000 | 23.761 | 45.145 |
| 10 | 10 11 | | | |
| S-izquierda | | 0.000 | 23.761 | 45.145 |
| S- centro | | 0.000 | 23.761 | 22.573 |
| S- derecha | | 0.000 | 23.761 | 0.000 |
| 11 | 111 12 | | | |
| S-izquierda | | 0.000 | -24.300 | -0.000 |
| S- centro | | 0.000 | -24.300 | 37.774 |
| S- derecha | | 0.000 | -24.300 | 75.549 |
| 12 | 12 13 | | | |
| S-izquierda | | 0.000 | -24.300 | 75.549 |
| S- centro | | 0.000 | -24.300 | 113.323 |
| S- derecha | | 0.000 | -24.300 | 151.097 |
| 13 | 13 14 | | | |
| S-izquierda | | 0.000 | -24.300 | 151.097 |
| S- centro | | 0.000 | -24.300 | 188.871 |
| S- derecha | | 0.000 | -24.300 | 226.646 |
| 14 | 14 15 | | | |
| S-izquierda | | 0.000 | -24.300 | 226.646 |
| S- centro | | 0.000 | -18.225 | 259.698 |
| S- derecha | | 0.000 | -12.150 | 283.307 |

| | | | |
|---|---|---|---|
| 15 15 16 | | | |
| S-izquierda | 0.000 | -12.150 | 283.307 |
| S- centro | 0.000 | -6.075 | 297.472 |
| S- derecha | 0.000 | -0.000 | 302.194 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | -0.000 | 302.194 |
| S- centro | 0.000 | 6.075 | 297.472 |
| S- derecha | 0.000 | 12.150 | 283.307 |
| 17 17 18 | | | |
| S-izquierda | 0.000 | 12.150 | 283.307 |
| S- centro | 0.000 | 18.225 | 259.698 |
| S- derecha | 0.000 | 24.300 | 226.646 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | 24.300 | 226.646 |
| S- centro | 0.000 | 24.300 | 188.871 |
| S- derecha | 0.000 | 24.300 | 151.097 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | 24.300 | 151.097 |
| S centro | 0.000 | 24.300 | 113.323 |
| S- derecha | 0.000 | 24.300 | 75.549 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | 24.300 | 75.549 |
| S- centro | 0.000 | 24.300 | 37.774 |
| S- derecha | 0.000 | 24.300 | -0.000 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | -23.761 | 0.000 |
| S- centro | 0.000 | -23.761 | 22.573 |
| S- derecha | 0.000 | -23.761 | 45.145 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | -23.761 | 45.145 |
| S- centro | 0.000 | -23.761 | 67.718 |
| S- derecha | 0.000 | -23.761 | 90.290 |
| 23 23 24 | | | |
| S- zquierda | 0.000 | -23.761 | 90.290 |
| S- centro | 0.000 | -20.048 | 111.100 |
| S- derecha | 0.000 | -16.335 | 128.382 |
| 24 24 25 | | | |
| S-izquierda | 0.000 | -16.335 | 128.382 |
| S- centro | 0.000 | -12.623 | 142.137 |
| S- derecha | 0.000 | -8.910 | 152.365 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | -8.910 | 152.365 |
| S- centro | 0.000 | -5.198 | 159.066 |
| S- derecha | 0.000 | -1.485 | 162.241 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | -1.485 | 162.241 |
| S- centro | 0.000 | 2.228 | 161.888 |
| S- derecha | 0.000 | 5.940 | 158.008 |
| 27 28 | | | |
| S- quierda | 0.000 | 5.940 | 158.008 |
| S- centro | 0.000 | 9.653 | 150.602 |
| S- derecha | 0.000 | 13.365 | 139.668 |
| 28 28 29 | | | |
| S-izquierda | 0.000 | 13.365 | 139.668 |
| S- centro | 0.000 | 17.078 | 125.207 |
| S- derecha | 0.000 | 20.791 | 107.220 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | 20.791 | 107.220 |
| S- centro | 0.000 | 24.503 | 85.705 |
| S- derecha | 0.000 | 28.216 | 60.664 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | 28.216 | 60.664 |
| S- centro | 0.000 | 31.928 | 32.095 |
| S- derecha | 0.000 | 35.641 | -0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 35.641 | 0.000 |
| 11 | 0.000 | 23.761 | 0.000 |
| 21 | 0.000 | 24.300 | 0.000 |
| 31 | 0.000 | 35.641 | 0.000 |
| 111 | 0.000 | 24.300 | 0.000 |
| 121 | 0.000 | 23.761 | 0.000 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0])...(<1%)

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Pr ecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
FASE 5:HORM.BC RESTO LOSA

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

DATOS DE LOS NUDOS

| Nudo | Xi(m.) | Yi(m.) | Peso(Tn) | Movimientos Impuestos Ux | Vy | øz |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | | | | |
| 2 | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| 21 | 50.09 | 0.00 | | | | |
| 2 | 51.99 | 0.00 | | | | |
| | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| 11 | | ****** | |
| 1 | | ****** | |
| | | ****** | |
| 111 | I* 11 | ****** | I* 11 |
| 121 | I* 21 | ****** | I* 21 |

DATOS DE SECCIONES TIPO

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

DATOS DE LOS ELEMENTOS

| Num | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 4 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 5 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 5 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 1 | 4 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 4 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 7 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 16 | 16 | 17 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 17 | 17 | 18 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 18 | 18 | 19 | 6 | 7 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 19 | 19 | 20 | 1 | 1 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 1 | 4 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 4 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 1 | 1 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 6 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 5 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 5 | 4 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

Nota: En Elementos Curvos [Long] y [Alf]
corresponden a la Cuerda

DATOS DE LOS ESTADOS DE CARGA

ESTADO DE CARGA 1 :

**Titulo:**
**BC RESTO LOSA**
**Tipo:** [ 1]Cargas Exteriores/Movimientos Apoyo

**ACCIONES EN ELEMENTOS (m.;Tn;gsex.) :**

| Nel | aj | Parametros de Carga: | |
|---|---|---|---|
| 9 | 1 | 3.908 | (Carga Repartida) |
| | | Misma Accion en Elementos : 10 <= j <= 13 | |
| 18 | 1 | 3.908 | (Carga Repartida) |
| | | Misma Accion en Elementos : 19 <= j <= 22 | |

***** BARRA (RESULTADOS) *****

**Proyecto:**
**SUBTRAMO XV AVE / E-1505.0**

**Comentario:**
FASE 5:HORM.BC RESTO LOSA

**Estado de Carga 1:**
BC RESTO LOSA

**** MOVIMIENTOS NUDOS (Ejes Generales) ****

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | .000160 |
| 2 | 0.000000 | .000303 | .000157 |
| 3 | 0.000000 | .000595 | .000150 |
| 4 | 0.000000 | .000868 | .000137 |
| 5 | 0.000000 | .001110 | .000116 |
| 6 | 0.000000 | .001307 | .000091 |
| 7 | 0.000000 | .001450 | .000059 |
| 8 | 0.000000 | .001458 | -.000054 |
| 9 | 0.000000 | .001235 | -.000184 |
| 10 | 0.000000 | .000745 | -.000338 |
| 11 | 0.000000 | 0.000000 | -.000454 |
| 12 | 0.000000 | -.001625 | -.000551 |
| 13 | 0.000000 | -.003132 | -.000373 |
| 14 | 0.000000 | -.004118 | -.000256 |
| 15 | 0.000000 | -.004714 | -.000128 |
| 16 | 0.000000 | -.004913 | -0.000000 |
| 17 | 0.000000 | -.004714 | .000128 |
| 18 | 0.000000 | -.004118 | .000256 |
| 19 | 0.000000 | -.003132 | .000373 |
| 20 | 0.000000 | -.001625 | .000551 |
| 21 | 0.000000 | 0.000000 | .000454 |
| 22 | 0.000000 | .000745 | .000338 |
| 23 | 0.000000 | .001235 | .000184 |
| 24 | 0.000000 | .001458 | .000054 |
| 25 | 0.000000 | .001450 | -.000059 |
| 26 | 0.000000 | .001307 | -.000091 |
| 27 | 0.000000 | .001110 | -.000116 |
| 28 | 0.000000 | .000868 | -.000137 |
| 29 | 0.000000 | .000595 | -.000150 |
| 30 | 0.000000 | .000303 | -.000157 |
| 31 | 0.000000 | 0.000000 | -.000160 |
| 111 | 0.000000 | 0.000000 | -.000454 |
| 121 | 0.000000 | 0.000000 | .000454 |

**** ESFUERZOS ELEMENTOS (Ejes Locales) ****

| Nel | N-i | N-d | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|---|
| 1 | 1 | 2 | | | |
| S-izquierda | | | 0.000 | 3.161 | 0.000 |
| S- centro | | | 0.000 | 3.161 | -3.003 |
| S- derecha | | | 0.000 | 3.161 | -6.006 |
| 2 | 2 | 3 | | | |

| | | | |
|---|---|---|---|
| S-izquierda | 0.000 | 3.161 | -6.006 |
| S- centro | 0.000 | 3.161 | -9.009 |
| S- derecha | 0.000 | 3.161 | -12.013 |
| 3 4 | | | |
| S-izquierda | 0.000 | 3.161 | -12.013 |
| S- centro | 0.000 | 3.161 | -15.016 |
| S- derecha | 0.000 | 3.161 | -18.019 |
| 4 4 5 | | | |
| S-izquierda | 0.000 | 3.161 | -18.019 |
| S- centro | 0.000 | 3.161 | -21.022 |
| S- derecha | 0.000 | 3.161 | -24.025 |
| 5 5 6 | | | |
| S-izquierda | 0.000 | 3.161 | -24.025 |
| S- centro | 0.000 | 3.161 | -27.028 |
| S- derecha | 0.000 | 3.161 | -30.031 |
| 6 6 7 | | | |
| S-izquierda | 0.000 | 3.161 | -30.031 |
| S- centro | 0.000 | 3.161 | -33.035 |
| S derecha | 0.000 | 3.161 | -36.038 |
| 7 7 8 | | | |
| S-izquierda | 0.000 | 3.161 | -36.038 |
| S- centro | 0.000 | 3.161 | -39.041 |
| S- derecha | 0.000 | 3.161 | -42.044 |
| 8 8 9 | | | |
| S-izquierda | 0.000 | 3.161 | -42.044 |
| S- centro | 0.000 | 3.161 | -45.047 |
| S- derecha | 0.000 | 3.161 | -48.050 |
| 9 9 10 | | | |
| S-izquierda | 0.000 | 3.161 | -48.050 |
| S- centro | 0.000 | 6.874 | -52.817 |
| S- derecha | 0.000 | 10.586 | -61.110 |
| 10 10 11 | | | |
| S-izquierda | 0.000 | 10.586 | -61.110 |
| S centro | 0.000 | 14.299 | -72.931 |
| S- derecha | 0.000 | 18.012 | -88.279 |
| 11 111 12 | | | |
| S-izquierda | 0.000 | -36.450 | -88.279 |
| S- centro | 0.000 | -30.375 | -36.339 |
| S- derecha | 0.000 | -24.300 | 6.157 |
| 12 12 13 | | | |
| S-izquierda | 0.000 | -24.300 | 6.157 |
| S- centro | 0.000 | -18.225 | 39.210 |
| S- derecha | 0.000 | -12.150 | 62.818 |
| 13 13 14 | | | |
| S-izquierda | 0.000 | -12.150 | 62.818 |
| S- centro | 0.000 | -6.075 | 76.984 |
| S- derecha | 0.000 | 0.000 | 81.706 |
| 14 14 15 | | | |
| S zquierda | 0.000 | -0.000 | 81.706 |
| S- centro | 0.000 | -0.000 | 81.706 |
| S- derecha | 0.000 | -0.000 | 81.706 |
| 15 15 16 | | | |
| S-izquierda | 0.000 | 0.000 | 81.706 |
| S- centro | 0.000 | 0.000 | 81.706 |
| S- derecha | 0.000 | 0.000 | 81.706 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | 0.000 | 81.706 |
| S- centro | 0.000 | 0.000 | 81.706 |
| S- derecha | 0.000 | 0.000 | 81.706 |
| 17 17 18 | | | |
| S-izquierda | 0.000 | 0.000 | 81.706 |
| S- centro | 0.000 | 0.000 | 81.706 |
| S- derecha | 0.000 | 0.000 | 81.706 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | 0.000 | 81.706 |
| S- centro | 0.000 | 6.075 | 76.984 |
| S- derecha | 0.000 | 12.150 | 62.818 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | 12.150 | 62.818 |
| S- centro | 0.000 | 18.225 | 39.210 |
| S- derecha | 0.000 | 24.300 | 6.157 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | 24.300 | 6.157 |
| S- centro | 0.000 | 30.375 | -36.339 |
| S- derecha | 0.000 | 36.450 | -88.279 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | -18.012 | -88.279 |
| S- centro | 0.000 | -14.299 | -72.931 |
| S- derecha | 0.000 | -10.586 | -61.110 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | -10.586 | -61.110 |
| S- centro | 0.000 | -6.874 | -52.817 |
| S- derecha | 0.000 | -3.161 | -48.050 |
| 23 23 24 | | | |
| S-izquierda | 0.000 | -3.161 | -48.050 |
| S- centro | 0.000 | -3.161 | -45.047 |
| S- derecha | 0.000 | -3.161 | -42.044 |
| 24 24 25 | | | |
| S-izquierda | 0.000 | -3.161 | -42.044 |
| S- centro | 0.000 | -3.161 | -39.041 |
| S- derecha | 0.000 | -3.161 | -36.038 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | -3.161 | -36.038 |
| S- centro | 0.000 | -3.161 | -33.035 |
| S- derecha | 0.000 | -3.161 | -30.031 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | -3.161 | -30.031 |
| S- centro | 0.000 | -3.161 | -27.028 |
| S- derecha | 0.000 | -3.161 | -24.025 |
| 27 27 28 | | | |
| S-izquierda | 0.000 | -3.161 | -24.025 |
| S- centro | 0.000 | -3.161 | -21.022 |
| S- derecha | 0.000 | -3.161 | -18.019 |

| | | | |
|---|---|---|---|
| 28 28 29 | | | |
| 3-izquierda | 0.000 | -3.161 | -18.019 |
| 3- centro | 0.000 | -3.161 | -15.016 |
| 3- derecha | 0.000 | -3.161 | -12.013 |
| 29 29 30 | | | |
| 3-izquierda | 0.000 | -3.161 | -12.013 |
| 3- centro | 0.000 | -3.161 | -9.009 |
| 3- derecha | 0.000 | -3.161 | -6.006 |
| 30 30 31 | | | |
| 3-izquierda | 0.000 | -3.161 | -6.006 |
| 3- centro | 0.000 | -3.161 | -3.003 |
| 3- derecha | 0.000 | -3.161 | 0.000 |

Nota:Los esfuerzos se refieren a los extremos del elemento,excluyendo zonas rigidas en nudos de tamaño finito

** EACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | -3.161 | 0.000 |
| 11 | 0.000 | 18.012 | 0.000 |
| 21 | 0.000 | 36.450 | 0.000 |
| 31 | 0.000 | -3.161 | 0.000 |
| 111 | 0.000 | 36.450 | 0.000 |
| 121 | 0.000 | 18.012 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | 88.279 |
| 121 | 0.000 | 0.000 | 88.279 |

Nota:Se han controlado Errores de Cierre en Nudos y Reacciones(respecto a [0,0])...(<1%)

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
FASE 6:HORM.VOLADIZOS

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

DATOS DE LOS NUDOS

| Nudo | Xi(m.) | Yi(m.) | Movimientos Impuestos Peso(Tn) | Ux | Vy | øz |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | | | | |
| 2 | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| 4 | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| 21 | 50.09 | 0.00 | | | | |
| 22 | 51.99 | 0.00 | | | | |
| 23 | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| 11 | | ****** | |
| 21 | | ****** | |
| 31 | | ****** | |
| 111 | I* 11 | ****** | I* 11 |
| 121 | I* 21 | ****** | I* 21 |

## DATOS DE SECCIONES TIPO

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

## DATOS DE LOS ELEMENTOS

| Nu | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 4 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 5 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 5 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 6 | 7 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 7 | 7 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 7 | 8 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 8 | 7 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 7 | 7 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 7 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 16 | 16 | 17 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 17 | 17 | 18 | 6 | 6 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| [illegible] | 18 | 19 | 6 | 7 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 1 | 19 | 20 | 7 | 7 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 7 | 8 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 8 | 7 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 7 | 7 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 7 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 6 | 6 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 6 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 5 | 5 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 5 | 4 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

Nota: En Elementos Curvos [Long] y [Alf]
corresponden a la Cuerda

## DATOS DE LOS ESTADOS DE CARGA

### ESTADO DE CARGA 1 :

**Titulo:**
**VOLADIZOS**
**Tipo:** [ 1]Cargas Exteriores/Movimientos Apoyo

## ACCIONES EN ELEMENTOS (m.;Tn;gsex.) :

| Nel | aj | Parametros de Carga: | |
|---|---|---|---|
| 1 | 1 | .844 | (Carga Repartida) |

Misma Accion en Elementos : 2 <= j <= 30

*** BARRA (RESULTADOS) ***

P vecto:
SU RAMO XV AVE / E-1505.0

Comentario:
FASE 6:HORM.VOLADIZOS

Estado de Carga 1:
VOLADIZOS

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.000025 |
| 2 | 0.000000 | -.000045 | -.000021 |
| 3 | 0.000000 | -.000078 | -.000013 |
| 4 | 0.000000 | -.000091 | -0.000000 |
| 5 | 0.000000 | -.000079 | .000013 |
| , | 0.000000 | -.000044 | .000023 |
| 7 | 0.000000 | .000005 | .000028 |
| 8 | 0.000000 | .000056 | .000024 |
| 9 | 0.000000 | .000090 | .000009 |
| 10 | 0.000000 | .000081 | -.000021 |
| 11 | 0.000000 | 0.000000 | -.000068 |
| 12 | 0.000000 | -.000325 | -.000131 |
| 13 | 0.000000 | -.000763 | -.000143 |
| 14 | 0.000000 | -.001175 | -.000117 |
| 15 | 0.000000 | -.001463 | -.000065 |
| 16 | 0.000000 | -.001565 | -0.000000 |
| 17 | 0.000000 | -.001463 | .000065 |
| 18 | 0.000000 | -.001175 | .000117 |
| 19 | 0.000000 | -.000763 | .000143 |
| 20 | 0.000000 | -.000325 | .000131 |
| 21 | 0.000000 | 0.000000 | .000068 |
| 22 | 0.000000 | .000081 | .000021 |
| 23 | 0.000000 | .000090 | -.000009 |
| 1 | 0.000000 | .000056 | -.000024 |
| | 0.000000 | .000005 | -.000028 |
| 26 | 0.000000 | -.000044 | -.000023 |
| 27 | 0.000000 | -.000079 | -.000013 |
| 28 | 0.000000 | -.000091 | 0.000000 |
| 29 | 0.000000 | -.000078 | .000013 |
| 30 | 0.000000 | -.000045 | .000021 |
| 31 | 0.000000 | 0.000000 | .000025 |
| 111 | 0.000000 | 0.000000 | -.000068 |
| 121 | 0.000000 | 0.000000 | .000068 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 | 1 2 | | | |
| S-izquierda | | 0.000 | -4.900 | -0.000 |
| S- centro | | 0.000 | -4.098 | 4.274 |
| S- derecha | | 0.000 | -3.296 | 7.787 |
| 2 | 2 3 | | | |
| S-izquierda | | 0.000 | -3.296 | 7.787 |
| S- centro | | 0.000 | -2.495 | 10.537 |
| S- derecha | | 0.000 | -1.693 | 12.526 |
| 3 | 3 4 | | | |
| S-izquierda | | 0.000 | -1.693 | 12.526 |
| S- centro | | 0.000 | -.891 | 13.754 |
| S- derecha | | 0.000 | -.089 | 14.219 |
| 4 | 4 5 | | | |
| S-izquierda | | 0.000 | -.089 | 14.219 |
| S- centro | | 0.000 | .713 | 13.923 |
| S- derecha | | 0.000 | 1.514 | 12.865 |
| 5 | 5 6 | | | |
| S-izquierda | | 0.000 | 1.514 | 12.865 |
| S- centro | | 0.000 | 2.316 | 11.046 |
| S- derecha | | 0.000 | 3.118 | 8.464 |
| 6 | 6 7 | | | |
| S-izquierda | | 0.000 | 3.118 | 8.464 |
| S- centro | | 0.000 | 3.920 | 5.121 |
| S- derecha | | 0.000 | 4.722 | 1.017 |
| 7 | 7 8 | | | |
| S-izquierda | | 0.000 | 4.722 | 1.017 |
| S- centro | | 0.000 | 5.523 | -3.850 |
| S- derecha | | 0.000 | 6.325 | -9.478 |
| 8 | 8 9 | | | |
| S-izquierda | | 0.000 | 6.325 | -9.478 |
| S- centro | | 0.000 | 7.127 | -15.868 |
| S- derecha | | 0.000 | 7.929 | -23.019 |
| 9 | 9 10 | | | |
| S-izquierda | | 0.000 | 7.929 | -23.019 |
| S- centro | | 0.000 | 8.731 | -30.932 |
| S- derecha | | 0.000 | 9.532 | -39.607 |
| 10 | 10 11 | | | |
| S-izquierda | | 0.000 | 9.532 | -39.607 |
| S- centro | | 0.000 | 10.334 | -49.044 |
| S- derecha | | 0.000 | 11.136 | -59.242 |
| 11 | 111 12 | | | |
| S-izquierda | | 0.000 | -13.120 | -59.242 |
| S- centro | | 0.000 | -11.808 | -39.867 |
| S- derecha | | 0.000 | -10.496 | -22.531 |
| 12 | 12 13 | | | |
| S-izquierda | | 0.000 | -10.496 | -22.531 |
| S- centro | | 0.000 | -9.184 | -7.235 |
| S- derecha | | 0.000 | -7.872 | 6.022 |
| 13 | 13 14 | | | |
| S-izquierda | | 0.000 | -7.872 | 6.022 |
| S- centro | | 0.000 | -6.560 | 17.239 |
| S- derecha | | 0.000 | -5.248 | 26.417 |
| 14 | 14 15 | | | |
| S-izquierda | | 0.000 | -5.248 | 26.417 |
| S- centro | | 0.000 | -3.936 | 33.555 |
| S- derecha | | 0.000 | -2.624 | 38.654 |

| | | | |
|---|---|---|---|
| **15 15 16** | | | |
| **S-izquierda** | 0.000 | -2.624 | 38.654 |
| **S- centro** | 0.000 | -1.312 | 41.713 |
| **S- derecha** | 0.000 | 0.000 | 42.733 |
| **16 16 17** | | | |
| **S-izquierda** | 0.000 | 0.000 | 42.733 |
| **S- centro** | 0.000 | 1.312 | 41.713 |
| **S- derecha** | 0.000 | 2.624 | 38.654 |
| **17 17 18** | | | |
| **S-izquierda** | 0.000 | 2.624 | 38.654 |
| **S- centro** | 0.000 | 3.936 | 33.555 |
| **S- derecha** | 0.000 | 5.248 | 26.417 |
| **18 18 19** | | | |
| **S-izquierda** | 0.000 | 5.248 | 26.417 |
| **S- centro** | 0.000 | 6.560 | 17.239 |
| **S- derecha** | 0.000 | 7.872 | 6.022 |
| **19 19 20** | | | |
| **S-izquierda** | 0.000 | 7.872 | 6.022 |
| **S centro** | 0.000 | 9.184 | -7.235 |
| **S- derecha** | 0.000 | 10.496 | -22.531 |
| **20 20 21** | | | |
| **S-izquierda** | 0.000 | 10.496 | -22.531 |
| **S- centro** | 0.000 | 11.808 | -39.867 |
| **S- derecha** | 0.000 | 13.120 | -59.242 |
| **21 121 22** | | | |
| **S-izquierda** | 0.000 | -11.136 | -59.242 |
| **S- centro** | 0.000 | -10.334 | -49.044 |
| **S- derecha** | 0.000 | -9.532 | -39.607 |
| **22 22 23** | | | |
| **S-izquierda** | 0.000 | -9.532 | -39.607 |
| **S- centro** | 0.000 | -8.731 | -30.932 |
| **S- derecha** | 0.000 | -7.929 | -23.019 |
| **23 23 24** | | | |
| **S zquierda** | 0.000 | -7.929 | -23.019 |
| **S- centro** | 0.000 | -7.127 | -15.868 |
| **S- derecha** | 0.000 | -6.325 | -9.478 |
| **24 24 25** | | | |
| **S-izquierda** | 0.000 | -6.325 | -9.478 |
| **S- centro** | 0.000 | -5.523 | -3.850 |
| **S- derecha** | 0.000 | -4.722 | 1.017 |
| **25 25 26** | | | |
| **S-izquierda** | 0.000 | -4.722 | 1.017 |
| **S- centro** | 0.000 | -3.920 | 5.121 |
| **S- derecha** | 0.000 | -3.118 | 8.464 |
| **26 26 27** | | | |
| **S-izquierda** | 0.000 | -3.118 | 8.464 |
| **S- centro** | 0.000 | -2.316 | 11.046 |
| **S- derecha** | 0.000 | -1.514 | 12.865 |
| **27 28** | | | |
| **S- quierda** | 0.000 | -1.514 | 12.865 |
| **S- centro** | 0.000 | -.713 | 13.923 |
| **S- derecha** | 0.000 | .089 | 14.219 |
| **28 28 29** | | | |
| **S-izquierda** | 0.000 | .089 | 14.219 |
| **S- centro** | 0.000 | .891 | 13.754 |
| **S- derecha** | 0.000 | 1.693 | 12.526 |
| **29 29 30** | | | |
| **S-izquierda** | 0.000 | 1.693 | 12.526 |
| **S- centro** | 0.000 | 2.495 | 10.537 |
| **S- derecha** | 0.000 | 3.296 | 7.787 |
| **30 30 31** | | | |
| **S-izquierda** | 0.000 | 3.296 | 7.787 |
| **S- centro** | 0.000 | 4.098 | 4.274 |
| **S- derecha** | 0.000 | 4.900 | -0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 4.900 | 0.000 |
| 11 | 0.000 | 11.136 | 0.000 |
| 21 | 0.000 | 13.120 | 0.000 |
| 31 | 0.000 | 4.900 | 0.000 |
| 111 | 0.000 | 13.120 | 0.000 |
| 121 | 0.000 | 11.136 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | 59.242 |
| 121 | 0.000 | 0.000 | 59.242 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0]) ... (<1%)

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Pr ecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
ESTRUCTURA IDEAL

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

DATOS DE LOS NUDOS

| Nudo | Xi(m.) | Yi(m.) | Peso(Tn) | Movimientos Impuestos Ux | Vy | øz |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | | | | |
| 2 | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| . | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| 21 | 50.09 | 0.00 | | | | |
| ? | 51.99 | 0.00 | | | | |
| . | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| 11 | | ****** | |
| 1 | | ****** | |
| . | | ****** | |
| 111 | I* 11 | ****** | I* 11 |
| 121 | I* 21 | ****** | I* 21 |

DATOS DE SECCIONES TIPO

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

DATOS DE LOS ELEMENTOS

| Num | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 10 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 11 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 11 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 12 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 13 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 13 | 14 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 14 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 13 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 13 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 16 | 16 | 17 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 17 | 17 | 18 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 18 | 18 | 19 | 12 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 19 | 19 | 20 | 13 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 13 | 14 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 14 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 13 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 13 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 12 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 11 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 11 | 10 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

Nota: En Elementos Curvos [Long] y [Alf]
corresponden a la Cuerda

DATOS DE LOS ESTADOS DE CARGA

ESTADO DE CARGA 1 :

Titulo:
P.P.VIGA
Tipo: [ 1]Cargas Exteriores/Movimientos Apoyo

ACCIONES EN ELEMENTOS (m.;Tn;gsex.) :

| Nel | aj | Parametros de Carga: | |
|---|---|---|---|
| 1 | 1 | 2.958 | (Carga Repartida) |

Misma Accion en Elementos : 2 <= j <= 30

ESTADO DE CARGA 2 :

Titulo:
P.P.LOSA
Tipo: [ 1]Cargas Exteriores/Movimientos Apoyo

ACCIONES EN ELEMENTOS (m.;Tn;gsex.) :

| N | aj | Parametros de Carga: | |
|---|---|---|---|
| | 1 | 5.883 | (Carga Repartida) |

Misma Accion en Elementos : 2 <= j <= 30

ESTADO DE CARGA 3 :

Titulo:
C.M.
Tipo: [ 1]Cargas Exteriores/Movimientos Apoyo

ACCIONES EN ELEMENTOS (m.;Tn;gsex.) :

| Nel | aj | Parametros de Carga: | |
|---|---|---|---|
| 1 | 1 | 3.052 | (Carga Repartida) |

Misma Accion en Elementos : 2 <= j <= 30

ESTADO DE CARGA 4 :

Titulo:
SCU
Tipo: [ 6]Envolventes Sobrecargas Moviles

Sobrecarga Movil Tipo 1

Numero sobrecargas diferentes: 1
Maxima Longitud cargada por elemento(m.): Total

| No | pn(Tn/ml) | Elementos Afectados: |
|---|---|---|
| 1 | 3.240 | 1 <= j <= 30 |

ESTADO DE CARGA 5 :

Titulo:
VP
Tipo: [ 5]Envolventes Trenes de Carga

Tren de Cargas Tipo 1 con 3 Ejes Longitudinales

Delta(m.): standard
Xref (m.): c.gravedad del tren de cargas

Cargas Verticales Ejes Longitudinales (Tn.):
20.000 20.000 20.000

Interejes Longitudinales (m.):
1.500 1.500

Camino de Rodadura *0* : Elementos Afectados:
1 <= j <= 30

ESTADO DE CARGA 6 :

Titulo:
GRADIENTE TERMICO
Tipo: [ 3]Acciones Termicas

| No | Dilat.(gc) | Grad.(gc/m) | Elementos Afectados: |
|---|---|---|---|
| 1 | 0.00 | 6.31 | 1 <= j <= 30 |

*** BARRA (RESULTADOS) ***

Proyecto:
SUBRAMO XV AVE / E-1505.0

Comentario:
ESTRUCTURA IDEAL

Estado de Carga 1:
P.P.VIGA

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.000082 |
| 2 | 0.000000 | -.000147 | -.000070 |
| 3 | 0.000000 | -.000251 | -.000038 |
| 4 | 0.000000 | -.000285 | .000003 |
| 5 | 0.000000 | -.000239 | .000043 |
| 6 | 0.000000 | -.000125 | .000075 |
| 7 | 0.000000 | .000035 | .000089 |
| 8 | 0.000000 | .000197 | .000077 |
| 9 | 0.000000 | .000301 | .000026 |
| 10 | 0.000000 | .000264 | -.000075 |
| 11 | 0.000000 | 0.000000 | -.000212 |
| 12 | 0.000000 | -.000988 | -.000396 |
| 13 | 0.000000 | -.002322 | -.000438 |
| 14 | 0.000000 | -.003581 | -.000355 |
| 15 | 0.000000 | -.004454 | -.000197 |
| 16 | 0.000000 | -.004766 | 0.000000 |
| 17 | 0.000000 | -.004454 | .000197 |
| 18 | 0.000000 | -.003581 | .000355 |
| 19 | 0.000000 | -.002322 | .000438 |
| 20 | 0.000000 | -.000988 | .000396 |
| 21 | 0.000000 | 0.000000 | .000212 |
| 22 | 0.000000 | .000264 | .000075 |
| 23 | 0.000000 | .000301 | -.000026 |
| 24 | 0.000000 | .000197 | -.000077 |
| 25 | 0.000000 | .000035 | -.000089 |
| 26 | 0.000000 | -.000125 | -.000075 |
| 27 | 0.000000 | -.000239 | -.000043 |
| 28 | 0.000000 | -.000285 | -.000003 |
| 29 | 0.000000 | -.000251 | .000038 |
| 30 | 0.000000 | -.000147 | .000070 |
| 31 | 0.000000 | 0.000000 | .000082 |
| 111 | 0.000000 | 0.000000 | -.000212 |
| 121 | 0.000000 | 0.000000 | .000212 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 | 1 2 | | | |
| S-izquierda | | 0.000 | -17.096 | 0.000 |
| S- centro | | 0.000 | -14.286 | 14.907 |
| S- derecha | | 0.000 | -11.476 | 27.144 |
| 2 | 2 3 | | | |
| S-izquierda | | 0.000 | -11.476 | 27.144 |
| S- centro | | 0.000 | -8.666 | 36.712 |
| S- derecha | | 0.000 | -5.856 | 43.610 |
| 3 | 3 4 | | | |
| S-izquierda | | 0.000 | -5.856 | 43.610 |
| S- centro | | 0.000 | -3.046 | 47.838 |
| S- derecha | | 0.000 | -.236 | 49.397 |
| 4 | 4 5 | | | |
| S-izquierda | | 0.000 | -.236 | 49.397 |
| S- centro | | 0.000 | 2.574 | 48.286 |
| S- derecha | | 0.000 | 5.384 | 44.506 |
| 5 | 5 6 | | | |
| S-izquierda | | 0.000 | 5.384 | 44.506 |
| S- centro | | 0.000 | 8.194 | 38.056 |
| S- derecha | | 0.000 | 11.005 | 28.937 |
| 6 | 6 7 | | | |
| S-izquierda | | 0.000 | 11.005 | 28.937 |
| S- centro | | 0.000 | 13.815 | 17.148 |
| S- derecha | | 0.000 | 16.625 | 2.689 |
| 7 | 7 8 | | | |
| S-izquierda | | 0.000 | 16.625 | 2.689 |
| S- centro | | 0.000 | 19.435 | -14.439 |
| S- derecha | | 0.000 | 22.245 | -34.237 |
| 8 | 8 9 | | | |
| S-izquierda | | 0.000 | 22.245 | -34.237 |
| S- centro | | 0.000 | 25.055 | -56.705 |
| S- derecha | | 0.000 | 27.865 | -81.842 |
| 9 | 9 10 | | | |
| S-izquierda | | 0.000 | 27.865 | -81.842 |
| S- centro | | 0.000 | 30.675 | -109.649 |
| S- derecha | | 0.000 | 33.485 | -140.125 |
| 10 | 10 11 | | | |
| S-izquierda | | 0.000 | 33.485 | -140.125 |
| S- centro | | 0.000 | 36.295 | -173.271 |
| S- derecha | | 0.000 | 39.106 | -209.086 |
| 11 | 111 12 | | | |
| S-izquierda | | 0.000 | -45.982 | -209.086 |
| S- centro | | 0.000 | -41.384 | -141.181 |
| S- derecha | | 0.000 | -36.786 | -80.424 |
| 12 | 12 13 | | | |
| S-izquierda | | 0.000 | -36.786 | -80.424 |
| S- centro | | 0.000 | -32.187 | -26.814 |
| S- derecha | | 0.000 | -27.589 | 19.647 |
| 13 | 13 14 | | | |
| S-izquierda | | 0.000 | -27.589 | 19.647 |
| S- centro | | 0.000 | -22.991 | 58.961 |
| S- derecha | | 0.000 | -18.393 | 91.126 |
| 14 | 14 15 | | | |
| S-izquierda | | 0.000 | -18.393 | 91.126 |
| S- centro | | 0.000 | -13.795 | 116.144 |
| S- derecha | | 0.000 | -9.196 | 134.014 |

| | | | |
|---|---|---|---|
| 15 15 16 | | | |
| S-izquierda | 0.000 | -9.196 | 134.014 |
| S- centro | 0.000 | -4.598 | 144.736 |
| S derecha | 0.000 | 0.000 | 148.310 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | 0.000 | 148.310 |
| S- centro | 0.000 | 4.598 | 144.736 |
| S- derecha | 0.000 | 9.196 | 134.014 |
| 17 17 18 | | | |
| S-izquierda | 0.000 | 9.196 | 134.014 |
| S- centro | 0.000 | 13.795 | 116.144 |
| S- derecha | 0.000 | 18.393 | 91.126 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | 18.393 | 91.126 |
| S- centro | 0.000 | 22.991 | 58.961 |
| S- derecha | 0.000 | 27.589 | 19.647 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | 27.589 | 19.647 |
| S centro | 0.000 | 32.187 | -26.814 |
| S- derecha | 0.000 | 36.786 | -80.424 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | 36.786 | -80.424 |
| S- centro | 0.000 | 41.384 | -141.181 |
| S- derecha | 0.000 | 45.982 | -209.086 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | -39.106 | -209.086 |
| S- centro | 0.000 | -36.295 | -173.271 |
| S- derecha | 0.000 | -33.485 | -140.125 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | -33.485 | -140.125 |
| S- centro | 0.000 | -30.675 | -109.649 |
| S- derecha | 0.000 | -27.865 | -81.842 |
| 23 23 24 | | | |
| S zquierda | 0.000 | -27.865 | -81.842 |
| S- centro | 0.000 | -25.055 | -56.705 |
| S- derecha | 0.000 | -22.245 | -34.237 |
| 24 24 25 | | | |
| S-izquierda | 0.000 | -22.245 | -34.237 |
| S- centro | 0.000 | -19.435 | -14.439 |
| S- derecha | 0.000 | -16.625 | 2.689 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | -16.625 | 2.689 |
| S- centro | 0.000 | -13.815 | 17.148 |
| S- derecha | 0.000 | -11.005 | 28.937 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | -11.005 | 28.937 |
| S- centro | 0.000 | -8.194 | 38.056 |
| S- derecha | 0.000 | -5.384 | 44.506 |
| 27 28 | | | |
| S- zquierda | 0.000 | -5.384 | 44.506 |
| S- centro | 0.000 | -2.574 | 48.286 |
| S- derecha | 0.000 | .236 | 49.397 |
| 28 28 29 | | | |
| S-izquierda | 0.000 | .236 | 49.397 |
| S- centro | 0.000 | 3.046 | 47.838 |
| S- derecha | 0.000 | 5.856 | 43.610 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | 5.856 | 43.610 |
| S- centro | 0.000 | 8.666 | 36.712 |
| S- derecha | 0.000 | 11.476 | 27.144 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | 11.476 | 27.144 |
| S- centro | 0.000 | 14.286 | 14.907 |
| S- derecha | 0.000 | 17.096 | 0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 17.096 | 0.000 |
| 11 | 0.000 | 39.106 | 0.000 |
| 21 | 0.000 | 45.982 | 0.000 |
| 31 | 0.000 | 17.096 | 0.000 |
| 111 | 0.000 | 45.982 | 0.000 |
| 121 | 0.000 | 39.106 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | 209.086 |
| 121 | 0.000 | 0.000 | 209.086 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0]) ... (<1%)

*** BARRA (RESULTADOS) ***

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
ESTRUCTURA IDEAL

Estado de Carga 2:
P.P.LOSA

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.000162 |
| 2 | 0.000000 | -.000293 | -.000139 |
| 3 | 0.000000 | -.000500 | -.000075 |
| 4 | 0.000000 | -.000566 | .000007 |
| 5 | 0.000000 | -.000476 | .000086 |
| 6 | 0.000000 | -.000248 | .000149 |
| 7 | 0.000000 | .000069 | .000177 |
| 8 | 0.000000 | .000391 | .000152 |
| 9 | 0.000000 | .000599 | .000053 |
| 10 | 0.000000 | .000524 | -.000149 |
| 11 | 0.000000 | 0.000000 | -.000421 |
| 12 | 0.000000 | -.001964 | -.000787 |
| 13 | 0.000000 | -.004619 | -.000871 |
| 14 | 0.000000 | -.007122 | -.000706 |
| 15 | 0.000000 | -.008859 | -.000392 |
| 16 | 0.000000 | -.009479 | 0.000000 |
| 17 | 0.000000 | -.008859 | .000392 |
| 18 | 0.000000 | -.007122 | .000706 |
| 19 | 0.000000 | -.004619 | .000871 |
| 20 | 0.000000 | -.001964 | .000787 |
| 21 | 0.000000 | 0.000000 | .000421 |
| 22 | 0.000000 | .000524 | .000149 |
| 23 | 0.000000 | .000599 | -.000053 |
| 24 | 0.000000 | .000391 | -.000152 |
| 25 | 0.000000 | .000069 | -.000177 |
| 26 | 0.000000 | -.000248 | -.000149 |
| 27 | 0.000000 | -.000476 | -.000086 |
| 28 | 0.000000 | -.000566 | -.000007 |
| 29 | 0.000000 | -.000500 | .000075 |
| 30 | 0.000000 | -.000293 | .000139 |
| 31 | 0.000000 | 0.000000 | .000162 |
| 111 | 0.000000 | 0.000000 | -.000421 |
| 121 | 0.000000 | 0.000000 | .000421 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 | 1 2 | | | |
| S-izquierda | | 0.000 | -34.002 | -0.000 |
| S- centro | | 0.000 | -28.413 | 29.647 |
| S- derecha | | 0.000 | -22.824 | 53.985 |
| 2 | 2 3 | | | |
| S-izquierda | | 0.000 | -22.824 | 53.985 |
| S- centro | | 0.000 | -17.236 | 73.014 |
| S- derecha | | 0.000 | -11.647 | 86.733 |
| 3 | 3 4 | | | |
| S-izquierda | | 0.000 | -11.647 | 86.733 |
| S- centro | | 0.000 | -6.058 | 95.143 |
| S- derecha | | 0.000 | -.469 | 98.243 |
| 4 | 4 5 | | | |
| S-izquierda | | 0.000 | -.469 | 98.243 |
| S- centro | | 0.000 | 5.120 | 96.034 |
| S- derecha | | 0.000 | 10.709 | 88.516 |
| 5 | 5 6 | | | |
| S-izquierda | | 0.000 | 10.709 | 88.516 |
| S- centro | | 0.000 | 16.297 | 75.688 |
| S- derecha | | 0.000 | 21.886 | 57.550 |
| 6 | 6 7 | | | |
| S-izquierda | | 0.000 | 21.886 | 57.550 |
| S- centro | | 0.000 | 27.475 | 34.104 |
| S- derecha | | 0.000 | 33.064 | 5.348 |
| 7 | 7 8 | | | |
| S-izquierda | | 0.000 | 33.064 | 5.348 |
| S- centro | | 0.000 | 38.653 | -28.718 |
| S- derecha | | 0.000 | 44.242 | -68.093 |
| 8 | 8 9 | | | |
| S-izquierda | | 0.000 | 44.242 | -68.093 |
| S- centro | | 0.000 | 49.831 | -112.777 |
| S- derecha | | 0.000 | 55.419 | -162.771 |
| 9 | 9 10 | | | |
| S-izquierda | | 0.000 | 55.419 | -162.771 |
| S- centro | | 0.000 | 61.008 | -218.074 |
| S- derecha | | 0.000 | 66.597 | -278.687 |
| 10 | 10 11 | | | |
| S-izquierda | | 0.000 | 66.597 | -278.687 |
| S- centro | | 0.000 | 72.186 | -344.608 |
| S- derecha | | 0.000 | 77.775 | -415.840 |
| 11 | 111 12 | | | |
| S-izquierda | | 0.000 | -91.451 | -415.840 |
| S- centro | | 0.000 | -82.306 | -280.787 |
| S- derecha | | 0.000 | -73.161 | -159.950 |
| 12 | 12 13 | | | |
| S-izquierda | | 0.000 | -73.161 | -159.950 |
| S- centro | | 0.000 | -64.016 | -53.329 |
| S- derecha | | 0.000 | -54.871 | 39.075 |
| 13 | 13 14 | | | |
| S-izquierda | | 0.000 | -54.871 | 39.075 |
| S- centro | | 0.000 | -45.726 | 117.264 |
| S- derecha | | 0.000 | -36.580 | 181.236 |
| 14 | 14 15 | | | |
| S-izquierda | | 0.000 | -36.580 | 181.236 |
| S- centro | | 0.000 | -27.435 | 230.992 |
| S- derecha | | 0.000 | -18.290 | 266.533 |

| | | | |
|---|---|---|---|
| 15 15 16 | | | |
| S-izquierda | 0.000 | -18.290 | 266.533 |
| S- centro | 0.000 | -9.145 | 287.857 |
| S- derecha | 0.000 | -0.000 | 294.965 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | -0.000 | 294.965 |
| S- centro | 0.000 | 9.145 | 287.857 |
| S- derecha | 0.000 | 18.290 | 266.533 |
| 17 17 18 | | | |
| S-izquierda | 0.000 | 18.290 | 266.533 |
| S- centro | 0.000 | 27.435 | 230.992 |
| S- derecha | 0.000 | 36.580 | 181.236 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | 36.580 | 181.236 |
| S- centro | 0.000 | 45.726 | 117.264 |
| S- derecha | 0.000 | 54.871 | 39.075 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | 54.871 | 39.075 |
| S centro | 0.000 | 64.016 | -53.329 |
| S- derecha | 0.000 | 73.161 | -159.950 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | 73.161 | -159.950 |
| S- centro | 0.000 | 82.306 | -280.787 |
| S- derecha | 0.000 | 91.451 | -415.840 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | -77.775 | -415.840 |
| S- centro | 0.000 | -72.186 | -344.608 |
| S- derecha | 0.000 | -66.597 | -278.687 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | -66.597 | -278.687 |
| S- centro | 0.000 | -61.008 | -218.074 |
| S- derecha | 0.000 | -55.419 | -162.771 |
| 23 23 24 | | | |
| S- zquierda | 0.000 | -55.419 | -162.771 |
| S- centro | 0.000 | -49.831 | -112.777 |
| S- derecha | 0.000 | -44.242 | -68.093 |
| 24 24 25 | | | |
| S-izquierda | 0.000 | -44.242 | -68.093 |
| S- centro | 0.000 | -38.653 | -28.718 |
| S- derecha | 0.000 | -33.064 | 5.348 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | -33.064 | 5.348 |
| S- centro | 0.000 | -27.475 | 34.104 |
| S- derecha | 0.000 | -21.886 | 57.550 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | -21.886 | 57.550 |
| S- centro | 0.000 | -16.297 | 75.688 |
| S- derecha | 0.000 | -10.709 | 88.516 |
| 27 28 | | | |
| S- zquierda | 0.000 | -10.709 | 88.516 |
| S- centro | 0.000 | -5.120 | 96.034 |
| S- derecha | 0.000 | .469 | 98.243 |
| 28 28 29 | | | |
| S-izquierda | 0.000 | .469 | 98.243 |
| S- centro | 0.000 | 6.058 | 95.143 |
| S- derecha | 0.000 | 11.647 | 86.733 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | 11.647 | 86.733 |
| S- centro | 0.000 | 17.236 | 73.014 |
| S- derecha | 0.000 | 22.824 | 53.985 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | 22.824 | 53.985 |
| S- centro | 0.000 | 28.413 | 29.647 |
| S- derecha | 0.000 | 34.002 | 0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 34.002 | 0.000 |
| 11 | 0.000 | 77.775 | 0.000 |
| 21 | 0.000 | 91.451 | 0.000 |
| 31 | 0.000 | 34.002 | 0.000 |
| 111 | 0.000 | 91.451 | 0.000 |
| 121 | 0.000 | 77.775 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | 415.840 |
| 121 | 0.000 | 0.000 | 415.840 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0]) ... (<1%)

*** BARRA (RESULTADOS) ***

Proyecto:
SUB RAMO XV AVE / E-1505.0

Comentario:
ESTRUCTURA IDEAL

Estado de Carga 3:
P.M.

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.000084 |
| 2 | 0.000000 | -.000152 | -.000072 |
| 3 | 0.000000 | -.000259 | -.000039 |
| 4 | 0.000000 | -.000294 | .000003 |
| 5 | 0.000000 | -.000247 | .000045 |
| 6 | 0.000000 | -.000129 | .000077 |
| 7 | 0.000000 | .000036 | .000092 |
| 8 | 0.000000 | .000203 | .000079 |
| 9 | 0.000000 | .000311 | .000027 |
| 10 | 0.000000 | .000272 | -.000077 |
| 11 | 0.000000 | 0.000000 | -.000219 |
| 12 | 0.000000 | -.001019 | -.000408 |
| 13 | 0.000000 | -.002396 | -.000452 |
| 14 | 0.000000 | -.003695 | -.000366 |
| 15 | 0.000000 | -.004596 | -.000203 |
| 16 | 0.000000 | -.004917 | 0.000000 |
| 17 | 0.000000 | -.004596 | .000203 |
| 18 | 0.000000 | -.003695 | .000366 |
| 19 | 0.000000 | -.002396 | .000452 |
| 20 | 0.000000 | -.001019 | .000408 |
| 21 | 0.000000 | 0.000000 | .000219 |
| 22 | 0.000000 | .000272 | .000077 |
| 23 | 0.000000 | .000311 | -.000027 |
| 1 | 0.000000 | .000203 | -.000079 |
| . | 0.000000 | .000036 | -.000092 |
| 26 | 0.000000 | -.000129 | -.000077 |
| 27 | 0.000000 | -.000247 | -.000045 |
| 28 | 0.000000 | -.000294 | -.000003 |
| 29 | 0.000000 | -.000259 | .000039 |
| 30 | 0.000000 | -.000152 | .000072 |
| 31 | 0.000000 | 0.000000 | .000084 |
| 111 | 0.000000 | 0.000000 | -.000219 |
| 121 | 0.000000 | 0.000000 | .000219 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 | 1 2 | | | |
| S-izquierda | | 0.000 | -17.640 | -0.000 |
| S- centro | | 0.000 | -14.740 | 15.381 |
| S- derecha | | 0.000 | -11.841 | 28.007 |
| 2 | 2 3 | | | |
| S-izquierda | | 0.000 | -11.841 | 28.007 |
| S- centro | | 0.000 | -8.942 | 37.878 |
| S- derecha | | 0.000 | -6.042 | 44.996 |
| 3 | 3 4 | | | |
| S-izquierda | | 0.000 | -6.042 | 44.996 |
| S- centro | | 0.000 | -3.143 | 49.358 |
| S- derecha | | 0.000 | -.243 | 50.967 |
| 4 | 4 5 | | | |
| S-izquierda | | 0.000 | -.243 | 50.967 |
| S- centro | | 0.000 | 2.656 | 49.821 |
| S- derecha | | 0.000 | 5.555 | 45.920 |
| 5 | 5 6 | | | |
| S-izquierda | | 0.000 | 5.555 | 45.920 |
| S- centro | | 0.000 | 8.455 | 39.266 |
| S- derecha | | 0.000 | 11.354 | 29.856 |
| 6 | 6 7 | | | |
| S-izquierda | | 0.000 | 11.354 | 29.856 |
| S- centro | | 0.000 | 14.254 | 17.692 |
| S- derecha | | 0.000 | 17.153 | 2.774 |
| 7 | 7 8 | | | |
| S-izquierda | | 0.000 | 17.153 | 2.774 |
| S- centro | | 0.000 | 20.052 | -14.898 |
| S- derecha | | 0.000 | 22.952 | -35.325 |
| 8 | 8 9 | | | |
| S-izquierda | | 0.000 | 22.952 | -35.325 |
| S- centro | | 0.000 | 25.851 | -58.507 |
| S- derecha | | 0.000 | 28.751 | -84.443 |
| 9 | 9 10 | | | |
| S-izquierda | | 0.000 | 28.751 | -84.443 |
| S- centro | | 0.000 | 31.650 | -113.133 |
| S- derecha | | 0.000 | 34.549 | -144.578 |
| 10 | 10 11 | | | |
| S-izquierda | | 0.000 | 34.549 | -144.578 |
| S- centro | | 0.000 | 37.449 | -178.777 |
| S- derecha | | 0.000 | 40.348 | -215.731 |
| 11 | 111 12 | | | |
| S-izquierda | | 0.000 | -47.443 | -215.731 |
| S- centro | | 0.000 | -42.699 | -145.667 |
| S- derecha | | 0.000 | -37.955 | -82.979 |
| 12 | 12 13 | | | |
| S-izquierda | | 0.000 | -37.955 | -82.979 |
| S- centro | | 0.000 | -33.210 | -27.666 |
| S- derecha | | 0.000 | -28.466 | 20.272 |
| 13 | 13 14 | | | |
| S-izquierda | | 0.000 | -28.466 | 20.272 |
| S- centro | | 0.000 | -23.722 | 60.834 |
| S- derecha | | 0.000 | -18.977 | 94.022 |
| 14 | 14 15 | | | |
| S-izquierda | | 0.000 | -18.977 | 94.022 |
| S- centro | | 0.000 | -14.233 | 119.835 |
| S- derecha | | 0.000 | -9.489 | 138.273 |

| | | | |
|---|---|---|---|
| **15 15 16** | | | |
| **S-izquierda** | 0.000 | -9.489 | 138.273 |
| **S- centro** | 0.000 | -4.744 | 149.335 |
| **S- derecha** | 0.000 | -0.000 | 153.023 |
| **16 16 17** | | | |
| **S-izquierda** | 0.000 | -0.000 | 153.023 |
| **S- centro** | 0.000 | 4.744 | 149.335 |
| **S- derecha** | 0.000 | 9.489 | 138.273 |
| **17 17 18** | | | |
| **S-izquierda** | 0.000 | 9.489 | 138.273 |
| **S- centro** | 0.000 | 14.233 | 119.835 |
| **S- derecha** | 0.000 | 18.977 | 94.022 |
| **18 18 19** | | | |
| **S-izquierda** | 0.000 | 18.977 | 94.022 |
| **S- centro** | 0.000 | 23.722 | 60.834 |
| **S- derecha** | 0.000 | 28.466 | 20.272 |
| **19 19 20** | | | |
| **S-izquierda** | 0.000 | 28.466 | 20.272 |
| **S- centro** | 0.000 | 33.210 | -27.666 |
| **S- derecha** | 0.000 | 37.955 | -82.979 |
| **20 20 21** | | | |
| **S-izquierda** | 0.000 | 37.955 | -82.979 |
| **S- centro** | 0.000 | 42.699 | -145.667 |
| **S- derecha** | 0.000 | 47.443 | -215.731 |
| **21 121 22** | | | |
| **S-izquierda** | 0.000 | -40.348 | -215.731 |
| **S- centro** | 0.000 | -37.449 | -178.777 |
| **S- derecha** | 0.000 | -34.549 | -144.578 |
| **22 22 23** | | | |
| **S-izquierda** | 0.000 | -34.549 | -144.578 |
| **S- centro** | 0.000 | -31.650 | -113.133 |
| **S- derecha** | 0.000 | -28.751 | -84.443 |
| **23 23 24** | | | |
| **S- zquierda** | 0.000 | -28.751 | -84.443 |
| **S- centro** | 0.000 | -25.851 | -58.507 |
| **S- derecha** | 0.000 | -22.952 | -35.325 |
| **24 24 25** | | | |
| **S-izquierda** | 0.000 | -22.952 | -35.325 |
| **S- centro** | 0.000 | -20.052 | -14.898 |
| **S- derecha** | 0.000 | -17.153 | 2.774 |
| **25 25 26** | | | |
| **S-izquierda** | 0.000 | -17.153 | 2.774 |
| **S- centro** | 0.000 | -14.254 | 17.692 |
| **S- derecha** | 0.000 | -11.354 | 29.856 |
| **26 26 27** | | | |
| **S-izquierda** | 0.000 | -11.354 | 29.856 |
| **S- centro** | 0.000 | -8.455 | 39.266 |
| **S- derecha** | 0.000 | -5.555 | 45.920 |
| **27 28** | | | |
| **S- quierda** | 0.000 | -5.555 | 45.920 |
| **S- centro** | 0.000 | -2.656 | 49.821 |
| **S- derecha** | 0.000 | .243 | 50.967 |
| **28 28 29** | | | |
| **S-izquierda** | 0.000 | .243 | 50.967 |
| **S- centro** | 0.000 | 3.143 | 49.358 |
| **S- derecha** | 0.000 | 6.042 | 44.996 |
| **29 29 30** | | | |
| **S-izquierda** | 0.000 | 6.042 | 44.996 |
| **S- centro** | 0.000 | 8.942 | 37.878 |
| **S- derecha** | 0.000 | 11.841 | 28.007 |
| **30 30 31** | | | |
| **S-izquierda** | 0.000 | 11.841 | 28.007 |
| **S- centro** | 0.000 | 14.740 | 15.381 |
| **S- derecha** | 0.000 | 17.640 | -0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 17.640 | 0.000 |
| 11 | 0.000 | 40.348 | 0.000 |
| 21 | 0.000 | 47.443 | 0.000 |
| 31 | 0.000 | 17.640 | 0.000 |
| 111 | 0.000 | 47.443 | 0.000 |
| 121 | 0.000 | 40.348 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | 215.731 |
| 121 | 0.000 | 0.000 | 215.731 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0]) ... (<1%)

*** BARRA (RESULTADOS) ***

Proyecto:
SUR RAMO XV AVE / E-1505.0

Comentario:
ESTRUCTURA IDEAL

Estado de Carga 4:
GCU

** MOVIMIENTOS NUDOS (Ejes Generales) **

ENVOLVENTE MAXIMA:

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | .000265 |
| [illegible] | -0.000000 | .000499 | .000258 |
| [illegible] | -0.000000 | .000968 | .000233 |
| 4 | -0.000000 | .001375 | .000193 |
| 5 | -0.000000 | .001692 | .000138 |
| 6 | -0.000000 | .001889 | .000103 |
| 7 | -0.000000 | .001938 | .000116 |
| 8 | -0.000000 | .001809 | .000204 |
| 9 | -0.000000 | .001467 | .000272 |
| 10 | -0.000000 | .000869 | .000307 |
| 11 | -0.000000 | 0.000000 | .000296 |
| 12 | -0.000000 | .000836 | .000242 |
| 13 | -0.000000 | .001488 | .000178 |
| 14 | -0.000000 | .001946 | .000117 |
| 15 | -0.000000 | .002218 | .000075 |
| 16 | -0.000000 | .002309 | .000136 |
| 17 | -0.000000 | .002218 | .000291 |
| 18 | -0.000000 | .001946 | .000505 |
| 19 | -0.000000 | .001488 | .000657 |
| 20 | -0.000000 | .000836 | .000675 |
| [illegible] | -0.000000 | 0.000000 | .000529 |
| [illegible] | -0.000000 | .000869 | .000389 |
| 23 | -0.000000 | .001467 | .000243 |
| 24 | -0.000000 | .001809 | .000120 |
| 25 | -0.000000 | .001938 | .000019 |
| 26 | -0.000000 | .001889 | .000021 |
| 27 | -0.000000 | .001692 | .000091 |
| 28 | -0.000000 | .001375 | .000189 |
| 29 | -0.000000 | .000968 | .000274 |
| 30 | -0.000000 | .000499 | .000334 |
| 31 | -0.000000 | 0.000000 | .000355 |
| 111 | -0.000000 | 0.000000 | .000296 |
| 121 | -0.000000 | 0.000000 | .000529 |

ENVOLVENTE MINIMA:

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.000355 |
| 2 | 0.000000 | -.000661 | -.000334 |
| 3 | 0.000000 | -.001243 | -.000274 |
| 4 | 0.000000 | -.001687 | -.000189 |
| 5 | 0.000000 | -.001954 | -.000091 |
| 6 | 0.000000 | -.002026 | -.000021 |
| 7 | 0.000000 | -.001901 | -.000019 |
| 8 | 0.000000 | -.001594 | -.000120 |
| 9 | 0.000000 | -.001137 | -.000243 |
| 10 | 0.000000 | -.000580 | -.000389 |
| 11 | 0.000000 | 0.000000 | -.000529 |
| 12 | 0.000000 | -.001918 | -.000675 |
| 13 | 0.000000 | -.004032 | -.000657 |
| 14 | 0.000000 | -.005869 | -.000505 |
| 15 | 0.000000 | -.007097 | -.000291 |
| 16 | 0.000000 | -.007529 | -.000136 |
| 17 | 0.000000 | -.007097 | -.000075 |
| 18 | 0.000000 | -.005869 | -.000117 |
| 19 | 0.000000 | -.004032 | -.000178 |
| 20 | 0.000000 | -.001918 | -.000242 |
| 21 | 0.000000 | 0.000000 | -.000296 |
| 22 | 0.000000 | -.000580 | -.000307 |
| 23 | 0.000000 | -.001137 | -.000272 |
| 24 | 0.000000 | -.001594 | -.000204 |
| 25 | 0.000000 | -.001901 | -.000116 |
| 26 | 0.000000 | -.002026 | -.000103 |
| 27 | 0.000000 | -.001954 | -.000138 |
| 28 | 0.000000 | -.001687 | -.000193 |
| 29 | 0.000000 | -.001243 | -.000233 |
| 30 | 0.000000 | -.000661 | -.000258 |
| 31 | 0.000000 | 0.000000 | -.000265 |
| 111 | 0.000000 | 0.000000 | -.000529 |
| 121 | 0.000000 | 0.000000 | -.000296 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

ENVOLVENTE MAXIMA:

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 | 1 2 | | | |
| S-izquierda | | -0.000 | 9.817 | 0.000 |
| S- centro | | -0.000 | 9.817 | 25.654 |
| S- derecha | | -0.000 | 10.189 | 48.384 |
| 2 | 2 3 | | | |
| S-izquierda | | -0.000 | 10.189 | 48.384 |
| S- centro | | -0.000 | 10.189 | 68.190 |
| S- derecha | | -0.000 | 11.303 | 85.072 |
| 3 | 3 4 | | | |
| S-izquierda | | -0.000 | 11.303 | 85.072 |
| S- centro | | -0.000 | 11.303 | 99.030 |
| S- derecha | | -0.000 | 13.145 | 110.063 |
| 4 | 4 5 | | | |
| S-izquierda | | -0.000 | 13.145 | 110.063 |
| S- centro | | -0.000 | 13.145 | 118.173 |
| S- derecha | | -0.000 | 15.697 | 123.358 |
| 5 | 5 6 | | | |

| | | | |
|---|---|---|---|
| S-izquierda | -0.000 | 15.697 | 123.358 |
| S- centro | -0.000 | 15.854 | 125.619 |
| S- derecha | -0.000 | 18.932 | 124.957 |
| 6 7 | | | |
| S-izquierda | -0.000 | 18.932 | 124.957 |
| S- centro | -0.000 | 19.736 | 121.370 |
| S- derecha | -0.000 | 22.814 | 114.859 |
| 7 7 8 | | | |
| S-izquierda | -0.000 | 22.814 | 114.859 |
| S- centro | -0.000 | 24.224 | 105.424 |
| S- derecha | -0.000 | 27.302 | 93.065 |
| 8 8 9 | | | |
| S-izquierda | -0.000 | 27.302 | 93.065 |
| S- centro | -0.000 | 29.268 | 77.781 |
| S- derecha | -0.000 | 32.346 | 59.574 |
| 9 9 10 | | | |
| S-izquierda | -0.000 | 32.346 | 59.574 |
| S- centro | -0.000 | 34.808 | 39.837 |
| S derecha | -0.000 | 37.886 | 26.823 |
| 10 10 11 | | | |
| S-izquierda | -0.000 | 37.886 | 26.823 |
| S- centro | -0.000 | 40.773 | 20.341 |
| S- derecha | -0.000 | 43.851 | 19.338 |
| 11 111 12 | | | |
| S-izquierda | -0.000 | 2.611 | 19.338 |
| S- centro | -0.000 | 2.611 | 18.419 |
| S- derecha | -0.000 | 2.929 | 25.080 |
| 12 12 13 | | | |
| S-izquierda | -0.000 | 2.929 | 25.080 |
| S- centro | -0.000 | 2.929 | 41.949 |
| S- derecha | -0.000 | 4.032 | 70.260 |
| 13 13 14 | | | |
| S-izquierda | -0.000 | 4.032 | 70.260 |
| S- centro | -0.000 | 4.032 | 107.078 |
| S- derecha | -0.000 | 6.118 | 142.310 |
| 14 14 15 | | | |
| S-izquierda | -0.000 | 6.118 | 142.310 |
| S- centro | -0.000 | 6.118 | 169.713 |
| S- derecha | -0.000 | 9.331 | 189.287 |
| 15 15 16 | | | |
| S-izquierda | -0.000 | 9.331 | 189.287 |
| S- centro | -0.000 | 9.331 | 201.031 |
| S- derecha | -0.000 | 13.750 | 204.945 |
| 16 16 17 | | | |
| S-izquierda | -0.000 | 13.750 | 204.945 |
| S- centro | -0.000 | 14.367 | 201.031 |
| S- derecha | -0.000 | 19.404 | 189.287 |
| 17 17 18 | | | |
| S-izquierda | -0.000 | 19.404 | 189.287 |
| S- centro | -0.000 | 21.228 | 169.713 |
| S- derecha | -0.000 | 26.265 | 142.310 |
| 18 18 19 | | | |
| S-izquierda | -0.000 | 26.265 | 142.310 |
| S- centro | -0.000 | 29.214 | 107.078 |
| S- derecha | -0.000 | 34.251 | 70.260 |
| 19 19 20 | | | |
| S-izquierda | -0.000 | 34.251 | 70.260 |
| S- centro | -0.000 | 38.185 | 41.949 |
| S- derecha | -0.000 | 43.222 | 25.080 |
| 20 20 21 | | | |
| S-izquierda | -0.000 | 43.222 | 25.080 |
| S- centro | -0.000 | 47.940 | 18.419 |
| S- derecha | -0.000 | 52.977 | 19.338 |
| 21 121 22 | | | |
| S-izquierda | -0.000 | 1.018 | 19.338 |
| S- centro | -0.000 | 1.018 | 20.341 |
| S- derecha | -0.000 | 1.208 | 26.823 |
| 22 22 23 | | | |
| S-izquierda | -0.000 | 1.208 | 26.823 |
| S- centro | -0.000 | 1.208 | 39.837 |
| S- derecha | -0.000 | 1.825 | 59.574 |
| 23 23 24 | | | |
| S-izquierda | -0.000 | 1.825 | 59.574 |
| S- centro | -0.000 | 1.825 | 77.781 |
| S- derecha | -0.000 | 2.937 | 93.065 |
| 24 24 25 | | | |
| S-izquierda | -0.000 | 2.937 | 93.065 |
| S- centro | -0.000 | 2.937 | 105.424 |
| S- derecha | -0.000 | 4.604 | 114.859 |
| 25 25 26 | | | |
| S-izquierda | -0.000 | 4.604 | 114.859 |
| S- centro | -0.000 | 4.604 | 121.370 |
| S- derecha | -0.000 | 6.878 | 124.957 |
| 26 26 27 | | | |
| S-izquierda | -0.000 | 6.878 | 124.957 |
| S- centro | -0.000 | 6.878 | 125.619 |
| S- derecha | -0.000 | 9.800 | 123.358 |
| 27 27 28 | | | |
| S-izquierda | -0.000 | 9.800 | 123.358 |
| S- centro | -0.000 | 10.326 | 118.173 |
| S- derecha | -0.000 | 13.404 | 110.063 |
| 28 28 29 | | | |
| S-izquierda | -0.000 | 13.404 | 110.063 |
| S- centro | -0.000 | 14.639 | 99.030 |
| S- derecha | -0.000 | 17.717 | 85.072 |
| 29 29 30 | | | |
| S-izquierda | -0.000 | 17.717 | 85.072 |
| S- centro | -0.000 | 19.682 | 68.190 |
| S- derecha | -0.000 | 22.760 | 48.384 |
| 30 30 31 | | | |
| S-izquierda | -0.000 | 22.760 | 48.384 |
| S- centro | -0.000 | 25.465 | 25.654 |
| S- derecha | -0.000 | 28.543 | 0.000 |

Nota:Los esfuerzos se refieren a los extremos del elemento,excluyendo zonas rigidas en nudos de tamaño finito

ENVOLVENTE MINIMA:

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 1 2 | | | | |
| S-izquierda | | 0.000 | -28.543 | -0.000 |
| S- centro | | 0.000 | -25.465 | -9.326 |
| S- derecha | | 0.000 | -22.760 | -18.652 |
| 2 2 3 | | | | |
| S-izquierda | | 0.000 | -22.760 | -18.652 |
| S- centro | | 0.000 | -19.682 | -27.978 |
| S- derecha | | 0.000 | -17.717 | -37.305 |
| 3 3 4 | | | | |
| S-izquierda | | 0.000 | -17.717 | -37.305 |
| S- centro | | 0.000 | -14.639 | -46.631 |
| S- derecha | | 0.000 | -13.404 | -55.957 |
| 4 4 5 | | | | |
| S-izquierda | | 0.000 | -13.404 | -55.957 |
| S- centro | | 0.000 | -10.326 | -65.283 |
| S- derecha | | 0.000 | -9.800 | -74.609 |
| 5 5 6 | | | | |
| S-izquierda | | 0.000 | -9.800 | -74.609 |
| S- centro | | 0.000 | -6.878 | -83.935 |
| S- derecha | | 0.000 | -6.878 | -93.261 |
| 6 6 7 | | | | |
| S-izquierda | | 0.000 | -6.878 | -93.261 |
| S- centro | | 0.000 | -4.604 | -102.588 |
| S- derecha | | 0.000 | -4.604 | -111.914 |
| 7 7 8 | | | | |
| S-izquierda | | 0.000 | -4.604 | -111.914 |
| S- centro | | 0.000 | -2.937 | -121.240 |
| S- derecha | | 0.000 | -2.937 | -130.566 |
| 8 8 9 | | | | |
| S-izquierda | | 0.000 | -2.937 | -130.566 |
| S- centro | | 0.000 | -1.825 | -139.892 |
| S- derecha | | 0.000 | -1.825 | -149.218 |
| 9 9 10 | | | | |
| S-izquierda | | 0.000 | -1.825 | -149.218 |
| S- centro | | 0.000 | -1.208 | -159.939 |
| S- derecha | | 0.000 | -1.208 | -180.307 |
| 10 10 11 | | | | |
| S- quierda | | 0.000 | -1.208 | -180.307 |
| S- centro | | 0.000 | -1.018 | -210.131 |
| S- derecha | | 0.000 | -1.018 | -248.358 |
| 11 111 12 | | | | |
| S-izquierda | | 0.000 | -52.977 | -248.358 |
| S- centro | | 0.000 | -47.940 | -173.059 |
| S- derecha | | 0.000 | -43.222 | -113.171 |
| 12 12 13 | | | | |
| S-izquierda | | 0.000 | -43.222 | -113.171 |
| S- centro | | 0.000 | -38.185 | -71.319 |
| S- derecha | | 0.000 | -34.251 | -48.740 |
| 13 13 14 | | | | |
| S-izquierda | | 0.000 | -34.251 | -48.740 |
| S- centro | | 0.000 | -29.214 | -42.497 |
| S- derecha | | 0.000 | -26.265 | -42.497 |
| 14 14 15 | | | | |
| S-izquierda | | 0.000 | -26.265 | -42.497 |
| S- centro | | 0.000 | -21.228 | -42.497 |
| S- derecha | | 0.000 | -19.404 | -42.497 |
| 15 15 16 | | | | |
| S-izquierda | | 0.000 | -19.404 | -42.497 |
| S- centro | | 0.000 | -14.367 | -42.497 |
| S- derecha | | 0.000 | -13.750 | -42.497 |
| 16 16 17 | | | | |
| S-izquierda | | 0.000 | -13.750 | -42.497 |
| S- centro | | 0.000 | -9.331 | -42.497 |
| S- derecha | | 0.000 | -9.331 | -42.497 |
| 17 17 18 | | | | |
| S-izquierda | | 0.000 | -9.331 | -42.497 |
| S- centro | | 0.000 | -6.118 | -42.497 |
| S- derecha | | 0.000 | -6.118 | -42.497 |
| 18 18 19 | | | | |
| S-izquierda | | 0.000 | -6.118 | -42.497 |
| S- centro | | 0.000 | -4.032 | -42.497 |
| S- derecha | | 0.000 | -4.032 | -48.740 |
| 19 19 20 | | | | |
| S-izquierda | | 0.000 | -4.032 | -48.740 |
| S- centro | | 0.000 | -2.929 | -71.319 |
| S- derecha | | 0.000 | -2.929 | -113.171 |
| 20 20 21 | | | | |
| S-izquierda | | 0.000 | -2.929 | -113.171 |
| S- centro | | 0.000 | -2.611 | -173.059 |
| S- derecha | | 0.000 | -2.611 | -248.358 |
| 21 121 22 | | | | |
| S-izquierda | | 0.000 | -43.851 | -248.358 |
| S- centro | | 0.000 | -40.773 | -210.131 |
| S- derecha | | 0.000 | -37.886 | -180.307 |
| 22 22 23 | | | | |
| S-izquierda | | 0.000 | -37.886 | -180.307 |
| S- centro | | 0.000 | -34.808 | -159.939 |
| S- derecha | | 0.000 | -32.346 | -149.218 |
| 23 23 24 | | | | |
| S-izquierda | | 0.000 | -32.346 | -149.218 |
| S- centro | | 0.000 | -29.268 | -139.892 |
| S- derecha | | 0.000 | -27.302 | -130.566 |

| | | | |
|---|---|---|---|
| 24 24 25 | | | |
| S-izquierda | 0.000 | -27.302 | -130.566 |
| S- centro | 0.000 | -24.224 | -121.240 |
| S- derecha | 0.000 | -22.814 | -111.914 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | -22.814 | -111.914 |
| S- centro | 0.000 | -19.736 | -102.588 |
| S- derecha | 0.000 | -18.932 | -93.261 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | -18.932 | -93.261 |
| S- centro | 0.000 | -15.854 | -83.935 |
| S- derecha | 0.000 | -15.697 | -74.609 |
| 27 27 28 | | | |
| S-izquierda | 0.000 | -15.697 | -74.609 |
| S- centro | 0.000 | -13.145 | -65.283 |
| S- derecha | 0.000 | -13.145 | -55.957 |
| 28 28 29 | | | |
| S -quierda | 0.000 | -13.145 | -55.957 |
| S- centro | 0.000 | -11.303 | -46.631 |
| S- derecha | 0.000 | -11.303 | -37.305 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | -11.303 | -37.305 |
| S- centro | 0.000 | -10.189 | -27.978 |
| S- derecha | 0.000 | -10.189 | -18.652 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | -10.189 | -18.652 |
| S- centro | 0.000 | -9.817 | -9.326 |
| S- derecha | 0.000 | -9.817 | -0.000 |

Nota:Los esfuerzos se refieren a los extremos del elemento,excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

ENVOLVENTE MAXIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | -0.000 | 28.543 | 0.000 |
| 11 | 0.000 | 43.851 | 0.000 |
| 21 | 0.000 | 52.977 | 0.000 |
| 31 | 0.000 | 28.543 | 0.000 |
| 111 | 0.000 | 52.977 | 0.000 |
| 121 | 0.000 | 43.851 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

EN LVENTE MAXIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | -0.000 | 0.000 | 248.358 |
| 121 | -0.000 | 0.000 | 248.358 |

** REACCIONES EXTERIORES (Ejes Generales) **

ENVOLVENTE MINIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | -9.817 | 0.000 |
| 11 | 0.000 | -1.018 | 0.000 |
| 21 | 0.000 | -2.611 | 0.000 |
| 31 | 0.000 | -9.817 | 0.000 |
| 111 | 0.000 | -2.611 | 0.000 |
| 121 | 0.000 | -1.018 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

ENVOLVENTE MINIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | -19.338 |
| 121 | 0.000 | 0.000 | -19.338 |

Nota:Se han controlado Errores de Cierre en Nudos y Reacciones(respecto a [0,0])...(<1%)

*** BARRA (RESULTADOS) ***

P vecto:
SU. RAMO XV AVE / E-1505.0

Comentario:
ESTRUCTURA IDEAL

Estado de Carga 5:
VP

** MOVIMIENTOS NUDOS (Ejes Generales) **

ENVOLVENTE MAXIMA:

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | .000255 |
| 2 | 0.000000 | .000480 | .000248 |
| 3 | 0.000000 | .000930 | .000224 |
| 4 | 0.000000 | .001321 | .000185 |
| 5 | 0.000000 | .001626 | .000133 |
| 6 | 0.000000 | .001816 | .000094 |
| 7 | 0.000000 | .001863 | .000214 |
| 8 | 0.000000 | .001738 | .000316 |
| 9 | 0.000000 | .001409 | .000383 |
| 10 | 0.000000 | .000835 | .000398 |
| 11 | 0.000000 | 0.000000 | .000355 |
| 12 | 0.000000 | .000931 | .000246 |
| 13 | 0.000000 | .001519 | .000136 |
| 14 | 0.000000 | .001801 | .000123 |
| 15 | 0.000000 | .001841 | .000105 |
| 16 | 0.000000 | .001698 | .000162 |
| 17 | 0.000000 | .001841 | .000370 |
| 18 | 0.000000 | .001801 | .000561 |
| 19 | 0.000000 | .001519 | .000675 |
| 20 | 0.000000 | .000931 | .000663 |
| 1 | 0.000000 | 0.000000 | .000508 |
| . . | 0.000000 | .000835 | .000374 |
| 23 | 0.000000 | .001409 | .000234 |
| 24 | 0.000000 | .001738 | .000116 |
| 25 | 0.000000 | .001863 | .000018 |
| 26 | 0.000000 | .001816 | .000044 |
| 27 | 0.000000 | .001626 | .000156 |
| 28 | 0.000000 | .001321 | .000282 |
| 29 | 0.000000 | .000930 | .000393 |
| 30 | 0.000000 | .000480 | .000471 |
| 31 | 0.000000 | 0.000000 | .000495 |
| 111 | 0.000000 | 0.000000 | .000355 |
| 121 | 0.000000 | 0.000000 | .000508 |

EN LVENTE MINIMA:

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | -.000495 |
| 2 | 0.000000 | -.000926 | -.000471 |
| 3 | 0.000000 | -.001752 | -.000393 |
| 4 | 0.000000 | -.002387 | -.000282 |
| 5 | 0.000000 | -.002753 | -.000156 |
| 6 | 0.000000 | -.002839 | -.000044 |
| 7 | 0.000000 | -.002616 | -.000018 |
| 8 | 0.000000 | -.002134 | -.000116 |
| 9 | 0.000000 | -.001472 | -.000234 |
| 10 | 0.000000 | -.000725 | -.000374 |
| 11 | 0.000000 | 0.000000 | -.000508 |
| 12 | 0.000000 | -.001856 | -.000663 |
| 13 | 0.000000 | -.003973 | -.000675 |
| 14 | 0.000000 | -.005856 | -.000561 |
| 15 | 0.000000 | -.007189 | -.000370 |
| 16 | 0.000000 | -.007664 | -.000162 |
| 17 | 0.000000 | -.007189 | -.000105 |
| 18 | 0.000000 | -.005856 | -.000123 |
| 19 | 0.000000 | -.003973 | -.000136 |
| 20 | 0.000000 | -.001856 | -.000246 |
| 21 | 0.000000 | 0.000000 | -.000355 |
| 22 | 0.000000 | -.000725 | -.000398 |
| 23 | 0.000000 | -.001472 | -.000383 |
| 24 | 0.000000 | -.002134 | -.000316 |
| 25 | 0.000000 | -.002616 | -.000214 |
| 26 | 0.000000 | -.002839 | -.000094 |
| 27 | 0.000000 | -.002753 | -.000133 |
| 28 | 0.000000 | -.002387 | -.000185 |
| 29 | 0.000000 | -.001752 | -.000224 |
| 30 | 0.000000 | -.000926 | -.000248 |
| 31 | 0.000000 | 0.000000 | -.000255 |
| 111 | 0.000000 | 0.000000 | -.000508 |
| 121 | 0.000000 | 0.000000 | -.000355 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

ENVOLVENTE MAXIMA:

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 1 2 | | | | |
| S-izquierda | | 0.000 | 9.434 | 0.000 |
| S- centro | | 0.000 | 9.434 | 45.667 |
| S- derecha | | 0.000 | 9.434 | 89.480 |
| 2 2 3 | | | | |
| S-izquierda | | 0.000 | 9.434 | 89.480 |
| S- centro | | 0.000 | 9.434 | 122.707 |
| S- derecha | | 0.000 | 9.434 | 152.188 |
| 3 3 4 | | | | |
| S-izquierda | | 0.000 | 9.434 | 152.188 |
| S- centro | | 0.000 | 9.434 | 173.439 |
| S- derecha | | 0.000 | 15.885 | 189.988 |
| 4 4 5 | | | | |
| S-izquierda | | 0.000 | 15.885 | 189.988 |
| S- centro | | 0.000 | 15.885 | 201.904 |
| S- derecha | | 0.000 | 22.851 | 211.788 |
| 5 5 6 | | | | |

| | | | |
|---|---|---|---|
| S-izquierda | 0.000 | 22.851 | 211.788 |
| S- centro | 0.000 | 22.851 | 209.013 |
| S- derecha | 0.000 | 29.574 | 210.666 |
| 6 6 7 | | | |
| S-izquierda | 0.000 | 29.574 | 210.666 |
| S- centro | 0.000 | 29.574 | 198.940 |
| S- derecha | 0.000 | 35.983 | 189.173 |
| 7 7 8 | | | |
| S-izquierda | 0.000 | 35.983 | 189.173 |
| S- centro | 0.000 | 35.983 | 170.229 |
| S- derecha | 0.000 | 42.002 | 150.463 |
| 8 8 9 | | | |
| S-izquierda | 0.000 | 42.002 | 150.463 |
| S- centro | 0.000 | 42.002 | 125.731 |
| S- derecha | 0.000 | 47.554 | 99.117 |
| 9 9 10 | | | |
| S-izquierda | 0.000 | 47.554 | 99.117 |
| S- centro | 0.000 | 47.554 | 69.074 |
| S derecha | 0.000 | 52.547 | 37.708 |
| 10 10 11 | | | |
| S-izquierda | 0.000 | 52.547 | 37.708 |
| S- centro | 0.000 | 52.547 | 27.019 |
| S- derecha | 0.000 | 56.899 | 28.441 |
| 11 111 12 | | | |
| S-izquierda | 0.000 | 3.840 | 28.441 |
| S- centro | 0.000 | 3.840 | 22.472 |
| S- derecha | 0.000 | 3.840 | 55.289 |
| 12 12 13 | | | |
| S-izquierda | 0.000 | 3.840 | 55.289 |
| S- centro | 0.000 | 4.115 | 97.189 |
| S- derecha | 0.000 | 6.704 | 138.266 |
| 13 13 14 | | | |
| S-izquierda | 0.000 | 6.704 | 138.266 |
| S centro | 0.000 | 9.407 | 175.558 |
| S- derecha | 0.000 | 12.569 | 208.586 |
| 14 14 15 | | | |
| S-izquierda | 0.000 | 12.569 | 208.586 |
| S- centro | 0.000 | 15.723 | 235.014 |
| S- derecha | 0.000 | 19.271 | 255.065 |
| 15 15 16 | | | |
| S-izquierda | 0.000 | 19.271 | 255.065 |
| S- centro | 0.000 | 22.700 | 266.710 |
| S- derecha | 0.000 | 26.456 | 271.233 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | 26.456 | 271.233 |
| S- centro | 0.000 | 30.000 | 266.710 |
| S- derecha | 0.000 | 33.796 | 255.065 |
| 17 17 18 | | | |
| S zquierda | 0.000 | 33.796 | 255.065 |
| S- centro | 0.000 | 37.300 | 235.014 |
| S- derecha | 0.000 | 40.969 | 208.586 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | 40.969 | 208.586 |
| S- centro | 0.000 | 44.277 | 175.558 |
| S- derecha | 0.000 | 47.649 | 138.266 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | 47.649 | 138.266 |
| S- centro | 0.000 | 50.593 | 97.189 |
| S- derecha | 0.000 | 53.479 | 55.289 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | 53.479 | 55.289 |
| S- centro | 0.000 | 55.885 | 22.472 |
| S- derecha | 0.000 | 58.126 | 28.441 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | 1.497 | 28.441 |
| S- centro | 0.000 | 1.497 | 27.019 |
| S- derecha | 0.000 | 1.497 | 37.708 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | 1.497 | 37.708 |
| S- centro | 0.000 | 1.497 | 69.074 |
| S- derecha | 0.000 | 4.848 | 99.117 |
| 23 23 24 | | | |
| S-izquierda | 0.000 | 4.848 | 99.117 |
| S- centro | 0.000 | 4.848 | 125.731 |
| S- derecha | 0.000 | 9.476 | 150.463 |
| 24 24 25 | | | |
| S-izquierda | 0.000 | 9.476 | 150.463 |
| S- centro | 0.000 | 9.476 | 170.229 |
| S- derecha | 0.000 | 14.715 | 189.173 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | 14.715 | 189.173 |
| S- centro | 0.000 | 14.715 | 198.940 |
| S- derecha | 0.000 | 20.474 | 210.666 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | 20.474 | 210.666 |
| S- centro | 0.000 | 20.474 | 209.013 |
| S- derecha | 0.000 | 26.666 | 211.788 |
| 27 27 28 | | | |
| S-izquierda | 0.000 | 26.666 | 211.788 |
| S- centro | 0.000 | 26.666 | 201.904 |
| S- derecha | 0.000 | 33.216 | 189.988 |
| 28 28 29 | | | |
| S-izquierda | 0.000 | 33.216 | 189.988 |
| S- centro | 0.000 | 33.216 | 173.439 |
| S- derecha | 0.000 | 40.049 | 152.188 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | 40.049 | 152.188 |
| S- centro | 0.000 | 40.049 | 122.707 |
| S- derecha | 0.000 | 47.095 | 89.480 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | 47.095 | 89.480 |
| S- centro | 0.000 | 47.095 | 45.667 |
| S- derecha | 0.000 | 54.278 | 0.000 |

Nota:Los esfuerzos se refieren a los extremos del elemento,excluyendo zonas rigidas en nudos de tamaño finito

ENVOLVENTE MINIMA:

| Nel N-i N-d | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|
| 1 1 2 | | | |
| S-izquierda | 0.000 | -54.278 | -0.000 |
| S- centro | 0.000 | -47.095 | -8.962 |
| S- derecha | 0.000 | -47.095 | -17.925 |
| 2 2 3 | | | |
| S-izquierda | 0.000 | -47.095 | -17.925 |
| S- centro | 0.000 | -40.049 | -26.887 |
| S derecha | 0.000 | -40.049 | -35.849 |
| 3 3 4 | | | |
| S-izquierda | 0.000 | -40.049 | -35.849 |
| S- centro | 0.000 | -33.216 | -44.812 |
| S- derecha | 0.000 | -33.216 | -53.774 |
| 4 4 5 | | | |
| S-izquierda | 0.000 | -33.216 | -53.774 |
| S- centro | 0.000 | -26.666 | -62.736 |
| S- derecha | 0.000 | -26.666 | -71.699 |
| 5 5 6 | | | |
| S-izquierda | 0.000 | -26.666 | -71.699 |
| S- centro | 0.000 | -20.474 | -80.661 |
| S- derecha | 0.000 | -20.474 | -89.623 |
| 6 6 7 | | | |
| S-izquierda | 0.000 | -20.474 | -89.623 |
| S- centro | 0.000 | -14.715 | -98.586 |
| S- derecha | 0.000 | -14.715 | -107.548 |
| 7 7 8 | | | |
| S-izquierda | 0.000 | -14.715 | -107.548 |
| S- centro | 0.000 | -9.476 | -116.510 |
| S- derecha | 0.000 | -9.476 | -125.473 |
| 8 8 9 | | | |
| S-izquierda | 0.000 | -9.476 | -125.473 |
| S- centro | 0.000 | -4.848 | -134.435 |
| S- derecha | 0.000 | -4.848 | -143.397 |
| 9 9 10 | | | |
| S-izquierda | 0.000 | -4.848 | -143.397 |
| S- centro | 0.000 | -1.497 | -152.360 |
| S- derecha | 0.000 | -1.497 | -161.322 |
| 10 10 11 | | | |
| S- quierda | 0.000 | -1.497 | -161.322 |
| S- centro | 0.000 | -1.497 | -170.284 |
| S- derecha | 0.000 | -1.497 | -179.247 |
| 11 111 12 | | | |
| S-izquierda | 0.000 | -58.126 | -179.247 |
| S- centro | 0.000 | -55.885 | -121.599 |
| S- derecha | 0.000 | -53.479 | -79.003 |
| 12 12 13 | | | |
| S-izquierda | 0.000 | -53.479 | -79.003 |
| S- centro | 0.000 | -50.593 | -73.034 |
| S- derecha | 0.000 | -47.649 | -67.065 |
| 13 13 14 | | | |
| S-izquierda | 0.000 | -47.649 | -67.065 |
| S- centro | 0.000 | -44.277 | -61.096 |
| S- derecha | 0.000 | -40.969 | -55.126 |
| 14 14 15 | | | |
| S-izquierda | 0.000 | -40.969 | -55.126 |
| S- centro | 0.000 | -37.300 | -49.157 |
| S- derecha | 0.000 | -33.796 | -43.188 |
| 15 15 16 | | | |
| S-izquierda | 0.000 | -33.796 | -43.188 |
| S- centro | 0.000 | -30.000 | -37.219 |
| S- derecha | 0.000 | -26.456 | -31.250 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | -26.456 | -31.250 |
| S- centro | 0.000 | -22.700 | -37.219 |
| S- derecha | 0.000 | -19.271 | -43.188 |
| 17 17 18 | | | |
| S-izquierda | 0.000 | -19.271 | -43.188 |
| S- centro | 0.000 | -15.723 | -49.157 |
| S- derecha | 0.000 | -12.569 | -55.126 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | -12.569 | -55.126 |
| S- centro | 0.000 | -9.407 | -61.096 |
| S- derecha | 0.000 | -6.704 | -67.065 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | -6.704 | -67.065 |
| S- centro | 0.000 | -4.115 | -73.034 |
| S- derecha | 0.000 | -3.840 | -79.003 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | -3.840 | -79.003 |
| S- centro | 0.000 | -3.840 | -121.599 |
| S- derecha | 0.000 | -3.840 | -179.247 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | -56.899 | -179.247 |
| S- centro | 0.000 | -52.547 | -170.284 |
| S- derecha | 0.000 | -52.547 | -161.322 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | -52.547 | -161.322 |
| S- centro | 0.000 | -47.554 | -152.360 |
| S- derecha | 0.000 | -47.554 | -143.397 |
| 23 23 24 | | | |
| S-izquierda | 0.000 | -47.554 | -143.397 |
| S- centro | 0.000 | -42.002 | -134.435 |
| S- derecha | 0.000 | -42.002 | -125.473 |

| | | | |
|---|---|---|---|
| 24 24 25 | | | |
| S-izquierda | 0.000 | -42.002 | -125.473 |
| S centro | 0.000 | -35.983 | -116.510 |
| S- derecha | 0.000 | -35.983 | -107.548 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | -35.983 | -107.548 |
| S- centro | 0.000 | -29.574 | -98.586 |
| S- derecha | 0.000 | -29.574 | -89.623 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | -29.574 | -89.623 |
| S- centro | 0.000 | -22.851 | -80.661 |
| S- derecha | 0.000 | -22.851 | -71.699 |
| 27 27 28 | | | |
| S-izquierda | 0.000 | -22.851 | -71.699 |
| S- centro | 0.000 | -15.885 | -62.736 |
| S- derecha | 0.000 | -15.885 | -53.774 |
| 28 28 29 | | | |
| S -quierda | 0.000 | -15.885 | -53.774 |
| S- centro | 0.000 | -9.434 | -44.812 |
| S- derecha | 0.000 | -9.434 | -35.849 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | -9.434 | -35.849 |
| S- centro | 0.000 | -9.434 | -26.887 |
| S- derecha | 0.000 | -9.434 | -17.925 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | -9.434 | -17.925 |
| S- centro | 0.000 | -9.434 | -8.962 |
| S- derecha | 0.000 | -9.434 | -0.000 |

Nota:Los esfuerzos se refieren a los extremos del elemento,excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

ENVOLVENTE MAXIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 54.278 | 0.000 |
| 11 | 0.000 | 56.899 | 0.000 |
| 21 | 0.000 | 58.126 | 0.000 |
| 31 | 0.000 | 54.278 | 0.000 |
| 111 | 0.000 | 58.126 | 0.000 |
| 121 | 0.000 | 56.899 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

EN LVENTE MAXIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | 179.247 |
| 121 | 0.000 | 0.000 | 179.247 |

** REACCIONES EXTERIORES (Ejes Generales) **

ENVOLVENTE MINIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | -9.434 | 0.000 |
| 11 | 0.000 | -1.497 | 0.000 |
| 21 | 0.000 | -3.840 | 0.000 |
| 31 | 0.000 | -9.434 | 0.000 |
| 111 | 0.000 | -3.840 | 0.000 |
| 121 | 0.000 | -1.497 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

ENVOLVENTE MINIMA:

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | -28.441 |
| 121 | 0.000 | 0.000 | -28.441 |

Nota:Se han controlado Errores de Cierre en Nudos y Reacciones(respecto a [0,0])...(<1%)

*** BARRA (RESULTADOS) ***

Proyecto:
SUBRAMO XV AVE / E-1505.0

Comentario:
ESTRUCTURA IDEAL

Estado de Carga 6:
GRADIENTE TERMICO

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | .000444 |
| 2 | 0.000000 | .000713 | .000308 |
| 3 | 0.000000 | .001184 | .000190 |
| 4 | 0.000000 | .001445 | .000088 |
| [illegible] | 0.000000 | .001527 | .000001 |
| [illegible] | 0.000000 | .001459 | -.000070 |
| 7 | 0.000000 | .001271 | -.000125 |
| 8 | 0.000000 | .000995 | -.000163 |
| 9 | 0.000000 | .000667 | -.000180 |
| 10 | 0.000000 | .000329 | -.000173 |
| 11 | 0.000000 | 0.000000 | -.000172 |
| 12 | 0.000000 | -.000511 | -.000157 |
| 13 | 0.000000 | -.000915 | -.000102 |
| 14 | 0.000000 | -.001166 | -.000060 |
| 15 | 0.000000 | -.001306 | -.000030 |
| 16 | 0.000000 | -.001353 | -0.000000 |
| 17 | 0.000000 | -.001306 | .000030 |
| 18 | 0.000000 | -.001166 | .000060 |
| 19 | 0.000000 | -.000915 | .000102 |
| 20 | 0.000000 | -.000511 | .000157 |
| 21 | 0.000000 | 0.000000 | .000172 |
| 22 | 0.000000 | .000329 | .000173 |
| 23 | 0.000000 | .000667 | .000180 |
| [illegible] | 0.000000 | .000995 | .000163 |
| [illegible] | 0.000000 | .001271 | .000125 |
| 26 | 0.000000 | .001459 | .000070 |
| 27 | 0.000000 | .001527 | -.000001 |
| 28 | 0.000000 | .001445 | -.000088 |
| 29 | 0.000000 | .001184 | -.000190 |
| 30 | 0.000000 | .000713 | -.000308 |
| 31 | 0.000000 | 0.000000 | -.000444 |
| 111 | 0.000000 | 0.000000 | -.000172 |
| 121 | 0.000000 | 0.000000 | .000172 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel N-i N-d | | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|
| 1 1 2 | | | | |
| [illegible]-izquierda | | 0.000 | -10.174 | 0.000 |
| S- | centro | 0.000 | -10.174 | 9.665 |
| S- | derecha | 0.000 | -10.174 | 19.330 |
| 2 2 3 | | | | |
| S-izquierda | | 0.000 | -10.174 | 19.330 |
| S- | centro | 0.000 | -10.174 | 28.996 |
| S- | derecha | 0.000 | -10.174 | 38.661 |
| 3 3 4 | | | | |
| S-izquierda | | 0.000 | -10.174 | 38.661 |
| S- | centro | 0.000 | -10.174 | 48.326 |
| S- | derecha | 0.000 | -10.174 | 57.991 |
| 4 4 5 | | | | |
| S-izquierda | | 0.000 | -10.174 | 57.991 |
| S- | centro | 0.000 | -10.174 | 67.656 |
| S- | derecha | 0.000 | -10.174 | 77.321 |
| 5 5 6 | | | | |
| S-izquierda | | 0.000 | -10.174 | 77.321 |
| S- | centro | 0.000 | -10.174 | 86.987 |
| S- | derecha | 0.000 | -10.174 | 96.652 |
| 6 6 7 | | | | |
| S-izquierda | | 0.000 | -10.174 | 96.652 |
| S- | centro | 0.000 | -10.174 | 106.317 |
| S- | derecha | 0.000 | -10.174 | 115.982 |
| 7 7 8 | | | | |
| S-izquierda | | 0.000 | -10.174 | 115.982 |
| S- | centro | 0.000 | -10.174 | 125.647 |
| S- | derecha | 0.000 | -10.174 | 135.312 |
| 8 8 9 | | | | |
| S-izquierda | | 0.000 | -10.174 | 135.312 |
| S- | centro | 0.000 | -10.174 | 144.978 |
| S- | derecha | 0.000 | -10.174 | 154.643 |
| 9 9 10 | | | | |
| S-izquierda | | 0.000 | -10.174 | 154.643 |
| S- | centro | 0.000 | -10.174 | 164.308 |
| S- | derecha | 0.000 | -10.174 | 173.973 |
| 10 10 11 | | | | |
| S-izquierda | | 0.000 | -10.174 | 173.973 |
| S- | centro | 0.000 | -10.174 | 183.638 |
| S- | derecha | 0.000 | -10.174 | 193.303 |
| 11 111 12 | | | | |
| [illegible]-izquierda | | 0.000 | -0.000 | 193.303 |
| S- | centro | 0.000 | -0.000 | 193.303 |
| S- | derecha | 0.000 | -0.000 | 193.303 |
| 12 12 13 | | | | |
| S-izquierda | | 0.000 | -0.000 | 193.303 |
| S- | centro | 0.000 | -0.000 | 193.303 |
| S- | derecha | 0.000 | -0.000 | 193.303 |
| 13 13 14 | | | | |
| [illegible]-izquierda | | 0.000 | -0.000 | 193.303 |
| S- | centro | 0.000 | -0.000 | 193.303 |
| S- | derecha | 0.000 | -0.000 | 193.303 |
| 14 14 15 | | | | |
| S-izquierda | | 0.000 | -0.000 | 193.303 |
| S- | centro | 0.000 | -0.000 | 193.303 |
| S- | derecha | 0.000 | -0.000 | 193.303 |

| | | | |
|---|---|---|---|
| 15 15 16 | | | |
| S-izquierda | 0.000 | -0.000 | 193.303 |
| S- centro | 0.000 | -0.000 | 193.303 |
| S derecha | 0.000 | -0.000 | 193.303 |
| 16 16 17 | | | |
| S-izquierda | 0.000 | -0.000 | 193.303 |
| S- centro | 0.000 | -0.000 | 193.303 |
| S- derecha | 0.000 | -0.000 | 193.303 |
| 17 17 18 | | | |
| S-izquierda | 0.000 | -0.000 | 193.303 |
| S- centro | 0.000 | -0.000 | 193.303 |
| S- derecha | 0.000 | -0.000 | 193.303 |
| 18 18 19 | | | |
| S-izquierda | 0.000 | -0.000 | 193.303 |
| S- centro | 0.000 | -0.000 | 193.303 |
| S- derecha | 0.000 | -0.000 | 193.303 |
| 19 19 20 | | | |
| S-izquierda | 0.000 | -0.000 | 193.303 |
| S centro | 0.000 | -0.000 | 193.303 |
| S- derecha | 0.000 | -0.000 | 193.303 |
| 20 20 21 | | | |
| S-izquierda | 0.000 | -0.000 | 193.303 |
| S- centro | 0.000 | -0.000 | 193.303 |
| S- derecha | 0.000 | -0.000 | 193.303 |
| 21 121 22 | | | |
| S-izquierda | 0.000 | 10.174 | 193.303 |
| S- centro | 0.000 | 10.174 | 183.638 |
| S- derecha | 0.000 | 10.174 | 173.973 |
| 22 22 23 | | | |
| S-izquierda | 0.000 | 10.174 | 173.973 |
| S- centro | 0.000 | 10.174 | 164.308 |
| S- derecha | 0.000 | 10.174 | 154.643 |
| 23 23 24 | | | |
| S quierda | 0.000 | 10.174 | 154.643 |
| S- centro | 0.000 | 10.174 | 144.978 |
| S- derecha | 0.000 | 10.174 | 135.312 |
| 24 24 25 | | | |
| S-izquierda | 0.000 | 10.174 | 135.312 |
| S- centro | 0.000 | 10.174 | 125.647 |
| S- derecha | 0.000 | 10.174 | 115.982 |
| 25 25 26 | | | |
| S-izquierda | 0.000 | 10.174 | 115.982 |
| S- centro | 0.000 | 10.174 | 106.317 |
| S- derecha | 0.000 | 10.174 | 96.652 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | 10.174 | 96.652 |
| S- centro | 0.000 | 10.174 | 86.987 |
| S- derecha | 0.000 | 10.174 | 77.321 |
| 27 28 | | | |
| S- quierda | 0.000 | 10.174 | 77.321 |
| S- centro | 0.000 | 10.174 | 67.656 |
| S- derecha | 0.000 | 10.174 | 57.991 |
| 28 28 29 | | | |
| S-izquierda | 0.000 | 10.174 | 57.991 |
| S- centro | 0.000 | 10.174 | 48.326 |
| S- derecha | 0.000 | 10.174 | 38.661 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | 10.174 | 38.661 |
| S- centro | 0.000 | 10.174 | 28.996 |
| S- derecha | 0.000 | 10.174 | 19.330 |
| 30 30 31 | | | |
| S-izquierda | 0.000 | 10.174 | 19.330 |
| S- centro | 0.000 | 10.174 | 9.665 |
| S- derecha | 0.000 | 10.174 | 0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 10.174 | 0.000 |
| 11 | 0.000 | -10.174 | 0.000 |
| 31 | 0.000 | 10.174 | 0.000 |
| 121 | 0.000 | -10.174 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | -193.303 |
| 121 | 0.000 | 0.000 | -193.303 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0]) ... (<1%)

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
HIPERESTATICOS DE PRETENSADO 1º TANTEO

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

Coef. Rozamiento Recta(m. -1) : 0.00000
Coef. Rozamiento Curva(rad-1) : 0.00000

DATOS DE LOS NUDOS

| Nudo | Xi(m.) | Yi(m.) | Peso(Tn) | Movimientos Impuestos Ux | Vy | øz |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | | | | |
| | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| 4 | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| | 50.09 | 0.00 | | | | |
| 22 | 51.99 | 0.00 | | | | |
| 23 | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| | | ****** | |
| 21 | | ****** | |
| 31 | | ****** | |
| 111 | | I* 11 | ****** I* 11 |
| 121 | | I* 21 | ****** I* 21 |

DATOS DE SECCIONES TIPO

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

DATOS DE LOS ELEMENTOS

| Num | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 10 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 11 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 11 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 12 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 13 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 13 | 14 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 14 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 13 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 13 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 16 | 16 | 17 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 17 | 17 | 18 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 18 | 18 | 19 | 12 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 19 | 19 | 20 | 13 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 13 | 14 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 14 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 13 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 13 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 12 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 11 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 11 | 10 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

Nota: En Elementos Curvos [Long] y [Alf]
corresponden a la Cuerda

DATOS DE LOS CABLES DE PRETENSADO

Cable Area(m2) Elem-i Elem-f Nudo Ycp(m.)

| | | | | | |
|---|---|---|---|---|---|
| 1 | .002800 | 1 | 10 | 1 | .700 |
| | | | | 2 | .742 |
| | | | | 3 | .742 |
| | | | | 4 | .748 |
| | | | | 5 | .748 |
| | | | | 6 | .748 |
| | | | | 7 | .748 |
| | | | | 8 | .748 |
| | | | | 9 | .737 |
| | | | | 10 | .737 |
| | | | | 11 | .806 |
| 2 | .001400 | 3 | 7 | 3 | .742 |
| | | | | 4 | .748 |
| | | | | 5 | .748 |
| | | | | 6 | .748 |
| | | | | 7 | .748 |
| | | | | 8 | .748 |
| 3 | .004200 | 11 | 20 | 111 | .806 |
| | | | | 12 | .737 |
| | | | | 13 | .737 |
| | | | | 14 | .748 |
| | | | | 15 | .748 |
| | | | | 16 | .748 |
| | | | | 17 | .748 |
| | | | | 18 | .748 |
| | | | | 19 | .737 |
| | | | | 20 | .737 |
| | | | | 21 | .806 |
| 4 | .004200 | 12 | 19 | 12 | .718 |
| | | | | 13 | .718 |
| | | | | 14 | .729 |
| | | | | 15 | .729 |
| | | | | 16 | .729 |
| | | | | 17 | .729 |
| | | | | 18 | .729 |
| | | | | 19 | .718 |
| | | | | 20 | .718 |
| 5 | .002800 | 13 | 18 | 13 | .689 |
| | | | | 14 | .700 |
| | | | | 15 | .700 |
| | | | | 16 | .700 |
| | | | | 17 | .700 |
| | | | | 18 | .700 |
| | | | | 19 | .689 |
| 6 | .002800 | 21 | 30 | 121 | .806 |
| | | | | 22 | .737 |
| | | | | 23 | .737 |
| | | | | 24 | .748 |
| | | | | 25 | .748 |
| | | | | 26 | .748 |
| | | | | 27 | .748 |
| | | | | 28 | .748 |
| | | | | 29 | .742 |
| | | | | 30 | .742 |
| | | | | 31 | .700 |
| 7 | .001400 | 24 | 28 | 24 | .748 |
| | | | | 25 | .748 |
| | | | | 26 | .748 |
| | | | | 27 | .748 |
| | | | | 28 | .748 |
| | | | | 29 | .742 |
| | .000600 | 1 | 10 | 1 | -.245 |
| | | | | 2 | -.203 |
| | | | | 3 | -.203 |
| | | | | 4 | -.197 |
| | | | | 5 | -.197 |
| | | | | 6 | -.197 |
| | | | | 7 | -.197 |
| | | | | 8 | -.197 |
| | | | | 9 | -.208 |
| | | | | 10 | -.208 |
| | | | | 11 | -.139 |
| 9 | .000560 | 11 | 20 | 111 | -.139 |
| | | | | 12 | -.208 |
| | | | | 13 | -.208 |
| | | | | 14 | -.197 |
| | | | | 15 | -.197 |
| | | | | 16 | -.197 |
| | | | | 17 | -.197 |
| | | | | 18 | -.197 |
| | | | | 19 | -.208 |
| | | | | 20 | -.208 |
| | | | | 21 | -.139 |
| 10 | .000560 | 21 | 30 | 121 | -.139 |
| | | | | 22 | -.208 |
| | | | | 23 | -.208 |
| | | | | 24 | -.197 |
| | | | | 25 | -.197 |
| | | | | 26 | -.197 |
| | | | | 27 | -.197 |
| | | | | 28 | -.197 |
| | | | | 29 | -.203 |
| | | | | 30 | -.203 |
| | | | | 31 | -.245 |

DATOS DE LOS ESTADOS DE CARGA

ESTADO DE CARGA 1 :

Titulo:
PRETENSADO
Tipo: [ 2]Acciones Pretensado

| Numero Cable | Fuerza Tesado(Tn) | Anclaje Activo | | Coeficientes k(/m) | Perdidas nu(/rad) |
|---|---|---|---|---|---|
| 1 | 414.400 | nudos y | 1 11 | 0.0000 | 0.0000 |
| 2 | 207.200 | nudos y | 3 8 | 0.0000 | 0.0000 |
| 3 | 621.600 | nudos y | 111 21 | 0.0000 | 0.0000 |
| 4 | 621.600 | nudos y | 12 20 | 0.0000 | 0.0000 |
| 5 | 414.400 | nudos y | 13 19 | 0.0000 | 0.0000 |
| 6 | 414.400 | nudos y | 121 31 | 0.0000 | 0.0000 |
| 7 | 207.200 | nudos y | 24 29 | 0.0000 | 0.0000 |
| 8 | 82.880 | nudos y | 1 11 | 0.0000 | 0.0000 |
| 9 | 82.880 | nudos y | 111 21 | 0.0000 | 0.0000 |
| 10 | 82.880 | nudos y | 121 31 | 0.0000 | 0.0000 |

*** BARRA (RESULTADOS) ***

Proyecto:
Su RAMO XV AVE / E-1505.0

Comentario:
HIPERESTATICOS DE PRETENSADO

Estado de Carga 1:
PRETENSADO

Puesta en carga Cable numero 1 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 1 | 414.400 | (Activo) |
| 2 | 414.400 | |
| 3 | 414.400 | |
| 4 | 414.400 | |
| 5 | 414.400 | |
| 6 | 414.400 | |
| | 414.400 | |
| 8 | 414.400 | |
| 9 | 414.400 | |
| 10 | 414.400 | |
| 11 | 414.400 | (Activo) |

Puesta en carga Cable numero 2 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 3 | 207.200 | (Activo) |
| 4 | 207.200 | |
| 5 | 207.200 | |
| 6 | 207.200 | |
| 7 | 207.200 | |
| 8 | 207.200 | (Activo) |

Puesta en carga Cable numero 3 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 111 | 621.600 | (Activo) |
| 12 | 621.600 | |
| 13 | 621.600 | |
| 14 | 621.600 | |
| 15 | 621.600 | |
| 16 | 621.600 | |
| 17 | 621.600 | |
| 18 | 621.600 | |
| 19 | 621.600 | |
| 20 | 621.600 | |
| 21 | 621.600 | (Activo) |

Puesta en carga Cable numero 4 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 2 | 621.600 | (Activo) |
| | 621.600 | |
| 14 | 621.600 | |
| 15 | 621.600 | |
| 16 | 621.600 | |
| 17 | 621.600 | |
| 18 | 621.600 | |
| 19 | 621.600 | |
| 20 | 621.600 | (Activo) |

Puesta en carga Cable numero 5 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 13 | 414.400 | (Activo) |
| 14 | 414.400 | |
| 15 | 414.400 | |
| 16 | 414.400 | |
| 17 | 414.400 | |
| 18 | 414.400 | |
| 19 | 414.400 | (Activo) |

Puesta en carga Cable numero 6 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 121 | 414.400 | (Activo) |
| 22 | 414.400 | |
| 23 | 414.400 | |
| 24 | 414.400 | |
| 25 | 414.400 | |
| 26 | 414.400 | |
| 27 | 414.400 | |
| 28 | 414.400 | |
| 29 | 414.400 | |
| 30 | 414.400 | |
| 31 | 414.400 | (Activo) |

Puesta en carga Cable numero 7 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 24 | 207.200 | (Activo) |
| 25 | 207.200 | |
| 26 | 207.200 | |
| 27 | 207.200 | |
| 28 | 207.200 | |
| 29 | 207.200 | (Activo) |

Puesta en carga Cable numero 8 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 1 | 82.880 | (Activo) |
| 2 | 82.880 | |
| 3 | 82.880 | |
| 4 | 82.880 | |
| 5 | 82.880 | |
| 6 | 82.880 | |
| 7 | 82.880 | |
| 8 | 82.880 | |
| 9 | 82.880 | |
| 10 | 82.880 | |
| 11 | 82.880 | (Activo) |

Puesta en carga Cable numero 9 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 111 | 82.880 | (Activo) |
| 12 | 82.880 | |
| 13 | 82.880 | |
| . | 82.880 | |
| 15 | 82.880 | |
| 16 | 82.880 | |
| 17 | 82.880 | |
| 18 | 82.880 | |
| 19 | 82.880 | |
| 20 | 82.880 | |
| 21 | 82.880 | (Activo) |

Puesta en carga Cable numero 10 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 121 | 82.880 | (Activo) |
| 22 | 82.880 | |
| 23 | 82.880 | |
| 24 | 82.880 | |
| 25 | 82.880 | |
| 26 | 82.880 | |
| . | 82.880 | |
| 28 | 82.880 | |
| 29 | 82.880 | |
| 30 | 82.880 | |
| 31 | 82.880 | (Activo) |

*** BARRA (RESULTADOS) ***

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
HIPERESTATICOS DE PRETENSADO

Estado de Carga 1:
PRETENSADO

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | .000369 |
| 2 | -.000072 | .000507 | .000174 |
| 3 | -.000163 | .000690 | .000031 |
| 4 | -.000289 | .000548 | -.000168 |
| 5 | -.000411 | .000100 | -.000292 |
| 6 | -.000533 | -.000515 | -.000343 |
| 7 | -.000655 | -.001158 | -.000322 |
| 8 | -.000777 | -.001692 | -.000229 |
| 9 | -.000867 | -.001843 | .000083 |
| 10 | -.000962 | -.001311 | .000491 |
| 11 | -.001023 | 0.000000 | .000896 |
| 12 | -.001162 | .003564 | .001407 |
| 13 | -.001578 | .007879 | .001368 |
| 14 | -.002095 | .011425 | .000908 |
| 15 | -.002589 | .013541 | .000454 |
| 16 | -.003082 | .014247 | 0.000000 |
| 17 | -.003575 | .013541 | -.000454 |
| 18 | -.004068 | .011425 | -.000908 |
| 19 | -.004586 | .007879 | -.001368 |
| 20 | -.005002 | .003564 | -.001407 |
| 21 | -.005141 | 0.000000 | -.000896 |
| 22 | -.005201 | -.001311 | -.000491 |
| 23 | -.005297 | -.001843 | -.000083 |
| 24 | -.005387 | -.001692 | .000229 |
| 25 | -.005509 | -.001158 | .000322 |
| 26 | -.005631 | -.000515 | .000343 |
| 27 | -.005753 | .000100 | .000292 |
| 28 | -.005875 | .000548 | .000168 |
| 29 | -.006001 | .000690 | -.000031 |
| 30 | -.006092 | .000507 | -.000174 |
| 31 | -.006164 | 0.000000 | -.000369 |
| 111 | -.001023 | 0.000000 | .000896 |
| 121 | -.005141 | 0.000000 | -.000896 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Nel | N-i | N-d | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|---|
| 1 | 1 | 2 | | | |
| S-izquierda | | | -0.000 | -45.331 | -0.000 |
| S- centro | | | -0.000 | -45.331 | 43.064 |
| S- derecha | | | -0.000 | -45.331 | 86.129 |
| 2 | 2 | 3 | | | |

| | | | |
|---|---|---|---|
| S-izquierda | -0.000 | -45.331 | 86.129 |
| S- centro | -0.000 | -45.331 | 129.193 |
| S- derecha | -0.000 | -45.331 | 172.258 |
| 3 4 | | | |
| S-izquierda | -0.000 | -45.331 | 172.258 |
| S- centro | -0.000 | -45.331 | 215.322 |
| S- derecha | -0.000 | -45.331 | 258.387 |
| 4 4 5 | | | |
| S-izquierda | -0.000 | -45.331 | 258.387 |
| S- centro | -0.000 | -45.331 | 301.451 |
| S- derecha | -0.000 | -45.331 | 344.516 |
| 5 5 6 | | | |
| S-izquierda | -0.000 | -45.331 | 344.516 |
| S- centro | -0.000 | -45.331 | 387.580 |
| S- derecha | -0.000 | -45.331 | 430.645 |
| 6 6 7 | | | |
| S-izquierda | -0.000 | -45.331 | 430.645 |
| S- centro | -0.000 | -45.331 | 473.709 |
| S derecha | -0.000 | -45.331 | 516.774 |
| 7 7 8 | | | |
| S-izquierda | -0.000 | -45.331 | 516.774 |
| S- centro | -0.000 | -45.331 | 559.838 |
| S- derecha | -0.000 | -45.331 | 602.903 |
| 8 8 9 | | | |
| S-izquierda | -0.000 | -45.331 | 602.903 |
| S- centro | -0.000 | -45.331 | 645.967 |
| S- derecha | -0.000 | -45.331 | 689.032 |
| 9 9 10 | | | |
| S-izquierda | -0.000 | -45.331 | 689.032 |
| S- centro | -0.000 | -45.331 | 732.096 |
| S- derecha | -0.000 | -45.331 | 775.161 |
| 10 10 11 | | | |
| S-izquierda | -0.000 | -45.331 | 775.161 |
| S centro | -0.000 | -45.331 | 818.225 |
| S- derecha | -0.000 | -45.331 | 861.290 |
| 11 111 12 | | | |
| S-izquierda | -0.000 | 0.000 | 861.290 |
| S- centro | -0.000 | 0.000 | 861.290 |
| S- derecha | -0.000 | 0.000 | 861.290 |
| 12 12 13 | | | |
| S-izquierda | -0.000 | 0.000 | 861.290 |
| S- centro | -0.000 | 0.000 | 861.290 |
| S- derecha | -0.000 | 0.000 | 861.290 |
| 13 13 14 | | | |
| S-izquierda | -0.000 | -0.000 | 861.290 |
| S- centro | -0.000 | -0.000 | 861.290 |
| S- derecha | -0.000 | -0.000 | 861.290 |
| 14 14 15 | | | |
| S zquierda | -0.000 | 0.000 | 861.290 |
| S- centro | -0.000 | 0.000 | 861.290 |
| S- derecha | -0.000 | 0.000 | 861.290 |
| 15 15 16 | | | |
| S-izquierda | -0.000 | -0.000 | 861.290 |
| S- centro | -0.000 | -0.000 | 861.290 |
| S- derecha | -0.000 | -0.000 | 861.290 |
| 16 16 17 | | | |
| S-izquierda | -0.000 | 0.000 | 861.290 |
| S- centro | -0.000 | 0.000 | 861.290 |
| S- derecha | -0.000 | 0.000 | 861.290 |
| 17 17 18 | | | |
| S-izquierda | -0.000 | -0.000 | 861.290 |
| S- centro | -0.000 | -0.000 | 861.290 |
| S- derecha | -0.000 | -0.000 | 861.290 |
| 18 18 19 | | | |
| S-izquierda | -0.000 | 0.000 | 861.290 |
| S- centro | -0.000 | 0.000 | 861.290 |
| S- derecha | -0.000 | 0.000 | 861.290 |
| 19 19 20 | | | |
| S-izquierda | -0.000 | 0.000 | 861.290 |
| S- centro | -0.000 | 0.000 | 861.290 |
| S- derecha | -0.000 | 0.000 | 861.290 |
| 20 20 21 | | | |
| S-izquierda | -0.000 | 0.000 | 861.290 |
| S- centro | -0.000 | 0.000 | 861.290 |
| S- derecha | -0.000 | 0.000 | 861.290 |
| 21 121 22 | | | |
| S-izquierda | -0.000 | 45.331 | 861.290 |
| S- centro | -0.000 | 45.331 | 818.225 |
| S- derecha | -0.000 | 45.331 | 775.161 |
| 22 22 23 | | | |
| S-izquierda | -0.000 | 45.331 | 775.161 |
| S- centro | -0.000 | 45.331 | 732.096 |
| S- derecha | -0.000 | 45.331 | 689.032 |
| 23 23 24 | | | |
| S-izquierda | -0.000 | 45.331 | 689.032 |
| S- centro | -0.000 | 45.331 | 645.967 |
| S- derecha | -0.000 | 45.331 | 602.903 |
| 24 24 25 | | | |
| S-izquierda | -0.000 | 45.331 | 602.903 |
| S- centro | -0.000 | 45.331 | 559.838 |
| S- derecha | -0.000 | 45.331 | 516.774 |
| 25 25 26 | | | |
| S-izquierda | -0.000 | 45.331 | 516.774 |
| S- centro | -0.000 | 45.331 | 473.709 |
| S- derecha | -0.000 | 45.331 | 430.645 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | 45.331 | 430.645 |
| S- centro | 0.000 | 45.331 | 387.580 |
| S- derecha | 0.000 | 45.331 | 344.516 |
| 27 27 28 | | | |
| S-izquierda | 0.000 | 45.331 | 344.516 |
| S- centro | 0.000 | 45.331 | 301.451 |
| S- derecha | 0.000 | 45.331 | 258.387 |

| | | | |
|---|---|---|---|
| 28 28 29 | | | |
| S-izquierda | 0.000 | 45.331 | 258.387 |
| S centro | 0.000 | 45.331 | 215.322 |
| S- derecha | 0.000 | 45.331 | 172.258 |
| 29 29 30 | | | |
| S-izquierda | 0.000 | 45.331 | 172.258 |
| S- centro | 0.000 | 45.331 | 129.193 |
| S- derecha | 0.000 | 45.331 | 86.129 |
| 30 30 31 | | | |
| S-izquierda | -0.000 | 45.331 | 86.129 |
| S- centro | -0.000 | 45.331 | 43.064 |
| S- derecha | -0.000 | 45.331 | 0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

Nota: La salida de esfuerzos no incluye los esfuerzos isostaticos de pretensado

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 45.331 | 0.000 |
| 11 | 0.000 | -45.331 | 0.000 |
| 31 | 0.000 | 45.331 | 0.000 |
| 121 | 0.000 | -45.331 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | -861.290 |
| 121 | 0.000 | 0.000 | -861.290 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones (respecto a [0,0]) ... (<1%)

*** PROGRAMA BARRA[MARCOS] ***
Version Noviembre 88

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
HIPERESTATICOS DE PRETENSADO 2º TANTEO

Material Base Homogeneizacion:
El (Tn/m2) : 3870880.00

Coef. Rozamiento Recta(m. -1) : 0.00000
Coef. Rozamiento Curva(rad-1) : 0.00000

DATOS DE LOS NUDOS

| Nudo | Xi(m.) | Yi(m.) | Movimientos Impuestos Peso(Tn) | Ux | Vy | øz |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | | | | |
| 2 | 1.90 | 0.00 | | | | |
| 3 | 3.80 | 0.00 | | | | |
| 4 | 5.70 | 0.00 | | | | |
| 5 | 7.60 | 0.00 | | | | |
| 6 | 9.50 | 0.00 | | | | |
| 7 | 11.40 | 0.00 | | | | |
| 8 | 13.30 | 0.00 | | | | |
| 9 | 15.20 | 0.00 | | | | |
| 10 | 17.10 | 0.00 | | | | |
| 11 | 19.00 | 0.00 | | | | |
| 12 | 22.11 | 0.00 | | | | |
| 13 | 25.22 | 0.00 | | | | |
| 14 | 28.33 | 0.00 | | | | |
| 15 | 31.44 | 0.00 | | | | |
| 16 | 34.55 | 0.00 | | | | |
| 17 | 37.65 | 0.00 | | | | |
| 18 | 40.76 | 0.00 | | | | |
| 19 | 43.87 | 0.00 | | | | |
| 20 | 46.98 | 0.00 | | | | |
| 21 | 50.09 | 0.00 | | | | |
| 22 | 51.99 | 0.00 | | | | |
| 23 | 53.89 | 0.00 | | | | |
| 24 | 55.79 | 0.00 | | | | |
| 25 | 57.69 | 0.00 | | | | |
| 26 | 59.59 | 0.00 | | | | |
| 27 | 61.49 | 0.00 | | | | |
| 28 | 63.39 | 0.00 | | | | |
| 29 | 65.29 | 0.00 | | | | |
| 30 | 67.19 | 0.00 | | | | |
| 31 | 69.09 | 0.00 | | | | |
| 111 | 19.00 | 0.00 | | | | |
| 121 | 50.09 | 0.00 | | | | |

VINCULACIONES NUDOS

| Nudo | Coaccion-Ux | Coaccion-Vy | Coaccion-øz |
|---|---|---|---|
| 1 | ****** | ****** | |
| 11 | | ****** | |
| 21 | | ****** | |
| 31 | | ****** | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 111 | I* | 11 | ****** | I* | 11 | | | | |
| 121 | I* | 21 | ****** | I* | 21 | | | | |

DATOS DE SECCIONES TIPO

| No | Area(m2) | M.Iner.(m4) | S.Cort.(m2) | Peso(T/ml) |
|---|---|---|---|---|
| 1 | 1.156000 | .170000 | | |
| 2 | 2.633000 | .198000 | | |
| 3 | 2.387000 | .227000 | | |
| 4 | 4.126000 | .454000 | | |
| 5 | 3.938000 | .591000 | | |
| 6 | 2.462000 | .513000 | | |
| 7 | 2.482000 | .517000 | | |
| 8 | 2.406000 | .502000 | | |
| 9 | 5.375000 | .682000 | | |
| 10 | 4.145000 | .641000 | | |
| 11 | 2.669000 | .554000 | | |
| 12 | 2.834000 | .585000 | | |
| 13 | 2.565000 | .534000 | | |
| 14 | 5.534000 | .710000 | | |

DATOS DE LOS ELEMENTOS

| Num | Nd-i | Nd-d | Sti | Std | Vin | Var | Vp | Long(m) | Alf(sx) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 10 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 2 | 2 | 3 | 11 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 3 | 3 | 4 | 11 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 4 | 4 | 5 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 5 | 5 | 6 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 6 | 6 | 7 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 7 | 7 | 8 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 8 | 8 | 9 | 12 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 9 | 9 | 10 | 13 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 10 | 10 | 11 | 13 | 14 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 11 | 111 | 12 | 14 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 12 | 12 | 13 | 13 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 13 | 13 | 14 | 13 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 14 | 14 | 15 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 15 | 15 | 16 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| [illegible] | 16 | 17 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| [illegible] | 17 | 18 | 12 | 12 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 18 | 18 | 19 | 12 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 19 | 19 | 20 | 13 | 13 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 20 | 20 | 21 | 13 | 14 | 0.0 | 0.0 | 0.0 | 3.109 | 0.00 |
| 21 | 121 | 22 | 14 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 22 | 22 | 23 | 13 | 13 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 23 | 23 | 24 | 13 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 24 | 24 | 25 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 25 | 25 | 26 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 26 | 26 | 27 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 27 | 27 | 28 | 12 | 12 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 28 | 28 | 29 | 12 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 29 | 29 | 30 | 11 | 11 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |
| 30 | 30 | 31 | 11 | 10 | 0.0 | 0.0 | 0.0 | 1.900 | 0.00 |

Nota: En Elementos Curvos [Long] y [Alf] corresponden a la Cuerda

DATOS DE LOS CABLES DE PRETENSADO

Cable Area(m2) Elem-i Elem-f Nudo Ycp(m.)

| | | | | | |
|---|---|---|---|---|---|
| 1 | .004200 | 1 | 10 | 1 | .700 |
| | | | | 2 | .742 |
| | | | | 3 | .742 |
| | | | | 4 | .748 |
| | | | | 5 | .748 |
| | | | | 6 | .748 |
| | | | | 7 | .748 |
| | | | | 8 | .748 |
| | | | | 9 | .737 |
| | | | | 10 | .737 |
| | | | | 11 | .806 |
| 2 | .001400 | 3 | 7 | 3 | .742 |
| | | | | 4 | .748 |
| | | | | 5 | .748 |
| | | | | 6 | .748 |
| | | | | 7 | .748 |
| | | | | 8 | .748 |
| 3 | .005000 | 11 | 20 | 111 | .806 |
| | | | | 12 | .737 |
| | | | | 13 | .737 |
| | | | | 14 | .748 |
| | | | | 15 | .748 |
| | | | | 16 | .748 |
| | | | | 17 | .748 |
| | | | | 18 | .748 |
| | | | | 19 | .737 |
| | | | | 20 | .737 |
| | | | | 21 | .806 |
| 4 | .004200 | 12 | 19 | 12 | .718 |
| | | | | 13 | .718 |
| | | | | 14 | .729 |
| | | | | 15 | .729 |
| | | | | 16 | .729 |
| | | | | 17 | .729 |
| | | | | 18 | .729 |
| | | | | 19 | .718 |
| | | | | 20 | .718 |
| 5 | .004200 | 13 | 18 | 13 | .689 |
| | | | | 14 | .700 |
| | | | | 15 | .700 |
| | | | | 16 | .700 |
| | | | | 17 | .700 |
| | | | | 18 | .700 |
| | | | | 19 | .689 |
| 6 | .004200 | 21 | 30 | 121 | .806 |
| | | | | 22 | .737 |
| | | | | 23 | .737 |
| | | | | 24 | .748 |
| | | | | 25 | .748 |
| | | | | 26 | .748 |
| | | | | 27 | .748 |
| | | | | 28 | .748 |
| | | | | 29 | .742 |
| | | | | 30 | .742 |
| | | | | 31 | .700 |
| 7 | .001400 | 24 | 28 | 24 | .748 |
| | | | | 25 | .748 |
| | | | | 26 | .748 |
| | | | | 27 | .748 |
| | | | | 28 | .748 |
| | | | | 29 | .742 |
| 8 | .000600 | 1 | 10 | 1 | -.245 |
| | | | | 2 | -.203 |
| | | | | 3 | -.203 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | 4 | -.197 |
| | | | | 5 | -.197 |
| | | | | 6 | -.197 |
| | | | | 7 | -.197 |
| | | | | 8 | -.197 |
| | | | | 9 | -.208 |
| | | | | 10 | -.208 |
| | | | | 11 | -.139 |
| 9 | .000560 | 11 | 20 | 111 | -.139 |
| | | | | 12 | -.208 |
| | | | | 13 | -.208 |
| | | | | 14 | -.197 |
| | | | | 15 | -.197 |
| | | | | 16 | -.197 |
| | | | | 17 | -.197 |
| | | | | 18 | -.197 |
| | | | | 19 | -.208 |
| | | | | 20 | -.208 |
| | | | | 21 | -.139 |
| 10 | .000560 | 21 | 30 | 121 | -.139 |
| | | | | 22 | -.208 |
| | | | | 23 | -.208 |
| | | | | 24 | -.197 |
| | | | | 25 | -.197 |
| | | | | 26 | -.197 |
| | | | | 27 | -.197 |
| | | | | 28 | -.197 |
| | | | | 29 | -.203 |
| | | | | 30 | -.203 |
| | | | | 31 | -.245 |

DATOS DE LOS ESTADOS DE CARGA

ESTADO DE CARGA 1 :

Titulo:
PRETENSADO
Tipo: [ 2]Acciones Pretensado

| Numero Cable | Fuerza Tesado(Tn) | Anclaje Activo | | Coeficientes k(/m) | Perdidas nu(/rad) |
|---|---|---|---|---|---|
| 1 | 621.600 | nudos | 1 | 0.0000 | 0.0000 |
| | | y | 11 | | |
| 2 | 207.200 | nudos | 3 | 0.0000 | 0.0000 |
| | | y | 8 | | |
| 3 | 745.920 | nudos | 111 | 0.0000 | 0.0000 |
| | | y | 21 | | |
| 4 | 621.600 | nudos | 12 | 0.0000 | 0.0000 |
| | | y | 20 | | |
| 5 | 621.600 | nudos | 13 | 0.0000 | 0.0000 |
| | | y | 19 | | |
| 6 | 621.600 | nudos | 121 | 0.0000 | 0.0000 |
| | | y | 31 | | |
| 7 | 207.200 | nudos | 24 | 0.0000 | 0.0000 |
| | | y | 29 | | |
| 8 | 82.880 | nudos | 1 | 0.0000 | 0.0000 |
| | | y | 11 | | |
| 9 | 82.880 | nudos | 111 | 0.0000 | 0.0000 |
| | | y | 21 | | |
| 10 | 82.880 | nudos | 121 | 0.0000 | 0.0000 |
| | | y | 31 | | |

*** BARRA (RESULTADOS) ***

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
HIPERESTATICOS DE PRETENSADO

Estado de Carga 1:
PRETENSADO

Puesta en carga Cable numero 1 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 1 | 621.600 | (Activo) |
| 2 | 621.600 | |
| 3 | 621.600 | |
| 4 | 621.600 | |
| 5 | 621.600 | |
| 6 | 621.600 | |
| 7 | 621.600 | |
| 8 | 621.600 | |
| 9 | 621.600 | |
| 10 | 621.600 | |
| 11 | 621.600 | (Activo) |

Puesta en carga Cable numero 2 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 3 | 207.200 | (Activo) |
| 4 | 207.200 | |
| 5 | 207.200 | |
| 6 | 207.200 | |
| 7 | 207.200 | |
| 8 | 207.200 | (Activo) |

Puesta en carga Cable numero 3 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 111 | 745.920 | (Activo) |
| 12 | 745.920 | |
| 13 | 745.920 | |
| 14 | 745.920 | |
| 15 | 745.920 | |
| 16 | 745.920 | |
| 17 | 745.920 | |
| 18 | 745.920 | |
| 19 | 745.920 | |
| 20 | 745.920 | |
| 21 | 745.920 | (Activo) |

Puesta en carga Cable numero 4 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 12 | 621.600 | (Activo) |
| 13 | 621.600 | |
| 14 | 621.600 | |
| 15 | 621.600 | |

| | | |
|---|---|---|
| 16 | 621.600 | |
| 17 | 621.600 | |
| 18 | 621.600 | |
| [illegible] | 621.600 | |
| [illegible] | 621.600 | (Activo) |

Puesta en carga Cable numero 5 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 13 | 621.600 | (Activo) |
| 14 | 621.600 | |
| 15 | 621.600 | |
| 16 | 621.600 | |
| 17 | 621.600 | |
| 18 | 621.600 | |
| 19 | 621.600 | (Activo) |

Puesta en carga Cable numero 6 :

| Nudo | Tension(Tn) | |
|---|---|---|
| [illegible] | 621.600 | (Activo) |
| 22 | 621.600 | |
| 23 | 621.600 | |
| 24 | 621.600 | |
| 25 | 621.600 | |
| 26 | 621.600 | |
| 27 | 621.600 | |
| 28 | 621.600 | |
| 29 | 621.600 | |
| 30 | 621.600 | |
| 31 | 621.600 | (Activo) |

Puesta en carga Cable numero 7 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 24 | 207.200 | (Activo) |
| 25 | 207.200 | |
| 26 | 207.200 | |
| [illegible] | 207.200 | |
| [illegible] | 207.200 | |
| 29 | 207.200 | (Activo) |

Puesta en carga Cable numero 8 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 1 | 82.880 | (Activo) |
| 2 | 82.880 | |
| 3 | 82.880 | |
| 4 | 82.880 | |
| 5 | 82.880 | |
| 6 | 82.880 | |
| 7 | 82.880 | |
| 8 | 82.880 | |
| 9 | 82.880 | |
| 10 | 82.880 | |
| 11 | 82.880 | (Activo) |

Puesta en carga Cable numero 9 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 111 | 82.880 | (Activo) |
| 12 | 82.880 | |
| 13 | 82.880 | |
| 14 | 82.880 | |
| 15 | 82.880 | |
| 16 | 82.880 | |
| 17 | 82.880 | |
| 18 | 82.880 | |
| 19 | 82.880 | |
| 20 | 82.880 | |
| 21 | 82.880 | (Activo) |

Puesta en carga Cable numero 10 :

| Nudo | Tension(Tn) | |
|---|---|---|
| 121 | 82.880 | (Activo) |
| 22 | 82.880 | |
| 23 | 82.880 | |
| 24 | 82.880 | |
| 25 | 82.880 | |
| 26 | 82.880 | |
| 27 | 82.880 | |
| 28 | 82.880 | |
| 29 | 82.880 | |
| 30 | 82.880 | |
| 31 | 82.880 | (Activo) |

*** BARRA (RESULTADOS) ***

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Comentario:
HIPERESTATICOS DE PRETENSADO

Estado de Carga 1:
PRETENSADO

** MOVIMIENTOS NUDOS (Ejes Generales) **

| Nudo | Ux ( m. ) | Vy ( m. ) | øz (rad.) |
|---|---|---|---|
| 1 | 0.000000 | 0.000000 | .000744 |
| 2 | -.000101 | .001110 | .000435 |
| 3 | -.000231 | .001681 | .000182 |
| 4 | -.000394 | .001737 | -.000109 |
| 5 | -.000552 | .001329 | -.000305 |
| 6 | -.000709 | .000634 | -.000413 |
| 7 | -.000867 | -.000182 | -.000431 |
| | -.001025 | -.000950 | -.000362 |
| 9 | -.001153 | -.001363 | -.000057 |
| 10 | -.001288 | -.001087 | .000363 |
| 11 | -.001374 | 0.000000 | .000789 |
| 12 | -.001538 | .003427 | .001428 |
| 13 | -.001992 | .008049 | .001545 |
| 14 | -.002608 | .012053 | .001025 |
| 15 | -.003196 | .014444 | .000513 |
| 16 | -.003783 | .015241 | -0.000000 |
| 17 | -.004370 | .014444 | -.000513 |
| 18 | -.004957 | .012053 | -.001025 |
| 19 | -.005574 | .008049 | -.001545 |
| 20 | -.006028 | .003427 | -.001428 |
| 21 | -.006192 | 0.000000 | -.000789 |
| 22 | -.006278 | -.001087 | -.000363 |
| 23 | -.006412 | -.001363 | .000057 |
| 24 | -.006541 | -.000950 | .000362 |
| 25 | -.006698 | -.000182 | .000431 |
| 26 | -.006856 | .000634 | .000413 |
| | -.007014 | .001329 | .000305 |
| 28 | -.007172 | .001737 | .000109 |
| 29 | -.007335 | .001681 | -.000182 |
| 30 | -.007464 | .001110 | -.000435 |
| 31 | -.007566 | 0.000000 | -.000744 |
| 111 | -.001374 | 0.000000 | .000789 |
| 121 | -.006192 | 0.000000 | -.000789 |

** ESFUERZOS ELEMENTOS (Ejes Locales) **

| Mel | N-i | N-d | Axil(T) | Cortante(T) | Flector(mT) |
|---|---|---|---|---|---|
| | 1 | 2 | | | |
| 3-izquierda | | | -0.000 | -55.603 | 0.000 |
| 3- centro | | | -0.000 | -55.603 | 52.823 |
| 3- derecha | | | -0.000 | -55.603 | 105.645 |
| | 2 | 3 | | | |

| | | | |
|---|---|---|---|
| S-izquierda | -0.000 | -55.603 | 105.645 |
| S- centro | -0.000 | -55.603 | 158.468 |
| S- derecha | -0.000 | -55.603 | 211.291 |
| 3 4 | | | |
| S-izquierda | -0.000 | -55.603 | 211.291 |
| S- centro | -0.000 | -55.603 | 264.114 |
| S- derecha | -0.000 | -55.603 | 316.936 |
| 4 4 5 | | | |
| S-izquierda | -0.000 | -55.603 | 316.936 |
| S- centro | -0.000 | -55.603 | 369.759 |
| S- derecha | -0.000 | -55.603 | 422.582 |
| 5 5 6 | | | |
| S-izquierda | -0.000 | -55.603 | 422.582 |
| S- centro | -0.000 | -55.603 | 475.405 |
| S- derecha | -0.000 | -55.603 | 528.227 |
| 6 6 7 | | | |
| S-izquierda | -0.000 | -55.603 | 528.227 |
| S- centro | -0.000 | -55.603 | 581.050 |
| S derecha | -0.000 | -55.603 | 633.873 |
| 7 7 8 | | | |
| S-izquierda | -0.000 | -55.603 | 633.873 |
| S- centro | -0.000 | -55.603 | 686.696 |
| S- derecha | -0.000 | -55.603 | 739.518 |
| 8 8 9 | | | |
| S-izquierda | -0.000 | -55.603 | 739.518 |
| S- centro | -0.000 | -55.603 | 792.341 |
| S- derecha | -0.000 | -55.603 | 845.164 |
| 9 9 10 | | | |
| S-izquierda | -0.000 | -55.603 | 845.164 |
| S- centro | -0.000 | -55.603 | 897.987 |
| S- derecha | -0.000 | -55.603 | 950.809 |
| 10 10 11 | | | |
| S-izquierda | -0.000 | -55.603 | 950.809 |
| S centro | -0.000 | -55.603 | 1003.632 |
| S- derecha | -0.000 | -55.603 | 1056.455 |
| 11 111 12 | | | |
| S-izquierda | -0.000 | -0.000 | 1056.455 |
| S- centro | -0.000 | -0.000 | 1056.455 |
| S- derecha | -0.000 | -0.000 | 1056.455 |
| 12 12 13 | | | |
| S-izquierda | -0.000 | 0.000 | 1056.455 |
| S- centro | -0.000 | 0.000 | 1056.455 |
| S- derecha | -0.000 | 0.000 | 1056.455 |
| 13 13 14 | | | |
| S-izquierda | -0.000 | 0.000 | 1056.455 |
| S- centro | -0.000 | 0.000 | 1056.455 |
| S- derecha | -0.000 | 0.000 | 1056.455 |
| 14 14 15 | | | |
| S zquierda | -0.000 | 0.000 | 1056.455 |
| S- centro | -0.000 | 0.000 | 1056.455 |
| S- derecha | -0.000 | 0.000 | 1056.455 |
| 15 15 16 | | | |
| S-izquierda | -0.000 | -0.000 | 1056.455 |
| S- centro | -0.000 | -0.000 | 1056.455 |
| S- derecha | -0.000 | -0.000 | 1056.455 |
| 16 16 17 | | | |
| S-izquierda | -0.000 | 0.000 | 1056.455 |
| S- centro | -0.000 | 0.000 | 1056.455 |
| S- derecha | -0.000 | 0.000 | 1056.455 |
| 17 17 18 | | | |
| S-izquierda | -0.000 | 0.000 | 1056.455 |
| S- centro | -0.000 | 0.000 | 1056.455 |
| S- derecha | -0.000 | 0.000 | 1056.455 |
| 18 18 19 | | | |
| S-izquierda | -0.000 | 0.000 | 1056.455 |
| S- centro | -0.000 | 0.000 | 1056.455 |
| S- derecha | -0.000 | 0.000 | 1056.455 |
| 19 19 20 | | | |
| S-izquierda | -0.000 | -0.000 | 1056.455 |
| S- centro | -0.000 | -0.000 | 1056.455 |
| S- derecha | -0.000 | -0.000 | 1056.455 |
| 20 20 21 | | | |
| S-izquierda | -0.000 | 0.000 | 1056.455 |
| S- centro | -0.000 | 0.000 | 1056.455 |
| S- derecha | -0.000 | 0.000 | 1056.455 |
| 21 121 22 | | | |
| S-izquierda | -0.000 | 55.603 | 1056.455 |
| S- centro | -0.000 | 55.603 | 1003.632 |
| S- derecha | -0.000 | 55.603 | 950.809 |
| 22 22 23 | | | |
| S-izquierda | -0.000 | 55.603 | 950.809 |
| S- centro | -0.000 | 55.603 | 897.987 |
| S- derecha | -0.000 | 55.603 | 845.164 |
| 23 23 24 | | | |
| S-izquierda | -0.000 | 55.603 | 845.164 |
| S- centro | -0.000 | 55.603 | 792.341 |
| S- derecha | -0.000 | 55.603 | 739.518 |
| 24 24 25 | | | |
| S-izquierda | -0.000 | 55.603 | 739.518 |
| S- centro | -0.000 | 55.603 | 686.696 |
| S- derecha | -0.000 | 55.603 | 633.873 |
| 25 25 26 | | | |
| S-izquierda | -0.000 | 55.603 | 633.873 |
| S- centro | -0.000 | 55.603 | 581.050 |
| S- derecha | -0.000 | 55.603 | 528.227 |
| 26 26 27 | | | |
| S-izquierda | 0.000 | 55.603 | 528.227 |
| S- centro | 0.000 | 55.603 | 475.405 |
| S- derecha | 0.000 | 55.603 | 422.582 |
| 27 27 28 | | | |
| S-izquierda | 0.000 | 55.603 | 422.582 |
| S- centro | 0.000 | 55.603 | 369.759 |
| S- derecha | 0.000 | 55.603 | 316.936 |

| | | | |
|---|---|---|---|
| 28 28 29 | | | |
| B-izquierda | 0.000 | 55.603 | 316.936 |
| B- centro | 0.000 | 55.603 | 264.114 |
| B- derecha | 0.000 | 55.603 | 211.291 |
| 29 29 30 | | | |
| B-izquierda | 0.000 | 55.603 | 211.291 |
| B- centro | 0.000 | 55.603 | 158.468 |
| B- derecha | 0.000 | 55.603 | 105.645 |
| 30 30 31 | | | |
| B-izquierda | -0.000 | 55.603 | 105.645 |
| B- centro | -0.000 | 55.603 | 52.823 |
| B- derecha | -0.000 | 55.603 | 0.000 |

Nota: Los esfuerzos se refieren a los extremos del elemento, excluyendo zonas rigidas en nudos de tamaño finito

Nota: La salida de esfuerzos no incluye los esfuerzos isostaticos de pretensado

** REACCIONES EXTERIORES (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 1 | 0.000 | 55.603 | 0.000 |
| 11 | 0.000 | -55.603 | 0.000 |
| 31 | 0.000 | 55.603 | 0.000 |
| 121 | 0.000 | -55.603 | 0.000 |

** REACCIONES INTERNAS NUDOS (Ejes Generales) **

| Nudo | Fx (Tn) | Fy (Tn) | Mz (mT) |
|---|---|---|---|
| 111 | 0.000 | 0.000 | -1056.455 |
| 121 | 0.000 | 0.000 | -1056.455 |

Nota: Se han controlado Errores de Cierre en Nudos y Reacciones(respecto a [0,0])...(<1%)

# ANEXO 2

# CONSTANTES ESTATICAS EVOLUTIVAS

" CONSTANTES ESTATICAS EVOLUTIVAS "

$t=0$ , $j^{(1)}$ y $j^{(2)}$

**Proyecto:**
**SUBTRAMO XV / E-1505.0**

**Seccion:TEM-V1**

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 49.0 | 25.0 | C* | 0 |
| 6 | 1 | 0.0 | 0.0 | 0.0 | C* | 0 |
| 7 | 1 | 346.5 | 66.0 | 74.0 | C* | 0 |
| 8 | 3 | 20.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 |
| | | 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 |
| | | 8 9 10 11 12 13 |

*** CONSTANTES ESTATICAS ***

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 962.6 | 7.82 | 425176.4 |
| | (1) | 539.6 | 13.05 | 399739.4 |
| | (2) | 631.9 | 11.39 | 407644.7 |
| F.pura - | (0) | 1065.0 | 124.77 | 950764.9 |
| | (1) | 595.7 | 114.39 | 841795.8 |
| | (2) | 698.2 | 117.71 | 875919.7 |

| | | | | |
|---|---|---|---|---|
| C.Simple | (0) | 7760.7 | 67.23 | 17402258.8 |
| | (1) | 2451.9 | 66.64 | 5581642.8 |
| | (2) | 3355.5 | 66.87 | 7593940.9 |
| T.Simple | (0) | 92.4 | 44.64 | 282114.4 |
| | (1) | 92.4 | 44.64 | 282114.4 |
| | (2) | 92.4 | 44.64 | 282114.4 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TEM-V1

S.Intermedia CA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 300.0 | 41.91 | 239508.8 |
| | (1) | 160.1 | 53.27 | 202582.7 |
| | (2) | 197.1 | 49.61 | 214054.4 |
| F.pura - | (0) | 280.2 | 136.05 | 46378.7 |
| | (1) | 157.5 | 133.46 | 44521.7 |
| | (2) | 184.2 | 134.28 | 45094.5 |
| C.Simple | (0) | 4913.8 | 98.97 | 3754184.4 |
| | (1) | 1532.4 | 99.24 | 1188858.4 |
| | (2) | 2108.0 | 99.14 | 1625546.7 |
| T.Simple | (0) | 29.6 | 119.25 | 36711.3 |
| | (1) | 29.6 | 119.25 | 36711.3 |
| | (2) | 29.6 | 119.25 | 36711.3 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TEM-V1

S.Intermedia CBC

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 895.1 | 8.35 | 422502.2 |
| | (1) | 502.5 | 13.87 | 395941.8 |
| | (2) | 588.1 | 12.12 | 404146.9 |
| F.pura - | (0) | 1065.0 | 124.77 | 950764.9 |
| | (1) | 595.7 | 114.39 | 841795.8 |
| | (2) | 698.2 | 117.71 | 875919.7 |
| C.Simple | (0) | 7380.4 | 70.05 | 16184649.6 |
| | (1) | 2334.9 | 69.35 | 5215374.6 |
| | (2) | 3193.7 | 69.63 | 7082854.7 |
| T.Simple | (0) | 92.4 | 44.64 | 282114.4 |
| | (1) | 92.4 | 44.64 | 282114.4 |
| | (2) | 92.4 | 44.64 | 282114.4 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

** CALCULO ELASTICO **

Tipo Sección: TEM-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : 1000.00m.T MOMCA
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 67.6 | -53.5 | -33.7 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 67.6 | -53.5 | -33.7 | 0.0 | 0.0 |
| 3 | 99.0 | -363.2 | -240.5 | 0.0 | 0.0 | 3 | 73.9 | -59.6 | -29.1 | 0.0 | 0.0 |
| 4 | 99.0 | -214.9 | -138.3 | 0.0 | 0.0 | 4 | 73.9 | -22.8 | -3.8 | 0.0 | 0.0 |
| 5 | 99.0 | -363.2 | -122.6 | 0.0 | 0.0 | 5 | 73.9 | -59.6 | .1 | 0.0 | 0.0 |
| 6 | 99.0 | -486.0 | -486.0 | 0.0 | 0.0 | 6 | 73.9 | -90.0 | -90.0 | 0.0 | 0.0 |
| 7 | 99.0 | -122.6 | 201.4 | 0.0 | 0.0 | 7 | 73.9 | .1 | 80.5 | 0.0 | 0.0 |
| 8 | 99.0 | 829.7 | 861.0 | 0.0 | 861.0 | 8 | 89.1 | 1546.3 | 1592.0 | 0.0 | 1592.0 |
| 9 | 99.0 | 717.0 | 748.4 | 0.0 | 748.4 | 9 | 89.1 | 1382.2 | 1427.8 | 0.0 | 1427.8 |
| 10 | 99.0 | -1387.8 | -1356.5 | 0.0 | 1387.8 | 10 | 89.1 | -1685.5 | -1639.8 | 0.0 | 1685.5 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 67.6 | -798.8 | -786.6 | 0.0 | 798.8 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 67.6 | -628.2 | -616.0 | 0.0 | 628.2 |
| 13 | 99.0 | 917.0 | 983.6 | 0.0 | 983.6 | 13 | 89.1 | 1719.2 | 1816.2 | 0.0 | 1816.2 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : 1000.00m.T MOMBC
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 70.0 | -66.1 | -42.5 | 0.0 | 0.0 | 1 | 66.8 | -56.4 | -35.3 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 66.3 | -52.2 | -32.5 | 0.0 | 0.0 |
| 3 | 70.0 | -51.3 | -22.8 | 0.0 | 0.0 | 3 | 66.8 | -42.6 | -17.1 | 0.0 | 0.0 |
| 4 | 70.0 | -16.9 | .9 | 0.0 | 0.0 | 4 | 66.8 | -11.8 | 4.1 | 0.0 | 0.0 |
| 5 | 70.0 | -51.3 | 4.5 | 0.0 | 0.0 | 5 | 66.8 | -42.6 | 7.3 | 0.0 | 0.0 |
| 6 | 70.0 | -79.8 | -79.8 | 0.0 | 0.0 | 6 | 66.8 | -68.1 | -68.1 | 0.0 | 0.0 |
| 7 | 70.0 | 4.5 | 79.7 | 0.0 | 0.0 | 7 | 66.8 | 7.3 | 74.6 | 0.0 | 0.0 |
| 8 | 70.0 | 349.9 | 357.2 | 0.0 | 357.2 | 8 | 67.5 | 1077.4 | 1098.9 | 0.0 | 1098.9 |
| 9 | 70.0 | 323.8 | 331.0 | 0.0 | 331.0 | 9 | 67.5 | 999.9 | 1021.5 | 0.0 | 1021.5 |
| 10 | 70.0 | -164.5 | -157.2 | 0.0 | 164.5 | 10 | 67.5 | -446.8 | -425.3 | 0.0 | 446.8 |
| 11 | 70.0 | -420.4 | -414.3 | 0.0 | 420.4 | 11 | 67.5 | -1199.8 | -1181.5 | 0.0 | 1199.8 |
| 12 | 70.0 | -333.9 | -327.8 | 0.0 | 333.9 | 12 | 67.5 | -943.5 | -925.2 | 0.0 | 943.5 |
| 13 | 70.0 | 391.4 | 406.9 | 0.0 | 406.9 | 13 | 67.5 | 1205.9 | 1251.7 | 0.0 | 1251.7 |

Incrementos de Carga:
2

Incremento de Carga 3 :
Flector : 1000.00m.T MOMTOT
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 67.2 | -59.0 | -37.1 | 0.0 | 0.0 | 1 | 66.6 | -56.1 | -35.1 | 0.0 | 0.0 |
| 2 | 67.2 | -59.0 | -37.1 | 0.0 | 0.0 | 2 | 66.6 | -56.1 | -35.1 | 0.0 | 0.0 |
| 3 | 67.2 | -44.7 | -18.2 | 0.0 | 0.0 | 3 | 66.6 | -42.3 | -16.9 | 0.0 | 0.0 |
| 4 | 67.2 | -12.7 | 3.8 | 0.0 | 0.0 | 4 | 66.6 | -11.6 | 4.2 | 0.0 | 0.0 |
| 5 | 67.2 | -44.7 | 7.2 | 0.0 | 0.0 | 5 | 66.6 | -42.3 | 7.5 | 0.0 | 0.0 |
| 6 | 67.2 | -71.2 | -71.2 | 0.0 | 0.0 | 6 | 66.6 | -67.7 | -67.7 | 0.0 | 0.0 |
| 7 | 67.2 | 7.2 | 77.1 | 0.0 | 0.0 | 7 | 66.6 | 7.5 | 74.5 | 0.0 | 0.0 |
| 8 | 67.2 | 339.7 | 346.5 | 0.0 | 346.5 | 8 | 66.6 | 1068.4 | 1089.5 | 0.0 | 1089.5 |
| 9 | 67.2 | 315.4 | 322.2 | 0.0 | 322.2 | 9 | 66.6 | 992.6 | 1013.7 | 0.0 | 1013.7 |
| 10 | 67.2 | -138.7 | -131.9 | 0.0 | 138.7 | 10 | 66.6 | -423.1 | -402.0 | 0.0 | 423.1 |
| 11 | 67.2 | -374.8 | -369.1 | 0.0 | 374.8 | 11 | 66.6 | -1158.0 | -1140.1 | 0.0 | 1158.0 |
| 12 | 67.2 | -294.4 | -288.6 | 0.0 | 294.4 | 12 | 66.6 | -907.2 | -889.3 | 0.0 | 907.2 |
| 13 | 67.2 | 380.3 | 394.6 | 0.0 | 394.6 | 13 | 66.6 | 1196.1 | 1240.9 | 0.0 | 1240.9 |

Incrementos de Carga:
3

Incremento de Carga 4 :
Flector : 1000.00m.T MOMINF
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 66.9 | -57.2 | -35.8 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 66.9 | -57.2 | -35.8 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 66.9 | -43.2 | -17.4 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 66.9 | -12.1 | 4.1 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 66.9 | -43.2 | 7.4 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 66.9 | -69.1 | -69.1 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 66.9 | 7.4 | 75.5 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 66.9 | 782.6 | 798.1 | 0.0 | 798.1 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 66.9 | 726.9 | 742.4 | 0.0 | 742.4 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 66.9 | -313.7 | -298.2 | 0.0 | 313.7 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 66.9 | -854.2 | -841.1 | 0.0 | 854.2 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 66.9 | -669.9 | -656.7 | 0.0 | 669.9 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 66.9 | 876.1 | 909.0 | 0.0 | 909.0 |

Incrementos de Carga:
4

** CALCULO ELASTICO **

Ti. lo Sección: TEM-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Axil : 1000.00Tn. AXILCA
Excentricidad: 98.97cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | -4.1 | 1.1 | 7.5 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -4.1 | 1.1 | 7.5 | 0.0 | 0.0 |
| 3 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 3 | -8.2 | 10.5 | 18.4 | 0.0 | 0.0 |
| 4 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 4 | -8.2 | 20.1 | 25.0 | 0.0 | 0.0 |
| 5 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 5 | -8.2 | 10.5 | 26.0 | 0.0 | 0.0 |
| 6 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 6 | -8.2 | 2.6 | 2.6 | 0.0 | 0.0 |
| 7 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 7 | -8.2 | 26.0 | 46.9 | 0.0 | 0.0 |
| 8 | $$$$$$ | 179.3 | 179.3 | 0.0 | 179.3 | 8 | -55.4 | 663.9 | 668.6 | 0.0 | 668.6 |
| 9 | $$$$$$ | 179.3 | 179.3 | 0.0 | 179.3 | 9 | -55.4 | 647.1 | 651.8 | 0.0 | 651.8 |
| 10 | $$$$$$ | 179.3 | 179.3 | 0.0 | 179.3 | 10 | -55.4 | 333.2 | 337.9 | 0.0 | 337.9 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | -4.1 | 24.4 | 28.4 | 0.0 | 28.4 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | -4.1 | 80.0 | 84.0 | 0.0 | 84.0 |
| 13 | $$$$$$ | 203.5 | 203.5 | 0.0 | 203.5 | 13 | -55.4 | 749.9 | 759.9 | 0.0 | 759.9 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Axil : 1000.00Tn. AXILBC
Excentricidad: 70.05cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 20.7 | 20.7 | 0.0 | 0.0 | 1 | -625.4 | 17.4 | 18.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -533.7 | 16.1 | 16.9 | 0.0 | 0.0 |
| 3 | $$$$$$ | 25.0 | 25.0 | 0.0 | 0.0 | 3 | -625.4 | 21.8 | 22.6 | 0.0 | 0.0 |
| 4 | $$$$$$ | 25.0 | 25.0 | 0.0 | 0.0 | 4 | -625.4 | 22.8 | 23.3 | 0.0 | 0.0 |
| 5 | $$$$$$ | 25.0 | 25.0 | 0.0 | 0.0 | 5 | -625.4 | 21.8 | 23.4 | 0.0 | 0.0 |
| 6 | $$$$$$ | 25.0 | 25.0 | 0.0 | 0.0 | 6 | -625.4 | 21.0 | 21.0 | 0.0 | 0.0 |
| 7 | $$$$$$ | 25.0 | 25.0 | 0.0 | 0.0 | 7 | -625.4 | 23.4 | 25.6 | 0.0 | 0.0 |
| 8 | $$$$$$ | 119.4 | 119.4 | 0.0 | 119.4 | 8 | -825.3 | 392.5 | 393.0 | 0.0 | 393.0 |
| 9 | $$$$$$ | 119.4 | 119.4 | 0.0 | 119.4 | 9 | -825.3 | 390.5 | 391.1 | 0.0 | 391.1 |
| 10 | $$$$$$ | 119.4 | 119.4 | 0.0 | 119.4 | 10 | -825.3 | 353.8 | 354.4 | 0.0 | 354.4 |
| 11 | $$$$$$ | 135.5 | 135.5 | 0.0 | 135.5 | 11 | -825.3 | 384.1 | 384.6 | 0.0 | 384.6 |
| 12 | $$$$$$ | 135.5 | 135.5 | 0.0 | 135.5 | 12 | -825.3 | 390.6 | 391.0 | 0.0 | 391.0 |
| 13 | $$$$$$ | 135.5 | 135.5 | 0.0 | 135.5 | 13 | -825.3 | 445.1 | 446.2 | 0.0 | 446.2 |

Incrementos de Carga:

Incremento de Carga 3 :
Axil : 1000.00Tn. AXILTOT
Excentricidad: 67.23cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 19.7 | 19.7 | 0.0 | 0.0 | 1 | $$$$$$ | 18.8 | 19.0 | 0.0 | 0.0 |
| 2 | $$$$$$ | 19.7 | 19.7 | 0.0 | 0.0 | 2 | $$$$$$ | 18.8 | 19.0 | 0.0 | 0.0 |
| 3 | $$$$$$ | 23.8 | 23.8 | 0.0 | 0.0 | 3 | $$$$$$ | 22.9 | 23.0 | 0.0 | 0.0 |
| 4 | $$$$$$ | 23.8 | 23.8 | 0.0 | 0.0 | 4 | $$$$$$ | 23.1 | 23.2 | 0.0 | 0.0 |
| 5 | $$$$$$ | 23.8 | 23.8 | 0.0 | 0.0 | 5 | $$$$$$ | 22.9 | 23.2 | 0.0 | 0.0 |
| 6 | $$$$$$ | 23.7 | 23.7 | 0.0 | 0.0 | 6 | $$$$$$ | 22.7 | 22.7 | 0.0 | 0.0 |
| 7 | $$$$$$ | 23.8 | 23.8 | 0.0 | 0.0 | 7 | $$$$$$ | 23.2 | 23.6 | 0.0 | 0.0 |
| 8 | $$$$$$ | 113.5 | 113.5 | 0.0 | 113.5 | 8 | $$$$$$ | 365.6 | 365.7 | 0.0 | 365.7 |
| 9 | $$$$$$ | 113.5 | 113.5 | 0.0 | 113.5 | 9 | $$$$$$ | 365.2 | 365.3 | 0.0 | 365.3 |
| 10 | $$$$$$ | 113.5 | 113.5 | 0.0 | 113.5 | 10 | $$$$$$ | 356.8 | 356.9 | 0.0 | 356.9 |
| 11 | $$$$$$ | 128.8 | 128.8 | 0.0 | 128.8 | 11 | $$$$$$ | 401.0 | 401.1 | 0.0 | 401.1 |
| 12 | $$$$$$ | 128.8 | 128.8 | 0.0 | 128.8 | 12 | $$$$$$ | 402.5 | 402.6 | 0.0 | 402.6 |
| 13 | $$$$$$ | 128.9 | 128.9 | 0.0 | 128.9 | 13 | $$$$$$ | 414.9 | 415.2 | 0.0 | 415.2 |

Incrementos de Carga:
3

Incremento de Carga 4 :
Axil : 1000.00Tn. AXILINF
Excentricidad: 67.23cm.(respecto a la directriz)
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | $$$$$$ | 19.2 | 19.2 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | $$$$$$ | 19.2 | 19.2 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | $$$$$$ | 23.2 | 23.3 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | $$$$$$ | 23.3 | 23.4 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | $$$$$$ | 23.2 | 23.4 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | $$$$$$ | 23.1 | 23.1 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | $$$$$$ | 23.4 | 23.6 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | $$$$$$ | 265.4 | 265.4 | 0.0 | 265.4 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | $$$$$$ | 265.2 | 265.2 | 0.0 | 265.2 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | $$$$$$ | 261.4 | 261.5 | 0.0 | 261.5 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | $$$$$$ | 294.9 | 295.0 | 0.0 | 295.0 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | $$$$$$ | 295.6 | 295.7 | 0.0 | 295.7 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | $$$$$$ | 301.2 | 301.3 | 0.0 | 301.3 |

Incrementos de Carga:
4

Proyecto:
SUBTRAMO XV / E-1505.0

Se ion:TE-V1

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| Fpura + | (0) | 1140.1 | 9.30 | 622244.9 |
| | (1) | 638.6 | 15.58 | 579218.7 |
| | (2) | 748.1 | 13.58 | 592636.1 |
| F. ra - | (0) | 1055.8 | 124.65 | 949438.0 |
| | (1) | 479.4 | 113.60 | 841075.6 |
| | (2) | 605.5 | 117.41 | 875766.8 |
| C.Simple | (0) | 5067.1 | 50.90 | 12984230.6 |
| | (1) | 1631.6 | 51.09 | 4253281.5 |
| | (2) | 2216.4 | 51.02 | 5739420.5 |
| F.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TE-V1

S.Intermedia CA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 366.6 | 45.29 | 342371.5 |
| | (1) | 191.6 | 58.84 | 279236.1 |
| | (2) | 226.0 | 54.43 | 298835.5 |
| F.pura - | (0) | 290.3 | 135.95 | 46345.8 |
| | (1) | 165.1 | 133.48 | 44489.1 |
| | (2) | 192.4 | 134.24 | 45043.7 |
| C.Simple | (0) | 2220.2 | 100.22 | 3222323.3 |
| | (1) | 712.2 | 101.19 | 1033980.5 |
| | (2) | 968.9 | 100.81 | 1406678.7 |
| T.Simple | (0) | 41.9 | 123.88 | 38872.3 |
| | (1) | 41.9 | 123.88 | 38872.3 |
| | (2) | 41.9 | 123.88 | 38872.3 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TE-V1

S.Intermedia CBC

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1060.0 | 9.94 | 617740.8 |
| | (1) | 594.6 | 16.56 | 572757.3 |
| | (2) | 696.1 | 14.46 | 586704.8 |
| F.pura - | (0) | 1055.8 | 124.65 | 949438.0 |
| | (1) | 479.4 | 113.60 | 841075.6 |
| | (2) | 605.5 | 117.41 | 875766.8 |
| C.Simple | (0) | 4686.8 | 54.02 | 12358135.9 |
| | (1) | 1514.6 | 54.08 | 4059418.8 |
| | (2) | 2054.6 | 54.05 | 5471968.1 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

** CALCULO ELASTICO **

Título Sección: TE-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : 1000.00m.T MOMCA
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| | ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 52.5 | -53.4 | -28.0 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 52.5 | -53.4 | -28.0 | 0.0 | 0.0 |
| 3 | 100.2 | -430.3 | -287.3 | 0.0 | 0.0 | 3 | 61.4 | -56.8 | -17.8 | 0.0 | 0.0 |
| 4 | 100.2 | -257.5 | -168.3 | 0.0 | 0.0 | 4 | 61.4 | -9.7 | 14.6 | 0.0 | 0.0 |
| 5 | 100.2 | -430.3 | 124.6 | 0.0 | 0.0 | 5 | 61.4 | -56.8 | 94.5 | 0.0 | 0.0 |
| 6 | 100.2 | 80.0 | 146.3 | 0.0 | 0.0 | 6 | 61.4 | 82.3 | 100.4 | 0.0 | 0.0 |
| 7 | 100.2 | 124.6 | 227.5 | 0.0 | 0.0 | 7 | 61.4 | 94.5 | 122.6 | 0.0 | 0.0 |
| 8 | 100.2 | 932.5 | 969.0 | 0.0 | 969.0 | 8 | 84.2 | 2059.2 | 2114.1 | 0.0 | 2114.1 |
| 9 | 100.2 | 801.3 | 837.8 | 0.0 | 837.8 | 9 | 84.2 | 1861.9 | 1916.8 | 0.0 | 1916.8 |
| 10 | 100.2 | -1651.0 | -1614.5 | 0.0 | 1651.0 | 10 | 84.2 | -1826.2 | -1771.3 | 0.0 | 1826.2 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 52.5 | -790.4 | -774.8 | 0.0 | 790.4 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 52.5 | -571.5 | -555.9 | 0.0 | 571.5 |
| 13 | 100.2 | 1029.7 | 1107.2 | 0.0 | 1107.2 | 13 | 84.2 | 2294.1 | 2410.8 | 0.0 | 2410.8 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : 1000.00m.T MOMBC
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| | ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 54.0 | -66.8 | -35.9 | 0.0 | 0.0 | 1 | 51.3 | -56.8 | -29.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 51.1 | -52.3 | -26.7 | 0.0 | 0.0 |
| 3 | 54.0 | -43.3 | -6.0 | 0.0 | 0.0 | 3 | 51.3 | -35.1 | -1.7 | 0.0 | 0.0 |
| 4 | 54.0 | 1.8 | 25.0 | 0.0 | 0.0 | 4 | 51.3 | 5.3 | 26.1 | 0.0 | 0.0 |
| 5 | 54.0 | -43.3 | 101.4 | 0.0 | 0.0 | 5 | 51.3 | -35.1 | 94.5 | 0.0 | 0.0 |
| 6 | 54.0 | 89.8 | 107.1 | 0.0 | 0.0 | 6 | 51.3 | 84.1 | 99.6 | 0.0 | 0.0 |
| 7 | 54.0 | 101.4 | 128.3 | 0.0 | 0.0 | 7 | 51.3 | 94.5 | 118.6 | 0.0 | 0.0 |
| 8 | 54.0 | 572.5 | 582.0 | 0.0 | 582.0 | 8 | 52.1 | 1729.3 | 1757.3 | 0.0 | 1757.3 |
| 9 | 54.0 | 538.3 | 547.8 | 0.0 | 547.8 | 9 | 52.1 | 1628.4 | 1656.4 | 0.0 | 1656.4 |
| 10 | 54.0 | -101.1 | -91.6 | 0.0 | 101.1 | 10 | 52.1 | -257.3 | -229.2 | 0.0 | 257.3 |
| 11 | 54.0 | -420.9 | -412.8 | 0.0 | 420.9 | 11 | 52.1 | -1194.7 | -1170.9 | 0.0 | 1194.7 |
| 12 | 54.0 | -307.6 | -299.5 | 0.0 | 307.6 | 12 | 52.1 | -860.7 | -836.8 | 0.0 | 860.7 |
| 13 | 54.0 | 642.4 | 662.6 | 0.0 | 662.6 | 13 | 52.1 | 1940.8 | 2000.4 | 0.0 | 2000.4 |

Incrementos de Carga:
2

**Incremento de Carga 3 :**
Flector : 1000.00m.T MOMTOT
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 50.9 | -59.9 | -30.5 | 0.0 | 0.0 | 1 | 51.1 | -56.5 | -28.8 | 0.0 | 0.0 |
| 2 | 50.9 | -59.9 | -30.5 | 0.0 | 0.0 | 2 | 51.1 | -56.5 | -28.8 | 0.0 | 0.0 |
| 3 | 50.9 | -36.8 | -1.3 | 0.0 | 0.0 | 3 | 51.1 | -34.8 | -1.5 | 0.0 | 0.0 |
| 4 | 50.9 | 6.1 | 28.3 | 0.0 | 0.0 | 4 | 51.1 | 5.5 | 26.3 | 0.0 | 0.0 |
| 5 | 50.9 | -36.8 | 100.9 | 0.0 | 0.0 | 5 | 51.1 | -34.8 | 94.6 | 0.0 | 0.0 |
| 6 | 50.9 | 89.9 | 106.3 | 0.0 | 0.0 | 6 | 51.1 | 84.2 | 99.6 | 0.0 | 0.0 |
| 7 | 50.9 | 100.9 | 126.5 | 0.0 | 0.0 | 7 | 51.1 | 94.6 | 118.6 | 0.0 | 0.0 |
| 8 | 50.9 | 566.1 | 575.1 | 0.0 | 575.1 | 8 | 51.1 | 1724.0 | 1751.7 | 0.0 | 1751.7 |
| 9 | 50.9 | 533.5 | 542.6 | 0.0 | 542.6 | 9 | 51.1 | 1624.6 | 1652.2 | 0.0 | 1652.2 |
| 10 | 50.9 | -75.1 | -66.0 | 0.0 | 75.1 | 10 | 51.1 | -233.3 | -205.6 | 0.0 | 233.3 |
| 11 | 50.9 | -376.6 | -368.9 | 0.0 | 376.6 | 11 | 51.1 | -1154.3 | -1130.7 | 0.0 | 1154.3 |
| 12 | 50.9 | -268.8 | -261.1 | 0.0 | 268.8 | 12 | 51.1 | -825.1 | -801.6 | 0.0 | 825.1 |
| 13 | 50.9 | 635.4 | 654.6 | 0.0 | 654.6 | 13 | 51.1 | 1935.1 | 1993.9 | 0.0 | 1993.9 |

Incrementos de Carga:
3

**Incremento de Carga 4 :**
Flector : 1000.00m.T MOMINF
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 50.9 | -59.9 | -30.5 | 0.0 | 0.0 | 1 | 51.1 | -56.5 | -28.8 | 0.0 | 0.0 |
| 2 | 50.9 | -59.9 | -30.5 | 0.0 | 0.0 | 2 | 51.1 | -56.5 | -28.8 | 0.0 | 0.0 |
| 3 | 50.9 | -36.8 | -1.3 | 0.0 | 0.0 | 3 | 51.1 | -34.8 | -1.5 | 0.0 | 0.0 |
| 4 | 50.9 | 6.1 | 28.3 | 0.0 | 0.0 | 4 | 51.1 | 5.5 | 26.3 | 0.0 | 0.0 |
| 5 | 50.9 | -36.8 | 100.9 | 0.0 | 0.0 | 5 | 51.1 | -34.8 | 94.6 | 0.0 | 0.0 |
| 6 | 50.9 | 89.9 | 106.3 | 0.0 | 0.0 | 6 | 51.1 | 84.2 | 99.6 | 0.0 | 0.0 |
| 7 | 50.9 | 100.9 | 126.5 | 0.0 | 0.0 | 7 | 51.1 | 94.6 | 118.6 | 0.0 | 0.0 |
| 8 | 50.9 | 566.1 | 575.1 | 0.0 | 575.1 | 8 | 51.1 | 1724.0 | 1751.7 | 0.0 | 1751.7 |
| 9 | 50.9 | 533.5 | 542.6 | 0.0 | 542.6 | 9 | 51.1 | 1624.6 | 1652.2 | 0.0 | 1652.2 |
| 10 | 50.9 | -75.1 | -66.0 | 0.0 | 75.1 | 10 | 51.1 | -233.3 | -205.6 | 0.0 | 233.3 |
| 11 | 50.9 | -376.6 | -368.9 | 0.0 | 376.6 | 11 | 51.1 | -1154.3 | -1130.7 | 0.0 | 1154.3 |
| 12 | 50.9 | -268.8 | -261.1 | 0.0 | 268.8 | 12 | 51.1 | -825.1 | -801.6 | 0.0 | 825.1 |
| 13 | 50.9 | 635.4 | 654.6 | 0.0 | 654.6 | 13 | 51.1 | 1935.1 | 1993.9 | 0.0 | 1993.9 |

Incrementos de Carga:
4

**Incremento de Carga 5 :**
Flector : 1000.00m.T MOMINF
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 51.0 | -57.8 | -29.5 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 51.0 | -57.8 | -29.5 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 51.0 | -35.6 | -1.4 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 51.0 | 5.7 | 27.0 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 51.0 | -35.6 | 97.0 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 51.0 | 86.3 | 102.2 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 51.0 | 97.0 | 121.6 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 51.0 | 1278.8 | 1299.3 | 0.0 | 1299.3 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 51.0 | 1205.1 | 1225.6 | 0.0 | 1225.6 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 51.0 | -171.7 | -151.2 | 0.0 | 171.7 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 51.0 | -854.1 | -836.6 | 0.0 | 854.1 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 51.0 | -610.1 | -592.7 | 0.0 | 610.1 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 51.0 | 1435.4 | 1478.9 | 0.0 | 1478.9 |

Incrementos de Carga:
5

** CALCULO ELASTICO **

Título Sección: TE-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Axil : 1000.00Tn. AXILCA
Excentricidad: 100.22cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | -2.5 | 1.3 | 13.9 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -2.5 | 1.3 | 13.9 | 0.0 | 0.0 |
| 3 | $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 3 | -6.8 | 20.1 | 35.9 | 0.0 | 0.0 |
| 4 | $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 4 | -6.8 | 39.2 | 49.0 | 0.0 | 0.0 |
| 5 | $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 5 | -6.8 | 20.1 | 81.3 | 0.0 | 0.0 |
| 6 | $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 6 | -6.8 | 76.4 | 83.7 | 0.0 | 0.0 |
| 7 | $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 7 | -6.8 | 81.3 | 92.7 | 0.0 | 0.0 |
| 8 | $$$$$$ | 396.8 | 396.8 | 0.0 | 396.8 | 8 | -60.3 | 1336.0 | 1345.1 | 0.0 | 1345.1 |
| 9 | $$$$$$ | 396.8 | 396.8 | 0.0 | 396.8 | 9 | -60.3 | 1303.0 | 1312.2 | 0.0 | 1312.2 |
| 10 | $$$$$$ | 396.8 | 396.8 | 0.0 | 396.8 | 10 | -60.3 | 687.4 | 696.6 | 0.0 | 696.6 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | -2.5 | 35.2 | 43.0 | 0.0 | 43.0 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | -2.5 | 144.3 | 152.0 | 0.0 | 152.0 |
| 13 | $$$$$$ | 450.4 | 450.4 | 0.0 | 450.4 | 13 | -60.3 | 1509.3 | 1528.7 | 0.0 | 1528.7 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Axil : 1000.00Tn. AXILBC
Excentricidad: 54.02cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 32.6 | 32.6 | 0.0 | 0.0 | 1 | -883.1 | 27.3 | 28.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -826.7 | 25.4 | 26.1 | 0.0 | 0.0 |
| 3 | $$$$$$ | 39.3 | 39.3 | 0.0 | 0.0 | 3 | -883.1 | 33.9 | 34.8 | 0.0 | 0.0 |
| 4 | $$$$$$ | 39.3 | 39.3 | 0.0 | 0.0 | 4 | -883.1 | 35.0 | 35.6 | 0.0 | 0.0 |
| 5 | $$$$$$ | 39.3 | 39.3 | 0.0 | 0.0 | 5 | -883.1 | 33.9 | 37.5 | 0.0 | 0.0 |
| 6 | $$$$$$ | 39.3 | 39.3 | 0.0 | 0.0 | 6 | -883.1 | 37.2 | 37.7 | 0.0 | 0.0 |
| 7 | $$$$$$ | 39.3 | 39.3 | 0.0 | 0.0 | 7 | -883.1 | 37.5 | 38.2 | 0.0 | 0.0 |
| 8 | $$$$$$ | 188.0 | 188.0 | 0.0 | 188.0 | 8 | $$$$$$ | 587.6 | 588.1 | 0.0 | 588.1 |
| 9 | $$$$$$ | 188.0 | 188.0 | 0.0 | 188.0 | 9 | $$$$$$ | 585.6 | 586.1 | 0.0 | 586.1 |
| 10 | $$$$$$ | 188.0 | 188.0 | 0.0 | 188.0 | 10 | $$$$$$ | 548.2 | 548.8 | 0.0 | 548.8 |
| 11 | $$$$$$ | 213.3 | 213.3 | 0.0 | 213.3 | 11 | $$$$$$ | 604.4 | 604.9 | 0.0 | 604.9 |
| 12 | $$$$$$ | 213.3 | 213.3 | 0.0 | 213.3 | 12 | $$$$$$ | 611.1 | 611.5 | 0.0 | 611.5 |
| 13 | $$$$$$ | 213.4 | 213.4 | 0.0 | 213.4 | 13 | $$$$$$ | 666.5 | 667.7 | 0.0 | 667.7 |

Incrementos de Carga:

Incremento de Carga 3 :
Axil : 1000.00Tn. AXILTOT
Excentricidad: 50.90cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 30.1 | 30.1 | 0.0 | 0.0 | 1 | $$$$$$ | 28.9 | 28.9 | 0.0 | 0.0 |
| 2 | $$$$$$ | 30.1 | 30.1 | 0.0 | 0.0 | 2 | $$$$$$ | 28.9 | 28.9 | 0.0 | 0.0 |
| 3 | $$$$$$ | 36.4 | 36.4 | 0.0 | 0.0 | 3 | $$$$$$ | 34.8 | 34.8 | 0.0 | 0.0 |
| 4 | $$$$$$ | 36.4 | 36.4 | 0.0 | 0.0 | 4 | $$$$$$ | 34.7 | 34.7 | 0.0 | 0.0 |
| 5 | $$$$$$ | 36.4 | 36.4 | 0.0 | 0.0 | 5 | $$$$$$ | 34.8 | 34.6 | 0.0 | 0.0 |
| 6 | $$$$$$ | 36.4 | 36.4 | 0.0 | 0.0 | 6 | $$$$$$ | 34.6 | 34.6 | 0.0 | 0.0 |
| 7 | $$$$$$ | 36.4 | 36.4 | 0.0 | 0.0 | 7 | $$$$$$ | 34.6 | 34.5 | 0.0 | 0.0 |
| 8 | $$$$$$ | 173.9 | 173.9 | 0.0 | 173.9 | 8 | $$$$$$ | 536.6 | 536.5 | 0.0 | 536.6 |
| 9 | $$$$$$ | 173.9 | 173.9 | 0.0 | 173.9 | 9 | $$$$$$ | 536.8 | 536.7 | 0.0 | 536.8 |
| 10 | $$$$$$ | 173.9 | 173.9 | 0.0 | 173.9 | 10 | $$$$$$ | 540.4 | 540.3 | 0.0 | 540.4 |
| 11 | $$$$$$ | 197.3 | 197.3 | 0.0 | 197.3 | 11 | $$$$$$ | 615.1 | 615.1 | 0.0 | 615.1 |
| 12 | $$$$$$ | 197.3 | 197.3 | 0.0 | 197.3 | 12 | $$$$$$ | 614.5 | 614.4 | 0.0 | 614.5 |
| 13 | $$$$$$ | 197.4 | 197.4 | 0.0 | 197.4 | 13 | $$$$$$ | 609.1 | 609.0 | 0.0 | 609.1 |

Incrementos de Carga:
3

Incremento de Carga 4 :
Axil : 1000.00Tn. AXILINF
Excentricidad: 50.90cm.(respecto a la directriz)
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | $$$$$$ | 29.4 | 29.4 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | $$$$$$ | 29.4 | 29.4 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | $$$$$$ | 35.4 | 35.4 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | $$$$$$ | 35.4 | 35.4 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | $$$$$$ | 35.4 | 35.3 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | $$$$$$ | 35.3 | 35.3 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | $$$$$$ | 35.3 | 35.2 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | $$$$$$ | 396.0 | 395.9 | 0.0 | 396.0 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | $$$$$$ | 396.0 | 396.0 | 0.0 | 396.0 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | $$$$$$ | 397.7 | 397.6 | 0.0 | 397.7 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | $$$$$$ | 452.2 | 452.2 | 0.0 | 452.2 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | $$$$$$ | 451.9 | 451.9 | 0.0 | 451.9 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | $$$$$$ | 449.5 | 449.4 | 0.0 | 449.5 |

Incrementos de Carga:
4

Proyecto:
SUBTRAMO XV / E-1505.0

Sec .on:T-V1

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 640.0 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 170.0 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1201.2 | 8.87 | 625327.7 |
| | (1) | 672.1 | 14.91 | 583702.5 |
| | (2) | 787.6 | 12.97 | 596733.2 |
| F. ra - | (0) | 1055.8 | 124.65 | 949438.0 |
| | (1) | 479.4 | 113.60 | 841075.6 |
| | (2) | 605.5 | 117.41 | 875766.8 |
| S.Simple | (0) | 5376.1 | 48.69 | 13429640.2 |
| | (1) | 1726.7 | 48.97 | 4392014.5 |
| | (2) | 2347.9 | 48.86 | 5930376.5 |
| S.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: T-V1

S.Intermedia CA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 366.6 | 45.29 | 342371.5 |
| | (1) | 191.6 | 58.84 | 279236.1 |
| | (2) | 226.0 | 54.43 | 298835.5 |
| F.pura - | (0) | 290.3 | 135.95 | 46345.8 |
| | (1) | 165.1 | 133.48 | 44489.1 |
| | (2) | 192.4 | 134.24 | 45043.7 |
| C.Simple | (0) | 2220.2 | 100.22 | 3222323.3 |
| | (1) | 712.2 | 101.19 | 1033980.5 |
| | (2) | 968.9 | 100.81 | 1406678.7 |
| T.Simple | (0) | 41.9 | 123.88 | 38872.3 |
| | (1) | 41.9 | 123.88 | 38872.3 |
| | (2) | 41.9 | 123.88 | 38872.3 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: T-V1

S.Intermedia CBC

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1068.7 | 9.87 | 618259.9 |
| | (1) | 599.3 | 16.45 | 573496.6 |
| | (2) | 701.8 | 14.36 | 587385.0 |
| F.pura - | (0) | 1055.8 | 124.65 | 949438.0 |
| | (1) | 479.4 | 113.60 | 841075.6 |
| | (2) | 605.5 | 117.41 | 875766.8 |
| C.Simple | (0) | 4726.9 | 53.66 | 12428740.3 |
| | (1) | 1527.0 | 53.74 | 4081213.2 |
| | (2) | 2071.6 | 53.71 | 5502071.8 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

** CALCULO ELASTICO **

Tipo Sección: T-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : 1000.00m.T MOMCA
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 50.4 | -49.5 | -24.9 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 50.4 | -49.5 | -24.9 | 0.0 | 0.0 |
| 3 | 100.2 | -430.3 | -287.3 | 0.0 | 0.0 | 3 | 60.0 | -53.1 | -15.1 | 0.0 | 0.0 |
| 4 | 100.2 | -257.5 | -168.3 | 0.0 | 0.0 | 4 | 60.0 | -7.2 | 16.5 | 0.0 | 0.0 |
| 5 | 100.2 | -430.3 | 124.6 | 0.0 | 0.0 | 5 | 60.0 | -53.1 | 94.2 | 0.0 | 0.0 |
| 6 | 100.2 | 80.0 | 146.3 | 0.0 | 0.0 | 6 | 60.0 | 82.4 | 100.0 | 0.0 | 0.0 |
| 7 | 100.2 | 124.6 | 227.5 | 0.0 | 0.0 | 7 | 60.0 | 94.2 | 121.6 | 0.0 | 0.0 |
| 8 | 100.2 | 932.5 | 969.0 | 0.0 | 969.0 | 8 | 83.9 | 2050.8 | 2105.0 | 0.0 | 2105.0 |
| 9 | 100.2 | 801.3 | 837.8 | 0.0 | 837.8 | 9 | 83.9 | 1855.6 | 1909.9 | 0.0 | 1909.9 |
| 10 | 100.2 | -1651.0 | -1614.5 | 0.0 | 1651.0 | 10 | 83.9 | -1791.2 | -1736.9 | 0.0 | 1791.2 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 50.4 | -730.9 | -715.8 | 0.0 | 730.9 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 50.4 | -519.3 | -504.1 | 0.0 | 519.3 |
| 13 | 100.2 | 1029.7 | 1107.2 | 0.0 | 1107.2 | 13 | 83.9 | 2285.0 | 2400.3 | 0.0 | 2400.3 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : 1000.00m.T MOMBC
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 53.7 | -65.9 | -35.2 | 0.0 | 0.0 | 1 | 49.3 | -52.9 | -26.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 48.9 | -48.5 | -23.7 | 0.0 | 0.0 |
| 3 | 53.7 | -42.5 | -5.4 | 0.0 | 0.0 | 3 | 49.3 | -31.4 | 1.0 | 0.0 | 0.0 |
| 4 | 53.7 | 2.3 | 25.4 | 0.0 | 0.0 | 4 | 49.3 | 7.7 | 27.9 | 0.0 | 0.0 |
| 5 | 53.7 | -42.5 | 101.3 | 0.0 | 0.0 | 5 | 49.3 | -31.4 | 94.3 | 0.0 | 0.0 |
| 6 | 53.7 | 89.8 | 107.0 | 0.0 | 0.0 | 6 | 49.3 | 84.2 | 99.2 | 0.0 | 0.0 |
| 7 | 53.7 | 101.3 | 128.0 | 0.0 | 0.0 | 7 | 49.3 | 94.3 | 117.6 | 0.0 | 0.0 |
| 8 | 53.7 | 571.8 | 581.2 | 0.0 | 581.2 | 8 | 50.6 | 1720.4 | 1747.8 | 0.0 | 1747.8 |
| 9 | 53.7 | 537.7 | 547.2 | 0.0 | 547.2 | 9 | 50.6 | 1621.8 | 1649.2 | 0.0 | 1649.2 |
| 10 | 53.7 | -98.0 | -88.6 | 0.0 | 98.0 | 10 | 50.6 | -220.4 | -193.0 | 0.0 | 220.4 |
| 11 | 53.7 | -415.7 | -407.6 | 0.0 | 415.7 | 11 | 50.6 | -1132.0 | -1108.7 | 0.0 | 1132.0 |
| 12 | 53.7 | -303.0 | -295.0 | 0.0 | 303.0 | 12 | 50.6 | -805.7 | -782.4 | 0.0 | 805.7 |
| 13 | 53.7 | 641.6 | 661.7 | 0.0 | 661.7 | 13 | 50.6 | 1931.2 | 1989.4 | 0.0 | 1989.4 |

Incrementos de Carga:
2

Incremento de Carga 3 :
Flector : 1000.00m.T MOMTOT
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 48.7 | -55.4 | -26.9 | 0.0 | 0.0 | 1 | 49.0 | -52.4 | -25.6 | 0.0 | 0.0 |
| 2 | 48.7 | -55.4 | -26.9 | 0.0 | 0.0 | 2 | 49.0 | -52.4 | -25.6 | 0.0 | 0.0 |
| 3 | 48.7 | -32.5 | 1.8 | 0.0 | 0.0 | 3 | 49.0 | -31.0 | 1.3 | 0.0 | 0.0 |
| 4 | 48.7 | 8.9 | 30.3 | 0.0 | 0.0 | 4 | 49.0 | 8.0 | 28.2 | 0.0 | 0.0 |
| 5 | 48.7 | -32.5 | 100.6 | 0.0 | 0.0 | 5 | 49.0 | -31.0 | 94.3 | 0.0 | 0.0 |
| 6 | 48.7 | 89.9 | 105.8 | 0.0 | 0.0 | 6 | 49.0 | 84.2 | 99.2 | 0.0 | 0.0 |
| 7 | 48.7 | 100.6 | 125.3 | 0.0 | 0.0 | 7 | 49.0 | 94.3 | 117.6 | 0.0 | 0.0 |
| 8 | 48.7 | 561.8 | 570.5 | 0.0 | 570.5 | 8 | 49.0 | 1712.2 | 1738.9 | 0.0 | 1738.9 |
| 9 | 48.7 | 530.3 | 539.0 | 0.0 | 539.0 | 9 | 49.0 | 1615.9 | 1642.7 | 0.0 | 1642.7 |
| 10 | 48.7 | -58.1 | -49.4 | 0.0 | 58.1 | 10 | 49.0 | -183.3 | -156.5 | 0.0 | 183.3 |
| 11 | 48.7 | -347.7 | -340.2 | 0.0 | 347.7 | 11 | 49.0 | -1069.4 | -1046.7 | 0.0 | 1069.4 |
| 12 | 48.7 | -243.4 | -236.0 | 0.0 | 243.4 | 12 | 49.0 | -750.7 | -727.9 | 0.0 | 750.7 |
| 13 | 48.7 | 630.7 | 649.4 | 0.0 | 649.4 | 13 | 49.0 | 1922.4 | 1979.3 | 0.0 | 1979.3 |

Incrementos de Carga:
3

Incremento de Carga 4 :
Flector : 1000.00m.T MOMINF
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 48.9 | -53.6 | -26.2 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 48.9 | -53.6 | -26.2 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 48.9 | -31.6 | 1.5 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 48.9 | 8.4 | 29.0 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 48.9 | -31.6 | 96.7 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 48.9 | 86.4 | 101.8 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 48.9 | 96.7 | 120.5 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 48.9 | 1269.6 | 1289.5 | 0.0 | 1289.5 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 48.9 | 1198.3 | 1218.2 | 0.0 | 1218.2 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 48.9 | -134.2 | -114.3 | 0.0 | 134.2 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 48.9 | -790.2 | -773.3 | 0.0 | 790.2 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 48.9 | -554.1 | -537.3 | 0.0 | 554.1 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 48.9 | 1425.5 | 1467.7 | 0.0 | 1467.7 |

Incrementos de Carga:
4

** CALCULO ELASTICO **

Tipo Sección: T-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Axil : 1000.00Tn. AXILCA
Excentricidad: 100.22cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 -1.1 | .6 | 13.4 | 0.0 | 0.0 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 -1.1 | .6 | 13.4 | 0.0 | 0.0 |
| 3 $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 3 -5.4 | 19.4 | 35.4 | 0.0 | 0.0 |
| 4 $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 4 -5.4 | 38.7 | 48.6 | 0.0 | 0.0 |
| 5 $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 5 -5.4 | 19.4 | 81.3 | 0.0 | 0.0 |
| 6 $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 6 -5.4 | 76.3 | 83.7 | 0.0 | 0.0 |
| 7 $$$$$$ | 83.0 | 83.0 | 0.0 | 0.0 | 7 -5.4 | 81.3 | 92.8 | 0.0 | 0.0 |
| 8 $$$$$$ | 396.8 | 396.8 | 0.0 | 396.8 | 8 -58.3 | 1336.6 | 1345.9 | 0.0 | 1345.9 |
| 9 $$$$$$ | 396.8 | 396.8 | 0.0 | 396.8 | 9 -58.3 | 1303.3 | 1312.6 | 0.0 | 1312.6 |
| 0 $$$$$$ | 396.8 | 396.8 | 0.0 | 396.8 | 10 -58.3 | 681.0 | 690.2 | 0.0 | 690.2 |
| 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 -1.1 | 24.6 | 32.5 | 0.0 | 32.5 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 -1.1 | 134.9 | 142.8 | 0.0 | 142.8 |
| 3 $$$$$$ | 450.4 | 450.4 | 0.0 | 450.4 | 13 -58.3 | 1509.9 | 1529.6 | 0.0 | 1529.6 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Axil : 1000.00Tn. AXILBC
Excentricidad: 53.66cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 32.3 | 32.3 | 0.0 | 0.0 | 1 -522.0 | 25.9 | 26.2 | 0.0 | 0.0 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 -484.8 | 23.1 | 24.3 | 0.0 | 0.0 |
| 3 $$$$$$ | 39.0 | 39.0 | 0.0 | 0.0 | 3 -522.0 | 31.7 | 33.1 | 0.0 | 0.0 |
| 4 $$$$$$ | 39.0 | 39.0 | 0.0 | 0.0 | 4 -522.0 | 33.4 | 34.3 | 0.0 | 0.0 |
| 5 $$$$$$ | 39.0 | 39.0 | 0.0 | 0.0 | 5 -522.0 | 31.7 | 37.3 | 0.0 | 0.0 |
| 6 $$$$$$ | 39.0 | 39.0 | 0.0 | 0.0 | 6 -522.0 | 36.8 | 37.5 | 0.0 | 0.0 |
| 7 $$$$$$ | 39.0 | 39.0 | 0.0 | 0.0 | 7 -522.0 | 37.3 | 38.3 | 0.0 | 0.0 |
| 8 $$$$$$ | 186.4 | 186.4 | 0.0 | 186.4 | 8 -773.7 | 586.2 | 587.0 | 0.0 | 587.0 |
| 9 $$$$$$ | 186.4 | 186.4 | 0.0 | 186.4 | 9 -773.7 | 583.1 | 583.9 | 0.0 | 583.9 |
| 10 $$$$$$ | 186.4 | 186.4 | 0.0 | 186.4 | 10 -773.7 | 525.2 | 526.0 | 0.0 | 526.0 |
| 11 $$$$$$ | 211.6 | 211.6 | 0.0 | 211.6 | 11 -773.7 | 568.4 | 569.1 | 0.0 | 569.1 |
| 12 $$$$$$ | 211.6 | 211.6 | 0.0 | 211.6 | 12 -773.7 | 578.7 | 579.4 | 0.0 | 579.4 |
| 13 $$$$$$ | 211.5 | 211.5 | 0.0 | 211.5 | 13 -773.7 | 664.7 | 666.5 | 0.0 | 666.5 |

Incrementos de Carga:

Incremento de Carga 3 :
Axil : 1000.00Tn. AXILTOT
Excentricidad: 48.69cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 28.4 | 28.4 | 0.0 | 0.0 | 1 $$$$$$ | 27.4 | 27.3 | 0.0 | 0.0 |
| 2 $$$$$$ | 28.4 | 28.4 | 0.0 | 0.0 | 2 $$$$$$ | 27.4 | 27.3 | 0.0 | 0.0 |
| 3 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 3 $$$$$$ | 32.9 | 32.8 | 0.0 | 0.0 |
| 4 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 4 $$$$$$ | 32.8 | 32.8 | 0.0 | 0.0 |
| 5 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 5 $$$$$$ | 32.9 | 32.6 | 0.0 | 0.0 |
| 6 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 6 $$$$$$ | 32.6 | 32.6 | 0.0 | 0.0 |
| 7 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 7 $$$$$$ | 32.6 | 32.5 | 0.0 | 0.0 |
| 8 $$$$$$ | 163.9 | 163.9 | 0.0 | 163.9 | 8 $$$$$$ | 505.4 | 505.3 | 0.0 | 505.4 |
| 9 $$$$$$ | 163.9 | 163.9 | 0.0 | 163.9 | 9 $$$$$$ | 505.7 | 505.6 | 0.0 | 505.7 |
| 10 $$$$$$ | 163.9 | 163.9 | 0.0 | 163.9 | 10 $$$$$$ | 510.7 | 510.6 | 0.0 | 510.7 |
| 11 $$$$$$ | 186.0 | 186.0 | 0.0 | 186.0 | 11 $$$$$$ | 582.1 | 582.1 | 0.0 | 582.1 |
| 12 $$$$$$ | 186.0 | 186.0 | 0.0 | 186.0 | 12 $$$$$$ | 581.2 | 581.2 | 0.0 | 581.2 |
| 13 $$$$$$ | 186.0 | 186.0 | 0.0 | 186.0 | 13 $$$$$$ | 573.8 | 573.6 | 0.0 | 573.8 |

Incrementos de Carga:
3

Incremento de Carga 4 :
Axil : 1000.00Tn. AXILINF
Excentricidad: 48.69cm.(respecto a la directriz)
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 28.4 | 28.4 | 0.0 | 0.0 | 1 $$$$$$ | 55.1 | 55.0 | 0.0 | 0.0 |
| 2 $$$$$$ | 28.4 | 28.4 | 0.0 | 0.0 | 2 $$$$$$ | 55.1 | 55.0 | 0.0 | 0.0 |
| 3 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 3 $$$$$$ | 66.4 | 66.2 | 0.0 | 0.0 |
| 4 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 4 $$$$$$ | 66.2 | 66.1 | 0.0 | 0.0 |
| 5 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 5 $$$$$$ | 66.4 | 65.8 | 0.0 | 0.0 |
| 6 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 6 $$$$$$ | 65.9 | 65.8 | 0.0 | 0.0 |
| 7 $$$$$$ | 34.3 | 34.3 | 0.0 | 0.0 | 7 $$$$$$ | 65.8 | 65.7 | 0.0 | 0.0 |
| 8 $$$$$$ | 163.9 | 163.9 | 0.0 | 163.9 | 8 $$$$$$ | 878.5 | 878.3 | 0.0 | 878.5 |
| 9 $$$$$$ | 163.9 | 163.9 | 0.0 | 163.9 | 9 $$$$$$ | 878.8 | 878.7 | 0.0 | 878.8 |
| 10 $$$$$$ | 163.9 | 163.9 | 0.0 | 163.9 | 10 $$$$$$ | 886.2 | 886.0 | 0.0 | 886.2 |
| 11 $$$$$$ | 186.0 | 186.0 | 0.0 | 186.0 | 11 $$$$$$ | 1009.4 | 1009.3 | 0.0 | 1009.4 |
| 12 $$$$$$ | 186.0 | 186.0 | 0.0 | 186.0 | 12 $$$$$$ | 1008.1 | 1008.0 | 0.0 | 1008.1 |
| 13 $$$$$$ | 186.0 | 186.0 | 0.0 | 186.0 | 13 $$$$$$ | 997.2 | 997.0 | 0.0 | 997.2 |

Incrementos de Carga:
3 4

Proyecto:
SUBTRAMO XV / E-1505.0

Se ion:TP-V2

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 602.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 77.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 48.0 | 13.4 | 39.8 | *T | 0 |
| 9 | 3 | 12.0 | 13.4 | 134.3 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 129.5 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1090.8 | 9.14 | 394421.3 |
| | (1) | 616.6 | 14.86 | 357952.4 |
| | (2) | 719.7 | 13.08 | 368971.4 |
| F. ura - | (0) | 1281.2 | 120.71 | 1312131.1 |
| | (1) | 535.2 | 105.31 | 1085902.9 |
| | (2) | 669.4 | 110.57 | 1159674.2 |
| C.Simple | (0) | 4917.0 | 51.95 | 12573125.6 |
| | (1) | 1611.1 | 51.20 | 4045218.1 |
| | (2) | 2173.8 | 51.49 | 5497061.1 |
| F.Simple | (0) | 141.8 | 39.74 | 235218.7 |
| | (1) | 141.8 | 39.74 | 235218.7 |
| | (2) | 141.8 | 39.74 | 235218.7 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TP-V2

S.Intermedia CA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 322.8 | 40.25 | 191674.2 |
| | (1) | 190.8 | 47.72 | 168615.6 |
| | (2) | 218.9 | 45.57 | 174951.8 |
| F.pura - | (0) | 864.5 | 127.26 | 489002.8 |
| | (1) | 437.2 | 118.50 | 427614.7 |
| | (2) | 560.4 | 121.41 | 446862.2 |
| C.Simple | (0) | 2257.2 | 98.51 | 3386830.0 |
| | (1) | 749.2 | 95.98 | 1192286.5 |
| | (2) | 1005.9 | 96.95 | 1567345.3 |
| C.Simple | (0) | 78.9 | 63.82 | 128906.9 |
| | (1) | 78.9 | 63.82 | 128906.9 |
| | (2) | 78.9 | 63.82 | 128906.9 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TP-V2

S.Intermedia CBC

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1027.7 | 9.63 | 391159.8 |
| | (1) | 582.3 | 15.56 | 353680.9 |
| | (2) | 679.1 | 13.72 | 364930.3 |
| F.pura - | (0) | 1281.2 | 120.71 | 1312131.1 |
| | (1) | 535.2 | 105.31 | 1085902.9 |
| | (2) | 669.4 | 110.57 | 1159674.2 |
| C.Simple | (0) | 4620.7 | 54.47 | 12067078.2 |
| | (1) | 1519.9 | 53.52 | 3895711.8 |
| | (2) | 2047.7 | 53.89 | 5287020.9 |
| C.Simple | (0) | 141.8 | 39.74 | 235218.7 |
| | (1) | 141.8 | 39.74 | 235218.7 |
| | (2) | 141.8 | 39.74 | 235218.7 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

** CALCULO ELASTICO **

Título Sección: TP-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : 1000.00m.T MOMCA
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 47.9 | -51.6 | -24.7 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 47.9 | -51.6 | -24.7 | 0.0 | 0.0 |
| 3 | 98.5 | -400.1 | -264.0 | 0.0 | 0.0 | 3 | 64.4 | -70.7 | -25.9 | 0.0 | 0.0 |
| 4 | 98.5 | -235.7 | -150.8 | 0.0 | 0.0 | 4 | 64.4 | -16.6 | 11.4 | 0.0 | 0.0 |
| 5 | 98.5 | -400.1 | 127.9 | 0.0 | 0.0 | 5 | 64.4 | -70.7 | 103.2 | 0.0 | 0.0 |
| 6 | 98.5 | 85.4 | 148.5 | 0.0 | 0.0 | 6 | 64.4 | 89.2 | 110.0 | 0.0 | 0.0 |
| 7 | 98.5 | 127.9 | 225.8 | 0.0 | 0.0 | 7 | 64.4 | 103.2 | 135.4 | 0.0 | 0.0 |
| 8 | 98.5 | -1526.3 | -1491.6 | 0.0 | 1526.3 | 8 | 80.3 | -1644.5 | -1590.3 | 0.0 | 1644.5 |
| 9 | 98.5 | 931.7 | 966.5 | 0.0 | 966.5 | 9 | 80.3 | 2191.7 | 2245.9 | 0.0 | 2245.9 |
| 10 | 98.5 | 806.9 | 841.6 | 0.0 | 841.6 | 10 | 80.3 | 1996.8 | 2051.0 | 0.0 | 2051.0 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 47.9 | -760.3 | -743.8 | 0.0 | 760.3 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 47.9 | -528.6 | -512.0 | 0.0 | 528.6 |
| 13 | 98.5 | 1030.2 | 1104.0 | 0.0 | 1104.0 | 13 | 80.3 | 2445.0 | 2560.2 | 0.0 | 2560.2 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : 1000.00m.T MOMBC
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 54.5 | -69.0 | -37.3 | 0.0 | 0.0 | 1 | 51.3 | -59.7 | -30.6 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 50.7 | -55.1 | -27.9 | 0.0 | 0.0 |
| 3 | 54.5 | -45.0 | -6.8 | 0.0 | 0.0 | 3 | 51.3 | -37.0 | -1.8 | 0.0 | 0.0 |
| 4 | 54.5 | 1.1 | 24.9 | 0.0 | 0.0 | 4 | 51.3 | 5.5 | 27.4 | 0.0 | 0.0 |
| 5 | 54.5 | -45.0 | 103.1 | 0.0 | 0.0 | 5 | 51.3 | -37.0 | 99.3 | 0.0 | 0.0 |
| 6 | 54.5 | 91.2 | 109.0 | 0.0 | 0.0 | 6 | 51.3 | 88.3 | 104.6 | 0.0 | 0.0 |
| 7 | 54.5 | 103.1 | 130.6 | 0.0 | 0.0 | 7 | 51.3 | 99.3 | 124.6 | 0.0 | 0.0 |
| 8 | 54.5 | -106.9 | -97.2 | 0.0 | 106.9 | 8 | 51.9 | -266.9 | -237.5 | 0.0 | 266.9 |
| 9 | 54.5 | 583.0 | 592.7 | 0.0 | 592.7 | 9 | 51.9 | 1815.8 | 1845.2 | 0.0 | 1845.2 |
| 10 | 54.5 | 547.9 | 557.7 | 0.0 | 557.7 | 10 | 51.9 | 1710.0 | 1739.4 | 0.0 | 1739.4 |
| 11 | 54.5 | -434.9 | -426.6 | 0.0 | 434.9 | 11 | 51.9 | -1249.4 | -1224.4 | 0.0 | 1249.4 |
| 12 | 54.5 | -318.8 | -310.6 | 0.0 | 318.8 | 12 | 51.9 | -899.2 | -874.2 | 0.0 | 899.2 |
| 13 | 54.5 | 654.1 | 674.8 | 0.0 | 674.8 | 13 | 51.9 | 2037.9 | 2100.5 | 0.0 | 2100.5 |

Incrementos de Carga:
2

**Incremento de Carga 3 :**
Flector : 1000.00m.T MOMTOT
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 51.9 | -63.1 | -32.7 | 0.0 | 0.0 | 1 | 51.2 | -59.5 | -30.4 | 0.0 | 0.0 |
| 2 | 51.9 | -63.1 | -32.7 | 0.0 | 0.0 | 2 | 51.2 | -59.5 | -30.4 | 0.0 | 0.0 |
| 3 | 51.9 | -39.5 | -2.9 | 0.0 | 0.0 | 3 | 51.2 | -36.7 | -1.7 | 0.0 | 0.0 |
| 4 | 51.9 | 4.8 | 27.6 | 0.0 | 0.0 | 4 | 51.2 | 5.6 | 27.5 | 0.0 | 0.0 |
| 5 | 51.9 | -39.5 | 102.7 | 0.0 | 0.0 | 5 | 51.2 | -36.7 | 99.3 | 0.0 | 0.0 |
| 6 | 51.9 | 91.3 | 108.3 | 0.0 | 0.0 | 6 | 51.2 | 88.3 | 104.6 | 0.0 | 0.0 |
| 7 | 51.9 | 102.7 | 129.1 | 0.0 | 0.0 | 7 | 51.2 | 99.3 | 124.5 | 0.0 | 0.0 |
| 8 | 51.9 | -84.9 | -75.5 | 0.0 | 84.9 | 8 | 51.2 | -247.7 | -218.6 | 0.0 | 247.7 |
| 9 | 51.9 | 577.2 | 586.6 | 0.0 | 586.6 | 9 | 51.2 | 1810.3 | 1839.4 | 0.0 | 1839.4 |
| 10 | 51.9 | 543.6 | 553.0 | 0.0 | 553.0 | 10 | 51.2 | 1705.8 | 1734.9 | 0.0 | 1734.9 |
| 11 | 51.9 | -397.2 | -389.3 | 0.0 | 397.2 | 11 | 51.2 | -1216.3 | -1191.6 | 0.0 | 1216.3 |
| 12 | 51.9 | -285.9 | -277.9 | 0.0 | 285.9 | 12 | 51.2 | -870.2 | -845.5 | 0.0 | 870.2 |
| 13 | 51.9 | 647.8 | 667.7 | 0.0 | 667.7 | 13 | 51.2 | 2032.0 | 2093.8 | 0.0 | 2093.8 |

Incrementos de Carga:
3

**Incremento de Carga 4 :**
Flector : 1000.00m.T MOMINF
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 51.5 | -60.9 | -31.3 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 51.5 | -60.9 | -31.3 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 51.5 | -37.8 | -2.1 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 51.5 | 5.3 | 27.6 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 51.5 | -37.8 | 100.6 | 0.0 | 0.0 |
| 6 | $$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 51.5 | 89.5 | 106.0 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 51.5 | 100.6 | 126.3 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 51.5 | -186.8 | -165.4 | 0.0 | 186.8 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 51.5 | 1327.6 | 1349.0 | 0.0 | 1349.0 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 51.5 | 1250.7 | 1272.1 | 0.0 | 1272.1 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 51.5 | -900.3 | -882.1 | 0.0 | 900.3 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 51.5 | -645.6 | -627.4 | 0.0 | 645.6 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 51.5 | 1490.1 | 1535.6 | 0.0 | 1535.6 |

Incrementos de Carga:
4

**** CALCULO ELASTICO ****

**Título Sección: TP-V2**

**Analisis SIN FISURACION**

Secuencia Incrementos de Carga:

**Incremento de Carga 1 :**
Axil : 1000.00Tn. AXILCA
Excentricidad: 98.51cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 0.0 | -0.0 | 13.0 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 0.0 | -0.0 | 13.0 | 0.0 | 0.0 |
| 3 | $$$$$$ | 81.7 | 81.7 | 0.0 | 0.0 | 3 | -17.4 | 24.8 | 39.4 | 0.0 | 0.0 |
| 4 | $$$$$$ | 81.7 | 81.7 | 0.0 | 0.0 | 4 | -17.4 | 42.4 | 51.5 | 0.0 | 0.0 |
| 5 | $$$$$$ | 81.7 | 81.7 | 0.0 | 0.0 | 5 | -17.4 | 24.8 | 81.5 | 0.0 | 0.0 |
| 6 | $$$$$$ | 81.7 | 81.7 | 0.0 | 0.0 | 6 | -17.4 | 76.9 | 83.7 | 0.0 | 0.0 |
| 7 | $$$$$$ | 81.7 | 81.7 | 0.0 | 0.0 | 7 | -17.4 | 81.5 | 92.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 390.3 | 390.3 | 0.0 | 390.3 | 8 | -55.1 | 672.1 | 681.5 | 0.0 | 681.5 |
| 9 | $$$$$$ | 390.3 | 390.3 | 0.0 | 390.3 | 9 | -55.1 | 1341.4 | 1350.9 | 0.0 | 1350.9 |
| 10 | $$$$$$ | 390.3 | 390.3 | 0.0 | 390.3 | 10 | -55.1 | 1307.4 | 1316.9 | 0.0 | 1316.9 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 0.0 | 15.7 | 23.8 | 0.0 | 23.8 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 0.0 | 128.3 | 136.3 | 0.0 | 136.3 |
| 13 | $$$$$$ | 443.0 | 443.0 | 0.0 | 443.0 | 13 | -55.1 | 1515.2 | 1535.3 | 0.0 | 1535.3 |

Incrementos de Carga:
1

**Incremento de Carga 2 :**
Axil : 1000.00Tn. AXILBC
Excentricidad: 54.47cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 33.1 | 33.1 | 0.0 | 0.0 | 1 | -750.9 | 27.4 | 28.3 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -609.9 | 24.9 | 26.0 | 0.0 | 0.0 |
| 3 | $$$$$$ | 39.9 | 39.9 | 0.0 | 0.0 | 3 | -750.9 | 34.2 | 35.3 | 0.0 | 0.0 |
| 4 | $$$$$$ | 39.9 | 39.9 | 0.0 | 0.0 | 4 | -750.9 | 35.5 | 36.2 | 0.0 | 0.0 |
| 5 | $$$$$$ | 39.9 | 39.9 | 0.0 | 0.0 | 5 | -750.9 | 34.2 | 38.4 | 0.0 | 0.0 |
| 6 | $$$$$$ | 39.9 | 39.9 | 0.0 | 0.0 | 6 | -750.9 | 38.1 | 38.6 | 0.0 | 0.0 |
| 7 | $$$$$$ | 39.9 | 39.9 | 0.0 | 0.0 | 7 | -750.9 | 38.4 | 39.2 | 0.0 | 0.0 |
| 8 | $$$$$$ | 190.7 | 190.7 | 0.0 | 190.7 | 8 | -954.7 | 550.7 | 551.4 | 0.0 | 551.4 |
| 9 | $$$$$$ | 190.6 | 190.6 | 0.0 | 190.6 | 9 | -954.7 | 603.0 | 603.7 | 0.0 | 603.7 |
| 10 | $$$$$$ | 190.6 | 190.6 | 0.0 | 190.6 | 10 | -954.7 | 600.3 | 601.1 | 0.0 | 601.1 |
| 11 | $$$$$$ | 216.4 | 216.4 | 0.0 | 216.4 | 11 | -954.7 | 601.3 | 601.9 | 0.0 | 601.9 |
| 12 | $$$$$$ | 216.4 | 216.4 | 0.0 | 216.4 | 12 | -954.7 | 610.1 | 610.7 | 0.0 | 610.7 |
| 13 | $$$$$$ | 216.4 | 216.4 | 0.0 | 216.4 | 13 | -954.7 | 683.9 | 685.5 | 0.0 | 685.5 |

**Incrementos de Carga:**

2

**Incremento de Carga 3 :**

Axil : 1000.00Tn. AXILTOT
Excentricidad: 51.95cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 31.1 | 31.1 | 0.0 | 0.0 | 1 | $$$$$$ | 28.7 | 28.9 | 0.0 | 0.0 |
| 2 | $$$$$$ | 31.1 | 31.1 | 0.0 | 0.0 | 2 | $$$$$$ | 28.7 | 28.9 | 0.0 | 0.0 |
| 3 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 3 | $$$$$$ | 34.9 | 35.2 | 0.0 | 0.0 |
| 4 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 4 | $$$$$$ | 35.2 | 35.4 | 0.0 | 0.0 |
| 5 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 5 | $$$$$$ | 34.9 | 35.9 | 0.0 | 0.0 |
| 6 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 6 | $$$$$$ | 35.9 | 36.0 | 0.0 | 0.0 |
| 7 | $$$$$$ | 37.5 | 37.5 | 0.0 | 0.0 | 7 | $$$$$$ | 35.9 | 36.1 | 0.0 | 0.0 |
| 8 | $$$$$$ | 179.2 | 179.2 | 0.0 | 179.2 | 8 | $$$$$$ | 545.0 | 545.2 | 0.0 | 545.2 |
| 9 | $$$$$$ | 179.2 | 179.2 | 0.0 | 179.2 | 9 | $$$$$$ | 560.4 | 560.6 | 0.0 | 560.6 |
| 10 | $$$$$$ | 179.2 | 179.2 | 0.0 | 179.2 | 10 | $$$$$$ | 559.6 | 559.8 | 0.0 | 559.8 |
| 11 | $$$$$$ | 203.4 | 203.4 | 0.0 | 203.4 | 11 | $$$$$$ | 611.6 | 611.8 | 0.0 | 611.8 |
| 12 | $$$$$$ | 203.4 | 203.4 | 0.0 | 203.4 | 12 | $$$$$$ | 614.2 | 614.4 | 0.0 | 614.4 |
| 13 | $$$$$$ | 203.4 | 203.4 | 0.0 | 203.4 | 13 | $$$$$$ | 635.9 | 636.4 | 0.0 | 636.4 |

Incrementos de Carga:
3

**Incremento de Carga 4 :**

Flector : 1000.00m.T AXILINF
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 51.5 | -60.9 | -31.3 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 51.5 | -60.9 | -31.3 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 51.5 | -37.8 | -2.1 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 51.5 | 5.3 | 27.6 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 51.5 | -37.8 | 100.6 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 51.5 | 89.5 | 106.0 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 51.5 | 100.6 | 126.3 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 51.5 | -186.8 | -165.4 | 0.0 | 186.8 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 51.5 | 1327.6 | 1349.0 | 0.0 | 1349.0 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 51.5 | 1250.7 | 1272.1 | 0.0 | 1272.1 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 51.5 | -900.3 | -882.1 | 0.0 | 900.3 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 51.5 | -645.6 | -627.4 | 0.0 | 645.6 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 51.5 | 1490.1 | 1535.6 | 0.0 | 1535.6 |

Incrementos de Carga:
4

**Incremento de Carga 5 :**

Axil : 1000.00Tn. AXILINF
Excentricidad: 51.95cm.(respecto a la directriz)
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | $$$$$$ | 29.6 | 29.8 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | $$$$$$ | 29.6 | 29.8 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | $$$$$$ | 35.9 | 36.1 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | $$$$$$ | 36.1 | 36.2 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | $$$$$$ | 35.9 | 36.5 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | $$$$$$ | 36.5 | 36.6 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | $$$$$$ | 36.5 | 36.7 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | $$$$$$ | 404.4 | 404.5 | 0.0 | 404.5 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | $$$$$$ | 411.4 | 411.5 | 0.0 | 411.5 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | $$$$$$ | 411.0 | 411.1 | 0.0 | 411.1 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | $$$$$$ | 455.9 | 456.0 | 0.0 | 456.0 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | $$$$$$ | 457.0 | 457.1 | 0.0 | 457.1 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | $$$$$$ | 466.9 | 467.1 | 0.0 | 467.1 |

Incrementos de Carga:
5

Proyecto:
SUBTRAMO XV / E-1505.0

Seccion:TP -V2

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 24.5 | 43.3 | 25.0 | C* | 0 |
| 4 | 2 | 267.5 | 65.0 | 25.0 | C* | 0 |
| 5 | 1 | 87.6 | 65.0 | 25.0 | C* | 0 |
| 6 | 1 | 0.0 | 0.0 | 0.0 | C* | 0 |
| 7 | 1 | 342.5 | 50.0 | 90.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 5 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |
| 8 | CAM | 3 4 5 7 8 9 10 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1140.1 | 9.30 | 622244.9 |
| | (1) | 638.5 | 15.58 | 579218.7 |
| | (2) | 748.0 | 13.58 | 592636.1 |
| F.pura - | (0) | 1063.7 | 124.81 | 951186.8 |
| | (1) | 596.4 | 114.69 | 845711.5 |
| | (2) | 698.4 | 117.90 | 878423.2 |
| C.Simple | (0) | 9945.9 | 62.92 | 18314597.0 |
| | (1) | 3132.8 | 62.74 | 5896200.9 |
| | (2) | 4292.5 | 62.81 | 8010002.5 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TPM-V2

S.Intermedia CA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 415.8 | 43.11 | 353279.9 |
| | (1) | 233.3 | 55.12 | 294979.7 |
| | (2) | 273.2 | 51.31 | 313025.9 |
| F.pura - | (0) | 293.8 | 135.99 | 46377.9 |
| | (1) | 166.7 | 133.54 | 44530.4 |
| | (2) | 194.2 | 134.30 | 45083.0 |
| C.Simple | (0) | 4443.2 | 98.50 | 4271860.2 |
| | (1) | 1396.2 | 99.03 | 1359638.7 |
| | (2) | 1914.8 | 98.82 | 1855463.3 |
| T.Simple | (0) | 41.9 | 123.88 | 38872.3 |
| | (1) | 41.9 | 123.88 | 38872.3 |
| | (2) | 41.9 | 123.88 | 38872.3 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

* CONSTANTES ESTATICAS *

Título Sección: TPM-V2

S.Intermedia CAM

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 715.0 | 35.95 | 389950.3 |
| | (1) | 398.3 | 43.83 | 349655.0 |
| | (2) | 467.6 | 41.27 | 362569.6 |
| F.pura - | (0) | 293.8 | 135.99 | 46377.9 |
| | (1) | 166.7 | 133.54 | 44530.4 |
| | (2) | 194.2 | 134.30 | 45083.0 |
| C.Simple | (0) | 7099.0 | 83.16 | 8001053.3 |
| | (1) | 2213.3 | 83.70 | 2536267.3 |
| | (2) | 3044.9 | 83.48 | 3466651.5 |
| T.Simple | (0) | 41.9 | 123.88 | 38872.3 |
| | (1) | 41.9 | 123.88 | 38872.3 |
| | (2) | 41.9 | 123.88 | 38872.3 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*** CONSTANTES ESTATICAS ***

Título Sección: TPM-V2

S.Intermedia CBC

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1060.1 | 9.94 | 617740.8 |
| | (1) | 594.6 | 16.56 | 572757.3 |
| | (2) | 696.2 | 14.46 | 586704.8 |
| F.pura - | (0) | 1063.7 | 124.81 | 951186.8 |
| | (1) | 596.4 | 114.69 | 845711.5 |
| | (2) | 698.4 | 117.90 | 878423.2 |
| C.Simple | (0) | 9565.6 | 64.92 | 17289641.8 |
| | (1) | 3015.8 | 64.69 | 5583278.5 |
| | (2) | 4130.6 | 64.78 | 7575904.0 |
| C.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

**** CALCULO ELASTICO ****

Título Sección: TPM-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Flector : 1000.00m.T MOMCA
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 63.7 | -47.3 | -28.7 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 63.7 | -47.3 | -28.7 | 0.0 | 0.0 |
| 3 | 98.5 | -317.1 | -130.3 | 0.0 | 0.0 | 3 | 70.3 | -51.4 | -2.2 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 63.7 | -28.7 | 19.5 | 0.0 | 0.0 |
| 5 | 98.5 | -317.1 | -36.7 | 0.0 | 0.0 | 5 | 70.3 | -51.4 | 22.4 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 63.7 | -57.1 | -57.1 | 0.0 | 0.0 |
| 7 | 98.5 | -36.7 | 179.1 | 0.0 | 0.0 | 7 | 70.3 | 22.4 | 79.1 | 0.0 | 0.0 |
| 8 | 98.5 | 738.9 | 766.4 | 0.0 | 766.4 | 8 | 87.1 | 1449.4 | 1490.3 | 0.0 | 1490.3 |
| 9 | 98.5 | 639.9 | 667.4 | 0.0 | 667.4 | 9 | 87.1 | 1302.1 | 1343.1 | 0.0 | 1343.1 |
| 10 | 98.5 | -1209.9 | -1182.4 | 0.0 | 1209.9 | 10 | 87.1 | -1450.0 | -1409.0 | 0.0 | 1450.0 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 63.7 | -704.5 | -693.1 | 0.0 | 704.5 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 63.7 | -544.7 | -533.2 | 0.0 | 544.7 |
| 13 | 98.5 | 817.0 | 875.5 | 0.0 | 875.5 | 13 | 87.1 | 1612.8 | 1699.9 | 0.0 | 1699.9 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Flector : 1000.00m.T MOMCAM
Tipo de Solicitacion: CP
Seccion Afectada: CAM

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 63.6 | -47.8 | -29.0 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 63.6 | -47.8 | -29.0 | 0.0 | 0.0 |
| 3 | 83.2 | -134.0 | -34.2 | 0.0 | 0.0 | 3 | 65.5 | -41.7 | 2.9 | 0.0 | 0.0 |
| 4 | 83.2 | -111.0 | 13.1 | 0.0 | 0.0 | 4 | 65.5 | -34.6 | 20.9 | 0.0 | 0.0 |
| 5 | 83.2 | -134.0 | 15.8 | 0.0 | 0.0 | 5 | 65.5 | -41.7 | 25.3 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 63.6 | -57.6 | -57.6 | 0.0 | 0.0 |
| 7 | 83.2 | 15.8 | 130.9 | 0.0 | 0.0 | 7 | 65.5 | 25.3 | 76.8 | 0.0 | 0.0 |
| 8 | 83.2 | 563.4 | 578.1 | 0.0 | 578.1 | 8 | 73.7 | 1283.9 | 1312.1 | 0.0 | 1312.1 |
| 9 | 83.2 | 510.5 | 525.2 | 0.0 | 525.2 | 9 | 73.7 | 1182.1 | 1210.4 | 0.0 | 1210.4 |
| 10 | 83.2 | -477.1 | -462.4 | 0.0 | 477.1 | 10 | 73.7 | -718.8 | -690.5 | 0.0 | 718.8 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 63.6 | -711.6 | -700.0 | 0.0 | 711.6 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 63.6 | -549.8 | -538.2 | 0.0 | 549.8 |
| 13 | 83.2 | 627.9 | 659.1 | 0.0 | 659.1 | 13 | 73.7 | 1435.0 | 1495.1 | 0.0 | 1495.1 |

Incrementos de Carga:
2

**Incremento de Carga 3 :**
Flector : 1000.00m.T MOMBC
Tipo de Solicitacion: CP
Seccion Afectada: CBC

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 64.9 | -57.4 | -35.3 | 0.0 | 0.0 | 1 | 62.9 | -50.2 | -30.3 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 62.6 | -46.7 | -28.0 | 0.0 | 0.0 |
| 3 | 64.9 | -42.6 | 3.6 | 0.0 | 0.0 | 3 | 62.9 | -36.5 | 5.3 | 0.0 | 0.0 |
| 4 | 64.9 | -35.3 | 22.2 | 0.0 | 0.0 | 4 | 62.9 | -30.3 | 21.7 | 0.0 | 0.0 |
| 5 | 64.9 | -42.6 | 26.7 | 0.0 | 0.0 | 5 | 62.9 | -36.5 | 26.2 | 0.0 | 0.0 |
| 6 | 64.9 | -69.2 | -69.2 | 0.0 | 0.0 | 6 | 62.9 | -60.6 | -60.6 | 0.0 | 0.0 |
| 7 | 64.9 | 26.7 | 80.0 | 0.0 | 0.0 | 7 | 62.9 | 26.2 | 74.4 | 0.0 | 0.0 |
| 8 | 64.9 | 353.7 | 360.5 | 0.0 | 360.5 | 8 | 63.4 | 1078.5 | 1098.8 | 0.0 | 1098.8 |
| 9 | 64.9 | 329.2 | 336.0 | 0.0 | 336.0 | 9 | 63.4 | 1005.6 | 1025.9 | 0.0 | 1025.9 |
| 10 | 64.9 | -127.8 | -121.0 | 0.0 | 127.8 | 10 | 63.4 | -358.0 | -337.7 | 0.0 | 358.0 |
| 11 | 64.9 | -363.9 | -358.1 | 0.0 | 363.9 | 11 | 63.4 | -1059.2 | -1041.9 | 0.0 | 1059.2 |
| 12 | 64.9 | -283.0 | -277.2 | 0.0 | 283.0 | 12 | 63.4 | -817.6 | -800.3 | 0.0 | 817.6 |
| 13 | 64.9 | 396.1 | 410.5 | 0.0 | 410.5 | 13 | 63.4 | 1208.2 | 1251.4 | 0.0 | 1251.4 |

**Incrementos de Carga:**
3

**Incremento de Carga 4 :**
Flector : 1000.00m.T MOMTOT
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 62.9 | -52.5 | -31.6 | 0.0 | 0.0 | 1 | 62.7 | -50.0 | -30.1 | 0.0 | 0.0 |
| 2 | 62.9 | -52.5 | -31.6 | 0.0 | 0.0 | 2 | 62.7 | -50.0 | -30.1 | 0.0 | 0.0 |
| 3 | 62.9 | -38.2 | 5.4 | 0.0 | 0.0 | 3 | 62.7 | -36.3 | 5.3 | 0.0 | 0.0 |
| 4 | 62.9 | -31.6 | 22.6 | 0.0 | 0.0 | 4 | 62.7 | -30.1 | 21.7 | 0.0 | 0.0 |
| 5 | 62.9 | -38.2 | 27.3 | 0.0 | 0.0 | 5 | 62.7 | -36.3 | 26.2 | 0.0 | 0.0 |
| 6 | 62.9 | -63.3 | -63.3 | 0.0 | 0.0 | 6 | 62.7 | -60.3 | -60.3 | 0.0 | 0.0 |
| 7 | 62.9 | 27.3 | 77.6 | 0.0 | 0.0 | 7 | 62.7 | 26.2 | 74.3 | 0.0 | 0.0 |
| 8 | 62.9 | 343.5 | 349.9 | 0.0 | 349.9 | 8 | 62.7 | 1069.6 | 1089.6 | 0.0 | 1089.6 |
| 9 | 62.9 | 320.4 | 326.8 | 0.0 | 326.8 | 9 | 62.7 | 997.9 | 1017.9 | 0.0 | 1017.9 |
| 10 | 62.9 | -111.0 | -104.6 | 0.0 | 111.0 | 10 | 62.7 | -342.3 | -322.3 | 0.0 | 342.3 |
| 11 | 62.9 | -332.6 | -327.2 | 0.0 | 332.6 | 11 | 62.7 | -1030.1 | -1013.2 | 0.0 | 1030.1 |
| 12 | 62.9 | -256.2 | -250.7 | 0.0 | 256.2 | 12 | 62.7 | -792.7 | -775.7 | 0.0 | 792.7 |
| 13 | 62.9 | 384.8 | 398.5 | 0.0 | 398.5 | 13 | 62.7 | 1198.4 | 1240.8 | 0.0 | 1240.8 |

**Incrementos de Carga:**
4

**Incremento de Carga 5 :**
Flector : 1000.00m.T MOMINF
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

**TENSIONES (Kg/cm2):**

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 62.8 | -51.0 | -30.7 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 62.8 | -51.0 | -30.7 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 62.8 | -37.0 | 5.4 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 62.8 | -30.7 | 22.1 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 62.8 | -37.0 | 26.6 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 62.8 | -61.5 | -61.5 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 62.8 | 26.6 | 75.6 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 62.8 | 786.6 | 801.3 | 0.0 | 801.3 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 62.8 | 733.8 | 748.5 | 0.0 | 748.5 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 62.8 | -252.7 | -238.0 | 0.0 | 252.7 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 62.8 | -759.2 | -746.7 | 0.0 | 759.2 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 62.8 | -584.4 | -571.9 | 0.0 | 584.4 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 62.8 | 881.3 | 912.5 | 0.0 | 912.5 |

**Incrementos de Carga:**
5

** CALCULO ELASTICO **

Título Sección: TPM-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Axil : 1000.00Tn. AXILCA
Excentricidad: 98.50cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 9.9 | 2.7 | 4.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 9.9 | -2.7 | 4.1 | 0.0 | 0.0 |
| 3 | $$$$$$ | 41.5 | 41.5 | 0.0 | 0.0 | 3 | 5.8 | 6.4 | 20.8 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 9.9 | 4.1 | 21.6 | 0.0 | 0.0 |
| 5 | $$$$$$ | 41.5 | 41.5 | 0.0 | 0.0 | 5 | 5.8 | 6.4 | 28.0 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 9.9 | -3.2 | -3.2 | 0.0 | 0.0 |
| 7 | $$$$$$ | 41.5 | 41.5 | 0.0 | 0.0 | 7 | 5.8 | 28.0 | 44.7 | 0.0 | 0.0 |
| 8 | $$$$$$ | 198.3 | 198.3 | 0.0 | 198.3 | 8 | -44.5 | 652.1 | 657.0 | 0.0 | 657.0 |
| 9 | $$$$$$ | 198.3 | 198.3 | 0.0 | 198.3 | 9 | -44.5 | 634.6 | 639.5 | 0.0 | 639.5 |
| 10 | $$$$$$ | 198.3 | 198.3 | 0.0 | 198.3 | 10 | -44.5 | 307.5 | 312.4 | 0.0 | 312.4 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 9.9 | -32.5 | -28.4 | 0.0 | 32.5 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 9.9 | 25.4 | 29.5 | 0.0 | 29.5 |
| 13 | $$$$$$ | 225.1 | 225.1 | 0.0 | 225.1 | 13 | -44.5 | 736.4 | 746.7 | 0.0 | 746.7 |

Incrementos de Carga:
1

Incremento de Carga 2 :
Axil : 1000.00Tn. AXILCAM
Excentricidad: 83.16cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CAM

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | -31.0 | 4.7 | 8.6 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -31.0 | 4.7 | 8.6 | 0.0 | 0.0 |
| 3 | $$$$$$ | 26.0 | 26.0 | 0.0 | 0.0 | 3 | -34.7 | 11.3 | 19.5 | 0.0 | 0.0 |
| 4 | $$$$$$ | 21.5 | 21.5 | 0.0 | 0.0 | 4 | -34.7 | 9.4 | 19.5 | 0.0 | 0.0 |
| 5 | $$$$$$ | 26.0 | 26.0 | 0.0 | 0.0 | 5 | -34.7 | 11.3 | 23.6 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | -31.0 | 5.7 | 5.7 | 0.0 | 0.0 |
| 7 | $$$$$$ | 26.0 | 26.0 | 0.0 | 0.0 | 7 | -34.7 | 23.6 | 33.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 124.1 | 124.1 | 0.0 | 124.1 | 8 | -90.8 | 466.7 | 469.4 | 0.0 | 469.4 |
| 9 | $$$$$$ | 124.1 | 124.1 | 0.0 | 124.1 | 9 | -90.8 | 456.7 | 459.5 | 0.0 | 459.5 |
| 10 | $$$$$$ | 124.1 | 124.1 | 0.0 | 124.1 | 10 | -90.8 | 270.8 | 273.6 | 0.0 | 273.6 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | -31.0 | 77.5 | 79.9 | 0.0 | 79.9 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | -31.0 | 110.5 | 112.8 | 0.0 | 112.8 |
| 13 | $$$$$$ | 140.9 | 140.9 | 0.0 | 140.9 | 13 | -90.8 | 527.5 | 533.4 | 0.0 | 533.4 |

Incrementos de Carga:

Incremento de Carga 3 :
Axil : 1000.00Tn. AXILBC
Excentricidad: 64.92cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 16.0 | 16.0 | 0.0 | 0.0 | 1 | -831.9 | 14.0 | 14.4 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -746.5 | 13.1 | 13.5 | 0.0 | 0.0 |
| 3 | $$$$$$ | 19.3 | 19.3 | 0.0 | 0.0 | 3 | -831.9 | 17.4 | 18.2 | 0.0 | 0.0 |
| 4 | $$$$$$ | 16.0 | 16.0 | 0.0 | 0.0 | 4 | -831.9 | 14.4 | 15.5 | 0.0 | 0.0 |
| 5 | $$$$$$ | 19.3 | 19.3 | 0.0 | 0.0 | 5 | -831.9 | 17.4 | 18.7 | 0.0 | 0.0 |
| 6 | $$$$$$ | 19.3 | 19.3 | 0.0 | 0.0 | 6 | -831.9 | 16.9 | 16.9 | 0.0 | 0.0 |
| 7 | $$$$$$ | 19.3 | 19.3 | 0.0 | 0.0 | 7 | -831.9 | 18.7 | 19.7 | 0.0 | 0.0 |
| 8 | $$$$$$ | 92.1 | 92.1 | 0.0 | 92.1 | 8 | $$$$$$ | 301.6 | 301.9 | 0.0 | 301.9 |
| 9 | $$$$$$ | 92.1 | 92.1 | 0.0 | 92.1 | 9 | $$$$$$ | 300.4 | 300.8 | 0.0 | 300.8 |
| 10 | $$$$$$ | 92.1 | 92.1 | 0.0 | 92.1 | 10 | $$$$$$ | 279.1 | 279.4 | 0.0 | 279.4 |
| 11 | $$$$$$ | 104.5 | 104.5 | 0.0 | 104.5 | 11 | $$$$$$ | 306.6 | 306.9 | 0.0 | 306.9 |
| 12 | $$$$$$ | 104.5 | 104.5 | 0.0 | 104.5 | 12 | $$$$$$ | 310.4 | 310.7 | 0.0 | 310.7 |
| 13 | $$$$$$ | 104.5 | 104.5 | 0.0 | 104.5 | 13 | $$$$$$ | 342.1 | 342.8 | 0.0 | 342.8 |

Incrementos de Carga:
3

Incremento de Carga 4 :
Axil : 1000.00Tn. AXILTOT
Excentricidad: 98.50cm.(respecto a la directriz)
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 11.2 | -3.3 | 4.1 | 0.0 | 0.0 | 1 | 10.1 | -2.9 | 4.2 | 0.0 | 0.0 |
| 2 | 11.2 | -3.3 | 4.1 | 0.0 | 0.0 | 2 | 10.1 | -2.9 | 4.2 | 0.0 | 0.0 |
| 3 | 11.2 | 5.0 | 20.5 | 0.0 | 0.0 | 3 | 10.1 | 5.1 | 20.0 | 0.0 | 0.0 |
| 4 | 11.2 | 4.1 | 23.4 | 0.0 | 0.0 | 4 | 10.1 | 4.2 | 22.8 | 0.0 | 0.0 |
| 5 | 11.2 | 5.0 | 28.2 | 0.0 | 0.0 | 5 | 10.1 | 5.1 | 27.5 | 0.0 | 0.0 |
| 6 | 11.2 | -4.0 | -4.0 | 0.0 | 0.0 | 6 | 10.1 | -3.5 | -3.5 | 0.0 | 0.0 |
| 7 | 11.2 | 28.2 | 46.1 | 0.0 | 0.0 | 7 | 10.1 | 27.5 | 44.7 | 0.0 | 0.0 |
| 8 | 11.2 | 210.8 | 213.1 | 0.0 | 213.1 | 8 | 10.1 | 663.7 | 670.8 | 0.0 | 670.8 |
| 9 | 11.2 | 202.6 | 204.9 | 0.0 | 204.9 | 9 | 10.1 | 638.1 | 645.2 | 0.0 | 645.2 |
| 10 | 11.2 | 49.1 | 51.3 | 0.0 | 51.3 | 10 | 10.1 | 158.8 | 165.9 | 0.0 | 165.9 |
| 11 | 11.2 | -17.8 | -15.9 | 0.0 | 17.8 | 11 | 10.1 | -49.2 | -43.1 | 0.0 | 49.2 |
| 12 | 11.2 | 9.4 | 11.3 | 0.0 | 11.3 | 12 | 10.1 | 35.7 | 41.8 | 0.0 | 41.8 |
| 13 | 11.2 | 237.5 | 242.3 | 0.0 | 242.3 | 13 | 10.1 | 747.8 | 762.9 | 0.0 | 762.9 |

Incrementos de Carga:
4

Incremento de Carga 5 :
Axil : 1000.00Tn. MOMINF
Excentricidad: 98.50cm.(respecto a la directriz)
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 11.2 | -3.3 | 4.1 | 0.0 | 0.0 | 1 | 10.3 | -5.9 | 8.4 | 0.0 | 0.0 |
| 2 | 11.2 | -3.3 | 4.1 | 0.0 | 0.0 | 2 | 10.3 | -5.9 | 8.4 | 0.0 | 0.0 |
| 3 | 11.2 | 5.0 | 20.5 | 0.0 | 0.0 | 3 | 10.3 | 10.2 | 40.2 | 0.0 | 0.0 |
| 4 | 11.2 | 4.1 | 23.4 | 0.0 | 0.0 | 4 | 10.3 | 8.4 | 45.8 | 0.0 | 0.0 |
| 5 | 11.2 | 5.0 | 28.2 | 0.0 | 0.0 | 5 | 10.3 | 10.2 | 55.3 | 0.0 | 0.0 |
| 6 | 11.2 | -4.0 | -4.0 | 0.0 | 0.0 | 6 | 10.3 | -7.2 | -7.2 | 0.0 | 0.0 |
| 7 | 11.2 | 28.2 | 46.1 | 0.0 | 0.0 | 7 | 10.3 | 55.3 | 89.9 | 0.0 | 0.0 |
| 8 | 11.2 | 210.8 | 213.1 | 0.0 | 213.1 | 8 | 10.3 | 1149.7 | 1162.1 | 0.0 | 1162.1 |
| 9 | 11.2 | 202.6 | 204.9 | 0.0 | 204.9 | 9 | 10.3 | 1105.2 | 1117.6 | 0.0 | 1117.6 |
| 10 | 11.2 | 49.1 | 51.3 | 0.0 | 51.3 | 10 | 10.3 | 273.8 | 286.2 | 0.0 | 286.2 |
| 11 | 11.2 | -17.8 | -15.9 | 0.0 | 17.8 | 11 | 10.3 | -87.2 | -76.6 | 0.0 | 87.2 |
| 12 | 11.2 | 9.4 | 11.3 | 0.0 | 11.3 | 12 | 10.3 | 60.1 | 70.6 | 0.0 | 70.6 |
| 13 | 11.2 | 237.5 | 242.3 | 0.0 | 242.3 | 13 | 10.3 | 1295.3 | 1321.6 | 0.0 | 1321.6 |

Incrementos de Carga:
4 5

# ANEXO 3

## TENSIONES ISOSTATICAS DE PRETENSADO Y RETRACCION

TENSIONES ISOSTATICAS PRETENSADO (1-ER TANTEO)

TENSIONES ISOSTATICAS DE RETRACCION

** CALCULO ELASTICO **

Título Sección: TEM-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 414.40Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 23.3 | 4.6 | -.3 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 23.3 | 4.6 | -.3 | 0.0 | 0.0 |
| 3 | 61.3 | 18.0 | 5.6 | 0.0 | 0.0 | 3 | 28.9 | 1.1 | -5.8 | 0.0 | 0.0 |
| 4 | 61.3 | 3.0 | -4.7 | 0.0 | 0.0 | 4 | 28.9 | -7.2 | -11.4 | 0.0 | 0.0 |
| 5 | 61.3 | 18.0 | -6.3 | 0.0 | 0.0 | 5 | 28.9 | 1.1 | -12.3 | 0.0 | 0.0 |
| 6 | 61.3 | 30.3 | 30.3 | 0.0 | 0.0 | 6 | 28.9 | 7.9 | 7.9 | 0.0 | 0.0 |
| 7 | 61.3 | -6.3 | -39.0 | 0.0 | 0.0 | 7 | 28.9 | -12.3 | -30.3 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14629.8 | 14626.6 | 0.0 | 14629.8 | 8 | $$$$$$ | 13742.7 | 13736.0 | 0.0 | 13742.7 |
| 9 | 61.3 | -161.4 | -164.6 | 0.0 | 164.6 | 9 | 41.2 | -443.6 | -450.4 | 0.0 | 450.4 |
| 10 | $$$$$$ | 14853.3 | 14850.2 | 0.0 | 14853.3 | 10 | $$$$$$ | 14217.4 | 14210.7 | 0.0 | 14217.4 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 23.3 | 64.4 | 61.4 | 0.0 | 64.4 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 23.3 | 22.1 | 19.1 | 0.0 | 22.1 |
| 13 | 61.3 | -193.7 | -200.4 | 0.0 | 200.4 | 13 | 41.2 | -525.7 | -539.9 | 0.0 | 539.9 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Titulo Sección: TE-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 414.40Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
S ion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 13.0 | 4.4 | -4.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 13.0 | 4.4 | -4.1 | 0.0 | 0.0 |
| 3 | 24.4 | -.3 | -14.0 | 0.0 | 0.0 | 3 | 14.9 | -4.6 | -16.0 | 0.0 | 0.0 |
| 4 | 24.4 | -16.9 | -25.5 | 0.0 | 0.0 | 4 | 14.9 | -18.4 | -25.5 | 0.0 | 0.0 |
| 5 | 24.4 | -.3 | -53.6 | 0.0 | 0.0 | 5 | 14.9 | -4.6 | -48.8 | 0.0 | 0.0 |
| 6 | 24.4 | -49.3 | -55.7 | 0.0 | 0.0 | 6 | 14.9 | -45.2 | -50.5 | 0.0 | 0.0 |
| 7 | 24.4 | -53.6 | -63.5 | 0.0 | 0.0 | 7 | 14.9 | -48.8 | -57.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14514.1 | 14510.6 | 0.0 | 14514.1 | 8 | $$$$$$ | 13361.3 | 13351.6 | 0.0 | 13361.3 |
| 9 | 24.4 | -275.9 | -279.4 | 0.0 | 279.4 | 9 | 17.1 | -814.4 | -824.1 | 0.0 | 824.1 |
| 10 | $$$$$$ | 14762.2 | 14758.7 | 0.0 | 14762.2 | 10 | $$$$$$ | 14046.1 | 14036.4 | 0.0 | 14046.1 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 13.0 | 57.6 | 52.4 | 0.0 | 57.6 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 13.0 | -15.8 | -21.0 | 0.0 | 21.0 |
| 13 | 24.4 | -324.7 | -332.1 | 0.0 | 332.1 | 13 | 17.1 | -956.3 | -976.8 | 0.0 | 976.8 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TE-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 621.60Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 15.2 | 7.5 | -4.8 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 15.2 | 7.5 | -4.8 | 0.0 | 0.0 |
| 3 | 38.9 | 13.2 | -10.6 | 0.0 | 0.0 | 3 | 18.9 | -4.2 | -21.2 | 0.0 | 0.0 |
| 4 | 38.9 | -15.6 | -30.4 | 0.0 | 0.0 | 4 | 18.9 | -24.7 | -35.3 | 0.0 | 0.0 |
| 5 | 38.9 | 13.2 | -79.3 | 0.0 | 0.0 | 5 | 18.9 | -4.2 | -70.2 | 0.0 | 0.0 |
| 6 | 38.9 | -71.8 | -82.9 | 0.0 | 0.0 | 6 | 18.9 | -64.8 | -72.7 | 0.0 | 0.0 |
| 7 | 38.9 | -79.3 | -96.4 | 0.0 | 0.0 | 7 | 18.9 | -70.2 | -82.4 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14367.6 | 14361.5 | 0.0 | 14367.6 | 8 | $$$$$$ | 12976.6 | 12961.6 | 0.0 | 12976.6 |
| 9 | 38.9 | -413.1 | -419.2 | 0.0 | 419.2 | 9 | 24.8 | -1179.8 | -1194.8 | 0.0 | 1194.8 |
| 10 | $$$$$$ | 14798.2 | 14792.2 | 0.0 | 14798.2 | 10 | $$$$$$ | 14041.0 | 14025.9 | 0.0 | 14041.0 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 15.2 | 100.5 | 92.9 | 0.0 | 100.5 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 15.2 | -6.1 | -13.7 | 0.0 | 13.7 |
| 13 | 38.9 | -488.9 | -501.8 | 0.0 | 501.8 | 13 | 24.8 | -1388.7 | -1420.7 | 0.0 | 1420.7 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: T-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

**Incremento de Carga 1 :**

| | |
|---|---|
| Pretensado: | 82.88Tn. |
| P.relajacion: | 4.00(%) |
| Alfa: | 0.00(gsex.) |
| Actua sobre la Sintermedia | PS |
| Seccion Afectada: | CA |

**Incremento de Carga 2 :**

| | |
|---|---|
| Pretensado: | 621.60Tn. |
| P.relajacion: | 4.00(%) |
| Alfa: | 0.00(gsex.) |
| Actua sobre la Sintermedia | PII |
| Seccion Afectada: | CA |

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 14.9 | 7.4 | -5.0 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 14.9 | 7.4 | -5.0 | 0.0 | 0.0 |
| 3 | 38.9 | 13.2 | -10.6 | 0.0 | 0.0 | 3 | 18.7 | -4.3 | -21.3 | 0.0 | 0.0 |
| 4 | 38.9 | -15.6 | -30.4 | 0.0 | 0.0 | 4 | 18.7 | -24.8 | -35.4 | 0.0 | 0.0 |
| 5 | 38.9 | 13.2 | -79.3 | 0.0 | 0.0 | 5 | 18.7 | -4.3 | -70.1 | 0.0 | 0.0 |
| 6 | 38.9 | -71.8 | -82.9 | 0.0 | 0.0 | 6 | 18.7 | -64.8 | -72.7 | 0.0 | 0.0 |
| 7 | 38.9 | -79.3 | -96.4 | 0.0 | 0.0 | 7 | 18.7 | -70.1 | -82.3 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14367.6 | 14361.5 | 0.0 | 14367.6 | 8 | $$$$$$ | 12977.5 | 12962.5 | 0.0 | 12977.5 |
| 9 | 38.9 | -413.1 | -419.2 | 0.0 | 419.2 | 9 | 24.6 | -1179.0 | -1194.0 | 0.0 | 1194.0 |
| 10 | $$$$$$ | 14798.2 | 14792.2 | 0.0 | 14798.2 | 10 | $$$$$$ | 14039.8 | 14024.8 | 0.0 | 14039.8 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 14.9 | 98.2 | 90.6 | 0.0 | 98.2 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 14.9 | -8.0 | -15.6 | 0.0 | 15.6 |
| 13 | 38.9 | -488.9 | -501.8 | 0.0 | 501.8 | 13 | 24.6 | -1387.7 | -1419.6 | 0.0 | 1419.6 |

**Incrementos de Carga:**
1 2

** CALCULO ELASTICO **

Título Sección: TP-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

**Incremento de Carga 1 :**

| | |
|---|---|
| Pretensado: | 82.88Tn. |
| P.relajacion: | 4.00(%) |
| Alfa: | 0.00(gsex.) |
| Actua sobre la Sintermedia | PS |
| Seccion Afectada: | CA |

**Incremento de Carga 2 :**

| | |
|---|---|
| Pretensado: | 414.40Tn. |
| P.relajacion: | 4.00(%) |
| Alfa: | 0.00(gsex.) |
| Actua sobre la Sintermedia | PII |
| Seccion Afectada: | CA |

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 13.0 | 4.5 | -4.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 13.0 | 4.5 | -4.1 | 0.0 | 0.0 |
| 3 | 24.4 | -.3 | -14.0 | 0.0 | 0.0 | 3 | 15.0 | -4.6 | -16.0 | 0.0 | 0.0 |
| 4 | 24.4 | -16.9 | -25.5 | 0.0 | 0.0 | 4 | 15.0 | -18.3 | -25.5 | 0.0 | 0.0 |
| 5 | 24.4 | -.3 | -53.6 | 0.0 | 0.0 | 5 | 15.0 | -4.6 | -48.8 | 0.0 | 0.0 |
| 6 | 24.4 | -49.3 | -55.7 | 0.0 | 0.0 | 6 | 15.0 | -45.2 | -50.5 | 0.0 | 0.0 |
| 7 | 24.4 | -53.6 | -63.5 | 0.0 | 0.0 | 7 | 15.0 | -48.8 | -57.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14514.1 | 14510.6 | 0.0 | 14514.1 | 8 | $$$$$$ | 13361.0 | 13351.3 | 0.0 | 13361.0 |
| 9 | 24.4 | -275.9 | -279.4 | 0.0 | 279.4 | 9 | 17.2 | -814.7 | -824.3 | 0.0 | 824.3 |
| 10 | $$$$$$ | 14762.2 | 14758.7 | 0.0 | 14762.2 | 10 | $$$$$$ | 14046.2 | 14036.5 | 0.0 | 14046.2 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 13.0 | 58.0 | 52.7 | 0.0 | 58.0 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 13.0 | -15.5 | -20.8 | 0.0 | 20.8 |
| 13 | 24.4 | -324.7 | -332.1 | 0.0 | 332.1 | 13 | 17.2 | -956.6 | -977.2 | 0.0 | 977.2 |

**Incrementos de Carga:**
1 2

** CALCULO ELASTICO **

Título Sección: TPM-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 414.40Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| | ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 29.6 | 6.0 | .9 | 0.0 | 0.0 |
| 2 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 29.6 | 6.0 | .9 | 0.0 | 0.0 |
| 3 | | 52.3 | 12.3 | -7.2 | 0.0 | 0.0 | 3 | 32.8 | 2.2 | -9.8 | 0.0 | 0.0 |
| 4 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 29.6 | .9 | -12.2 | 0.0 | 0.0 |
| 5 | | 52.3 | 12.3 | -16.9 | 0.0 | 0.0 | 5 | 32.8 | 2.2 | -15.9 | 0.0 | 0.0 |
| 6 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 29.6 | 7.2 | 7.2 | 0.0 | 0.0 |
| 7 | | 52.3 | -16.9 | 39.4 | 0.0 | 0.0 | 7 | 32.8 | -15.9 | -29.7 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14626.6 | 14623.7 | | 0.0 | 14626.6 | 8 | $$$$$$ | 13746.8 | 13740.2 | 0.0 | 13746.8 |
| 9 | | 52.3 | -165.7 | -168.6 | 0.0 | 168.6 | 9 | 39.6 | -440.2 | -446.7 | 0.0 | 446.7 |
| 10 | $$$$$$ | 14829.4 | 14826.6 | | 0.0 | 14829.4 | 10 | $$$$$$ | 14209.3 | 14202.7 | 0.0 | 14209.3 |
| 11 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 29.6 | 86.2 | 83.1 | 0.0 | 86.2 |
| 12 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 29.6 | 42.5 | 39.4 | 0.0 | 42.5 |
| 13 | | 52.3 | -197.5 | -203.6 | 0.0 | 203.6 | 13 | 39.6 | -521.2 | -535.1 | 0.0 | 535.1 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TPM-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 621.60Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| | ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 32.0 | 9.7 | 2.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 32.0 | 9.7 | 2.1 | 0.0 | 0.0 |
| 3 | | 60.6 | 27.5 | -5.9 | 0.0 | 0.0 | 3 | 36.5 | 4.9 | -13.5 | 0.0 | 0.0 |
| 4 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 32.0 | 2.1 | -17.6 | 0.0 | 0.0 |
| 5 | | 60.6 | 27.5 | -22.7 | 0.0 | 0.0 | 5 | 36.5 | 4.9 | -22.8 | 0.0 | 0.0 |
| 6 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 32.0 | 11.7 | 11.7 | 0.0 | 0.0 |
| 7 | | 60.6 | -22.7 | -61.7 | 0.0 | 0.0 | 7 | 36.5 | -22.8 | -44.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14530.8 | 14525.9 | | 0.0 | 14530.8 | 8 | $$$$$$ | 13518.2 | 13507.8 | 0.0 | 13518.2 |
| 9 | | 60.6 | -254.1 | -259.0 | 0.0 | 259.0 | 9 | 45.5 | -654.8 | -665.2 | 0.0 | 665.2 |
| 10 | $$$$$$ | 14879.2 | 14874.3 | | 0.0 | 14879.2 | 10 | $$$$$$ | 14255.1 | 14244.6 | 0.0 | 14255.1 |
| 11 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 32.0 | 140.1 | 135.4 | 0.0 | 140.1 |
| 12 | $$$$$$ | | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 32.0 | 74.8 | 70.1 | 0.0 | 74.8 |
| 13 | | 60.6 | -304.6 | -315.1 | 0.0 | 315.1 | 13 | 45.5 | -777.6 | -799.7 | 0.0 | 799.7 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TP-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 621.60Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| | ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 14.9 | 6.6 | -4.5 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 14.9 | 6.6 | -4.5 | 0.0 | 0.0 |
| 3 | 38.3 | 12.2 | -10.8 | 0.0 | 0.0 | 3 | 20.0 | -3.2 | -19.1 | 0.0 | 0.0 |
| 4 | 38.3 | -15.6 | -30.0 | 0.0 | 0.0 | 4 | 20.0 | -22.4 | -32.3 | 0.0 | 0.0 |
| 5 | 38.3 | 12.2 | -77.1 | 0.0 | 0.0 | 5 | 20.0 | -3.2 | -64.9 | 0.0 | 0.0 |
| 6 | 38.3 | -69.9 | -80.6 | 0.0 | 0.0 | 6 | 20.0 | -60.0 | -67.3 | 0.0 | 0.0 |
| 7 | 38.3 | -77.1 | -93.6 | 0.0 | 0.0 | 7 | 20.0 | -64.9 | -76.4 | 0.0 | 0.0 |
| 8 | $$$$$$ | 8829.0 | 8823.1 | 0.0 | 8829.0 | 8 | 878.2 | 7741.2 | 7727.3 | 0.0 | 7741.2 |
| 9 | 38.3 | -401.5 | -407.4 | 0.0 | 407.4 | 9 | 24.8 | -1090.4 | -1104.3 | 0.0 | 1104.3 |
| 10 | $$$$$$ | 14795.7 | 14789.8 | 0.0 | 14795.7 | 10 | $$$$$$ | 14053.6 | 14039.7 | 0.0 | 14053.6 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 14.9 | 87.7 | 80.9 | 0.0 | 87.7 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 14.9 | -7.8 | -14.6 | 0.0 | 14.6 |
| 13 | 38.3 | -475.1 | -487.6 | 0.0 | 487.6 | 13 | 24.8 | -1283.5 | -1313.0 | 0.0 | 1313.0 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TP-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 994.56Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

Incremento de Carga 3 :
Pretensado: 248.64Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PIS
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| | ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 17.3 | 15.3 | -6.8 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 17.3 | 15.3 | -6.8 | 0.0 | 0.0 |
| 3 | 48.1 | 47.4 | -3.9 | 0.0 | 0.0 | 3 | 23.3 | -2.2 | -34.4 | 0.0 | 0.0 |
| 4 | 48.1 | -14.6 | -46.7 | 0.0 | 0.0 | 4 | 23.3 | -41.1 | -61.1 | 0.0 | 0.0 |
| 5 | 48.1 | 47.4 | -152.0 | 0.0 | 0.0 | 5 | 23.3 | -2.2 | -127.0 | 0.0 | 0.0 |
| 6 | 48.1 | -135.9 | -159.8 | 0.0 | 0.0 | 6 | 23.3 | -116.9 | -131.8 | 0.0 | 0.0 |
| 7 | 48.1 | -152.0 | -189.0 | 0.0 | 0.0 | 7 | 23.3 | -127.0 | -150.1 | 0.0 | 0.0 |
| 8 | $$$$$$ | 13955.2 | 13942.1 | 0.0 | 13955.2 | 8 | 682.3 | 11959.0 | 11929.9 | 0.0 | 11959.0 |
| 9 | $$$$$$ | 14002.4 | 13989.3 | 0.0 | 14002.4 | 9 | 682.3 | 12063.7 | 12034.6 | 0.0 | 12063.7 |
| 10 | $$$$$$ | 14883.6 | 14870.5 | 0.0 | 14883.6 | 10 | 682.3 | 14021.3 | 13992.2 | 0.0 | 14021.3 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 17.3 | 208.5 | 194.9 | 0.0 | 208.5 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 17.3 | 17.8 | 4.2 | 0.0 | 17.8 |
| 13 | 48.1 | -951.5 | -979.4 | 0.0 | 979.4 | 13 | 31.2 | -2532.7 | -2594.6 | 0.0 | 2594.6 |

Incrementos de Carga:
1 2 3

** CALCULO ELASTICO **

Título Sección: T-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 994.56Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

Incremento de Carga 3 :
Pretensado: 663.04Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PIS
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 16.5 | 16.5 | -8.4 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 16.5 | 16.5 | -8.4 | 0.0 | 0.0 |
| 3 | 48.7 | 62.3 | -3.4 | 0.0 | 0.0 | 3 | 24.6 | -.6 | -39.2 | 0.0 | 0.0 |
| 4 | 48.7 | -17.1 | -58.1 | 0.0 | 0.0 | 4 | 24.6 | -47.3 | -71.4 | 0.0 | 0.0 |
| 5 | 48.7 | -62.3 | -192.7 | 0.0 | 0.0 | 5 | 24.6 | -.6 | -150.6 | 0.0 | 0.0 |
| 6 | 48.7 | -172.2 | -202.7 | 0.0 | 0.0 | 6 | 24.6 | -138.5 | -156.5 | 0.0 | 0.0 |
| 7 | 48.7 | -192.7 | -240.0 | 0.0 | 0.0 | 7 | 24.6 | -150.6 | -178.4 | 0.0 | 0.0 |
| 8 | $$$$$$ | 13726.9 | 13710.1 | 0.0 | 13726.9 | 8 | 576.3 | 11539.2 | 11504.3 | 0.0 | 11539.2 |
| 9 | $$$$$$ | 13787.2 | 13770.4 | 0.0 | 13787.2 | 9 | 576.3 | 11664.5 | 11629.6 | 0.0 | 11664.5 |
| 10 | $$$$$$ | 14913.9 | 14897.1 | 0.0 | 14913.9 | 10 | 576.3 | 14006.4 | 13971.6 | 0.0 | 14006.4 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 16.5 | 223.7 | 208.3 | 0.0 | 223.7 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 16.5 | 8.4 | -6.9 | 0.0 | 8.4 |
| 13 | 48.7 | -1207.8 | -1243.4 | 0.0 | 1243.4 | 13 | 32.0 | -3004.7 | -3078.8 | 0.0 | 3078.8 |

Incrementos de Carga:
1 2 3

** CALCULO ELASTICO **

Título Sección: T-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Retraccion(Eso/øi;Tinf.): 11.19(*1.E-05) = 23,10/2,065
Actua sobre la Sintermedia HC
Seccion Afectada: CA

Incremento de Carga 2 :
Retraccion(Eso/øi;Tinf.): 9.21(*1.E-05) = 25,60/2,78
Actua sobre la Sintermedia HL
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | -2.3 | .6 | 6.7 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | -2.3 | .6 | 6.7 | 0.0 | 0.0 |
| 3 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 3 | 114.3 | -27.7 | -20.0 | 0.0 | 0.0 |
| 4 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 114.3 | -18.4 | -13.5 | 0.0 | 0.0 |
| 5 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 5 | 114.3 | -27.7 | 2.4 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 114.3 | -0.0 | 3.6 | 0.0 | 0.0 |
| 7 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 7 | 114.3 | 2.4 | 8.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 253.8 | -177.3 | -175.3 | 0.0 | 177.3 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 253.8 | -184.4 | -182.4 | 0.0 | 184.4 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 253.8 | -317.5 | -315.5 | 0.0 | 317.5 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 117.7 | -186.5 | -184.9 | 0.0 | 186.5 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 117.7 | -163.9 | -162.3 | 0.0 | 163.9 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 253.8 | -202.8 | -198.6 | 0.0 | 202.8 |

Incrementos de Carga:
1 2

TENSIONES ISOSTATICAS PRETENSADO (2° TANTEO)

** CALCULO ELASTICO **

Título Sección: TEM-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 621.60Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 26.7 | 7.9 | .5 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 26.7 | 7.9 | .5 | 0.0 | 0.0 |
| 3 | 68.2 | 36.9 | 15.6 | 0.0 | 0.0 | 3 | 33.8 | 3.7 | -6.8 | 0.0 | 0.0 |
| 4 | 68.2 | 11.1 | -2.2 | 0.0 | 0.0 | 4 | 33.8 | -9.0 | -15.6 | 0.0 | 0.0 |
| 5 | 68.2 | 36.9 | -4.9 | 0.0 | 0.0 | 5 | 33.8 | 3.7 | -17.0 | 0.0 | 0.0 |
| 6 | 68.2 | 58.3 | 58.3 | 0.0 | 0.0 | 6 | 33.8 | 14.3 | 14.3 | 0.0 | 0.0 |
| 7 | 68.2 | -4.9 | -61.4 | 0.0 | 0.0 | 7 | 33.8 | -17.0 | -44.9 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14532.5 | 14527.1 | 0.0 | 14532.5 | 8 | $$$$$$ | 13510.4 | 13499.6 | 0.0 | 13510.4 |
| 9 | 68.2 | -250.4 | -255.9 | 0.0 | 255.9 | 9 | 47.7 | -661.3 | -672.0 | 0.0 | 672.0 |
| 10 | $$$$$$ | 14918.6 | 14913.1 | 0.0 | 14918.6 | 10 | $$$$$$ | 14274.2 | 14263.4 | 0.0 | 14274.2 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 26.7 | 112.2 | 107.7 | 0.0 | 112.2 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 26.7 | 48.7 | 44.2 | 0.0 | 48.7 |
| 13 | 68.2 | -302.2 | -313.8 | 0.0 | 313.8 | 13 | 47.7 | -786.1 | -809.1 | 0.0 | 809.1 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Ti lo Sección: TE-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 621.60Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Se cion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 15.2 | 7.5 | -4.8 | 0.0 | 0.0 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 15.2 | 7.5 | -4.8 | 0.0 | 0.0 |
| 3 38.9 | 13.2 | -10.6 | 0.0 | 0.0 | 3 18.9 | -4.2 | -21.2 | 0.0 | 0.0 |
| 4 38.9 | -15.6 | -30.4 | 0.0 | 0.0 | 4 18.9 | -24.7 | -35.3 | 0.0 | 0.0 |
| 5 38.9 | 13.2 | -79.3 | 0.0 | 0.0 | 5 18.9 | -4.2 | -70.2 | 0.0 | 0.0 |
| 6 38.9 | -71.8 | -82.9 | 0.0 | 0.0 | 6 18.9 | -64.8 | -72.7 | 0.0 | 0.0 |
| 7 38.9 | -79.3 | -96.4 | 0.0 | 0.0 | 7 18.9 | -70.2 | -82.4 | 0.0 | 0.0 |
| 8 $$$$$$14367.6 | | 14361.5 | 0.0 | 14367.6 | 8 $$$$$$12976.6 | | 12961.6 | 0.0 | 12976.6 |
| 9 38.9 | -413.1 | -419.2 | 0.0 | 419.2 | 9 24.8 | -1179.8 | -1194.8 | 0.0 | 1194.8 |
| 10 $$$$$$14798.2 | | 14792.2 | 0.0 | 14798.2 | 10 $$$$$$14041.0 | | 14025.9 | 0.0 | 14041.0 |
| 11 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 15.2 | 100.5 | 92.9 | 0.0 | 100.5 |
| 12 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 15.2 | -6.1 | -13.7 | 0.0 | 13.7 |
| 13 38.9 | -488.9 | -501.8 | 0.0 | 501.8 | 13 24.8 | -1388.7 | -1420.7 | 0.0 | 1420.7 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TE-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 828.80Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 16.3 | 10.4 | -5.5 | 0.0 | 0.0 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 16.3 | 10.4 | -5.5 | 0.0 | 0.0 |
| 3 44.6 | 26.5 | -7.2 | 0.0 | 0.0 | 3 21.1 | -3.5 | -25.9 | 0.0 | 0.0 |
| 4 44.6 | -14.3 | -35.3 | 0.0 | 0.0 | 4 21.1 | -30.5 | -44.5 | 0.0 | 0.0 |
| 5 44.6 | 26.5 | -104.4 | 0.0 | 0.0 | 5 21.1 | -3.5 | -90.4 | 0.0 | 0.0 |
| 6 44.6 | -93.9 | -109.5 | 0.0 | 0.0 | 6 21.1 | -83.4 | -93.8 | 0.0 | 0.0 |
| 7 44.6 | -104.4 | -128.7 | 0.0 | 0.0 | 7 21.1 | -90.4 | -106.5 | 0.0 | 0.0 |
| 8 $$$$$$14224.1 | | 14215.5 | 0.0 | 14224.1 | 8 970.8 | 12613.4 | 12593.3 | 0.0 | 12613.4 |
| 9 44.6 | -547.5 | -556.1 | 0.0 | 556.1 | 9 28.4 | -1524.7 | -1544.8 | 0.0 | 1544.8 |
| 10 $$$$$$14833.5 | | 14824.9 | 0.0 | 14833.5 | 10 970.8 | 14038.4 | 14018.2 | 0.0 | 14038.4 |
| 11 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 16.3 | 140.1 | 130.3 | 0.0 | 140.1 |
| 12 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 16.3 | 2.9 | -6.9 | 0.0 | 6.9 |
| 13 44.6 | -649.8 | -668.1 | 0.0 | 668.1 | 13 28.4 | -1796.9 | -1839.7 | 0.0 | 1839.7 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Tipo Sección: T-V1

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
% relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 828.88Tn.
% relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 15.9 | 10.1 | -5.7 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 15.9 | 10.1 | -5.7 | 0.0 | 0.0 |
| 3 | | 44.6 | 26.5 | -7.2 | 0.0 | 0.0 | 3 | 20.8 | -3.7 | -26.0 | 0.0 | 0.0 |
| 4 | | 44.6 | -14.3 | -35.3 | 0.0 | 0.0 | 4 | 20.8 | -30.7 | -44.6 | 0.0 | 0.0 |
| 5 | | 44.6 | 26.5 | -104.4 | 0.0 | 0.0 | 5 | 20.8 | -3.7 | -90.3 | 0.0 | 0.0 |
| 6 | | 44.6 | -93.9 | -109.5 | 0.0 | 0.0 | 6 | 20.8 | -83.3 | -93.7 | 0.0 | 0.0 |
| 7 | | 44.6 | -104.4 | -128.7 | 0.0 | 0.0 | 7 | 20.8 | -90.3 | -106.3 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14225.5 | 14216.9 | 0.0 | 14225.5 | 8 | 972.9 | 12615.9 | 12595.8 | 0.0 | 12615.9 |
| 9 | | 44.6 | -547.6 | -556.2 | 0.0 | 556.2 | 9 | 28.2 | -1523.7 | -1543.8 | 0.0 | 1543.8 |
| 10 | $$$$$$ | 14833.6 | 14824.9 | 0.0 | 14833.6 | 10 | 972.8 | 14036.2 | 14016.1 | 0.0 | 14036.2 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 15.9 | 136.1 | 126.3 | 0.0 | 136.1 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 15.9 | -.5 | -10.3 | 0.0 | 10.3 |
| 13 | | 44.6 | -649.9 | -668.2 | 0.0 | 668.2 | 13 | 28.2 | -1795.7 | -1838.4 | 0.0 | 1838.4 |

Incrementos de Carga:
1 2

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 15.9 | 10.1 | -5.7 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 15.9 | 10.1 | -5.7 | 0.0 | 0.0 |
| 3 | | 44.6 | 26.5 | -7.2 | 0.0 | 0.0 | 3 | 20.8 | -3.7 | -26.0 | 0.0 | 0.0 |
| 4 | | 44.6 | -14.3 | -35.3 | 0.0 | 0.0 | 4 | 20.8 | -30.7 | -44.6 | 0.0 | 0.0 |
| 5 | | 44.6 | 26.5 | -104.4 | 0.0 | 0.0 | 5 | 20.8 | -3.7 | -90.3 | 0.0 | 0.0 |
| 6 | | 44.6 | -93.9 | -109.5 | 0.0 | 0.0 | 6 | 20.8 | -83.3 | -93.7 | 0.0 | 0.0 |
| 7 | | 44.6 | -104.4 | -128.7 | 0.0 | 0.0 | 7 | 20.8 | -90.3 | -106.3 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14225.5 | 14216.9 | 0.0 | 14225.5 | 8 | 972.9 | 12615.9 | 12595.8 | 0.0 | 12615.9 |
| 9 | | 44.6 | -547.6 | -556.2 | 0.0 | 556.2 | 9 | 28.2 | -1523.7 | -1543.8 | 0.0 | 1543.8 |
| 10 | $$$$$$ | 14833.6 | 14824.9 | 0.0 | 14833.6 | 10 | 972.8 | 14036.2 | 14016.1 | 0.0 | 14036.2 |
| 11 | $$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 15.9 | 136.1 | 126.3 | 0.0 | 136.1 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 15.9 | -.5 | -10.3 | 0.0 | 10.3 |
| 13 | | 44.6 | -649.9 | -668.2 | 0.0 | 668.2 | 13 | 28.2 | -1795.7 | -1838.4 | 0.0 | 1838.4 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

ítulo Sección: TPM-V1

nalisis SIN FISURACION

ecuencia Incrementos de Carga:

ncremento de Carga 1 :
retensado: 82.88Tn.
.relajacion: 4.00(%)
lfa: 0.00(gsex.)
ctua sobre la Sintermedia PS
eccion Afectada: CA

ncremento de Carga 2 :
retensado: 621.60Tn.
.relajacion: 4.00(%)
lfa: 0.00(gsex.)
ctua sobre la Sintermedia PII
ion Afectada: CA

ENSIONES (Kg/cm2):

| STADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| sp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 32.0 | 9.7 | 2.1 | 0.0 | 0.0 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 32.0 | 9.7 | 2.1 | 0.0 | 0.0 |
| 3 60.6 | 27.5 | -5.9 | 0.0 | 0.0 | 3 | 36.5 | 4.9 | -13.5 | 0.0 | 0.0 |
| 4 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 32.0 | 2.1 | -17.6 | 0.0 | 0.0 |
| 5 60.6 | 27.5 | -22.7 | 0.0 | 0.0 | 5 | 36.5 | 4.9 | -22.8 | 0.0 | 0.0 |
| 6 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 32.0 | 11.7 | 11.7 | 0.0 | 0.0 |
| 7 60.6 | -22.7 | -61.2 | 0.0 | 0.0 | 7 | 36.5 | -22.8 | -44.0 | 0.0 | 0.0 |
| 8 $$$$$$14530.8 | 14525.9 | | 0.0 | 14530.8 | 8 | $$$$$$13518.2 | 13507.8 | | 0.0 | 13518.2 |
| 9 60.6 | -254.1 | -259.0 | 0.0 | 259.0 | 9 | 45.5 | -654.8 | -665.2 | 0.0 | 665.2 |
| 0 $$$$$$14879.2 | 14874.3 | | 0.0 | 14879.2 | 10 | $$$$$$14255.1 | 14244.6 | | 0.0 | 14255.1 |
| 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 32.0 | 140.1 | 135.4 | 0.0 | 140.1 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 32.0 | 74.8 | 70.1 | 0.0 | 74.8 |
| 3 60.6 | -304.6 | -315.1 | 0.0 | 315.1 | 13 | 45.5 | -777.6 | -799.7 | 0.0 | 799.7 |

ncrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TPM-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 745.92Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nsp Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 32.8 | 11.9 | 2.8 | 0.0 | 0.0 |
| 2 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 32.8 | 11.9 | 2.8 | 0.0 | 0.0 |
| 3 62.9 | 36.5 | -5.2 | 0.0 | 0.0 | 3 | 37.8 | 6.6 | -15.6 | 0.0 | 0.0 |
| 4 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 4 | 32.8 | 2.8 | -20.7 | 0.0 | 0.0 |
| 5 62.9 | 36.5 | -26.1 | 0.0 | 0.0 | 5 | 37.8 | 6.6 | -26.8 | 0.0 | 0.0 |
| 6 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 32.8 | 14.3 | 14.3 | 0.0 | 0.0 |
| 7 62.9 | -26.1 | -74.2 | 0.0 | 0.0 | 7 | 37.8 | -26.8 | -52.5 | 0.0 | 0.0 |
| 8 $$$$$$14473.9 | 14467.8 | | 0.0 | 14473.9 | 8 | $$$$$$13384.7 | 13372.0 | | 0.0 | 13384.7 |
| 9 62.9 | -306.6 | -312.7 | 0.0 | 312.7 | 9 | 47.4 | -780.2 | -792.9 | 0.0 | 792.9 |
| 10 $$$$$$14908.8 | 14902.7 | | 0.0 | 14908.8 | 10 | $$$$$$14282.3 | 14269.6 | | 0.0 | 14282.3 |
| 11 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 32.8 | 171.2 | 165.7 | 0.0 | 171.2 |
| 12 $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 32.8 | 93.4 | 87.8 | 0.0 | 93.4 |
| 13 62.9 | -368.2 | -381.3 | 0.0 | 381.3 | 13 | 47.4 | -927.4 | -954.3 | 0.0 | 954.3 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TP-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 745.92Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 16.2 | 9.4 | -5.2 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 16.2 | 9.4 | -5.2 | 0.0 | 0.0 |
| 3 | 42.8 | 21.2 | -8.6 | 0.0 | 0.0 | 3 | 20.5 | -3.6 | -24.0 | 0.0 | 0.0 |
| 4 | 42.8 | -14.8 | -33.4 | 0.0 | 0.0 | 4 | 20.5 | -28.2 | -40.9 | 0.0 | 0.0 |
| 5 | 42.8 | 21.2 | -94.4 | 0.0 | 0.0 | 5 | 20.5 | -3.6 | -82.5 | 0.0 | 0.0 |
| 6 | 42.8 | -85.1 | -98.9 | 0.0 | 0.0 | 6 | 20.5 | -76.1 | -85.5 | 0.0 | 0.0 |
| 7 | 42.8 | -94.4 | -115.9 | 0.0 | 0.0 | 7 | 20.5 | -82.5 | -97.1 | 0.0 | 0.0 |
| 8 | $$$$$$ | 14281.2 | 14273.6 | 0.0 | 14281.2 | 8 | $$$$$$ | 12755.5 | 12737.4 | 0.0 | 12755.5 |
| 9 | 42.8 | -494.1 | -501.7 | 0.0 | 501.7 | 9 | 27.3 | -1389.7 | -1407.8 | 0.0 | 1407.8 |
| 0 | $$$$$$ | 14819.5 | 14811.9 | 0.0 | 14819.5 | 10 | $$$$$$ | 14040.4 | 14022.3 | 0.0 | 14040.4 |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 16.2 | 127.0 | 118.0 | 0.0 | 127.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 16.2 | 1.4 | -7.5 | 0.0 | 7.5 |
| 3 | 42.8 | -585.9 | -602.0 | 0.0 | 602.0 | 13 | 27.3 | -1637.2 | -1675.8 | 0.0 | 1675.8 |

Incrementos de Carga:
1 2

** CALCULO ELASTICO **

Título Sección: TP-V2

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Pretensado: 82.88Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PS
Seccion Afectada: CA

Incremento de Carga 2 :
Pretensado: 994.56Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PII
Seccion Afectada: CA

Incremento de Carga 3 :
Pretensado: 372.96Tn.
P.relajacion: 4.00(%)
Alfa: 0.00(gsex.)
Actua sobre la Sintermedia PIS
Seccion Afectada: CA

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 17.4 | 16.5 | -7.2 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 17.4 | 16.5 | -7.2 | 0.0 | 0.0 |
| 3 | 48.4 | 52.6 | -3.6 | 0.0 | 0.0 | 3 | 23.6 | -2.0 | -36.8 | 0.0 | 0.0 |
| 4 | 48.4 | -15.3 | -50.4 | 0.0 | 0.0 | 4 | 23.6 | -44.0 | -65.8 | 0.0 | 0.0 |
| 5 | 48.4 | 52.6 | -165.6 | 0.0 | 0.0 | 5 | 23.6 | -2.0 | -137.1 | 0.0 | 0.0 |
| 6 | 48.4 | -148.1 | -174.2 | 0.0 | 0.0 | 6 | 23.6 | -126.2 | -142.4 | 0.0 | 0.0 |
| 7 | 48.4 | -165.6 | -206.1 | 0.0 | 0.0 | 7 | 23.6 | -137.1 | -162.2 | 0.0 | 0.0 |
| 8 | $$$$$$ | 13878.4 | 13864.0 | 0.0 | 13878.4 | 8 | 632.4 | 11778.4 | 11746.8 | 0.0 | 11778.4 |
| 9 | $$$$$$ | 13930.0 | 13915.6 | 0.0 | 13930.0 | 9 | 632.4 | 11891.9 | 11860.4 | 0.0 | 11891.9 |
| 10 | $$$$$$ | 14894.7 | 14880.3 | 0.0 | 14894.7 | 10 | 632.4 | 14013.1 | 13981.5 | 0.0 | 14013.1 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 17.4 | 225.1 | 210.4 | 0.0 | 225.1 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 17.4 | 20.2 | 5.5 | 0.0 | 20.2 |
| 13 | 48.4 | -1037.7 | -1068.3 | 0.0 | 1068.3 | 13 | 31.5 | -2735.8 | -2802.9 | 0.0 | 2802.9 |

Incrementos de Carga:
1 2 3

* CALCULO ELASTICO **

ítulo Sección: T-V2

nalisis SIN FISURACION

ecuencia Incrementos de Carga:

ncremento de Carga 1 :
retensado: 82.88Tn.
.relajacion: 4.00(%)
lfa: 0.00(gsex.)
ctua sobre la Sintermedia PS
eccion Afectada: CA

ncremento de Carga 2 :
retensado: 994.56Tn.
.relajacion: 4.00(%)
lfa: 0.00(gsex.)
ctua sobre la Sintermedia PII
e ion Afectada: CA

ncremento de Carga 3 :
retensado: 994.56Tn.
.relajacion: 4.00(%)
lfa: 0.00(gsex.)
ctua sobre la Sintermedia PIS
eccion Afectada: CA

ENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | ESTADO FINAL (Tinf) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| sp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 16.6 | 18.9 | -9.5 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 16.6 | 18.9 | -9.5 | 0.0 | 0.0 |
| 3 | 49.1 | 75.1 | -2.7 | 0.0 | 0.0 | 3 | 25.3 | .5 | -44.4 | 0.0 | 0.0 |
| 4 | 49.1 | -18.9 | -67.5 | 0.0 | 0.0 | 4 | 25.3 | -53.7 | -81.7 | 0.0 | 0.0 |
| 5 | 49.1 | 75.1 | -226.9 | 0.0 | 0.0 | 5 | 25.3 | .5 | -173.7 | 0.0 | 0.0 |
| 6 | 49.1 | -202.6 | -238.7 | 0.0 | 0.0 | 6 | 25.3 | -159.7 | -180.5 | 0.0 | 0.0 |
| 7 | 49.1 | -226.9 | -283.0 | 0.0 | 0.0 | 7 | 25.3 | -173.7 | -206.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 13534.6 | 13514.8 | 0.0 | 13534.6 | 8 | 501.7 | 11128.5 | 11088.1 | 0.0 | 11128.5 |
| 9 | $$$$$$ | 13606.1 | 13586.2 | 0.0 | 13606.1 | 9 | 501.7 | 11273.9 | 11233.5 | 0.0 | 11273.9 |
| 0 | $$$$$$ | 14941.0 | 14921.2 | 0.0 | 14941.0 | 10 | 501.7 | 13991.5 | 13951.0 | 0.0 | 13991.5 |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 16.6 | 256.1 | 238.6 | 0.0 | 256.1 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 16.6 | 11.2 | -6.3 | 0.0 | 11.2 |
| 3 | 49.1 | -1423.6 | -1465.8 | 0.0 | 1465.8 | 13 | 32.6 | -3466.5 | -3552.5 | 0.0 | 3552.5 |

ncrementos de Carga:
1 2 3

# ANEXO 4

# MOMENTOS ULTIMOS FASES DE MONTAJE

MOMENTOS ULTIMOS

SECCION SIMPLE (CCA)

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TEM-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 653.4 Xu(cm.): 62.1

Nu(Tn.): 1.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= 0.00000 Etmx= .00723
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -92.6 Xu(cm.): 129.1

Nu(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00116 Etmx= .00723
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -8043.9 aplicado en Yo(cm)= 98.9

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 739.8 aplicado en Yo(cm)= 123.9

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TE-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 653.4 Xu(cm.): 61.7

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00721
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -92.1 Xu(cm.): 129.9

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00118 Etmx= .01000
Rompe la fibra superior de la S.parcial 5

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 739.8 aplicado en Yo(cm)= 123.9

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TE-V1b

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1417.00Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 1020.3 Xu(cm.): 103.2

Nu(Tn.): -.5 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00116
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -84.0 Xu(cm.): 126.0

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00187 Etmx= .01000
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1610.2 aplicado en Yo(cm)= 128.5

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: T-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1417.00Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

[illegible].T): 1020.3 Xu(cm.): 103.2

Nu(Tn.): -.5 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00116
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -84.0 Xu(cm.): 126.0

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00187 Etmx= .01000
Rompe la fibra superior de la S.parcial 5

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1610.2 aplicado en Yo(cm)= 128.5

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TP-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 653.4 Xu(cm.): 61.7

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00721
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -92.1 Xu(cm.): 129.9

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00118 Etmx= .01000
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 739.8 aplicado en Yo(cm)= 123.9

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TPM-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 697.2 Xu(cm.): 53.2

Nu(Tn.): .1 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00327 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -92.4 Xu(cm.): 129.0

Nu(Tn.): .7 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00116 Etmx= .01000
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -7248.6 aplicado en Yo(cm)= 98.3

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 739.8 aplicado en Yo(cm)= 123.9

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TPM-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1194.21Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 808.8 Xu(cm.): 57.0

Nu(Tn.): .2 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00890
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -90.5 Xu(cm.): 128.5

Nu(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00128 Etmx= .01000
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -7248.6 aplicado en Yo(cm)= 98.3

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 870.4 aplicado en Yo(cm)= 125.5

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

ANALISIS EN ROTURA(ELASTOPLASTICO)*

ítulo Sección: TP-V2

PRESOLICITACIONES ELASTICAS
nalisis SIN FISURACION
retensado: 1340.41Tn.
Todas las Armaduras activas a .80*Fyk)

STUDIO SECCION CA

nalisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
ef. Ultima Acero Estructural( TRACCION)(%): 2.50
eformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
oeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

LEXION PURA POSITIVA:

T): 1003.4 Xu(cm.): 99.5

u(Tn.): -.6 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00350 Etmx= .00144
ompe la fibra superior de la S.parcial 3

LEXION PURA NEGATIVA:

u(m.T): -84.7 Xu(cm.): 126.3

u(Tn.): 0.0 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00181 Etmx= .01000
ompe la fibra superior de la S.parcial 3

OMPRESION SIMPLE(Rigido/Plastico):

u(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

ACCION SIMPLE(Rigido/Plastico):

u(Tn.): 1523.2 aplicado en Yo(cm)= 128.4

ORTANTE ULTIMO(Rigido/Plastico):

u(Tn.): 0.0 Ru(Kg/cm): 0.0

v1(cm): 0.0 Xv2(cm): 0.0
.parciales resistentes: Rcu(Kg/cm):

ANALISIS EN ROTURA(ELASTOPLASTICO)*

ítulo Sección: TP-V2b

* PRESOLICITACIONES ELASTICAS
nalisis SIN FISURACION
retensado: 1914.87Tn.
(Todas las Armaduras activas a .80*Fyk)

STUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
ef. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
oeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

u(m.T): 1078.9 Xu(cm.): 116.3

u(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00027
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

u(m.T): -77.0 Xu(cm.): 123.3

Nu(Tn.): -.2 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00233 Etmx= .01000
Rompe la fibra superior de la S.parcial 5

OMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 2176.0 aplicado en Yo(cm)= 128.9

ORTANTE ULTIMO(Rigido/Plastico):

u(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

ANALISIS EN ROTURA(ELASTOPLASTICO)*

ítulo Sección: T-V2

PRESOLICITACIONES ELASTICAS
nalisis SIN FISURACION
retensado: 1914.87Tn.
Todas las Armaduras activas a .80*Fyk)

STUDIO SECCION CA

nalisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
ef. Ultima Acero Estructural( TRACCION)(%): 2.50
eformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
oeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

LEXION PURA POSITIVA:

.T): 1078.8 Xu(cm.): 116.3

u(Tn.): 0.0 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00350 Etmx= .00027
ompe la fibra superior de la S.parcial 3

LEXION PURA NEGATIVA:

u(m.T): -77.0 Xu(cm.): 123.3

u(Tn.): -.2 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00233 Etmx= .01000
ompe la fibra superior de la S.parcial 3

OMPRESION SIMPLE(Rigido/Plastico):

u(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

ACCION SIMPLE(Rigido/Plastico):

u(Tn.): 2176.0 aplicado en Yo(cm)= 128.9

ORTANTE ULTIMO(Rigido/Plastico):

u(Tn.): 0.0 Ru(Kg/cm): 0.0

v1(cm): 0.0 Xv2(cm): 0.0
.parciales resistentes: Rcu(Kg/cm):

MOMENTOS ULTIMOS

SECCION CBC

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TEM-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 946.2 Xu(cm.): 16.1

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00129 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -429.8 Xu(cm.): 125.2

Nu(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00129 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -10552.0 aplicado en Yo(cm)= 78.2

ACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1018.5 aplicado en Yo(cm)= 92.6

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TE-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 946.2 Xu(cm.): 16.0

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00129 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -428.8 Xu(cm.): 126.1

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00132 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6095.6 aplicado en Yo(cm)= 63.7

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1018.5 aplicado en Yo(cm)= 92.6

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TE-V1b

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1417.00Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 2073.0 Xu(cm.): 24.7

Nu(Tn.): -.1 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00218 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -409.4 Xu(cm.): 122.1

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00193 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6095.6 aplicado en Yo(cm)= 63.7

ACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1888.9 aplicado en Yo(cm)= 110.9

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: T-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1417.00Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 2074.8 Xu(cm.): 24.5

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00215 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -409.4 Xu(cm.): 122.1

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00193 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6132.8 aplicado en Yo(cm)= 63.4

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1888.9 aplicado en Yo(cm)= 110.9

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

ANALISIS EN ROTURA(ELASTOPLASTICO)*

i. .o Sección: TP-V1

PRESOLICITACIONES ELASTICAS
nalisis SIN FISURACION
retensado: 651.05Tn.
Todas las Armaduras activas a .80*Fyk)

STUDIO SECCION CBC

nalisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
ef. Ultima Acero Estructural( TRACCION)(%): 2.50
eformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
oeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

LEXION PURA POSITIVA:

'n.T): 945.1 Xu(cm.): 16.3

u(Tn.): 0.0 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00132 Etmx= .01000
ompe la fibra inferior de la S.parcial 7

LEXION PURA NEGATIVA:

u(m.T): -428.8 Xu(cm.): 126.1

u(Tn.): 0.0 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00132 Etmx= .01000
ompe la fibra superior de la S.parcial 1

OMPRESION SIMPLE(Rigido/Plastico):

u(Tn.): -6000.0 aplicado en Yo(cm)= 64.5

ACCION SIMPLE(Rigido/Plastico):

u(Tn.): 1018.5 aplicado en Yo(cm)= 92.6

ORTANTE ULTIMO(Rigido/Plastico):

u(Tn.): 0.0 Ru(Kg/cm): 0.0

v1(cm): 0.0 Xv2(cm): 0.0
.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

ítulo Sección: TPM-V1

* PRESOLICITACIONES ELASTICAS
nalisis SIN FISURACION
retensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
ef. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
oeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

u(m.T): 946.2 Xu(cm.): 16.2

u(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00129 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

u(m.T): -429.5 Xu(cm.): 125.1

u(Tn.): .3 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00130 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

OMPRESION SIMPLE(Rigido/Plastico):

u(Tn.): -12219.9 aplicado en Yo(cm)= 72.4

TRACCION SIMPLE(Rigido/Plastico):

u(Tn.): 1018.5 aplicado en Yo(cm)= 92.6

ORTANTE ULTIMO(Rigido/Plastico):

u(Tn.): 0.0 Ru(Kg/cm): 0.0

v1(cm): 0.0 Xv2(cm): 0.0
.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TPM-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1194.21Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 1138.5 Xu(cm.): 15.3

Nu(Tn.): .9 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00122 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -1216.2 Xu(cm.): 118.7

Nu(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00195 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -12871.4 aplicado en Yo(cm)= 69.0

ACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1800.5 aplicado en Yo(cm)= 64.6

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TP-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1340.41Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 1961.6 Xu(cm.): 24.5

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00215 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -410.6 Xu(cm.): 122.6

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00186 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6000.0 aplicado en Yo(cm)= 64.5

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1801.8 aplicado en Yo(cm)= 110.0

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TP-V2b

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1914.87Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

M .T): 2740.5 Xu(cm.): 32.8

Nu(Tn.): -.9 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00316 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -399.3 Xu(cm.): 118.4

Nu(Tn.): -.4 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00244 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6000.0 aplicado en Yo(cm)= 64.5

ACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 2454.6 aplicado en Yo(cm)= 115.4

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: T-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1914.87Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CBC

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 2753.7 Xu(cm.): 30.9

Nu(Tn.): -.4 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00293 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -399.3 Xu(cm.): 118.4

Nu(Tn.): -.4 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00244 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6132.8 aplicado en Yo(cm)= 63.4

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 2454.6 aplicado en Yo(cm)= 115.4

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

CONTROL EN ROTURA SECCION CDV VANOS 1 y 3
PARA FASE 3 DE MONTAJE

Se ion:T

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 640.0 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 170.0 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 |
| | | 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 |
| | | 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1201.2 | 8.87 | 625327.7 |
| | (1) | 672.1 | 14.91 | 583702.5 |
| | (2) | 787.6 | 12.97 | 596733.2 |
| F. ra - | (0) | 1055.8 | 124.65 | 949438.0 |
| | (1) | 479.4 | 113.60 | 841075.6 |
| | (2) | 605.5 | 117.41 | 875766.8 |
| T.Simple | (0) | 5376.1 | 48.69 | 13429640.2 |
| | (1) | 1726.7 | 48.97 | 4392014.5 |
| | (2) | 2347.9 | 48.86 | 5930376.5 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

ANALISIS EN ROTURA(ELASTOPLASTICO)*

i_ o Sección: T

PRESOLICITACIONES ELASTICAS
nalisis SIN FISURACION
retensado: 651.05Tn.
Todas las Armaduras activas a .80*Fyk)

STUDIO SECCION CA

nalisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
ef. Ultima Acero Estructural( TRACCION)(%): 2.50
eformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
oeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

LEXION PURA POSITIVA:

'm.T): 653.4 Xu(cm.): 61.7

u(Tn.): -0.0 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00350 Etmx= .00721
ompe la fibra superior de la S.parcial 3

Md = (133,50 + 51 + 162.20) x 1.50 x 0
= 468,04 mT (ver pag 7-20)

Md < Mu ✓

LEXION PURA NEGATIVA:

u(m.T): -92.1 Xu(cm.): 129.9

u(Tn.): 0.0 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00118 Etmx= .01000
ompe la fibra superior de la S.parcial 3

OMPRESION SIMPLE(Rigido/Plastico):

u(Tn.): -3587.5 aplicado en Yo(cm)= 99.8

CCION SIMPLE(Rigido/Plastico):

u(Tn.): 739.8 aplicado en Yo(cm)= 123.9

ORTANTE ULTIMO(Rigido/Plastico):

u(Tn.): 0.0 Ru(Kg/cm): 0.0

v1(cm): 0.0 Xv2(cm): 0.0
.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV / E-1505.0

CONTROL EN ROTURA SECCION CON VANO 2

Seccion:T-V2

PARA FASE 3 DE MONTAJE

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 640.0 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 170.0 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 48.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 32.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 6.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 2113.0 | 15.50 | 1944480.4 |
| | (1) | 1152.3 | 25.95 | 1723569.0 |
| | (2) | 1386.4 | 22.61 | 1792417.0 |
| F.pura - | (0) | 1103.5 | 125.31 | 955512.2 |
| | (1) | 560.4 | 116.70 | 869774.0 |
| | (2) | 686.8 | 119.44 | 895019.9 |

| | | | | |
|---|---|---|---|---|
| .Simple | (0) | 5467.2 | 50.09 | 14063998.5 |
| | (1) | 1817.8 | 53.17 | 5000787.9 |
| | (2) | 2439.0 | 52.00 | 6548910.1 |
| .Simple | (0) | 195.9 | 91.34 | 664339.6 |
| | (1) | 195.9 | 91.34 | 664339.6 |
| | (2) | 195.9 | 91.34 | 664339.6 |

** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: T-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1608.49Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 1057.6 Xu(cm.): 112.5

Nu(Tn.): .5 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00057
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -86.8 Xu(cm.): 125.7

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00195 Etmx= .01000
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3724.1 aplicado en Yo(cm)= 101.0

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1964.4 aplicado en Yo(cm)= 129.1

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TP-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 663.2 Xu(cm.): 60.4

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00763
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -120.0 Xu(cm.): 129.6

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00121 Etmx= .01000
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3614.3 aplicado en Yo(cm)= 99.2

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 766.6 aplicado en Yo(cm)= 120.6

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

ANALISIS EN ROTURA(ELASTOPLASTICO)*

Tipo Sección: TP-V2b

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1914.87Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION CA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 1129.7 Xu(cm.): 115.3

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00350 Etmx= .00032
Rompe la fibra superior de la S.parcial 3

FLEXION PURA NEGATIVA:

Mu(m.T): -130.0 Xu(cm.): 122.7

Nu(Tn.): -.9 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00240 Etmx= .01000
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -3641.0 aplicado en Yo(cm)= 98.7

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 2229.5 aplicado en Yo(cm)= 126.5

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

# ANEXO 5
# MOMENTOS ULTIMOS ESTRUCTURA COMPLETA

- MOMENTOS ULTIMOS

SIN REFUERZO

SOLICITA

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:TEM-V1

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 49.0 | 25.0 | C* | 0 |
| 6 | 1 | 0.0 | 0.0 | 0.0 | C* | 0 |
| 7 | 1 | 346.5 | 66.0 | 74.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 |
| | | 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 |
| | | 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1140.1 | 9.30 | 622244.9 |
| | (1) | 638.6 | 15.58 | 579218.7 |
| | (2) | 748.1 | 13.58 | 592636.1 |
| F.pura - | (0) | 1069.8 | 124.89 | 952041.5 |
| | (1) | 599.8 | 114.81 | 846929.3 |
| | (2) | 702.4 | 118.01 | 879543.6 |

| | | | | |
|---|---|---|---|---|
| C.Simple | (0) | 7773.0 | 67.34 | 17458805.1 |
| | (1) | 2464.2 | 66.98 | 5638980.1 |
| | (2) | 3367.8 | 67.12 | 7650966.4 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TEM-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 949.9 Xu(cm.): 15.0

Nu(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00119 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -429.8 Xu(cm.): 125.2

Nu(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00129 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -10904.7 aplicado en Yo(cm)= 76.1

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1018.5 aplicado en Yo(cm)= 92.6

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:TE-V1

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 |
| | | 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 |
| | | 8 9 10 11 12 13 |

*** CONSTANTES ESTATICAS ***

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F.pura + | (0) | 1140.1 | 9.30 | 622244.9 |
| | (1) | 638.6 | 15.58 | 579218.7 |
| | (2) | 748.1 | 13.58 | 592636.1 |
| F. pura - | (0) | 1055.8 | 124.65 | 949438.0 |
| | (1) | 479.4 | 113.60 | 841075.6 |
| | (2) | 605.5 | 117.41 | 875766.8 |
| C.Simple | (0) | 5067.1 | 50.90 | 12984230.6 |
| | (1) | 1631.6 | 51.09 | 4253281.5 |
| | (2) | 2216.4 | 51.02 | 5739420.5 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Tipo Sección: TE-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 949.9 Xu(cm.): 14.9

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00119 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -428.8 Xu(cm.): 126.1

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00132 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6448.4 aplicado en Yo(cm)= 60.9

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1018.5 aplicado en Yo(cm)= 92.6

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:TE-V1b

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 48.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 22.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1663.4 | 13.55 | 1342206.8 |
| | (1) | 931.6 | 22.69 | 1209124.8 |
| | (2) | 1091.4 | 19.78 | 1250598.9 |
| F.pura - | (0) | 1082.3 | 125.00 | 952525.7 |
| | (1) | 523.3 | 115.36 | 857087.2 |
| | (2) | 649.4 | 118.54 | 886240.4 |

| | | | | |
|---|---|---|---|---|
| C.Simple | (0) | 5116.5 | 51.68 | 13308656.9 |
| | (1) | 1681.0 | 53.48 | 4569743.2 |
| | (2) | 2265.7 | 52.79 | 6058943.1 |
| T.Simple | (0) | 154.1 | 79.95 | 570475.0 |
| | (1) | 154.1 | 79.95 | 570475.0 |
| | (2) | 154.1 | 79.95 | 570475.0 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

***ANALISIS EN ROTURA(ELASTOPLASTICO)***

**Título Sección: TE-V1b**

*** PRESOLICITACIONES ELASTICAS**
**Analisis SIN FISURACION**
Pretensado: 1417.00Tn.
(Todas las Armaduras activas a .80*Fyk)

**ESTUDIO SECCION COMPLETA**

**Analisis con Resistencia de materiales MINORADAS**
**Def. Ultima Acero Estructural(COMPRESION)(%): 2.50**
**Def. Ultima Acero Estructural( TRACCION)(%): 2.50**
**Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon**
**Deformacion Ultima Hormigon( TRACCION)(%): 1.00**
**Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00**

**FLEXION PURA POSITIVA:**

**Mu(m.T): 2087.7 Xu(cm.): 22.8**

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00197 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

**FLEXION PURA NEGATIVA:**

**Mu(m.T): -409.4 Xu(cm.): 122.1**

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00193 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

**COMPRESION SIMPLE(Rigido/Plastico):**

**Nu(Tn.): -6448.4 aplicado en Yo(cm)= 60.9**

**TRACCION SIMPLE(Rigido/Plastico):**

**Nu(Tn.): 1888.9 aplicado en Yo(cm)= 110.9**

**CORTANTE ULTIMO(Rigido/Plastico):**

**Vu(Tn.): 0.0 Ru(Kg/cm): 0.0**

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Se ion:T-V1

## MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

## SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 640.0 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 170.0 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 48.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 22.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

## SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

## S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| Pura + | (0) | 1752.4 | 12.92 | 1351751.1 |
| | (1) | 980.6 | 21.71 | 1222981.7 |
| | (2) | 1149.3 | 18.90 | 1263268.4 |
| Pura - | (0) | 1082.3 | 125.00 | 952525.7 |
| | (1) | 523.3 | 115.36 | 857087.2 |
| | (2) | 649.4 | 118.54 | 886240.4 |
| C.Simple | (0) | 5425.4 | 49.45 | 13772053.6 |
| | (1) | 1776.0 | 51.29 | 4725762.6 |
| | (2) | 2397.2 | 50.58 | 6267461.8 |
| T.Simple | (0) | 154.1 | 79.95 | 570475.0 |
| | (1) | 154.1 | 79.95 | 570475.0 |
| | (2) | 154.1 | 79.95 | 570475.0 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Titulo Sección: T-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1417.00Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 2097.2 Xu(cm.): 21.5

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00184 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -409.4 Xu(cm.): 122.1

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00193 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6734.9 aplicado en Yo(cm)= 58.9

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1888.9 aplicado en Yo(cm)= 110.9

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:TP-V1

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 602.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 77.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 |
| | | 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 |
| | | 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1101.5 | 9.60 | 620141.0 |
| | (1) | 617.3 | 16.04 | 576187.3 |
| | (2) | 723.0 | 13.99 | 589857.4 |
| F.pura - | (0) | 1055.8 | 124.65 | 949438.0 |
| | (1) | 479.4 | 113.60 | 841075.6 |
| | (2) | 605.5 | 117.41 | 875766.8 |

| | | | | |
|---|---|---|---|---|
| C.Simple | (0) | 4880.0 | 52.37 | 12688021.7 |
| | (1) | 1574.1 | 52.51 | 4161396.2 |
| | (2) | 2136.8 | 52.45 | 5612745.8 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

***ANALISIS EN ROTURA(ELASTOPLASTICO)***

**Título Sección: TP-V1**

*** PRESOLICITACIONES ELASTICAS**
**Analisis SIN FISURACION**
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

**ESTUDIO SECCION COMPLETA**

**Analisis con Resistencia de materiales MINORADAS**
**Def. Ultima Acero Estructural(COMPRESION)(%): 2.50**
**Def. Ultima Acero Estructural( TRACCION)(%): 2.50**
**Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon**
**Deformacion Ultima Hormigon( TRACCION)(%): 1.00**
**Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00**

**FLEXION PURA POSITIVA:**

**Mu(m.T): 948.2 Xu(cm.): 15.4**

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00123 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

**FLEXION PURA NEGATIVA:**

**Mu(m.T): -428.8 Xu(cm.): 126.1**

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00132 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

**COMPRESION SIMPLE(Rigido/Plastico):**

**Nu(Tn.): -6274.8 aplicado en Yo(cm)= 62.3**

**TRACCION SIMPLE(Rigido/Plastico):**

**Nu(Tn.): 1018.5 aplicado en Yo(cm)= 92.6**

**CORTANTE ULTIMO(Rigido/Plastico):**

**Vu(Tn.): 0.0 Ru(Kg/cm): 0.0**

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Sec ion:TPM-V1

## MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

## SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 24.5 | 43.3 | 25.0 | C* | 0 |
| 4 | 2 | 267.5 | 65.0 | 25.0 | C* | 0 |
| 5 | 1 | 87.6 | 65.0 | 25.0 | C* | 0 |
| 6 | 1 | 0.0 | 0.0 | 0.0 | C* | 0 |
| 7 | 1 | 342.5 | 50.0 | 90.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

## SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 5 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |
| 8 | CAM | 3 4 5 7 8 9 10 13 |

* CONSTANTES ESTATICAS *

## S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F.pura + | (0) | 1140.1 | 9.30 | 622244.9 |
| | (1) | 638.5 | 15.58 | 579218.7 |
| | (2) | 748.0 | 13.58 | 592636.1 |
| F.pura - | (0) | 1063.7 | 124.81 | 951186.8 |
| | (1) | 596.4 | 114.69 | 845711.5 |
| | (2) | 698.4 | 117.90 | 878423.2 |
| C.Simple | (0) | 9945.9 | 62.92 | 18314597.0 |
| | (1) | 3132.8 | 62.74 | 5896200.9 |
| | (2) | 4292.5 | 62.81 | 8010002.5 |
| T.Simple | (0) | 104.8 | 55.28 | 370941.2 |
| | (1) | 104.8 | 55.28 | 370941.2 |
| | (2) | 104.8 | 55.28 | 370941.2 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TPM-V1

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 949.8 Xu(cm.): 15.1

Nu(Tn.): .7 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00119 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -429.5 Xu(cm.): 125.1

Nu(Tn.): .3 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00130 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -12572.7 aplicado en Yo(cm)= 70.7

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1018.5 aplicado en Yo(cm)= 92.6

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:TPM-V2

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 24.5 | 43.3 | 25.0 | C* | 0 |
| 4 | 2 | 267.5 | 65.0 | 25.0 | C* | 0 |
| 5 | 1 | 87.6 | 65.0 | 25.0 | C* | 0 |
| 6 | 1 | 0.0 | 0.0 | 0.0 | C* | 0 |
| 7 | 1 | 342.5 | 50.0 | 90.0 | C* | 0 |
| 8 | 3 | 36.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 45.0 | 20.0 | 2.0 | CT | 0 |
| 12 | 4 | 34.0 | 16.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |
| 14 | 6 | 3.0 | 40.0 | 103.0 | *T | 0 |
| 15 | 6 | 2.0 | 40.0 | 46.0 | *T | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 5 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |
| 8 | CAM | 3 4 5 7 8 9 10 13 |
| 9 | MAM | 1 2 3 4 5 7 11 12 14 15 |
| 10 | CMJ | 3 4 5 7 14 15 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| :pura + | (0) | 1651.7 | 12.06 | 1034670.2 |
| | (1) | 951.5 | 18.77 | 950225.9 |
| | (2) | 1102.5 | 16.76 | 974563.2 |
| .p ra - | (0) | 2013.5 | 112.99 | 2890322.2 |
| | (1) | 1146.0 | 96.88 | 2332945.3 |
| | (2) | 1334.1 | 101.82 | 2498128.1 |
| .Simple | (0) | 10149.6 | 62.25 | 18876033.4 |
| | (1) | 3336.5 | 60.72 | 6446138.3 |
| | (2) | 4496.1 | 61.31 | 8564356.8 |
| .Simple | (0) | 308.4 | 38.33 | 756643.2 |
| | (1) | 308.4 | 38.33 | 756643.2 |
| | (2) | 308.4 | 38.33 | 756643.2 |

** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TPM-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1194.21Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 1514.4 Xu(cm.): 18.2

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00149 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -1417.2 Xu(cm.): 114.9

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00235 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -13224.2 aplicado en Yo(cm)= 67.5

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 2287.2 aplicado en Yo(cm)= 68.3

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:TP-V2

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 602.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 77.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 48.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 18.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| Pura + | (0) | 1564.6 | 13.63 | 1268876.1 |
| | (1) | 876.7 | 22.76 | 1143143.4 |
| | (2) | 1026.9 | 19.86 | 1182239.6 |
| Pura - | (0) | 1078.9 | 124.97 | 952390.9 |
| | (1) | 518.9 | 115.22 | 855990.6 |
| | (2) | 644.9 | 118.45 | 885564.6 |
| C.Simple | (0) | 4924.4 | 53.09 | 12971427.3 |
| | (1) | 1618.5 | 54.70 | 4438613.9 |
| | (2) | 2181.2 | 54.08 | 5892341.3 |
| T.Simple | (0) | 149.2 | 78.29 | 557609.8 |
| | (1) | 149.2 | 78.29 | 557609.8 |
| | (2) | 149.2 | 78.29 | 557609.8 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Fi. .lo Sección: TP-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1340.41Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

f m.T): 1972.9 Xu(cm.): 22.9

Vu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00198 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -410.6 Xu(cm.): 122.6

Vu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00186 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6274.8 aplicado en Yo(cm)= 62.3

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1801.8 aplicado en Yo(cm)= 110.0

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:TP-V2b

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 602.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 77.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 48.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 48.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 |
| | | 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 |
| | | 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 1860.4 | 16.12 | 1760566.4 |
| | (1) | 994.4 | 26.87 | 1553570.9 |
| | (2) | 1221.8 | 23.43 | 1617723.3 |
| F.pura - | (0) | 1104.5 | 125.15 | 953372.6 |
| | (1) | 552.4 | 116.22 | 863739.9 |
| | (2) | 678.8 | 119.09 | 890395.0 |

| | | | | |
|---|---|---|---|---|
| .Simple | (0) | 4961.4 | 53.67 | 13189714.5 |
| | (1) | 1655.5 | 56.39 | 4644754.8 |
| | (2) | 2218.2 | 55.35 | 6103084.2 |
| .Simple | (0) | 186.1 | 88.61 | 637480.6 |
| | (1) | 186.1 | 88.61 | 637480.6 |
| | (2) | 186.1 | 88.61 | 637480.6 |

** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TP-V2b

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1914.87Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 2765.8 Xu(cm.): 29.4

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00273 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -399.3 Xu(cm.): 118.4

Nu(Tn.): -.4 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00244 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6274.8 aplicado en Yo(cm)= 62.3

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 2454.6 aplicado en Yo(cm)= 115.4

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Se. ion:T-V2

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 640.0 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 170.0 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 48.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 48.0 | 13.4 | 129.5 | *T | 0 |
| 0 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 1 | 4 | 40.0 | 10.0 | 2.0 | CT | 0 |
| 2 | 4 | 40.0 | 10.0 | 16.0 | CT | 0 |
| 3 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 |
| | | 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 |
| | | 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| F:pura + | (0) | 2028.6 | 14.89 | 1785141.2 |
| | (1) | 1135.9 | 24.95 | 1588833.5 |
| | (2) | 1330.9 | 21.74 | 1650055.4 |
| F. ra - | (0) | 1104.5 | 125.15 | 953372.6 |
| | (1) | 552.4 | 116.22 | 863739.9 |
| | (2) | 678.8 | 119.09 | 890395.0 |
| C.Simple | (0) | 5457.4 | 49.93 | 13979856.8 |
| | (1) | 1808.1 | 52.68 | 4921876.8 |
| | (2) | 2429.2 | 51.63 | 6468020.7 |
| I.Simple | (0) | 186.1 | 88.61 | 637480.6 |
| | (1) | 186.1 | 88.61 | 637480.6 |
| | (2) | 186.1 | 88.61 | 637480.6 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: T-V2

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1914.87Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 2797.0 Xu(cm.): 25.8

Nu(Tn.): -1.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00231 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -399.3 Xu(cm.): 118.4

Nu(Tn.): -.4 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00244 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6734.9 aplicado en Yo(cm)= 58.9

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 2454.6 aplicado en Yo(cm)= 115.4

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

- MOMENTO ULTIMO

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Sec ion:TP-V1

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 602.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 77.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 46.8 | 25.0 | 25.0 | C* | 0 |
| 4 | 1 | 32.0 | 15.6 | 55.2 | C* | 0 |
| 5 | 1 | 40.0 | 97.0 | 25.0 | C* | 0 |
| 6 | 1 | 21.4 | 11.6 | 114.2 | C* | 0 |
| 7 | 1 | 334.5 | 18.0 | 122.0 | C* | 0 |
| 8 | 3 | 30.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 40.0 | 20.0 | 2.0 | CT | 0 |
| 12 | 4 | 40.0 | 16.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PS | 10 |
| 4 | PII | 8 |
| 5 | PIS | 9 |
| 6 | CA | 3 4 5 6 7 8 9 10 13 |
| 7 | CBC | 1 3 4 5 6 7 8 9 10 11 12 13 |

* CONSTANTES ESTATICAS *

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|
| Fpura + | (0) | 1224.3 | 9.40 | 626709.8 |
| | (1) | 709.8 | 14.45 | 590055.8 |
| | (2) | 820.5 | 12.95 | 600482.0 |
| Fibra - | (0) | 1472.5 | 112.65 | 2702635.5 |
| | (1) | 675.6 | 90.27 | 2089959.5 |
| | (2) | 816.9 | 97.43 | 2282290.3 |
| C.Simple | (0) | 5023.3 | 51.10 | 12969506.2 |
| | (1) | 1717.3 | 48.78 | 4428890.0 |
| | (2) | 2280.0 | 49.65 | 5885485.6 |
| T.Simple | (0) | 248.0 | 27.91 | 512981.4 |
| | (1) | 248.0 | 27.91 | 512981.4 |
| | (2) | 248.0 | 27.91 | 512981.4 |

*** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: TP-V1

PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 651.05Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 959.2 Xu(cm.): 13.9

Nu(Tn.): .1 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00110 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -1199.3 Xu(cm.): 119.3

Nu(Tn.): -0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00195 Etmx= .01000
Rompe la fibra superior de la S.parcial 1

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -6910.1 aplicado en Yo(cm)= 57.3

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1653.8 aplicado en Yo(cm)= 60.1

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

# ANEXO 6
# JUNTA HUMEDA

- JUNTA HUMEDA -

* ROTURA

* TENSIONES

Proyecto:
SUBTRAMO XV AVE / E-1505.0

Seccion:JUNTA HUMEDA

MATERIALES

| Num. | Fck (Kg/cm2) | Gamma | M.El. (Kg/cm2) | Jø1 | Jø2 |
|---|---|---|---|---|---|
| 1(HO) | 500.0 | 1.40 | 387088 | 2.25 | 1.35 |
| 2(HO) | 250.0 | 1.50 | 320753 | 2.25 | 1.35 |
| 3(PR) | 17100.0 | 1.10 | 1850000 | | |
| 4(RD) | 5100.0 | 1.15 | 2100000 | | |
| 5(RD) | 5100.0 | 1.10 | 2100000 | | |
| 6(PR) | 8520.0 | 1.10 | 1650000 | | |

SECCIONES PARCIALES

| Num | Mat. | B(cm) Num | H(cm) ø(mm) | Yo(cm) | Mc | Nsr |
|---|---|---|---|---|---|---|
| 1 | 2 | 629.5 | 25.0 | 0.0 | C* | 0 |
| 2 | 2 | 99.6 | 25.0 | 0.0 | C* | 0 |
| 3 | 1 | 24.5 | 43.3 | 25.0 | C* | 0 |
| 4 | 1 | 207.5 | 65.0 | 25.0 | C* | 0 |
| 5 | 1 | 87.6 | 65.0 | 25.0 | C* | 0 |
| 6 | 1 | 0.0 | 0.0 | 0.0 | C* | 0 |
| 7 | 1 | 342.5 | 50.0 | 90.0 | C* | 0 |
| 8 | 3 | 36.0 | 13.4 | 134.3 | *T | 0 |
| 9 | 3 | 0.0 | 13.4 | 129.5 | *T | 0 |
| 10 | 3 | 4.0 | 13.4 | 39.8 | *T | 0 |
| 11 | 4 | 45.0 | 20.0 | 2.0 | CT | 0 |
| 12 | 4 | 34.0 | 16.0 | 16.0 | CT | 0 |
| 13 | 5 | 0.0 | 25.0 | 133.4 | CT | 0 |
| 14 | 6 | 3.0 | 40.0 | 103.0 | *T | 0 |
| 15 | 6 | 2.0 | 40.0 | 46.0 | *T | 0 |

SECCIONES INTERMEDIAS

| Num. | Codigo | Componentes |
|---|---|---|
| 1 | HC | 3 4 5 6 7 |
| 2 | HL | 1 2 |
| 3 | PBI | 14 |
| 4 | PBS | 15 |
| 5 | TOT | 1 2 3 4 5 7 11 12 14 15 |
| 6 | CA | 3 5 7 14 15 |
| 7 | CBC | 1 3 4 5 7 11 12 14 15 |
| 8 | CAM | 3 4 5 7 8 9 10 13 |
| 9 | MAM | 3 4 5 7 11 12 14 15 |
| 10 | CMJ | 3 4 5 7 14 15 |

*** CONSTANTES ESTATICAS ***

S.COMPLETA

| Tipo | Acciones | Area(cm2) | Xcg(cm) | Inercia(cm4) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| F:pura + | (0) | 1651.6 | 12.06 | 1034670.2 |
| | (1) | 951.4 | 18.77 | 950225.9 |
| | (2) | 1102.5 | 16.76 | 974563.2 |
| F.p..a - | (0) | 2013.5 | 112.99 | 2890322.2 |
| | (1) | 1146.0 | 96.88 | 2332945.3 |
| | (2) | 1334.1 | 101.82 | 2498128.1 |
| F.Simple | (0) | 10698.8 | 62.00 | 19081158.9 |
| | (1) | 3505.5 | 60.56 | 6507304.7 |
| | (2) | 4729.9 | 61.12 | 8649863.4 |
| F.Simple | (0) | 308.4 | 38.33 | 756643.2 |
| | (1) | 308.4 | 38.33 | 756643.2 |
| | (2) | 308.4 | 38.33 | 756643.2 |

** Nota: Homogeneizadas a E=2100000 Kp/cm2 ***

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Título Sección: JUNTA HUMEDA

* PRESOLICITACIONES ELASTICAS
Analisis SIN FISURACION
Pretensado: 1194.21Tn.
(Todas las Armaduras activas a .80*Fyk)

ESTUDIO SECCION MAM

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
Deformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
Deformacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 393.7 Xu(cm.): 21.0

Nu(Tn.): .4 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00151 Etmx= .01000
Rompe la fibra inferior de la S.parcial 7

FLEXION PURA NEGATIVA:

Mu(m.T): -1411.4 Xu(cm.): 121.5

Nu(Tn.): 0.0 Qu(Tn.): 0.0

Deformaciones Ultimas: Ecmx= -.00209 Etmx= .01231
Rompe la fibra superior de la S.parcial 3

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -13457.1 aplicado en Yo(cm)= 76.0

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 1416.8 aplicado en Yo(cm)= 33.2

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

ANALISIS EN ROTURA(ELASTOPLASTICO)*

ítulo Sección: JUNTA HUMEDA

PRESOLICITACIONES ELASTICAS
nalisis SIN FISURACION
retensado: 1194.21Tn.
Todas las Armaduras activas a .80*Fyk)

STUDIO SECCION CMJ

nalisis con Resistencia de materiales MINORADAS
ef. Ultima Acero Estructural(COMPRESION)(%): 2.50
ef. Ultima Acero Estructural( TRACCION)(%): 2.50
eformacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
eformacion Ultima Hormigon( TRACCION)(%): 1.00
oeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

LEXION PURA POSITIVA:

( .T): 268.6 Xu(cm.): 35.0

u(Tn.): .6 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00097 Etmx= .01000
ompe la fibra inferior de la S.parcial 7

LEXION PURA NEGATIVA:

u(m.T): -272.2 Xu(cm.): 130.7

u(Tn.): 1.0 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00105 Etmx= .01000
ompe la fibra superior de la S.parcial 3

OMPRESION SIMPLE(Rigido/Plastico):

u(Tn.): -12526.9 aplicado en Yo(cm)= 81.1

A ACCION SIMPLE(Rigido/Plastico):

u(Tn.): 486.7 aplicado en Yo(cm)= 82.2

ORTANTE ULTIMO(Rigido/Plastico):

u(Tn.): 0.0 Ru(Kg/cm): 0.0

v1(cm): 0.0 Xv2(cm): 0.0
.parciales resistentes: Rcu(Kg/cm):

** CALCULO ELASTICO **

ítulo Sección: JUNTA HUMEDA

Analisis SIN FISURACION

ecuencia Incrementos de Carga:

Incremento de Carga 1 :
retensado: 143.80Tn.
.relajacion: 9.85(%)
Alfa: 0.00(gsex.)
ctua sobre la Sintermedia PBS
eccion Afectada: CMJ

ncremento de Carga 2 :
retensado: 503.30Tn.
.relajacion: 9.85(%)
Alfa: 0.00(gsex.)
ctua sobre la Sintermedia PBI
eccion Afectada: CMJ

ENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 2.6 | .3 | -2.6 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 2.6 | .3 | -2.6 | 0.0 | 0.0 |
| 3 | -17.1 | -6.7 | -13.6 | 0.0 | 0.0 | 3 | .9 | -3.9 | -10.9 | 0.0 | 0.0 |
| 4 | -17.1 | -6.7 | -17.0 | 0.0 | 0.0 | 4 | .9 | -3.9 | -14.4 | 0.0 | 0.0 |
| 5 | -17.1 | -6.7 | -17.0 | 0.0 | 0.0 | 5 | .9 | -3.9 | -14.4 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 2.6 | .4 | .4 | 0.0 | 0.0 |
| 7 | -17.1 | -17.0 | -24.9 | 0.0 | 0.0 | 7 | .9 | -14.4 | -22.5 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 2.6 | -219.8 | -222.0 | 0.0 | 222.0 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 2.6 | -211.8 | -214.0 | 0.0 | 214.0 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 2.6 | -62.1 | -64.4 | 0.0 | 64.4 |
| 11 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 2.6 | 1.1 | -2.7 | 0.0 | 2.7 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 2.6 | -25.4 | -28.4 | 0.0 | 28.4 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 2.6 | -247.8 | -252.5 | 0.0 | 252.5 |
| 14 | $$$$$$ | 13259.2 | 13266.5 | 0.0 | 13269.2 | 14 | $$$$$$ | 11804.8 | 11796.1 | 0.0 | 11804.8 |
| 15 | $$$$$$ | 5678.9 | 5676.2 | 0.0 | 5678.9 | 15 | $$$$$$ | 5050.8 | 5042.1 | 0.0 | 5050.8 |

Incrementos de Carga:
1 2

Incremento de Carga 3 :
Flector : -88.30m.T FASE 5
Tipo de Solicitacion: CP
Seccion Afectada: CMJ

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 22.4 | 4.2 | -.5 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 22.4 | 4.2 | -.5 | 0.0 | 0.0 |
| 3 | 36.7 | 4.1 | -11.1 | 0.0 | 0.0 | 3 | 22.3 | -.7 | -11.4 | 0.0 | 0.0 |
| 4 | 36.7 | 4.1 | -18.7 | 0.0 | 0.0 | 4 | 22.3 | -.7 | -16.7 | 0.0 | 0.0 |
| 5 | 36.7 | 4.1 | -18.7 | 0.0 | 0.0 | 5 | 22.3 | -.7 | -16.7 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 22.4 | 5.0 | 5.0 | 0.0 | 0.0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 36.7 | -18.7 | -36.3 | 0.0 | 0.0 | 7 | 22.3 | -16.7 | -29.0 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 22.4 | -282.3 | -285.6 | 0.0 | 285.6 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 22.4 | -270.2 | -273.5 | 0.0 | 273.5 |
| 10 | $$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 22.4 | -44.0 | -47.3 | 0.0 | 47.3 |
| 11 | $$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 11 | 22.4 | 58.4 | 52.7 | 0.0 | 58.4 |
| 12 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 12 | 22.4 | 18.3 | 13.7 | 0.0 | 18.3 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 22.4 | -317.8 | -324.9 | 0.0 | 324.9 |
| 14 | $$$$$$13251.213245.3 | | | 0.013251.2 | | 14 | $$$$$$11754.911739.9 | | | 0.011754.9 | |
| 15 | $$$$$$ 5707.7 | | 5701.7 | 0.0 | 5707.7 | 15 | $$$$$$ 5091.1 | | 5076.1 | 0.0 | 5091.1 |

**Incrementos de Carga:**
1 2 3

**Incremento de Carga 4 :**
Flector : -59.24m.T FASE 6
Tipo de Solicitacion: CP
Seccion Afectada: CBC

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 63.5 | 3.2 | 2.0 | 0.0 | 0.0 | 1 | 29.6 | 6.8 | 1.1 | 0.0 | 0.0 |
| 2 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 28.8 | 6.5 | .9 | 0.0 | 0.0 |
| 3 | 40.7 | 6.5 | -11.4 | 0.0 | 0.0 | 3 | 29.0 | 1.2 | -11.8 | 0.0 | 0.0 |
| 4 | 40.7 | 6.5 | -20.3 | 0.0 | 0.0 | 4 | 29.0 | 1.2 | -18.3 | 0.0 | 0.0 |
| 5 | 40.7 | 6.5 | -20.3 | 0.0 | 0.0 | 5 | 29.0 | 1.2 | -18.3 | 0.0 | 0.0 |
| 6 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 6 | 28.8 | 7.9 | 7.9 | 0.0 | 0.0 |
| 7 | 40.7 | -20.3 | -40.9 | 0.0 | 0.0 | 7 | 29.0 | -18.3 | -33.2 | 0.0 | 0.0 |
| 8 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 8 | 28.8 | -322.8 | -326.9 | 0.0 | 326.9 |
| 9 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 9 | 28.8 | -308.1 | -312.2 | 0.0 | 312.2 |
| 10 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 10 | 28.8 | -33.6 | -37.7 | 0.0 | 37.7 |
| 11 | 63.5 | 20.4 | 19.7 | 0.0 | 20.4 | 11 | 31.9 | 113.7 | 106.1 | 0.0 | 113.7 |
| 12 | 63.5 | 15.8 | 15.2 | 0.0 | 15.8 | 12 | 31.9 | 60.4 | 54.3 | 0.0 | 60.4 |
| 13 | $$$$$$ | 0.0 | 0.0 | 0.0 | 0.0 | 13 | 28.8 | -363.2 | -371.8 | 0.0 | 371.8 |
| 14 | $$$$$$13241.013233.9 | | | 0.013241.0 | | 14 | $$$$$$11723.611705.6 | | | 0.011723.6 | |
| 15 | $$$$$$ 5712.3 | | 5705.3 | 0.0 | 5712.3 | 15 | $$$$$$ 5101.9 | | 5084.0 | 0.0 | 5101.9 |

**Incrementos de Carga:**
1 2 3 4

**Incremento de Carga 5 :**
Flector : -215.70m.T CM
Tipo de Solicitacion: CP
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 62.4 | 13.9 | 8.3 | 0.0 | 0.0 | 1 | 42.1 | 16.2 | 6.6 | 0.0 | 0.0 |
| 2 | 62.0 | 10.7 | 6.4 | 0.0 | 0.0 | 2 | 41.8 | 15.9 | 6.4 | 0.0 | 0.0 |
| 3 | 47.9 | 14.2 | -12.7 | 0.0 | 0.0 | 3 | 41.2 | 7.9 | -13.2 | 0.0 | 0.0 |
| 4 | 47.9 | 14.2 | -26.2 | 0.0 | 0.0 | 4 | 41.2 | 7.9 | -23.8 | 0.0 | 0.0 |
| 5 | 47.9 | 14.2 | -26.2 | 0.0 | 0.0 | 5 | 41.2 | 7.9 | -23.8 | 0.0 | 0.0 |
| 6 | 62.0 | 12.9 | 12.9 | 0.0 | 0.0 | 6 | 41.8 | 19.2 | 19.2 | 0.0 | 0.0 |
| 7 | 47.9 | -26.2 | -57.2 | 0.0 | 0.0 | 7 | 41.2 | -23.8 | -48.2 | 0.0 | 0.0 |
| 8 | 62.0 | -72.0 | -73.4 | 0.0 | 73.4 | 8 | 44.3 | -538.2 | -546.2 | 0.0 | 546.2 |
| | 62.0 | -67.2 | -68.6 | 0.0 | 68.6 | 9 | 44.3 | -509.5 | -517.5 | 0.0 | 517.5 |
| 10 | 62.0 | 22.1 | 20.8 | 0.0 | 22.1 | 10 | 44.3 | 26.9 | 19.0 | 0.0 | 26.9 |
| 11 | 62.4 | 88.2 | 85.3 | 0.0 | 88.2 | 11 | 45.2 | 307.8 | 293.5 | 0.0 | 307.8 |
| 12 | 62.4 | 67.8 | 65.4 | 0.0 | 67.8 | 12 | 45.2 | 208.1 | 196.7 | 0.0 | 208.1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 62.0 | -80.7 | -83.5 | 0.0 | 83.5 | 13 | 44.3 | -604.6 | -621.6 | 0.0 | 621.6 |
| 14 | $$$$$$13204.513194.0 | | | 0.013204.5 | | 14 | $$$$$$11613.011584.7 | | | 0.011613.0 | |
| 15 | $$$$$$ 5726.5 | | 5715.9 | 0.0 | 5726.5 | 15 | 770.8 | 5139.8 | 5111.5 | 0.0 | 5139.8 |

**Incrementos de Carga:**
1 2 3 4 5

**Incremento de Carga 6 :**
Flector : 249.24m.T REDIST
Tipo de Solicitacion: CP:tf[2]
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 62.4 | 13.9 | 8.3 | 0.0 | 0.0 | 1 | 24.1 | 4.8 | -.2 | 0.0 | 0.0 |
| 2 | 62.0 | 10.7 | 6.4 | 0.0 | 0.0 | 2 | 23.2 | 4.5 | -.4 | 0.0 | 0.0 |
| 3 | 47.9 | 14.2 | -12.7 | 0.0 | 0.0 | 3 | 23.9 | -.3 | -11.6 | 0.0 | 0.0 |
| 4 | 47.9 | 14.2 | -26.2 | 0.0 | 0.0 | 4 | 23.9 | -.3 | -17.3 | 0.0 | 0.0 |
| 5 | 47.9 | 14.2 | -26.2 | 0.0 | 0.0 | 5 | 23.9 | -.3 | -17.3 | 0.0 | 0.0 |
| 6 | 62.0 | 12.9 | 12.9 | 0.0 | 0.0 | 6 | 23.2 | 5.4 | 5.4 | 0.0 | 0.0 |
| 7 | 47.9 | -26.2 | -57.2 | 0.0 | 0.0 | 7 | 23.9 | -17.3 | -38.3 | 0.0 | 0.0 |
| 8 | 62.0 | -72.0 | -73.4 | 0.0 | 73.4 | 8 | 32.0 | -352.3 | -356.9 | 0.0 | 356.9 |
| 9 | 62.0 | -67.2 | -68.6 | 0.0 | 68.6 | 9 | 32.0 | -335.8 | -340.4 | 0.0 | 340.4 |
| 10 | 62.0 | 22.1 | 20.8 | 0.0 | 22.1 | 10 | 32.0 | -27.1 | -31.7 | 0.0 | 31.7 |
| 11 | 62.4 | 88.2 | 85.3 | 0.0 | 88.2 | 11 | 34.4 | 137.4 | 132.8 | 0.0 | 137.4 |
| 12 | 62.4 | 67.8 | 65.4 | 0.0 | 67.8 | 12 | 34.4 | 78.1 | 73.4 | 0.0 | 78.1 |
| 13 | 62.0 | -80.7 | -83.5 | 0.0 | 83.5 | 13 | 32.0 | -396.3 | -406.1 | 0.0 | 406.1 |
| 14 | $$$$$$13204.513194.0 | | | 0.013204.5 | | 14 | $$$$$$11707.911688.5 | | | 0.011707.9 | |
| 15 | $$$$$$ 5726.5 | | 5715.9 | 0.0 | 5726.5 | 15 | $$$$$$ 5105.6 | | 5086.3 | 0.0 | 5105.6 |

**Incrementos de Carga:**
1 2 3 4 5 6

**Incremento de Carga 7 :**
Retraccion(Eso/øi;Tinf.): 11.90(*1.E-05)
Actua sobre la Sintermedia HC
Seccion Afectada: CA

**Incremento de Carga 8 :**
Retraccion(Eso/øi;Tinf.): 9.21(*1.E-05)
Actua sobre la Sintermedia HL
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 62.4 | 13.9 | 8.3 | 0.0 | 0.0 | 1 | -871.0 | 13.4 | 13.8 | 0.0 | 0.0 |
| 2 | 62.0 | 10.7 | 6.4 | 0.0 | 0.0 | 2 | -686.8 | 13.1 | 13.6 | 0.0 | 0.0 |
| 3 | 47.9 | 14.2 | -12.7 | 0.0 | 0.0 | 3 | 135.4 | -154.0 | -93.6 | 0.0 | 0.0 |
| 4 | 47.9 | 14.2 | -26.2 | 0.0 | 0.0 | 4 | $$$$$$ | 27.0 | 26.7 | 0.0 | 0.0 |
| 5 | 47.9 | 14.2 | -26.2 | 0.0 | 0.0 | 5 | 135.4 | -154.0 | -63.3 | 0.0 | 0.0 |
| 6 | 62.0 | 12.9 | 12.9 | 0.0 | 0.0 | 6 | $$$$$$ | 26.3 | 26.3 | 0.0 | 0.0 |
| 7 | 47.9 | -26.2 | -57.2 | 0.0 | 0.0 | 7 | 135.4 | -63.3 | 6.5 | 0.0 | 0.0 |
| 8 | 62.0 | -72.0 | -73.4 | 0.0 | 73.4 | 8 | -4.8 | -307.7 | -310.6 | 0.0 | 310.6 |
| 9 | 62.0 | -67.2 | -68.6 | 0.0 | 68.6 | 9 | -4.8 | -297.1 | -300.0 | 0.0 | 300.0 |
| 10 | 62.0 | 22.1 | 20.8 | 0.0 | 22.1 | 10 | -4.8 | -98.7 | -101.7 | 0.0 | 101.7 |
| 11 | 62.4 | 88.2 | 85.3 | 0.0 | 88.2 | 11 | 3.2 | 3.3 | -2.4 | 0.0 | 3.3 |
| 12 | 62.4 | 67.8 | 65.4 | 0.0 | 67.8 | 12 | 3.2 | -36.5 | -41.0 | 0.0 | 41.0 |
| 13 | 62.0 | -80.7 | -83.5 | 0.0 | 83.5 | 13 | -4.8 | -346.9 | -353.2 | 0.0 | 353.2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | $$$$$$ | 13204.5 | 13194.0 | 0.0 | 13204.5 | 14 | $$$$$$ | 11407.1 | 11416.0 | 0.0 | 11416.0 |
| 5 | $$$$$$ | 5726.5 | 5715.9 | 0.0 | 5726.5 | 15 | $$$$$$ | 4402.4 | 4411.3 | 0.0 | 4411.3 |

ncrementos de Carga:
1 2 3 4 5 6 7 8

ncremento de Carga 9 :
lector : 19.30m.T SCU
ipo de Solicitacion: SC
eccion Afectada: TOTAL

ENSIONES (Kg/cm2):

| STADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| sp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 62.4 | 13.0 | 7.8 | 0.0 | 0.0 | 1 | -403.5 | 12.4 | 13.2 | 0.0 | 0.0 |
| 2 | 62.0 | 9.7 | 5.8 | 0.0 | 0.0 | 2 | -352.1 | 12.2 | 13.0 | 0.0 | 0.0 |
| 3 | 47.4 | 13.5 | -12.6 | 0.0 | 0.0 | 3 | 134.4 | -154.7 | -93.5 | 0.0 | 0.0 |
| 4 | 47.4 | 13.5 | -25.6 | 0.0 | 0.0 | 4 | $$$$$$ | 26.3 | 27.3 | 0.0 | 0.0 |
| 5 | 47.4 | 13.5 | -25.6 | 0.0 | 0.0 | 5 | 134.4 | -154.7 | -62.8 | 0.0 | 0.0 |
| 6 | 62.0 | 11.8 | 11.8 | 0.0 | 0.0 | 6 | -601.7 | 25.1 | 25.1 | 0.0 | 0.0 |
| 7 | 47.4 | -25.6 | -55.7 | 0.0 | 0.0 | 7 | 134.4 | -62.8 | 7.9 | 0.0 | 0.0 |
| 8 | 62.0 | -65.6 | -66.8 | 0.0 | 66.8 | 8 | -7.6 | -301.2 | -304.1 | 0.0 | 304.1 |
| 9 | 62.0 | -61.2 | -62.4 | 0.0 | 62.4 | 9 | -7.6 | -291.0 | -293.9 | 0.0 | 293.9 |
| 0 | 62.0 | 20.1 | 18.9 | 0.0 | 20.1 | 10 | -7.6 | -100.7 | -103.5 | 0.0 | 103.5 |
| 1 | 62.4 | 82.2 | 79.4 | 0.0 | 82.2 | 11 | 1.0 | -2.8 | -8.3 | 0.0 | 8.3 |
| 2 | 62.4 | 63.1 | 60.9 | 0.0 | 63.1 | 12 | 1.0 | -41.2 | -45.5 | 0.0 | 45.5 |
| 3 | 62.0 | -73.5 | -76.1 | 0.0 | 76.1 | 13 | -7.6 | -339.7 | -345.7 | 0.0 | 345.7 |
| 4 | $$$$$$ | 13207.8 | 13197.5 | 0.0 | 13207.8 | 14 | $$$$$$ | 11410.3 | 11419.6 | 0.0 | 11419.6 |
| 5 | $$$$$$ | 5725.2 | 5715.0 | 0.0 | 5725.2 | 15 | $$$$$$ | 4401.1 | 4410.4 | 0.0 | 4410.4 |

ncrementos de Carga:
1 2 3 4 5 6 7 8 9

ncremento de Carga 10 :
lector : 28.40m.T VP
ipo de Solicitacion: SC
eccion Afectada: TOTAL

IONES (Kg/cm2):

| STADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| sp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 62.4 | 11.6 | 6.9 | 0.0 | 0.0 | 1 | -206.0 | 11.0 | 12.4 | 0.0 | 0.0 |
| 2 | 62.0 | 8.3 | 5.0 | 0.0 | 0.0 | 2 | -187.8 | 10.8 | 12.2 | 0.0 | 0.0 |
| 3 | 46.7 | 12.5 | -12.4 | 0.0 | 0.0 | 3 | 133.0 | -155.7 | -93.3 | 0.0 | 0.0 |
| 4 | 46.7 | 12.5 | -24.9 | 0.0 | 0.0 | 4 | -571.8 | 25.3 | 28.0 | 0.0 | 0.0 |
| 5 | 46.7 | 12.5 | -24.9 | 0.0 | 0.0 | 5 | 133.0 | -155.7 | -62.0 | 0.0 | 0.0 |
| 6 | 62.0 | 10.1 | 10.1 | 0.0 | 0.0 | 6 | -338.4 | 23.4 | 23.4 | 0.0 | 0.0 |
| 7 | 46.7 | -24.9 | -53.6 | 0.0 | 0.0 | 7 | 133.0 | -62.0 | 10.1 | 0.0 | 0.0 |
| 8 | 62.0 | -56.1 | -57.1 | 0.0 | 57.1 | 8 | -12.2 | -291.7 | -294.4 | 0.0 | 294.4 |
| 9 | 62.0 | -52.4 | -53.4 | 0.0 | 53.4 | 9 | -12.2 | -282.2 | -284.8 | 0.0 | 284.8 |
| 0 | 62.0 | 17.2 | 16.2 | 0.0 | 17.2 | 10 | -12.2 | -103.6 | -106.3 | 0.0 | 106.3 |
| 1 | 62.4 | 73.2 | 70.8 | 0.0 | 73.2 | 11 | -2.5 | -11.7 | -16.9 | 0.0 | 16.9 |
| 2 | 62.4 | 56.3 | 54.3 | 0.0 | 56.3 | 12 | -2.5 | -48.0 | -52.1 | 0.0 | 52.1 |
| 3 | 62.0 | -62.9 | -65.1 | 0.0 | 65.1 | 13 | -12.2 | -329.1 | -334.7 | 0.0 | 334.7 |
| 4 | $$$$$$ | 13212.6 | 13202.8 | 0.0 | 13212.6 | 14 | $$$$$$ | 11415.1 | 11424.9 | 0.0 | 11424.9 |
| 5 | $$$$$$ | 5723.4 | 5713.6 | 0.0 | 5723.4 | 15 | $$$$$$ | 4399.3 | 4409.0 | 0.0 | 4409.0 |

n ementos de Carga:
1 2 3 4 5 6 7 8 9 10

Incremento de Carga 11 :
Flector : 193.30m.T GRADIENTE
Tipo de Solicitacion: SC
Seccion Afectada: TOTAL

TENSIONES (Kg/cm2):

| ESTADO INICIAL (To) | | | | | | ESTADO FINAL (Tinf) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp | Nsp | Yn(cm) | Tsup. | Tinf. | Tao | Tcomp |
| 1 | 64.6 | 2.0 | 1.2 | 0.0 | 0.0 | 1 | -6.9 | 1.4 | 6.6 | 0.0 | 0.0 |
| 2 | 62.0 | -1.3 | -.7 | 0.0 | 0.0 | 2 | -5.5 | 1.2 | 6.5 | 0.0 | 0.0 |
| 3 | 39.4 | 5.6 | -11.2 | 0.0 | 0.0 | 3 | 124.9 | -162.6 | -92.1 | 0.0 | 0.0 |
| 4 | 39.4 | 5.6 | -19.6 | 0.0 | 0.0 | 4 | -55.1 | 18.4 | 33.2 | 0.0 | 0.0 |
| 5 | 39.4 | 5.6 | -19.6 | 0.0 | 0.0 | 5 | 124.9 | -162.6 | -56.8 | 0.0 | 0.0 |
| 6 | 62.0 | -1.5 | -1.5 | 0.0 | 0.0 | 6 | -46.2 | 11.8 | 11.8 | 0.0 | 0.0 |
| 7 | 39.4 | -19.6 | -39.0 | 0.0 | 0.0 | 7 | 124.9 | -56.8 | 24.6 | 0.0 | 0.0 |
| 8 | 62.0 | 8.4 | 8.6 | 0.0 | 8.6 | 8 | -72.5 | -227.2 | -228.7 | 0.0 | 228.7 |
| 9 | 62.0 | 7.9 | 8.0 | 0.0 | 8.0 | 9 | -72.5 | -221.9 | -223.4 | 0.0 | 223.4 |
| 10 | 62.0 | -2.6 | -2.4 | 0.0 | 2.6 | 10 | -72.5 | -123.4 | -124.9 | 0.0 | 124.9 |
| 11 | 64.6 | 12.4 | 12.0 | 0.0 | 12.4 | 11 | -43.9 | -72.5 | -75.7 | 0.0 | 75.7 |
| 12 | 64.6 | 9.7 | 9.3 | 0.0 | 9.7 | 12 | -43.9 | -94.6 | -97.1 | 0.0 | 97.1 |
| 13 | 62.0 | 9.5 | 9.8 | 0.0 | 9.8 | 13 | -72.5 | -256.7 | -259.9 | 0.0 | 259.9 |
| 14 | $$$$$$ | 13245.2 | 13238.6 | 0.0 | 13245.2 | 14 | $$$$$$ | 11447.8 | 11460.7 | 0.0 | 11460.7 |
| 15 | $$$$$$ | 5710.6 | 5704.0 | 0.0 | 5710.6 | 15 | $$$$$$ | 4386.5 | 4399.4 | 0.0 | 4399.4 |

Incrementos de Carga:
1 2 3 4 5 6 7 8 9 10 11

ESTUDIO: 24785

OBRA: L.A.V.MADRID-BARCELONA-FRONTERA FRANCESA / SUBTRAMO XV

E-1505.0

CLIENTE: N.E.C.S.O.

# COMPROBACION DE PILAS, ESTRIBOS Y CIMENTACIONES

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 18-1 |

# 18. CALCULO DE LA SUBESTRUCTURA

## 18.1. CALCULO DEL REPARTO DE FUERZAS HORIZONTALES

Se realiza con el programa "REPARTO" tanteando sucesivos aparatos de apoyo para el encaje de pilas y estribos.

En lo que respecta a las acciones de viento y frenado se considerarán las de proyecto, si bien las deformaciones impuestas correspondrán a las del tablero prefabricado en particular.

Se adjuntan a continuación las listados de datos y salida de resultados para acciones lentas G = 80 T/m² y para acciones rápidas G = 160 T/m².

Así mismo se obtienen los coeficientes "β" de pandeo para el cálculo de pilas.

PROGRAMA REPARTO
RESUMEN DE DATOS INTRODUCIDOS

Unidades de fuerza en t.
Unidades de longitud en m.
Unidades de angulos en grados sexagesimales.

1.- GEOMETRIA

Tipo de geometria en planta: Puente recto

1.1.- Datos del tablero

Numero de vanos: 3

| vano | longitud(m) | Ax(m2) | Ix(m4) | Iy(m4) | Iz(m4) |
|---|---|---|---|---|---|
| 1 | 19 | 2.834 | 1.637 | 3.458 | .585 |
| 2 | 31.03 | 2.834 | 1.637 | 3.458 | .585 |
| 3 | 19 | 2.834 | 1.637 | 3.458 | .585 |

1.2.- Datos de las pilas

| Pila | H | Iy | Iz | Ax | Neo 1 | Neo 2 | Or. |
|---|---|---|---|---|---|---|---|
| 1 | 11.58 | .1018 | .1018 | 1.1309 | 1 | 0 | 0 |
| 2 | 11.43 | .1018 | .1018 | 1.1309 | 1 | 0 | 0 |

H: altura de la pila en metros
Neo 1: numero de neoprenos en el caso de estribos y pilas sin junta; numero de neoprenos en extremo anterior de juntas
Neo 2: numero de neoprenos en extremo posterior de juntas
Or: angulo de orientacion de los ejes de la pila respecto a la normal a la directriz en grados sexagesimales

1.3.- Datos de las juntas

No hay juntas en las pilas

1.4.- Datos de los aparatos de apoyo

Estribo 1: 4 aparato(s) (50 x 45 x 12,5 (Pxxxx apoyos)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .2025 | .093 | 3.55 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .2025 | .093 | 1.35 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 3 | .2025 | .093 | -1.35 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 4 | .2025 | .093 | -3.55 | 0 | 0 |

Tipo: Neopreno

Estribo 2: 4 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .2025 | .093 | 3.55 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .2025 | .093 | 1.35 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 3 | .2025 | .093 | -1.35 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 4 | .2025 | .093 | -3.55 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Pila 1 : 600x600 mm (Sección cuadrada)
1 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .42 | .06 | 0 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Pila 2 :
1 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .42 | .06 | 0 | 0 | 0 |
| | Tipo: Neopreno | | | | |

A.C.: Angulo de colocacion de la linea de aparatos de apoyo
Or.: Angulo de orientacion respecto a la normal a la directriz
de los ejes del aparato de apoyo

2.- CARACTERISTICAS MECANICAS DE LOS MATERIALES

Modulo E del hormigon del tablero: 3870880 t/m2
Modulo E del hormigon de las pilas: 3568471 t/m2
Modulo E de los neoprenos: 192 t/m2; G = 80 t/m2 (160 t/m2 )
Coeficiente de dilatacion termica de los materiales: alfa =
.00001
Coeficiente de Poisson de los materiales: .2

3.- COACCIONES:

3.1.- Apoyos coaccionados transversalmente:
(apoyo 1 = estribo 1, apoyo2 = pila 1 ...)

3.2.- Apoyos coaccionados longitudinalmente:
(apoyo 1 = estribo 1, apoyo2 = pila 1 ...)

4.- ACCIONES:

Peso especifico del material tablero: 2.5 t/m3
Peso especifico del material pilas: 2.5 t/m3
Carga muerta: 4.7295 t/ml
Carga de frenado: .205 t/ml
Carga de viento:
Sobre tablero:
Fx = 0 t/ml Fz = .947 t/ml (H = 3,732 m)
Sobre pilas:
Fx = 0 t/ml Fz = .3 t/ml
Carga debida a la fuerza centrifuga: 0 t/ml
Incremento de temperatura: 28 grados centigrados
Movimiento impuesto por retraccion: .000231
Movimiento impuesto por fluencia: .000282



CALCULO DEL REPARTO DE FUERZAS HORIZONTALES:
G=80 t/m2

HIPOTESIS CONSIDERADAS:

HIPOTESIS 1: Carga de Fuerza Centrifuga
HIPOTESIS 2: Carga longitudinal de frenado
HIPOTESIS 3: Carga de Viento sobre tablero y pilas
HIPOTESIS 4: Carga por aumento de temperatura
HIPOTESIS 5: Carga por retraccion
HIPOTESIS 6: Carga por fluencia

REACCIONES EN ESTRIBOS Y BASE DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

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REACCIONES EN ESTRIBO 1:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Reacciones | | | | | |
|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = 0.00 |
| 2) | Fl = | 4.90 | Ft = | 0.00 | Ml = | 0.74 | Mt = 0.00 |
| 3) | Fl = | 0.00 | Ft = | -21.14 | Ml = | 0.00 | Mt = 3.17 |
| 4) | Fl = | 6.72 | Ft = | 0.00 | Ml = | 1.01 | Mt = 0.00 |
| 5) | Fl = | 5.54 | Ft = | 0.00 | Ml = | 0.83 | Mt = 0.00 |
| 6) | Fl = | 6.77 | Ft = | 0.00 | Ml = | 1.02 | Mt = 0.00 |

REACCIONES EN ESTRIBO 2:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Esfuerzos | | | | | |
|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = 0.00 |
| 2) | Fl = | 4.90 | Ft = | 0.00 | Ml = | 0.74 | Mt = 0.00 |
| 3) | Fl = | 0.00 | Ft = | -21.04 | Ml = | 0.00 | Mt = 3.16 |
| 4) | Fl = | -6.72 | Ft = | 0.00 | Ml = | -1.01 | Mt = 0.00 |
| 5) | Fl = | -5.54 | Ft = | 0.00 | Ml = | -0.83 | Mt = 0.00 |
| 6) | Fl = | -6.77 | Ft = | 0.00 | Ml = | -1.02 | Mt = 0.00 |

REACCIONES EN PILA 1

| Hip. | | Reacciones | | | | | |
|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = 0.00 |
| 2) | Fl = | 2.16 | Ft = | 0.00 | Ml = | 25.30 | Mt = 0.00 |
| 3) | Fl = | 0.00 | Ft = | -14.97 | Ml = | 0.00 | Mt = 154.91 |
| 4) | Fl = | 1.34 | Ft = | 0.00 | Ml = | 15.62 | Mt = 0.00 |
| 5) | Fl = | 1.11 | Ft = | 0.00 | Ml = | 12.89 | Mt = 0.00 |
| 6) | Fl = | 1.35 | Ft = | 0.00 | Ml = | 15.74 | Mt = 0.00 |

REACCIONES EN PILA 2

| Hip. | | Reacciones | | | | | |
|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = 0.00 |
| 2) | Fl = | 2.19 | Ft = | 0.00 | Ml = | 25.41 | Mt = 0.00 |
| 3) | Fl = | 0.00 | Ft = | -15.13 | Ml = | 0.00 | Mt = 155.07 |
| 4) | Fl = | -1.34 | Ft = | 0.00 | Ml = | -15.60 | Mt = 0.00 |
| 5) | Fl = | -1.11 | Ft = | 0.00 | Ml = | -12.87 | Mt = 0.00 |
| 6) | Fl = | -1.35 | Ft = | 0.00 | Ml = | -15.71 | Mt = 0.00 |

ESFUERZOS EN CABEZA DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

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ESFUERZOS EN PILA 1:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -2.16 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 11.49 |
| Hip. | 4) | Flong = | -1.34 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | -1.11 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | -1.35 | Ftrans = | 0.00 |

ESFUERZOS EN PILA 2:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -2.19 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 11.70 |
| Hip. | 4) | Flong = | 1.34 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | 1.11 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | 1.35 | Ftrans = | 0.00 |

DESPLAZAMIENTOS EN LOS NEOPRENOS (segun ejes LOCALES)
Unidades: cm

ESTRIBO E1

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NEOPRENO 1
Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | 0.00001 | 0.00005 |
| 4 | -0.00006 | 0.00000 |
| 5 | -0.00005 | 0.00000 |
| 6 | -0.00006 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70339 | -0.00000 |
| 3 | 0.19504 | 3.03401 |
| 4 | -0.96519 | 0.00000 |
| 5 | -0.79628 | 0.00000 |
| 6 | -0.97208 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70334 | -0.00000 |
| 3 | 0.19502 | 3.03396 |
| 4 | -0.96513 | 0.00000 |

| | | |
|---|---|---|
| 5 | -0.79623 | 0.00000 |
| 6 | -0.97203 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | 0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | -0.00000 |
| 3 | 0.07417 | 3.03404 |
| 4 | -0.96524 | 0.00000 |
| 5 | -0.79633 | 0.00000 |
| 6 | -0.97214 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | -0.00000 |
| 3 | 0.07417 | 3.03402 |
| 4 | -0.96524 | 0.00000 |
| 5 | -0.79633 | 0.00000 |
| 6 | -0.97214 | 0.00000 |

NEOPRENO 3

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | -0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | -0.00000 |
| 3 | -0.07417 | 3.03404 |
| 4 | -0.96524 | 0.00000 |
| 5 | -0.79633 | 0.00000 |
| 6 | -0.97214 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | -0.00000 |
| 3 | -0.07417 | 3.03402 |
| 4 | -0.96524 | 0.00000 |
| 5 | -0.79633 | 0.00000 |
| 6 | -0.97214 | 0.00000 |

NEOPRENO 4

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | -0.00001 | 0.00005 |
| 4 | -0.00006 | 0.00000 |
| 5 | -0.00005 | 0.00000 |
| 6 | -0.00006 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70339 | -0.00000 |
| 3 | -0.19504 | 3.03401 |
| 4 | -0.96519 | 0.00000 |
| 5 | -0.79628 | 0.00000 |
| 6 | -0.97209 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70334 | -0.00000 |
| 3 | -0.19502 | 3.03396 |
| 4 | -0.96513 | 0.00000 |
| 5 | -0.79623 | 0.00000 |
| 6 | -0.97203 | 0.00000 |

PILA 1

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NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.31262 | -0.00000 |
| 3 | -0.00000 | 1.85115 |
| 4 | -0.19292 | 0.00000 |
| 5 | -0.15916 | 0.00000 |
| 6 | -0.19430 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70395 | -0.00000 |
| 3 | -0.00000 | 3.93961 |
| 4 | -0.43442 | 0.00000 |
| 5 | -0.35840 | 0.00000 |
| 6 | -0.43752 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |

| | | |
|---|---|---|
| 2 | -0.39132 | -0.00000 |
| 3 | -0.00000 | 2.08846 |
| 4 | -0.24150 | 0.00000 |
| 5 | -0.19924 | 0.00000 |
| 6 | -0.24322 | 0.00000 |

PILA 2

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NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.30595 | -0.00000 |
| 3 | -0.00000 | 1.80717 |
| 4 | 0.18782 | 0.00000 |
| 5 | 0.15495 | 0.00000 |
| 6 | 0.18917 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70394 | -0.00000 |
| 3 | -0.00000 | 3.93231 |
| 4 | 0.43215 | 0.00000 |
| 5 | 0.35653 | 0.00000 |
| 6 | 0.43524 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.39799 | -0.00000 |
| 3 | -0.00000 | 2.12514 |
| 4 | 0.24433 | 0.00000 |
| 5 | 0.20157 | 0.00000 |
| 6 | 0.24607 | 0.00000 |

ESTRIBO E2

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NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | -0.00001 | 0.00005 |
| 4 | 0.00006 | 0.00000 |
| 5 | 0.00005 | 0.00000 |
| 6 | 0.00006 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70339 | 0.00000 |
| 3 | -0.19601 | 3.02068 |
| 4 | 0.96292 | 0.00000 |
| 5 | 0.79441 | 0.00000 |
| 6 | 0.96980 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70334 | 0.00000 |
| 3 | -0.19600 | 3.02063 |
| 4 | 0.96286 | 0.00000 |
| 5 | 0.79436 | 0.00000 |
| 6 | 0.96974 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | -0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | 0.00000 |
| 3 | -0.07454 | 3.02071 |
| 4 | 0.96298 | 0.00000 |
| 5 | 0.79446 | 0.00000 |
| 6 | 0.96985 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | 0.00000 |
| 3 | -0.07454 | 3.02069 |
| 4 | 0.96298 | 0.00000 |
| 5 | 0.79446 | 0.00000 |
| 6 | 0.96985 | 0.00000 |

NEOPRENO 3

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | 0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | 0.00000 |
| 3 | 0.07454 | 3.02071 |
| 4 | 0.96298 | 0.00000 |
| 5 | 0.79446 | 0.00000 |
| 6 | 0.96985 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70343 | 0.00000 |
| 3 | 0.07454 | 3.02069 |
| 4 | 0.96298 | 0.00000 |
| 5 | 0.79446 | 0.00000 |
| 6 | 0.96985 | 0.00000 |

NEOPRENO 4

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | 0.00001 | 0.00005 |
| 4 | 0.00006 | 0.00000 |
| 5 | 0.00005 | 0.00000 |
| 6 | 0.00006 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70339 | 0.00000 |
| 3 | 0.19601 | 3.02068 |
| 4 | 0.96292 | 0.00000 |
| 5 | 0.79441 | 0.00000 |
| 6 | 0.96980 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.70334 | 0.00000 |
| 3 | 0.19600 | 3.02063 |
| 4 | 0.96286 | 0.00000 |
| 5 | 0.79436 | 0.00000 |
| 6 | 0.96974 | 0.00000 |

CALCULO DE RIGIDECES EQUIVALENTES DE LA ESTRUCTURA
ACTUANDO SOBRE CADA PILA.
CALCULO DE LONGITUDES DE PANDEO.
G=80 t/m2
ESFUERZOS QUE SE LLEVA LA ESTRUCTURA Y MOVIMIENTOS EN CABEZA DE PILAS
(segun ejes LOCALES)

Unidades: Fuerza t
Desplazamientos cm
Rigideces t/m o m.t/rad

Acciones: Para cada pila dos casos de carga.
1.- Carga longitudinal de 1000 t en cabeza
2.- Carga transversal de 1000 t en cabeza

En caso ser empotrada la pila, dos casos mas:
3.- Momento longitudinal de 1000 m.t en cabeza
4.- Carga transversal de 1000 m.t en cabeza

Las rigideces se calculan: K = F tablero / U cabeza de pila
Kgiro = M tablero / Giro cabeza de pila

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PILA: 1

Sentido longitudinal:

Flong. = 376.30 t Ulong. = 87.65 cm
Kl. = 429.3 t/m

EIlongitudinal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.57

Sentido transversal:

Ftrans. = 337.82 t Utrans. = 93.23 cm
Kt. = 362.3 t/m

EItransversal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.62

PILA: 2

Sentido longitudinal:

Flong. = 367.12 t Ulong. = 85.56 cm
Kl. = 429.1 t/m

EIlongitudinal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.58

Sentido transversal:

Ftrans. = 329.07 t  Utrans. = 90.86 cm
Kt. = 362.2 t/m

EItransversal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.63

CALCULO DEL REPARTO DE FUERZAS HORIZONTALES:
G=160 t/m2

HIPOTESIS CONSIDERADAS:

HIPOTESIS 1: Carga de Fuerza Centrifuga
HIPOTESIS 2: Carga longitudinal de frenado
HIPOTESIS 3: Carga de Viento sobre tablero y pilas
HIPOTESIS 4: Carga por aumento de temperatura
HIPOTESIS 5: Carga por retraccion
HIPOTESIS 6: Carga por fluencia

REACCIONES EN ESTRIBOS Y BASE DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

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REACCIONES EN ESTRIBO 1:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 5.41 | Ft = | 0.00 | Ml = | 0.81 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -22.49 | Ml = | 0.00 | Mt = | 3.37 |
| 4) | Fl = | 13.41 | Ft = | 0.00 | Ml = | 2.02 | Mt = | 0.00 |
| 5) | Fl = | 11.06 | Ft = | 0.00 | Ml = | 1.66 | Mt = | 0.00 |
| 6) | Fl = | 13.51 | Ft = | 0.00 | Ml = | 2.03 | Mt = | 0.00 |

REACCIONES EN ESTRIBO 2:
(Segun eje de colocacion de aparatos de apoyo)

| Hip. | | Esfuerzos | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 5.41 | Ft = | 0.00 | Ml = | 0.81 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -22.37 | Ml = | 0.00 | Mt = | 3.36 |
| 4) | Fl = | -13.38 | Ft = | 0.00 | Ml = | -2.02 | Mt = | 0.00 |
| 5) | Fl = | -11.04 | Ft = | 0.00 | Ml = | -1.66 | Mt = | 0.00 |
| 6) | Fl = | -13.48 | Ft = | 0.00 | Ml = | -2.03 | Mt = | 0.00 |

REACCIONES EN PILA 1

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 1.64 | Ft = | 0.00 | Ml = | 19.26 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -13.60 | Ml = | 0.00 | Mt = | 138.86 |
| 4) | Fl = | 1.82 | Ft = | 0.00 | Ml = | 21.45 | Mt = | 0.00 |
| 5) | Fl = | 1.50 | Ft = | 0.00 | Ml = | 17.69 | Mt = | 0.00 |
| 6) | Fl = | 1.83 | Ft = | 0.00 | Ml = | 21.60 | Mt = | 0.00 |

REACCIONES EN PILA 2

| Hip. | | Reacciones | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1) | Fl = | 0.00 | Ft = | 0.00 | Ml = | 0.00 | Mt = | 0.00 |
| 2) | Fl = | 1.68 | Ft = | 0.00 | Ml = | 19.47 | Mt = | 0.00 |
| 3) | Fl = | 0.00 | Ft = | -13.82 | Ml = | 0.00 | Mt = | 139.87 |
| 4) | Fl = | -1.85 | Ft = | 0.00 | Ml = | -21.56 | Mt = | 0.00 |
| 5) | Fl = | -1.52 | Ft = | 0.00 | Ml = | -17.79 | Mt = | 0.00 |

6) Fl = -1.86 Ft = 0.00 Ml = -21.71 Mt = 0.00

ESFUERZOS EN CABEZA DE PILAS (segun ejes LOCALES)
Unidades: t y m.t

ESFUERZOS EN PILA 1:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -1.64 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 10.12 |
| Hip. | 4) | Flong = | -1.82 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | -1.50 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | -1.83 | Ftrans = | 0.00 |

ESFUERZOS EN PILA 2:

| | | | | | |
|---|---|---|---|---|---|
| Hip. | 1) | Flong = | 0.00 | Ftrans = | 0.00 |
| Hip. | 2) | Flong = | -1.68 | Ftrans = | 0.00 |
| Hip. | 3) | Flong = | 0.00 | Ftrans = | 10.39 |
| Hip. | 4) | Flong = | 1.85 | Ftrans = | 0.00 |
| Hip. | 5) | Flong = | 1.52 | Ftrans = | 0.00 |
| Hip. | 6) | Flong = | 1.86 | Ftrans = | 0.00 |

DESPLAZAMIENTOS EN LOS NEOPRENOS (segun ejes LOCALES)
Unidades: cm

ESTRIBO E1

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | 0.00003 | 0.00005 |
| 4 | -0.00014 | 0.00000 |
| 5 | -0.00012 | 0.00000 |
| 6 | -0.00014 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38858 | -0.00000 |
| 3 | 0.20932 | 1.61409 |
| 4 | -0.96303 | 0.00000 |
| 5 | -0.79450 | 0.00000 |
| 6 | -0.96991 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38853 | -0.00000 |
| 3 | 0.20930 | 1.61404 |
| 4 | -0.96289 | 0.00000 |
| 5 | -0.79439 | 0.00000 |
| 6 | -0.96977 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | 0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | -0.00000 |
| 3 | 0.07961 | 1.61413 |
| 4 | -0.96314 | 0.00000 |
| 5 | -0.79459 | 0.00000 |
| 6 | -0.97002 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | -0.00000 |
| 3 | 0.07961 | 1.61411 |
| 4 | -0.96314 | 0.00000 |
| 5 | -0.79459 | 0.00000 |
| 6 | -0.97002 | 0.00000 |

NEOPRENO 3

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | -0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | -0.00000 |
| 3 | -0.07961 | 1.61413 |
| 4 | -0.96314 | 0.00000 |
| 5 | -0.79459 | 0.00000 |
| 6 | -0.97002 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | -0.00000 |
| 3 | -0.07961 | 1.61411 |
| 4 | -0.96314 | 0.00000 |

| | | |
|---|---|---|
| 5 | -0.79459 | 0.00000 |
| 6 | -0.97002 | 0.00000 |

NEOPRENO 4

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | -0.00003 | 0.00005 |
| 4 | -0.00014 | 0.00000 |
| 5 | -0.00012 | 0.00000 |
| 6 | -0.00014 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38858 | -0.00000 |
| 3 | -0.20932 | 1.61409 |
| 4 | -0.96303 | 0.00000 |
| 5 | -0.79450 | 0.00000 |
| 6 | -0.96991 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38853 | -0.00000 |
| 3 | -0.20929 | 1.61404 |
| 4 | -0.96289 | 0.00000 |
| 5 | -0.79439 | 0.00000 |
| 6 | -0.96977 | 0.00000 |

PILA 1

---

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.23797 | -0.00000 |
| 3 | 0.00000 | 1.65287 |
| 4 | -0.26502 | 0.00000 |
| 5 | -0.21864 | 0.00000 |
| 6 | -0.26691 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38924 | -0.00000 |
| 3 | 0.00000 | 2.58895 |
| 4 | -0.43350 | 0.00000 |
| 5 | -0.35763 | 0.00000 |
| 6 | -0.43659 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.15127 | -0.00000 |
| 3 | 0.00000 | 0.93608 |
| 4 | -0.16848 | 0.00000 |
| 5 | -0.13899 | 0.00000 |
| 6 | -0.16968 | 0.00000 |

PILA 2

---

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.23443 | -0.00000 |
| 3 | 0.00000 | 1.62411 |
| 4 | 0.25962 | 0.00000 |
| 5 | 0.21418 | 0.00000 |
| 6 | 0.26147 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38923 | -0.00000 |
| 3 | 0.00000 | 2.58351 |
| 4 | 0.43103 | 0.00000 |
| 5 | 0.35560 | 0.00000 |
| 6 | 0.43411 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.15480 | -0.00000 |
| 3 | 0.00000 | 0.95939 |
| 4 | 0.17142 | 0.00000 |
| 5 | 0.14142 | 0.00000 |
| 6 | 0.17264 | 0.00000 |

ESTRIBO E2

---

NEOPRENO 1

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | -0.00003 | 0.00005 |
| 4 | 0.00014 | 0.00000 |
| 5 | 0.00012 | 0.00000 |
| 6 | 0.00014 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38858 | 0.00000 |
| 3 | -0.20969 | 1.60565 |
| 4 | 0.96060 | 0.00000 |
| 5 | 0.79249 | 0.00000 |
| 6 | 0.96746 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38853 | 0.00000 |
| 3 | -0.20966 | 1.60560 |
| 4 | 0.96046 | 0.00000 |
| 5 | 0.79238 | 0.00000 |
| 6 | 0.96732 | 0.00000 |

NEOPRENO 2

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | -0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | 0.00000 |
| 3 | -0.07975 | 1.60568 |
| 4 | 0.96071 | 0.00000 |
| 5 | 0.79258 | 0.00000 |
| 6 | 0.96757 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | 0.00000 |
| 3 | -0.07975 | 1.60566 |
| 4 | 0.96071 | 0.00000 |
| 5 | 0.79258 | 0.00000 |
| 6 | 0.96757 | 0.00000 |

NEOPRENO 3

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00000 | 0.00000 |
| 3 | 0.00000 | 0.00002 |
| 4 | 0.00000 | 0.00000 |
| 5 | 0.00000 | 0.00000 |
| 6 | 0.00000 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | 0.00000 |
| 3 | 0.07975 | 1.60568 |
| 4 | 0.96071 | 0.00000 |
| 5 | 0.79258 | 0.00000 |
| 6 | 0.96757 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38863 | 0.00000 |
| 3 | 0.07975 | 1.60566 |
| 4 | 0.96071 | 0.00000 |
| 5 | 0.79258 | 0.00000 |
| 6 | 0.96757 | 0.00000 |

NEOPRENO 4

Movimientos en cara inferior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.00005 | 0.00000 |
| 3 | 0.00003 | 0.00005 |
| 4 | 0.00014 | 0.00000 |
| 5 | 0.00012 | 0.00000 |
| 6 | 0.00014 | 0.00000 |

Movimientos en cara superior:

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38858 | 0.00000 |
| 3 | 0.20969 | 1.60565 |
| 4 | 0.96060 | 0.00000 |
| 5 | 0.79249 | 0.00000 |
| 6 | 0.96746 | 0.00000 |

Movimientos relativos de las caras de los neoprenos (superior-inferior):

| Hipotesis | U-long. | U-trans |
|---|---|---|
| 1 | 0.00000 | 0.00000 |
| 2 | -0.38853 | 0.00000 |
| 3 | 0.20966 | 1.60560 |
| 4 | 0.96046 | 0.00000 |
| 5 | 0.79238 | 0.00000 |
| 6 | 0.96732 | 0.00000 |

CALCULO DE RIGIDECES EQUIVALENTES DE LA ESTRUCTURA
ACTUANDO SOBRE CADA PILA.
CALCULO DE LONGITUDES DE PANDEO.
G=160 T/m2
ESFUERZOS QUE SE LLEVA LA ESTRUCTURA Y MOVIMIENTOS EN CABEZA DE PILAS
(segun ejes LOCALES)

Unidades: Fuerza t
Desplazamientos cm
Rigideces t/m o m.t/rad

Acciones: Para cada pila dos casos de carga.
1.- Carga longitudinal de 1000 t en cabeza
2.- Carga transversal de 1000 t en cabeza

En caso ser empotrada la pila, dos casos mas:
3.- Momento longitudinal de 1000 m.t en cabeza
4.- Carga transversal de 1000 m.t en cabeza

Las rigideces se calculan: K = F tablero / U cabeza de pila
Kgiro = M tablero / Giro cabeza de pila

---

PILA: 1

---

Sentido longitudinal:

Flong. = 540.23 t Ulong. = 63.89 cm
Kl. = 845.6 t/m

EIlongitudinal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.34

Sentido transversal:

Ftrans. = 479.08 t Utrans. = 72.75 cm
Kt. = 658.5 t/m

EItransversal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.43

PILA: 2

---

Sentido longitudinal:

Flong. = 530.51 t Ulong. = 62.78 cm
Kl. = 845.1 t/m

EIlongitudinal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.35

Sentido transversal:

Ftrans. = 469.24 t Utrans. = 71.32 cm
Kt. = 657.9 t/m

EItransversal = 363270.35 t.m2

Coeficiente de pandeo: beta = 1.44

## 18.2 CALCULO DE APARATOS DE APOYO

APOYOS EN PILAS 600 x 600 x 84 (60)

a/ Estructura completa

$N_{max}$ = 528,83 T

$N_{min}$ = 297,84 T

$H_{2x}$ = 5,91 T

$H_{2y}$ = 13,60 T

$u_{1x}$ = 0,618 cm

$u_{1y}$ = 0,00 cm

$\alpha_{c.perm}$ = 0,0017 rad

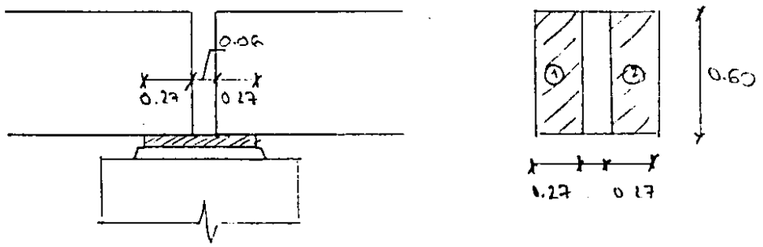
$\alpha_{s.c}$ = 0,0012 rad

$\alpha_o$ = 0,0030 rad

NOTA. Valores tomados directamente de los cap. 16, 17 y 18.

b/ Fases 1 + 2 + 3 de montaje

Cada viga apoya en medio neopreno :




Se calcula la fracción del neopreno sobre la que apoya el vano 2 por ser el mayor :



$N_{max}$ = 45,981 + 17,581 + 24,300 = 87,86 T

$H_{1x}$ = 0,00 T

$H_{1y}$ = viento en montaje :

$W = 0{,}250\ T/m \times 0{,}84/1{,}04 = 0{,}202\ T/m^2$

$F_W = 0{,}202\ T/m \times 1.48\ m = 0{,}299\ T/m \approx 0{,}300\ T/m$

$H_{1y} = 13{,}60\ T \times 0{,}300\ T/m / 0{,}947 = 1{,}309\ T$

$u_{1x}$ = 0,00 T

$u_{1y}$ = 0,00 T

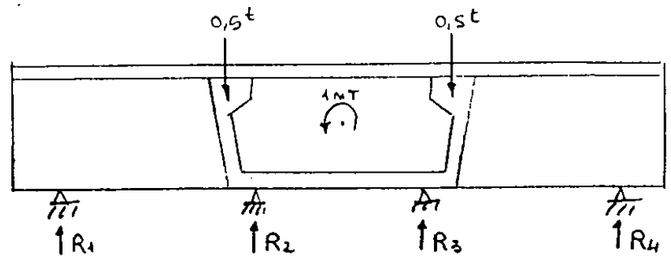
$\alpha_{cp}$ = 0,000332 rad

$\alpha_o$ = 0,003 rad

APOYOS EN ESTRIBOS

a/ Apoyos bajo almas de viga

Del modelo de cálculo de la rienda ir en el adjunto se deduce la fracción de cargas que viajan hasta los apoyos extremos de la rienda y la fracción restante que absorben los neoprenos bajo la viga, tanto para una carga vertical centrada como para un momento torsor.



Para un corrimiento de 1t :

$R_1 = 0.0961$

$R_2 = 0.4039$

$R_3 = 0.4039$

$R_4 = 0.0961$

Para un momento de 1mT

$R_1 = -0,0432$

$R_2 = 0,4840$

$R_3 = -0,4840$

$R_4 = 0,0432$

APOYOS BAJO VIGA

$N_{max} = 0,50 \times [\overset{F.1}{28,101} + \overset{F.2}{10,744} + \overset{F.3}{35,641}] + 0,404 [\overset{F.5}{-3,161} + \overset{F.6}{4,900} + \overset{CM}{17,640} + \overset{SCU}{28,543} + \overset{VP}{54,278} + \overset{GRAD}{10,174}] + 0,484 \times 90 =$

$= 126,11$ T para Vmax - Tconc

$N_{max} = 0,50 \times [28,101 + 10,744 + 35,641] + 0,404 \times [-3,161 + 4,900 + 17,640 + 14,271 + 54,278 + 10,174] + 0,484 \times [90 + 49,38] =$

$= \underline{144,31}$ T para Tmax - Vconc

$N_{min} = 0,50 \times [28,101 + 10,744 + 35,641] + 0,404 \times [-3,161 + 4,900 + 17,64] = 44,98$ T sin sobrecarga

$N_{min} = 0,50 \times [28,101 + 10,744 + 35,641] + 0,404 \times [-3,161 + 4,90 + 17,64 + 14,271] - 0,484 \times 49,38 = 26,84$ T

con sobrecarga uniforme en medio tablero Tmax-Vconc



$N_{min} = 0,50 \times [28,101 + 10,744 + 35,641] + 0,404 \times [-3,161 + 4,901 + 17,64 + 14,271 + 54,278] - 0,484 \times [49,38 + 90] =$

$= \underline{5,113}$ T

con sobrecarga uniforme en medio tablero - V. pesado

$H_{1x} = 5,11\,t/4 = 1,35\,t$

$H_{1y} = 22,49\,t/4 = 5,62\,t$

$u_{1x} = 2,738$ cm

$u_{1y} = 1,614$ cm

$\alpha_{c.perm} = 9,02$ rad $\times 10^{-3}$

$\alpha_{s.c} = 0,95$ rad $\times 10^{-3}$

$\alpha_0 = 0,003$ rad

APOYOS BAJO RIOSTRA

Se dimensionaron de idéntica dimensión que los apoyos bajo viga para evitar una solicitación horizontal excesiva en los estribos (ya construidos).

$N_{max} = 0,0961 \times [35,641 - 3,161 + 4,900 + 17,640 + 14,271 + 54,278 + 10,174] + 0,0432 \times [90 + 49,38] = 18,37\,t$

$N_{min} = 0,0961 \times [35,641 - 3,161 + 4,900 + 17,640 + 14,271 + 54,278] - 0,0432 \times [90 + 49,38] = 5,85\,t$

$H_{2x} = 1,35\,t$

$H_{2y} = 5,62\,t$

$u_{1x} = 2{,}738$ cm

$u_{1y} = 1{,}614$ cm

$\alpha_{epsm} = 9{,}08$ rad $\times 10^{-3}$

$\alpha_{sc} = 0{,}95$ rad $\times 10^{-3}$

$\alpha_0 = 0{,}003$ rad

Se adjunta calculos de comprobación de los apoyos se donde se observe que los apoyos del estribo, tanto de viga como viga rehundida o la viga y al estribo, ya que $\sigma_{min} < 10$ kp/cm².

# COMPROBACION DE LOS APOYOS DE NEOPRENO

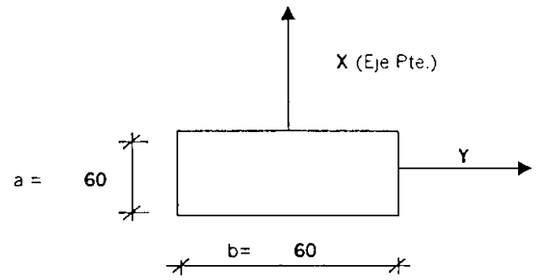
## SUBTRAMO XV AVE / E-1505,0 / PILAS.E.COMPLETA

**COMPROBACIÓN CON SÍSMO:** **NO** (SI / NO)
**TIPO DE TABLERO:** **CARRETERA** (CARRETERA O FERROCARRIL)

### A).- CARACTERISTICAS GEOMETRICAS DEL NEOPRENO:

**Ancho: a =** **60** cm Sentido X-X (Normalmente: a < b)
**Largo: b =** **60** cm Sentido Y-Y

| | | | |
|---|---|---|---|
| Número capas de elastómero | **n =** | **5** | |
| Espesor de capas elastómero | **t =** | **11** | mm |
| Altura total de elastómero | **T =** | **60** | mm |
| Factor de forma **S= a*b / 2*t*(a+b)** | = | **13,6** | |
| Espesor del zuncho o chapa | **e =** | **4** | mm |
| Altura Total del Neopreno | **et =** | **84** | mm |
| Módulo de elasticidad transversal del neopreno | **G =** | **8** | Kp/cm² |
| Tipo de Neopreno | T= n * t + 5 | (Tipo A) | |




### B).- COMPROBACION BAJO CARGAS VERTICALES:

Siendo:

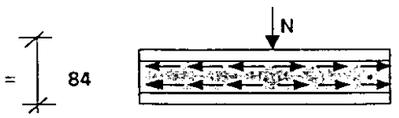
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **N.max =** | **528,83** | Tn. | **h2,x max=** | **5,92** | Tn. | **h2,y max=** | **13,60** | Tn. |
| **N.min =** | **297,84** | Tn. | **h2,x min=** | **0,00** | Tn. | **h2,y min=** | **0,00** | Tn. |

(h2 son fuerzas instantaneas)

Tensión media en neopreno : $\sigma_m$ = **N. max / a * b**

$\sigma_m$ = **147** Kp/cm² < **150** Kp/cm² => **Vale**

Por lo tanto la tensión tangencial $\tau,n$ es:




$\tau,n = 1{,}5 * \sigma m / S$

$\tau,n =$ **16,16** Kp/cm²

### C).- COMPROBACION BAJO CARGAS HORIZONTALES:

* **Deformación lenta, u1: (dilatación, retración y fluencia.)**

$\tau_{,h1} = G * u1 / T$

| | | | | | |
|---|---|---|---|---|---|
| | **u1,x =** | **0,618** | cm | **u1,y =** | **0,000** | cm |
| Luego: | **τ,h1x =** | **0,82** | Kp/cm² | **τ,h1y =** | **0,00** | Kp/cm² |

* **Fuerza horizontal instantanea, h2, deformación, u2:**

$h2 = u2 * 2 * G * a * b / T$ y $\tau_{,h2} = h2 / a * b$

$u2 = h2 * T / 2 * G * a * b$

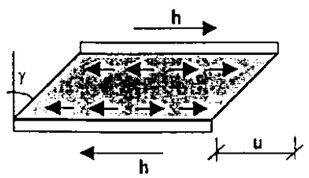
| | | | | | |
|---|---|---|---|---|---|
| h2,x = | 5,92 | Tn. | h2,y = | 13,60 | Tn. |
| u2,x = | 0,62 | cm | u2,y = | 1,42 | cm |

Luego: $\tau,h2x$ = 1,64 Kp/cm² $\tau,h2y$ = 3,78 Kp/cm²

*** τ totales, por fuerza horizontal:**

$\tau,thx = \tau,h1x + 0,50 * \tau,h2x$

$\tau,thy = \tau,h1y + 0,50 * \tau,h2y$




$\tau,t1 = RCUAD [( \tau,h1x ) ^ 2 + ( \tau,h1y ) ^ 2]$

$\tau,t2 = RCUAD [( \tau,h2x ) ^ 2 + ( \tau,h2y ) ^ 2]$

$\tau,th = RCUAD [( \tau,thx ) ^ 2 + ( \tau,thy ) ^ 2]$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| τ,thx = | 1,65 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,thy = | 1,89 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,t1 = | 0,82 | Kp/cm² | < 0,5*G= | 4,00 | Kp/cm² | => | Vale |
| τ,t2 = | 4,12 | Kp/cm² | | | | | |
| τ,th = | 2,51 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |

*** Giros:**

$\tau,ax = G/2 * ( a / t ) ^ 2 * \alpha,xt$

$\tau,ay = G/2 * ( b / t ) ^ 2 * \alpha,yt$

Siendo:

$\alpha,tx = \alpha,Tx / n$

$\alpha,ty = \alpha,Ty / n$

$\alpha,Tx = \alpha,1x + \alpha,scx + \alpha,0x$

$\alpha,Ty = \alpha,1y + \alpha,scy + \alpha,0y$

Donde:

| | | | | | | |
|---|---|---|---|---|---|---|
| α,1x = | 0,0017 | rad | α,1y = | 0,0000 | rad | (Suma giros c. perman.) |
| α,scx = | 0,0012 | rad | α,scy = | 0,0000 | rad | (Suma giros sobrecargas) |
| α,0x = | 0,0030 | rad | α,0y = | 0,0000 | rad | (Giro accidental) |

Por lo tanto:

| | | | | | |
|---|---|---|---|---|---|
| α,Tx = | 0,0059 | rad | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0012 | rad | α,ty = | 0,0000 | rad |

*** τ totales, por giros:**

| | | | | | |
|---|---|---|---|---|---|
| τ,tax = | 14,00 | Kp/cm² | τ,tay = | 0,00 | Kp/cm² |
| τ,ta = | 14,00 | Kp/cm² | | | |

*** τ totales debidos al axil, fuerza horizontal y giro:**

Axil:

$\tau,n = 1,50 * \sigma_m / S$

τ,n = 16,16 Kp/cm²

Fuerza horizontal y giro:

$\tau,tx = \tau,tax + \tau,thx$ $\tau,ty = \tau,tay + \tau,thy$

τ,tx = 15,64 Kp/cm² τ,ty = 1,89 Kp/cm²

Total:

$\tau,t = \tau,n + RCUAD [( \tau,tx ) ^ 2 + ( \tau,ty ) ^ 2]$

τ,t = 31,91 Kp/cm² < 5 * G = 40,00 Kp/cm² => Vale

## D).- CONDICION DE NO DESPLAZAMIENTO DEL APOYO:

Se debe verificar la condición:

$\sigma_m$ => 20 Kp/cm² y $H <= f * N$

con: $f = 0,10 + 6 / \sigma m$ (Para apoyos tipo A)

Siendo **H** la fuerza concomitante con la carga vertical **N**

Siendo **f** el coeficiente de rozamiento

En nuestro caso:

N,min = 297,84 Tn.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| σ,min = | 82,73 | Kp/cm² | > | 20 | Kp/cm² | => | Vale |
| f = | 0,17 | | H = | 14,83 | Tn. | | |
| | | Luego: | H < = | 51,38 | Tn. | => | Vale |

## E).- CONDICION DE ESTABILIDAD:

Se debe verificar la condición:

$a / 10 <= T <= a / 5$

En nuestro caso:

Como a = 600 mm

a/10 = 60 mm

a/5 = 120 mm Como T = 60 mm => Vale

## F).- CONDICION DE NO LEVANTAMIENTO:

Se debe verificar la condición:

$\alpha,t = \alpha,T / n <= ( 3 / S ) * ( t^2 / a^2 ) * ( \sigma m / G )$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| α,Tx = | 0,0059 | rad | | | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0012 | rad | | | α,ty = | 0,0000 | rad |
| α,tx = | 0,0012 | rad <= | 0,0014 | rad | | => | Vale |
| α,ty = | 0,0000 | rad <= | 0,0014 | rad | | => | Vale |

## G).- ESPESOR DE LOS ZUNCHOS:

El espesor del zuncho, debe cumplir:

**e >= ( a / S ) * ( σm/σe )** σe= límite elástico del acero (Kp/cm²)

**e >= 2 mm**

Para σe= **2400** Kp/cm²

**e =** **2,7** mm.

Como **e =** **4** mm. => **Vale**

# COMPROBACION DE LOS APOYOS DE NEOPRENO

## SUBTRAMO XV AVE / E-1505,0 / PILAS.MONTAJE

**COMPROBACIÓN CON SÍSMO:** **NO** (SI / NO)

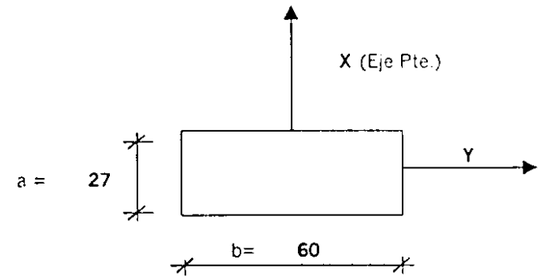
**TIPO DE TABLERO:** **CARRETERA** (CARRETERA O FERROCARRIL)

## A).- CARACTERISTICAS GEOMETRICAS DEL NEOPRENO:

**Ancho: a =** **27** cm Sentido X-X (Normalmente: a < b)

**Largo: b =** **60** cm Sentido Y-Y

| | | | |
|---|---|---|---|
| Número capas de elastómero | **n =** | **5** | |
| Espesor de capas elastómero | **t =** | **11** | mm |
| Altura total de elastómero | **T =** | **60** | mm |
| Factor de forma **S= a*b / 2*t*(a+b)** | = | **8,5** | |
| Espesor del zuncho o chapa | **e =** | **4** | mm |
| Altura Total del Neopreno | **et =** | **84** | mm |
| Módulo de elasticidad transversal del neopreno | **G =** | **8** | Kp/cm² |
| Tipo de Neopreno | T= n * t + 5 | (Tipo A) | |




## B).- COMPROBACION BAJO CARGAS VERTICALES:

Siendo:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **N.max =** | **87,86** | Tn. | **h2,x max=** | **0,00** | Tn. | **h2,y max=** | **4,31** | Tn. |
| **N.min =** | **87,86** | Tn. | **h2,x min=** | **0,00** | Tn. | **h2,y min=** | **0,00** | Tn. |

(h2 son fuerzas instantaneas)

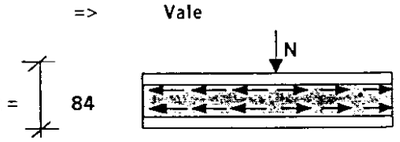
Tensión media en neopreno : $\sigma_m$ = **N. max / a * b**

$\sigma_m$ = **54** Kp/cm² < **150** Kp/cm² => **Vale**

Por lo tanto la tensión tangencial **τ,n** es:

**τ,n = 1,5 * σm / S**

**τ,n = 9,61** Kp/cm²




## C).- COMPROBACION BAJO CARGAS HORIZONTALES:

* **Deformación lenta, u1: (dilatación, retración y fluencia.)**

**$\tau_{,h1}$ = G * u1 / T**

| | | | | | | |
|---|---|---|---|---|---|---|
| | **u1,x =** | **0,000** | cm | **u1,y =** | **0,000** | cm |
| Luego: | **τ,h1x =** | **0,00** | Kp/cm² | **τ,h1y =** | **0,00** | Kp/cm² |

* **Fuerza horizontal instantanea, h2, deformación, u2:**

$h2 = u2 * 2 * G * a * b / T$ y $\tau_{,h2} = h2 / a * b$

$u2 = h2 * T / 2 * G * a * b$

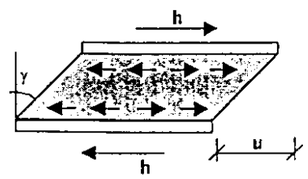
| | | | | | |
|---|---|---|---|---|---|
| h2,x = | 0,00 | Tn. | h2,y = | 4,31 | Tn. |
| u2,x = | 0,00 | cm | u2,y = | 1,00 | cm |

Luego: $\tau,h2x$ = 0,00 Kp/cm² $\tau,h2y$ = 2,66 Kp/cm²

*** τ totales, por fuerza horizontal:**

$\tau,thx = \tau,h1x + 0,50 * \tau,h2x$

$\tau,thy = \tau,h1y + 0,50 * \tau,h2y$




$\tau,t1 = RCUAD [( \tau,h1x )^2 + ( \tau,h1y )^2]$

$\tau,t2 = RCUAD [( \tau,h2x )^2 + ( \tau,h2y )^2]$

$\tau,th = RCUAD [( \tau,thx )^2 + ( \tau,thy )^2]$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| τ,thx = | 0,00 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,thy = | 1,33 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,t1 = | 0,00 | Kp/cm² | < 0,5*G= | 4,00 | Kp/cm² | => | Vale |
| τ,t2 = | 2,66 | Kp/cm² | | | | | |
| τ,th = | 1,33 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |

*** Giros:**

$\tau,ax = G/2 * ( a / t )^2 * \alpha,xt$

$\tau,ay = G/2 * ( b / t )^2 * \alpha,yt$

Siendo:

$\alpha,tx = \alpha,Tx / n$

$\alpha,ty = \alpha,Ty / n$

$\alpha,Tx = \alpha,1x + \alpha,scx + \alpha,0x$

$\alpha,Ty = \alpha,1y + \alpha,scy + \alpha,0y$

Donde:

| | | | | | | |
|---|---|---|---|---|---|---|
| α,1x = | 0,0003 | rad | α,1y = | 0,0000 | rad | (Suma giros c. perman.) |
| α,scx = | 0,0000 | rad | α,scy = | 0,0000 | rad | (Suma giros sobrecargas) |
| α,0x = | 0,0030 | rad | α,0y = | 0,0000 | rad | (Giro accidental) |

Por lo tanto:

| | | | | | |
|---|---|---|---|---|---|
| α,Tx = | 0,0033 | rad | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0007 | rad | α,ty = | 0,0000 | rad |

*** τ totales, por giros:**

| | | | | | |
|---|---|---|---|---|---|
| τ,tax = | 1,60 | Kp/cm² | τ,tay = | 0,00 | Kp/cm² |
| τ,ta = | 1,60 | Kp/cm² | | | |

*** τ totales debidos al axil, fuerza horizontal y giro:**

Axil:

$\tau,n = 1,50 * \sigma_m / S$

τ,n = 9,61 Kp/cm²

Fuerza horizontal y giro:

$\tau,tx = \tau,tax + \tau,thx$ $\tau,ty = \tau,tay + \tau,thy$

| | | | | | |
|---|---|---|---|---|---|
| τ,tx = | 1,60 | Kp/cm² | τ,ty = | 1,33 | Kp/cm² |

Total:

$\tau,t = \tau,n + RCUAD [( \tau,tx )^2 + ( \tau,ty )^2]$

τ,t = 11,69 Kp/cm² < 5 * G = 40,00 Kp/cm² => Vale

## D).- CONDICION DE NO DESPLAZAMIENTO DEL APOYO:

Se debe verificar la condición:

$\sigma_m$ => 20 Kp/cm² y $H <= f * N$

con: $f = 0,10 + 6 / \sigma m$ (Para apoyos tipo A)

Siendo H la fuerza concomitante con la carga vertical N

Siendo f el coeficiente de rozamiento

En nuestro caso:

N,min = 87,86 Tn.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| σ,min = | 54,23 | Kp/cm² | > | 20 | Kp/cm² | => | Vale |
| f = | 0,21 | | H = | 4,31 | Tn. | | |
| | | Luego: | H < = | 18,51 | Tn. | => | Vale |

## E).- CONDICION DE ESTABILIDAD:

Se debe verificar la condición:

$a / 10 <= T <= a / 5$

En nuestro caso:

Como a = 270 mm

a/10 = 27 mm

a/5 = 54 mm Como T = 60 mm => **No Cumple**

## F).- CONDICION DE NO LEVANTAMIENTO:

Se debe verificar la condición:

$\alpha,t = \alpha,T / n <= ( 3 / S ) * ( t^2 / a^2 ) * ( \sigma m / G )$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| α,Tx = | 0,0033 | rad | | | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0007 | rad | | | α,ty = | 0,0000 | rad |
| α,tx = | 0,0007 | rad <= | 0,0040 | rad | => | Vale | |
| α,ty = | 0,0000 | rad <= | 0,0008 | rad | => | Vale | |

## G).- ESPESOR DE LOS ZUNCHOS:

El espesor del zuncho, debe cumplir:

**e >= ( a / S ) * ( σm/σe )** σe= límite elástico del acero (Kp/cm²)

**e >= 2 mm**

Para σe= **2400** Kp/cm²

**e =** **0,7** mm.

Como **e =** **4** mm. => **Vale**

# COMPROBACION DE LOS APOYOS DE NEOPRENO

## SUBTRAMO XV AVE / E-1505,0 / ESTRIBOS / APOYOS BAJO VIGA

**COMPROBACIÓN CON SÍSMO:** **NO** (SI / NO)

**TIPO DE TABLERO:** **CARRETERA** (CARRETERA O FERROCARRIL)

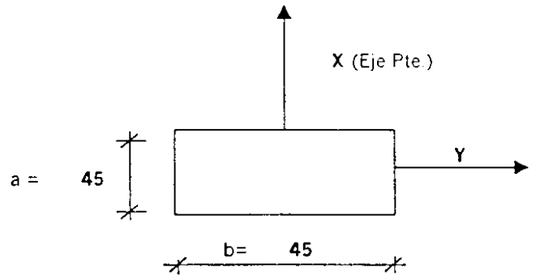
## A).- CARACTERISTICAS GEOMETRICAS DEL NEOPRENO:

**Ancho: a =** **45** cm Sentido X-X (Normalmente: a < b)

**Largo: b =** **45** cm Sentido Y-Y

| | | | |
|---|---|---|---|
| Número capas de elastómero | **n =** | **8** | |
| Espesor de capas elastómero | **t =** | **11** | mm |
| Altura total de elastómero | **T =** | **93** | mm |
| Factor de forma **S= a*b / 2*t*(a+b)** | = | **10,2** | |
| Espesor del zuncho o chapa | **e =** | **4** | mm |
| Altura Total del Neopreno | **et =** | **129** | mm |
| Módulo de elasticidad transversal del neopreno | | | |
| | **G =** | **8** | Kp/cm² |

Tipo de Neopreno T= n * t + 5 (Tipo A)




## B).- COMPROBACION BAJO CARGAS VERTICALES:

Siendo:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **N.max =** | **144,34** | Tn. | **h2,x max=** | **1,35** | Tn. | **h2,y max=** | **5,62** | Tn. |
| **N.min =** | **5,21** | Tn. | **h2,x min=** | **0,00** | Tn. | **h2,y min=** | **0,00** | Tn. |

(h2 son fuerzas instantaneas)

Tensión media en neopreno : $\sigma_m$ = **N. max / a * b**

$\sigma_m$ = **71** Kp/cm² < **150** Kp/cm² => **Vale**

Por lo tanto la tensión tangencial **τ,n** es:

**τ,n = 1,5 * σm / S**

**τ,n = 10,45** Kp/cm²




## C).- COMPROBACION BAJO CARGAS HORIZONTALES:

* **Deformación lenta, u1: (dilatación, retración y fluencia.)**

**$\tau_{,h1}$ = G * u1 / T**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **u1,x =** | **2,738** | cm | | **u1,y =** | **1,614** | cm |
| Luego: | **τ,h1x =** | **2,36** | Kp/cm² | | **τ,h1y =** | **1,39** | Kp/cm² |

* **Fuerza horizontal instantanea, h2, deformación, u2:**

$h2 = u2 * 2 * G * a * b / T$ y $\tau_{,h2} = h2 / a * b$

$u2 = h2 * T / 2 * G * a * b$

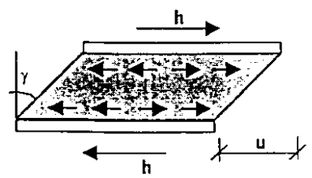
| | | | | | |
|---|---|---|---|---|---|
| h2,x = | 1,35 | Tn. | h2,y = | 5,62 | Tn. |
| u2,x = | 0,39 | cm | u2,y = | 1,61 | cm |

Luego: $\tau,h2x$ = 0,67 Kp/cm² $\tau,h2y$ = 2,78 Kp/cm²

*** τ totales, por fuerza horizontal:**

$\tau,thx = \tau,h1x + 0,50 * \tau,h2x$

$\tau,thy = \tau,h1y + 0,50 * \tau,h2y$




$\tau,t1 = RCUAD [( \tau,h1x ) ^ 2 + ( \tau,h1y ) ^ 2]$

$\tau,t2 = RCUAD [( \tau,h2x ) ^ 2 + ( \tau,h2y ) ^ 2]$

$\tau,th = RCUAD [( \tau,thx ) ^ 2 + ( \tau,thy ) ^ 2]$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| τ,thx = | 2,69 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,thy = | 2,78 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,t1 = | 2,73 | Kp/cm² | < 0,5*G= | 4,00 | Kp/cm² | => | Vale |
| τ,t2 = | 2,85 | Kp/cm² | | | | | |
| τ,th = | 3,86 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |

*** Giros:**

$\tau,ax = G/2 * ( a / t ) ^ 2 * \alpha,xt$

$\tau,ay = G/2 * ( b / t ) ^ 2 * \alpha,yt$

Siendo:

$\alpha,tx = \alpha,Tx / n$

$\alpha,ty = \alpha,Ty / n$

$\alpha,Tx = \alpha,1x + \alpha,scx + \alpha,0x$

$\alpha,Ty = \alpha,1y + \alpha,scy + \alpha,0y$

Donde:

| | | | | | | |
|---|---|---|---|---|---|---|
| α,1x = | 0,0091 | rad | α,1y = | 0,0000 | rad | (Suma giros c. perman.) |
| α,scx = | 0,0010 | rad | α,scy = | 0,0000 | rad | (Suma giros sobrecargas) |
| α,0x = | 0,0030 | rad | α,0y = | 0,0000 | rad | (Giro accidental) |

Por lo tanto:

| | | | | | |
|---|---|---|---|---|---|
| α,Tx = | 0,0130 | rad | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0016 | rad | α,ty = | 0,0000 | rad |

*** τ totales, por giros:**

| | | | | | |
|---|---|---|---|---|---|
| τ,tax = | 10,90 | Kp/cm² | τ,tay = | 0,00 | Kp/cm² |
| τ,ta = | 10,90 | Kp/cm² | | | |

*** τ totales debidos al axil, fuerza horizontal y giro:**

Axil:

$\tau,n = 1,50 * \sigma_m / S$

τ,n = 10,45 Kp/cm²

Fuerza horizontal y giro:

$\tau,tx = \tau,tax + \tau,thx$ $\tau,ty = \tau,tay + \tau,thy$

| | | | | | |
|---|---|---|---|---|---|
| τ,tx = | 13,59 | Kp/cm² | τ,ty = | 2,78 | Kp/cm² |

Total:

$\tau,t = \tau,n + RCUAD [( \tau,tx ) ^ 2 + ( \tau,ty ) ^ 2]$

τ,t = 24,33 Kp/cm² < 5 * G = 40,00 Kp/cm² => Vale

## D).- CONDICION DE NO DESPLAZAMIENTO DEL APOYO:

Se debe verificar la condición:

$\sigma_m$ => 20 Kp/cm² y $H <= f * N$

con: $f = 0,10 + 6 / \sigma m$ (Para apoyos tipo A)

Siendo **H** la fuerza concomitante con la carga vertical **N**

Siendo **f** el coeficiente de rozamiento

En nuestro caso:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N,min = | 5,21 | Tn. | | | | | |
| σ,min = | 2,57 | Kp/cm² | > | 20 | Kp/cm² | => | No cumple |
| f = | 2,43 | | H = | 5,78 | Tn. | | |
| | | Luego: | H < = | 12,67 | Tn. | => | Vale |

## E).- CONDICION DE ESTABILIDAD:

Se debe verificar la condición:

$a / 10 <= T <= a / 5$

En nuestro caso:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Como | | a = | 450 | mm | | | |
| a/10 = | 45 | mm | | | | | | |
| a/5 = | 90 | mm | | Como | T = | 93 | mm | => Cumple (si t |

## F).- CONDICION DE NO LEVANTAMIENTO:

Se debe verificar la condición:

$\alpha,t = \alpha,T / n <= ( 3 / S ) * ( t^2 / a^2 ) * ( \sigma m / G )$

| | | | | | |
|---|---|---|---|---|---|
| α,Tx = | 0,0130 | rad | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0016 | rad | α,ty = | 0,0000 | rad |

| | | | | | | |
|---|---|---|---|---|---|---|
| α,tx = | 0,0016 | rad <= | 0,0016 | rad | => | Vale |
| α,ty = | 0,0000 | rad <= | 0,0016 | rad | => | Vale |

## G).- ESPESOR DE LOS ZUNCHOS:

El espesor del zuncho, debe cumplir:

**e >= ( a / S ) * ( σm/σe )** σe= límite elástico del acero (Kp/cm²)

**e >= 2 mm**

Para σe= **2400** Kp/cm²

**e =** **1,3** mm.

Como **e =** **4** mm. => **Vale**

# COMPROBACION DE LOS APOYOS DE NEOPRENO

## SUBTRAMO XV AVE / E-1505,0 / ESTRIBOS / APOYOS BAJO RIOSTRA

**COMPROBACIÓN CON SÍSMO:** **NO** (SI / NO)

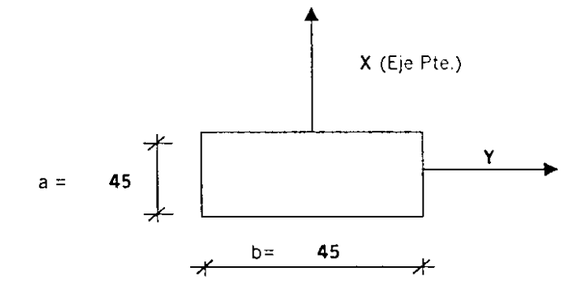
**TIPO DE TABLERO:** **CARRETERA** (CARRETERA O FERROCARRIL)

## A).- CARACTERISTICAS GEOMETRICAS DEL NEOPRENO:

**Ancho: a =** **45** cm Sentido X-X (Normalmente: a < b)

**Largo: b =** **45** cm Sentido Y-Y

| | | | |
|---|---|---|---|
| Número capas de elastómero | **n =** | **8** | |
| Espesor de capas elastómero | **t =** | **11** | mm |
| Altura total de elastómero | **T =** | **93** | mm |
| Factor de forma **S= a*b / 2*t*(a+b)** | = | **10,2** | |
| Espesor del zuncho o chapa | **e =** | **4** | mm |
| Altura Total del Neopreno | **et =** | **129** | mm |
| Módulo de elasticidad transversal del neopreno | **G =** | **8** | Kp/cm² |
| Tipo de Neopreno | T= n * t + 5 | (Tipo A) | |




## B).- COMPROBACION BAJO CARGAS VERTICALES:

Siendo:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **N.max =** | **18,87** | Tn. | **h2,x max=** | **1,35** | Tn. | **h2,y max=** | **5,62** | Tn. |
| **N.min =** | **5,85** | Tn. | **h2,x min=** | **0,00** | Tn. | **h2,y min=** | **0,00** | Tn. |

(h2 son fuerzas instantaneas)

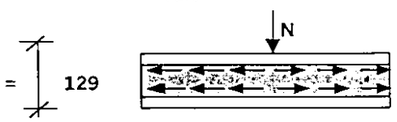
Tensión media en neopreno : $\sigma_m$ = **N. max / a * b**

$\sigma_m$ = **9** Kp/cm² < **150** Kp/cm² => **Vale**

Por lo tanto la tensión tangencial **τ,n** es:

**τ,n = 1,5 * σm / S**

**τ,n = 1,37** Kp/cm²




## C).- COMPROBACION BAJO CARGAS HORIZONTALES:

* **Deformación lenta, u1: (dilatación, retración y fluencia.)**

$\tau_{,h1}$ = **G * u1 / T**

| | | | | | | |
|---|---|---|---|---|---|---|
| | **u1,x =** | **2,738** | cm | **u1,y =** | **1,614** | cm |
| Luego: | **τ,h1x =** | **2,36** | Kp/cm² | **τ,h1y =** | **1,39** | Kp/cm² |

* **Fuerza horizontal instantanea, h2, deformación, u2:**

$h2 = u2 * 2 * G * a * b / T$ y $\tau_{,h2} = h2 / a * b$

$u2 = h2 * T / 2 * G * a * b$

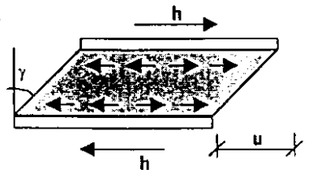
| | | | | | |
|---|---|---|---|---|---|
| h2,x = | 1,35 | Tn. | h2,y = | 5,62 | Tn. |
| u2,x = | 0,39 | cm | u2,y = | 1,61 | cm |

Luego: $\tau,h2x$ = 0,67 Kp/cm² $\tau,h2y$ = 2,78 Kp/cm²

*** τ totales, por fuerza horizontal:**

$\tau,thx = \tau,h1x + 0,50 * \tau,h2x$

$\tau,thy = \tau,h1y + 0,50 * \tau,h2y$




$\tau,t1 = RCUAD [( \tau,h1x ) ^ 2 + ( \tau,h1y ) ^ 2]$

$\tau,t2 = RCUAD [( \tau,h2x ) ^ 2 + ( \tau,h2y ) ^ 2]$

$\tau,th = RCUAD [( \tau,thx ) ^ 2 + ( \tau,thy ) ^ 2]$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| τ,thx = | 2,69 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,thy = | 2,78 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |
| τ,t1 = | 2,73 | Kp/cm² | < 0,5*G= | 4,00 | Kp/cm² | => | Vale |
| τ,t2 = | 2,85 | Kp/cm² | | | | | |
| τ,th = | 3,86 | Kp/cm² | < 0,7*G= | 5,60 | Kp/cm² | => | Vale |

*** Giros:**

$\tau,ax = G/2 * ( a / t ) ^ 2 * \alpha,xt$

$\tau,ay = G/2 * ( b / t ) ^ 2 * \alpha,yt$

Siendo:

$\alpha,tx = \alpha,Tx / n$

$\alpha,ty = \alpha,Ty / n$

$\alpha,Tx = \alpha,1x + \alpha,scx + \alpha,0x$

$\alpha,Ty = \alpha,1y + \alpha,scy + \alpha,0y$

Donde:

| | | | | | | |
|---|---|---|---|---|---|---|
| α,1x = | 0,0091 | rad | α,1y = | 0,0000 | rad | (Suma giros c. perman.) |
| α,scx = | 0,0010 | rad | α,scy = | 0,0000 | rad | (Suma giros sobrecargas) |
| α,0x = | 0,0030 | rad | α,0y = | 0,0000 | rad | (Giro accidental) |

Por lo tanto:

| | | | | | |
|---|---|---|---|---|---|
| α,Tx = | 0,0130 | rad | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0016 | rad | α,ty = | 0,0000 | rad |

*** τ totales, por giros:**

| | | | | | |
|---|---|---|---|---|---|
| τ,tax = | 10,90 | Kp/cm² | τ,tay = | 0,00 | Kp/cm² |
| τ,ta = | 10,90 | Kp/cm² | | | |

*** τ totales debidos al axil, fuerza horizontal y giro:**

Axil:

$\tau,n = 1,50 * \sigma_m / S$

τ,n = 1,37 Kp/cm²

Fuerza horizontal y giro:

$\tau,tx = \tau,tax + \tau,thx$ $\tau,ty = \tau,tay + \tau,thy$

| | | | | | |
|---|---|---|---|---|---|
| τ,tx = | 13,59 | Kp/cm² | τ,ty = | 2,78 | Kp/cm² |

Total:

$\tau,t = \tau,n + RCUAD [( \tau,tx ) ^ 2 + ( \tau,ty ) ^ 2]$

τ,t = 15,24 Kp/cm² < 5 * G = 40,00 Kp/cm² => Vale

## D).- CONDICION DE NO DESPLAZAMIENTO DEL APOYO:

Se debe verificar la condición:

$\sigma_m$ => 20 Kp/cm² y $H <= f * N$

con: $f = 0,10 + 6 / \sigma m$ (Para apoyos tipo A)

Siendo **H** la fuerza concomitante con la carga vertical **N**

Siendo **f** el coeficiente de rozamiento

En nuestro caso:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N,min = | 5,85 | Tn. | | | | | |
| σ,min = | 2,89 | Kp/cm² | > | 20 | Kp/cm² | => | No cumple |
| f = | 2,18 | | H = | 5,78 | Tn. | | |
| Luego: | | | H < = | 12,74 | Tn. | => | Vale |

## E).- CONDICION DE ESTABILIDAD:

Se debe verificar la condición:

$a / 10 <= T <= a / 5$

En nuestro caso:

Como a = 450 mm

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| a/10 = | 45 | mm | | | | | |
| a/5 = | 90 | mm | Como | T = | 93 | mm | => Cumple (si t |

## F).- CONDICION DE NO LEVANTAMIENTO:

Se debe verificar la condición:

$\alpha,t = \alpha,T / n <= ( 3 / S ) * ( t^2 / a^2 ) * ( \sigma m / G )$

| | | | | | |
|---|---|---|---|---|---|
| α,Tx = | 0,0130 | rad | α,Ty = | 0,0000 | rad |
| α,tx = | 0,0016 | rad | α,ty = | 0,0000 | rad |

| | | | | | | |
|---|---|---|---|---|---|---|
| α,tx = | 0,0016 | rad <= | 0,0002 | rad | => | Vale |
| α,ty = | 0,0000 | rad <= | 0,0002 | rad | => | Vale |

## G).- ESPESOR DE LOS ZUNCHOS:

El espesor del zuncho, debe cumplir:

$e >= ( a / S ) * ( \sigma m / \sigma e )$ $\sigma e$= límite elástico del acero ($Kp/cm^2$)

$e >= 2$ mm

Para $\sigma e =$ **2400** $Kp/cm^2$

$e =$ **0,2** mm.

Como $e =$ **4** mm. => **Vale**

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 18-44

## 18.3 COMPROBACION DE PILAS

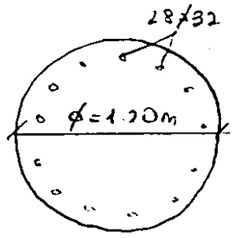
Se realiza la comprobación de la pila P-1 por ser la de mayor altura.

Esfuerzos en cabeza de pila (sin mayorar) (T, MT)

| Carga | N | FL | FT | ML | MT | γfav | γdesf |
|---|---|---|---|---|---|---|---|
| P.P. | 229,185 | 0 | 0 | 0 | 0 | 1,00 | 1,35 |
| S.C pos | 211,850 | 1,65 | 0 | 0 | 0 | 0,00 | 1,50 |
| S.C. neg | 8,966 | 1,68 | 0 | 0 | 0 | 0,00 | 1,50 |
| termico | -10,174 | 1,85 | 0 | 0 | 0 | 0,00 | 1,50 |
| reológico | 0 | 2,46 | 0 | 0 | 0 | 1,00 | 1,25 |
| viento t | 0 | 0 | 13,32 | 0 | 26,175 | 0,00 | 1,50 |

NOTA. Las cargas verticales se obtienen directamente del apoyados de reacciones del cálculo del tablero. Las cargas horizontales se obtienen del mismo del reparto transversal de cargas (apt 18.1) con G=80 T/m² para las reológicas y G=160 T/m² para el resto.

• Constantes estáticas de la pila




$A_x = 1.1309\ m^2$

$I_z = I_y = 0.1018\ m^4$

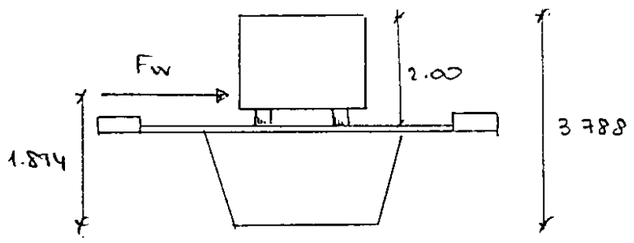
$H = 11.58\ m$

H-300 / $\gamma_c = 1.50$

AEH-500 N / $\gamma_s = 1.15$

• Acción de viento

$W = 0{,}250\ T/m^2$ (según proyecto)




$F_{w_{tablero}} = 0{,}250\ T/m^2 \times 3{,}788\ m = 0{,}947\ T/m$

Del reparto transversal de cargas:

$F_{w_{P-1}} = 13{,}82\ T$

$M_{w_{P-1}} = 13{,}82 \times 3{,}788 \times \frac{1}{2} = 13{,}82 \times 1{,}894 = 26{,}175\ mT$

$F_{w_{pila}} = 0{,}250\ T/m^2 \times 1{,}20\ m = 0{,}300\ T/m$



• Peso propio de pila

$P_{PILA} = 1.1309\ m^2 \times 2{,}5\ T/m^3 = 2{,}827\ T/m$



• Coeficientes β de pandeo

Directamente del reparto Capt 18.1):

$\beta_{LONG} = 1{,}58$

$\beta_{TRANSV} = 1{,}63$

• Comprobación armadura longitudinal de pila

La armadura dispuesta en proyecto 28 ϕ 32 es suficiente.

• Comprobación armadura de cortante

$Vd_L = \max(Vd_{L_1}\ ;\ Vd_{L_2})$

$Vd_{L_1} = 1{,}35 \times 2{,}46^t + 1{,}50 \times 1{,}68^t = 5{,}841^t$

$Vd_{L_2} = 0{,}00^t$

$Vd_T = \max(Vd_{T_1}\ ;\ Vd_{T_2})$

$Vd_{T_1} = 1{,}50 \times 13{,}82^t = \underline{20{,}730^t}$

$Vd_{T_2} = 0{,}00^t$

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 18-47 |

$$\sigma_d = V_d / b \cdot \delta = 20{,}730^t / 1.20 \times 0.9 \times 1.15 = 16\ T/m^2$$

Comprobación biela:

$$\sigma_d \leq 0{,}3 f_{cd} = 0.3 \times 3000 / 1.50 = 600\ T/m^2$$

$$V_{cu} = 5 \times \sqrt{\frac{300}{1.50}} \times 1.20 \times 1.15 = 97{,}58\ T$$

$$A_\alpha = 20{,}73 - 97{,}58 < 0$$

$$A_{\alpha,min} = 0.02 \times \frac{3000}{1.50} \times \frac{1.1 I}{5{,}17\ T/m^2} \times 1.20 = 10{,}82\ cm^2/m$$

$$A_{\alpha,disp} = \phi 12\ a\ 20 = 11{,}30\ cm^2/m > 10{,}82\ \checkmark$$

```
"*****************************************************************************
"       PROGRAMA  PILAS  v1.1
"       PLANTILLA PARA FICHERO DE ENTRADA
"*****************************************************************************

"--------------------- Definicion de la seccion --------------------------
* TITULO
  ESTRUCTURA E-1505 . SUBTRAMO XV

* SECCION
"  Introduzca los comandos de definicion de la seccion de la pila, o bien
"  el comando NOMBRE nombre_fichero, donde nombre_fichero es el nombre
"  del fichero de definicion de la seccion (extension .QS) creado con el
"  programa FAGUS2. nombre_fichero debe introducirse SIN EXTENSION.

NOMBRE  pl      "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
            "de la seccion creado con FAGUS2. Desactive el codigo CREAR
"CREAR      ?     "Introduzca el nombre (SIN EXTENSION) del fichero de
definicion
            "de la seccion que se va a crear con el programa PILAS.
            "Desactive el codigo NOMBRE

"  Los siguientes codigos se utilizan si se ha seleccionado la opcion CREAR

"Unidad_long      ?     "Unidad de longitud para entrada de la seccion

"-------------
"Rectangular            "Active este codigo para definir secciones rectangulares
"Dim_trans  ?     "Dimension transversal de la seccion
"Dim_long   ?     "Dimension longitudinal de la seccion
"Hormigon   ?     "Tipo de hormigon de la seccion
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"Cuantia_long     ?     ?     "Cuantia de armadura en la direccion longitudinal
                        "(en una cara); incluya el codigo de dimensionamiento
"Coef_c_tr  ?     ?     "Coeficiente para cuantia transversal (en una cara);
                        "incluya el codigo de dimensionamiento
"Recubrimiento    ?     "Distancia del paramento a eje de redondos
"Acero            ?     "Tipo de acero de las armaduras

"-------------
"Rectangular_Hueca      "Active este codigo para definir secciones rectangulares
                  "huecas
"Dim_trans_ext    ?     "Dimension transversal contorno exterior
"Dim_long_ext     ?     "Dimension longitudinal contorno exterior
"Hormigon   ?     "Tipo de hormigon de la seccion
"Dim_trans_int    ?     "Dimension transversal contorno interior
"Dim_long_int     ?     "Dimension longitudinal contorno interior
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"Cuantia_long_ext ?     ?     "Cuantia longitudinal (por cara) contorno
exterior;
                              "incluya el codigo de dimensionamiento
```

```
"Coef_c_tr_ext    ?     ?     "Coeficiente cuantia transversal (por cara)
contorno
                        "exterior; incluya el codigo de dimensionamiento
"Recubrimiento_ext      ?     "Distancia paramento exterior a eje de redondos
"Cuantia_long_int ?     ?     "Cuantia longitudinal (por cara) contorno
interior;
                              "incluya el codigo de dimensionamiento
"Coef_c_tr_int    ?     ?     "Coeficiente cuantia transversal (por cara)
contorno
                        "interior; incluya el codigo de dimensionamiento
"Recubrimiento_int      ?     "Distancia paramento interior a eje de redondos
"Acero            ?           "Tipo de acero de las armaduras

"-------------
"Circular         "Active este codigo para crear secciones circulares
"Radio            ?     "Radio de la seccion
"Hormigon   ?     "Tipo de hormigon de la seccion
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"N_redondos ?     "Numero de redondos a disponer perimetralmente
"Cuantia    ?     ?     "Cuantia de armadura en % area hormigon; incluya el
                        "codigo de dimensionamiento
"Recubrimiento    ?     "Distancia paramento a eje de redondos
"Acero            ?     "Tipo de acero de las armaduras

"-------------
"Circular_Hueca         "Active este codigo para crear secc. circulares huecas
"Radio_ext  ?     "Radio contorno exterior
"Radio_int  ?     "Radio contorno interior
"Hormigon   ?     "Tipo de hormigon de la seccion
"Armadura   ?     "Definicion de la armadura; si no se asigna un nombre
                  "se emplearan los nombres por defecto (B1, B2, etc)
                  "Introduzca tantos bloques de definicion de armadura
                  "como secciones se vayan a dimensionar
"N_redondos_ext   ?     "Numero de redondos contorno exterior
"Cuantia_ext      ?     ?     "Cuantia de armadura exterior en % area hormigon;
                        "incluya el codigo de dimensionamiento
"Recubrimiento_ext      ?     "Distancia paramento exterior a eje de redondos
"N_redondos_int         ?     "Numero de redondos contorno interior
"Cuantia_int      ?     ?     "Cuantia de armadura interior en % area hormigon;
                        "incluya el codigo de dimensionamiento
"Recubrimiento_int      ?     "Distancia paramento interior a eje de redondos
"Acero            ?           "Tipo de acero de las armaduras



"-------------------------------------------------------------------------


"------------------------ Estados de carga -----------------------------
* EC

"  Introduzca el nombre del grupo de cargas; introduzca tantos grupos como
"  desee.
```

```
+ GRUPO normal   "cargas comunes"

"  Introduzca los estados de carga segun el siguiente formato:
"  NO OLVIDE LA COMA ANTES DEL CAMPO OPCIONAL DE GRUPO

"cod    N               Fl              Ft              Ml              Mt
Gf      Gd [,   Grupo]
pp      229.186         0               0               0               0
1.0     1.35
sc      211.85          1.68            0               0               0
0       1.50
sc      -8.966          1.68            0               0               0
0       1.50
term    -10.174         1.85            0               0               0
0       1.50
reol    0               2.46            0               0               0
0       1.35
vt      0               0               13.82           0               26.175
0       1.50

+ COMBINAR

"  Introduzca la combinacion de grupos de carga y las hipotesis que se deseen
"  calcular en cada combinacion:
"  NO OLVIDE LA COMA ANTES DEL CAMPO OPCIONAL DE HIPOTESIS

"nombre_grupo nombre_grupo ....  [, Hipotesis ? ? ?]

normal , Hipotesis 1 2 4

+ FUSTE

"  Introduzca los esfuerzos en el fuste, definiendo una ley de cargas
"  repartidas en el fuste (t/m) dada por el valor en cabeza y base.

"tipo_carga valor_cabeza      valor_base

pp                2.827         2.827
vt                0.3           0.3
vl                0.3           0.3


"-------------------------------------------------------------------------


"------------------------ Datos de pandeo ------------------------------
* PANDEO

fyd             4434.78 "Resistencia de calculo del acero en kp/cm2
alfapl          1.58    "Coeficiente de pandeo longitudinal
alfapt          1.63    "Coeficiente de pandeo transversal
lpila           11.58   "Altura de pila en m
hl              1.20    "Canto longitudinal en m
ht              1.20    "Canto transversal en m
inl             0.1018   "Inercia longitudinal
int             0.1018   "Inercia transversal
```

```
area            1.1309  "Area seccion transversal
plano_pandeo    long       "Plano de pandeo: introduzca (long), (trans) o
(ambos)
"salida         completa       "Por defecto la salida es reducida; introduzca
(completa)
"                       para incluir el calculo de excentricidades

"-------------------------------------------------------------------------


"------------------------- Opciones de control  -------------------------
* OPCIONES

"  Introduzca los comandos de control del programa. Entre () se indican
"  los valores por defecto

compresiones    positivas       "Introduzca (positivas) o (negativas).
"                       Codigo obligatorio. No hay valor por defecto
acero       AEH500      "Introduzca el tipo de acero de las armaduras.
"                  C¢digo obligatorio
base_pila       B3      "Introduzca el nombre de la armadura de base de pila
"                  C¢digo obligatorio

ndiv            1       "Numero de secciones intermedias de calculo (0)
"solo_base        "Active este codigo para calcular unicamente la base del fuste
"solo_cabeza            "Active este codigo para calcular unicamente la cabeza
del fuste
"umbral           ?     "Valor umbral para cargas significativas (0)
"salida           ?     "Introduzca (completa) o (reducida). (reducida)
f_hipviento     1       "Factor de reduccion general para hipotesis de viento
(0.9)
f_hipsismo      1       "Factor de reduccion de cp y sc en hipotesis con sismo
(0.8)
c_vsc         0.3       "Factor de concomitancia viento - sobrecarga (0.5)
c_vsis          0       "Factor de concomitancia viento - sismo (0.25)

"-------------------------------------------------------------------------


"---------------------METODO COLUMNA MODELO-------------------------------

* COL_MOD

"  Los siguientes c¢digos definen par metros de entrada para el programa
"  CMOD (Aplicaci¢n del m,todo de la Columna Modelo para obtenci¢n de
"  excentricidades de 2§ orden en base de pila)

"ndiv ?      " N£mero de divisiones del diagrama M-X
"completo    " Active este c¢digo para calcular el diagrama M-X completo,
             " comenzando desde el valor 0 del momento

"-------------------------------------------------------------------------
```



SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 642.44 | 0.00 | 0.00 | 155.10 |
| 2 | Nmin Mlmax Mtmax | 200.48 | 0.00 | 0.00 | 48.40 |
| 3 | Mlmax Mtmax Nmax | 642.44 | 0.00 | 0.00 | 155.10 |
| 4 | Mlmax Mtmax Nmin | 200.48 | 0.00 | 0.00 | 48.40 |
| 5 | Mtmax Nmax Mlmax | 642.44 | 0.00 | 0.00 | 155.10 |
| 6 | Mtmax Nmin Mlmax | 200.48 | 0.00 | 0.00 | 48.40 |



SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 7 | Nmax Mlmax Mtmax | 324.66 | 0.00 | 39.26 | 78.38 |
| 8 | Nmin Mlmax Mtmax | 213.93 | 0.00 | 39.26 | 51.65 |
| 9 | Mlmax Mtmax Nmax | 324.66 | 0.00 | 39.26 | 78.38 |
| 10 | Mlmax Mtmax Nmin | 213.93 | 0.00 | 39.26 | 51.65 |
| 11 | Mtmax Nmax Mlmax | 324.66 | 0.00 | 39.26 | 78.38 |
| 12 | Mtmax Nmin Mlmax | 213.93 | 0.00 | 39.26 | 51.65 |



SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 642.44 | 0.00 | 11.78 | 155.10 |
| 14 | Nmin Mlmax Mtmax | 200.48 | 0.00 | 11.78 | 48.40 |
| 15 | Mlmax Mtmax Nmax | 642.44 | 0.00 | 11.78 | 155.10 |
| 16 | Mlmax Mtmax Nmin | 200.48 | 0.00 | 11.78 | 48.40 |
| 17 | Mtmax Nmax Mlmax | 642.44 | 0.00 | 11.78 | 155.10 |
| 18 | Mtmax Nmin Mlmax | 200.48 | 0.00 | 11.78 | 48.40 |



SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 19 | Nmax Mlmax Mtmax | 664.53 | 17.75 | 0.00 | 160.44 |
| 20 | Nmin Mlmax Mtmax | 216.84 | 49.89 | 0.00 | 98.79 |
| 21 | Mlmax Mtmax Nmax | 634.01 | 49.89 | 0.00 | 170.33 |
| 22 | Mlmax Mtmax Nmin | 548.07 | 49.89 | 0.00 | 156.63 |
| 23 | Mtmax Nmax Mlmax | 634.01 | 49.89 | 0.00 | 170.33 |
| 24 | Mtmax Nmin Mlmax | 216.84 | 49.89 | 0.00 | 98.79 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 25 | Nmax Mlmax Mtmax | 346.76 | 3.16 | 166.83 | 83.72 |
| 26 | Nmin Mlmax Mtmax | 230.29 | 35.30 | 166.83 | 84.21 |
| 27 | Mlmax Mtmax Nmax | 316.24 | 35.30 | 166.83 | 99.06 |
| 28 | Mlmax Mtmax Nmin | 230.29 | 35.30 | 166.83 | 84.21 |
| 29 | Mtmax Nmax Mlmax | 316.24 | 35.30 | 166.83 | 99.06 |
| 30 | Mtmax Nmin Mlmax | 230.29 | 35.30 | 166.83 | 84.21 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 31 | Nmax Mlmax Mtmax | 664.53 | 17.75 | 50.05 | 160.44 |
| 32 | Nmin Mlmax Mtmax | 216.84 | 49.89 | 50.05 | 98.79 |
| 33 | Mlmax Mtmax Nmax | 634.01 | 49.89 | 50.05 | 170.33 |
| 34 | Mlmax Mtmax Nmin | 548.07 | 49.89 | 50.05 | 156.63 |
| 35 | Mtmax Nmax Mlmax | 634.01 | 49.89 | 50.05 | 170.33 |
| 36 | Mtmax Nmin Mlmax | 216.84 | 49.89 | 50.05 | 98.79 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 37 | Nmax Mlmax Mtmax | 686.63 | 35.50 | 0.00 | 165.77 |
| 38 | Nmin Mlmax Mtmax | 233.21 | 99.77 | 0.00 | 156.29 |
| 39 | Mlmax Mtmax Nmax | 656.11 | 99.77 | 0.00 | 238.95 |
| 40 | Mlmax Mtmax Nmin | 564.44 | 99.77 | 0.00 | 222.33 |
| 41 | Mtmax Nmax Mlmax | 656.11 | 99.77 | 0.00 | 238.95 |
| 42 | Mtmax Nmin Mlmax | 233.21 | 99.77 | 0.00 | 156.29 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 43 | Nmax Mlmax Mtmax | 368.86 | 6.32 | 309.49 | 89.05 |
| 44 | Nmin Mlmax Mtmax | 246.66 | 70.59 | 309.49 | 127.80 |
| 45 | Mlmax Mtmax Nmax | 338.33 | 70.59 | 309.49 | 145.86 |
| 46 | Mlmax Mtmax Nmin | 246.66 | 70.59 | 309.49 | 127.80 |
| 47 | Mtmax Nmax Mlmax | 338.33 | 70.59 | 309.49 | 145.86 |
| 48 | Mtmax Nmin Mlmax | 246.66 | 70.59 | 309.49 | 127.80 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mlpan |
|---|---|---|---|---|---|
| 49 | Nmax Mlmax Mtmax | 686.63 | 35.50 | 92.85 | 165.77 |
| 50 | Nmin Mlmax Mtmax | 233.21 | 99.77 | 92.85 | 156.29 |
| 51 | Mlmax Mtmax Nmax | 656.11 | 99.77 | 92.85 | 238.95 |
| 52 | Mlmax Mtmax Nmin | 564.44 | 99.77 | 92.85 | 222.33 |
| 53 | Mtmax Nmax Mlmax | 656.11 | 99.77 | 92.85 | 238.95 |
| 54 | Mtmax Nmin Mlmax | 233.21 | 99.77 | 92.85 | 156.29 |

ESFUERZOS ADICIONALES

| N | Ml | Mt | Mlpan |
|---|---|---|---|

Programa PILAS v1.1 P A C A D A R,
S.A.
PANDEO LONGITUDINAL
ESTRUCTURA E-1505 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax Mlmax Mtmax | 642.44 | 155.10 | 0.00 | 44.72 |
| 2 | 1 | B1 | 1 | Nmin Mlmax Mtmax | 200.48 | 48.40 | 0.00 | 44.72 |
| 3 | 1 | B1 | 1 | Mlmax Mtmax Nmax | 642.44 | 155.10 | 0.00 | 44.72 |
| 4 | 1 | B1 | 1 | Mlmax Mtmax Nmin | 200.48 | 48.40 | 0.00 | 44.72 |
| 5 | 1 | B1 | 1 | Mtmax Nmax Mlmax | 642.44 | 155.10 | 0.00 | 44.72 |
| 6 | 1 | B1 | 1 | Mtmax Nmin Mlmax | 200.48 | 48.40 | 0.00 | 44.72 |
| 7 | 1 | B1 | 2 | Nmax Mlmax Mtmax | 324.66 | 78.38 | 39.26 | 44.72 |
| 8 | 1 | B1 | 2 | Nmin Mlmax Mtmax | 213.93 | 51.65 | 39.26 | 44.72 |
| 9 | 1 | B1 | 2 | Mlmax Mtmax Nmax | 324.66 | 78.38 | 39.26 | 44.72 |
| 10 | 1 | B1 | 2 | Mlmax Mtmax Nmin | 213.93 | 51.65 | 39.26 | 44.72 |
| 11 | 1 | B1 | 2 | Mtmax Nmax Mlmax | 324.66 | 78.38 | 39.26 | 44.72 |
| 12 | 1 | B1 | 2 | Mtmax Nmin Mlmax | 213.93 | 51.65 | 39.26 | 44.72 |
| 13 | 1 | B1 | 4 | Nmax Mlmax Mtmax | 642.44 | 155.10 | 11.78 | 44.72 |
| 14 | 1 | B1 | 4 | Nmin Mlmax Mtmax | 200.48 | 48.40 | 11.78 | 44.72 |
| 15 | 1 | B1 | 4 | Mlmax Mtmax Nmax | 642.44 | 155.10 | 11.78 | 44.72 |
| 16 | 1 | B1 | 4 | Mlmax Mtmax Nmin | 200.48 | 48.40 | 11.78 | 44.72 |
| 17 | 1 | B1 | 4 | Mtmax Nmax Mlmax | 642.44 | 155.10 | 11.78 | 44.72 |
| 18 | 1 | B1 | 4 | Mtmax Nmin Mlmax | 200.48 | 48.40 | 11.78 | 44.72 |

Programa PILAS v1.1 P A C A D A R,
S.A.

ESTRUCTURA E-1505 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 19 | 1 | B2 | 1 | Nmax Mlmax Mtmax | 664.53 | 160.44 | 0.00 | 44.72 |
| 20 | 1 | B2 | 1 | Nmin Mlmax Mtmax | 216.84 | 98.79 | 0.00 | 44.72 |
| 21 | 1 | B2 | 1 | Mlmax Mtmax Nmax | 634.01 | 170.33 | 0.00 | 44.72 |
| 22 | 1 | B2 | 1 | Mlmax Mtmax Nmin | 548.07 | 156.63 | 0.00 | 44.72 |
| 23 | 1 | B2 | 1 | Mtmax Nmax Mlmax | 634.01 | 170.33 | 0.00 | 44.72 |
| 24 | 1 | B2 | 1 | Mtmax Nmin Mlmax | 216.84 | 98.79 | 0.00 | 44.72 |
| 25 | 1 | B2 | 2 | Nmax Mlmax Mtmax | 346.76 | 83.72 | 166.83 | 44.72 |
| 26 | 1 | B2 | 2 | Nmin Mlmax Mtmax | 230.29 | 84.21 | 166.83 | 44.72 |
| 27 | 1 | B2 | 2 | Mlmax Mtmax Nmax | 316.24 | 99.06 | 166.83 | 44.72 |
| 28 | 1 | B2 | 2 | Mlmax Mtmax Nmin | 230.29 | 84.21 | 166.83 | 44.72 |
| 29 | 1 | B2 | 2 | Mtmax Nmax Mlmax | 316.24 | 99.06 | 166.83 | 44.72 |
| 30 | 1 | B2 | 2 | Mtmax Nmin Mlmax | 230.29 | 84.21 | 166.83 | 44.72 |
| 31 | 1 | B2 | 4 | Nmax Mlmax Mtmax | 664.53 | 160.44 | 50.05 | 44.72 |
| 32 | 1 | B2 | 4 | Nmin Mlmax Mtmax | 216.84 | 98.79 | 50.05 | 44.72 |
| 33 | 1 | B2 | 4 | Mlmax Mtmax Nmax | 634.01 | 170.33 | 50.05 | 44.72 |
| 34 | 1 | B2 | 4 | Mlmax Mtmax Nmin | 548.07 | 156.63 | 50.05 | 44.72 |
| 35 | 1 | B2 | 4 | Mtmax Nmax Mlmax | 634.01 | 170.33 | 50.05 | 44.72 |
| 36 | 1 | B2 | 4 | Mtmax Nmin Mlmax | 216.84 | 98.79 | 50.05 | 44.72 |

Programa PILAS v1.1 P A C A D A R,
S.A.

ESTRUCTURA E-1505 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 37 | 1 | B3 | 1 | Nmax Mlmax Mtmax | 686.63 | 165.77 | 0.00 | 44.72 |
| 38 | 1 | B3 | 1 | Nmin Mlmax Mtmax | 233.21 | 156.29 | 0.00 | 44.72 |
| 39 | 1 | B3 | 1 | Mlmax Mtmax Nmax | 656.11 | 238.95 | 0.00 | 44.72 |
| 40 | 1 | B3 | 1 | Mlmax Mtmax Nmin | 564.44 | 222.33 | 0.00 | 44.72 |
| 41 | 1 | B3 | 1 | Mtmax Nmax Mlmax | 656.11 | 238.95 | 0.00 | 44.72 |
| 42 | 1 | B3 | 1 | Mtmax Nmin Mlmax | 233.21 | 156.29 | 0.00 | 44.72 |
| 43 | 1 | B3 | 2 | Nmax Mlmax Mtmax | 368.86 | 89.05 | 309.49 | 225.12 |
| 44 | 1 | B3 | 2 | Nmin Mlmax Mtmax | 246.66 | 127.80 | 309.49 | 225.12 |
| 45 | 1 | B3 | 2 | Mlmax Mtmax Nmax | 338.33 | 145.86 | 309.49 | 225.12 |
| 46 | 1 | B3 | 2 | Mlmax Mtmax Nmin | 246.66 | 127.80 | 309.49 | 225.12 |
| 47 | 1 | B3 | 2 | Mtmax Nmax Mlmax | 338.33 | 145.86 | 309.49 | 225.12 |
| 48 | 1 | B3 | 2 | Mtmax Nmin Mlmax | 246.66 | 127.80 | 309.49 | 225.12 |
| 49 | 1 | B3 | 4 | Nmax Mlmax Mtmax | 686.63 | 165.77 | 92.85 | 44.72 |
| 50 | 1 | B3 | 4 | Nmin Mlmax Mtmax | 233.21 | 156.29 | 92.85 | 44.72 |
| 51 | 1 | B3 | 4 | Mlmax Mtmax Nmax | 656.11 | 238.95 | 92.85 | 44.72 |
| 52 | 1 | B3 | 4 | Mlmax Mtmax Nmin | 564.44 | 222.33 | 92.85 | 44.72 |
| 53 | 1 | B3 | 4 | Mtmax Nmax Mlmax | 656.11 | 238.95 | 92.85 | 44.72 |
| 54 | 1 | B3 | 4 | Mtmax Nmin Mlmax | 233.21 | 156.29 | 92.85 | 44.72 |

PANDEO LONGITUDINAL
Programa ZAPATAS v1.0.
RESULTADOS DE DIMENSIONAMIENTO

| | |
|---|---|
| Dimension longitudinal | 5.20 |
| Dimension transversal | 5.20 |
| Presion media pesima (kp/cm2) | 2.43 |
| Presion punta pesima (kp/cm2) | 3.47 |

Programa ZAPATAS v1.0.
RESULTADOS DE DIMENSIONAMIENTO

PANDEO LONGITUDINAL
" Fichero de esfuerzos solicitantes en base de pila,
" para dimensionamiento de la cimentación.

```
* HIPOTESIS        11
    686.63      3.07      0.00     35.50      0.00    165.77
0.00
    233.21      8.62      0.00     99.77      0.00    156.29
0.00
    656.11      8.62      0.00     99.77      0.00    238.95
0.00
    564.44      8.62      0.00     99.77      0.00    222.33
0.00
    656.11      8.62      0.00     99.77      0.00    238.95
0.00
    233.21      8.62      0.00     99.77      0.00    156.29
0.00
* HIPOTESIS        12
    368.86      0.55     25.94      6.32    309.49     89.05
309.49
    246.66      6.10     25.94     70.59    309.49    127.80
309.49
    338.33      6.10     25.94     70.59    309.49    145.86
309.49
    246.66      6.10     25.94     70.59    309.49    127.80
309.49
    338.33      6.10     25.94     70.59    309.49    145.86
309.49
    246.66      6.10     25.94     70.59    309.49    127.80
309.49
* HIPOTESIS        14
    686.63      3.07      7.78     35.50     92.85    165.77
92.85
    233.21      8.62      7.78     99.77     92.85    156.29
92.85
    656.11      8.62      7.78     99.77     92.85    238.95
92.85
    564.44      8.62      7.78     99.77     92.85    222.33
92.85
    656.11      8.62      7.78     99.77     92.85    238.95
92.85
    233.21      8.62      7.78     99.77     92.85    156.29
92.85
```

PANDEO LONGITUDINAL
" FICHERO DE ENTRADA PARA EL PROGRAMA CMOD
" (Aplicacion metodo Columna Modelo)

```
* CODIGOS
LP_L                 18.30  "Longitud de pandeo longitudinal
LP_T                 18.88  "Longitud de pandeo transversal
COMPRESIONES      POSITIVAS     "Signo de las compresiones.
* ESFUERZOS
"          N          Ml          Mt       Mlpan       Mtpan
      686.63       35.50        0.00      165.77        0.00
      233.21       99.77        0.00      156.29        0.00
      656.11       99.77        0.00      238.95        0.00
      564.44       99.77        0.00      222.33        0.00
      656.11       99.77        0.00      238.95        0.00
      233.21       99.77        0.00      156.29        0.00
      368.86        6.32      309.49       89.05      309.49
      246.66       70.59      309.49      127.80      309.49
      338.33       70.59      309.49      145.86      309.49
      246.66       70.59      309.49      127.80      309.49
      338.33       70.59      309.49      145.86      309.49
      246.66       70.59      309.49      127.80      309.49
      686.63       35.50       92.85      165.77       92.85
      233.21       99.77       92.85      156.29       92.85
      656.11       99.77       92.85      238.95       92.85
      564.44       99.77       92.85      222.33       92.85
      656.11       99.77       92.85      238.95       92.85
      233.21       99.77       92.85      156.29       92.85
```

Pandeo longitudinal

RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 1 CP + SC

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 656.09 | 126.20 | 0.00 | 2.96 | 2.43 | 78.24 | 68.15 |
| | | | | | | 12.372/15.047/14.471 | 10.388/13.106/14.471 |
| 2 | 320.23 | 125.35 | 0.00 | 1.72 | 1.18 | 42.74 | 29.93 |
| | | | | | | 6.037/ 8.219/14.471 | 4.093/ 5.755/14.471 |
| 3 | 633.49 | 186.58 | 0.00 | 3.14 | 2.34 | 80.75 | 65.86 |
| | | | | | | 12.895/15.529/14.471 | 9.961/12.666/14.471 |
| 4 | 565.58 | 174.27 | 0.00 | 2.84 | 2.09 | 73.49 | 58.73 |
| | | | | | | 11.415/14.134/14.471 | 8.683/11.295/14.471 |
| 5 | 633.49 | 186.58 | 0.00 | 3.14 | 2.34 | 80.75 | 65.86 |
| | | | | | | 12.895/15.529/14.471 | 9.961/12.666/14.471 |
| 6 | 320.23 | 125.35 | 0.00 | 1.72 | 1.18 | 42.74 | 29.93 |
| | | | | | | 6.037/ 8.219/14.471 | 4.093/ 5.755/14.471 |

RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 2 CP + Viento Trans.

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 420.71 | 66.57 | 258.07 | 2.94 | 1.56 | 51.22 | 73.65 |
| | | | | | | 7.405/ 9.850/14.471 | 11.446/14.163/14.471 |
| 2 | 330.19 | 101.44 | 258.07 | 2.77 | 1.22 | 45.57 | 69.02 |
| | | | | | | 6.486/ 8.764/14.471 | 10.550/13.272/14.471 |
| 3 | 398.09 | 114.82 | 258.07 | 3.06 | 1.47 | 54.92 | 72.09 |
| | | | | | | 8.026/10.562/14.471 | 11.140/13.864/14.471 |
| 4 | 330.19 | 101.44 | 258.07 | 2.77 | 1.22 | 45.57 | 69.02 |
| | | | | | | 6.486/ 8.764/14.471 | 10.550/13.272/14.471 |
| 5 | 398.09 | 114.82 | 258.07 | 3.06 | 1.47 | 54.92 | 72.09 |
| | | | | | | 8.026/10.562/14.471 | 11.140/13.864/14.471 |
| 6 | 330.19 | 101.44 | 258.07 | 2.77 | 1.22 | 45.57 | 69.02 |
| | | | | | | 6.486/ 8.764/14.471 | 10.550/13.272/14.471 |

RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 4 c1*(CP + SC + c2*Viento Trans.

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 656.09 | 126.20 | 77.42 | 3.30 | 2.43 | 81.92 | 76.80 |
| | | | | | | 13.144/15.753/14.471 | 12.077/14.770/14.471 |
| 2 | 320.23 | 125.35 | 77.42 | 2.05 | 1.18 | 47.48 | 40.96 |
| | | | | | | 6.793/ 9.131/14.471 | 5.759/ 7.877/14.471 |
| 3 | 633.49 | 186.58 | 77.42 | 3.47 | 2.34 | 88.43 | 74.67 |
| | | | | | | 14.594/17.005/14.471 | 11.649/14.361/14.471 |
| 4 | 565.58 | 174.27 | 77.42 | 3.17 | 2.09 | 78.76 | 68.04 |
| | | | | | | 12.479/15.147/14.471 | 10.366/13.084/14.471 |
| 5 | 633.49 | 186.58 | 77.42 | 3.47 | 2.34 | 88.43 | 74.67 |
| | | | | | | 14.594/17.005/14.471 | 11.649/14.361/14.471 |
| 6 | 320.23 | 125.35 | 77.42 | 2.05 | 1.18 | 47.48 | 40.96 |
| | | | | | | 6.793/ 9.131/14.471 | 5.759/ 7.877/14.471 |



SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 642.44 | 0.00 | 0.00 | 162.60 |
| 2 | Nmin Mlmax Mtmax | 177.56 | 0.00 | 0.00 | 44.94 |
| 3 | Mlmax Mtmax Nmax | 642.44 | 0.00 | 0.00 | 162.60 |
| 4 | Mlmax Mtmax Nmin | 177.56 | 0.00 | 0.00 | 44.94 |
| 5 | Mtmax Nmax Mlmax | 642.44 | 0.00 | 0.00 | 162.60 |
| 6 | Mtmax Nmin Mlmax | 177.56 | 0.00 | 0.00 | 44.94 |



SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 7 | Nmax Mlmax Mtmax | 324.66 | 0.00 | 39.26 | 109.88 |
| 8 | Nmin Mlmax Mtmax | 191.01 | 0.00 | 39.26 | 84.39 |
| 9 | Mlmax Mtmax Nmax | 324.66 | 0.00 | 39.26 | 109.88 |
| 10 | Mlmax Mtmax Nmin | 191.01 | 0.00 | 39.26 | 84.39 |
| 11 | Mtmax Nmax Mlmax | 324.66 | 0.00 | 39.26 | 109.88 |
| 12 | Mtmax Nmin Mlmax | 191.01 | 0.00 | 39.26 | 84.39 |



SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 642.44 | 0.00 | 11.78 | 162.60 |
| 14 | Nmin Mlmax Mtmax | 177.56 | 0.00 | 11.78 | 46.65 |
| 15 | Mlmax Mtmax Nmax | 642.44 | 0.00 | 11.78 | 162.60 |
| 16 | Mlmax Mtmax Nmin | 177.56 | 0.00 | 11.78 | 46.65 |
| 17 | Mtmax Nmax Mlmax | 642.44 | 0.00 | 11.78 | 162.60 |
| 18 | Mtmax Nmin Mlmax | 177.56 | 0.00 | 11.78 | 46.65 |



SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 19 | Nmax Mlmax Mtmax | 664.53 | 17.75 | 0.00 | 168.19 |
| 20 | Nmin Mlmax Mtmax | 192.29 | 49.89 | 0.00 | 48.67 |
| 21 | Mlmax Mtmax Nmax | 634.01 | 49.89 | 0.00 | 160.47 |
| 22 | Mlmax Mtmax Nmin | 523.51 | 49.89 | 0.00 | 132.50 |
| 23 | Mtmax Nmax Mlmax | 634.01 | 49.89 | 0.00 | 160.47 |
| 24 | Mtmax Nmin Mlmax | 192.29 | 49.89 | 0.00 | 48.67 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 25 | Nmax Mlmax Mtmax | 346.76 | 3.16 | 166.83 | 257.24 |
| 26 | Nmin Mlmax Mtmax | 205.74 | 35.30 | 166.83 | 222.58 |
| 27 | Mlmax Mtmax Nmax | 316.24 | 35.30 | 166.83 | 249.94 |
| 28 | Mlmax Mtmax Nmin | 205.74 | 35.30 | 166.83 | 222.58 |
| 29 | Mtmax Nmax Mlmax | 316.24 | 35.30 | 166.83 | 249.94 |
| 30 | Mtmax Nmin Mlmax | 205.74 | 35.30 | 166.83 | 222.58 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 31 | Nmax Mlmax Mtmax | 664.53 | 17.75 | 50.05 | 183.40 |
| 32 | Nmin Mlmax Mtmax | 192.29 | 49.89 | 50.05 | 96.96 |
| 33 | Mlmax Mtmax Nmax | 634.01 | 49.89 | 50.05 | 178.30 |
| 34 | Mlmax Mtmax Nmin | 523.51 | 49.89 | 50.05 | 159.48 |
| 35 | Mtmax Nmax Mlmax | 634.01 | 49.89 | 50.05 | 178.30 |
| 36 | Mtmax Nmin Mlmax | 192.29 | 49.89 | 50.05 | 96.96 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 37 | Nmax Mlmax Mtmax | 686.63 | 35.50 | 0.00 | 173.78 |
| 38 | Nmin Mlmax Mtmax | 207.02 | 99.77 | 0.00 | 52.40 |
| 39 | Mlmax Mtmax Nmax | 656.11 | 99.77 | 0.00 | 166.06 |
| 40 | Mlmax Mtmax Nmin | 538.24 | 99.77 | 0.00 | 136.23 |
| 41 | Mtmax Nmax Mlmax | 656.11 | 99.77 | 0.00 | 166.06 |
| 42 | Mtmax Nmin Mlmax | 207.02 | 99.77 | 0.00 | 52.40 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 43 | Nmax Mlmax Mtmax | 368.86 | 6.32 | 309.49 | 409.64 |
| 44 | Nmin Mlmax Mtmax | 220.47 | 70.59 | 309.49 | 370.83 |
| 45 | Mlmax Mtmax Nmax | 338.33 | 70.59 | 309.49 | 401.80 |
| 46 | Mlmax Mtmax Nmin | 220.47 | 70.59 | 309.49 | 370.83 |
| 47 | Mtmax Nmax Mlmax | 338.33 | 70.59 | 309.49 | 401.80 |
| 48 | Mtmax Nmin Mlmax | 220.47 | 70.59 | 309.49 | 370.83 |



ESTRUCTURA E-1505 . SUBTRAMO XV

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | Mtpan |
|---|---|---|---|---|---|
| 49 | Nmax Mlmax Mtmax | 686.63 | 35.50 | 92.85 | 244.97 |
| 50 | Nmin Mlmax Mtmax | 207.02 | 99.77 | 92.85 | 146.48 |
| 51 | Mlmax Mtmax Nmax | 656.11 | 99.77 | 92.85 | 239.28 |
| 52 | Mlmax Mtmax Nmin | 538.24 | 99.77 | 92.85 | 216.77 |
| 53 | Mtmax Nmax Mlmax | 656.11 | 99.77 | 92.85 | 239.28 |
| 54 | Mtmax Nmin Mlmax | 207.02 | 99.77 | 92.85 | 146.48 |

ESFUERZOS ADICIONALES

| N | Ml | Mt | Mtpan |
|---|---|---|---|

Programa PILAS v1.1
PANDEO TRANSVERSAL
ESTRUCTURA E-1505 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax Mlmax Mtmax | 642.44 | 0.00 | 162.60 | 44.72 |
| 2 | 1 | B1 | 1 | Nmin Mlmax Mtmax | 177.56 | 0.00 | 44.94 | 44.72 |
| 3 | 1 | B1 | 1 | Mlmax Mtmax Nmax | 642.44 | 0.00 | 162.60 | 44.72 |
| 4 | 1 | B1 | 1 | Mlmax Mtmax Nmin | 177.56 | 0.00 | 44.94 | 44.72 |
| 5 | 1 | B1 | 1 | Mtmax Nmax Mlmax | 642.44 | 0.00 | 162.60 | 44.72 |
| 6 | 1 | B1 | 1 | Mtmax Nmin Mlmax | 177.56 | 0.00 | 44.94 | 44.72 |
| 7 | 1 | B1 | 2 | Nmax Mlmax Mtmax | 324.66 | 0.00 | 109.88 | 44.72 |
| 8 | 1 | B1 | 2 | Nmin Mlmax Mtmax | 191.01 | 0.00 | 84.39 | 44.72 |
| 9 | 1 | B1 | 2 | Mlmax Mtmax Nmax | 324.66 | 0.00 | 109.88 | 44.72 |
| 10 | 1 | B1 | 2 | Mlmax Mtmax Nmin | 191.01 | 0.00 | 84.39 | 44.72 |
| 11 | 1 | B1 | 2 | Mtmax Nmax Mlmax | 324.66 | 0.00 | 109.88 | 44.72 |
| 12 | 1 | B1 | 2 | Mtmax Nmin Mlmax | 191.01 | 0.00 | 84.39 | 44.72 |
| 13 | 1 | B1 | 4 | Nmax Mlmax Mtmax | 642.44 | 0.00 | 162.60 | 44.72 |
| 14 | 1 | B1 | 4 | Nmin Mlmax Mtmax | 177.56 | 0.00 | 46.65 | 44.72 |
| 15 | 1 | B1 | 4 | Mlmax Mtmax Nmax | 642.44 | 0.00 | 162.60 | 44.72 |
| 16 | 1 | B1 | 4 | Mlmax Mtmax Nmin | 177.56 | 0.00 | 46.65 | 44.72 |
| 17 | 1 | B1 | 4 | Mtmax Nmax Mlmax | 642.44 | 0.00 | 162.60 | 44.72 |
| 18 | 1 | B1 | 4 | Mtmax Nmin Mlmax | 177.56 | 0.00 | 46.65 | 44.72 |

Programa PILAS v1.1

ESTRUCTURA E-1505 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 19 | 1 | B2 | 1 | Nmax Mlmax Mtmax | 664.53 | 17.75 | 168.19 | 44.72 |
| 20 | 1 | B2 | 1 | Nmin Mlmax Mtmax | 192.29 | 49.89 | 48.67 | 44.72 |
| 21 | 1 | B2 | 1 | Mlmax Mtmax Nmax | 634.01 | 49.89 | 160.47 | 44.72 |
| 22 | 1 | B2 | 1 | Mlmax Mtmax Nmin | 523.51 | 49.89 | 132.50 | 44.72 |
| 23 | 1 | B2 | 1 | Mtmax Nmax Mlmax | 634.01 | 49.89 | 160.47 | 44.72 |
| 24 | 1 | B2 | 1 | Mtmax Nmin Mlmax | 192.29 | 49.89 | 48.67 | 44.72 |
| 25 | 1 | B2 | 2 | Nmax Mlmax Mtmax | 346.76 | 3.16 | 257.24 | 225.12 |
| 26 | 1 | B2 | 2 | Nmin Mlmax Mtmax | 205.74 | 35.30 | 222.58 | 225.12 |
| 27 | 1 | B2 | 2 | Mlmax Mtmax Nmax | 316.24 | 35.30 | 249.94 | 225.12 |
| 28 | 1 | B2 | 2 | Mlmax Mtmax Nmin | 205.74 | 35.30 | 222.58 | 225.12 |
| 29 | 1 | B2 | 2 | Mtmax Nmax Mlmax | 316.24 | 35.30 | 249.94 | 225.12 |
| 30 | 1 | B2 | 2 | Mtmax Nmin Mlmax | 205.74 | 35.30 | 222.58 | 225.12 |
| 31 | 1 | B2 | 4 | Nmax Mlmax Mtmax | 664.53 | 17.75 | 183.40 | 44.72 |
| 32 | 1 | B2 | 4 | Nmin Mlmax Mtmax | 192.29 | 49.89 | 96.96 | 44.72 |
| 33 | 1 | B2 | 4 | Mlmax Mtmax Nmax | 634.01 | 49.89 | 178.30 | 44.72 |
| 34 | 1 | B2 | 4 | Mlmax Mtmax Nmin | 523.51 | 49.89 | 159.48 | 44.72 |
| 35 | 1 | B2 | 4 | Mtmax Nmax Mlmax | 634.01 | 49.89 | 178.30 | 44.72 |
| 36 | 1 | B2 | 4 | Mtmax Nmin Mlmax | 192.29 | 49.89 | 96.96 | 44.72 |

Programa PILAS v1.1

ESTRUCTURA E-1505 . SUBTRAMO XV

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 37 | 1 | B3 | 1 | Nmax Mlmax Mtmax | 686.63 | 35.50 | 173.78 | 44.72 |
| 38 | 1 | B3 | 1 | Nmin Mlmax Mtmax | 207.02 | 99.77 | 52.40 | 44.72 |
| 39 | 1 | B3 | 1 | Mlmax Mtmax Nmax | 656.11 | 99.77 | 166.06 | 44.72 |
| 40 | 1 | B3 | 1 | Mlmax Mtmax Nmin | 538.24 | 99.77 | 136.23 | 44.72 |
| 41 | 1 | B3 | 1 | Mtmax Nmax Mlmax | 656.11 | 99.77 | 166.06 | 44.72 |
| 42 | 1 | B3 | 1 | Mtmax Nmin Mlmax | 207.02 | 99.77 | 52.40 | 44.72 |
| 43 | 1 | B3 | 2 | Nmax Mlmax Mtmax | 368.86 | 6.32 | 409.64 | 225.12 |
| 44 | 1 | B3 | 2 | Nmin Mlmax Mtmax | 220.47 | 70.59 | 370.83 | 225.12 |
| 45 | 1 | B3 | 2 | Mlmax Mtmax Nmax | 338.33 | 70.59 | 401.80 | 225.12 |
| 46 | 1 | B3 | 2 | Mlmax Mtmax Nmin | 220.47 | 70.59 | 370.83 | 225.12 |
| 47 | 1 | B3 | 2 | Mtmax Nmax Mlmax | 338.33 | 70.59 | 401.80 | 225.12 |
| 48 | 1 | B3 | 2 | Mtmax Nmin Mlmax | 220.47 | 70.59 | 370.83 | 225.12 |
| 49 | 1 | B3 | 4 | Nmax Mlmax Mtmax | 686.63 | 35.50 | 244.97 | 44.72 |
| 50 | 1 | B3 | 4 | Nmin Mlmax Mtmax | 207.02 | 99.77 | 146.48 | 44.72 |
| 51 | 1 | B3 | 4 | Mlmax Mtmax Nmax | 656.11 | 99.77 | 239.28 | 44.72 |
| 52 | 1 | B3 | 4 | Mlmax Mtmax Nmin | 538.24 | 99.77 | 216.77 | 44.72 |
| 53 | 1 | B3 | 4 | Mtmax Nmax Mlmax | 656.11 | 99.77 | 239.28 | 44.72 |
| 54 | 1 | B3 | 4 | Mtmax Nmin Mlmax | 207.02 | 99.77 | 146.48 | 44.72 |

PANDEO TRANSVERSAL
Programa ZAPATAS v1.0.
RESULTADOS DE DIMENSIONAMIENTO

| | |
|---|---|
| Dimension longitudinal | 5.20 |
| Dimension transversal | 5.20 |
| Presion media pesima (kp/cm2) | 2.43 |
| Presion punta pesima (kp/cm2) | 3.49 |

PANDEO TRANSVERSAL
" FICHERO DE ENTRADA PARA EL PROGRAMA CMOD
" (Aplicacion metodo Columna Modelo)

* CODIGOS
LP_L 18.30 "Longitud de pandeo longitudinal
LP_T 18.88 "Longitud de pandeo transversal
COMPRESIONES POSITIVAS "Signo de las compresiones.
* ESFUERZOS

| " N | Ml | Mt | Mlpan | Mtpan |
|---|---|---|---|---|
| 686.63 | 35.50 | 0.00 | 35.50 | 173.78 |
| 207.02 | 99.77 | 0.00 | 99.77 | 52.40 |
| 656.11 | 99.77 | 0.00 | 99.77 | 166.06 |
| 538.24 | 99.77 | 0.00 | 99.77 | 136.23 |
| 656.11 | 99.77 | 0.00 | 99.77 | 166.06 |
| 207.02 | 99.77 | 0.00 | 99.77 | 52.40 |
| 368.86 | 6.32 | 309.49 | 6.32 | 409.64 |
| 220.47 | 70.59 | 309.49 | 70.59 | 370.83 |
| 338.33 | 70.59 | 309.49 | 70.59 | 401.80 |
| 220.47 | 70.59 | 309.49 | 70.59 | 370.83 |
| 338.33 | 70.59 | 309.49 | 70.59 | 401.80 |
| 220.47 | 70.59 | 309.49 | 70.59 | 370.83 |
| 686.63 | 35.50 | 92.85 | 35.50 | 244.97 |
| 207.02 | 99.77 | 92.85 | 99.77 | 146.48 |
| 656.11 | 99.77 | 92.85 | 99.77 | 239.28 |
| 538.24 | 99.77 | 92.85 | 99.77 | 216.77 |
| 656.11 | 99.77 | 92.85 | 99.77 | 239.28 |
| 207.02 | 99.77 | 92.85 | 99.77 | 146.48 |

PANDEO TRANSVERSAL
" Fichero de esfuerzos solicitantes en base de pila,
" para dimensionamiento de la cimentación.

| | | | | | |
|---|---|---|---|---|---|
| * HIPOTESIS 11 | | | | | |
| 686.63 | 3.07 | 0.00 | 35.50 | 0.00 | 35.50 |
| 173.78 | | | | | |
| 207.02 | 8.62 | 0.00 | 99.77 | 0.00 | 99.77 |
| 52.40 | | | | | |
| 656.11 | 8.62 | 0.00 | 99.77 | 0.00 | 99.77 |
| 166.06 | | | | | |
| 538.24 | 8.62 | 0.00 | 99.77 | 0.00 | 99.77 |
| 136.23 | | | | | |
| 656.11 | 8.62 | 0.00 | 99.77 | 0.00 | 99.77 |
| 166.06 | | | | | |
| 207.02 | 8.62 | 0.00 | 99.77 | 0.00 | 99.77 |
| 52.40 | | | | | |
| * HIPOTESIS 12 | | | | | |
| 368.86 | 0.55 | 25.94 | 6.32 | 309.49 | 6.32 |
| 409.64 | | | | | |
| 220.47 | 6.10 | 25.94 | 70.59 | 309.49 | 70.59 |
| 370.83 | | | | | |
| 338.33 | 6.10 | 25.94 | 70.59 | 309.49 | 70.59 |
| 401.80 | | | | | |
| 220.47 | 6.10 | 25.94 | 70.59 | 309.49 | 70.59 |
| 370.83 | | | | | |
| 338.33 | 6.10 | 25.94 | 70.59 | 309.49 | 70.59 |
| 401.80 | | | | | |
| 220.47 | 6.10 | 25.94 | 70.59 | 309.49 | 70.59 |
| 370.83 | | | | | |
| * HIPOTESIS 14 | | | | | |
| 686.63 | 3.07 | 7.78 | 35.50 | 92.85 | 35.50 |
| 244.97 | | | | | |
| 207.02 | 8.62 | 7.78 | 99.77 | 92.85 | 99.77 |
| 146.48 | | | | | |
| 656.11 | 8.62 | 7.78 | 99.77 | 92.85 | 99.77 |
| 239.28 | | | | | |
| 538.24 | 8.62 | 7.78 | 99.77 | 92.85 | 99.77 |
| 216.77 | | | | | |
| 656.11 | 8.62 | 7.78 | 99.77 | 92.85 | 99.77 |
| 239.28 | | | | | |
| 207.02 | 8.62 | 7.78 | 99.77 | 92.85 | 99.77 |
| 146.48 | | | | | |

PANDEO TRANSVERSAL
RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 1 CP + SC

| Terna | N | M1 | Mt sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|
| 1 | 656.09 | 29.71 | 128.73 | 3.10 | 2.43 | 71.55 | 81.53 |
| | | | | | 11.035/13.759/14.471 | 13.062/15.680/14.471 |
| 2 | 300.83 | 83.48 | 38.81 | 1.63 | 1.11 | 39.47 | 33.13 |
| | | | | | 5.527/ 7.590/14.471 | 4.566/ 6.370/14.471 |
| 3 | 633.49 | 83.48 | 123.01 | 3.22 | 2.34 | 75.34 | 79.56 |
| | | | | | 11.781/14.488/14.471 | 12.645/15.300/14.471 |
| 4 | 546.18 | 83.48 | 100.91 | 2.81 | 2.02 | 66.78 | 68.81 |
| | | | | | 10.131/12.842/14.471 | 10.511/13.232/14.471 |
| 5 | 633.49 | 83.48 | 123.01 | 3.22 | 2.34 | 75.34 | 79.56 |
| | | | | | 11.781/14.488/14.471 | 12.645/15.300/14.471 |
| 6 | 300.83 | 83.48 | 38.81 | 1.63 | 1.11 | 39.47 | 33.13 |
| | | | | | 5.527/ 7.590/14.471 | 4.566/ 6.370/14.471 |

RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 2 CP + Viento Trans.

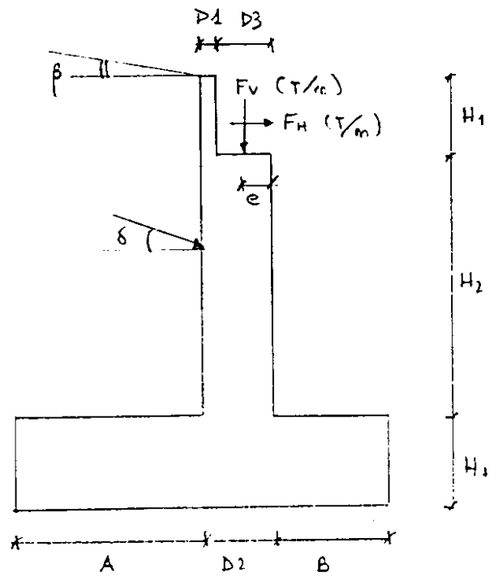
| Terna | N | M1 | Mt sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|
| 1 | 420.71 | 5.29 | 332.26 | 3.00 | 1.56 | 43.02 | 72.78 |
| | | | | | 6.081/ 8.273/14.471 | 11.275/13.996/14.471 |
| 2 | 310.79 | 59.07 | 303.51 | 2.74 | 1.15 | 37.52 | 66.47 |
| | | | | | 5.228/ 7.216/14.471 | 10.074/12.783/14.471 |
| 3 | 398.09 | 59.07 | 326.45 | 3.12 | 1.47 | 47.67 | 76.13 |
| | | | | | 6.824/ 9.168/14.471 | 11.941/14.641/14.471 |
| 4 | 310.79 | 59.07 | 303.51 | 2.74 | 1.15 | 37.52 | 66.47 |
| | | | | | 5.228/ 7.216/14.471 | 10.074/12.783/14.471 |
| 5 | 398.09 | 59.07 | 326.45 | 3.12 | 1.47 | 47.67 | 76.13 |
| | | | | | 6.824/ 9.168/14.471 | 11.941/14.641/14.471 |
| 6 | 310.79 | 59.07 | 303.51 | 2.74 | 1.15 | 37.52 | 66.47 |
| | | | | | 5.228/ 7.216/14.471 | 10.074/12.783/14.471 |

RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 4 c1*(CP + SC + c2*Viento Trans.

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 656.09 | 29.71 | 190.10 | 3.36 | 2.43 | 71.55 | 85.96 |
| | | | | | | 11.035/13.759/14.471 | 14.032/16.532/14.471 |
| 2 | 300.83 | 83.48 | 117.15 | 1.97 | 1.11 | 39.47 | 44.11 |
| | | | | | | 5.527/ 7.590/14.471 | 6.253/ 8.482/14.471 |
| 3 | 633.49 | 83.48 | 185.89 | 3.49 | 2.34 | 75.34 | 85.93 |
| | | | | | | 11.781/14.488/14.471 | 14.024/16.524/14.471 |
| 4 | 546.18 | 83.48 | 169.21 | 3.10 | 2.02 | 66.78 | 76.43 |
| | | | | | | 10.131/12.842/14.471 | 12.001/14.698/14.471 |
| 5 | 633.49 | 83.48 | 185.89 | 3.49 | 2.34 | 75.34 | 85.93 |
| | | | | | | 11.781/14.488/14.471 | 14.024/16.524/14.471 |
| 6 | 300.83 | 83.48 | 117.15 | 1.97 | 1.11 | 39.47 | 44.11 |
| | | | | | | 5.527/ 7.590/14.471 | 6.253/ 8.482/14.471 |

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 18-76

## 18.4 COMPROBACIÓN DE ESTRIBOS




Las cargas Fv y FH se reparten uniformemente en todo el ancho del cargadero.

Hipotesis de cálculo :

HIPOTESIS 1 : Estribo en vacio con tierras saturadas y una sobrecarga de 1 T/m² sobre las tierras.

HIPOTESIS 2 : Carga muerta + 1 T/m² sobre las tierras

HIPOTESIS 3 : Sobrecarga + 1 T/m² sobre las tierras

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 18-77

ESTRIBO E-1

D1 = 0.5 m  B = 1.80 m  Neopreno: 450x450

D2 = 1.55 m  A = 4.15 m

D3 = 1.05 m  H2 = 1.60 m

H1 = 17.28 m

H2 = 5.49 m

$\gamma_{hormigon}$ = 1.80 T/m³  Fck = 250 kp/cm²

$\phi$ = 30°  Fyk = 5100 kp/cm²

$\beta$ = 0.0°  $\gamma_c$ = 1.50

$\gamma_{med}$ = 2.1 T/m³  $\gamma_s$ = 1.15

C.rozam = 0,577 (tg $\phi$)

HIPOTESIS 2

Eactivo = 0.333

Qsob = 1 T/m²

Fv = 93.865 t / 8.10 m = 11,58 T/m

$F_H$ = 23,6 T/m² x 0,45² m² x 4 neopr / 8.10 m = 19.11 / 8.10 = 2,36 T/m

e = 0.50 m

$\gamma_f$ = 1,25

$\gamma_{desliz}$ = 1.50

$\gamma_{vuelco}$ = 1.80

$\gamma_{sismo}$ = 0

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 18-78

HIPOTESIS 3

Eactivo = 1

Qsob = 1 T/m²

Fv = 186,86 t / 8.10 m = 23,07 T/m

$F_H$ = 2,26 T/m² + 1,35 t x 4 neopr / 8.10 m = 3,02 T/m

e = 0.50 m

$\gamma_f$ = 1.50

$\gamma_{desliz}$ = 1.50

$\gamma_{vuelco}$ = 1.80

$\gamma_{sismo}$ = 0.00

HIPOTESIS 4

Eactivo = 1

Qsob = 1 T/m²

Fv = 0 T/m

$F_H$ = 0 T/m

e = 0.50 m

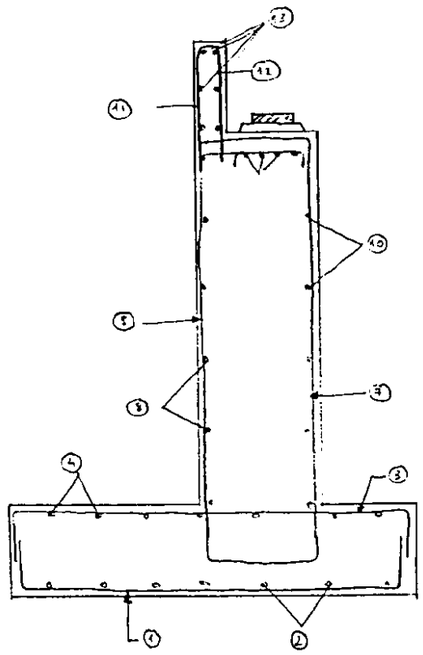
$\gamma_f$ = 1.35

$\gamma_{desliz}$ = 1.35

$\gamma_{vuelco}$ = 1.80

$\gamma_{sismo}$ = 0.00

Armaduras dispuestas :




| Armadura tipo | Necesaria (cm²) | Dispuesta (nØ / cm²) | |
|---|---|---|---|
| ① | 19 | Ø16 a 0.15 / 13,39 | x |
| ② | 6 | Ø16 a 0.15 / 13,39 | |
| ③ | 24 | Ø25 a 0.15 / 32,66 | |
| ⑪ | 6 | Ø16 a 0.15 / 13,39 | |
| ⑤ | 27 | Ø25 a 0.15 / 32,66 | |
| ⑦ | 9 | Ø12 a 0.20 / 5,65 | |
| ⑧ | 16 | Ø16 a 0.15 / 13,39 | x |
| ⑩ | 16 | Ø16 a 0.15 / 13,39 | x |
| ⑪ | 4 | Ø12 a 0.20 / 5,65 | |



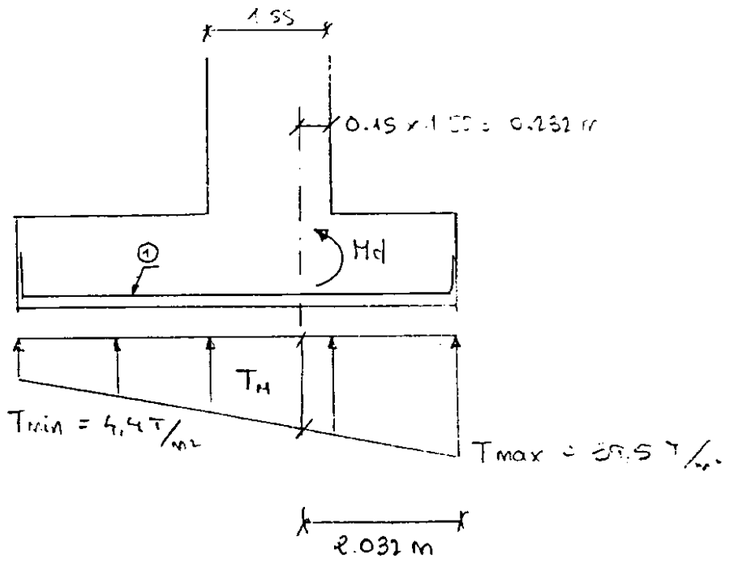
| | | |
|---|---|---|
| ⑫ | 2 | Ø12 a 0.20 / 5.65 |
| ⑬ | 5 | Ø12 a 0.20 / 5.65 |

Fallan las armaduras ⑧ y ⑩ ... [illegible] ... no se colocan por ... [illegible] ... no se colocan.

La armadura ... ⑦ ... [illegible] ... de longitud de anclaje ... [illegible] ... las vigas para sobrecargas ...

... [illegible] ... $\gamma_f$ 1.33 para cargas ... y $\gamma_f$ 1.50 para sobrecargas.

Hipótesis simultánea ... :




Coeficiente ... adoptado :

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 18-8

$$T_M = -\frac{(35,79 - 3,99)}{3,50} \times 2,032 + 35,79 = 31,55\ T/m'$$

$$Md = 1,36 \times \left[ 31,55 \times \frac{2,032}{2} + \frac{1}{2} \times 9,95 \times 2,032^2 \times \frac{2}{3} \right] = 58,47\ mT$$

$$T = \frac{Md}{\delta} = \frac{58,47}{0,9 \times 1,60 - 0,05} = 42,74\ T$$

$$As = \frac{42,74 \times 1,15}{2,1} = 9,638\ cm^2 < 13,39 \quad \checkmark$$

Por tanto se considera válido el estribo contruido.

ESTUDIO: 24785
NOMBRE SECCION DE MURO: BASE

# ESTRIBO E-1

DEFINICION GEOMETRICA

| | | |
|---|---|---|
| D1 | .50 | [m] |
| D2 | 1.55 | [m] |
| D3 | 1.05 | [m] |
| H1 | 1.73 | [m] |
| H2 | 8.49 | [m] |
| A | 4.15 | [m] |
| B | 1.80 | [m] |
| Hz | 1.60 | [m] |

CARACTERISTICAS DEL TERRENO

| | | |
|---|---|---|
| Gamatt | 1.80 | [Mp/m3] |
| Fi | 30.00 | [grados] |
| Beta | 0.00 | [grados] |
| Delta | 0.00 | [grados] |
| Sadmt | 31.00 | [Mp/m2] |
| Coefr | .577 | |

CARACTERISTICAS DE LOS MATERIALES
Y COEFICIENTES DE MINORACION

| | | |
|---|---|---|
| Fck | 250 | [Kp/cm2] |
| Fyk | 5100 | [Kp/cm2] |
| Gamac | 1.50 | |
| Gamas | 1.15 | |

DATOS DE APOYO PUNTUAL

| | | |
|---|---|---|
| Bnp | 45.00 | [Cm] |
| Dnp | 45.00 | [Cm] |
| Sepvig | 2.85 | [M] |

HIPOTESIS DE CARGA

| Hipot. | Ea | q | Fv [Mp] | Fh [Mp] | Efv [Mp] | Gamaf | Cd | Cv | Sish | Sisv |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 1.00 | 0.00 | 0.00 | .50 | 1.35 | 1.35 | 1.62 | 0.000 | 0.000 |
| 2 | 1.000 | 1.00 | 11.58 | 2.36 | .50 | 1.35 | 1.50 | 1.80 | 0.000 | 0.000 |
| 3 | 1.000 | 1.00 | 23.07 | 3.02 | .50 | 1.50 | 1.50 | 1.80 | 0.000 | 0.000 |

## VALORES GEOMETRICOS CALCULADOS

| | | |
|---|---|---|
| D1 ..... | .50 | [m] |
| D2 ..... | 1.55 | [m] |

## RESULTADOS COMPROBACION DESLIZAMIENTO, VUELCO , Y TENSIONES SOBRE EL TERRENO

| Hipotesis | Deslizamiento Nv [Mp] | Nh [Mp] | Cdc | Vuelco Mv [Mpm] | Mh [Mpm] | Cvc | N [Mp] | Tensiones e [m] | Tmax [Mp/m2] | Tmin [Mp/m2] | Zona |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 141.4 | 45.8 | 1.8 | 618.0 | 188.3 | 3.3 | 141.4 | .7 | 29.6 | 8.1 | 7.5C |
| 2 | 153.0 | 48.2 | 1.8 | 644.6 | 212.1 | 3.0 | 153.0 | .9 | 35.5 | 5.3 | 7.5C |
| 3 | 164.5 | 48.9 | 1.9 | 671.1 | 218.8 | 3.1 | 164.5 | 1.0 | 39.5 | 4.4 | 7.5C |

## ESFUERZOS DE DIMENSIONAMIENTO ZAPATA

| Hipotesis | Talon Ms [Mpm] | Vs [Mp] | Vsa [Mp] | Puntera Ms [Mpm] | Vs [Mp] | Vsa [Mp] |
|---|---|---|---|---|---|---|
| 1 | -131.472 | -40.532 | -52.278 | 65.916 | 33.363 | 62.203 |
| 2 | -145.298 | -45.044 | -54.466 | 80.116 | 40.674 | 75.103 |
| 3 | -161.932 | -50.413 | -57.897 | 100.079 | 50.850 | 93.647 |

## ESFUERZOS DE DIMENSIONAMIENTO MURO

| Hip. | Muro abajo Msi [Mpm] | Nsi [Mp] | Vsi [Mp] | Muro medio Msm [Mpm] | Nsm [Mp] | Vsm [Mp] | Muro sup.-Murete Vss [Mp] | Ms [Mpm] | Vs [Mp] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 165.984 | 47.329 | 46.883 | 51.802 | 29.564 | 21.918 | 1.987 | 1.368 | 1.987 |
| 2 | 197.332 | 62.962 | 50.069 | 72.331 | 45.197 | 25.104 | 5.173 | 1.368 | 1.987 |
| 3 | 232.402 | 87.193 | 56.622 | 90.150 | 67.454 | 28.884 | 6.738 | 1.520 | 2.208 |

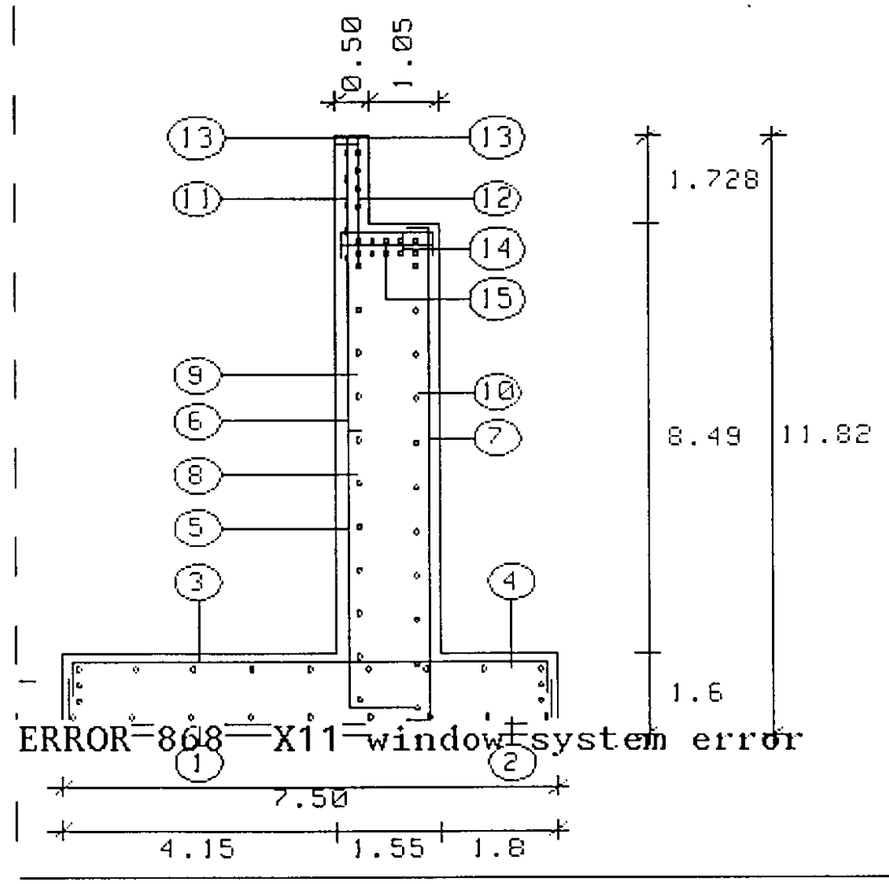
## DETALLE DE LA ARMADURA

| Tipo | Anec. (cm2) | Aexis. (cm2) | n | Phy | l (m) | ln (m) | Obs |
|---|---|---|---|---|---|---|---|
| 1 | 19 | 20 | 10 | 16 | 10.60 | .12 | |
| 2 | 6 | 7 | 9 | 10 | 1.00 | 0.00 | |
| 3 | 24 | 25 | 8 | 20 | 7.40 | 0.00 | |
| 4 | 6 | 7 | 9 | 10 | 1.00 | 0.00 | |
| 5 | 27 | 28 | 9 | 20 | 7.45 | .40 | |
| 6 | 23 | 25 | 8 | 20 | 3.64 | .40 | |
| 7 | 9 | 10 | 9 | 12 | 9.99 | .24 | |
| 8 | 16 | 16 | 8 | 16 | 1.00 | 0.00 | |
| 9 | 16 | 16 | 8 | 16 | 1.00 | 0.00 | |
| 10 | 16 | 16 | 8 | 16 | 1.00 | 0.00 | |
| 11 | 4 | 5 | 6 | 10 | 2.73 | .20 | |
| 12 | 2 | 2 | 3 | 10 | 2.73 | .20 | |
| 13 | 5 | 5 | 7 | 10 | 1.00 | 0.00 | |
| 14 | 2 | 2 | 3 | 10 | 1.95 | 0.00 | # |
| 15 | 2 | 2 | 3 | 10 | 1.00 | 0.00 | ## |

\# Armadura no por m. sino bajo cada carga a repartir en 1 m.en planta
## Armadura total bajo cada carga
#/## Armaduras a repetir en 2 capas entre .1 m. y 1 m. en vertical
l longitud principal
ln longitud patilla
NOTA: Las armaduras indicadas deben distribuirse por metro
salvo las 14 y 15 que se dan por apoyo

## MEDICIONES (sin mayorar)

| | Hormigon (m3) | Acero (Kp) |
|---|---|---|
| ZAPATA | 12.00 | 326.19 |
| ALZADO | 14.02 | 399.37 |
| TOTAL | 26.02 | 725.55 |




ERROR 808 X11 window system error

## ESTRIBO E-2

$D_1 = 0.30$ m  $B = 0.90$ m

$D_2 = 1.35$ m  $A = 3.50$ m

$D_3 = 1.05$ m  $H_2 = 1.00$ m

$H_1 = 1.922$ m

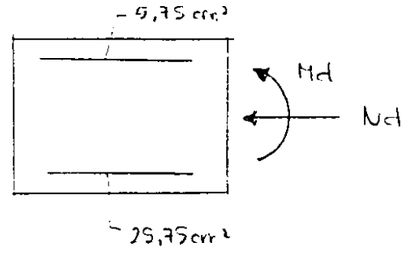
$H_2 = 5.11$ m

Dadas la similitud del trabajo a repetir las mismas hipótesis del estribo E-1.

| Armadura tipo | Necesaria cm²/ml | Dispuesta cm²/ml | |
|---|---|---|---|
| ① | 9 | ϕ16 c/0.10 / 10,05 | |
| ② | 4 | ϕ16 a 0.20 / 10,05 | |
| ③ | 19 | ϕ25 a 0.10 / 24,5 | |
| ④ | 5 | ϕ16a 0.10 / 10,05 | |
| ⑤ | 20 | ϕ16 a 0.10 + ϕ10 a 0.10 / 25,15 | |
| ⑥ | 8 | ϕ12 a 0.20 / 5.65 | x |
| ⑦ | 14 | ϕ12 a 0.15 / 7,53 | x |
| ⑩ | 14 | ϕ16a 0.10 / 10,05 | x |
| ⑪ | 2 | ϕ12 a 0.20 / 5,65 | |
| ⑫ | 1 | ϕ12 a 0.20 / 5,65 | |
| ⑬ | 3 | ϕ12 a 0.20 / 5,65 | |



Análogamente al estribo E-1, faltan las armaduras ① y ⑩ que se consideran válidas por idéntico concepto. La armadura ⑦ es ligeramente inferior a la necesaria según cálculo. No obstante dicha armadura trabaja a compresión ya que la que se calcula en la cara interior del muro en la base es tracción:




$Nd = 21,412\ t / 8.10 = 7.705$ T

$Md = 27,690\ mT / 8.10 = 10,225$ mT

Para $Nd = 7,705$ T

$Mu = 89,5$ mT >> 10,225 mT ✓

*ANALISIS EN ROTURA(ELASTOPLASTICO)*

Tí. lo Sección: MURO

* PRESOLICITACIONES ELASTICAS *

Analisis SIN FISURACION

Secuencia Incrementos de Carga:

Incremento de Carga 1 :
Axil : -7.71Tn. AXIL
Excentricidad: 67.50cm.(respecto a la directriz)
Seccion Afectada: TOTAL

ESTUDIO SECCION COMPLETA

Analisis con Resistencia de materiales MINORADAS
Def. Ultima Acero Estructural(COMPRESION)(%): 2.50
Def. Ultima Acero Estructural( TRACCION)(%): 2.50
De rmacion Ultima Hormigon(COMPRESION) : Pivote en Bloque de Hormigon
De. rmacion Ultima Hormigon( TRACCION)(%): 1.00
Coeficiente Ideal Fluencia[ø*(Cperm./Ctot.)]: 0.00

FLEXION PURA POSITIVA:

Mu(m.T): 89.5 Xu(cm.): 11.9

Nu(Tn.): -7.5 Qu(Tn.): 0.0

eformaciones Ultimas: Ecmx= -.00097 Etmx= .01000
ompe la fibra inferior de la S.parcial 1
ibra referencia Momento Ultimo: Yo= 0.0 cm.

FLEXION PURA NEGATIVA:

Mu(m.T): -41.9 Xu(cm.): 128.6

Nu(Tn.): -7.1 Qu(Tn.): 0.0

De rmaciones Ultimas: Ecmx= -.00050 Etmx= .01000
Compe la fibra superior de la S.parcial 1
Fibra referencia Momento Ultimo: Yo= 0.0 cm.

COMPRESION SIMPLE(Rigido/Plastico):

Nu(Tn.): -2007.2 aplicado en Yo(cm)= 69.0

TRACCION SIMPLE(Rigido/Plastico):

Nu(Tn.): 94.7 aplicado en Yo(cm)= 98.7

CORTANTE ULTIMO(Rigido/Plastico):

Vu(Tn.): 0.0 Ru(Kg/cm): 0.0

Xv1(cm): 0.0 Xv2(cm): 0.0
S.parciales resistentes: Rcu(Kg/cm):

ESTUDIO: 24785
NOMBRE SECCION DE MURO: BASE

- ESTRIBO E-2 -

DEFINICION GEOMETRICA

| | | |
|---|---|---|
| D1 | .30 | [m] |
| D2 | 1.35 | [m] |
| D3 | 1.05 | [m] |
| H1 | 1.72 | [m] |
| H2 | 5.11 | [m] |
| A | 3.50 | [m] |
| B | .70 | [m] |
| Hz | 1.00 | [m] |

CARACTERISTICAS DEL TERRENO

| | | |
|---|---|---|
| Gamatt | 1.80 | [Mp/m3] |
| Fi | 30.00 | [grados] |
| Beta | 0.00 | [grados] |
| Delta | 0.00 | [grados] |
| Sadmt | 31.00 | [Mp/m2] |
| Coefr | .577 | |

CARACTERISTICAS DE LOS MATERIALES
Y COEFICIENTES DE MINORACION

| | | |
|---|---|---|
| Fck | 250 | [Kp/cm2] |
| Fyk | 5100 | [Kp/cm2] |
| Gamac | 1.50 | |
| Gamas | 1.15 | |

DATOS DE APOYO PUNTUAL

| | | |
|---|---|---|
| Bnp | 45.00 | [Cm] |
| Dnp | 45.00 | [Cm] |
| Sepvig | 2.85 | [M] |

HIPOTESIS DE CARGA

| Hipot. | Ea | q | Fv [Mp] | Fh [Mp] | Efv [Mp] | Gamaf | Cd | Cv | Sish | Sisv |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 1.00 | 0.00 | 0.00 | .50 | 1.35 | 1.35 | 1.62 | 0.000 | 0.000 |
| 2 | 1.000 | 1.00 | 11.58 | 2.36 | .50 | 1.35 | 1.50 | 1.80 | 0.000 | 0.000 |
| 3 | 1.000 | 1.00 | 23.07 | 3.02 | .50 | 1.50 | 1.50 | 1.80 | 0.000 | 0.000 |

## VALORES GEOMETRICOS CALCULADOS

D1 ..... .30 [m]
D2 ..... 1.35 [m]

## RESULTADOS COMPROBACION DESLIZAMIENTO, VUELCO , Y TENSIONES SOBRE EL TERRENO

| Hipotesis | Deslizamiento Nv [Mp] | Nh [Mp] | Cdc | Vuelco Mv [Mpm] | Mh [Mpm] | Cvc | Tensiones N [Mp] | e [m] | Tmax [Mp/m2] | Tmin [Mp/m2] | Zona |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 75.5 | 21.0 | 2.1 | 228.2 | 58.3 | 3.9 | 75.5 | .5 | 21.3 | 5.9 | 5.55 |
| 2 | 87.0 | 23.4 | 2.1 | 242.1 | 72.7 | 3.3 | 87.0 | .8 | 29.7 | 1.6 | 5.55 |
| 3 | 98.5 | 24.0 | 2.4 | 255.9 | 76.7 | 3.3 | 98.5 | 1.0 | 36.1 | 0.0 | 5.46 |

## ESFUERZOS DE DIMENSIONAMIENTO ZAPATA

| Hipotesis | Talon Ms [Mpm] | Vs [Mp] | Vsa [Mp] | Puntera Ms [Mpm] | Vs [Mp] | Vsa [Mp] |
|---|---|---|---|---|---|---|
| 1 | -55.011 | -21.870 | -23.807 | 9.864 | 5.608 | 21.353 |
| 2 | -68.245 | -26.525 | -25.051 | 14.130 | 8.096 | 30.385 |
| 3 | -79.740 | -30.474 | -25.339 | 19.317 | 11.093 | 41.461 |

## ESFUERZOS DE DIMENSIONAMIENTO MURO

| ip. | Muro abajo Msi [Mpm] | Nsi [Mp] | Vsi [Mp] | Muro medio Msm [Mpm] | Nsm [Mp] | Vsm [Mp] | Muro sup.-Murete Vss [Mp] | Ms [Mpm] | Vs [Mp] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 52.637 | 25.026 | 21.978 | 19.061 | 15.713 | 11.439 | 1.976 | 1.357 | 1.976 |
| 2 | 71.653 | 40.659 | 25.164 | 31.565 | 31.346 | 14.625 | 5.162 | 1.357 | 1.976 |
| 3 | 87.690 | 62.412 | 28.950 | 41.124 | 52.064 | 17.240 | 6.725 | 1.507 | 2.195 |

## DETALLE DE LA ARMADURA

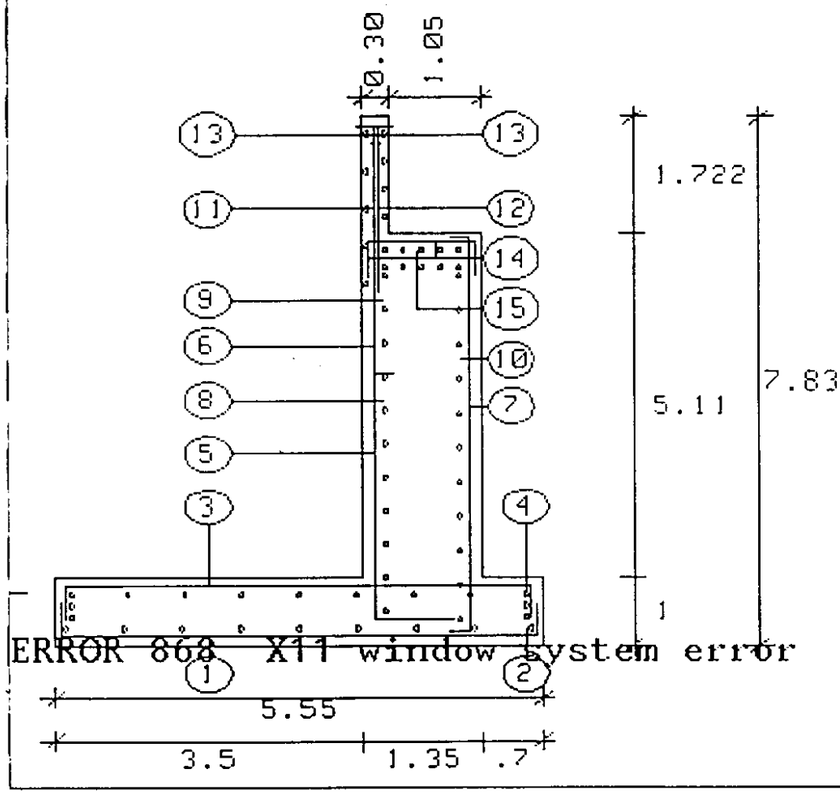
| Tipo | Anec. (cm2) | Aexis. (cm2) | n | Phy | l (m) | ln (m) | Obs |
|---|---|---|---|---|---|---|---|
| 1 | 9 | 9 | 8 | 12 | 7.45 | .15 | * |
| 2 | 4 | 4 | 8 | 8 | 1.00 | 0.00 | |
| 3 | 19 | 20 | 10 | 16 | 5.45 | 0.00 | |
| 4 | 5 | 5 | 10 | 8 | 1.00 | 0.00 | |
| 5 | 20 | 20 | 10 | 16 | 5.29 | .32 | |
| 6 | 20 | 20 | 10 | 16 | 1.82 | .32 | |
| 7 | 8 | 9 | 8 | 12 | 6.01 | .24 | |
| 8 | 14 | 14 | 7 | 16 | 1.00 | 0.00 | |
| 9 | 14 | 14 | 7 | 16 | 1.00 | 0.00 | |
| 10 | 14 | 14 | 7 | 16 | 1.00 | 0.00 | |
| 11 | 2 | 3 | 4 | 10 | 2.72 | .20 | |
| 12 | 1 | 2 | 3 | 10 | 2.72 | .20 | |
| 13 | 3 | 3 | 4 | 10 | 1.00 | 0.00 | |
| 14 | 2 | 2 | 3 | 10 | 1.75 | 0.00 | # |
| 15 | 2 | 2 | 3 | 10 | 1.00 | 0.00 | ## |

*  No cumple la condicion de adherencia
\#  Armadura no por m. sino bajo cada carga a repartir en 1 m.en planta
\#\#  Armadura total bajo cada carga
\#/\#\# Armaduras a repetir en 2 capas entre .1 m. y 1 m. en vertical
l  longitud principal
ln  longitud patilla

NOTA: Las armaduras indicadas deben distribuirse por metro salvo las 14 y 15 que se dan por apoyo

## MEDICIONES (sin mayorar)

| | Hormigon (m3) | Acero (Kp) |
|---|---|---|
| ZAPATA | 5.55 | 147.03 |
| ALZADO | 7.42 | 219.91 |
| TOTAL | 12.97 | 366.93 |




ERROR 868 X11 window system error

## *2.2 Cálculo del tablero E-1511.3 y E-1514.2*

ESTUDIO: 24785 FECHA: 6-06-00
TITULO: E-1511.3 y E-1514.2 (VANO CENTRAL)
TRAMO:MADRID-ZARAGOZA SUBTRAMO : XV

## ANEJO DE CALCULO DEL TABLERO DE VIGAS CAJON

### 1. DATOS GENERALES

**1.1 Seccion transversal (Datos para el calculo)**

| | | |
|---|---|---|
| Ancho total plataforma ..... | 8.80(Real) | 8.10 Calc. . |
| Ancho de las aceras (sin trafico). | 1.40(Real) | 1.05 (Calc.izq) |
| | | 1.05 (Calc.dch) |

**1.2 Seccion longitudinal**

Tramo isostatico

| | |
|---|---|
| Luz de calculo ..... | 30.39 m. |
| Longitud de la viga ..... | 31.03 m. |

**1.3 Planta**

| | |
|---|---|
| Esviaje ..... | 90.00 ° |
| Radio curvatura ..... | RECTO |

### 2. SOLUCION ADOPTADA

El tablero esta formado por vigas prefabricadas pretensadas sobre las que se vierte hormigon fabricado in situ para formar la losa de compresion

| | |
|---|---|
| Tipo de viga ..... | CAJON-330.140.20 |
| Canto de la viga ..... | 1.40 m. |
| Canto de la losa ..... | .27 m. |
| Numero de vigas ..... | 1 |
| Separacion entre vigas ..... | 0.000 m. |

Las caracteristicas de la viga figuran en el listado de resultados

### 3. ACCIONES A CONSIDERAR

| | |
|---|---|
| Peso propio de la viga ..... | 3181.17 Kg/m |
| Peso propio de la losa ..... | 675.00 Kg/m2. |
| Carga muerta ..... | 207.0 Kg/m2. |
| Carga adicional en bordes debida a aceras .. | 700.00 Kg/m. |
| Sobrecarga ..... | IAP-98 |

### 4. CARACTERISTICAS DE LOS MATERIALES Y COEFICIENTES DE SEGURIDAD SEGUN EP.-93

**4.1 Hormigon de la viga**

| | |
|---|---|
| Resistencia caracteristica a los 28 dias ..... | >= 400 Kgr/cm2 |
| Nivel de control intenso (prefabricacion) ..... | = 1.4 |

**4.2 Hormigon de la losa**

| | |
|---|---|
| Resistencia caracteristica a los 28 dias ..... | >= 250 Kgr/cm2 |
| Nivel de control normal (fabricacion in situ)... | = 1.5 |

**4.3 Acero de pretensado en viga**

| | |
|---|---|
| Tension de rotura ..... | >= 19000 Kgr/cm2 |
| Limite elastico al 0.2 ..... | >= 17100 Kgr/cm2 |
| Nivel de control intenso (prefabricacion) ..... | = 1.1 |

**4.4 Acero pasivo en viga**

| | |
|---|---|
| Limite elastico ..... | >= 5100 Kgr/cm2 |
| Nivel de control intenso (prefabricacion) ..... | = 1.1 |

**4.5 Acero pasivo en la losa**

| | |
|---|---|
| Limite elastico ..... | >= 5100 Kgr/cm2 |
| Nivel de control normal (fabricacion in situ)... | = 1.15 |

**4.6 Acciones**

Cargas permanentes .....= 1.35 Sobrecargas .....= 1.50

## 5.- ESTUDIO DEL REPARTO TRANSVERSAL: OBTENCIÓN DE ESFUERZOS EN LAS VIGAS, CÁLCULO DE TENSIONES.

### 5.1.- Descripción general

El cálculo del reparto transversal se realiza por medio de un programa de cálculo matricial, de emparrillados planos diseñado específicamente para el cálculo de tableros de vigas cajón denominado TVC.

En líneas generales, el programa TVC se atiene a las especificaciones de cualquier programa de cálculo matricial de emparrillados, por lo que, a continuación, únicamente se describen sus características específicas que principalmente proceden de su particularización al cálculo de tableros de vigas cajón.

El programa TVC utiliza el método del emparrillado plano (una excelente discusión del mismo puede verse en Hormigón y Acero num. 98 págs. 115-135 A. Sanmartín). No se pretende lograr una precisión total, pero si un nivel razonable de adecuación a la conexión interna entre cajones y losa. Para ello se ha ideado una partición en barras en la que la losa se discretiza en forma de barras transversales ligadas a las piezas longitudinales (éstas coinciden con los ejes de los cajones), a través de unas barras de gran rigidez en los puntos de las uniones almas-losa. En estos puntos de unión, almas-losa, se introduce una rótula, ya que se juzgan despreciables los momentos que pueda transmitir la unión real. De esta forma, se asegura una deformación transversal rígida de cada cajón con sus dimensiones reales, si bien con discontinuidades en los giros transversales entre cajón y losa, existiendo en cambio continuidad entre los giros longitudinales del cajón, y los giros torsores en la losa. La rigidez de las barras ficticias indicadas anteriormente se ha estimado del orden de la del cajón.

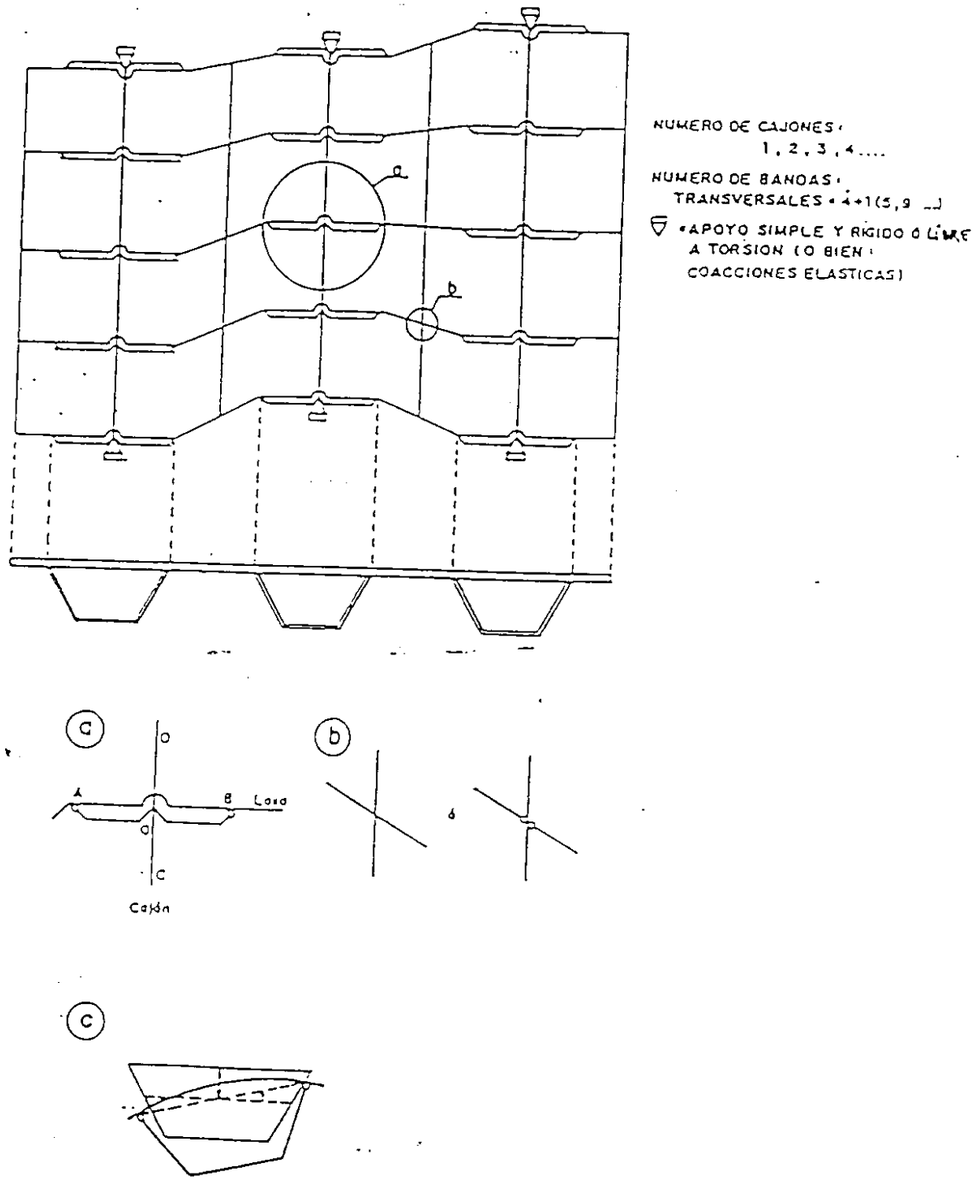
El reparto transversal queda asignado exclusivamente a la losa, ya que no existen diafragmas entre cajones (sin embargo su inclusión nos ofrecería problemas). En la evaluación de las constantes estáticas de los cajones, se incorpora el correspondiente ancho "eficaz" de losa. Se supone que el resto de esta última trabaja de forma independiente; de ahí que figuren barras longitudinal adicionales a los cajones.



Además de las cargas permanentes, se considera una sobrecarga uniforme situada independientemente en diversas franjas longitudinales, más un vehículo en distintas posiciones (según la instrucción española de puentes de carretera). Toda la asignación de cargas, así como la combinación de resultados parciales para la obtención de máximos y mínimos esfuerzos, movimientos y reacciones (con valores concomicantes) es realizada independientemente por el mismo programa.

Dado que este cálculo se realiza en sección compuesta no se introducen en el mismo determinadas cargas como son el peso propio del cajón y de la losa, que actúan en sección simple. El peso propio del cajón y losa se incorpora más tarde, en el cálculo de la viga. En la losa, una vez calculados los esfuerzos debidos a los movimientos del conjunto de la estructura, el programa incorpora, mediante un cálculo independiente, los esfuerzos "propios de la losa", es decir, los que la misma tendría si estuviera rígidamente apoyada sobre las almas de los cajones.

EMPARRILLADO EQUIVALENTE






## 5.2.- Nomenclatura de datos

### 5.2.1. Nomenclatura de datos de la viga

| | |
|---|---|
| Y | Canto de la viga en cm. |
| YG | Distancia en cm. del centro de gravedad de la sección simple bruta de la viga al borde inferior. |
| A1 | Área en $cm^2$ de la sección bruta simple de la viga. |
| IN | Momento de inercia en $cm^4$ de la sección bruta simple. |
| WI | Momento resistente inferior en $cm^3$. |
| WS | Momento resistente superior en $cm^3$. |
| E | Espesor mínimo del ala en $cm^3$. |
| KS | Coeficiente para el cálculo a corte de la armadura del ala superior = (Bsup - E ) / ( 2 * Bsup ), siendo Bsup la base superior. |
| IOV | Momento de inercia torsional. |

### 5.2.2.- Nomenclatura de datos del pretensado.

| | |
|---|---|
| ASI | Área de acero de la armadura inferior de la viga en $cm^2$. |
| EI | Recubrimiento de la armadura inferior de la viga al borde inferior en cm. |
| ASS | Área de acero de la armadura superior de la viga en $cm^2$. |
| ES | Recubrimiento de la armadura superior de la viga al borde superior en cm. |
| KI | Coeficiente de relación del número de torones que existen en el ala inferior de la viga, por fuera del plano de unión de ésta con el alma, con respecto al total de torones. Este coeficiente se utiliza para el cálculo a cortante de la armadura del ala inferior. |
| AS1 | Área de armadura de pretensado no enfundada en la primera zona en $cm^2$. |
| EI1 | Recubrimiento de dicha armadura al borde inferior de la viga. |
| AS2 | Área de armadura de pretensado no enfundada en la segunda zona en $cm^2$. |

EI2 Recubrimiento de dicha armadura al borde inferior de la viga.

**5.2.3.- Nomenclatura de datos de los materiales.**

FCD Resistencia de cálculo minorada del hormigón de la viga.

R Coeficiente de reducción del hormigón de la losa.

FYV Límite elástico minorado del acero de la viga (Kg/cm²).

FYL Límite elástico minorado del acero de la losa (Kg/cm²).

FR0 Tensión de tesado de la armadura de pretensar (Kg/cm²).

FRR Tensión de rotura de la armadura de pretensar (Kg/cm²).

RET Coeficiente de retracción en tanto por mil.

FLU Coeficiente de fluencia.

REL Valor de la relajación de los aceros a tiempo infinito en tanto por mil.

NM Coeficiente de equivalencia acero-hormigón para cargas muertas.

NS Coeficiente de equivalencia acero-hormigón para cargas instantáneas.

CS Coeficiente de seguridad para cargas.

NU Módulo de Poisson.

Si la viga está pretensada con armadura postesa, es preciso dar:

APO Área a descontar debido a la vaina de postensado en cm².

APS Área en acero de la armadura de postensado en cm².

FS0 Tensión inicial de tesado de la armadura postesa en Kg/cm², una vez descontadas las pérdidas por rozamiento.

FSF Tensión final una vez descontadas todas las pérdidas.

FI Diámetro de la vaina de postensado.

C1
C2 Coeficientes de la parábola del cable Y = C1*X2 + C2 estando situados los ejes en el punto inferior del centro de la pieza. Unidades para C1 m/m² y para C2 m.



A continuación se calculan las características de las secciones simple, neta y homogeneizadas necesarias según EP-93 para el cálculo correcto de tensiones.

YG0 Distancia del centro de gravedad de la sección neta (descontando pretensado y postesado) de la viga a su borde inferior en cm.

A0
I0 } Características de la sección citada.

YG0P
A0P
I0P } Características de la sección neta teniendo en cuenta la armadura pretensada homogeneizada con N = NM

YGM
AM
IM
P } Características de la sección simple de la viga una vez homogeneizadas todas las armaduras con N = NM. Si no existiera armadura de postesado los valores 0 coinciden con los valores M.

**5.2.4.- Nomenclatura de datos del tablero.**

ANCH Ancho real del tablero en metros.

DVEI Distancia del eje de la viga extrema izquierda al borde real del tablero en metros. (Si las vigas están uniformemente distribuidas hay que dar este valor totalmente exacto, evitando los decimales periódicos).

DVED Distancia del eje de la viga extrema derecha al borde real del tablero en metros.

L Luz de cálculo del tablero en metros.

LTE Longitud total de la viga en el eje.

NVG Número de vigas del tablero.

AACEDE Ancho de la acera derecha en metros.

AACEDI Ancho de la acera izquierda en metros.

LOS Espesor de la losa en cm.

CM Carga muerta a considerar a efectos del cálculo de la armadura local de flexión del ala superior (Kg/cm²).

PACI Incremento de peso que supone la acera izquierda sobre la carga muerta extendida en todo el tablero. La carga se aplica a una distancia del borde del tablero definida por DPAC.

PACD Incremento de peso que supone la acera derecha sobre la carga muerta extendida en todo el tablero. La carga se aplica a una distancia del borde del tablero definida por DPAC.

DPAC Distancia del punto de aplicación de la carga de aceras al borde real del tablero en metros.

ELI Recubrimiento de la armadura inferior transversal de la losa en cm.

ELS Recubrimiento de la armadura superior transversal de la losa en cm.

TRL Tracción límite admisible bajo todas las cargas en la fibra inferior de la viga en Kg/cm².

### 5.2.5.- Nomenclatura de datos de dibujo.

LM Longitud de la zona macizada de la viga en cm.

LTRAM Longitud de la zona de transición entre el macizado y la sección en cajón, en cm.

LAP Longitud en cm., en que la viga tiene de apoyo a media madera. Caso de no existir apoyo a media madera dar 0.

CPAR Canto parcial de la viga en la sección de apoyo a media madera. Si no existiera apoyo a media madera dar 0.

PEND Pendiente longitudinal en tanto por ciento (%) de la viga, que deberá reflejarse en los extremos.

CU Dimensión de la cuña de apoyo, caso de que la viga tenga pendiente longitudinal.

ESV1, ESV2 Ángulo y dimensión mínima de la viga, caso de extremo biselado.

BEI Ángulo de esviaje del estribo izquierdo, en planta del tablero en grados sexagesimales (90 corresponde a tablero recto).

BED Ángulo de esviaje del estribo derecho en planta, del tablero en grados sexagesimales (90 corresponde a tablero recto).

ENTI Entrega de la viga en el extremo izquierdo del tablero.

ENTD Entrega de la viga en el extremo derecho del tablero.

DAPI Distancia desde el eje izquierdo de la pila o desde el muro de cierre del estribo izquierdo al apoyo de la viga, según la dirección de ésta.



DAPD Distancia desde el eje de la pila derecha o desde el muro de cierre del estribo derecho al apoyo de la viga, según la dirección de ésta.

PTR Pendiente, en tanto por ciento (%) de la sección transversal del tablero según un corte perpendicular al eje de la viga.

ANI Anchura entre ejes de vigas extremas en el estribo derecho, medido perpendicularmente al eje de la viga.

AND Anchura entre ejes de vigas extremas en el estribo derecho, medido perpendicularmente al eje de la viga.

DVIS Distancia del eje de la viga superior, según se dibuja la planta del borde del tablero en el apoyo izquierdo, medida perpendicularmente a la viga.

DVII Distancia del eje de la viga inferior, según se dibuja la planta del borde del tablero en el apoyo izquierdo medida perpendicularmente a la viga.

DVDS Distancia del eje de la viga superior, según se dibuja la planta del borde del tablero en el apoyo derecho, medida perpendicularmente a la viga.

DVDI Distancia del eje de la viga inferior, según se dibuja la planta del borde del tablero en el apoyo derecho, medida perpendicularmetne a la viga.

LMEN Distancia medida paralelamente a los ejes de las vigas entre el punto medio de ANI y AND.

### 5.2.6- Nomenclatura de opciones de cálculo.

OPCIR Opción no utilizada en este programa.

OPMAN Opción no utilizada en este programa.

OPTV Opción no utilizada en este programa.

OPCOR Opción para el cálculo a cortante: si se desea que se calcule todo en zona C, dar -1; en caso contrario, dar otro valor.

OPAL Opción para el cálculo de la armadura de corte del ala superior: -1 si se desea que calcule sólo para cargas actuando en sección simple y arme con barra; -2 para las mismas cargas y armando con cerco; y cualquier otro valor para la totalidad de cargas armando con cerco.

OPD1 Opción para dibujo del plano de planta y sección del tablero, si se desea dar -1; en caso contrario dar cualquier otro valor.

OPDF Opción para dibujo del plano de fabricación de la viga, si se desea dar -1, en caso contrario, dar cualquier otro valor.

OPNEO Opción de cálculo de neopreno, permite calcular más de un neopreno para una viga.

### 5.2.7 Nomenclatura de datos de neoprenos.

BNP Dimensión menor del neopreno en cm.

DNP Dimensión mayor del neopreno en cm.

TNP Espesor total del neopreno en cm.

GNP Espesor de goma del neopreno con la siguiente clave: la parte entera indica el número de capas iguales del neopreno; la parte decimal indicará con dos cifras el espesor en mm. del neopreno. Ejemplo 4.07 indica 4 capas de 7 mm. de espesor.

G Módulo de Young de la goma del neopreno, normalmente 10.

TEMP Máxima oscilación en grados, para el cálculo del alargamiento por temperatura.

CHNP Espesor de cada capa de chapa del neopreno en cm.

SNEO Distancia en cm. entre los dos neoprenos de un mismo apoyo de la viga. Si se da cero se supone un único neopreno.

### 5.2.8.- Datos del emparrillado.

Con los datos indicados en 5.2.1. a 5.2.7., el programa elabora los datos de emparrillado cuya sección es:

Geometría y características mecánicas:

IT Número de barras transversales consideradas normalmente (IT = 1).

EC Módulo de elasticidad del hormigón de la viga en Kg/m².

EL Módulo de elasticidad del hormigón de la losa en Kg/m².

NC Número de cajones.



V1 Voladizo izquierdo (metros).

V2 Voladizo derecho (metros).

X0 Distancia desde el centro de gravedad de la sección simple de la viga al borde superior en cm.

AO Área de la sección simple en $cm^2$.

I0 Inercia de la sección en $cm^4$.

HC Canto del cajón en sección simple en cm.

EB Espesor de cada alma de la sección del cajón en cm.

E0 Espesor del ala inferior del cajón en cm.

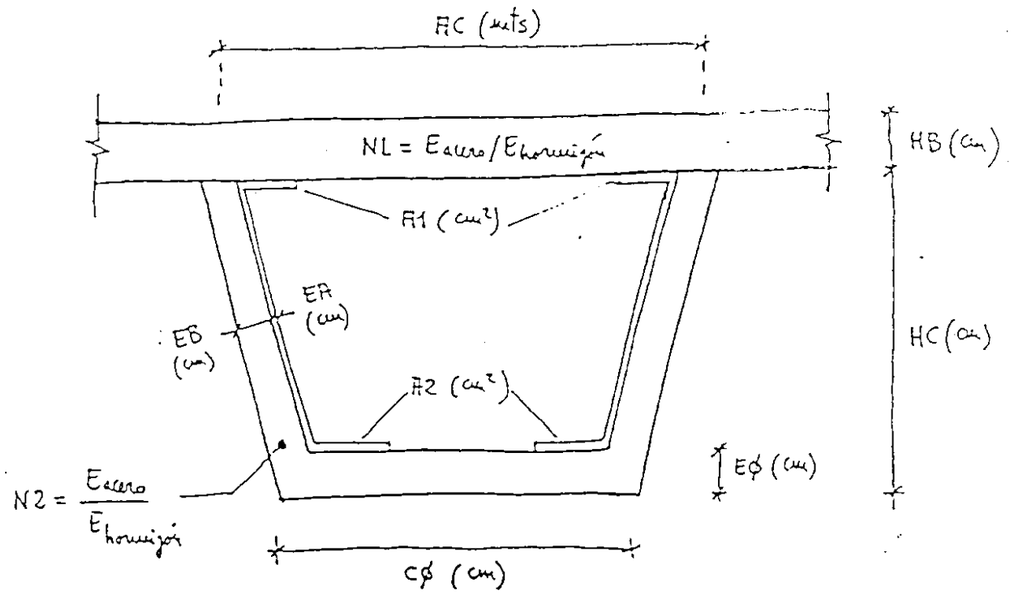
C0 Ancho del ala inferior del cajón en cm.

Ea, A1, A2 Espesor y áreas de posibles chapas de acero en almas y alas superior e inferior

YC Coordenada y (longitudinal) del extremo 1 de cada cajón (metros).

LC Longitud de cada cajón (metros).

AC Ancho superior entre ejes almas (metros).



BC Ancho eficaz de la losa (metros).

SC Interejes (metros) con signo negativo si existe articulación longitudinal en la losa.

IC Momento de inercia ($m^4$) referido al módulo E del acero.

JC Módulo de torsión ($m^4$) referido al módulo G del acero.

HB Canto de la losa (cm).

NL Coeficiente de equivalencia (Es/Ec) hormigón losa.

Coacciones

L1 Coacción elástica al giro longitudinal (mTn/radián) en el extremo 1 de cada cajón.

D1 Coacción elástica al descenso (Tn/m).

T1 Coacción elástica al girar torsor (mTn/radian).

L2,D2,T2 Análogas en extremo 2.

L,D,T = 0 Significa ausencia de coacción

L,D,T = -1 Significa (convencionalmente) coacción infinitamente rígida.

Cargas

PL Peso losa, uniformemente repartido, actuando sobre la viga en sección compuesta (*).

PV Pavimento, uniformemente repartido, actuando sobre la viga en sección compuesta.

P1 Carga lineal (Tn/m) actuando en V1, descontando incidencia de PV.

U1 Distancia de P1 al borde V1.

U2 Distancia de P2 al borde V2.

PC Peso del cajón en Tn/m a lo largo de cada cajón (*).

W1 Distancia límite en m. del centro del vehículo de 60 Tns. al borde V1.

W2 Distancia límite en m. del centro del vehículo de 60 Tns. al borde V2.



AL Rotación, en grados sexagesimales según las agujas del reloj, del eje longitudinal del vehículo respecto del eje de los cajones.

GP Coeficiente de mayoración para cargas permanentes.

GS Coeficiente de mayoración para sobrecargas.

* Si son 0 (cero) no se incluyen en el cálculo del emparrillado, pues la viga no se apea, pero sí el peso de la losa en el cálculo local de ésta.

### 5.3.- Análisis de resultados

El programa obtiene los esfuerzos pésimos de hasta tres vigas simultáneamente; la lateral izquierda, la pésima central, y la lateral derecha. Las condiciones para analizar cada una de estas vigas son:

a) Si los vuelos de la losa son diferentes, se analiza por separado la viga lateral izquierda y derecha, siempre y cuando existan al menos dos vigas.

b) Si hay más de dos vigas se estudia, además, la viga interior pésima.

El programa se puede emplear para el cálculo de tableros con vuelos de la losa iguales o diferentes en cada extremo, lo que se fija por los datos DVEI y DVED, distancias de cada viga extrema al borde del tablero. En el intervalo entre las dos vigas extremas se consideran uniformemente distribuidas el resto.

También se permite el cálculo de tableros con distinto ancho de aceras en cada extremo, así como el de tableros esviados, para lo cual se supone que la primera viga coincide con el eje X (longitudinal) y se pide su longitud, generándose automáticamente los datos de las restantes vigas del tablero.

En el listado de resultados se obtiene, en primer lugar, la envolvente de esfuerzos pésimos mayorados sobre los cajones, con lo cual, el programa determina para cada tipo de viga; interior, exterior, el cajón pésimo y los esfuerzos de armado de losa; a continuación se obtienen de los esfuerzos significativos y sus concomicantes para la acción 2 (valores sin

mayorar) y las sobrecargas tipo CB (uniforme) y CR (vehículo, ambas mayoradas) con lo que es posible obtener las cargas equivalentes por separado para cada acción. Este resumen de esfuerzos y cargas equivalentes que se incluyen en la última hoja del emparrillado, son los valores pasados por este programa al módulo siguiente que realiza el cálculo y comprobación de las vigas a estados límites de servicio y último.

A efectos del cálculo de cortantes y reacciones, se toma siempre el valor pésimo, máximo en valor absoluto, entre el cortante en la barra y la reacción en el apoyo, con ello se evitan los problemas que se pudieran presentar en las proximidades de los apoyos con los cortantes transmitidos por las barras transversales.

El programa obtiene también las cargas pésimas a efectos del cálculo de neoprenos con sus valores máximos y mínimos significativos, y los esfuerzos concomicantes.

Si entre los datos del neopreno se ha dado una separación entre neoprenos distinta de cero, el programa asume la existencia de doble neopreno, empotrando la viga a torsión en los apoyos.

Si se desea hacer el cálculo de la losa sin incrementar los esfuerzos de reparto transversal con los creados a partir del peso propio de la losa, caso, por ejemplo, de que se suponga que estas cargas las soportan las placas de encofrado perdido, basta con dar un valor a PL suficientemente pequeño pero distinto de cero.

**5.4.- Nomenclatura de resultados del emparrillado.**

CAJONES

| | |
|---|---|
| M | Momento flector en m*Tn. |
| Q | Esfuerzo cortante en Tn. |
| T | Momento torsor en m*Tn. |
| F | Flecha en mm. |
| G | Giro longitudinal en milésimas de radián. |
| J | Giro torsor en milésimas de radián. |



A partir de los esfuerzos máximos de cada viga el programa determina las cargas equivalentes, ya afectadas por el reparto transversal, y que producen los mismos efectos.

Para el cálculo de las vigas, el programa no utiliza las longitudes reales que conoce por el cálculo del emparrillado, utiliza el valor de la luz de cálculo que se le ha introducido, esto puede obligar en el caso de puentes con vigas de diferente luz al cálculo de todas aquellas que se estimen por el usuario como significativas, siendo preciso en este caso la introducción manual de datos.

En cambio, el cálculo de las cargas equivalentes afectadas por el reparto transversal entre vigas, se realiza con las longitudes reales, tras haber incorporado aquellas cargas que, por actuar sobre sección simple, no se incluyeron en el cálculo del emparrillado como son los pesos propios de viga y losa.

Por tanto, los valores que figuran bajo el epígrafe "Esfuerzo con las cargas equivalentes de cada viga" pueden no coincidir con los del emparrillado en caso de tableros con longitudes de viga variables.

Los citados esfuerzos sirven para determinar con toda exactitud la viga pésima en tableros vigas de luces iguales, y proporcionan un cálculo del lado de la seguridad para todas las vigas de luz menor o igual que Lc los de longitudes variables.

Las vigas pueden llevar armadura activa pretesa, o pretesa y postesa; la armadura puede tener o no sus zonas extremas parcialmente enfundadas.

A continuación, se describe detalladamente el proceso de cálculo seguido por el programa, indicando las bases teóricas en que se apoya, y el significado de los datos y resultados que figuran en el listado.

## 7.- CÁLCULO A FLEXIÓN

### 7.1.- Descripción General

En primer lugar, el programa analiza las vigas que hasta este momento se han considerado como "de estudio necesario" con objeto de localizar la pésima a flexión. El criterio utilizado

para estimar una viga como pésima, es que en ella aparezcan las máximas tracciones o mínimas compresiones en su fibra inferior.

Los momentos y cortantes debidos al peso propio de la losa, se calculan tomando el ancho real de losa que corresponde a cada viga.

Para calcular las tensiones de la viga bajo las distintas cargas, es preciso obtener primero las pérdidas de tensión de la armadura de pretensado; las fórmulas empleadas para ello se indican en el apartado 7.3. y son las que figuran en la EP-93.

Obtenidas estas tensiones, la máquina calcula las siguientes:

- Tensiones debidas a pretensado inicial. Se calculan con la fuerza de pretensado inicial:

  FRI = FRO-Pérdidas por acotamiento elástico actuando sobre la sección neta.

- Tensiones de pretensado final. Con la fuerza final de pretensado en la misma sección.

- Tensiones de postensado. Con la fuerza de postensado en sección neta respecto a las vainas de postensado y homogeneizada la armadura de pretensado; estas tensiones sólo se calculan si hay postensado OP.

- Tensiones de peso propio de la viga. Sobre sección OP.

- Tensiones de peso propio de losa. Sobre la sección con todas las armaduras homogeneizada con N=NM (M).

- Tensiones de carga muerta. Sobre sección compuesta homogeneizada con N=NM (M).

- Tensiones de sobrecarga. Sobre sección compuesta homogeneizada con N=NS (SC)

La razón del empleo de las distintas secciones de las vigas para el cálculo de las tensiones de pretensado y peso propio, reside en el proceso de fabricación de la viga, la cual se pretensa en el banco, se saca de él y posteriormente se postensa.

Sumando las tensiones antes citadas se obtiene la tensión final de la fibra inferior de la viga que permite decidir cuál de las estudiadas está en peor situación frente a la flexión.



El listado de resultados indica las vigas que se han calculado imprimiéndose, aparte de sus características mecánicas en sección compuesta, la tensión final de la fibra inferior.

Decidida cuál es la viga pésima, se repite el cálculo que se ha indicado anteriormente, imprimiendo para ella la totalidad de los valores anteriormente citados.

**7.2.- Nomenclatura de resultados**

| | |
|---|---|
| SEFIC | Ancho eficaz de losa considerado en los cálculos en en sección compuesta en cm. |
| SCAJ | Ancho de la parte superior de la cabeza, incluyendo el hueco interior en cm. |
| SDER | Semiancho de losa a la derecha de la viga en cm. |
| SIZQ | Semiancho de losa a la izquierda de la viga en cm. |
| S | Separación entre vigas o ancho total del tablero si sólo hay una viga. |
| MPP | Momento debido al peso propio de la viga y losa que actúa en sección simple. |
| MCM | Momento debido a cargas muertas que actúa en sección compuesta en m.Kg. |
| MSOB | Momento debido a sobrecargas que actúan en sección compuesta en m.Kg. |
| TINF | Tensión final debida a pretensado y todas las cargas. |
| MP | Momento de peso propio de la viga en m.kg. |
| ML | Momento de peso propio de la losa en m.Kg. |
| MCM | Momento de carga muerta en m.Kg. |
| MS | Momento de sobrecargas en m.Kg. |
| DT3 | Pérdidas de pretensado debidas al acortamiento elástico del hormigón Kg/cm². |
| FRI | Tensión inicial de pretensado restante en Kg/cm². |
| DTS | Pérdidas de tensión de pretensado debidas al acortamiento elástico del hormigón producido por el postensado en Kg/cm². |
| DT4 | Pérdidas de tensión debidas a la retracción del hormigón en Kg/cm². |

DT5 Pérdidas de tensión debidas a la fluencia del hormigón en kg/cm².

DT6 Pérdidas de tensión debidas a la relajación en Kg/cm².

FRF Tensión final de pretensado en Kg/cm².

A continuación, la máquina escribe un cuadro de tensiones parciales y acumuladas bajo las casillas:

SL Tensión de la fibra superior de la losa.
IL Tensión de la fibra inferior de la losa.
SV Tensión de la fibra superior de la viga.
IV Tensión de la fibra inferior de la viga.

Estas tensiones se escriben para las siguientes fases:
PRET.INIC. Para pretensado inicial sin pérdidas diferidas
PRET.FIN. Para pretensado final con todas las pérdidas
y se calculan sobre sección neta (0)

POST Tensiones bajo postensado final con todas las pérdidas (sólo si existe postensado), se calculan con sección homogeneizada con N = NM, la armadura activa pero neta respecto a la pasiva (OP).

PPROP.VIGA Tensiones debidas al peso propio de la viga actuando sobre la sección OP.

PPROP.LOSA Tensiones debidas al peso propio de la losa actuando sobre la sección M con carga muerta.

CAR.MUERTA Tensiones debidas a la carga muerta actuando sobre la sección S.

SOBRECARGA Tensiones debidas a la sobrecarga actuando sobre la sección S.



**7.3.- Fórmulas utilizadas**

Pérdidas por acortamiento elástico y postensado:

$$\Delta T3 = \sigma cpr \frac{Ap * Ep}{Ecj} \; ; \; \Delta TPS = \sigma cps \frac{Ap * Ep}{Ecj}$$

siendo:

Ap = Área armadura pretensado.

Ep = Módulo delasticidad acero activo = 1800000

Ecj = Módulo de elasticidad instantáneo del hormigón = 19000 fck

$\sigma cp$ = Tensión a la altura de las armaduras debida al pretensado inicial (o al postensado)

Pérdidas por retracción:

$$\Delta T4 = \varepsilon rf * Ep * Ap$$

Pérdidas por fluencia:

$$\Delta T5 = \varepsilon cpg \frac{Ep}{Ec} Ap$$

$\sigma cpg$ = Tensión inicial a nivel de las armaduras debida a pretensado inicial, (Po - Δ T3) y a la totalidad de las cargas permanentes.

Pérdidas por relajación.

$$P6F = \frac{REL}{100} [FPRI - 2 * (\Delta T4 + \Delta T5)]$$

## 8.- CÁLCULO A ROTURA

### 8.1.- Descripción general

En esta parte el programa calcula o puede calcular el diagrama de interacción de una sección cualquiera; esto es la curva axil último - momento último hasta encontrar dos puntos en los que el axil cambie de signo y por interpolación el momento de rotura que corresponde a un axil nulo.

Se consideran las cuatro zonas siguientes:

Zona 1
- Σsup varía de 0.0100 (tracción a 0)
- Σinf = cte = 0.0100

Zona 2
- Σsup varía de 0 a -0.0030 (compresión)
- Σinf = cte = 0.0100

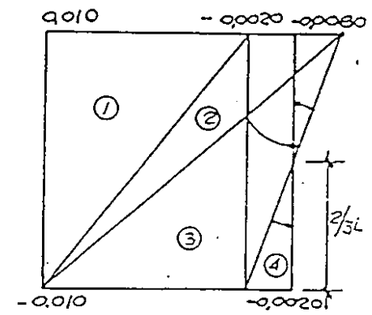
Zona 3
- Σsup = cte = -0.0030
- Σinf varía de 0.0100 a 0

Zona 4
- Σsup varía de -0.0300 a -0.0020
- Σinf varía de 0 a -0.0020

Girando alrededor de 0:

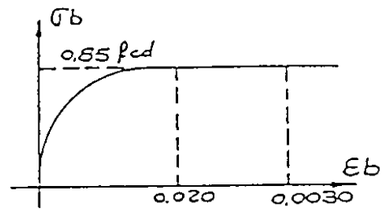
Σ = -0.002; Y = 2/3 h

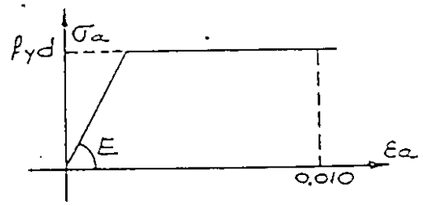





La máquina comienza en el punto divisorio entre las zonas 2 y 3, según el valor que obtenga del esfuerzo axil en ese punto, se mueve adentrándose en la zona conveniente hasta encontrar el punto que tiene axil nulo. El número máximo de puntos a tomar dentro de cada zona es de 20. Los diagramas de tensiones-deformaciones empleados en este programa son los siguientes:

a) Para el hormigón: Diagrama parábola rectángulo con un valor de 0.85 * fcd para una deformación de 0.0020.



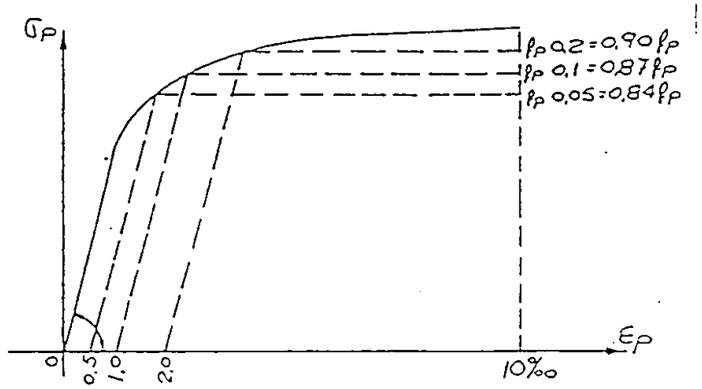




b) Para el acero pasivo: diagrama triangular hasta el valor del límite elástico minorado y rectangular para mayores deformaciones.

c) Para el acero de pretensado el diagrama de cálculo se obtiene minorando el diagrama característico indicado en las normas de CEB-FIP mediante una afinidad oblicua paralela a la recta de Hooke de razón 1 / s, tomando para s = 1.1 (control sistemático del acero).

El diagrama característico está formado por una parte recta y otra curva cuya ecuación es:

$$\Sigma p = \frac{\sigma p}{Ep} + 0.823 \left(\frac{\sigma p}{fpy} - 0.7\right)^5$$




La sección considerada por el programa es la formada por el ancho de losa que corresponde a la viga, según que la viga pésima sea central o no, y por las bases y alturas que se dieron al principio del programa.

Como resistencia del hormigón y de los aceros, se toman los valores de rotura dados al comienzo del programa. Como módulo de eslasticidad se toma 1.800.000 para el acero de pretensado y 2.000.000 para el acero pasivo. Como área de acero y posición de armaduras se toman las que corresponden a la armadura principal de pretensado y postesado en su caso, y como armadura pasiva se toma la que haya obtenido la máquina en el cálculo a fisuración como armadura inferior con un recubrimiento de 3 cm., no considerándose armadura superior pasiva. Como valores de deformaciones iniciales en la armadura de pretensado se toman:

$$\Sigma o = \frac{\text{Tensión final de pretensado}}{\text{Módulo de elasticidad del acero de pretensado}}$$



Una vez calculado el momento de rotura, la máquina lo escribe y lo compara con el necesario, disponiendo, si es preciso, un refuerzo del que se indica su longitud, número de hierros y diámetro.

## 9.- CÁLCULO DE NEOPRENOS

### 9.1.- Descripción general

El cálculo de neoprenos se hace para todas las vigas, determinándose la carga vertical máxima y mínima que se presenta en cualquiera de ellas.

Si se dieron valores de las dimensiones del neopreno distintos de cero, la máquina pasa a comprobar el neopreno introducido, modificando sus dimensiones tanto en planta como altura, si fuese preciso.

En primer lugar, el programa obtiene los desplazamientos y giros debidos a las distintas cargas y sobrecargas, con el criterio de que signos positivos corresponden a acortamientos de la viga.

A partir de estos valores se realiza la comprobación del neopreno, para lo cual, se han seguido básicamente las normas UIC Code 772R publicadas por la Unión Internacional de Ferrocarriles, edición de Enero de 1969, que coinciden casi exactamente con las italianas sobre estos temas, y con las recomendaciones de M.O.P.U. Las comprobaciones realizadas son las siguientes:

- Que la máxima distorsión del neopreno no supera el valor de 0.7.
- Que la tensión bajo el neopreno se encuentra entre los limites de 20 y 150 Kg/cm².

No son causa de variación del neopreno el no cumplimiento de la condición de desplazamiento bajo cargas permanentes y bajo cargas totales en la zona entre neopreno y hormigón de apoyo, pues ésta se puede evitar poniendo el neopreno en un cajetín o pegándolo mediante resina entre la pila y la viga, en todo caso se escribe un aviso

colocando un asterisco (*) al lado de GNP, si esta condición no se cumple. Asimismo, se comprueba también la condición límite de estabilidad del apoyo y se sustituye, tal y como indican las normas ya citadas, la limitación de giro por otra de no levantamiento del borde menos cargado tanto bajo cargas permanentes como bajo las totales.

La suma de las tensiones tangenciales debe ser menor que 5 * G y la suma de deformaciones del neopreno debe a su vez ser menor que:

TAN (ALC) (bajo cargas permanentes)
TAN (ALC) + 1.5 * TAN (ALS) (bajo todas las cargas)

Si el neopreno cumple todas las condiciones exigidas, se escriben sus dimensiones que coincidirán con las de entrada; si por el contrario no se cumplen las condiciones de tensión máxima y mínima, se modifican las dimensiones en planta y si se falla en el resto de las condiciones se aumentará el espesor del neopreno, aumentando el número de capas. En este caso, las dimensiones BNP, DNP, TNT, GNP, no coincidirán con las originales; en todo caso sólo se imprimen los valores de tensión tangencial y deformación que corresponden al neopreno final.

Para el neopreno calculado se imprimen los valores de los movimientos y fuerzas horizontales en el neopreno.

El programa determina las cargas verticales, la excentricidad en fase de contrucción y el máximo desequilibrio de la reacción sobre el valor medio en fase de construcción. A efectos del cálculo de neoprenos, el programa no considera este desequilibrio, dado es posible tomar medidas en obra que impidan su aparición.

**9.2.- Nomenclatura de resultados.**

U1 Movimiento en cm. debido a la retracción del hormigón se toma un valor de $\Sigma r = 1.5/10000$ por estimarse que parte de la retracción se habrá producido en la viga cuando se hormigone la losa.



U2 Movimiento longitudinal en cm. debido a la variación de temperatura según el valor de TEMP que previamente se haya dado con un coeficiente de dilatación térmica $\alpha = 1/100000$.

U3 Acortamiento de la viga en su eje, debido a su pretensado por fenómenos de fluencia.

U4 Movimiento longitudinal del apoyo de neopreno debido al giro que se produce en la viga, a causa de su pretensado por fenómenos de fluencia (AL4).

U5 Movimiento longitudinal en cm. debido al giro que experimenta la viga bajo la acción del peso propio de la viga y losa, teniendo en cuenta la deformación instantánea y la de fluencia.

U´5 Mismo valor anterior debido al peso propio de la viga en el instante inicial. Este valor se descuenta del anterior, pues ya lo tenía la viga en el momento de ser colocada sobre el neopreno.

U6 Movimiento del neopreno debido al giro que experimenta la viga bajo la acción de la carga muerta.

UC Suma de todos los movimientos anteriores que corresponden a la máxima deformación permanente que ha de soportar el neopreno.

US Desplazamiento en cm. debido al giro que experimenta la viga bajo la acción del frenado.

AL4 Giro de la viga debido al pretensado en el instante final, teniendo en cuenta también la deformación inicial.

AL5 Giro de la viga debido al peso propio de losa y viga, teniendo en cuenta tanto la deformación inicial, como la fluencia.

AL6 Giro de la viga debido a la carga muerta con el mismo criterio que el anterior.

ALC Suma de los tres giros anteriores.

ALS Giro debido a la sobrecarga.

TAU1S Tensión tangencial en Kg/cm² debida a las fuerzas verticales bajo todas las cargas.

TAU2S Tensión tangencial debida al esfuerzo horizontal y al giro del neopreno bajo todas las cargas.

SUME1 Sumatoria de la deformación de todas las capas del neopreno bajo las cargas que están relacionadas con las condiciones de no levantamiento del borde menos cargado.

TAU1C Tensión tangencial en Kg/cm² debida a las fuerzas verticales bajo carga permanente.

TAU2C Tensión tangencial en el neopreno debida al esfuerzo horizontal y giro bajo carga permanente.

SUME2 Suma de las deformaciones de todas las cargas bajo carga permanente.

PMIN Carga vertical mínima que se presenta en un neopreno.

PMAX Carga vertical máxima que se presenta en un neopreno.



## 10.- CÁLCULO A CORTANTE

### 10.1.- Descripción general

En líneas generales, el cálculo a cortante se realiza siguiendo la norma EH-91.
El programa comienza eligiendo como viga pésima a esfuerzos transversales, aquella que presenta el máximo cortante, dada la escasa importancia que suelen presentar los momentos torsores, incorporando a esta viga los torsores pésimos, aún en el caso de que se presenten en una viga diferente de la estimada como pésima, e incluso, aunque cada uno de los torsores pésimos se presente en vigas diferentes entre sí. Esta forma garantiza totalmente que el programa calcula a esfuerzos transversales ligeramente del lado de la seguridad.

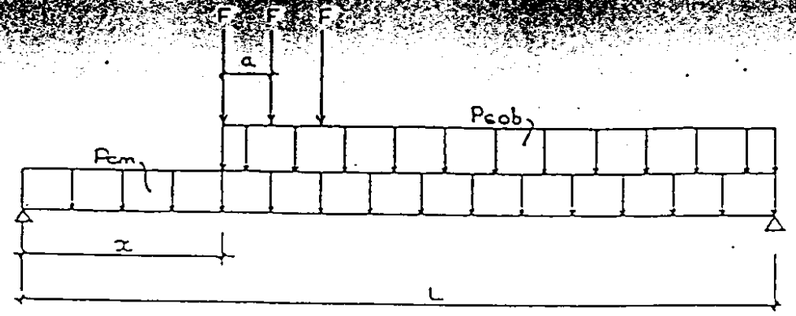
La tensión en la fibra inferior de la viga, debida a momentos mayorados y al pretensado sin mayorar, se compara con la tensión de rotura a tracción. Si la tensión en la viga es menor, nos encontramos en zona AB, y si es igual o mayor, en zona C.

Partiendo del esfuerzo cortante que actúa sobre la sección compuesta, obtenemos la tensión rasante en la fibra de unión entre viga y losa que será:

$$\tau r = \frac{Qsob * Me}{I * br}$$

La armadura rasante se obtiene con las mismas expresiones con las que se obtiene la armadura de corte del alma (ver 10.3), teniendo en cuenta que aquí no podemos contar con la colaboración del pretensado, y tomando sólo las solicitaciones que actúan sobre sección compuesta.

Como cargas actuando sobre la viga se consideran: una carga muerta PCM igual al peso propio de viga más losa, actuando sobre la sección simple de la viga; una sobrecarga PSOB cuya reacción en el extremo es igual al cortante QSOB obtenido por la máquina, 3 cargas F situadas a una distancia A del punto de cálculo cuyo cortante en el apoyo es igual al cortante debido al vehículo calculado por la máquina.




La armadura de rasante de ala en el ala inferior se calcula de acuerdo con la CEB, para ello el programa obtiene el esfuerzo de deslizamiento longitudinal en los planos de conexión ala-alma. Las cuantías mínimas dispuestas coinciden con las indicadas en la misma norma.

El programa calcula las armaduras necesarias de metro en metro restreando con un error menor de 0.10 el primer punto donde aparece la zona C y calcula los puntos límites de las zonas de enfundado con la armadura de pretensado menor de las dos que delimitan la zona.

El programa está también pensado para obtener una armadura real que cumpla con las áreas en cm²/m teóricas necesarias que se han obtenido en el programa de corte. Esta armadura, así como todos los detalles que definen el plano de fabricación y el del tablero, puede ser dibujada si se quiere.

### 10.2.- Nomenclatura de resultados

| | |
|---|---|
| Y | Canto de la viga en cm. |
| YG | Distancia del centro de gravedad de la sección al borde inferior en cm. |
| A | Área de la sección en cm². |
| I0 | Momento de inercia de la viga en cm⁴. |
| E | Espesor del alma en cm. |
| S | Separación entre ejes de vigas en cm. |
| LOS | Espesor de la losa en cm. |
| R | Coeficiente de reducción del ancho de losa. |
| YC | Canto de la sección compuesta de la viga en cm. |
| YGC | Distancia del centro de gravedad de la sección compuesta al borde inferior en cm. |



| | |
|---|---|
| AC | Área de la sección compuesta bruta en cm². |
| I0C | Momento de inercia de la sección compuesta bruta de la viga en cm⁴. |
| FI | Fuerza inferior final de pretensado en Kg. |
| FS | Fuerza superior final de pretensado en Kg. |
| EI | Distancia del centro de gravedad de la armadura inferior al borde inferior de la viga. |
| ES | Distancia del centro de gravedad de la armadura superior al borde superior de la viga. |
| FCD | Resistencia de cálculo del hormigón en Kg/cm². |
| FYD | Resistencia de cálculo a tracción de la armadura pasiva en Kg/cm² < 4.200 Kg/cm². |
| PP | Carga permanente que actúa sobre la sección simple en Kg/m. |
| PCM | Carga permanente que actúa sobre la sección compuesta en Kg/m. |
| PSOB | Sobrecarga que actúa sobre la sección compuesta en Kg/m. |
| F | Carga puntual para un tren de tres cargas iguales y equidistantes. |
| B | Distancia entre las cargas puntuales el tren de cargas. |
| LCAL | Luz de cálculo de la viga en metros. |
| CS | Coeficiente de seguridad de las cargas. |
| OPALA | Opción del programa para el cálculo de la armadura de la cabeza superior. |
| KS | Coeficiente para el cálculo a corte de la armadura del ala superior = (Bsup-E) / (2 * Bsup) siendo Bsup la base superior. |
| KI | Coeficiente de relación del número de torones que existen en el ala inferior de la viga por fuera del plano de unión de ésta con el alma, con respecto al total de torones. Este coeficiente se utiliza para el cálculo a cortante de la armadura del ala inferior. |
| BRAS | Ancho de contacto entre la losa "in situ" y la cabeza superior en cm = Bsup - 15. |
| HSUP/2 | Semiespesor del ala superior de la viga en cm. |
| V | Distancia del punto de cálculo de la tensión cortante al borde superior de la viga en cm. |

| | |
|---|---|
| X | Distancia del apoyo a la sección de cálculo en m. |
| MPP | Momento que actúa sobre sección simple en m.Kg. |
| MSOB | Momento que actúa sobre sección compuesta debido a la carga muerta, sobrecarga repartida y sobrecarga debida al tren de cargas en m.Kg. |
| QPP | Cortante que actúa sobre sección simple en Kg. |
| QSB | Cortante que actúa en sección compuesta debido a la carga muerta, sobrecarga repartida y sobrecarga debida al tren de cargas en m.Kg. |
| MTOR | Momento torsor que actúa en la sección de referencia debido a la carga muerta, sobrecarga repartida y sobrecarga debida al tren de cargas en m.Kg. |
| VRD | Cortante mayorado de cálculo en Kg. |
| VU1 | Cortante de agotamiento de la sección de hormigón en Kg. |
| TUD | Momento torsor de mayorado en m.Kg. |
| TU1 | Momento torsor de agotamiento de la sección compuesta en m.Kg. |
| COEF | Coeficiente de agotamiento para tener en cuenta la actuación simultánea de esfuerzos de torsión y corte (se aplica la fórmula de la CEB). |
| ZONA | Indica el estado de fisuración dentro del que aparece el agotamiento por esfuerzo cortante. |
| TRAS | Tensión rasante en la fibra de unión entre viga y losa en Kg/cm². |
| MLOC | Momento local de flexión del ala superior debido a cargas permanentes y sobrecarga uniforme en cm.Kg/m. |
| ASUP | Armadura superior de la viga por unión ala-alma en cm²/m. |
| AINF | Armadura inferior de la viga por unión ala-alma en cm²/m. |
| ALOS | Armadura en la losa por unión ala-alma en cm²/m. |
| ATOR | Armadura transversal de torsión en cm²/m. |
| ALTS | Armadura longitudinal en la losa debida a torsión en cm²/m. |
| ALTA | Armadura longitudinal en las almas debida a la torsión en cm²/m. |
| ALTI | Armadura longitudinal en el ala inferior debida a la torsión en cm²/m. |
| ARAS | Armadura de rasante en cm²/m. |
| ALOC | Armadura debida a la flexión local en cm²/m. |



**10.3.- Fórmulas utilizadas.**

Las comprobaciones a realizar son:

$$Vrd <= Vu1$$
$$Vrd <= Vu2$$

siendo:

$$Vu1 = 0{,}6 * fcd * \operatorname{sen}\theta * \cos\theta * bo * d1$$
$$Vu2 = Vsu + Vcu$$

$$Vcu = Vcuo \left[1 + \frac{Mo}{Md} * (2 - \operatorname{cotg}\theta)\right] * \left[1 - \frac{Vrd}{3 * Vcuo} * (\operatorname{cotg}\theta - 1)\right]$$

con $1 + \frac{Mo}{Md} (2 - \operatorname{cotg}\theta) <= 2$ en zona C

$$\operatorname{cotg}\theta = \sqrt{1 + \frac{6 * d}{fctk}}$$

en zona AB $Vcu = Vcuo$

$$Vcuo = 0.50 * fcd * bo * dz$$

$$Vsu = At/t * 0.9 * d * fyd * \operatorname{cotg}\theta \quad (0.5 <= \operatorname{cotg} <= 2 \text{ en zona C})$$

Como armadura mínima se considera:

$$\frac{At}{t} = \frac{(0.02 * fck * b)}{fyd}$$

La armadura de la cabeza superior según la regla de cosido será:

$$A = Vrd * \frac{b - bw}{2 * b} * \frac{1}{0.80 * Y * fyd * \operatorname{cotg}\theta}$$

La armadura de ala inferior se calcula según el articulado de la CEB.

Cuantías mínimas: Según el artículo 18.1.1.2.

Para Acero fyk = 5100 Kg/cm²
Hormigón con fck de 400 a 500 Kg/cm²

Amin = 0013 * Área ala inferior

Para Acero fyk = 5100 Kg/cm²
Hormigón con fck de 250 a 350 Kg/cm²

Amin = 0011 * Área ala inferior

Cálculo de la armadura necesaria: Según el artículo 11.3.3:

$$Vrd2 = \frac{Asf}{sf} fyd + 2.5\ Trd\ hf$$

siendo:

| | |
|---|---|
| Vrd2 | Cortante mayorado de cálculo |
| Asf | Armadura necesaria |
| sf | Separación entre armaduras |
| fyd | Resistencia de cálculo del acero |
| Trd | Valor deducido del cuadro 11.1 de la CEB |

| fck | 120 | 160 | 200 | 250 | 300 | 350 | 400 | 450 | 500 |
|---|---|---|---|---|---|---|---|---|---|
| Trd | 1.8 | 2.2 | 2.6 | 3.0 | 3.4 | 3.8 | 4.2 | 4.6 | 5.0 |

hf Espesor del ala

Para calcular el valor de Vrd2 se obtiene la tensión a nivel del centro de gravedad del ala inferior para posteriormente deducir el esfuerzo de deslizamiento longitudinal que actúa por unidad de longitud.



## 11.- CÁLCULOS ADICIONALES EN RELACIÓN CON LA ARMADURA DE LA LOSA

### 11.1. Descripción general

Hasta este momento y a efectos del cálculo de la losa sólo se han tenido en cuenta los efectos de los momentos torsores y flectores de cálculo debidos a las cargas que actúan en la losa. En este punto se comprueba la losa como formando parte de la viga teniendo en cuenta las necesidades de ésta:

a) Armaduras precisas a torsión
b) Armaduras por rasante del ala

Para ambas armaduras, de acuerdo con la bilbiografía existente, se admite que es posible considerar la mitad de la capa con mayor armadura mas la totalidad de la capa menos armada. Si ni aún así fuese posible cumplir las condiciones impuestas por estos efectos, el programa procede a aumentar el armado en la dirección correspondiente.

El programa corrije si es preciso el armado de la losa imprimiendo en este caso el correspondiente aviso.

## 12.- RECUBRIMIENTOS DE ARMADURDAS Y CARACTERÍSTICAS DE HORMIGÓN CONSIDERADAS EN LOS CÁLCULOS.

### 12.1. Recubrimientos

Se ha utilizado como recubrimiento mínimo de armaduras pasivas 2.00 cm. y de armaduras activas (según plano).

**12.2. Materiales**

Los componentes del hormigón son:

| | |
|---|---|
| Cemento | P-450 ARI |
| Grava | 10-20 mm. |
| Gravilla | 2.5-10 mm. |
| Arena | 0-2.5 mm. |
| Plastificante | |

La relación agua/cemento (incluido el platificante) se ajusta para obtener una consistencia del cono de ABRAMS entre 6 y 8 y la resistencia indicada.

La confirmación y aceptación de estos recubrimientos y materiales quedan a criterio del proyectista y la dirección facultativa. Asimismo, el proyectista y la dirección facultativa marcarán el criterio de protección superficial de las vigas (a realizar por terceros) suministradas por PACADAR y el mantenimiento de las mismas, en función de la situación de dichas vigas y la agresividad del medio ambiente donde vayan a estar ubicadas.

**12.3.- Contraflecha**

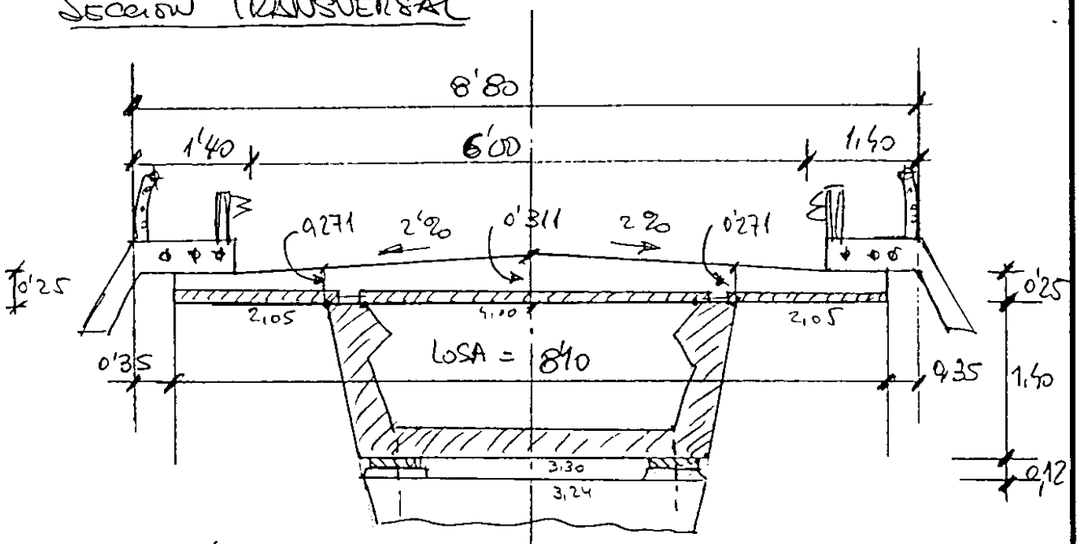
La contraflecha inicial de la viga, en cm. se indica en los cálculos bajo la denominación CFI. Este valor inicial aumenta con el tiempo bajo el efecto de la fluencia.



PACADAR | ESTUDIO: 21.898 | OBRA: LINEA DE ALTA VELOCIDAD TRAMO: MADRID-ZARAGOZA SUBTRAMO: X V | FECHA: | HOJA: 1

ESTRUCTURA: "E-1511.3" y "E-1514.2".-

SECCIÓN TRANSVERSAL




-Ancho = 8'10 m.

-Sobrecarga = IAP-98

-Acera = 1'05 m.

-Peso hormigón + tubo + barrera + Valla ≃ 823'50 kg/ml + 50 kg/ml = 873'50 kg/ml ≃ 900 kg/ml

-Aglomerado = 6 cm

-C. Fuerza = 2300 x 0'06 = 138 kg/m²; Tomando según la "IAP-98" el valor superior (+ 50%) 138 x 1'50 = 207 kg/m²

-PAC = 900 - (207 x (1,40 - 0'40)) = 693 kg/ml ≃ 700 kg/ml

-DPAC = 0'25 m

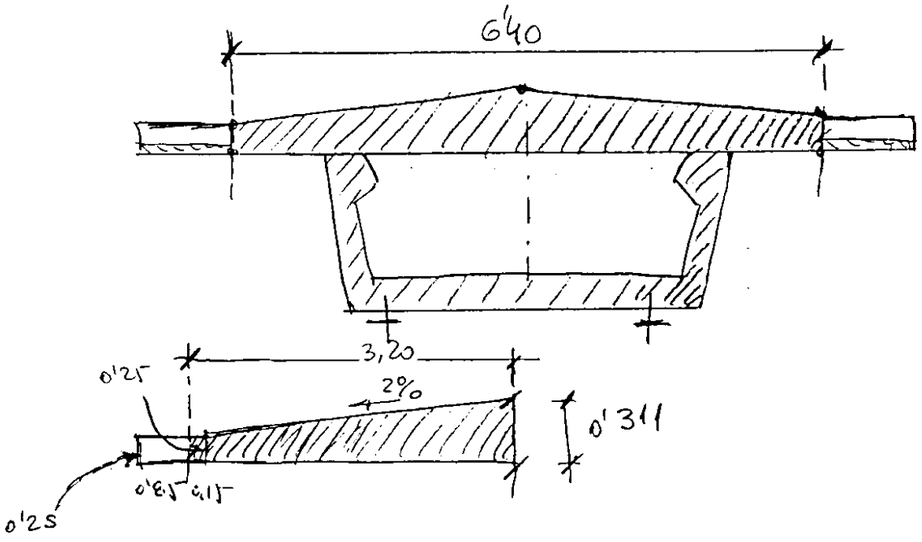
-Losa = Variable de 0'25 a 0'311 ⇒ de cálculo = 27 cm

| | VANOS LATERALES | VANO CENTRAL |
|---|---|---|
| Lc = | 18'65 m. | 30'39 m |
| LT = | 19'29 m. | 31'03 m |

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 2

# FASES DE HORMIGONADO DE LA LOSA.-

## Fase 1ª.- Los 6'40 m centrales de la losa




- pp viga = 3181'77 kg/ml
- pp losa = 2.500 × [(0'25 × 0'15) + ((0'25 + 0'311)/2) × 3'05] × 2 = 4465'13 "

pp(v+l) = 7.646'30 kg/ml

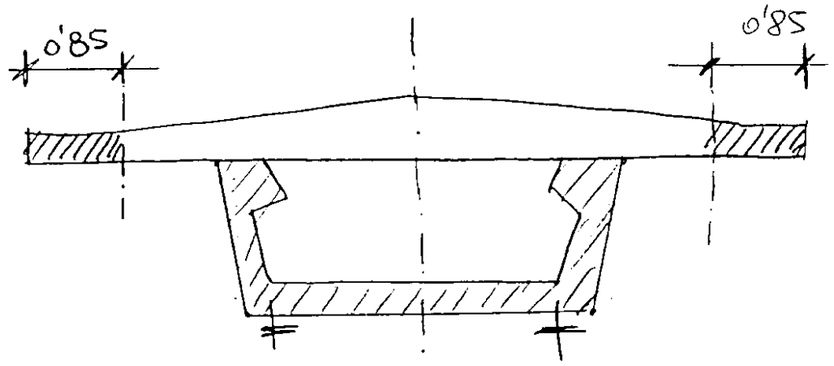
- p.c. permanente
  - Resto losa = 2.500 × (2 × 0'85 × 0'25) = 1.062'50 kg/ml
  - Resto c. muertas = 3076,70 "

p.c. perman = 4139'20 kg/ml

- p sobrec I - - 3.240 kg/ml
- p. sobrec II - 20.000 kg/ml

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 3

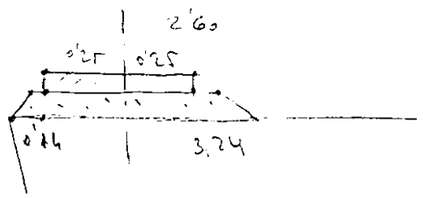
## FASE 2ª.- Los 0'85 m laterales de la losa




Frenado = 1/20 × (60 + 0'40 × 6'10 × 69'09) = 11.429 kg.

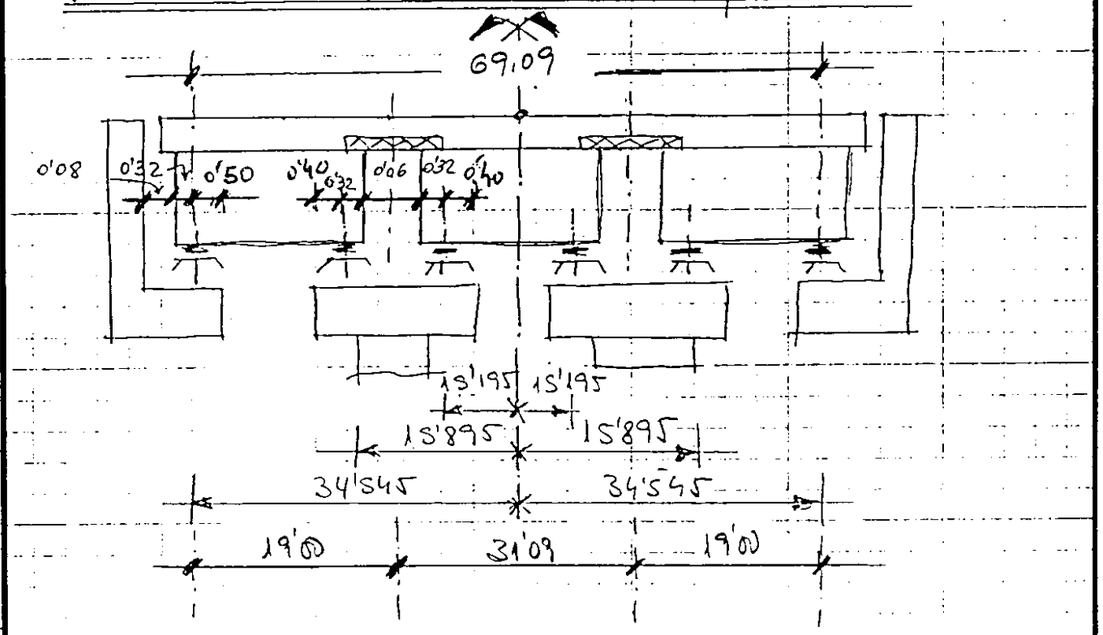
Fmínimo = 20 × b = 20 × 6'10/10 = 12'20 Tn < 14'00

Pa neopreno = 14.000/12 = 1167 kg/neop



| Grupo PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 4 |

# DETALLES DE APOYOS EN ESTRIBOS y PILAS.-



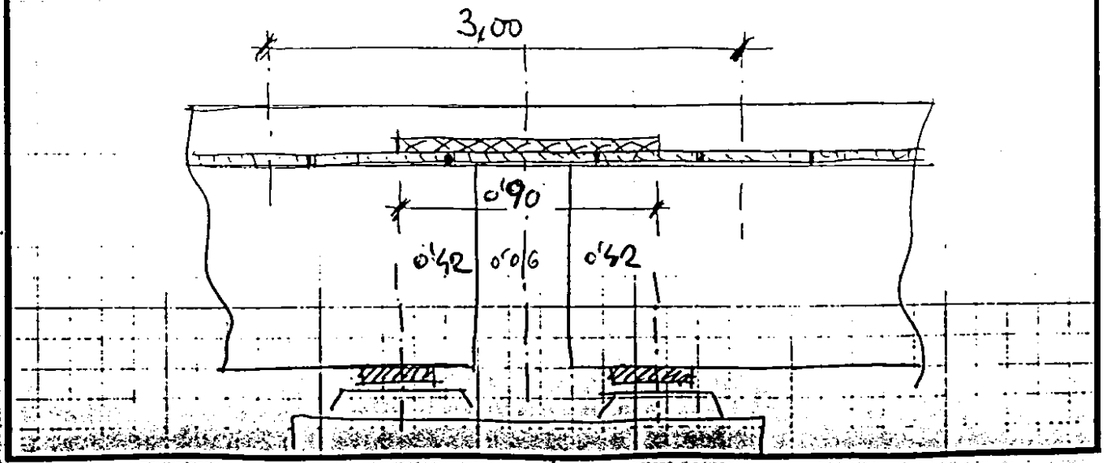

- Apoyos de Neoprenos -

- Para Lneop = 15'20 m ⇒ 250 × 500 × 41

" " = 15'90 m = "

" " = 34'55 m ⇒ 250 × 500 × 52

- Continuidad de losa -




ESTUDIO: 24785

DATOS DE LA VIGA CAJON-330.140.20(463)

FICHERO:CAJONES5

DATOS DE FORMA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BASES EXTERIORES | 330.00 | 339.00 | 68.60 | 40.00 | 40.00 | 93.90 | 98.02 |
| BASES INTERIORES | 0.00 | 0.00 | 270.40 | 304.80 | 339.90 | 296.20 | 301.98 |
| ALTURAS | 18.00 | 0.00 | 11.60 | 70.20 | 20.40 | 19.82 | |

| Y | YG | A | In | Ws | Wi | E | Rs |
|---|---|---|---|---|---|---|---|
| 140.00 | 51.10 | 12724.67 | 29927363.45 | 336634.67 | 585680.52 | 41.00 | .30 |

DATOS PRETENSADO

| Asi | Ei | Ass | Es | Ki | As1 | Ei1 | As2 | Ei2 |
|---|---|---|---|---|---|---|---|---|
| 126.000 | 7.347 | 5.600 | 10.500 | .500 | 103.600 | 6.816 | 114.800 | 7.137 |

DATOS MATERIALES

| Fcd | B | Fyv | Fyl | Fzo | Frr | Ret | Flu | Fel | Nc | Ns | Usp | Css | Ni |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 240.71 | .79 | 4434.34 | 4434.78 | 14800.00 | 15545.45 | .25 | 2.00 | 4.00 | 11 - | 5.0 | 1.15 | 1.50 | 0.00 |

CARACTERISTICAS HOMOGENEIZADAS

| Yg | Ac | Io | Ygop | Aop | Iop | Ygs | As | Is | Ygm | Am | Im |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 140.00 | 18555.83 | 23570381.17 | 47.32 | 14138.71 | 32624146.45 | 47.34 | 13332.27 | 31158000.38 | 47.32 | 14138.71 | 32624146.45 |

## CALCULO GENERAL DE VIGAS

DATOS TABLERO

| ANCH | DVEI | DVED | L | LTE | LMED | NVG | ACEI | ACED | LOS | ELI | ELS | BRAS | PASIO | AINTC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.10 | 4.05 | 4.05 | 30.39 | 31.03 | 31.03 | 1.00 | 1.05 | 1.05 | 27.00 | 8.00 | 2.50 | 58.02 | 5.16 | 46473.37 |

| CM | PACI | PACD | DPAC | TRL | PE | LAP | CPAR | APOY | NAPO | EEI | EED |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 207 | 700.00 | 700.00 | .25 | -60.00 | 5500.00 | 0.00 | 0.00 | 0.00 | 0.00 | 90.00 | 90.00 |

OPCIONES

| OPCIR | OPMAN | OPTV | OPCOR | OPAL | OPD1 | OPDF | OPNEO |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | -2.00 | 0.00 | 0.00 | -1.00 |

NEOPRENO

| BNP | DNP | TNP | GNP | CHNP | G | TEMP . | SNEO |
|---|---|---|---|---|---|---|---|
| 25.00 | 50.00 | 4.10 | 3.05 | .30 | 10.00 | 30.00 | 250.00 |

RESUMEN DE RESULTADOS PARA ENLACE CON TENSCAJ
Valores caracteristicos (Kg/m,mTn.)

VIGAS EXTERIORES

| TIPO DE CARGA | CARGAS VIRTUALES Flexion | Corte |
|---|---|---|
| Peso propio | 7646.300 | 7646.300 |
| Permanentes | 4139.200 | 4139.200 |
| Sobrecarg.I | 3240.000 | 3240.000 |
| Sobrecarg.II | 20000.000 | 20000.000 |
| Torsor apoyo | 135.405 | 135.405 |
| Torsor L/4 | 91.097 | 91.097 |
| Torsor L/2 | 53.020 | 53.020 |

DATOS DE LAS CARGAS EXCENTRICAS

SOBRECARGA EXCENTRICA.....= 1620.000 Kg/m.
Brazos de las cargas respecto al eje del tablero:
Brazo de las CARGAS PUNTUALES ....= 1.50 m.
Brazo de la SOBRECARGA EXCENTRICA.= 2.03 m.

CARGAS PESIMAS EN EXTREMOS
Solo validas a efectos del calculo de neoprenos
Valores caracteristicos (Tn,mTn.)

| EXTERIOR | Reaccion | Torsor |
|---|---|---|
| Rperm..... | 183.441 | 0.000 |
| Rmax..... | 292.299 | 85.558 |
| Rmin..... | 183.441 | 0.000 |
| T.Rmax..... | 267.084 | 135.405 |
| T.Rmin..... | 183.441 | 0.000 |

## CALCULO DE LAS ARMADURAS DE FLEXION DE LA LOSA

**DATOS PARA EL CALCULO:**

VUELO IZQUIERDA:229.51 cm.
VANO CENTRAL...:350.99 cm.
VUELO DERECHA..:229.51 cm.

**MOMENTOS FLECTORES:(Valores sin mayorar)**

A LA IZQUIERDA:

Permanentes.....: -3.75 mt.
Sobrecarga.....: -1.13 mt.
Carro(Extremo)..: -7.48 mt.
Carro(Resto)....: -3.74 mt.

EN VANO CENTRAL

Permanentes.....: -2.40 mt.
Sobrecarga.....: .62 mt.
Carro(Extremo)..: 6.74 mt.
Carro(Resto)....: 4.27 mt.

A LA DERECHA:

Permanentes:....: -3.75 mt.
Sobrecarga.....: -1.13 mt.
Carro(Extremo)..: -7.48 mt.
Carro(Resto)....: -3.74 mt.

**ARMADO DE LA LOSA POR FLEXION**

EN APOYO(L/8)

| Armadura | Md(mt) | Teorica | Real |
|---|---|---|---|
| Trans.inf. | 8.63 | 11.11 | 10.12 |
| Trans.sup. | -17.98 | 18.38 | 9.16 |
| Long. inf. | 0.00 | 4.62 | 9.08 |
| Long. sup. | 0.00 | 5.52 | 7.10 |

ARMADO EN EL RESTO DE LA LOSA

| Armadura | Md(mt) | Teorica | Real |
|---|---|---|---|
| Trans.inf. | 4.93 | 6.11 | 8.10 |
| Trans.sup. | -12.37 | 12.19 | 6.16 |
| Long. inf. | 0.00 | 2.82 | 6.08 |
| Long. sup. | 0.00 | 3.66 | 7.08 |

## CALCULO DE LA ESTABILIDAD

RESULTADOS
(T,mT)

MOMENTOS VOLCADORES:

| | Pesos | Momentos |
|---|---|---|
| LOSA..... | 58.84 | 82.37 |
| ACERA..... | 21.79 | 55.57 |
| CARGA MUERTA..... | 18.04 | 25.26 |
| SOBRECARGA UNIFORME. | 34.87 | 48.81 |
| CARRO..... | 60.00 | 15.00 |
| FUERZA HORIZONTAL... | 19.09 | 26.27 |

MOMENTOS ESTABILIZADORES:

| | Pesos | Momentos |
|---|---|---|
| LOSA..... | 111.37 | 295.12 |
| ACERA..... | 21.79 | 110.04 |
| CARGA MUERTA..... | 34.15 | 90.50 |
| VIGA..... | 109.71 | 137.14 |

Coef. mayoracion acciones permanentes.....=1.154
Coef. minoracion acciones permanentes.....= .900
Coef. mayoracion sobrecargas.....=1.500

MOMENTO VOLCADOR MAYORADO.....Mv= 323.43 mT.
MOMENTO ESTABILIZADOR MINORADO...Me= 569.53 mT.

SE CUMPLE QUE Me>Mv , LUEGO HAY ESTABILIDAD.

ELECCION VIGA PESIMA A FLEXION

SECCIONES COMPUESTAS

| | SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| VIGAS EXTERIORES | 645.96 | 104.35 | 26513.36 | 100158387.1 | 93.80 | 27897.40 | 112086922.9 | 102.33 | 27120.96 | 105534400.9 |

MOMENTOS FLECTORES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=31.33

| VIGA | SCAJ | SDER | SIZQ | S | MP | MV | MSOB | TINF |
|---|---|---|---|---|---|---|---|---|
| EXTERIORES | 400.00 | 205.00 | 205.00 | 810.00 | 882719.65 | 477845.86 | 799888.60 | -25.13 |

CALCULO VIGA PESIMA A FLEXION

DATOS DE LUCES Y CARGAS DE CALCULO

DATOS DE ESFUERZOS

| FI | FCM | FSOB | F | B | Lc | Csp | Css | MP | ML | MCM | MS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7.61 | 4139.20 | 3240.00 | 20000.00 | 1.50 | 30.33 | 1.35 | 1.50 | 882719.65 | 515472.87 | 477845.86 | 799888.6 |

SECCIONES COMPUESTAS

| | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|
| VIGAS EXTERIORES | 104.35 | 26513.36 | 100158387.1 | 93.80 | 27897.40 | 112086922.9 | 102.33 | 27120.96 | 105534400.9 |

PERDIDAS PRETENSADO

| DTI | FRI | DTS | DTA | DTS | DTA | FRP |
|---|---|---|---|---|---|---|
| 1362.44 | 13437.56 | 0.00 | 450.01 | 916.32 | 424.27 | 11490.68 |

TENSIONES

| | PARCIALES | | | | ACUMULADAS | | | |
|---|---|---|---|---|---|---|---|---|
| | SL | IL | SV | IV | SL | IL | SV | IV |
| PRET INIC | 0.00 | 0.00 | -65.67 | 261.45 | 0.00 | 0.00 | -65.67 | 261.45 |
| PRET FIN | 0.00 | 0.00 | -56.01 | 222.97 | 0.00 | 0.00 | -56.01 | 222.97 |
| PPROP.VIGA | 0.00 | 0.00 | 104.33 | -83.06 | 0.00 | 0.00 | 48.32 | 139.71 |
| PPROP.LOSA | 0.00 | 0.00 | 146.44 | -74.76 | 0.00 | 0.00 | 194.77 | 64.95 |
| CAR.MUERTA | 28.65 | 17.14 | 17.14 | -42.55 | 28.65 | 17.14 | 211.91 | 52.40 |
| SOB.CASI-PERM | 9.81 | 5.72 | 5.72 | -15.51 | 38.46 | 22.85 | 217.63 | 36.89 |
| SOB.FRECUENTE | 24.52 | 14.29 | 14.29 | -38.77 | 53.17 | 31.43 | 226.19 | 13.63 |
| SOB.CARACT. | 49.04 | 28.58 | 28.58 | -77.54 | 77.69 | 45.71 | 240.48 | -25.13 |

FISURACION C2 COMPROBADA

CALCULO A ROTURA

| | |
|---|---|
| MOMENTO DE ROTURA | 3182693.30 |
| MOMENTO NECESARIO | 3036596.20 |

ELECCION VIGA PESIMA A CORTANTE

SECCIONES COMPUESTAS

| | SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| VIGAS EXTERIORES. | 810.00 | 110.09 | 30014.43 | 1078403928.5 | 105.79 | 31338.47 | 1212701341.1 | 108.15 | 30622.03 | 1138765144 |

ESFUERZOS CORTANTES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=30.39

| VIGA | SCAJ | SDER | SIZQ | S | QP | QM | QSCB | VRD |
|---|---|---|---|---|---|---|---|---|
| EXTERIORES | 400.00 | 235.00 | 235.00 | 810.00 | 116185.53 | 62895.14 | 136270.30 | 401164.36 |

CALCULO NEOPRENO

DESPLAZAMIENTOS

| U0 | U1 | U2 | U3 | U4 | U5 | U'5 | U6 | UC | US |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | .23 | .46 | .26 | .45 | -1.21 | .17 | -.39 | 1.12 | .11 |

GIROS

| AL4 | AL5 | AL6 | ALC | ALS |
|---|---|---|---|---|
| -.0218 | .0236 | .0035 | .0053 | .0018 |

COMPROBACIONES

| TAU1S | TAU2S | SUME1 | TAU1C | TAU2C | SUME2 |
|---|---|---|---|---|---|
| 26.792 | 19.020 | .018 | 10.566 | 13.362 | .009 |

NEOPRENO COMPROBADO

| BNP | DNP | TNP | GNP | LNEOP | HS | PTLONG |
|---|---|---|---|---|---|---|
| 25.000 | 50.000 | 4.100 | 3.080 | 15.210 | 1167.000 | 0.000 |

| Pmin. | Pmax. | Sneo. |
|---|---|---|
| 81463.17 | 185620.83 | 260.00 |

ACORTAMIENTOS Y FUERZAS HORIZONTALES EN LOS NEOPRENOS

| CAUSA | | DESPL +acort (cm) | FUERZA (Kgr.) |
|---|---|---|---|
| Debido a acortamientos en el eje por fluencia, retraccion y temperatura.. | Max | .943 | 4921.16 |
| | Min | .032 | 168.03 |
| Debido a giros de pretensado, peso propio y cargas permanentes..... | | -.983 | -5119.56 |
| Debido a giros de sobrec. uniforme.. | | -.192 | -1060.28 |
| Debido a giros del tanque..... | | -.096 | -992.41 |
| Debido a esfuerzos de frenado..... | Max | .112 | 1167.00 |
| | Min | -.112 | -1167.00 |
| Suma pesima positiva (Ver nota)..... | | .074 | 668.2.. |
| Suma pesima negativa (Ver nota)..... | | -1.243 | -8171.61 |

NOTA.- Suma solo valida para distancia entre punto medio entre juntas y eje de neopreno= 15.210 y sin considerar la influencia de la flexibilidad de pilas o estribos

MAXIMO CORTANTE VERTICAL POR EXTREMO DE VIGA = 267442.90 Kg

VIGAS EXTERIORES (Esf. por neopr.)

REACCION EN FASE DE CONSTRUCCION..... = 67308.251 Kg
EXCENTRICIDAD EN FASE DE CONSTRUCCION..... = 0.000 cm
MAXIMO DESEQ. DE LA REACCION SOBRE VALOR MEDIO = 0.000 Kg

CALCULO VIGA PESIMA A CORTANTE

DATOS VIGA SECCION SIMPLE Y COMPUESTA (cm)

| Y | YG | A | I | E | OP | SEF | LOS | R | YC | YGC | AC | IC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140.00 | 51.10 | 12724.67 | 29327363.45 | 40.00 | 0.00 | 810.00 | 27.00 | .79 | 167.01 | 110.00 | 30014.43 | 107840928.49 |

PRETENSADO Y MATERIALES (kg y cm)

| FI | FS | EI | ES | FCD | FYD | PP | PCM | PSOB | P | B | LCAL | CSP | CSS | OPAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1443960.00 | 64170.00 | 7.35 | 10.50 | 285.71 | 4200.00 | 7646.30 | 4139.20 | 3240.00 | 20000.00 | 1.50 | 30.39 | 1.35 | 1.50 | -2.00 |

DATOS LUCES Y CARGAS (kg y m)

DATOS ALAS

| KS | KI | BFAS | HSUP/2 | Y |
|---|---|---|---|---|
| .296 | .500 | 58.020 | 16.650 | 40.200 |

ENFUNDADOS

| F1 | EI1 | X1 | F2 | EI2 | X2 |
|---|---|---|---|---|---|
| 1147256.00 | 6.82 | 6.42 | 1315[illegible] | 7.11 | 1.11 |

RESULTADOS ESFUERZOS

| X | MPP | MSB | QPP | QMAX | TCON | QCON | TMAX | VRD | VU1 | TUD | TU1 | COEF | ZONA | TRAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.0 | 0.0 | 116185.5 | 169165.4 | 85558 | 144549.5 | 135405 | 410598.6 | 549202.3 | 128336.6 | 1265713.1 | .85 | AB | 20.2 |
| 1.00 | 112362.4 | 101109.3 | 108539.2 | 159865.2 | 82596 | 136842.7 | 129217 | 386325.8 | 484585.3 | 123894.4 | 1149549.1 | .91 | AB | 19.1 |
| 2.00 | 217078.5 | 192109.7 | 100892.9 | 150671.6 | 79635 | 129189.1 | 123137 | 362212.9 | 451769.9 | 119452.1 | 1149549.1 | .91 | AB | 18.0 |
| 3.00 | 314148.2 | 273321.2 | 93246.6 | 141584.6 | 76673 | 121588.8 | 117165 | 338259.9 | 425636.5 | 115009.9 | 1149549.1 | .89 | AB | 16.9 |
| 4.00 | 403571.7 | 345063.5 | 85600.3 | 132604.2 | 73712 | 114041.9 | 111301 | 314466.8 | 404765.3 | 110567.6 | 1149549.1 | .87 | AB | 15.9 |
| 5.00 | 485348.9 | 407656.5 | 77954.0 | 123730.5 | 70750 | 106548.2 | 105544 | 290833.6 | 387929.5 | 106125.4 | 1149549.1 | .84 | C | 14.8 |
| 6.00 | 559479.8 | 461420.1 | 70307.7 | 114963.3 | 67789 | 99107.9 | 99896 | 267360.4 | 374229.5 | 101683.1 | 1149549.1 | .80 | C | 13.7 |
| 7.00 | 625964.3 | 506674.1 | 62661.4 | 106302.8 | 64827 | 91720.8 | 94356 | 244047.1 | 361207.5 | 97240.9 | 1149549.1 | .76 | C | 12.7 |
| 8.00 | 684802.6 | 543738.2 | 55015.1 | 97748.8 | 61866 | 84387.1 | 88923 | 220893.7 | 350534.5 | 92798.6 | 1149549.1 | .71 | C | 11.7 |
| 9.00 | 735994.6 | 572932.5 | 47368.8 | 89301.5 | 58904 | 77106.7 | 83599 | 197900.2 | 343194.8 | 88356.4 | 1149549.1 | .65 | C | 10.7 |
| 10.00 | 779540.3 | 594576.6 | 39722.5 | 80960.8 | 55943 | 69879.6 | 78382 | 175066.6 | 337263.1 | 83914.1 | 1149549.1 | .59 | C | 9.7 |
| 11.00 | 815439.7 | 608990.6 | 32076.2 | 72726.7 | 52981 | 62705.7 | 73274 | 152393.0 | 332561.9 | 79471.9 | 1149549.1 | .53 | C | 8.7 |
| 12.00 | 843692.7 | 616494.1 | 24429.9 | 64599.2 | 50020 | 55585.2 | 68273 | 129879.3 | 328961.3 | 75029.6 | 1149549.1 | .46 | C | 7.7 |
| 13.00 | 864299.5 | 617407.0 | 16783.6 | 56578.4 | 47058 | 48518.0 | 63381 | 107525.5 | 326367.8 | 70587.4 | 1149549.1 | .39 | C | 6.7 |
| 14.00 | 877260.0 | 612049.2 | 9137.3 | 48664.1 | 44097 | 41504.2 | 58598 | 85331.6 | 324718.1 | 66145.1 | 1149549.1 | .32 | C | 5.8 |
| 15.00 | 882574.2 | 600740.6 | 1491.0 | 40856.5 | 41135 | 34543.6 | 53919 | 63297.7 | 323973.9 | 61702.9 | 1149549.1 | .25 | C | 4.9 |
| 4.90 | 477515.3 | 401799.8 | 78718.7 | 124613.0 | 71046 | 107295.2 | 106115 | 293189.7 | 389459.4 | 106569.6 | 1149549.1 | .85 | C | 14.9 |
| 6.38 | 565337.4 | 479390.9 | 67437.0 | 111693.3 | 66677 | 96328.2 | 97803 | 258588.8 | 369757.4 | 100015.3 | 1149549.1 | .79 | C | 13.4 |
| 7.80 | 643673.8 | 536981.9 | 56540.7 | 99447.0 | 62457 | 85846.1 | 89998 | 225500.4 | 353794.6 | 93684.9 | 1149549.1 | .72 | C | 11.9 |

RESULTADOS ESFUERZOS LOCALES

- En ala superior ..... : Md= 475.27 m*kgr/m. Asup= .28 cm2. Ainf= 0.00 cm2.
- En alma :Hacia el exterior... : Md= 1212.81 m*kgr/m. Aint= 1.55 cm2. Aext= 0.00 cm2.

RESULTADOS ARMADO (CORTANTE MAXIMO)

| X | Asup | Ainf | Alos | Acor | Ator | Alts | Alta | Alti | Aras |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 9.87 | 26.64 | 9.78 | 52.77 | 4.77 | 4.07 | 3.89 | 3.89 | 33.20 |
| 1.00 | 6.82 | 25.08 | 7.01 | 29.49 | 4.55 | 3.88 | 3.71 | 3.71 | 31.43 |
| 2.00 | 4.77 | 23.52 | 5.62 | 23.89 | 4.34 | 3.70 | 3.54 | 3.54 | 18.55 |
| 3.00 | 3.73 | 21.98 | 4.72 | 19.93 | 4.13 | 3.52 | 3.37 | 3.37 | 15.90 |
| 4.00 | 3.04 | 20.43 | 4.08 | 16.88 | 3.92 | 3.34 | 3.20 | 3.20 | 13.72 |
| 5.00 | 3.31 | 18.90 | 3.60 | 21.89 | 3.72 | 3.17 | 3.03 | 3.03 | 18.23 |
| 6.00 | 2.99 | 17.36 | 3.35 | 20.11 | 3.52 | 3.00 | 2.87 | 2.87 | 16.37 |
| 7.00 | 2.66 | 15.84 | 3.10 | 18.38 | 3.33 | 2.83 | 2.71 | 2.71 | 14.75 |
| 8.00 | 2.34 | 14.32 | 2.85 | 16.64 | 3.13 | 2.67 | 2.56 | 2.56 | 13.28 |
| 9.00 | 2.01 | 12.80 | 2.61 | 14.88 | 2.95 | 2.51 | 2.41 | 2.41 | 11.92 |
| 10.00 | 1.69 | 11.29 | 2.36 | 13.03 | 2.76 | 2.35 | 2.25 | 2.25 | 10.36 |
| 11.00 | 1.36 | 9.79 | 2.12 | 10.70 | 2.56 | 2.20 | 2.11 | 2.11 | 8.46 |
| 12.00 | 1.04 | 8.29 | 1.88 | 8.38 | 2.41 | 2.05 | 1.96 | 1.96 | 7.62 |
| 13.00 | .71 | 6.80 | 1.64 | 6.07 | 2.23 | 1.90 | 1.82 | 1.82 | 7.62 |
| 14.00 | .39 | 5.32 | 1.40 | 3.77 | 2.07 | 1.76 | 1.68 | 1.68 | 7.62 |
| 15.00 | .06 | 3.85 | 1.17 | 1.47 | 1.92 | 1.62 | 1.55 | 1.55 | 7.62 |
| 4.90 | 3.34 | 19.05 | 3.63 | 22.07 | 3.74 | 3.17 | 3.05 | 3.05 | 18.43 |
| 6.38 | 2.86 | 16.79 | 3.26 | 19.45 | 3.46 | 2.94 | 2.81 | 2.81 | 15.73 |
| 7.80 | 2.40 | 14.62 | 2.90 | 16.97 | 3.17 | 2.70 | 2.59 | 2.59 | 13.55 |

ARMADURA MINIMA ALMA 7.62

CALCULOS A TORSOR SOLO VALIDOS EN SECCION CERRADA.

RESULTADOS ARMADO (TORSOR MAXIMO)

| X | Asup | Ainf | Alos | Acor | Ator | Alts | Alta | Alti | Aras |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 9.87 | 29.27 | 11.45 | 58.87 | 3.02 | 2.57 | 2.46 | 2.46 | 36.86 |
| 1.00 | 6.82 | 27.54 | 8.19 | 32.92 | 2.91 | 2.48 | 2.37 | 2.37 | 34.72 |
| 2.00 | 4.77 | 25.82 | 6.55 | 26.68 | 2.81 | 2.39 | 2.29 | 2.29 | 34.61 |
| 3.00 | 3.73 | 24.11 | 5.50 | 22.28 | 2.70 | 2.30 | 2.20 | 2.20 | 32.52 |
| 4.00 | 3.04 | 22.42 | 4.74 | 18.91 | 2.60 | 2.21 | 2.12 | 2.12 | 17.03 |
| 5.00 | 3.31 | 20.73 | 4.19 | 24.02 | 2.49 | 2.13 | 2.03 | 2.03 | 21.17 |
| 6.00 | 2.99 | 19.06 | 3.89 | 22.08 | 2.39 | 2.04 | 1.95 | 1.95 | 18.99 |
| 7.00 | 2.66 | 17.40 | 3.60 | 20.19 | 2.28 | 1.95 | 1.86 | 1.86 | 17.09 |
| 8.00 | 2.34 | 15.75 | 3.31 | 18.30 | 2.18 | 1.86 | 1.78 | 1.78 | 15.38 |
| 9.00 | 2.01 | 14.11 | 3.02 | 16.40 | 2.08 | 1.77 | 1.69 | 1.69 | 13.80 |
| 10.00 | 1.69 | 12.48 | 2.74 | 14.50 | 1.97 | 1.68 | 1.61 | 1.61 | 12.34 |
| 11.00 | 1.36 | 10.86 | 2.46 | 12.36 | 1.87 | 1.59 | 1.52 | 1.52 | 10.48 |
| 12.00 | 1.04 | 9.26 | 2.19 | 9.89 | 1.76 | 1.50 | 1.44 | 1.44 | 8.44 |
| 13.00 | .71 | 7.67 | 1.91 | 7.41 | 1.66 | 1.41 | 1.35 | 1.35 | 7.62 |
| 14.00 | .39 | 6.06 | 1.65 | 4.95 | 1.55 | 1.32 | 1.27 | 1.27 | 7.62 |
| 15.00 | .06 | 4.51 | 1.38 | 2.52 | 1.45 | 1.24 | 1.18 | 1.18 | 7.62 |
| 4.90 | 3.34 | 20.90 | 4.22 | 24.21 | 2.50 | 2.13 | 2.04 | 2.04 | 21.40 |
| 6.38 | 2.86 | 18.43 | 3.78 | 21.35 | 2.35 | 2.00 | 1.92 | 1.92 | 18.24 |
| 7.80 | 2.40 | 16.08 | 3.36 | 18.66 | 2.20 | 1.88 | 1.79 | 1.79 | 15.69 |

## COMPROBACION DE LA LOSA A CORTANTE

DATOS PARA EL CALCULO

VUELO IZQUIERDA ..... 191.50 cm.
VUELO DERECHA ..... 191.50 cm.
VANO INTERIOR AL CAJON .. 274.98 cm.

CORTANTES (Sin mayorar y en T.)

| | Vpp | Vcm | Vsb | Vac | Vc |
|---|---|---|---|---|---|
| VUELO IZQUIERDA ..... | 1.29 | .37 | .71 | .70 | 5.68 |
| VUELO DERECHA ..... | 1.29 | .37 | .71 | .70 | 5.68 |
| VANO INTERIOR AL CAJON .. | .93 | .26 | .50 | 0.00 | 6.07 |

RESULTADOS

| | Vd(t) | Astsup(cm2) | Vu2a(t) | Aparte(cm2) |
|---|---|---|---|---|
| VUELO IZQUIERDA ..... | 12.78 | 12.06 | 13.35 | 0.00 |
| VUELO DERECHA ..... | 12.78 | 12.06 | 13.35 | 0.00 |
| VANO INTERIOR AL CAJON .. | 11.45 | 12.06 | 13.35 | 0.00 |

ARMADURAS

- No se modifica la armadura existente.
- No se necesita armadura por cortante.

ARMADURA FINAL DE LA LOSA

| | Arm. transversal | | Arm. longitudinal | |
|---|---|---|---|---|
| | Inferior | Superior | Inferior | Superior |
| L/8 | 10d12 | 9d16 | 9d 8 | 7d10 |
| L/4 | 8d10 | 6d16 | 6d 8 | 7d 8 |
| L/4 | 8d10 | 6d16 | 6d 8 | 7d 8 |
| L/4 | 8d10 | 6d16 | 6d 8 | 7d 8 |
| L/8 | 10d12 | 9d16 | 9d 8 | 7d10 |

Puede sustituirse la ARMADURA SUPERIOR por la siguientes MALLAS ELECTROSOLDADAS:

| | TRANS | LONG |
|---|---|---|
| L/8 | d 16 a 10 | d 10 a 12.5 |
| L/4 | d 16 a 15 | d 8 a 12.5 |
| L/4 | d 16 a 15 | d 8 a 12.5 |
| L/4 | d 16 a 15 | d 8 a 12.5 |
| L/8 | d 16 a 10 | d 10 a 12.5 |

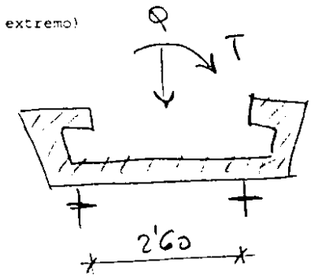
PLACAS DE ENCOFRADO PERDIDO

Placa entre cajones.....
Placa cubriendo cajones..... ..... GA-60.33.7

CFI= 7.276

## RESUMEN DE REACCIONES

(sin mayorar y por extremo)




DATOS DE CARGAS MAXIMAS (EXTREMO ANTERIOR):

| | | TABLERO UNA SOLA VIGA Q Tn. | T mTn |
|---|---|---|---|
| * | Peso prop.+ Perm. | * 182.852 | 0.000 |
| | Sobrec.unif (Qmax) | 50.269 | 0.000 |
| | Sobrec.unif (Tmax) | 25.134 | 49.847 |
| | Vehiculo (Qmax) | 57.038 | 85.558 |
| | Vehiculo (Tmax) | 57.038 | 85.558 |

DATOS DE CARGAS MAXIMAS (EXTREMO POSTERIOR):

| | | TABLERO UNA SOLA VIGA Q .Tn. | T mTn |
|---|---|---|---|
| | Peso prop.+ Perm. | * 182.852 | 0.000 |
| | Sobrec.unif (Qmax) | 50.269 | 0.000 |
| | Sobrec.unif (Tmax) | 25.134 | 49.847 |
| | Vehiculo (Qmax) | 57.038 | 85.558 |
| | Vehiculo (Tmax) | 57.038 | 85.558 |

CARGAS PUNTUALES EN LA VIGA ( Ver desglose en hoja de calculo de neoprenos):

( ESTUDIO: Dieg36 La: 30.39 Lmax: 31.75 )

* Peso total viga = 112'26 Tn
3'18117 × 31'03 = 98'71 "

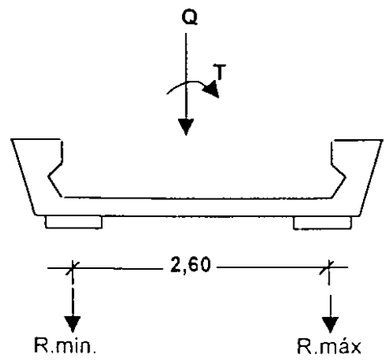
$$\frac{13'55}{2}\ Tn. + 182'85 = 189.62\ Tn/extremo$$

## RESUMEN DE REACCIONES.- ( Sin mayorar y por extremo )

**VANO CENTRAL**

| | Q ( Tn.) | T.( mTn.) |
|---|---|---|
| - Peso propio + c.perman. = | 189,62 | 0,00 |
| - Sobrec. Unifor. ( Q.max. ) = | 50,27 | 0,00 |
| - Sobrec. Unifor. ( T.max. ) = | 25,14 | 49,85 |
| - Vehiculo ( Q.max. = | 57,04 | 85,56 |
| - Vehiculo ( T.max. ) = | 57,04 | 85,56 |

Separación de neoprenos = **2,60** m.




### A ). - VERTICALES

**Reacción Máxima.- ( Sin mayorar y por neopreno )**

- R.c.permanentes = 189,62 / 2 + 0,00 / 2,60 = 94,81 Tn.
- R.sobrec. Uniforme = 50,27 / 2 + 0,00 / 2,60 = 25,14 Tn.
- R.sobrec. Uniforme = 25,14 / 2 + 49,85 / 2,60 = 31,74 Tn.
- R.vehiculo = 57,04 / 2 + 85,56 / 2,60 = 61,43 Tn.

**R.máxima = 187,98 Tn.**

**Reacción Mínima- ( Sin mayorar y por neopreno )**

- R.c.permanentes = 189,62 / 2 - 0,00 / 2,60 = 94,81 Tn.
- R.sobrec. Uniforme = 50,27 / 2 - 0,00 / 2,60 = 25,14 Tn.
- R.sobrec. Uniforme = 25,14 / 2 - 49,85 / 2,60 = -6,60 Tn.
- R.vehiculo = 57,04 / 2 - 85,56 / 2,60 = -4,39 Tn.

**R.mínima = 83,82 Tn.**

ESTUDIO: 24.785
TITULO: E-1511.3 y E-1514.2 (VANOS LATERALES)
TRAMO: MADRID-ZARAGOZA SUBTRAMO: XV

FECHA: 6-06-00

## ANEJO DE CALCULO DEL TABLERO DE VIGAS CAJON

### 1. DATOS GENERALES

**1.1 Seccion transversal (Datos para el calculo)**

| | | |
|---|---|---|
| Ancho total plataforma ..... | 8.80(Real) | 8.10 Calc. |
| Ancho de las aceras (sin trafico). | 1.40(Real) | 1.05 (Calc.izq) |
| | | 1.05 (Calc.dch) |

**1.2 Seccion longitudinal**

Tramo isostatico

| | |
|---|---|
| Luz de calculo ..... | 18.65 m. |
| Longitud de la viga ..... | 19.29 m. |

**1.3 Planta**

| | |
|---|---|
| Esviaje ..... | 90.00 ° |
| Radio curvatura ..... | RECTO |

### 2. SOLUCION ADOPTADA

El tablero esta formado por vigas prefabricadas pretensadas sobre las que se vierte hormigon fabricado in situ para formar la losa de compresion

| | |
|---|---|
| Tipo de viga ..... | CAJON-330.140.20 |
| Canto de la viga ..... | 1.40 m. |
| Canto de la losa ..... | .27 m. |
| Numero de vigas ..... | 1 |
| Separacion entre vigas ..... | 0.000 m. |

Las caracteristicas de la viga figuran en el listado de resultados

### 3. ACCIONES A CONSIDERAR

| | |
|---|---|
| Peso propio de la viga ..... | 3181.17 Kg/m |
| Peso propio de la losa ..... | 675.00 Kg/m2. |
| Carga muerta ..... | 207.0 Kg/m2. |
| Carga adicional en bordes debida a aceras .. | 700.00 Kg/m. |
| Sobrecarga ..... | IAP-98 |

### 4. CARACTERISTICAS DE LOS MATERIALES Y COEFICIENTES DE SEGURIDAD SEGUN EP.-93

**4.1 Hormigon de la viga**

| | |
|---|---|
| Resistencia caracteristica a los 28 dias .....>= | 400 Kgr/cm2 |
| Nivel de control intenso (prefabricacion) .....= | 1.4 |

**4.2 Hormigon de la losa**

| | |
|---|---|
| Resistencia caracteristica a los 28 dias .....>= | 250 Kgr/cm2 |
| Nivel de control normal (fabricacion in situ)...= | 1.5 |

**4.3 Acero de pretensado en viga**

| | |
|---|---|
| Tension de rotura .....>= | 19000 Kgr/cm2 |
| Limite elastico al 0.2 .....>= | 17100 Kgr/cm2 |
| Nivel de control intenso (prefabricacion) .....= | 1.1 |

**4.4 Acero pasivo en viga**

| | |
|---|---|
| Limite elastico .....>= | 5100 Kgr/cm2 |
| Nivel de control intenso (prefabricacion) .....= | 1.1 |

**4.5 Acero pasivo en la losa**

| | |
|---|---|
| Limite elastico .....>= | 5100 Kgr/cm2 |
| Nivel de control normal (fabricacion in situ)...= | 1.15 |

**4.6 Acciones**

Cargas permanentes .....= 1.35 Sobrecargas .....= 1.50

ESTUDIO: 24785

DATOS DE LA VIGA CAJON-330.140.20(463)

FICHERO:CAJONES5

DATOS DE FORMA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BASES EXTERIORES | 330.00 | 339.00 | 68.60 | 40.00 | 40.00 | 93.90 | 98.02 |
| BASES INTERIORES | 0.00 | 0.00 | 270.40 | 304.80 | 339.90 | 296.20 | 301.98 |
| ALTURAS | 18.00 | 0.00 | 11.60 | 70.20 | 20.40 | 19.80 | |

| Y | YG | A | In | Ws | Wi | E | Ks |
|---|---|---|---|---|---|---|---|
| 140.00 | 51.10 | 12724.67 | 29327363.45 | 336634.87 | 585680.52 | 40.00 | .30 |

DATOS PRETENSADO

| Asi | Ei | Ass | Es | Ki | Asl | Eil | As2 | Ei2 |
|---|---|---|---|---|---|---|---|---|
| 64.400 | 5.000 | 5.600 | 10.500 | .500 | 64.400 | 5.000 | 64.400 | 5.000 |

DATOS MATERIALES

| Fcd | R | Fyv | Fyl | Fr0 | Frr | Ret | Flu | Rel | Nm | Ns | Cap | Css | Nu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 285.71 | .79 | 4636.36 | 4434.78 | 14800.00 | 15545.45 | .25 | 2.00 | 4.00 | 11.80 | 5.90 | 1.35 | 1.50 | 0.00 |

CARACTERISTICAS HOMOGENEIZADAS

| Yg0 | A0 | I0 | Yg0p | A0p | I0p | Yga | As | Ia | Ygm | An | Im |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51.36 | 12634.86 | 29706782.13 | 49.12 | 13460.86 | 31676094.15 | 50.20 | 13047.86 | 30707691.74 | 49.12 | 13460.86 | 31676034.15 |

## CALCULO GENERAL DE VIGAS

DATOS TABLERO

| ANCH | DVEI | DVED | L | LTE | LMED | NVG | ACEI | ACED | LCS | ELI | ELS | BRAS | PASIO | AINTO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.10 | 4.05 | 4.05 | 18.65 | 19.29 | 19.29 | 1.00 | 1.05 | 1.05 | 27.00 | 8.00 | 2.50 | 59.02 | 5.15 | 46473.37 |

| CM | PACI | PACD | DPAC | TRL | PE | LAP | CPAR | APOY | NAPO | BEI | BED |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 207 | 700.00 | 700.00 | .25 | -60.00 | 5500.00 | 0.00 | 0.00 | 0.00 | 0.00 | 90.00 | 90.00 |

OPCIONES

| OPCIR | OPMAN | OPTV | OPCOR | OPAL | OPD1 | OPDF | OPNEO |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | -2.00 | 0.00 | 0.00 | -1.00 |

NEOPRENO

| BNP | DNP | TNP | GNP | CHNP | G | TEMP | SNEO |
|---|---|---|---|---|---|---|---|
| 25.00 | 50.00 | 4.10 | 3.08 | .30 | 10.00 | 30.00 | 260.00 |



RESUMEN DE RESULTADOS PARA ENLACE CON TENSCAJ

Valores caracteristicos (Kg/m,mTn.)

VIGAS EXTERIORES

| TIPO DE CARGA | CARGAS VIRTUALES Flexion | Corte |
|---|---|---|
| Peso propio | 7646.300 | 7646.300 |
| Permanentes | 4139.200 | 4139.200 |
| Sobrecarg.I | 3240.000 | 3240.000 |
| Sobrecarg.II | 20000.000 | 20000.000 |
| Torsor apoyo | 113.352 | 113.352 |
| Torsor L/4 | 77.469 | 77.469 |
| Torsor L/2 | 45.409 | 45.409 |

DATOS DE LAS CARGAS EXCENTRICAS

SOBRECARGA EXCENTRICA.....= 1620.000 Kg/m.
Brazos de las cargas respecto al eje del tablero:
Brazo de las CARGAS PUNTUALES ....= 1.50 m.
Brazo de la SOBRECARGA EXCENTRICA.= 2.03 m.

CARGAS PESIMAS EN EXTREMOS

Solo validas a efectos del calculo de neoprenos
Valores caracteristicos (Tn,mTn.)

| EXTERIOR | Reaccion | Torsor |
|---|---|---|
| Rperm..... | 114.260 | 0.000 |
| Rmax..... | 203.036 | 82.761 |
| Rmin..... | 114.260 | 0.000 |
| T.Rmax..... | 187.330 | 113.352 |
| T.Rmin..... | 114.260 | 0.000 |

## CALCULO DE LAS ARMADURAS DE FLEXION DE LA LOSA

**DATOS PARA EL CALCULO:**

VUELO IZQUIERDA:229.51 cm.
VANO CENTRAL...:350.99 cm.
VUELO DERECHA..:229.51 cm.

**MOMENTOS FLECTORES:(Valores sin mayorar)**

A LA IZQUIERDA:

| | |
|---|---|
| Permanentes.....: | -3.75 mt. |
| Sobrecarga.....: | -1.13 mt. |
| Carro(Extremo)..: | -7.48 mt. |
| Carro(Resto)....: | -3.74 mt. |

EN VANO CENTRAL

| | |
|---|---|
| Permanentes.....: | -2.40 mt. |
| Sobrecarga.....: | .62 mt. |
| Carro(Extremo)..: | 6.74 mt. |
| Carro(Resto)....: | 4.27 mt. |

A LA DERECHA:

| | |
|---|---|
| Permanentes:....: | -3.75 mt. |
| Sobrecarga.....: | -1.13 mt. |
| Carro(Extremo)..: | -7.48 mt. |
| Carro(Resto)....: | -3.74 mt. |

**ARMADO DE LA LOSA POR FLEXION**

EN APOYO(L/8)

| Armadura | Md(mt) | Teorica | Real |
|---|---|---|---|
| Trans.inf. | 8.63 | 11.11 | 10.12 |
| Trans.sup. | -17.98 | 18.38 | 9.16 |
| Long. inf. | 0.00 | 4.62 | 9.08 |
| Long. sup. | 0.00 | 5.52 | 7.10 |

ARMADO EN EL RESTO DE LA LOSA

| Armadura | Md(mt) | Teorica | Real |
|---|---|---|---|
| Trans.inf. | 4.93 | 6.11 | 8.10 |
| Trans.sup. | -12.37 | 12.19 | 6.16 |
| Long. inf. | 0.00 | 2.82 | 6.08 |
| Long. sup. | 0.00 | 3.66 | 7.08 |

## CALCULO DE LA ESTABILIDAD

RESULTADOS
(T,mT)

MOMENTOS VOLCADORES:

| | Pesos | Momentos |
|---|---|---|
| LOSA..... | 36.32 | 50.39 |
| ACERA..... | 13.57 | 34.27 |
| CARGA MUERTA..... | 11.14 | 15.45 |
| SOBRECARGA UNIFORME. | 21.52 | 29.86 |
| CARRO..... | 60.00 | 13.50 |
| FUERZA HORIZONTAL... | 11.88 | 16.36 |

MOMENTOS ESTABILIZADORES:

| | Pesos | Momentos |
|---|---|---|
| LOSA..... | 69.69 | 185.56 |
| ACERA..... | 13.57 | 68.88 |
| CARGA MUERTA..... | 21.37 | 56.91 |
| VIGA..... | 72.36 | 92.27 |

Coef. mayoracion acciones permanentes.....=1.154
Coef. minoracion acciones permanentes.....= .900
Coef. mayoracion sobrecargas.....=1.500

MOMENTO VOLCADOR MAYORADO.....Mv= 205.10 mT.
MOMENTO ESTABILIZADOR MINORADO...Me= 363.25 mT.

SE CUMPLE QUE Me>Mv , LUEGO HAY ESTABILIDAD.

**ELECCION VIGA PESIMA A FLEXION**

SECCIONES COMPUESTAS

| | SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| VIGAS EXTERIORES. | 645.98 | 104.35 | 26513.36 | 100158387.1 | 101.94 | 27249.55 | 106722410.2 | 103.28 | 26836.55 | 103078688.9 |

MOMENTOS FLECTORES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=18.65

| VIGA | SCAJ | SDER | SIZQ | S | MP | MM | MSOB | TINF |
|---|---|---|---|---|---|---|---|---|
| EXTERIORES | 400.00 | 205.00 | 205.00 | 810.00 | 332444.40 | 179963.36 | 390618.11 | 6.08 |

CALCULO VIGA PESIMA A FLEXION

DATOS DE LUCES Y CARGAS DE CALCULO

| PP | PCM | PSOB | F | B | Lc | Csp | Css |
|---|---|---|---|---|---|---|---|
| 7646.30 | 4139.20 | 3240.00 | 20000.00 | 1.50 | 18.65 | 1.35 | 1.50 |

DATOS DE ESFUERZOS

| MP | ML | MCM | MS |
|---|---|---|---|
| 138310.18 | 194134.22 | 179963.36 | 390618.1 |

SECCIONES COMPUESTAS

| SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|
| 645.98 | 104.35 | 26513.36 | 100158387.1 | 101.94 | 27249.55 | 106722410.2 | 103.28 | 26836.55 | 103078688.9 |

PERDIDAS PRETENSADO

| DT3 | FRI | DTS | DT4 | DT5 | DT6 | FRF |
|---|---|---|---|---|---|---|
| 713.16 | 14086.84 | 0.00 | 456.00 | 676.35 | 473.37 | 11460.01 |

TENSIONES

| | PARCIALES | | | | ACUMULADAS | | | |
|---|---|---|---|---|---|---|---|---|
| | SL | IL | SV | IV | SL | IL | SV | IV |
| PRET INIC | 0.00 | 0.00 | -29.05 | 140.09 | 0.00 | 0.00 | -29.05 | 140.09 |
| PRET FIN | 0.00 | 0.00 | -23.63 | 113.96 | 0.00 | 0.00 | -23.63 | 113.96 |
| PPROP.VIGA | 0.00 | 0.00 | 39.68 | -21.45 | 0.00 | 0.00 | 16.05 | 92.52 |
| PPROP.LOSA | 0.00 | 0.00 | 55.70 | -30.11 | 0.00 | 0.00 | 71.75 | 62.41 |
| CAR.MUERTA | 10.97 | 6.42 | 6.42 | -17.19 | 10.97 | 6.42 | 78.17 | 45.22 |
| SOB.CASI-PERM | 4.83 | 2.78 | 2.78 | -7.83 | 15.80 | 9.20 | 80.95 | 37.39 |
| SOB.FRECUENTE | 12.07 | 6.96 | 6.96 | -19.57 | 23.04 | 13.38 | 85.12 | 25.65 |
| SOB.CARACT. | 24.15 | 13.92 | 13.92 | -39.14 | 35.12 | 20.33 | 92.08 | 6.08 |

**TENSIONES EN ELEVACION Y TRANSPORTE**

**FISURACION C2 COMPROBADA**

CALCULO A ROTURA

MOMENTO DE ROTURA 1706477.91

MOMENTO NECESARIO 1277677.64

## ELECCION VIGA PESIMA A CORTANTE

### SECCIONES COMPUESTAS

| | SEFIC. | YGC | AC | IC | YGCMC | ACMC | ICMC | YGCSC | ACSC | ICSC |
|---|---|---|---|---|---|---|---|---|---|---|
| IGAS EXTERIORES. | 810.00 | 110.09 | 30014.43 | 107840928.5 | 107.81 | 30750.62 | 115183146.6 | 109.07 | 30337.62 | 111103048.5 |

### ESFUERZOS CORTANTES CON LAS CARGAS EQUIVALENTES DE CADA VIGA Y L=18.65

| VIGA | SCAJ | SDER | SIZQ | S | QP | QM | QSOB | VRD |
|---|---|---|---|---|---|---|---|---|
| EXTERIORES | 400.00 | 205.00 | 205.00 | 810.00 | 71301.75 | 38598.04 | 85387.26 | 276445.61 |

### CALCULO NEOPRENO

DESPLAZAMIENTOS

| U0 | U1 | U2 | U3 | U4 | U5 | U'5 | U6 | UC | US |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | .24 | .48 | .16 | .15 | -.28 | .04 | -.09 | .69 | .11 |

GIROS

| AL4 | AL5 | AL6 | ALC | ALS |
|---|---|---|---|---|
| -.0071 | .0055 | .0008 | -.0009 | .0035 |

COMPROBACIONES

| TAU1S | TAU2S | SUME1 | TAU1C | TAU2C | SUME2 |
|---|---|---|---|---|---|
| 23.428 | 3.425 | .014 | 6.581 | 4.275 | .006 |

NEOPRENO COMPROBADO

| BNP | DNP | TNP | GNP | LNEOP | HS | PTLCNG |
|---|---|---|---|---|---|---|
| 25.000 | 50.000 | 4.100 | 3.080 | 15.910 | 1167.000 | 0.000. |

| Pmin. | Pmax. | Sneo. |
|---|---|---|
| 50067.96 | 137261.85 | 260.00 |

### ACORTAMIENTOS Y FUERZAS HORIZONTALES EN LOS NEOPRENOS

| CAUSA | | DESPL +acort (cm | FUERZA (Kgs.) |
|---|---|---|---|
| Debido a acortamientos en el eje por fluencia, retraccion y temperatura.. | Max | .874 | 4583.75 |
| | Min | -.080 | +418.12 |
| Debido a giros de pretensado, peso propio y cargas permanentes..... | | -.164 | +860.17 |
| Debido a giros de sobrec. uniforme.. | | -.024 | -245.06 |
| Debido a giros del tanque..... | | -.036 | -373.77 |
| Debido a esfuerzos de frenad..... | Max | .110 | 1107.0 |
| | Min | -.110 | -1107.0 |
| Suma pesima positiva (Ver nota ..... | | .802 | 4.. .6 |
| Suma pesima negativa (Ver nota..... | | -.430 | -[illegible].1 |

NOTA.- Suma solo valida para distancia entre punto medio entre juntas y eje de neopreno= 15.910 y sin considerar la influencia de la flexibilidad de pilas o estribos

MAXIMO CORTANTE VERTICAL POR EXTREMO DE VIGA = 184207.07 Kg

VIGAS EXTERIORES (Esf. por neopr.)

REACCION EN FASE DE CONSTRUCCION..... = 41924.413 Kg

EXCENTRICIDAD EN FASE DE CONSTRUCCION..... = [illegible] cm

MAXIMO DESEQ. DE LA REACCION SOBRE VALOR MEDIO = 0.000 Kg

## CALCULO NEOPRENO

### DESPLAZAMIENTOS

| U0 | U1 | U2 | U3 | U4 | U5 | U'5 | U6 | UC | US |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | .52 | 1.04 | .34 | .15 | -.28 | .04 | -.09 | 1.71 | .15 |

### GIROS

| AL4 | AL5 | AL6 | ALC | ALS |
|---|---|---|---|---|
| -.0071 | .0055 | .0008 | -.0009 | .0005 |

### COMPROBACIONES

| TAU1S | TAU2S | SUME1 | TAU1C | TAU2C | SUME2 |
|---|---|---|---|---|---|
| 20.428 | 5.898 | .018 | 6.581 | 6.409 | .008 |

### NEOPRENO COMPROBADO

| BNP | DNP | TNP | GNP | LNEOP | HS | PTLONG |
|---|---|---|---|---|---|---|
| 25.000 | 50.000 | 5.200 | 4.080 | 34.560 | 1167.000 | 0.000 |

| Pmin. | Pmax. | Sneo. |
|---|---|---|
| 50067.96 | 137261.85 | 260.00 |

### ACORTAMIENTOS Y FUERZAS HORIZONTALES EN LOS NEOPRENOS

| CAUSA | | DESPL +acort (cm | FUERZA (kgr.) |
|---|---|---|---|
| Debido a acortamientos en el eje por | Max | 1.839 | 7418.61 |
| fluencia, retraccion y temperatura.. | Min | -.174 | -681.19 |
| Debido a giros de pretensado, peso propio y cargas permanentes..... | | -.184 | -720.13 |
| Debido a giros de sobrec. uniforme.. | | -.024 | -183.77 |
| Debido a giros del tanque..... | | -.030 | -261.30 |
| Debido a esfuerzos de frenado..... | Max | .149 | 1167.00 |
| | Min | -.149 | -1167.00 |
| Suma pesima positiva (Ver nota)..... | | 1.654 | 7465.64 |
| Suma pesima negativa (Ver nota)..... | | -.503 | -3032.42 |

NOTA.- Suma solo valida para distancia entre punto medio entre juntas y eje de neopreno= 34.560 y sin considerar la influencia de la flexibilidad de pilas o estribos

MAXIMO CORTANTE VERTICAL POR EXTREMO DE VIGA = 184297.07 Kg

VIGAS EXTERIORES (Esf. por Neopr.)

REACCION EN FASE DE CONSTRUCCION..... = 41324.413 Kg
EXCENTRICIDAD EN FASE DE CONSTRUCCION..... = 0.000 cm
MAXIMO DESEQ. DE LA REACCION SOBRE VALOR MEDIO = 0.000 Kg

## CALCULO VIGA PESIMA A CORTANTE

### DATOS VIGA SECCION SIMPLE Y COMPUESTA (cm)

| Y | YG | A | I | E | OP | SEF | LOS | R | YC | YGC | AC | IC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 141.00 | 51.10 | 12724.67 | 29927363.45 | 40.00 | 0.00 | 810.00 | 27.00 | .79 | 167.00 | 110.00 | 30014.43 | 107840928.49 |

### PRETENSADO Y MATERIALES (kg y cm)

| FI | FS | EI | ES | FCD | FYD |
|---|---|---|---|---|---|
| 738024.00 | 64176.00 | 5.00 | 10.50 | 285.71 | 4200.00 |

### DATOS LUCES Y CARGAS (kg y m)

| PP | PCM | PSOB | F | B | LCAL | CSP | CSS | OPAL |
|---|---|---|---|---|---|---|---|---|
| 7646.30 | 4139.20 | 3240.00 | 20000.00 | 1.60 | 18.65 | 1.35 | 1.50 | -2.0 |

### DATOS ALAS

| KS | KI | BRAS | RSUP/I | V |
|---|---|---|---|---|
| .296 | .500 | 58.030 | 16.659 | 40.200 |

RESULTADOS ESFUERZOS

| X | MPP | MSB | QPP | QMAX | TCON | QCON | TMAX | VRD | VU1 | TUD | TU1 | COEF | ZONA | TRAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.0 | 0.0 | 71301.7 | 123985.3 | 82761 | 108878.8 | 113352 | 282235.3 | 555428.6 | 124142.1 | 1265713.1 | .61 | AB | 14.8 |
| 1.00 | 67478.6 | 79017.0 | 63655.4 | 113475.8 | 77936 | 99945.9 | 105334 | 256148.6 | 515302.2 | 116903.5 | 1144243.3 | .60 | AB | 13.6 |
| 2.00 | 127310.9 | 145640.8 | 56009.1 | 103140.0 | 73110 | 91099.8 | 97491 | 230322.4 | 494478.8 | 109664.9 | 1099160.2 | .57 | AB | 12.3 |
| 3.00 | 179496.9 | 200392.7 | 48362.8 | 92978.0 | 68284 | 82340.6 | 89825 | 204756.8 | 477236.1 | 102426.3 | 1149549.1 | .52 | AB | 11.1 |
| 4.00 | 224036.6 | 243793.8 | 40716.5 | 82989.7 | 63458 | 73668.3 | 82334 | 179451.9 | 463393.6 | 95187.7 | 1149549.1 | .47 | AB | 9.9 |
| 5.00 | 260930.0 | 276365.3 | 33070.2 | 73175.1 | 58633 | 65082.8 | 75020 | 154407.5 | 452541.4 | 87949.1 | 1149549.1 | .42 | AB | 8.7 |
| 6.00 | 290177.1 | 298628.3 | 25423.9 | 63534.2 | 53807 | 56584.2 | 67881 | 129623.7 | 444301.8 | 80710.5 | 1149549.1 | .36 | AB | 7.6 |
| 7.00 | 311777.9 | 311104.2 | 17777.6 | 54067.1 | 48981 | 48172.4 | 60918 | 105100.5 | 438381.8 | 73471.8 | 1149549.1 | .30 | C | 6.4 |
| 8.00 | 325732.4 | 314314.0 | 10131.3 | 44773.7 | 44155 | 39847.6 | 54131 | 80837.8 | 434575.4 | 66233.2 | 1149549.1 | .24 | C | 5.3 |
| 9.00 | 332040.6 | 308778.9 | 2485.0 | 35654.0 | 39330 | 31609.5 | 47520 | 56835.8 | 432755.6 | 58994.6 | 1149549.1 | .18 | C | 4.2 |
| 6.30 | 297460.2 | 303375.0 | 23130.1 | 60675.8 | 52359 | 54051.5 | 65773 | 122239.4 | 442293.2 | 78538.9 | 1149549.1 | .34 | C | 7.2 |

RESULTADOS ESFUERZOS LOCALES

- En ala superior .....: Md= 475.27 m*kgr/m. Asup= .28 cm2. Ainf= 0.00 cm2.
- En alma :Hacia el exterior..: Md= 1212.81 m*kgr/m. Aint= 1.55 cm2. Aext= 0.00 cm2.

RESULTADOS ARMADO (CORTANTE MAXIMO)

| X | Asup | Ainf | Alos | Acor | Acor | Alts | Alta | Alti | Aras |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 6.06 | 20.12 | 8.39 | 37.15 | 2.92 | 2.49 | 2.34 | 2.34 | 21.14 |
| 1.00 | 4.25 | 18.26 | 6.20 | 22.22 | 2.75 | 2.34 | 2.24 | 2.24 | 17.02 |
| 2.00 | 3.06 | 16.42 | 4.95 | 17.54 | 2.58 | 2.20 | 2.10 | 2.1 | 13.76 |
| 3.00 | 2.33 | 14.60 | 4.08 | 13.92 | 2.41 | 2.05 | 1.96 | 1.96 | 11.10 |
| 4.00 | 1.80 | 12.79 | 3.43 | 10.95 | 2.24 | 1.91 | 1.82 | 1.82 | 8.77 |
| 5.00 | 1.37 | 11.01 | 2.90 | 8.39 | 2.07 | 1.76 | 1.69 | 1.68 | 7.64 |
| 6.00 | 1.01 | 9.24 | 2.44 | 6.11 | 1.90 | 1.62 | 1.55 | 1.55 | 7.62 |
| 7.00 | .75 | 7.49 | 2.04 | 6.97 | 1.73 | 1.47 | 1.41 | 1.41 | 7.62 |
| 8.00 | .43 | 5.76 | 1.68 | 4.33 | 1.56 | 1.33 | 1.27 | 1.27 | 7.62 |
| 9.00 | .11 | 4.05 | 1.34 | 1.72 | 1.39 | 1.18 | 1.13 | 1.13 | 7.62 |
| 6.30 | .98 | 8.71 | 2.32 | 8.84 | 1.85 | 1.57 | 1.50 | 1.50 | 9.25 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

RESULTADOS ARMADO (TORSOR MAXIMO)

| X | Asup | Ainf | Alos | Acor | Ator | Alts | Alta | Alti | Aras |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 6.06 | 18.50 | 7.37 | 33.45 | 4.00 | 3.41 | 3.26 | 3.26 | 17.44 |
| 1.00 | 4.25 | 16.81 | 5.46 | 19.98 | 3.71 | 3.16 | 3.03 | 3.03 | 13.98 |
| 2.00 | 3.06 | 15.13 | 4.37 | 15.73 | 3.44 | 2.93 | 2.80 | 2.80 | 11.25 |
| 3.00 | 2.33 | 13.46 | 3.62 | 12.44 | 3.17 | 2.70 | 2.58 | 2.58 | 8.96 |
| 4.00 | 1.80 | 11.80 | 3.04 | 9.72 | 2.90 | 2.47 | 2.37 | 2.37 | 7.69 |
| 5.00 | 1.37 | 10.14 | 2.58 | 7.37 | 2.64 | 2.25 | 2.16 | 2.16 | 7.62 |
| 6.00 | 1.01 | 8.50 | 2.18 | 5.26 | 2.39 | 2.04 | 1.95 | 1.95 | 7.62 |
| 7.00 | .75 | 6.86 | 1.82 | 6.01 | 2.15 | 1.83 | 1.75 | 1.75 | 7.62 |
| 8.00 | .43 | 5.24 | 1.49 | 3.52 | 1.91 | 1.63 | 1.56 | 1.56 | 7.62 |
| 9.00 | .11 | 3.85 | 1.19 | 1.06 | 1.67 | 1.43 | 1.37 | 1.37 | 7.62 |
| 6.30 | .98 | 8.01 | 2.06 | 7.75 | 2.32 | 1.98 | 1.89 | 1.89 | 7.62 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

ARMADURA MINIMA ALMA 7.62

CALCULOS A TORSOR SOLO VALIDOS EN SECCION CERRADA.

## COMPROBACION DE LA LOSA A CORTANTE

DATOS PARA EL CALCULO

VUELO IZQUIERDA ..... 191.50 cm.
VUELO DERECHA ..... 191.50 cm.
VANO INTERIOR AL CAJON .. 274.98 cm.

CORTANTES (Sin mayorar y en T.)

| | Vpp | Vcm | Vsb | Vac | Vc |
|---|---|---|---|---|---|
| VUELO IZQUIERDA ..... | 1.29 | .37 | .71 | .70 | 5.68 |
| VUELO DERECHA ..... | 1.29 | .37 | .71 | .70 | 5.68 |
| VANO INTERIOR AL CAJON .. | .93 | .26 | .50 | 0.00 | 6.07 |

RESULTADOS

| | Vd(t) | Asesup(cm2) | Vu2a(t) | Aconte(cm2) |
|---|---|---|---|---|
| VUELO IZQUIERDA ..... | 12.78 | 12.06 | 13.35 | 0.00 |
| VUELO DERECHA ..... | 12.78 | 12.06 | 13.35 | 0.00 |
| VANO INTERIOR AL CAJON .. | 11.45 | 12.06 | 13.35 | 0.00 |

ARMADURAS

- No se modifica la armadura existente.
- No se necesita armadura por cortante.

ARMADURA FINAL DE LA LOSA

| | Arm. transversal | | Arm. longitudinal | |
|---|---|---|---|---|
| | Inferior | Superior | Inferior | Superior |
| L/8 | 10d12 | 9d16 | 9d 8 | 7d10 |
| L/4 | 8d10 | 6d16 | 6d 8 | 7d 8 |
| L/4 | 8d10 | 6d16 | 6d 8 | 7d 8 |
| L/4 | 8d10 | 6d16 | 6d 8 | 7d 8 |
| L/8 | 10d12 | 9d16 | 9d 8 | 7d10 |

Puede sustituirse la ARMADURA SUPERIOR por la siguientes MALLAS ELECTROSOLDADAS:

| | TRANS | LONG |
|---|---|---|
| L/8 | d 16 a 10 | d 10 a 12.5 |
| L/4 | d 16 a 15 | d 8 a 12.5 |
| L/4 | d 16 a 15 | d 8 a 12.5 |
| L/4 | d 16 a 15 | d 8 a 12.5 |
| L/8 | d 16 a 10 | d 10 a 12.5 |

PLACAS DE ENCOFRADO PERDIDO

Placa entre cajones.....
Placa cubriendo cajones..... GA-60.33.7

CFI= 2.247

## CALCULO DE LA ZONA DE CONTINUIDAD DE LOSA

| | VANO ANTERIOR | VANO POSTERIOR |
|---|---|---|
| Giro de cargas permanentes: | .001181 | .000273 |
| Giro de sobrecarga uniforme: | .000925 | .000214 |
| Giro del vehiculo: | .000865 | .000326 |

Dimensiones porexpan (cms): 12.00 90.00

HIPOTESIS A: CARGAS PERMANENTES EN AMBOS VANOS

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Cargas permanentes : | -3.92231 | -1.36502 | 1.19229 |

HIPOTESIS B: SOBRECARGAS EN VANO ANTERIOR

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Sobrecarga uniforme : | -3.47356 | -.84839 | 1.73678 |
| Sobrecarga vehiculo : | -3.24835 | -.81206 | 1.62413 |

HIPOTESIS C: SOBRECARGAS EN VANO POSTERIOR

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Sobrecarga uniforme : | .40181 | -.20090 | -.80361 |
| Sobrecarga vehiculo : | .61210 | -.30605 | -1.22421 |

HIPOTESIS D: CARGAS LOCALES EN LOSA CONTINUIDAD

| | M.izqdo | M.centro | M.derecho |
|---|---|---|---|
| Cargas permanentes : | -.83029 | .41764 | -.83529 |
| Sobrecarga uniforme : | -.02713 | .01356 | -.02713 |
| Sobrecarga vehiculo : | -1.42407 | 1.42407 | -1.42407 |

COMBINACIONES PESIMAS:

Pesimo flector negativo : -11.7104
Pesimo flector positivo : 4.4460

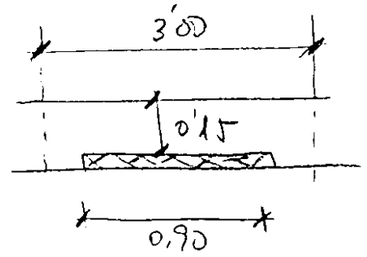
ARMADOS LOCALES :

| | Teorica | Real |
|---|---|---|
| Armadura long. inferior : | 21.23335 | 7.21 |
| Armadura long. superior : | 44.25964 | 11.25 |
| Armadura trans. inferior: | 6.34801 | 10.12 |
| Armadura trans. superior: | 13.26289 | 9.1s |

Longitud de la armadura longitudinal: 3.00 m.

COMPROBACION DE LA VIGA (POR ALMA):

| | |
|---|---|
| Vrd/2-Tud/B (Kgrs.)..... | 178622.83 |
| Vul (kgrs.)..... | 231428.57 |
| Vcu (kgrs.)..... | 22819.17 |
| Arm. teorica (cm2)..... | 30.53 |
| Armadura real..... | D16 a 10 |
| Longitud de armado..... | 45 |

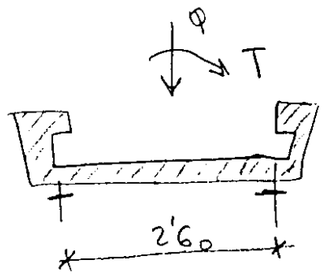


## RESUMEN DE REACCIONES
======= == ==========

(sin mayorar y por extremo)

DATOS DE CARGAS MAXIMAS (EXTREMO ANTERIOR):

| | TABLERO UNA SOLA VIGA Q Tn. | T mTn |
|---|---|---|
| Peso prop.+ Perm. | 113.671 | 0.000 |
| Sobrec.unif (Qmax) | 31.250 | 0.000 |
| Sobrec.unif (Tmax) | 15.625 | 30.591 |
| Vehiculo (Qmax) | 55.174 | 82.761 |
| Vehiculo (Tmax) | 55.174 | 82.761 |




DATOS DE CARGAS MAXIMAS (EXTREMO POSTERIOR):

| | TABLERO UNA SOLA VIGA Q Tn. | T mTn |
|---|---|---|
| Peso prop.+ Perm. | 113.671 | 0.000 |
| Sobrec.unif (Qmax) | 31.250 | 0.000 |
| Sobrec.unif (Tmax) | 15.625 | 30.591 |
| Vehiculo (Qmax) | 55.174 | 82.761 |
| Vehiculo (Tmax) | 55.174 | 82.761 |

CARGAS HORIZONTALES EN LA VIGA ( Ver desglose en hoja de calculo de neoprenos).

( ESTUDIO: 21898 La= 18.45 Lte= 19.29 )

* Peso total viga = 72'18 Tn

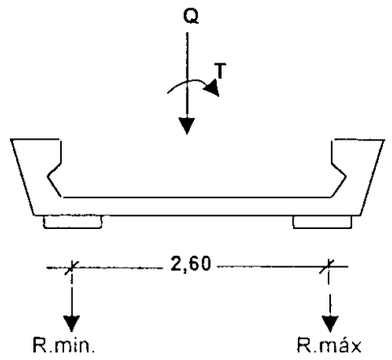
3'18 x 17 x 19'29 = 61'37

10,82/2 + 113'67 = 119'08 Tn/extremo

## RESUMEN DE REACCIONES.- ( Sin mayorar y por extremo )

### VANOS LATERALES

| | | Q ( Tn.) | T.( mTn.) |
|---|---|---|---|
| - Peso propio + c.perman. | = | 119,08 | 0,00 |
| - Sobrec. Unifor. ( Q.max. ) | = | 31,25 | 0,00 |
| - Sobrec. Unifor. ( T.max. ) | = | 15,63 | 30,59 |
| - Vehiculo ( Q.max. | = | 55,17 | 82,76 |
| - Vehiculo ( T.max. ) | = | 55,17 | 82,76 |
| Separación de neoprenos | = | 2,60 m. | |




### A ). - VERTICALES

**Reacción Máxima.- ( Sin mayorar y por neopreno )**

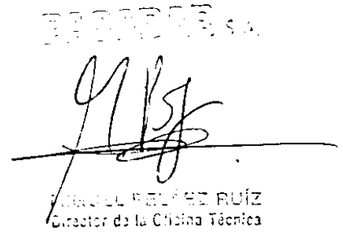
- R.c.permanentes = 119,08/2 + 0,00/2,60 = 59,54 Tn.
- R.sobrec. Uniforme = 31,25/2 + 0,00/2,60 = 15,63 Tn.
- R.sobrec. Uniforme = 15,63/2 + 30,59/2,60 = 19,58 Tn.
- R.vehiculo = 55,17/2 + 82,76/2,60 = 59,42 Tn.

**R.máxima = 138,54 Tn.**

**Reacción Mínima- ( Sin mayorar y por neopreno )**

- R.c.permanentes = 119,08/2 - 0,00/2,60 = 59,54 Tn.
- R.sobrec. Uniforme = 31,25/2 - 0,00/2,60 = 15,63 Tn.
- R.sobrec. Uniforme = 15,63/2 - 30,59/2,60 = -3,95 Tn.
- R.vehiculo = 55,17/2 - 82,76/2,60 = -4,25 Tn.

**R.mínima = 51,34 Tn.**



**Obra: L.A.V. MADRID-ZARAGOZA**
**SUBTRAMO XV**
**"E-1511.3 y "E-1512.4"**

PACADAR

14-jun-00

# CÁLCULO

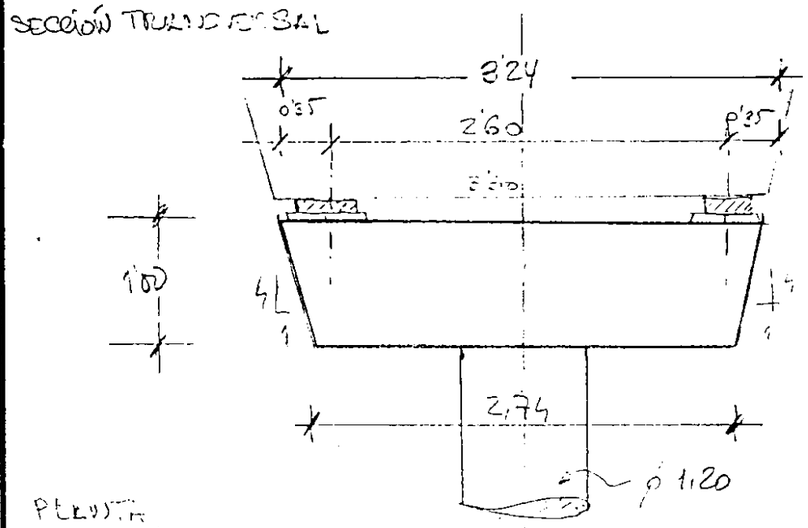
# DE LOS

# DINTELES

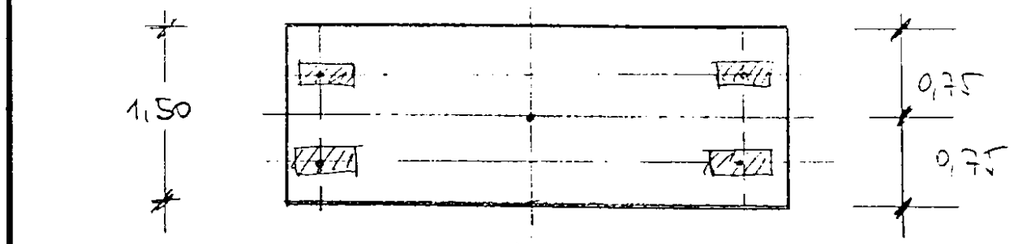
| PACADAR | ESTUDIO: 2470f | OBRA: L.A.V. MADRID-ZARAGOZA SUBTRAMO: XV | FECHA: HOJA: 1 de 20 |
|---|---|---|---|

# DINTEL -- "E-1511.3" y "E-1514.2"

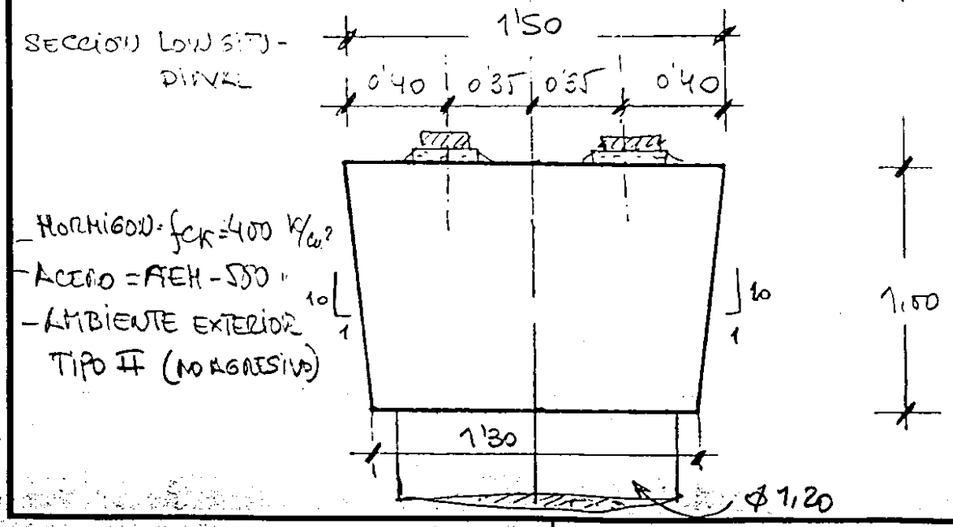
SECCIÓN TRANSVERSAL




PLANTA




SECCION LONGITUDINAL

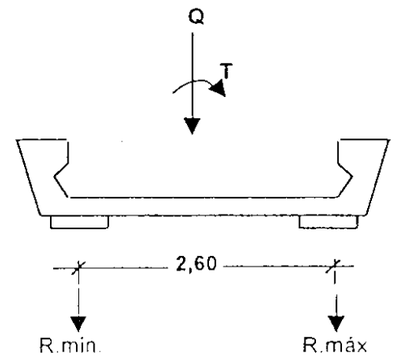



- HORMIGON: fck=400 K/cm²
- ACERO = AEH-500
- AMBIENTE EXTERIOR TIPO II (NO AGRESIVO)

## RESUMEN DE REACCIONES.- ( Sin mayorar y por extremo )

### VANOS LATERALES

| | | Q ( Tn.) | T.( mTn.) |
|---|---|---|---|
| - Peso propio + c.perman. | = | 119,08 | 0,00 |
| - Sobrec. Unifor. ( Q.max. ) | = | 31,25 | 0,00 |
| - Sobrec. Unifor. ( T.max. ) | = | 15,63 | 30,59 |
| - Vehiculo ( Q.max. | = | 55,17 | 82,76 |
| - Vehiculo ( T.max. ) | = | 55,17 | 82,76 |
| Separación de neoprenos | = | 2,60 m. | |




A ). - VERTICALES

Reacción Máxima.- ( Sin mayorar y por neopreno )

- R.c.permanentes = 119,08 / 2 + 0,00 / 2,60 = 59,54 Tn.
- R.sobrec Uniforme = 31,25 / 2 + 0,00 / 2.60 = 15,63 Tn.
- R.sobrec. Uniforme = 15,63 / 2 + 30,59 / 2,60 = 19,58 Tn.
- R.vehiculo = 55,17 / 2 + 82,76 / 2,60 = 59,42 Tn.

**R.máxima = 138,54 Tn.**

Reacción Minima- ( Sin mayorar y por neopreno )

- R.c.permanentes = 119,08 / 2 - 0,00 / 2,60 = 59,54 Tn.
- R.sobrec. Uniforme = 31,25 / 2 - 0,00 / 2,60 = 15,63 Tn.
- R.sobrec. Uniforme = 15,63 / 2 - 30,59 / 2,60 = -3,95 Tn.
- R.vehiculo = 55,17 / 2 - 82,76 / 2,60 = -4,25 Tn.

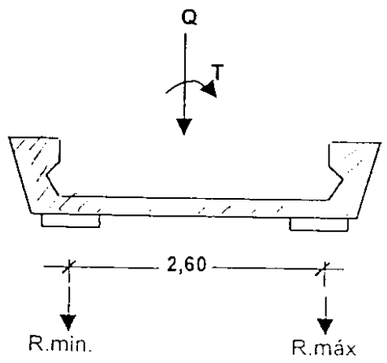
**R.mínima = 51,34 Tn.**

## RESUMEN DE REACCIONES.- ( Sin mayorar y por extremo )

VANO CENTRAL

| | Q ( Tn.) | T.( mTn.) |
|---|---|---|
| - Peso propio + c.perman. = | 189,62 | 0,00 |
| - Sobrec. Unifor. ( Q.max. ) = | 50,27 | 0,00 |
| - Sobrec. Unifor. ( T.max. ) = | 25,14 | 49,85 |
| - Vehiculo ( Q.max. = | 57,04 | 85,56 |
| - Vehiculo ( T.max. ) = | 57,04 | 85,56 |

Separación de neoprenos = 2,60 m.




### A ). - VERTICALES

Reacción Máxima.- ( Sin mayorar y por neopreno )

- R.c.permanentes = $\frac{189,62}{2} + \frac{0,00}{2,60}$ = 94,81 Tn.
- R.sobrec. Uniforme = $\frac{50,27}{2} + \frac{0,00}{2,60}$ = 25,14 Tn.
- R.sobrec. Uniforme = $\frac{25,14}{2} + \frac{49,85}{2,60}$ = 31,74 Tn.
- R.vehiculo = $\frac{57,04}{2} + \frac{85,56}{2,60}$ = 61,43 Tn.

**R.máxima = 187,98 Tn.**

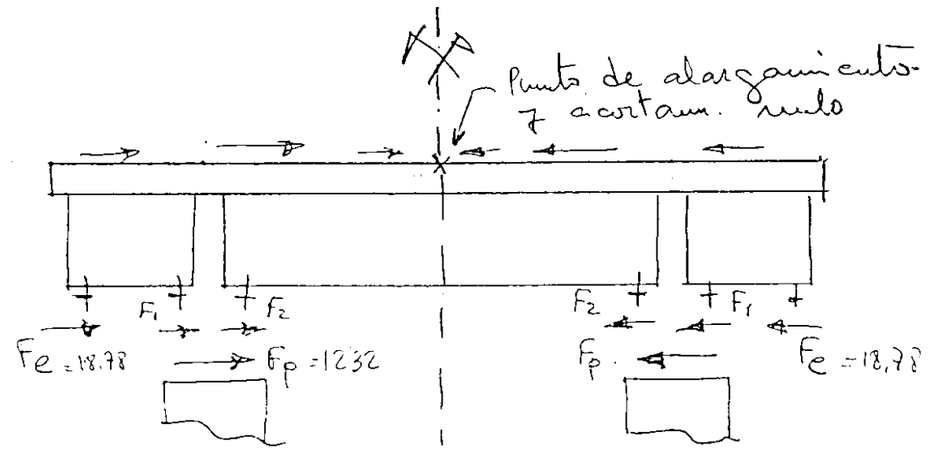
Reacción Mínima- ( Sin mayorar y por neopreno )

- R.c.permanentes = $\frac{189,62}{2} - \frac{0,00}{2,60}$ = 94,81 Tn.
- R.sobrec. Uniforme = $\frac{50,27}{2} - \frac{0,00}{2,60}$ = 25,14 Tn.
- R.sobrec. Uniforme = $\frac{25,14}{2} - \frac{49,85}{2,60}$ = -6,60 Tn.
- R.vehiculo = $\frac{57,04}{2} - \frac{85,56}{2,60}$ = -4,39 Tn.

**R.mínima = 83,82 Tn.**

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 4

FUERZAS HORIZONTALES.-




ESTRIBOS -

R+F+T = 2x(7'42 - 0,72) = 13'40 Tn/e

Frenado = 5'38 "

18,78 Tn/e

PILAS -

R+F+T ⇒ $F_1$ = (4'56+0'96) x 2 = 11'04 Tn/p.

$F_2$ = (4'92-5,12) x 2 = -0'40 "

R+F+T = 10,64 Tn/p.

Frenado = 1'68 "

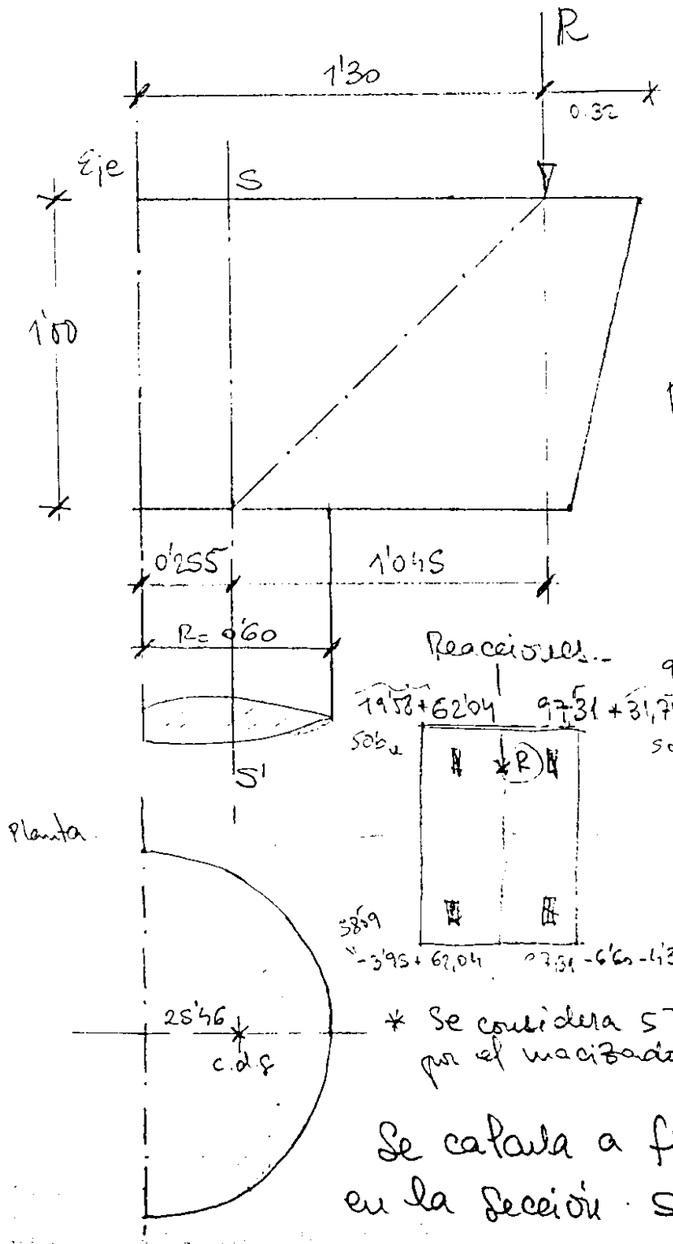
Fe total = 12'32 Tn/p

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 5

1

## CÁLCULO DE LA ARMADURA.

ARMADURA "As1" - (Flexión)




$R = R_{pers} + R_{sob}$

$R_{pers} = \frac{11'908 - 500}{2} = 6'204$

$\frac{18'362 + 500}{2} = 9'731$

$R_{sob} = 19'58 + 93'17 = 112,75$ Tn

$R_T = 272'10$ Tn

Reacciones:

$19'58 + 6'204 \quad 9'731 + 31,74 + 61,43 =$ sob. vert.

sob.

$-3'95 + 62,04 \quad 9'731 - 6'60 - 4'39 = 86'32$

5869

* Se considera 5 Tn más por el macizado extremo

Se calcula a flexión y cortante en la sección S-S'

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 6

— Momento sin mayorar (S-S')

$M_{pp} = 2'5 \times 1'40 \times \frac{1'045^2}{2} = 1'911$ mTn

$M_c = 1'045 \times 272'10 = 284'35$ "

$M = 286'26$ mTn

— Momento mayorado - (S-S')

$M_d = 1'35 \times [1'911 + (1'35 \times 284'35 \times 1'045)] +$

$+ 1'50 \times 112,75 \times 1'045 = 404'12$ mTn

Sección resistente 1'40 x 1'00, r = 7,5 cm

$M_d = 404'12$ mTn $\Rightarrow A_{s1} = 102'20$ cm²

$d = 0'925$ — $A_{sc} = 11'76$ cm²

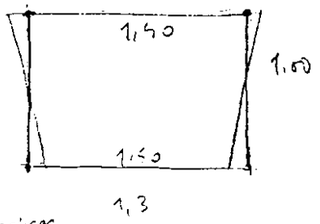
22 ϕ 25 $\equiv 102'20$ cm² $> 102,20$ cm²

Por fisuración, necesitamos

$M_k = 286'26$ mTn necesitamos $\Rightarrow$ 26 ϕ 25

Anclamos con 26 ϕ 25

## ZAPATA DOBLE "AS3". - Cortante máximo.



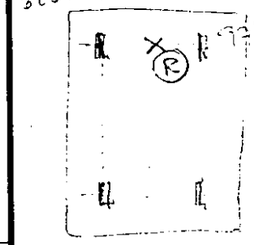

$Q^d_{max} = (\text{Sobrecarga uniforme en ambos vanos} + \text{Reacción})$

$Q_{ppd} = 2'5 \times 1'4 \times 1'045 = 366$

$Q_{cp} = \text{——} \quad 15935$

$16301$ Tn

$Q_{sob} = 112,75$ Tn



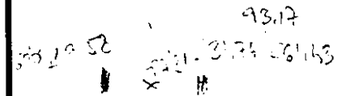

$Q_d = (1'35 \times 16301) + (1'50 \times 112,75) = 38719$ Tn

Sección rectangular $1'40 \times 1'00$

$r = 7'5$ cm

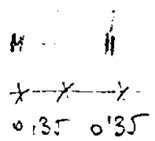
$A_{st} = 80'01$ cm²/ml

Torsor concomitante -



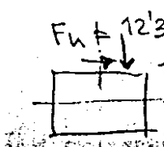

$Td = 0'35 \times \left[ (1'35 \times (97'31 - 62'04) + 1'50 \times (93'17 - 19'58) \right] = 0'35 \times 15800 =$

$Td^h = 0'50 \times \left[ (1'35 \times 10'64) + (1'50 \times 1'68) \right] = \begin{matrix} = 55'30 \\ 8,44 \end{matrix}$




$k = 0'764 < 1$

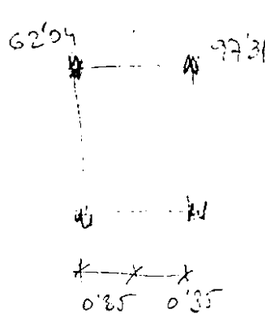
$Td = 63'74$ mt




- $A_{ts} = 14,77$ cm²/ml (2 ramas)
- $A_l = 276'4$ cm²



## Torsor máximo (Sobrecargas en un vano solo (Tramo))




$Q^d$ concomitante -

$Q_{ppd} = \text{——} \quad 366$ Tn

$Q_{cp} = \text{——} \quad 15935$

$16301$ Tn

$Q_{sob} = 93,17$ Tn

$Q_d = (1'35 \times 16301) + (1,50 \times 93,17) = 35983$ Tn

- $A_{st} = 71'61$ cm²/ml

Torsor máximo -

$Td = 0'35 \times \left[ 1'35 \times (97'31 - 62'04) + 1'50 \times 93'17 \right] = 65'58$ mt

$Td^h = \text{——} \quad 8'44$

$k = 0'804 < 1$

$Td = 74'02$

- $A_{ts} = 17'15$ cm²/ml
- $A_l = 32'10$ cm²

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 9

Luego en cada hipotesis, se necesita

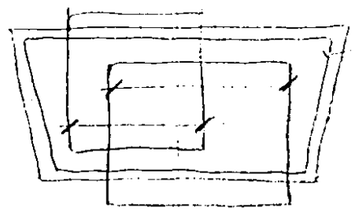
**$Q_{max}$** - Se necesita

$A_{st} = 80'01\ cm^2/m$
$+ 14,77$ "
$94,78\ cm^2/m$

**$T_{max}$** - Se necesita.

$A_{st} = 71'61\ cm^2/m$
$+ 12'15$ "
$83'76\ cm^2/m$

Armamos para $A_{st} = 94,78\ cm^2/m > 88,76$

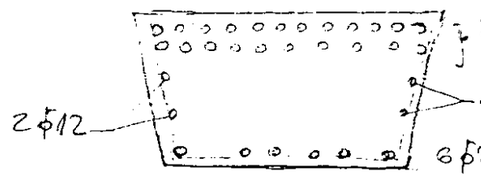


$1c\phi 20 \circ 0'15 = 4'87$
$\frac{1}{2}$ c $\phi 16 \circ 0'15 \times 5'36 =$
$\Sigma = 9'47\ cm^2/m$

$A_l = 27'64\ cm^2$ | $A_l = 32'10\ cm^2$ $> 94,78$.

Armamos para $A_l = 32'10\ cm^2$

Tenemos la armadura sobrante




Sobrante: $43'15\ cm^2$

Luego tenemos sobrante $= 43'15\ cm^2 > 32'10\ cm^2$

1

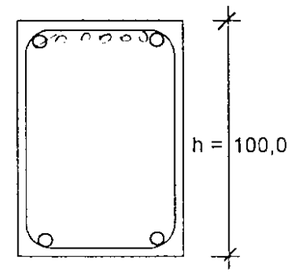
## SECCIÓN RECTANGULAR

**DINTEL**

— 26 φ25

**DATOS DE LA SECCIÓN:**

| | | | | |
|---|---|---|---|---|
| - CANTO TOTAL | h | = | **100,0** | cm. |
| - CANTO UTIL | d | = | **92,5** | cm. |
| - ANCHO | b | = | **140,0** | cm. |
| - d-d' | | = | **88,5** | cm. |
| - HORMIGÓN | fck | = | **400** | Kgs/cm2. |
| - ACERO | fyk | = | **5100** | Kgs/cm2. |
| - COEF: MINORACIÓN | | | | |
| - HORMIGÓN | Yc | = | **1,40** | |
| - ACERO | Ys | = | **1,10** | |




| | | | | |
|---|---|---|---|---|
| ESFUERZOS: | - Md | = | **404,12** | mTn. |
| | - Vrd | = | **389,19** | Tn. |
| | - Trd | = | **63,74** | mTn. |

**CÁLCULO A FLEXIÓN**

- Uc=fck*b*d/Yc

| | | | | |
|---|---|---|---|---|
| | Uc | = | 3700,00 | Tn. |

- Mt=0.35*Uc*d

| | | | | |
|---|---|---|---|---|
| Momento tope | Mt | = | 1197,88 | mTn. |

Luego M

- Si Md < Mt
  Us1=0.97*Md/d*(1+Md/Uc*d)
- Si Md > Mt
  Us2=Md-Mt/(d-d')
  Us1=(0.45*Uc)+Us2

| | | | | |
|---|---|---|---|---|
| | Us2 | = | 0,00 | Tn. |
| | Us1 | = | 473,82 | Tn. |

- As=Us/fyd

| | | | | |
|---|---|---|---|---|
| | As1 | = | 102,20 | cm2. |
| | As2 | = | 0,00 | cm2. |

- As1 mini.
  Si fyk=4100 ... As1=3.3*b*h/1000
  Si fyk=5100 ... As1=2.8*b*h/1000

| | | | | |
|---|---|---|---|---|
| | As1min. | = | 39,20 | cm2. |

- As2 mini.
  As2mini.=30%*As1 mini.

| | | | | |
|---|---|---|---|---|
| | As2min. | = | 11,76 | cm2. |

Luego la armadura será

| | | | | |
|---|---|---|---|---|
| - Armadura tracción | **As1** | = | **102,20** | **cm2.** |
| - Armadura compresión | **As2** | = | **11,76** | **cm2.** |

## CÁLCULO A CORTANTE

| | | | | |
|---|---|---|---|---|
| | **Vrd** | = | **389,19** | **Tn.** |
| - Vu1= 0.3*fcd*b*d | | | | |
| | Vu1 | = | 1110,00 | Tn. |
| | **Luego** | **Vrd < Vu1** | | |
| - Vcu= .5*fcd^.5*b*d | | | | |
| | Vcu | = | 109,45 | Tn. |
| - Vsu=Vrd-Vcu | | | | |
| | Vsu | = | 279,74 | Tn. |
| - Ast=Vsu*100/(.9*4.2*d) | | | | |
| | Ast | = | 80,01 | cm2./ml |
| - Amini= 0.02*fcd*b/42 | | | | |
| | Asmini. | = | 19,05 | cm2./ml |
| Luego | | | | |
| | **Ast** | = | **80,01** | **cm2./ml** |

## CÁLCULO A TORSIÓN

| | | | | |
|---|---|---|---|---|
| | **Td** | = | **63,74** | **mTn.** |
| - Tu1=0.36*fcd*Ae*he | Con 0.36*fcd < 90 Kgs/cm2. | | | |
| he=b/6 | | | | |
| | he | = | 16,67 | cm. |
| - Ae=(b-he)*(h-he) | | | | |
| | Ae | = | 10.277,78 | cm2. |
| | Tu1 | = | 154,17 | mTn. |

Limitación cortante más torsor

| | | | |
|---|---|---|---|
| - Td/Tu1+Vrd/Vu1 | = | 0,764 | **< 1** |

**- Armadura longitudinal**

- Td=2*Ae*Asl*fyd/u
- Asl=Td*u/2*Ae*fyd
- u=2*(b-he)+2*(h-he)

| | | | |
|---|---|---|---|
| u | = | 413,33 | cm. |

Luego armamos para

| | | | |
|---|---|---|---|
| **Asl** | = | **27,64** | **cm2.** |

**- Armadura transversal**

- Td=2*Ae*Ats*ftd
- Ats=Td*100*2/(2*Ae*ftd)

| | | | |
|---|---|---|---|
| ftd | = | 4.200,00 | Kgs/cm2. |

Contando con dos ramas

| | | | |
|---|---|---|---|
| **Ats** | = | **14,77** | **cm2/ml.** |

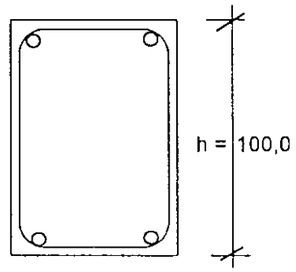
1

# SECCIÓN RECTANGULAR

**DINTEL**

## DATOS DE LA SECCIÓN:

| | | | | |
|---|---|---|---|---|
| - CANTO TOTAL | h | = | **100,0** | cm. |
| - CANTO UTIL | d | = | **92,5** | cm. |
| - ANCHO | b | = | **140,0** | cm. |
| - d-d' | | = | **88,5** | cm. |
| - HORMIGÓN | fck | = | **400** | Kgs/cm2. |
| - ACERO | fyk | = | **5100** | Kgs/cm2. |
| - COEF: MINORACIÓN | | | | |
| - HORMIGÓN | Yc | = | **1,40** | |
| - ACERO | Ys | = | **1,10** | |




ESFUERZOS:

| | | | | |
|---|---|---|---|---|
| | **- Vrd** | = | **359,82** | Tn. |
| | **- Trd** | = | **74,02** | mTn. |

## CÁLCULO A CORTANTE

| | | | | |
|---|---|---|---|---|
| | **Vrd** | = | **359,82** | Tn. |
| - Vu1= 0.3 * fcd * b * d | | | | |
| | Vu1 | = | 1110,00 | Tn. |
| | **Luego** | **Vrd < Vu1** | | |
| - Vcu= .5 * fcd ^.5 * b * d | | | | |
| | Vcu | = | 109,45 | Tn. |
| - Vsu=Vrd - Vcu | | | | |
| | Vsu | = | 250,37 | Tn. |
| - Ast=Vsu * 100 / (.9 * 4.2 * d) | | | | |
| | Ast | = | 71,61 | cm2./ml |
| - Amini= 0.02 * fcd * b / 42 | | | | |
| | Asmini. | = | 19,05 | cm2./ml |

Luego

| | | | |
|---|---|---|---|
| **Ast** | = | **71,61** | **cm2./ml** |

## CÁLCULO A TORSIÓN

| | | | | |
|---|---|---|---|---|
| | **Td** | = | **74,02** | **mTn.** |
| - Tu1=0.36 * fcd * Ae * he | Con 0.36 * fcd < 90 Kgs/cm2. | | | |
| he=b / 6 | | | | |
| | he | = | 16,67 | cm. |
| - Ae=(b - he) * (h - he) | | | | |
| | Ae | = | 10.277,78 | cm2. |
| | Tu1 | = | 154,17 | mTn. |

Limitación cortante más torsor

| | | | |
|---|---|---|---|
| - Td / Tu1 + Vrd / Vu1 | = | 0,804 | **< 1** |

2

**- Armadura longitudinal**

- Td=2 * Ae * Asl * fyd / u
- Asl=Td * u / 2 * Ae * fyd
- u=2 * (b - he) + 2 * (h - he)

u = 413,33 cm.

Luego armamos para

**Asl = 32,10 cm2.**

**- Armadura transversal**

- Td=2 * Ae * Ats * ftd
- Ats=Td * 100 * 2 / ( 2 * Ae * ftd )

ftd = 4.200,00 Kgs/cm2.

Contando con dos ramas

**Ats = 17,15 cm2/ml.**

PRONTUARIO INFORMATICO DEL HORMIGON - PROGRAMA F1

Obra : SUBTRAMO XV
Fecha: 12/6/2000
Hora : 10:58

COMPROBACION DEL ESTADO LIMITE DE FISURACION DEBIDO
A SOLICITACIONES NORMALES

1. Datos

- Materiales

fck [kp/cm²] = 400
fyk [kp/cm²] = 5100

- Sección

b [cm] = 140.0
h [cm] = 100.0
$\phi$ [mm] = 25.0
c [cm] = 4.1
n° de capas = 2
n° de diámetros capa 1 = 14
n° de diámetros capa 2 = 12
Sv [cm] = 5.0

- Solicitación de servicio

Mk [m·Mp] = 286.26

2. Resultados

ABERTURA DE FISURA CARACTERISTICA

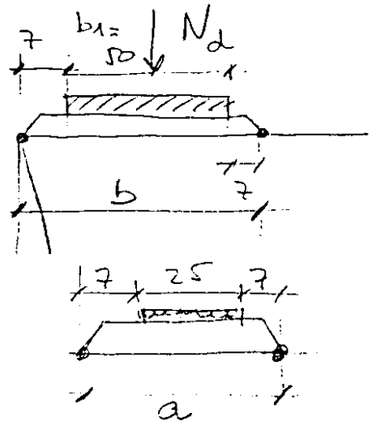
| wk [mm] | Sm [cm] | $\epsilon$sm ·1.E-3 | $\sigma$,sr [kp/cm²] | $\sigma$,s [kp/cm²] |
|---|---|---|---|---|
| 0.29 ✓ | 14.2 | 1.20 | 905 | 2679 |

ABERTURA DE FISURA MAXIMA ADMITIDA

| | |
|---|---|
| AMBIENTE I (interior) | 0.600 [mm] |
| AMBIENTE II (exterior no agresivo) | 0.300 [mm] ✓ |
| AMBIENTE III (agresivo) | 0.150 [mm] |

El número de capas consideradas en el cálculo es 2

## CALCULO ARMADURA BAJO APOYOS.-




$N_d = 384{,}250$ Kgs

$a_1 = 25$ cm

$b_1 = 50$ cm

$a = 25+7+7 = 39$ cm

$b = 50+7+7 = 64$ cm

$A_c = a \times b = 39 \times 64 = 2.496$ cm²

$A_{c1} = a_1 \times b_1 = 25 \times 50 = 1.250$ cm²

$$N_u = A_{c1} \times f_{cd} \times \sqrt{\frac{A_c}{A_{c1}}} < 3'3 \times A_{c1} \times f_{cd}$$

$$\frac{1250 \times \frac{400}{1.5} \times \sqrt{\frac{2496}{1250}}}{1000} = 504'67 \text{ Tn} \quad \Big| \quad \frac{3'3 \times 1250 \times \frac{400}{1.5}}{1000} = 1178'58 \text{ Tn}$$

$N_u = 504'67$ Tn $> N_d = 384'25$ Tn vale

-ARMADURA ⊥ a "a".-

$$A_{sa} = \frac{0'3 \times N_d \times \frac{(a-a_1)}{a}}{f_{yd}} = \frac{0'3 \times 384250 \times \frac{(39-25)}{39}}{4636'36} = 8'93 \text{ cm}^2$$

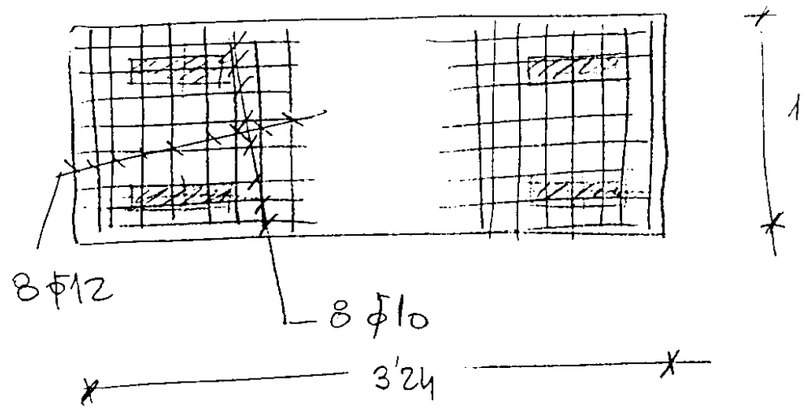
$\Rightarrow 8\phi 12$

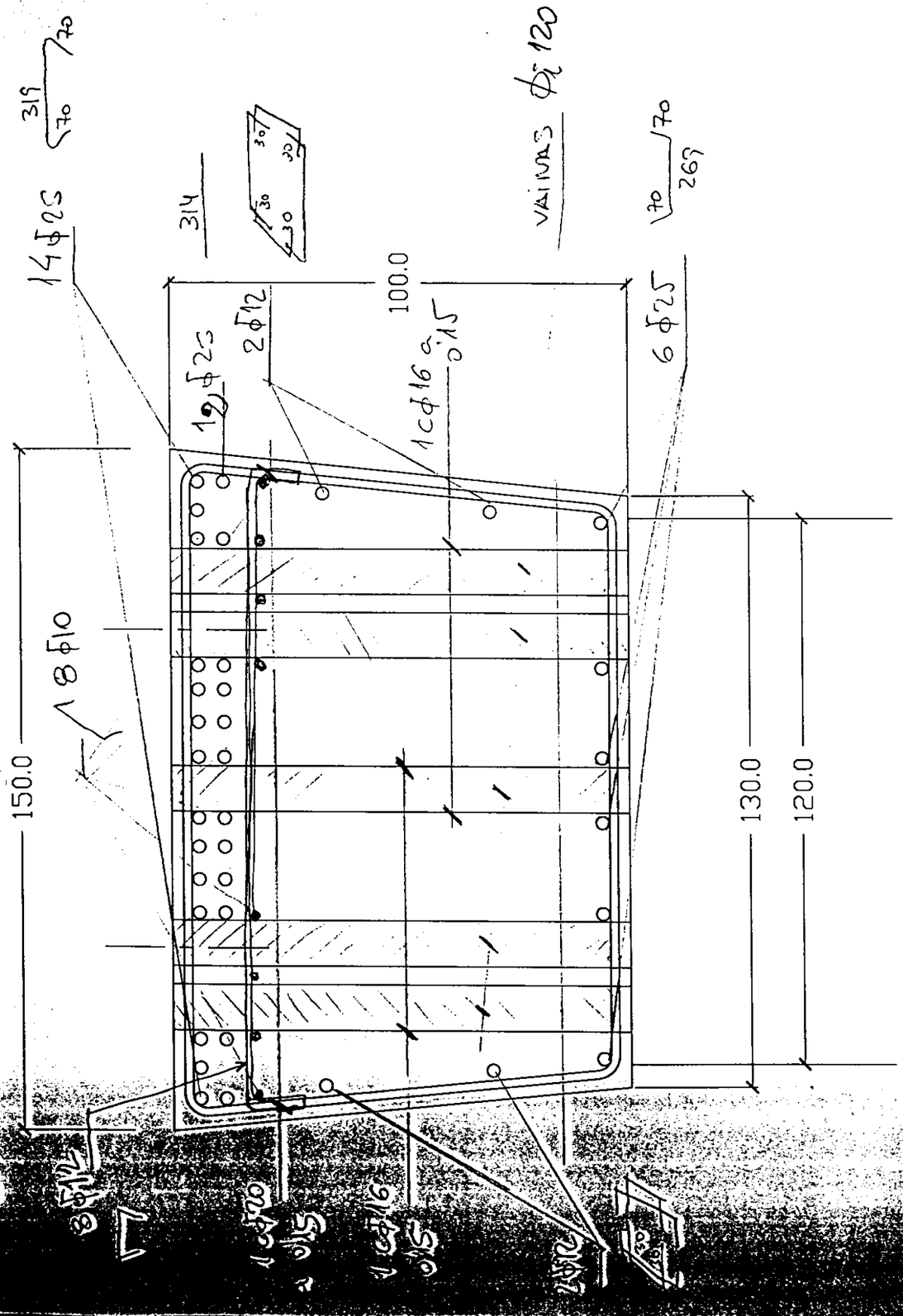


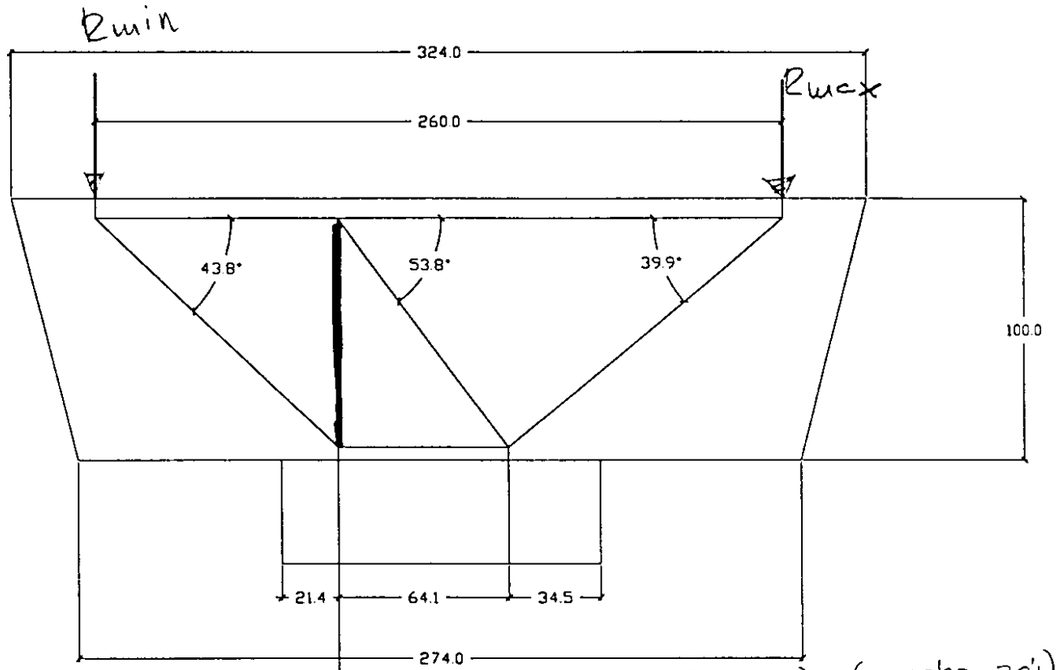
-ARMADURA ⊥ a "b".-

$$A_{sb} = \frac{0'3 \times N_d \times \frac{(b-b_1)}{b}}{f_{yd}} = \frac{0'3 \times 384250 \times \frac{(64-50)}{64}}{4636'36} = 5'44 \text{ cm}^2$$

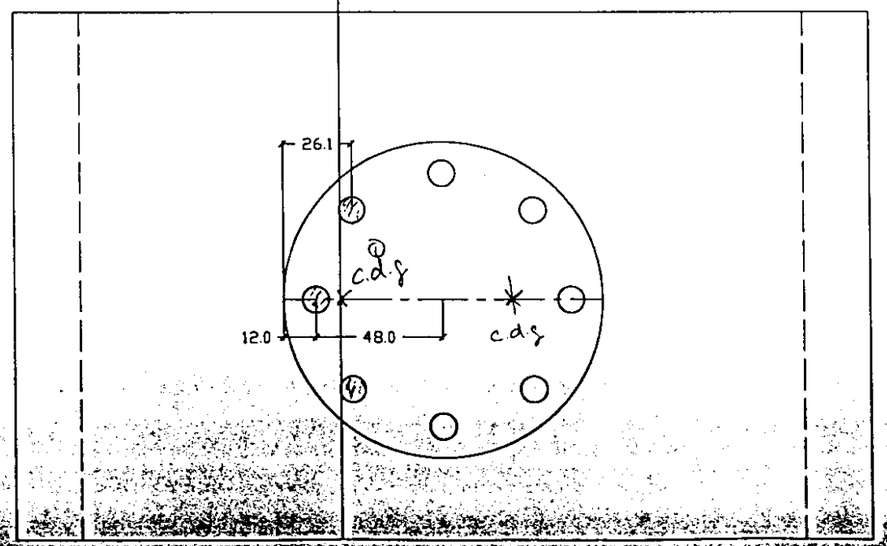
$\Rightarrow 8\phi 10$

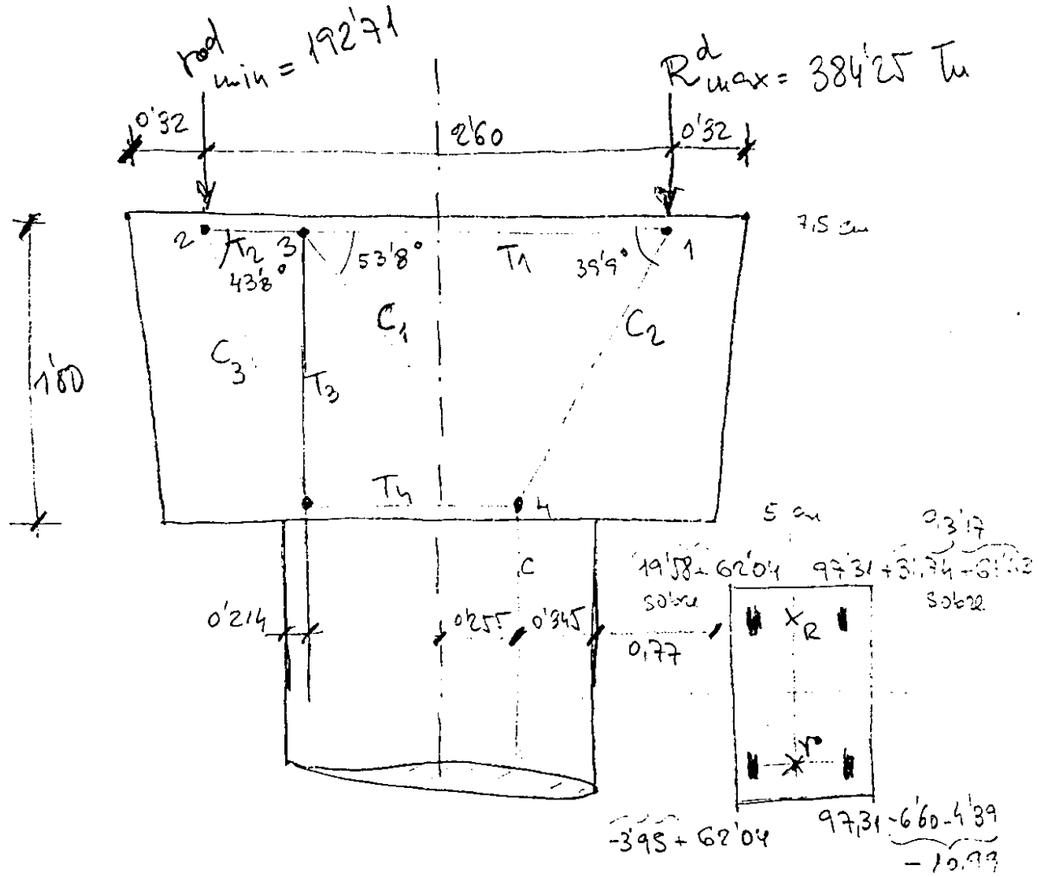





$$①_{c.d.g} = \frac{(19'22 \times 12) + (2 \times 19'22 \times 26'1)}{57,66} = 21,50$$

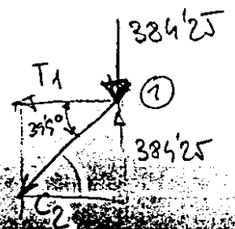





$R_{max} = 1'35 \times (62'04 + 97'31) + 1'50 \times (19,58 + 93'17) = 384,25$ Tn

$R^d_{min} = 1'35 \times$ " $+ 1'50 \times (-3'95 - 10'99) = 192,71$ Tn

## Nudo 1 -




$\text{Sen } 39'9° = \frac{384'25}{C_2}$

$C_2 = 599'03$ Tn

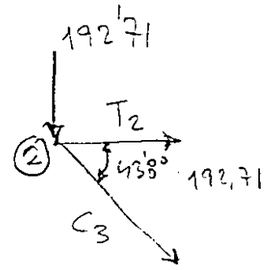
$T_1 = \sqrt{599'03^2 - 384'25^2} = 459'56$ Tn



## Nudo 2 -

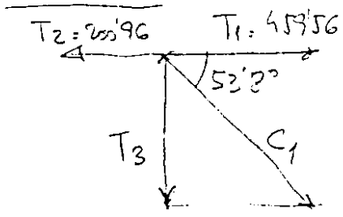
$\text{Sen } 43'5° = \frac{192'71}{C_3}$

$C_3 = 278'43$




$T_2 = \sqrt{278'43^2 - 192'71^2} = 200'96$ Tn

## Nudo 3 -



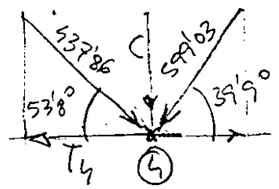

$\text{Cos } 53'8° = \frac{(459'56 - 200'96)}{C_1}$

$C_1 = \frac{258'60}{\text{Cos } 53'80°} = 437'86$ Tn

$T_3 = \sqrt{437'86^2 - 258'6^2} = 353'33$ Tn

$A = \frac{353'33}{\frac{5'10}{1,1}} = 76'21$ cm²

## Nudo 4 -




Reforzamos con 5 grupos de

⇉ ϕ20 a 0'15

⊞ 2cϕ16 a 0'15

} $5 \times 14'32$ cm² = 71'60 cm²

$\text{Sen } 39'90° = \frac{C}{599,03} \Rightarrow C = 384'25$ Tn

$\text{Sen } 53'8° = \frac{C}{437,86} \Rightarrow C = 353'34$ Tn

$C = 737'58$ Tn

PACADAR S.A.

MIGUEL PELAEZ RUIZ
Director de la Oficina Técnica

# COMPROBACIÓN

# DE LAS

# PILAS Y ZAPATAS

| PACADAR | ESTUDIO: 24785 | OBRA: L.A.V. MADRID-ZARAGOZA SUBTRAMO: XV | FECHA: 8-6-00 HOJA: 1 de 50 |
|---|---|---|---|

## COMPROBACIÓN PILAS DE PROYECTO DE LAS "E-1511.3" y "E-1514.2".-

Se procede a petición del contratista a comprobar las pilas de proyecto que eran para un pte. hiperestetico al pasarse la solución a isostatico con un tablero muy semejante a la solución proyectada.

Para ello, nos basamos en los datos que aparecen en dicho proyecto en cuanto a los materiales y armaduras de las citadas pilas y comprobamos el armado con las reacciones y neoprenos empleados en el nuevo tablero

Como se puede comprobar en los listados siguientes, con los nuevos esfuerzos resultantes, la armaduras que nos sale son 31 ϕ 32

Se adjuntan los cálculos realizados para su comprobación y aprobación por el proyectista o en su caso por la Dirección facultativa.

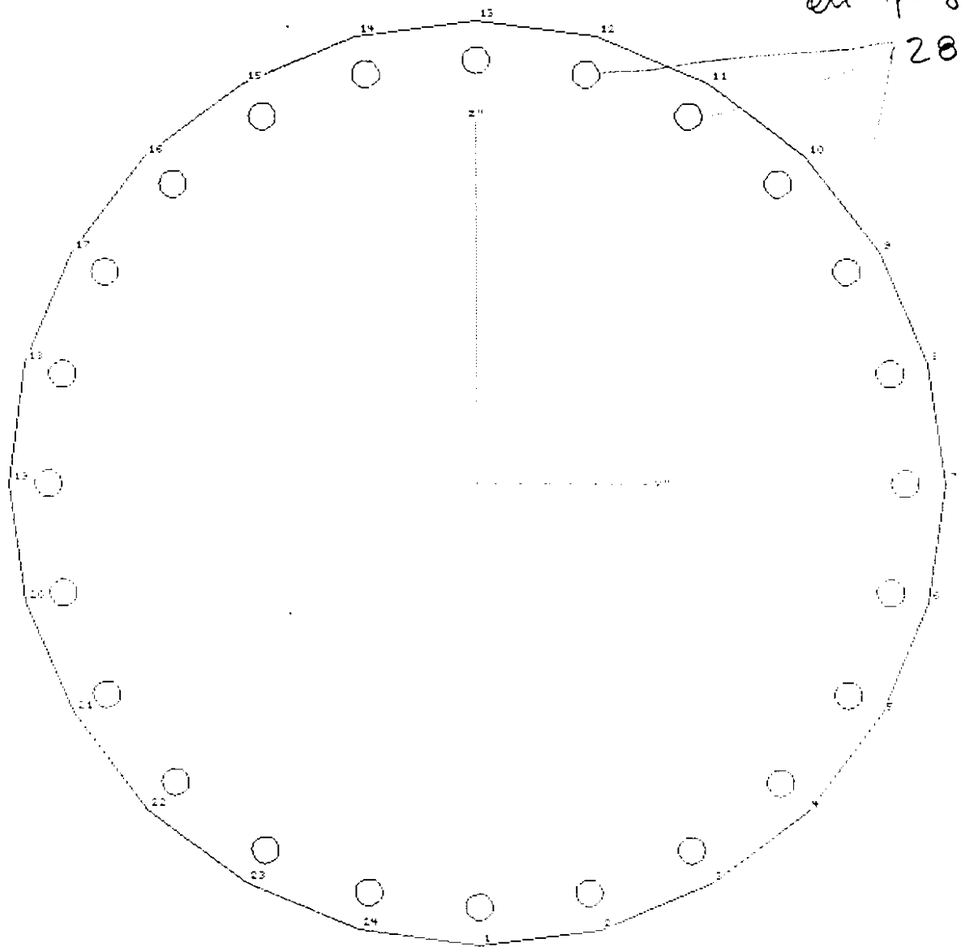
Armado sección

```
Programa   F A G U S - 2    V.1.29                          p gina    1
P A C A D A R                                              09.06.00/--
PILA E-1511.3 y E-1514.2                                   13:33
SUBTRAMO XV
-------------------------------------------------------------------------

L 'cm'  Q S
Q  'PILA DE PROYECTO'
K 120.000 0.000 M 'H-300P'
* B 'B1'
P 0.000 5.000 9.380 M 'AEH500'
P 14.240 6.870 9.380 M 'AEH500'
P 27.500 12.370 9.380 M 'AEH500'
P 38.890 21.110 9.380 M 'AEH500'
P 47.630 32.500 9.380 M 'AEH500'
P 53.130 45.770 9.380 M 'AEH500'
P 55.000 60.000 9.380 M 'AEH500'
P 53.130 74.230 9.380 M 'AEH500'
P 47.630 87.500 9.380 M 'AEH500'
P 38.890 98.890 9.380 M 'AEH500'
P 27.500 107.630 9.380 M 'AEH500'
P 14.240 113.130 9.380 M 'AEH500'
P 0.000 115.000 9.380 M 'AEH500'
P -14.240 113.130 9.380 M 'AEH500'
P -27.500 107.630 9.380 M 'AEH500'
P -38.890 98.890 9.380 M 'AEH500'
P -47.630 87.500 9.380 M 'AEH500'
P -53.130 74.230 9.380 M 'AEH500'
P -55.000 60.000 9.380 M 'AEH500'
P -53.130 45.770 9.380 M 'AEH500'
P -47.630 32.500 9.380 M 'AEH500'
P -38.890 21.110 9.380 M 'AEH500'
P -27.500 12.370 9.380 M 'AEH500'
P -14.240 6.870 9.380 M 'AEH500'
*
```

Escala 1 : 8.0
PILA DE PROYECTO

Armadura existente en proyecto 28 ϕ32



SecciÂn :"PILA-PRO" Armadura :"B1"
Tipo : tipo pila/ CÀrculo/tubo Unidades :[cm]
Material :"H-300P"

Di metro exterior = 120.000 cm

CaracterÀsticas mec nicas de la secciÂn:
Area : Ax= 1.118 [m2]
Momentos de inercia : Iy= 0.099487 [m4] Iz= 0.099487 [m4]
Inercia a torsiÂn : Ix= 0.203575 [m4]

PosiciÂn del centro de gravedad: ys= 0.000 [m] zs= 0.600000 [m]

| | I: | R=dist.borde [m] | W=I/R [m3] | W/Ax [m] |
|---|---|---|---|---|
| izq. | Iz | -0.600 | -0.165812 | 0.148 |
| dch. | Iz | 0.600 | 0.165812 | -0.148 |
| abajo | Iy | -0.600 | -0.165812 | 0.148 |



arriba Iy 0.600 0.165812 -0.148

Armadura: "B1"

| NÏ | Nom.mat | Cod.dim. | Area [cm2] | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] |
|---|---|---|---|---|---|---|---|
| 1 | AEH500 | (1) | 9.38 | 0.00 | 5.00 | | |
| 2 | AEH500 | (1) | 9.38 | 14.24 | 6.87 | | |
| 3 | AEH500 | (1) | 9.38 | 27.50 | 12.37 | | |
| 4 | AEH500 | (1) | 9.38 | 38.89 | 21.11 | | |
| 5 | AEH500 | (1) | 9.38 | 47.63 | 32.50 | | |
| 6 | AEH500 | (1) | 9.38 | 53.13 | 45.77 | | |
| 7 | AEH500 | (1) | 9.38 | 55.00 | 60.00 | | |
| 8 | AEH500 | (1) | 9.38 | 53.13 | 74.23 | | |
| 9 | AEH500 | (1) | 9.38 | 47.63 | 87.50 | | |
| 10 | AEH500 | (1) | 9.38 | 38.89 | 98.89 | | |
| 11 | AEH500 | (1) | 9.38 | 27.50 | 107.63 | | |
| 12 | AEH500 | (1) | 9.38 | 14.24 | 113.13 | | |
| 13 | AEH500 | (1) | 9.38 | 0.00 | 115.00 | | |
| 14 | AEH500 | (1) | 9.38 | -14.24 | 113.13 | | |
| 15 | AEH500 | (1) | 9.38 | -27.50 | 107.63 | | |
| 16 | AEH500 | (1) | 9.38 | -38.89 | 98.89 | | |
| 17 | AEH500 | (1) | 9.38 | -47.63 | 87.50 | | |
| 18 | AEH500 | (1) | 9.38 | -53.13 | 74.23 | | |
| 19 | AEH500 | (1) | 9.38 | -55.00 | 60.00 | | |
| 20 | AEH500 | (1) | 9.38 | -53.13 | 45.77 | | |
| 21 | AEH500 | (1) | 9.38 | -47.63 | 32.50 | | |
| 22 | AEH500 | (1) | 9.38 | -38.89 | 21.11 | | |
| 23 | AEH500 | (1) | 9.38 | -27.50 | 12.37 | | |
| 24 | AEH500 | (1) | 9.38 | -14.24 | 6.87 | | |
| Total: | | | 225.12 | Cuant Àa de armadura: 2.01? [o/o] | | | |

CÂd. dimensionamiento: (0) = As constante
CÂd. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
CÂd. dimensionamiento: (2) = Aumentar As solo en zona traccionada

ÙNo se han definido valores para el c lculo a cortante!

CaracterÀsticas del material:

| Nom.Mat. | MÂdulo E [ kp/cm2] | 0.85*fcd,fyd [ kp/cm2] | eps-fc [o/oo] | fct [ kp/cm2] | fcv [ kp/cm2] | fcw,mÀn [ kp/cm2] |
|---|---|---|---|---|---|---|
| "H-300P" | 330000.0 | -170.000 | -2.000 | 0.0 | 7.070 | 270.000 |
| "AEH500" | 2.10E+06 | 4434.700 | | | | |

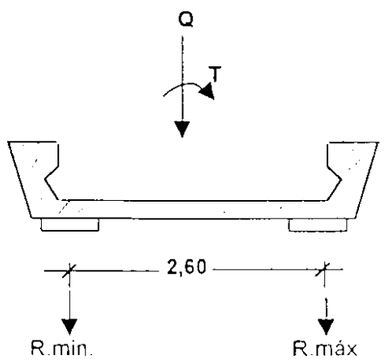
Leyenda:
fcd,fyd resistencia de c lculo del hormigÂn,acero
eps-fc deformaciÂn al final de la par bola (fig.2.3, cap.2.2)
fct resistencia de c lculo a tracciÂn del hormigÂn
fcv resistencia virtual de c lculo del hormigÂn a esfuerzo cortante

## RESUMEN DE REACCIONES.- ( Sin mayorar y por extremo )

### VANO CENTRAL

| | Q ( Tn.) | T.( mTn.) |
|---|---|---|
| - Peso propio + c.perman. = | 189,62 | 0,00 |
| - Sobrec. Unifor. ( Q.max. ) = | 50,27 | 0,00 |
| - Sobrec. Unifor. ( T.max. ) = | 25,14 | 49,85 |
| - Vehiculo ( Q.max. = | 57,04 | 85,56 |
| - Vehiculo ( T.max. ) = | 57,04 | 85,56 |

Separación de neoprenos = 2,60 m.




A ). - VERTICALES

Reacción Máxima.- ( Sin mayorar y por neopreno )

- R.c.permanentes = $\frac{189,62}{2} + \frac{0,00}{2,60}$ = 94,81 Tn.

- R.sobrec. Uniforme = $\frac{50,27}{2} + \frac{0,00}{2,60}$ = 25,14 Tn.

- R.sobrec. Uniforme = $\frac{25,14}{2} + \frac{49,85}{2,60}$ = 31,74 Tn.

- R.vehiculo = $\frac{57,04}{2} + \frac{85,56}{2,60}$ = 61,43 Tn.

**R.máxima = 187,98 Tn.**

Reacción Mínima- ( Sin mayorar y por neopreno )

- R.c.permanentes = $\frac{189,62}{2} - \frac{0,00}{2,60}$ = 94,81 Tn.

- R.sobrec. Uniforme = $\frac{50,27}{2} - \frac{0,00}{2,60}$ = 25,14 Tn.

- R.sobrec. Uniforme = $\frac{25,14}{2} - \frac{49,85}{2,60}$ = -6,60 Tn.

- R.vehiculo = $\frac{57,04}{2} - \frac{85,56}{2,60}$ = -4,39 Tn.

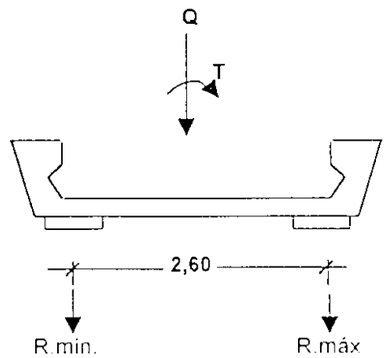
**R.mínima = 83,82 Tn.**

## RESUMEN DE REACCIONES.- ( Sin mayorar y por extremo )

### VANOS LATERALES

| | Q ( Tn.) | T.( mTn.) |
|---|---|---|
| - Peso propio + c.perman. = | 119,08 | 0,00 |
| - Sobrec. Unifor. ( Q.max. ) = | 31,25 | 0,00 |
| - Sobrec. Unifor. ( T.max. ) = | 15,63 | 30,59 |
| - Vehiculo ( Q.max. = | 55,17 | 82,76 |
| - Vehiculo ( T.max. ) = | 55,17 | 82,76 |

Separación de neoprenos = 2,60 m.




A ). - VERTICALES

Reacción Máxima.- ( Sin mayorar y por neopreno )

- R.c.permanentes = $\frac{119,08}{2} + \frac{0,00}{2,60}$ = 59,54 Tn.

- R.sobrec. Uniforme = $\frac{31,25}{2} + \frac{0,00}{2,60}$ = 15,63 Tn.

- R.sobrec. Uniforme = $\frac{15,63}{2} + \frac{30,59}{2,60}$ = 19,58 Tn.

- R.vehiculo = $\frac{55,17}{2} + \frac{82,76}{2,60}$ = 59,42 Tn.

**R.máxima = 138,54 Tn.**

Reacción Mínima- ( Sin mayorar y por neopreno )

- R.c.permanentes = $\frac{119,08}{2} - \frac{0,00}{2,60}$ = 59,54 Tn.

- R.sobrec. Uniforme = $\frac{31,25}{2} - \frac{0,00}{2,60}$ = 15,63 Tn.

- R.sobrec. Uniforme = $\frac{15,63}{2} - \frac{30,59}{2,60}$ = -3,95 Tn.

- R.vehiculo = $\frac{55,17}{2} - \frac{82,76}{2,60}$ = -4,25 Tn.

**R.mínima = 51,34 Tn.**

| PACADAR | ESTUDIO: 24785 | OBRA: SUBTRAMO XV | FECHA: HOJA: 1 |
|---|---|---|---|

## PROGRAMA REPARTO.-

"E-1511.3" y "E-1512.4"
(Para calcular las β de pandeo)

- Nº de vanos = 3
- Lcálculo Vano 1º = 18'65 m
- " " 2º = 30'39 m
- " " 3º = 18'65 m
- Altura de pila nº 1 = 13'77 m - La pila tiene junta = NO
- " " " nº 2 = 14'13 - " " " = NO

## CONSTANTES ESTÁTICAS DE LA SECCIÓN DEL TABLERO.-

Nº DEL VANO 1.

- $A_x$ (area transversal) = 3'001 $m^2$
- $I_x$ (inercia a Torsión) = 2'173 $m^4$
- $I_y$ (inercia a flexion transversal) = 11'957 $m^4$
- $I_z$ (inercia a " longitudinal) = 1'078 $m^4$

| PACADAR | ESTUDIO: | OBRA: | FECHA: HOJA: 2 |
|---|---|---|---|

## CONSTANTES ESTÁTICAS DE LA SECCIÓN DE LAS PILAS.-

Nº de pila: 1

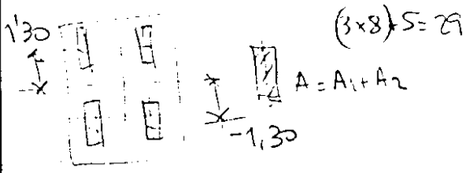
- $I_y$ (Inercia a flexión transversal) = 0'102 $m^4$
- $I_z$ (Inercia a " longitudinal) = 0'102 $m^4$
- $A_x$ (area transversal) = 1'131 $m^2$

## DATOS DE APARATOS DE APOYOS.-

Pilas:

Nº de pila = 1 Nº aparatos apoyo = 2

250 × 500 × 41




A = 2 × 0'25 × 0'50 = 0'25 $m^2$
e = 0'029 m.

Aparato apoyo 1
- Area total = 0'25 $m^2$
- Espesor goma = 0'029 m.
- Brazo = 1'30 m.

Aparato apoyo 2.
- Area total = 0'25 $m^2$
- Espesor goma = 0'029 m.
- Brazo = -1'30 m.

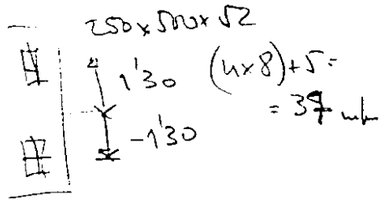
Nº de pila = 2 ... Nº aparato apoyo = 2

Aparato apoyo 1
- Area total = 0'25 $m^2$
- Espesor goma = 0'029 m
- Brazo = 1'30 m

Aparato apoyo 2
- Area total = 0'25 $m^2$
- Espesor goma = 0'029 m
- Brazo = -1'30 m

Estribos

Estribo 1 ... Nº de aparato = 2




Aparato apoyo 1
- Area Total = 0'125 $m^2$
- Espesor goma: 0'037 m
- Brazo: 1'30 m

$A = 0'25 \times 0'50 = 0'125\ m^2$
e 0'037 m

Aparato apoyo 2
- Area total: 0'125 $m^2$
- Espesor goma: 0'037 m
- Brazo = -1'30 m



Estribo 2 ... Nº de aparato =

Aparato apoyo 1
- Area total = 0'125 $m^2$
- Espesor goma = 0'037 m
- Brazo = 1'30 m

Aparato apoyo 2
- Area total = 0'125 $m^2$
- Espesor goma = 0'037 m
- Brazo = -1'30 m

COACCIONES TRANSVERSALES -

Nº de apoyos coaccionados transversalmente.
= 0

Nº de apoyos coaccionados longitudinalmente
= 0

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 5

## CARACTERISTICAS GENERALES DE LOS MATERIALES.-

- Módulo "G" de los neoprenos = 200 Tn/m²
- Hormigón del tablero = H-400
- Hormigón de las pilas = H-300

Según EH-91

- Coefic. de POISSON = 0,2
- Coefic. de dilatación térmica = 0,00001

## CARGAS A INTRODUCIR EN EL MODELO.-

- Densidad tablero = 2,5
- " pilas = 2,5
- Cargas permanentes tablero = 4'139 Tn/ml

Restantes cargas para calcular el reparto de fuerzas horizontales

- C. de Viento Tn/ml

S/tablero Fx = 0 Fz = 0'413 Tn/ml

0'25 x 1'65 = 0'413

S/pilas Fx = 0 Fz = 0'30 Tn/ml

0'25 x 1'20 = 0'30

- C. Fuerza Centrifuga = 0 Tn/ml

14'00 / 69'09

- C. Frenado = 0'203 Tn/ml
- Variación temperatura = 30° ±

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 6

- C. Reologicas (deformación unitaria)

Retracción = 0'00025

Fluencia = 0'00020

```
*TIPO PUENTE
 0
*VANOS
 NUMERO     3
    65      3.001      2.173      11.957      1.078
 38.39      3.001      2.173      11.957      1.078
 18.65      3.001      2.173      11.957      1.078
*PILAS
 altura  iy  iz  ax  junta   neoprenos1   neoprenos2   orientacion
                13.77  .102  .102  1.131  0  2  0  0
                14.13  .102  .102  1.131  0  2  0  0
*ESTRIBOS  (número de aparatos de apoyo)
 num1     num2
 2        2
*JUNTAS  (numero de juntas)
 0
*NEOPRENOS
 1
 .037      .125      1.3      0      0      0      0      .01      0
 .037      .125     -1.3      0      0      0      0      .01      0
 2
 .029      .25       1.3      0      0      0      0      .01      0
 .029      .25      -1.3      0      0      0      0      .01      0
 3
 .029      .25       1.3      0      0      0      0      .01      0
 .029      .25      -1.3      0      0      0      0      .01      0
 .
 .037      .125      1.3      0      0      0      0      .01
 .037      .125     -1.3      0      0      0      0      .01
*MECANICAS
 3800000      340      3200
*COACCIONES TRANSVERSALES
 NUMERO          Apoyos:
*COACCIONES VERTICALES
 NUMERO          Apoyos:
*COEFICIENTES
 .00001
 .2
```

PROGRAMA REPARTO
RESUMEN DE DATOS INTRODUCIDOS

Unidades de fuerza en t.
Unidades de longitud en m.
Unidades de angulos en grados sexagesimales.

1.- GEOMETRIA

Tipo de geometria en planta: Puente recto

1.1.- Datos del tablero

Numero de vanos: 3

| Vano | Longitud(m) | Ax(m2) | Iz(m4) | Iy(m4) | Ix(m4) |
|---|---|---|---|---|---|
| 1 | 1[illegible] | [illegible] | 3.173 | 11.957 | [illegible] |
| 2 | 38.39 | [illegible] | 3.173 | 11.957 | [illegible] |
| 3 | 18.65 | [illegible] | 3.173 | 11.957 | [illegible] |

1.2.- Datos de las pilas

| Pila | H | Iy | Iz | Ax | Nº de [illegible] | Nº de [illegible] |
|---|---|---|---|---|---|---|
| 1 | 13.77 | .102 | .102 | 1.131 | | |
| 2 | 14.13 | .102 | .102 | 1.131 | | |

H: Altura de la pila en m.
Nº 1: Número de neoprenos en el [illegible] de la pila
Número de neoprenos en el [illegible] de la pila
Ne. 2: Número de neoprenos en el [illegible] de la pila
Or: Ángulo de orientación de los ejes de la pila respecto
a la dirección de [illegible] (grados sexagesimales)

1.3.- Datos de las juntas

No hay juntas en las pilas

1.4.- Datos de los aparatos de apoyo

Estribo 1: 2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .125 | .037 | 1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .125 | .037 | -1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Estribo 2: 2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .125 | .037 | 1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .125 | .037 | -1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Pila 1 :
2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .25 | .029 | 1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .25 | .029 | -1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |

Pila 2 :
2 aparato(s)

| Aparato | Area | Espesor | Brazo | A.C. | Or. |
|---|---|---|---|---|---|
| 1 | .25 | .029 | 1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |
| 2 | .25 | .029 | -1.3 | 0 | 0 |
| | Tipo: Neopreno | | | | |

A.C.: Angulo de orientación de la línea de apoyos en grados
Or.: Angulo de rotación respecto a la normal de alineación de los ejes del aparato en grados

...- CARACTERISTICAS MECANICAS DE LOS MATERIALES

Modulo E del material del tablero: [illegible] t/m2
Modulo G del material del tablero: [illegible] t/m2
Modulo E del material de las pilas: [illegible] t/m2
Modulo G del material de las pilas: [illegible] t/m2
Modulo E de los neoprenos: [illegible] t/m2; G = 100 t/m2
Coeficiente de dilatación térmica de los materiales: alfa = .00011
Coeficiente de Poisson de los materiales: .2

3.- COACCIONES:

3.1.- - Apoyos coaccionados transversalmente:
(apoyo 1 = estribo 1, apoyo2 = pila 1 ...)

3.2.- Apoyos coaccionados longitudinalmente:
(apoyo 1 = estribo 1, apoyo2 = pila 1 ...)

4.- ACCIONES:

Peso especifico del material tablero: 2.5 t/m3
Peso especifico del material pilas: 2.5 t/m3
Carga muerta: 4.139 t/ml
Carga de frenado: .203 t/ml
Carga de viento:
Sobre tablero:
Fx = 0 t/ml Fz = .413 t/ml
Sobre pilas:
Fx = 0 t/ml Fz = .3 t/ml
Carga debida a la fuerza centrifuga: 0 t/ml
Incremento de temperatura: 30 grados centigrados
Movimiento impuesto por retraccion: .00025
Movimiento impuesto por fluencia: .0002

CALCULO DE RIGIDECES EQUIVALENTES DE LA ESTRUCTURA
ACTUANDO SOBRE CADA PILA.
CALCULO DE LONGITUDES DE PANDEO.

ESFUERZOS QUE SE LLEVA LA ESTRUCTURA Y MOVIMIENTOS EN CABEZA DE PILAS
(segun ejes LOCALES)

Unidades: Fuerza t
Desplazamientos cm
Rigideces t/m o m.t/rad

Acciones: Para cada pila dos casos de carga.
1.- Carga longitudinal de 1000 t en cabeza
2.- Carga transversal de 1000 t en cabeza

En caso ser empotrada la pila, dos casos mas:
3.- Momento longitudinal de 1000 m.t en cabeza
4.- Carga transversal de 1000 m.t en cabeza

Las rigideces se calculan: M = 0 tablero / 0 cabeza de pila
Pilas = M tablero / Giro cabeza de pila.

---

PILA: 1

[illegible]

[illegible]

[illegible]

PILA: 2

Sentido longitudinal:

Flong. = 698.17 t  Ulong. = 81.44 cm
Kl. = 857.3 t/m

EIlongitudinal = 335671.49 t.m2

Coeficiente de pandeo: beta = 1.09

Sentido transversal:

Ftrans. = 649.45 t  Utrans. = 93.12 cm
Kt. = 697.6 t/m

EItransversal = 335671.49 t.m2

Coeficiente de pandeo: beta = 1.14

No obstante tomamos una beta de pandeo en ambos planos de

$\beta = 1'20$

PACADAR | ESTUDIO: | OBRA: | FECHA: | HOJA: 20

Estados de carga - (Comprobación pila en base)

Definición de fuerzas para entrar en el programa "pilas"

Permanente -

$-N = 18'62 + 119'08 = 308,7$ Tn

$-M_l = 0'35 \times (18'62 - 119'08) = 24,72$ m.Tn

Sc (Para Qmax) -

$-N = 50'27 + 57'04 + 31'25 = 138'56$ Tn

$-F_l = 1'683$ (Frenado en pila)

$-M_l = 0'35 \times (50'27 + 57'04 - 31'25) = 28'62$ m.Tn

$-M_t = 55'56$ Tn

Sc (Para $M^l_{max}$) -

$-N = 50'27 + 57'04 = 107'31$ Tn

$-F_l = \frac{107'31}{138'56} \times 1'683 = 1,303$ Tn

$-M^l = 0'35 \times (50'27 + 57'04) = 37'56$ m.Tn

$-M^t = 85'56$ m.Tn

Sc (Para $M^t_{max}$) -

$-N = (25'14 + 57'04 + 15'63) = 97'81$ Tn

$F_l = \frac{97'81}{138'56} \times 1'683 = 1'188$ Tn

$-M^l = 0'35 \times (25'14 + 57'04 - 15'63) = 23'293$ m.Tn

$-M^t = 49'85 + 85'56 + 30'59 = 166'00$ m.Tn

| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 21 |

reológicas.-

- Fl = 10'64 Tn

Viento.- (presión de proyecto = 0'25 Tn/m²)

Según los cálculos del proyecto, la fuerza de viento mayor sobre las pilas es 11'18 Tn

luego como nosotros tenemos en cuenta la hipótesis un poco de viento transversal

$\frac{1'67}{5'0} \cdot 11'3 - 13'18$ Tn

y un momento en cabeza de

$M = 1'35 \times 13'18 = 17'84$ mTn

- $F_t = 13'18$ Tn
- $M_t = 17'84$ mTn

HIPOTESIS CONSIDERADAS - "pilas"

HIP I - C.perman + Sobrecargas

$(1'35 \times C.p + 1'50 \times Sobrec)$

HIP II - C.perman + Viento transversal

$(1'35 \times Cp + 1'50 \times Viento_t)$

HIP. IV - $\alpha_1 \times$ (C.permen + Sobrecarga + $\alpha_2$ Viento transv)

$1 \times (1'35 \times C.perm + 1'50 \times Sobrec + 1'50 \times 0'60 \times 0'5$ Viento)

```
"*************************************************************************
"       PROGRAMA  PILAS  v1.1
"       PLANTILLA PARA FICHERO DE ENTRADA
"*************************************************************************

"--------------------- Definicion de la seccion ----------------------------
* TITULO
  PILA P-2 / E-1511.3 / SUBTRAMO XV / NETSO                              pg1
* SECCION

"  Introduzca los comandos de definicion de la seccion de la pila, o bien
"  el comando NOMBRE nombre_fichero, donde nombre_fichero es el nombre
"  del fichero de definicion de la seccion (extension .QS  creado con el
"  programa FAQUSI. nombre_fichero debe introducirse SIN EXTENSION.

NOMBRE  PILA-P02       "Introduzca el nombre  SIN EXTENSION  del fichero de definicion
                       "de la seccion creado con FAQUSI. Seguidamente el codigo CREAR
"CREAR  ?              "Introduzca el nombre (SIN EXTENSION  del fichero de definicion
                       "de la seccion que se va a crear con el programa PILAS.
                       "Seguidamente el codigo NOMBRE

"  Los siguientes codigos se utilizan si en el seleccionado la opcion CREAR

"Control_Lons          "Lista de Lons para control de la seccion

"-------------- -
"Perfil_Tipo           "Activa este codigo para definir un perfil tipo
"Cap_Tramo             "Introduzca tramo(s) de la capa
"Cap_Long              "Introduzca long.total de la capa
"Relleno               "Tipo de relleno de la capa
"Armadura              "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (E1, E2, etc
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"N_redondos    ?       "Numero de redondos a disponer perimetralmente
"Cuantia       ?       ?       "Cuantia de armadura en % area hormigon;      incluya el
                       "codigo de dimensionamiento
"Recubrimiento ?       "Distancia paramento a eje de redondos
"Acero         ?       "Tipo de acero de las armaduras

"--------------
"Circular_Hueca                "Active este codigo para crear secc. circulares huecas
"Radio_ext     ?       "Radio contorno exterior
"Radio_int     ?       "Radio contorno interior
"Hormigon      ?       "Tipo de hormigon de la seccion
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (E1, E2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"N_redondos_ext        ?       "Numero de redondos contorno exterior
```

```
"Cuantia_ext    ?       ?       "Cuantia de armadura exterior en % area hormigon;
                                "incluya el codigo de dimensionamiento
"Recubrimiento_ext      ?       "Distancia paramento exterior a eje de redondos
"N_redondos_int                 ?       "Numero de redondos contorno interior
  "antia_int    ?       ?       "Cuantia de armadura interior en % area hormigon;
                                "incluya el codigo de dimensionamiento
"Recubrimiento_int      ?       "Distancia paramento interior a eje de redondos
"Acero          ?               "Tipo de acero de las
armaduras


"-------------------------------------------------------------------------


"------------------------ Estados de carga -------------------------------
* EC

"  Introduzca el nombre del grupo de cargas; introduzca tantos grupos como
"  desee.

- GRUPO normal

"  Introduzca los estados de carga segun el siguiente formato:
"  N1 FACTOR N2 FACTOR ... (EL NUMERO ORIGINAL DE GRUPO)

"Nom        N          F1          F2          N1          N2          N3     Nom_1...
gg       316.*         1.0         0.7       14.72          0.          0.     1.35
q1      198.56       1.487         0.7       10.421       41.63          0.     1.5
q2      107.31       1.371         0.7       37.54       47.69          0.     1.5
q3       97.61       1.184         0.7       23.034      104.13          0.     1.5
q4         2.7       13.71         0.7          0.1          0.          0.     1.5
q5          0.         0.*         0.7          0.1       17.41          0.     1.5

- COMBINAR

"  Introduzca la combinacion de grupos, factores y de tipo de combinacion
"  (Caracteristica, Frecuente, Cuasipermanente)
"  EL FACTOR DE CADA GRUPO (EL NUMERO DE GRUPO SEGUN EL ORDEN DADO)

"Nombre_de_combinacion  Tipo  ....  , Nom_1...
Caracteristica, Nom_1=gg  1.0  1.5

- PUNTOS

"  Introduzca los valores para los puntos, finalizando con Nom_1=0.0 para
"  separarlos del resto. Nom_1 indica el valor para el punto

"Nom_1=    Valor_puntual    Nom_2=...
gg              2.45*           0.45*
q1              0.7*            0.3*


"-------------------- ------------------------------------------------- --


"------------------------ Datos de pandeo ------------------------------.
  PANDEO

fyd             4474.34       "Resistencia de calculo del acero en kp/cm2
alfapl            1.00        "Coeficiente de pandeo longitudinal
alfapt            1.00        "Coeficiente de pandeo transversal
lpila            14.13        "Altura de pila en m
hl                1.2         "Canto longitudinal en m
ht                1.2         "Canto transversal en m
inl               0.1018      "Inercia longitudinal
int               0.1018      "Inercia transversal
area              1.131       "Area seccion transversal
plano_pandeo      long        "Plano de pandeo: introduzca  long=, (trans) o (ambos
salida            completa    "Por defecto la salida es reducida; introduzca (completa)
"                              para incluir el calculo de excentricidades

"-------------------------------------------------------------------------


"------------------------ Opciones de control  -------------------------
* OPCIONES

"  Introduzca los comandos de control del programa. Entre () se indican
"  los valores por defecto

compresiones    positivas       "Introduzca (positivas) o (negativas).
"                                Codigo obligatorio. No hay valor por defecto
acero           AEH500  "Introduzca el tipo de acero de las armaduras.
                         Código obligatorio
  se_pila       b3      "Introduzca el nombre de la armadura de base de pila
"                        Código obligatorio

ndiv            1       "Numero de secciones intermedias de calculo (0)

"solo_base              "Active este codigo para calcular unicamente la base del fuste
"solo_cabeza            "Active este codigo para calcular unicamente la cabeza del fuste
"umbral         ?       "Valor umbral para cargas significativas (0)
"salida         ?       "Introduzca (completa) o (reducida). (reducida)
f_hipviento     1        "Factor de reduccion general para hipotesis de viento (0.9
"f_hipsismo     ?       "Factor de reduccion de qp y sc en hipotesis con sismo (0.6
c_vsc           0.3      "Factor de concomitancia viento - sobrecarga (0.5
"c_vsis         ?       "Factor de concomitancia viento - sismo  0.25)

"-------------------------------------------------------------------------


"----------------------METODO COLUMNA MODELO-------------------------------


* COL_MOD

"  Los siguientes valores definen los parametros de entrada para el programa
"  COMOD (Aplicacion del metodo de la Columna Modelo para obtencion de
"  excentricidades de 2§ orden en base de pila

"Num_y   ?       " Número de divisiones del diagrama M-N
"completo        " Active este dato para calcular el diagrama M-N completo,
                 " incluso la parte de tracción o los signos

"----------------------- -  - ------------ ---------- ----------------  --
```

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 604.59 | 73.32 | 126.34 | 0.117 | 0.175 | 0.292 | 162.39 |
| 2 | Nmin Mlmax Mtmax | 308.70 | 24.72 | 0.00 | 0.080 | 0.164 | 0.244 | 75.24 |
| 3 | Mlmax Mtmax Nmax | 577.71 | 69.71 | 126.34 | 0.155 | 0.183 | 0.338 | 195.31 |
| 4 | Mlmax Mtmax Nmin | 577.71 | 69.71 | 126.34 | 0.155 | 0.183 | 0.338 | 195.31 |
| 5 | Mtmax Nmax Mlmax | 563.46 | 68.31 | 249.00 | 0.121 | 0.178 | 0.299 | 167.65 |
| 6 | Mtmax Nmin Mlmax | 455.42 | 59.66 | 249.00 | 0.131 | 0.179 | 0.309 | 140.66 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 7 | Nmax Mlmax Mtmax | 604.59 | 73.32 | 126.34 | 0.117 | 0.175 | 0.292 | 162.39 |
| 8 | Nmin Mlmax Mtmax | 308.70 | 24.72 | 0.00 | 0.080 | 0.164 | 0.244 | 75.24 |
| 9 | Mlmax Mtmax Nmax | 577.71 | 69.71 | 126.34 | 0.155 | 0.183 | 0.338 | 195.31 |
| 10 | Mlmax Mtmax Nmin | 577.71 | 69.71 | 126.34 | 0.155 | 0.183 | 0.338 | 195.31 |
| 11 | Mtmax Nmax Mlmax | 563.46 | 68.31 | 249.00 | 0.121 | 0.178 | 0.299 | 167.65 |
| 12 | Mtmax Nmin Mlmax | 455.42 | 59.66 | 249.00 | 0.131 | 0.179 | 0.309 | 140.66 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 3 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 604.59 | 73.32 | 126.34 | 0.117 | 0.175 | 0.292 | 162.39 |
| 14 | Nmin Mlmax Mtmax | 308.70 | 24.72 | 0.00 | 0.080 | 0.164 | 0.244 | 75.24 |
| 15 | Mlmax Mtmax Nmax | 577.71 | 69.71 | 126.34 | 0.155 | 0.183 | 0.338 | 195.31 |
| 16 | Mlmax Mtmax Nmin | 577.71 | 69.71 | 126.34 | 0.155 | 0.183 | 0.338 | 195.31 |
| 17 | Mtmax Nmax Mlmax | 563.46 | 68.31 | 249.00 | 0.121 | 0.178 | 0.299 | 167.65 |
| 18 | Mtmax Nmin Mlmax | 455.42 | 59.66 | 249.00 | 0.131 | 0.179 | 0.309 | 140.66 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 19 | Nmax Mlmax Mtmax | 651.85 | 190.02 | 126.34 | 0.292 | 0.200 | 0.492 | 322.93 |
| 20 | Nmin Mlmax Mtmax | 328.67 | 126.20 | 0.00 | 0.384 | 0.206 | 0.590 | 193.88 |
| 21 | Mlmax Mtmax Nmax | 604.67 | 205.00 | 126.34 | 0.339 | 0.203 | 0.542 | 327.86 |
| 22 | Mlmax Mtmax Nmin | 604.67 | 205.00 | 126.34 | 0.339 | 0.203 | 0.542 | 327.86 |
| 23 | Mtmax Nmax Mlmax | 590.42 | 182.36 | 249.00 | 0.309 | 0.201 | 0.510 | 301.08 |
| 24 | Mtmax Nmin Mlmax | 475.39 | 173.73 | 249.00 | 0.365 | 0.205 | 0.570 | 271.11 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 25 | Nmax Mlmax Mtmax | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 26 | Nmin Mlmax Mtmax | 328.67 | 126.20 | 177.67 | 0.384 | 0.206 | 0.590 | 193.88 |
| 27 | Mlmax Mtmax Nmax | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 28 | Mlmax Mtmax Nmin | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 29 | Mtmax Nmax Mlmax | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 30 | Mtmax Nmin Mlmax | 328.67 | 126.20 | 177.67 | 0.384 | 0.206 | 0.590 | 193.88 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 31 | Nmax Mlmax Mtmax | 651.85 | 190.02 | 181.04 | 0.292 | 0.200 | 0.492 | 322.93 |
| 32 | Nmin Mlmax Mtmax | 328.67 | 126.20 | 69.38 | 0.384 | 0.206 | 0.590 | 193.88 |
| 33 | Mlmax Mtmax Nmax | 604.67 | 205.00 | 181.04 | 0.339 | 0.203 | 0.542 | 327.86 |
| 34 | Mlmax Mtmax Nmin | 604.67 | 205.00 | 181.04 | 0.339 | 0.203 | 0.542 | 327.86 |
| 35 | Mtmax Nmax Mlmax | 590.42 | 182.36 | 304.00 | 0.309 | 0.201 | 0.510 | 301.08 |
| 36 | Mtmax Nmin Mlmax | 475.39 | 173.73 | 304.00 | 0.365 | 0.205 | 0.570 | 271.11 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 3 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 37 | Nmax Mlmax Mtmax | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 38 | Nmin Mlmax Mtmax | 328.67 | 126.20 | 177.67 | 0.384 | 0.206 | 0.590 | 193.88 |
| 39 | Mlmax Mtmax Nmax | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 40 | Mlmax Mtmax Nmin | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 41 | Mtmax Nmax Mlmax | 443.71 | 134.85 | 177.67 | 0.304 | 0.201 | 0.505 | 223.89 |
| 42 | Mtmax Nmin Mlmax | 328.67 | 126.20 | 177.67 | 0.384 | 0.206 | 0.590 | 193.88 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 43 | Nmax Mlmax Mtmax | 651.85 | 190.02 | 181.04 | 0.292 | 0.200 | 0.492 | 322.93 |
| 44 | Nmin Mlmax Mtmax | 328.67 | 126.20 | 69.38 | 0.384 | 0.206 | 0.590 | 193.88 |
| 45 | Mlmax Mtmax Nmax | 604.67 | 205.00 | 181.04 | 0.339 | 0.203 | 0.542 | 327.86 |
| 46 | Mlmax Mtmax Nmin | 604.67 | 205.00 | 181.04 | 0.339 | 0.203 | 0.542 | 327.86 |
| 47 | Mtmax Nmax Mlmax | 590.42 | 182.36 | 304.00 | 0.309 | 0.201 | 0.510 | 301.08 |
| 48 | Mtmax Nmin Mlmax | 475.39 | 173.73 | 304.00 | 0.365 | 0.205 | 0.570 | 271.11 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 49 | Nmax Mlmax Mtmax | 676.51 | 311.94 | 233.65 | 0.460 | 0.210 | 0.669 | 454.12 |
| 50 | Nmin Mlmax Mtmax | 348.65 | 227.68 | 105.31 | 0.653 | 0.216 | 0.869 | 302.85 |
| 51 | Mlmax Mtmax Nmax | 631.64 | 320.29 | 233.65 | 0.507 | 0.211 | 0.718 | 453.80 |
| 52 | Mlmax Mtmax Nmin | 631.64 | 320.29 | 233.65 | 0.507 | 0.211 | 0.718 | 453.80 |
| 53 | Mtmax Nmax Mlmax | 617.39 | 296.45 | 354.31 | 0.480 | 0.210 | 0.691 | 426.33 |
| 54 | Mtmax Nmin Mlmax | 495.36 | 287.80 | 354.31 | 0.581 | 0.214 | 0.795 | 393.68 |

ESFUERZOS ADICIONALES

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax Mlmax Mtmax | 624.59 | 182.39 | 128.34 | 225.12 |
| 2 | 1 | B1 | 1 | Nmin Mlmax Mtmax | 308.70 | 75.24 | 0.00 | 225.12 |
| 3 | 1 | B1 | 1 | Mlmax Mtmax Nmax | 577.71 | 195.31 | 128.34 | 225.12 |
| 4 | 1 | B1 | 1 | Mlmax Mtmax Nmin | 577.71 | 195.31 | 128.34 | 225.12 |
| 5 | 1 | B1 | 1 | Mtmax Nmax Mlmax | 563.46 | 167.26 | 249.00 | 225.12 |
| 6 | 1 | B1 | 1 | Mtmax Nmin Mlmax | 495.48 | 140.66 | 249.00 | 225.12 |
| 7 | 1 | B1 | 2 | Nmax Mlmax Mtmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 8 | 1 | B1 | 2 | Nmin Mlmax Mtmax | 308.70 | 75.24 | 26.76 | 225.12 |
| 9 | 1 | B1 | 2 | Mlmax Mtmax Nmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 10 | 1 | B1 | 2 | Mlmax Mtmax Nmin | 416.73 | 101.57 | 26.76 | 225.12 |
| 11 | 1 | B1 | 2 | Mtmax Nmax Mlmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 12 | 1 | B1 | 2 | Mtmax Nmin Mlmax | 308.70 | 75.24 | 26.76 | 225.12 |
| 13 | 1 | B1 | 4 | Nmax Mlmax Mtmax | 624.59 | 182.39 | 128.34 | 225.12 |
| 14 | 1 | B1 | 4 | Nmin Mlmax Mtmax | 308.70 | 75.24 | 0.00 | 225.12 |
| 15 | 1 | B1 | 4 | Mlmax Mtmax Nmax | 577.71 | 195.31 | 128.34 | 225.12 |
| 16 | 1 | B1 | 4 | Mlmax Mtmax Nmin | 577.71 | 195.31 | 128.34 | 225.12 |
| 17 | 1 | B1 | 4 | Mtmax Nmax Mlmax | 563.46 | 167.26 | 249.00 | 225.12 |
| 18 | 1 | B1 | 4 | Mtmax Nmin Mlmax | 495.48 | 140.66 | 249.00 | 225.12 |



PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 19 | 1 | B2 | 1 | Nmax Mlmax Mtmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 20 | 1 | B2 | 1 | Nmin Mlmax Mtmax | 308.70 | 75.24 | 26.76 | 225.12 |
| 21 | 1 | B2 | 1 | Mlmax Mtmax Nmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 22 | 1 | B2 | 1 | Mlmax Mtmax Nmin | 416.73 | 101.57 | 26.76 | 225.12 |
| 23 | 1 | B2 | 1 | Mtmax Nmax Mlmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 24 | 1 | B2 | 1 | Mtmax Nmin Mlmax | 308.70 | 75.24 | 26.76 | 225.12 |
| 25 | 1 | B2 | 2 | Nmax Mlmax Mtmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 26 | 1 | B2 | 2 | Nmin Mlmax Mtmax | 308.70 | 75.24 | 26.76 | 225.12 |
| 27 | 1 | B2 | 2 | Mlmax Mtmax Nmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 28 | 1 | B2 | 2 | Mlmax Mtmax Nmin | 416.73 | 101.57 | 26.76 | 225.12 |
| 29 | 1 | B2 | 2 | Mtmax Nmax Mlmax | 416.73 | 101.57 | 26.76 | 225.12 |
| 30 | 1 | B2 | 2 | Mtmax Nmin Mlmax | 308.70 | 75.24 | 26.76 | 225.12 |
| 31 | 1 | B2 | 4 | Nmax Mlmax Mtmax | 624.59 | 182.39 | 128.34 | 225.12 |
| 32 | 1 | B2 | 4 | Nmin Mlmax Mtmax | 308.70 | 75.24 | 0.00 | 225.12 |
| 33 | 1 | B2 | 4 | Mlmax Mtmax Nmax | 577.71 | 195.31 | 128.34 | 225.12 |
| 34 | 1 | B2 | 4 | Mlmax Mtmax Nmin | 577.71 | 195.31 | 128.34 | 225.12 |
| 35 | 1 | B2 | 4 | Mtmax Nmax Mlmax | 563.46 | 167.26 | 249.00 | 225.12 |
| 36 | 1 | B2 | 4 | Mtmax Nmin Mlmax | 495.48 | 140.66 | 249.00 | 225.12 |



PILA P-2 / E-1511.3 SUBTRAMO XV / NECSO

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 37 | 1 | B3 | 1 | Nmax Mlmax Mtmax | 678.51 | 454.12 | 128.34 | 225.12 |
| 38 | 1 | B3 | 1 | Nmin Mlmax Mtmax | 348.65 | 302.85 | 0.00 | 225.12 |
| 39 | 1 | B3 | 1 | Mlmax Mtmax Nmax | 631.64 | 453.80 | 128.34 | 225.12 |
| 40 | 1 | B3 | 1 | Mlmax Mtmax Nmin | 631.64 | 453.80 | 128.34 | 225.12 |
| 41 | 1 | B3 | 1 | Mtmax Nmax Mlmax | 617.39 | 426.33 | 249.00 | 225.12 |
| 42 | 1 | B3 | 1 | Mtmax Nmin Mlmax | 495.36 | 393.69 | 249.00 | 225.12 |
| 43 | 1 | B3 | 2 | Nmax Mlmax Mtmax | 470.67 | 335.74 | 351.03 | 225.12 |
| 44 | 1 | B3 | 2 | Nmin Mlmax Mtmax | 348.65 | 302.85 | 351.03 | 225.12 |
| 45 | 1 | B3 | 2 | Mlmax Mtmax Nmax | 470.67 | 335.74 | 351.03 | 225.12 |
| 46 | 1 | B3 | 2 | Mlmax Mtmax Nmin | 470.67 | 335.74 | 351.03 | 225.12 |
| 47 | 1 | B3 | 2 | Mtmax Nmax Mlmax | 470.67 | 335.74 | 351.03 | 225.12 |
| 48 | 1 | B3 | 2 | Mtmax Nmin Mlmax | 348.65 | 302.85 | 351.03 | 225.12 |
| 49 | 1 | B3 | 4 | Nmax Mlmax Mtmax | 678.51 | 454.12 | 233.65 | 225.12 |
| 50 | 1 | B3 | 4 | Nmin Mlmax Mtmax | 348.65 | 302.85 | 105.31 | 225.12 |
| 51 | 1 | B3 | 4 | Mlmax Mtmax Nmax | 631.64 | 453.80 | 233.65 | 225.12 |
| 52 | 1 | B3 | 4 | Mlmax Mtmax Nmin | 631.64 | 453.80 | 233.65 | 225.12 |
| 53 | 1 | B3 | 4 | Mtmax Nmax Mlmax | 617.39 | 426.33 | 354.31 | 232.53 |
| 54 | 1 | B3 | 4 | Mtmax Nmin Mlmax | 495.36 | 393.69 | 354.31 | 225.12 |

```
"*************************************************************************
"       PROGRAMA  PILAS  v1.1
"       PLANTILLA PARA FICHERO DE ENTRADA
"*************************************************************************

  ------------------- Definicion de la seccion ---------------------------
  TITULO
  PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO                          p2t

"  Introduzca los comandos de definicion de la seccion de la pila, o bien
"  el comando NOMBRE nombre_fichero, donde nombre_fichero es el nombre
"  del fichero de definicion de la seccion (extension .QS) creado con el
"  programa FAGUS2. nombre_fichero debe introducirse SIN EXTENSION.

NOMBRE  PILA-PPO      "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
                      "de la seccion creado con FAGUS2. Desactivo el codigo CREAR
"CREAR  ?             "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
                      "de la seccion que se va a crear con el programa PILAS.
                      "Desactive el codigo NOMBRE

"  Los siguientes codigos se utilizan si se ha seleccionado la opcion CREAR

"Unidad_long   ?      "Unidad de longitud para entrada de la seccion

"--------------
"Rectangular           "Active este codigo para definir secciones rectangulares
"Dim_trans     ?      "Dimension transversal de la seccion
"Dim_long      ?      "Dimension longitudinal de la seccion
"Hormigon      ?      "Tipo de hormigon de la seccion
"Armadura      ?      "Definicion de la armadura; si no se asigna un nombre
                      "se emplearan los nombres por defecto (B1, B2, etc)
                      "Introduzca tantos bloques de definicion de armadura
                      "como secciones se vayan a dimensionar
"Cuantia_long  ?      ?       "Cuantia longitudinal (por cara) contorno interior;
                              "incluya el codigo de dimensionamiento
"Coef_c_tr     ?      ?       "Coeficiente cuantia transversal (por cara) contorno
                              "interior; incluya el codigo de dimensionamiento
"Recubrimiento ?      "Distancia paramento a eje de redondos
"Acero         ?      "Tipo de acero de las armaduras

"--------------
"Circular              "Active este codigo para crear secciones circulares
"Radio         ?      "Radio de la seccion
"Hormigon      ?      "Tipo de hormigon de la seccion
"Armadura      ?      "Definicion de la armadura; si no se asigna un nombre
                      "se emplearan los nombres por defecto (B1, B2, etc)
                      "Introduzca tantos bloques de definicion de armadura
                      "como secciones se vayan a dimensionar
"N_redondos    ?      "Numero de redondos a disponer perimetralmente
"Cuantia       ?      ?       "Cuantia de armadura en % area hormigon;      incluya el
                              "codigo de dimensionamiento
"Recubrimiento ?      "Distancia paramento a eje de redondos
"Acero         ?      "Tipo de acero de las armaduras

"--------------
"Circular_Hueca               "Active este codigo para crear secc. circulares huecas
"Radio_ext     ?      "Radio contorno exterior
"Radio_int     ?      "Radio contorno interior
"Hormigon      ?      "Tipo de hormigon de la seccion
"Armadura      ?      "Definicion de la armadura; si no se asigna un nombre
                      "se emplearan los nombres por defecto (B1, B2, etc)
                      "Introduzca tantos bloques de definicion de armadura
                      "como secciones se vayan a dimensionar
"N_redondos_ext       ?       "Numero de redondos contorno exterior
"Cuantia_ext   ?      ?       "Cuantia de armadura exterior en % area hormigon;
                              "incluya el codigo de dimensionamiento
"Recubrimiento_ext    ?       "Distancia paramento exterior a eje de redondos
"N_redondos_int               ?       "Numero de redondos contorno interior
"Cuantia_int   ?      ?       "Cuantia de armadura interior en % area hormigon;
                              "incluya el codigo de dimensionamiento
"Recubrimiento_int    ?       "Distancia paramento interior a eje de redondos
"Acero         ?              "Tipo de acero de las
armaduras



"------------------------------------------------------------------------



"------------------------ Estados de Carga ------------------------------
* ES

"  Introduzca el numero de Estados de Carga que desea tratar hasta
"  desee.

* QPERM normal

"  Introduzca los estados de carga para el situacion firmes:
"  N  COMBINACION  Nx  My  Mz  Vy  Vz  Mt  Ny/Nz  Mz/My

"Cod      N            My            Mz            Vy            Vz            Mt          Ny/Nz    Mz/My
ES      3.e+7         -.e+7          .e+7          .e+7          .e+7          .e+7          .e+7     1.e+0
ES      3.e+7        -1.e+7         1.e+7          .e+7          .e+7          .e+7          .e+7     1.e+0
ES      3.e+7        -2.e+7         2.e+7          .e+7          .e+7          .e+7          .e+7     1.e+0
ES      3.e+7        -3.e+7         3.e+7          .e+7          .e+7          .e+7          .e+7     1.e+0
ES      3.e+7        -4.e+7         4.e+7          .e+7          .e+7          .e+7          .e+7     1.e+0
ES      3.e+7        -5.e+7         5.e+7          .e+7          .e+7          .e+7          .e+7     1.e+0

* COMBINE

"  Este bloque ...
"  ...
"  ... 0.85 e 1.5 de Vanda ... 0.5% ...

"Cod  Hipo  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef  Coef
1       1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1
2       1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1
3       1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1

"---------  ...  ---------  .  ...  ...  ...
```

```
"solo_cabeza            "Active este codigo para calcular unicamente la cabeza del fuste
"umbral        ?        "Valor umbral para cargas significativas (0)
"salida        ?        "Introduzca (completa) o (reducida). (reducida)
f_hipviento     1        "Factor de reduccion general para hipotesis de viento (0.9)
"f_hipsismo    ?        "Factor de reduccion de cp y sc en hipotesis con sismo (0.8)
   sc           0.3      "Factor de concomitancia viento - sobrecarga (0.5)
'_vsis         ?        "Factor de concomitancia viento - sismo (0.25)

"-------------------------------------------------------------------------


"--------------------METODO COLUMNA MODELO--------------------------------

* COL_MOD

"  Los siguientes codigos definen par metros de entrada para el programa
"  CMOD (Aplicabilidad del m,todo de la Columna Modelo para obtenci,n de
"  excentricidades de 2$ orden en base de pila.

"ndiv   ?       " N,mero de divisiones del diagrama M-N
"completo       " Active este c,digo para calcular el diagrama M-N completo,
                " comenzando desde el valor 1 del momento

"-------------------------------------------------------------------------
```



PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | ec | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 624.57 | 79.30 | 126.34 | 0.205 | 0.191 | 0.396 | 247.41 |
| 2 | Nmin Mlmax Mtmax | 309.71 | 24.72 | 0.00 | 0.080 | 0.136 | 0.216 | 66.91 |
| 3 | Mlmax Mtmax Nmax | 577.71 | 89.71 | 126.34 | 0.222 | 0.193 | 0.415 | 239.69 |
| 4 | Mlmax Mtmax Nmin | 577.71 | 89.71 | 126.34 | 0.222 | 0.193 | 0.415 | 239.69 |
| 5 | Mtmax Nmax Mlmax | 563.40 | 69.31 | 249.00 | 0.442 | 0.219 | 0.661 | 372.64 |
| 6 | Mtmax Nmin Mlmax | 455.41 | 59.66 | 249.00 | 0.547 | 0.219 | 0.766 | 348.97 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | ec | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 624.57 | 79.30 | 126.34 | 0.205 | 0.191 | 0.396 | 247.41 |
| 14 | Nmin Mlmax Mtmax | 309.71 | 24.72 | 0.00 | 0.080 | 0.136 | 0.216 | 66.91 |
| 15 | Mlmax Mtmax Nmax | 577.71 | 89.71 | 126.34 | 0.222 | 0.193 | 0.415 | 239.69 |
| 16 | Mlmax Mtmax Nmin | 577.71 | 89.71 | 126.34 | 0.222 | 0.193 | 0.415 | 239.69 |
| 17 | Mtmax Nmax Mlmax | 563.40 | 69.31 | 249.00 | 0.442 | 0.219 | 0.661 | 372.64 |
| 18 | Mtmax Nmin Mlmax | 455.41 | 59.66 | 249.00 | 0.547 | 0.219 | 0.766 | 348.97 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | ec | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|
| 19 | Nmax Mlmax Mtmax | 691.55 | 192.62 | 126.34 | 0.197 | 0.188 | 0.386 | 251.41 |
| 20 | Nmin Mlmax Mtmax | 326.67 | 126.20 | 0.00 | 0.060 | 0.156 | 0.216 | 70.84 |
| 21 | Mlmax Mtmax Nmax | 604.67 | 205.00 | 126.34 | 0.212 | 0.192 | 0.404 | 244.13 |
| 22 | Mlmax Mtmax Nmin | 604.67 | 205.00 | 126.34 | 0.212 | 0.192 | 0.404 | 244.13 |
| 23 | Mtmax Nmax Mlmax | 590.42 | 182.36 | 249.00 | 0.422 | 0.209 | 0.630 | 371.78 |
| 24 | Mtmax Nmin Mlmax | 475.39 | 173.73 | 249.00 | 0.524 | 0.212 | 0.736 | 349.76 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VT

| Num | Esfuerzos | N | Ml | Mt | ec | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 25 | Nmax | Mlmax | Mtmax | 443.71 | 134.85 | 177.67 | 0.400 | 0.207 | 0.607 | 269.42 |
| 26 | Nmin | Mlmax | Mtmax | 328.67 | 126.20 | 177.67 | 0.541 | 0.213 | 0.753 | 247.51 |
| 27 | Mlmax | Mtmax | Nmax | 443.71 | 134.85 | 177.67 | 0.400 | 0.207 | 0.607 | 269.42 |
| | Mlmax | Mtmax | Nmin | 443.71 | 134.85 | 177.67 | 0.400 | 0.207 | 0.607 | 269.42 |
| 29 | Mtmax | Nmax | Mlmax | 443.71 | 134.85 | 177.67 | 0.400 | 0.207 | 0.607 | 269.42 |
| 30 | Mtmax | Nmin | Mlmax | 328.67 | 126.20 | 177.67 | 0.541 | 0.213 | 0.753 | 247.51 |



PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | | | N | Ml | Mt | eo | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|---|---|
| 31 | Nmax | Mlmax | Mtmax | 651.55 | 190.62 | 181.64 | 0.279 | 0.169 | 0.477 | 311.71 |
| 32 | Nmin | Mlmax | Mtmax | 328.67 | 126.20 | 55.31 | 0.162 | 0.164 | 0.340 | 113.79 |
| 33 | Mlmax | Mtmax | Nmax | 604.69 | 206.07 | 181.64 | 0.300 | 0.203 | 0.521 | 311.80 |
| 34 | Mlmax | Mtmax | Nmin | 604.67 | 206.05 | 181.64 | 0.300 | 0.215 | 0.531 | 321.47 |
| 35 | Mtmax | Nmax | Mlmax | 581.42 | 182.34 | 310.81 | 0.512 | 0.218 | 0.729 | 407.21 |
| 36 | Mtmax | Nmin | Mlmax | 479.34 | 174.79 | 310.81 | 0.638 | 0.218 | 0.856 | 410.17 |



PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B3 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | | | N | Ml | Mt | eo | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | Nmax | Mlmax | Mtmax | 678.51 | 311.94 | 233.65 | 0.344 | 0.204 | 0.548 | 371.75 |
| 38 | Nmin | Mlmax | Mtmax | 348.65 | 227.68 | 105.31 | 0.302 | 0.201 | 0.503 | 175.22 |
| 39 | Mlmax | Mtmax | Nmax | 631.64 | 320.29 | 233.65 | 0.370 | 0.205 | 0.575 | 363.21 |
| 40 | Mlmax | Mtmax | Nmin | 631.64 | 320.29 | 233.65 | 0.370 | 0.205 | 0.575 | 363.21 |
| 41 | Mtmax | Nmax | Mlmax | 617.39 | 296.45 | 354.31 | 0.574 | 0.214 | 0.787 | 486.14 |
| 42 | Mtmax | Nmin | Mlmax | 495.36 | 287.80 | 354.31 | 0.715 | 0.217 | 0.932 | 461.78 |

ESFUERZOS ADICIONALES

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | | | N | Ml | Mt | eo | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|---|---|
| 43 | Nmax | Mlmax | Mtmax | 470.67 | 236.34 | 351.03 | 0.746 | 0.217 | 0.963 | 453.42 |
| 44 | Nmin | Mlmax | Mtmax | 348.65 | 227.68 | 351.03 | 1.007 | 0.221 | 1.228 | 428.18 |
| 45 | Mlmax | Mtmax | Nmax | 470.67 | 236.34 | 351.03 | 0.746 | 0.217 | 0.963 | 453.42 |
| 46 | Mlmax | Mtmax | Nmin | 470.67 | 236.34 | 351.03 | 0.746 | 0.217 | 0.963 | 453.42 |
| 47 | Mtmax | Nmax | Mlmax | 470.67 | 236.34 | 351.03 | 0.746 | 0.217 | 0.963 | 453.42 |
| 48 | Mtmax | Nmin | Mlmax | 348.65 | 227.68 | 351.03 | 1.007 | 0.221 | 1.228 | 428.18 |



PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B2 COMBINACION DE CARGAS: 1
HIPOTESIS: 4 1.00(CP + SC + 0.30Viento Trans.)
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM VT

| Num | Esfuerzos | | | N | Ml | Mt | eo | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|---|---|
| 49 | Nmax | Mlmax | Mtmax | 678.51 | 311.94 | 233.65 | 0.344 | 0.204 | 0.548 | 371.75 |
| 50 | Nmin | Mlmax | Mtmax | 348.65 | 227.68 | 105.31 | 0.302 | 0.201 | 0.503 | 175.22 |
| 51 | Mlmax | Mtmax | Nmax | 631.64 | 320.29 | 233.65 | 0.370 | 0.205 | 0.575 | 363.21 |
| 52 | Mlmax | Mtmax | Nmin | 631.64 | 320.29 | 233.65 | 0.370 | 0.205 | 0.575 | 363.21 |
| 53 | Mtmax | Nmax | Mlmax | 617.39 | 296.45 | 354.31 | 0.574 | 0.214 | 0.787 | 486.14 |
| 54 | Mtmax | Nmin | Mlmax | 495.36 | 287.80 | 354.31 | 0.715 | 0.217 | 0.932 | 461.78 |

ESFUERZOS ADICIONALES



PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

| Num | Cmb | Seccion | Hip | Esfuerzos | | | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax | Mlmax | Mtmax | 624.59 | 73.30 | 247.42 | 225.12 |
| 2 | 1 | B1 | 1 | Nmin | Mlmax | Mtmax | 308.70 | 24.72 | 66.62 | 225.12 |
| 3 | 1 | B1 | 1 | Mlmax | Mtmax | Nmax | 577.71 | 89.71 | 239.69 | 225.12 |
| 4 | 1 | B1 | 1 | Mlmax | Mtmax | Nmin | 577.71 | 89.71 | 239.69 | 225.12 |
| 5 | 1 | B1 | 1 | Mtmax | Nmax | Mlmax | 563.46 | 68.31 | 366.64 | 225.12 |
| 6 | 1 | B1 | 1 | Mtmax | Nmin | Mlmax | 455.42 | 55.66 | 345.87 | 225.12 |
| 7 | 1 | B1 | 2 | Nmax | Mlmax | Mtmax | 416.75 | 33.37 | 92.44 | 225.12 |
| 8 | 1 | B1 | 2 | Nmin | Mlmax | Mtmax | 308.70 | 24.72 | 77.97 | 225.12 |
| 9 | 1 | B1 | 2 | Mlmax | Mtmax | Nmax | 416.75 | 33.37 | 92.44 | 225.12 |
| 10 | 1 | B1 | 2 | Mlmax | Mtmax | Nmin | 416.75 | 33.37 | 92.44 | 225.12 |
| 11 | 1 | B1 | 2 | Mtmax | Nmax | Mlmax | 416.75 | 33.37 | 92.44 | 225.12 |
| 12 | 1 | B1 | 2 | Mtmax | Nmin | Mlmax | 308.70 | 24.72 | 77.97 | 225.12 |
| 13 | 1 | B1 | 4 | Nmax | Mlmax | Mtmax | 624.59 | 73.30 | 247.42 | 225.12 |
| 14 | 1 | B1 | 4 | Nmin | Mlmax | Mtmax | 308.70 | 24.72 | 66.62 | 225.12 |
| 15 | 1 | B1 | 4 | Mlmax | Mtmax | Nmax | 577.71 | 89.71 | 239.69 | 225.12 |
| 16 | 1 | B1 | 4 | Mlmax | Mtmax | Nmin | 577.71 | 89.71 | 239.69 | 225.12 |
| 17 | 1 | B1 | 4 | Mtmax | Nmax | Mlmax | 563.46 | 68.31 | 366.64 | 225.12 |
| 18 | 1 | B1 | 4 | Mtmax | Nmin | Mlmax | 455.42 | 55.66 | 345.87 | 225.12 |
| 19 | 1 | B2 | 1 | Nmax | Mlmax | Mtmax | 624.59 | 73.30 | 247.42 | 225.12 |
| 20 | 1 | B2 | 1 | Nmin | Mlmax | Mtmax | 308.70 | 24.72 | 66.62 | 225.12 |
| 21 | 1 | B2 | 1 | Mlmax | Mtmax | Nmax | 577.71 | 89.71 | 239.69 | 225.12 |
| 22 | 1 | B2 | 1 | Mlmax | Mtmax | Nmin | 577.71 | 89.71 | 239.69 | 225.12 |
| 23 | 1 | B2 | 1 | Mtmax | Nmax | Mlmax | 563.46 | 68.31 | 366.64 | 225.12 |
| 24 | 1 | B2 | 1 | Mtmax | Nmin | Mlmax | 455.42 | 55.66 | 345.87 | 225.12 |
| 25 | 1 | B2 | 2 | Nmax | Mlmax | Mtmax | 416.75 | 33.37 | 92.44 | 225.12 |
| 26 | 1 | B2 | 2 | Nmin | Mlmax | Mtmax | 308.70 | 24.72 | 77.97 | 225.12 |
| 27 | 1 | B2 | 2 | Mlmax | Mtmax | Nmax | 416.75 | 33.37 | 92.44 | 225.12 |
| 28 | 1 | B2 | 2 | Mlmax | Mtmax | Nmin | 416.75 | 33.37 | 92.44 | 225.12 |
| 29 | 1 | B2 | 2 | Mtmax | Nmax | Mlmax | 416.75 | 33.37 | 92.44 | 225.12 |
| 30 | 1 | B2 | 2 | Mtmax | Nmin | Mlmax | 308.70 | 24.72 | 77.97 | 225.12 |
| 31 | 1 | B2 | 4 | Nmax | Mlmax | Mtmax | 624.59 | 73.30 | 247.42 | 225.12 |
| 32 | 1 | B2 | 4 | Nmin | Mlmax | Mtmax | 308.70 | 24.72 | 66.62 | 225.12 |
| 33 | 1 | B2 | 4 | Mlmax | Mtmax | Nmax | 577.71 | 89.71 | 239.69 | 225.12 |
| 34 | 1 | B2 | 4 | Mlmax | Mtmax | Nmin | 577.71 | 89.71 | 239.69 | 225.12 |
| 35 | 1 | B2 | 4 | Mtmax | Nmax | Mlmax | 563.46 | 68.31 | 366.64 | 225.12 |
| 36 | 1 | B2 | 4 | Mtmax | Nmin | Mlmax | 455.42 | 55.66 | 345.87 | 225.12 |



PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

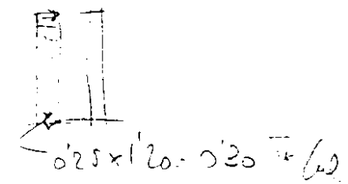
| Num | Cmb | Seccion | Hip | Esfuerzos | | | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 1 | B3 | 1 | Nmax | Mlmax | Mtmax | 678.51 | 311.94 | 256.15 | 225.12 |
| 38 | 1 | B3 | 1 | Nmin | Mlmax | Mtmax | 348.65 | 227.68 | 75.25 | 225.12 |
| 39 | 1 | B3 | 1 | Mlmax | Mtmax | Nmax | 631.64 | 320.29 | 248.57 | 225.12 |
| 40 | 1 | B3 | 1 | Mlmax | Mtmax | Nmin | 631.64 | 320.29 | 248.57 | 225.12 |
| 41 | 1 | B3 | 1 | Mtmax | Nmax | Mlmax | 617.39 | 296.45 | 376.76 | 225.12 |
| 42 | 1 | B3 | 1 | Mtmax | Nmin | Mlmax | 495.36 | 287.80 | 353.63 | 225.12 |
| 43 | 1 | B3 | 2 | Nmax | Mlmax | Mtmax | 470.67 | 236.34 | 453.42 | 225.12 |
| 44 | 1 | B3 | 2 | Nmin | Mlmax | Mtmax | 348.65 | 227.68 | 428.18 | 225.12 |
| 45 | 1 | B3 | 2 | Mlmax | Mtmax | Nmax | 470.67 | 236.34 | 453.42 | 225.12 |
| 46 | 1 | B3 | 2 | Mlmax | Mtmax | Nmin | 470.67 | 236.34 | 453.42 | 225.12 |
| 47 | 1 | B3 | 2 | Mtmax | Nmax | Mlmax | 470.67 | 236.34 | 453.42 | 225.12 |
| 48 | 1 | B3 | 2 | Mtmax | Nmin | Mlmax | 348.65 | 227.68 | 428.18 | 225.12 |
| 49 | 1 | B3 | 4 | Nmax | Mlmax | Mtmax | 678.51 | 311.94 | 371.75 | 225.12 |
| 50 | 1 | B3 | 4 | Nmin | Mlmax | Mtmax | 348.65 | 227.68 | 175.22 | 225.12 |
| 51 | 1 | B3 | 4 | Mlmax | Mtmax | Nmax | 631.64 | 320.29 | 363.21 | 225.12 |
| 52 | 1 | B3 | 4 | Mlmax | Mtmax | Nmin | 631.64 | 320.29 | 363.21 | 225.12 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 53 | 1 | B3 | 4 | Mtmax | Nmax | Mlmax | 617.39 | 296.45 | 486.14 | 242.46 |
| 54 | 1 | B3 | 4 | Mtmax | Nmin | Mlmax | 495.36 | 287.80 | 461.78 | 232.03 |

Como la armadura que se necesita son

$242'46\ cm^2 \rightarrow$ 31 ϕ 32 $(249'24\ cm^2)$

## Cortante en la base -

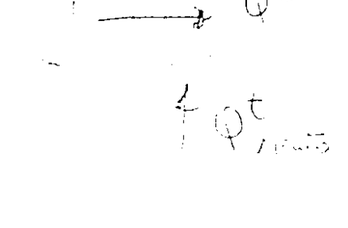



$\varphi_{viento} = 0'30 \times 14'13 = 4'24$ Tn

$-\ V_d^{flexit.} = (1'35 \times 10'64) + \left(1'50 \times (1'68 + 1'303 + 1'135)\right) + 20'625$

$+ 1'50 \times (0'60 \times 0'50 \times 4'24) = 22'54$ Tn

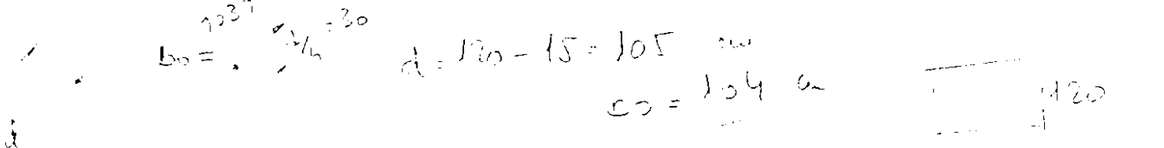
$-\ \varphi_d^{trans.} = 1'50 \times 0'60 \times 0'50 \times 13'18 = 5'92$ Tn




Sección calculo

$b_0 = 1'20$ $\quad d = 1'20 - 0'15 = 1'05$ m

$c_2 = 1'04$ m







$=$

- Para $\varphi_d^{long\,it} = 22'54$ Tn $\Rightarrow$ Ast = 990 $cm^2/m \geq$ 1 c/12 a 0'20 (11,31 $cm^2$)

- Para $\varphi_d = \sqrt{20'625^2 + 5'92^2} = 21'46$ Tn $< 22'54$ Tn

$\not\Rightarrow$

1

# PILA

## EMPOTRAMIENTO

**DATOS DE LA SECCIÓN:**

| | | | | |
|---|---|---|---|---|
| - CANTO TOTAL | h | = | **120,0** | cm. |
| - CANTO UTIL | d | = | **114,5** | cm. |
| - ANCHO | b | = | **104,0** | cm. |
| - d-d' | | = | **112,0** | cm. |
| - HORMIGÓN | fck | = | **300** | Kgs/cm2. |
| - ACERO | fyk | = | **5100** | Kgs/cm2. |
| - COEF: MINORACIÓN | | | | |
| - HORMIGÓN | Yc | = | **1,50** | |
| - ACERO | Ys | = | **1,10** | |

ESFUERZOS: - Vrd = **22,54** Tn.

CÁLCULO A CORTANTE

---

**Vrd** = **22,54** Tn

- Vu1= 0.3 * fcd * b * d

Vu1 = 714,48 Tn.

**Luego Vrd < Vu1**

- Vcu= .5 * fcd ^.5 * b * d

Vcu = 84,20 Tn.

- Vsu=Vrd - Vcu

Vsu = 0,00 Tn.

- Ast=Vsu * 100 / (.9 * 4.2 * d)

Ast = 0,00 cm2./ml

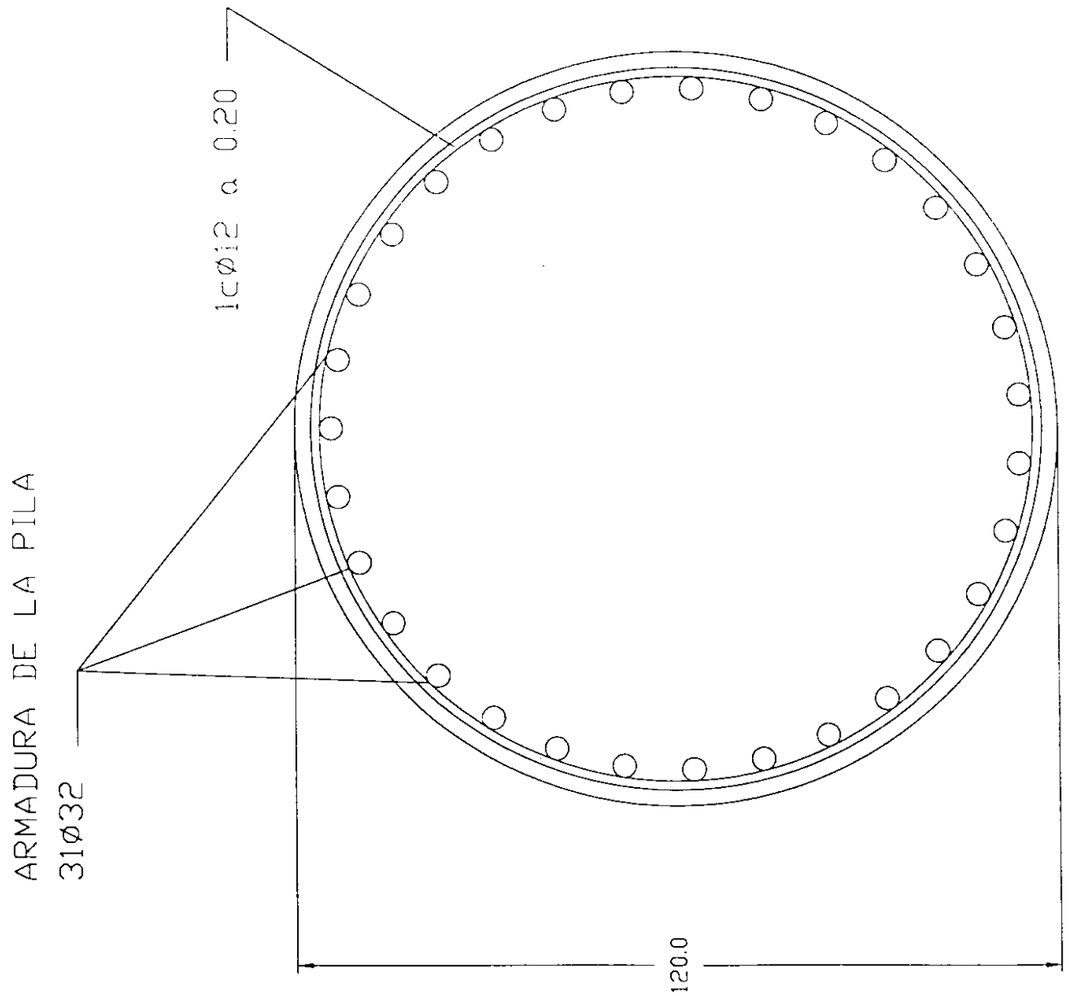
- Amini= 0.02 * fcd * b / 42

Asmini. = 9,90 cm2./ml

Luego

| | | | |
|---|---|---|---|
| **Ast** | = | **9,90** | **cm2./ml** |

≈ 1 c ϕ 12 a 0'20



| PACADAR | ESTUDIO: | OBRA: | FECHA: |
|---|---|---|---|
| | | | HOJA: 39 |

## ZAPATAS -

- Partimos de la zapata de proyecto de 5'00 x 5'00 m
- $\sigma_t$ = 3'00 Kg/cm²
- $\sigma_{adm\ punt.} = \frac{4}{3} \times 3'00 = 4'00$ Kg/cm²
- H-250 $\gamma = 1'50$
- AEH-500N $\gamma = 1'15$

```
"  FICHERO DE ENTRADA PARA EL PROGRAMA CMOD
"  (Aplicacion metodo Columna Modelo)                    p2t. Zap.

* CODIGOS
LP_L                  16.96  "Longitud de pandeo longitudinal
LP_T                  16.96  "Longitud de pandeo transversal
COMPRESIONES      POSITIVAS      "Signo de las compresiones.
* ESFUERZOS
"          N          Ml          Mt       Mlpan       Mtpan
      678.51      311.94      128.34      311.94      256.15
      348.65      227.68        0.00      227.68       75.25
      631.64      320.29      128.34      320.29      248.57
      631.64      320.29      128.34      320.29      248.57
      617.39      296.45      249.00      296.45      376.76
      495.36      287.80      249.00      287.80      353.63
      470.67      236.34      351.03      236.34      453.42
      348.65      227.68      351.03      227.68      428.18
      470.67      236.34      351.03      236.34      453.42
      470.67      236.34      351.03      236.34      453.42
      470.67      236.34      351.03      236.34      453.42
      348.65      227.68      351.03      227.68      428.18
      678.51      311.94      233.65      311.94      371.75
      348.65      227.68      105.31      227.68      175.22
      631.64      320.29      233.65      320.29      361.21
      631.64      320.29      233.65      320.29      361.21
      617.39      296.45      354.31      296.45      466.14
      495.36      287.80      354.31      287.80      441.78
```

```
"**** FICHERO DE DATOS ADICIONALES PARA EL PROGRAMA ZAPATAS ****

"      Datos de geometria
*      GEOMETRIA

Canto                 1.500000
Blong                 1.200000
Btrans                1.200000
Increm                0.100000

"      Datos de geotecnia
*      GEOTECNIA

Sigmaadm              3.000000
Sigmamax              4.000000

"      Datos de la cimentacion
*      CIMENTACION

Tesot                 1.800000
Pres_agua             0.000000
Dpila                 0.500000

"      Datos de armado
*      ARMADO

Recub                 3.500000
Fi                    20
Fck                   250.000000
Fyk                   5100.000000
Gammac                1.500000
Gammas                1.150000
Gammaf                1.400000

"      Codigos de control del preproceso de esfuerzos
*      CONTROL

Compresiones          positivas
Hipotesis              11 12 14
Real                  0.000000
Mat                   0.000000
```

```
" Fichero de esfuerzos solicitantes en base de pila,
" para dimensionamiento de la cimentaci$n.

* HIPOTESIS        11
    678.51    16.89     0.00   311.94   128.34   311.94   256.15
    348.65    14.36     0.00   227.68     0.00   227.68    75.25
    631.64    16.32     0.00   320.29   128.34   320.29   248.57
    631.64    16.32     0.00   320.29   128.34   320.29   248.57
    617.39    16.15     0.00   296.45   249.00   296.45   376.76
    495.36    16.15     0.00   287.80   249.00   287.80   353.63
* HIPOTESIS        12
    470.67    14.36    26.13   236.34   351.03   236.34   453.42
    348.65    14.36    26.13   227.68   351.03   227.68   428.18
    470.67    14.36    26.13   236.34   351.03   236.34   453.42
    470.67    14.36    26.13   236.34   351.03   236.34   453.42
    470.67    14.36    26.13   236.34   351.03   236.34   453.42
    348.65    14.36    26.13   227.68   351.03   227.68   428.18
* HIPOTESIS        14
    678.51    16.89     7.84   311.94   233.65   311.94   371.75
    348.65    14.36     7.84   227.68   105.31   227.68   175.22
    631.64    16.32     7.84   320.29   233.65   320.29   363.21
    631.64    16.32     7.84   320.29   233.65   320.29   363.21
    617.39    16.15     7.84   296.45   354.31   296.45   466.14
    495.36    16.15     7.84   287.80   354.31   287.80   461.78
```

Programa ZAPATAS v1.0.
RESULTADOS DE DIMENSIONAMIENTO

P A C A D A R

| | |
|---|---|
| Dimension longitudinal | 5.00 |
| Dimension transversal | 5.00 |
| Presion media pesima (kp/cm2) | 2.40 |
| Presion punta pesima (kp/cm2) | 5.05 → NO VALE |

Programa ZAPATAS v1.0.
RESULTADOS DE DIMENSIONAMIENTO

Admitimos $\frac{5}{3} \times 300 - 400$

P A C A D A R

| | |
|---|---|
| Dimension longitudinal | 5.00 |
| Dimension transversal | 6.20 |
| Presion media pesima (kp/cm2) | 2.02 |
| Presion punta pesima (kp/cm2) | 3.44 → VALE |

PESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 1 CP + SC

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 625.19 | 240.91 | 160.96 | 3.59 | 2.05 | 94.65 | 99.67 |
| | | | | | | 10.569/15.267/14.471 | 18.133/19.735/14.471 |
| 2 | 369.59 | 175.01 | 93.75 | 2.15 | 1.28 | 63.10 | 57.55 |
| | | | | | | 7.674/10.177/14.471 | 8.663/11.611/14.471 |
| 3 | 591.73 | 246.36 | 177.65 | 3.49 | 1.94 | 92.22 | 96.12 |
| | | | | | | 10.151/14.874/14.471 | 17.109/19.032/14.471 |
| 4 | 591.73 | 246.36 | 177.65 | 3.49 | 1.94 | 92.22 | 96.12 |
| | | | | | | 10.151/14.874/14.471 | 17.109/19.032/14.471 |
| 5 | 581.52 | 233.38 | 169.11 | 3.44 | 1.91 | 89.39 | 102.25 |
| | | | | | | 11.478/14.418/14.471 | 18.166/20.478/14.471 |
| 6 | 434.34 | 202.67 | 282.69 | 3.31 | 1.60 | 80.34 | 90.51 |
| | | | | | | 11.119/12.838/14.471 | 16.489/18.561/14.471 |

PESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 2 CP + Viento Presi.

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 576.12 | 194.93 | 530.47 | 3.44 | 1.89 | 87.27 | 91.85 |
| | | | | | | 9.744/13.708/14.471 | 16.726/18.196/14.471 |
| 2 | 340.52 | 141.61 | 311.04 | 2.24 | 1.18 | 58.15 | 53.05 |
| | | | | | | 7.074/9.382/14.471 | 8.019/10.704/14.471 |
| 3 | 545.17 | 199.36 | 585.47 | 3.44 | 1.79 | 85.01 | 88.57 |
| | | | | | | 9.356/13.711/14.471 | 15.768/17.542/14.471 |
| 4 | 545.17 | 199.36 | 585.47 | 3.44 | 1.79 | 85.01 | 88.57 |
| | | | | | | 9.356/13.711/14.471 | 15.768/17.542/14.471 |
| 5 | 535.77 | 188.93 | 557.63 | 3.39 | 1.76 | 82.39 | 94.29 |
| | | | | | | 10.577/13.289/14.471 | 16.744/18.878/14.471 |
| 6 | 400.16 | 164.07 | 932.19 | 3.26 | 1.47 | 74.05 | 83.40 |
| | | | | | | 10.253/12.627/14.471 | 16.201/17.955/14.471 |

FICHERO DE ENTRADA PARA EL PROGRAMA CMOD
(Aplicacion metodo Columna Modelo)

P2l zap

DIGOS
LP_L 16.96 "Longitud de pandeo longitudinal
LP_T 16.96 "Longitud de pandeo transversal
COMPRESIONES POSITIVAS "Signo de las compresiones.
ESFUERZOS

| N | Ml | Mt | Mlpan | Mtpan |
|---|---|---|---|---|
| 678.51 | 311.94 | 128.34 | 454.12 | 128.34 |
| 348.65 | 227.68 | 0.00 | 302.85 | 0.00 |
| 631.64 | 320.29 | 128.34 | 453.80 | 128.34 |
| 631.64 | 320.29 | 128.34 | 453.80 | 128.34 |
| 617.39 | 296.45 | 249.00 | 426.33 | 249.00 |
| 495.36 | 287.80 | 249.00 | 393.68 | 249.00 |
| 470.67 | 236.34 | 351.03 | 335.74 | 351.03 |
| 348.65 | 227.68 | 351.03 | 302.85 | 351.03 |
| 470.67 | 236.34 | 351.03 | 335.74 | 351.03 |
| 470.67 | 236.34 | 351.03 | 335.74 | 351.03 |
| 470.67 | 236.34 | 351.03 | 335.74 | 351.03 |
| 348.65 | 227.68 | 351.03 | 302.85 | 351.03 |
| 678.51 | 311.94 | 233.65 | 454.12 | 233.65 |
| 348.65 | 227.68 | 105.31 | 302.85 | 105.31 |
| 631.64 | 320.29 | 233.65 | 453.80 | 233.65 |
| 631.64 | 320.29 | 233.65 | 453.80 | 233.65 |
| 617.39 | 296.45 | 354.31 | 426.33 | 354.31 |
| 495.36 | 287.80 | 354.31 | 393.68 | 354.31 |

" Fichero de esfuerzos solicitantes en base de pila,
" para dimensionamiento de la cimentaci$\mu$n.

| | | | | | | |
|---|---|---|---|---|---|---|
| * HIPOTESIS | 11 | | | | | |
| 678.51 | 16.89 | 0.00 | 311.94 | 128.34 | 454.12 | 128.34 |
| 348.65 | 14.36 | 0.00 | 227.68 | 0.00 | 302.85 | 0.00 |
| 631.64 | 16.32 | 0.00 | 320.29 | 128.34 | 453.80 | 128.34 |
| 631.64 | 16.32 | 0.00 | 320.29 | 128.34 | 453.80 | 128.34 |
| 617.39 | 16.15 | 0.00 | 296.45 | 249.00 | 426.33 | 249.00 |
| 495.36 | 16.15 | 0.00 | 287.80 | 249.00 | 393.68 | 249.00 |
| * HIPOTESIS | 12 | | | | | |
| 470.67 | 14.36 | 26.13 | 236.34 | 351.03 | 335.74 | 351.03 |
| 348.65 | 14.36 | 26.13 | 227.68 | 351.03 | 302.85 | 351.03 |
| 470.67 | 14.36 | 26.13 | 236.34 | 351.03 | 335.74 | 351.03 |
| 470.67 | 14.36 | 26.13 | 236.34 | 351.03 | 335.74 | 351.03 |
| 470.67 | 14.36 | 26.13 | 236.34 | 351.03 | 335.74 | 351.03 |
| 348.65 | 14.36 | 26.13 | 227.68 | 351.03 | 302.85 | 351.03 |
| * HIPOTESIS | 14 | | | | | |
| 678.51 | 16.89 | 7.84 | 311.94 | 233.65 | 454.12 | 233.65 |
| 348.65 | 14.36 | 7.84 | 227.68 | 105.31 | 302.85 | 105.31 |
| 631.64 | 16.32 | 7.84 | 320.29 | 233.65 | 453.80 | 233.65 |
| 631.64 | 16.32 | 7.84 | 320.29 | 233.65 | 453.80 | 233.65 |
| 617.39 | 16.15 | 7.84 | 296.45 | 354.31 | 426.33 | 354.31 |
| 495.36 | 16.15 | 7.84 | 287.80 | 354.31 | 393.68 | 354.31 |

```
"**** FICHERO DE DATOS ADICIONALES PARA EL PROGRAMA ZAPATAS ****

"      Datos de geometria
*      GEOMETRIA

Canto                1.500000
Blong                1.200000
Btrans               1.200000
Increm               0.100000

"      Datos de geotecnia
*      GEOTECNIA

Sigmaadm             3.000000
Sigmamax             4.000000

"      Datos de la cimentacion
*      CIMENTACION

Pesot                1.800000
Pres_agua            0.000000
Vpila                0.500000

"      Datos de armado
*      ARMADO

fecwk                3.500000
Al                   20
Fck                  250.000000
Fyk                  5100.000000
Gammac               1.500000
Gammas               1.150000
Gammaf               1.400000

"      Indices de control del preproceso de esfuerzos
*      CONTROL

Compresiones         positivas
Hipotesis             11 12 14
Sal                  0.000000
Sat                  0.000000
```

```
Programa ZAPATAS v1.0.
RESULTADOS DE DIMENSIONAMIENTO

==========================================================================

Dimension longitudinal                5.00

Dimension transversal                 6.20

Presion media pesima (kp/cm2)         2.02

Presion punta pesima (kp/cm2)         2.95
```

RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 1 CP + SC

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 627.50 | 342.47 | 91.67 | 3.64 | 2.02 | 102.95 | 90.34 |
| | | | | | | 14.064/16.605/14.471 | 15.845/18.067/14.471 |
| 2 | 391.89 | 231.71 | 0.00 | 2.16 | 1.26 | 62.50 | 50.10 |
| | | | | | | 7.593/10.081/14.471 | 7.541/10.020/14.471 |
| 3 | 594.03 | 341.63 | 91.67 | 3.52 | 1.92 | 100.08 | 86.98 |
| | | | | | | 13.534/16.142/14.471 | 14.981/17.376/14.471 |
| 4 | 594.03 | 341.63 | 91.67 | 3.52 | 1.92 | 100.08 | 86.98 |
| | | | | | | 13.534/16.142/14.471 | 14.981/17.376/14.471 |
| 5 | 583.85 | 321.62 | 177.84 | 3.68 | 1.88 | 99.32 | 94.23 |
| | | | | | | 13.395/16.019/14.471 | 16.373/18.846/14.471 |
| 6 | 496.68 | 298.53 | 177.84 | 3.31 | 1.63 | 89.04 | 85.40 |
| | | | | | | 11.617/14.361/14.471 | 14.622/17.079/14.471 |

RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 2 DE + Viento Trans.

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 478.05 | 256.00 | 178.04 | 3.41 | 1.68 | 82.50 | 93.07 |
| | | | | | | 11.059/13.306/14.471 | 16.719/18.758/14.471 |
| 2 | 391.89 | 231.71 | 178.04 | 3.0 | 1.38 | 71.15 | 82.10 |
| | | | | | | 9.430/11.463/14.471 | 16.617/17.613/14.471 |
| 3 | 478.05 | 256.00 | 178.04 | 3.41 | 1.68 | 82.50 | 93.07 |
| | | | | | | 11.059/13.306/14.471 | 16.719/18.758/14.471 |
| 4 | 478.05 | 256.00 | 178.04 | 3.41 | 1.68 | 82.50 | 93.07 |
| | | | | | | 11.059/13.306/14.471 | 16.719/18.758/14.471 |
| 5 | 478.05 | 256.00 | 178.04 | 3.41 | 1.68 | 82.50 | 93.07 |
| | | | | | | 11.059/13.306/14.471 | 16.719/18.758/14.471 |
| 6 | 399.84 | 234.71 | 178.04 | 3.07 | 1.43 | 71.15 | 82.10 |
| | | | | | | 9.430/11.463/14.471 | 16.617/17.613/14.471 |

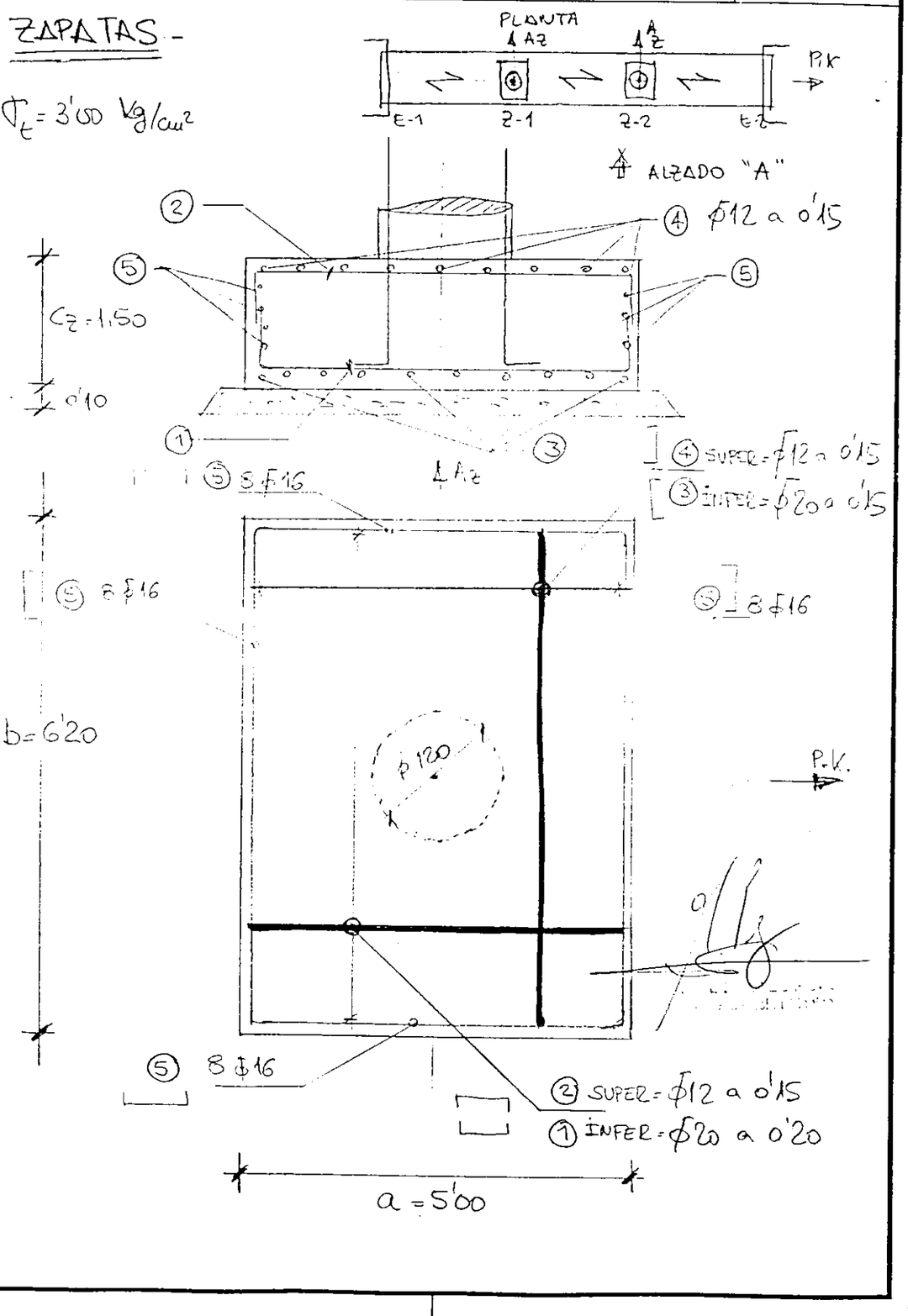
RESULTADOS DE PRESIONES SOBRE EL TERRENO
COMBINACION: 1 HIPOTESIS: 3 DE + Viento Long.

| Terna | N | Ml | Mt | sigma max | sigma med | As_long (cm2) E/M/G (cm2/m) | As_trans (cm2) E/M/G (cm2/m) |
|---|---|---|---|---|---|---|---|
| 1 | 627.50 | 342.47 | 178.04 | 3.64 | 2.02 | 102.95 | 90.34 |
| | | | | | | 14.064/16.605/14.471 | 15.845/18.067/14.471 |
| 2 | 391.89 | 231.71 | 91.67 | 2.83 | 1.26 | 71.15 | 50.10 |
| | | | | | | 9.430/11.463/14.471 | 9.378/11.402/14.471 |
| 3 | 594.03 | 341.63 | 178.04 | 3.52 | 1.92 | 100.08 | 86.98 |
| | | | | | | 13.534/16.142/14.471 | 14.981/17.376/14.471 |
| 4 | 594.03 | 341.63 | 178.04 | 3.52 | 1.92 | 100.08 | 86.98 |
| | | | | | | 13.534/16.142/14.471 | 14.981/17.376/14.471 |
| 5 | 583.85 | 321.62 | 261.48 | 3.68 | 1.88 | 99.32 | 121.45 |
| | | | | | | 13.395/16.019/14.471 | 18.877/21.288/14.471 |
| 6 | 496.68 | 298.53 | 261.48 | 3.34 | 1.60 | 89.16 | 93.19 |
| | | | | | | 11.637/14.381/14.471 | 16.711/16.751/14.471 |

PACADAR | ESTUDIO: | OBRA: SUBTRAMO: XV "E-1S11.3" y "E-1S14.2" | FECHA: 13-6-00 | HOJA: 50

ZAPATAS -

$\sigma_t = 3'00$ Kg/cm²



**Obra: L.A.V. MADRID-ZARAGOZA**
**SUBTRAMO XV**
**"E-1511.3 y "E-1512.4"**

PACADAR

14-jun-00

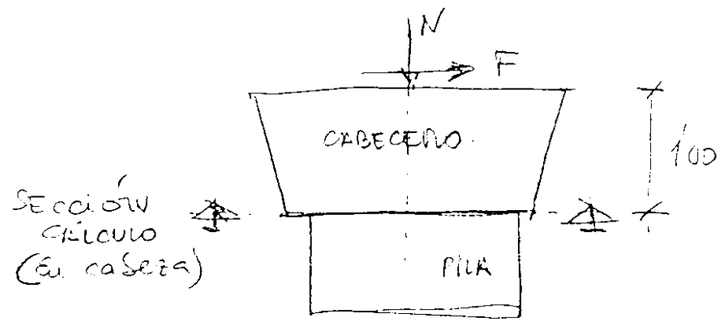
# CÁLCULO ARMADURA

## CONEXIÓN

## PILA-DINTEL

| PACADAR | ESTUDIO: 24.785 | OBRA: L.A.V. MADRID-ZARAGOZA SUBTRAMO: XV | FECHA: 8-6-00 HOJA: 1 de 27 |
|---|---|---|---|

ARMADURA NECESARIA EN CONEXIÓN PILA-CARGADERO (“E-1511.3” y “E-1514.2”).




Se comprueba la armadura con el programa “pilas”

Sc (Dinteles) –

– $M_t$ = 26'62 + (1'63 · 1'00) = 28'25 mt

resto igual

Sc ($M^e_{max}$) =

– $M^e$ = 27'36 + (1'33 × 1'00) = 28'69 mt

resto igual

Sc ($M^t_{max}$) –

– $M^t$ = 23'73 + (1'33 · 1'00) = 24'81 mt

resto igual

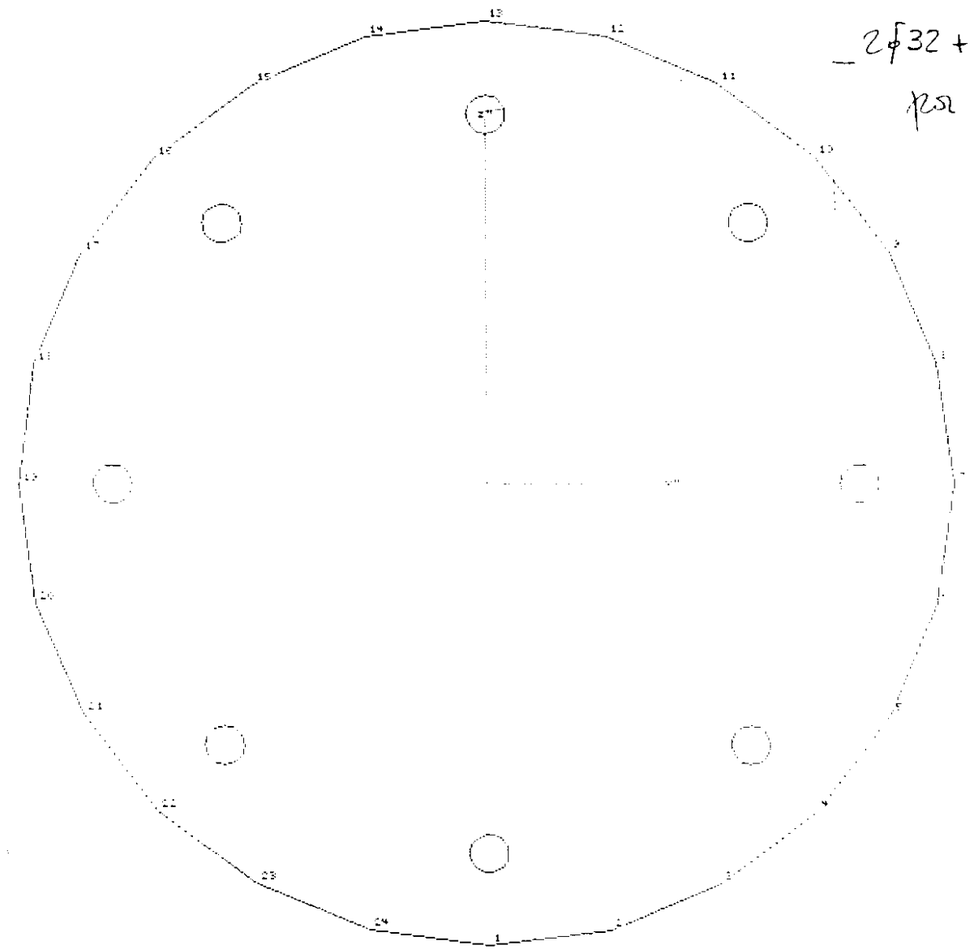
Vt =

– $M^t$ = 17'32 + (1'15 × 1'00) = 31'02 mt

resto igual

NP: N = 308,7 + 10'47 = 319'17 Tn

Escala 1 : 8.0
Pila E-1511.3 y E-1514.2



2ϕ32 + 1ϕ25 por punto

SecciÂn :"PILA_120" Armadura :"B1"
Tipo : tipo pila/ CÀrculo/tubo Unidades :[cm]
Material :"H-300P"

Di metro exterior = 120.000 cm

CaracterÀsticas mec nicas de la secciÂn:
Area : Ax= 1.118 [m2]
Momentos de inercia : Iy= 0.099487 [m4] Iz= 0.099487 [m4]
Inercia a torsiÂn : Ix= 0.203575 [m4]

PosiciÂn del centro de gravedad: ys= 0.000 [m] zs= 0.600000 [m]

| | I: | R=dist.borde [m] | W=I/R [m3] | W/Ax [m] |
|---|---|---|---|---|
| izq. | Iz | -0.600 | -0.165812 | 0.148 |
| dch. | Iz | 0.600 | 0.165812 | -0.148 |
| abajo | Iy | -0.600 | -0.165812 | 0.148 |

Programa F A G U S - 2 V.1.29 p gina
P A C A D A R 13.06.00/
PILA E-1511.3 y E-1514.2 09:21
SUBTRAMO XV

arriba Iy 0.600 0.165812 -0.148

Armadura: "B1"

| NÏ | Nom.mat | Cod.dim. | Area [cm2] | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] |
|---|---|---|---|---|---|---|---|
| 1 | AEH500 | (1) | 19.22 | 48.00 | 60.00 | | |
| 2 | AEH500 | (1) | 19.22 | 33.90 | 93.90 | | |
| 3 | AEH500 | (1) | 19.22 | 0.00 | 108.00 | | |
| 4 | AEH500 | (1) | 19.22 | -33.90 | 93.90 | | |
| 5 | AEH500 | (1) | 19.22 | -48.00 | 60.00 | | |
| 6 | AEH500 | (1) | 19.22 | -33.90 | 26.10 | | |
| 7 | AEH500 | (1) | 19.22 | 0.00 | 12.00 | | |
| 8 | AEH500 | (1) | 19.22 | 33.90 | 26.10 | | |
| Total: | | | 153.76 | CuantÀa de armadura: 1.375 [o/o] | | | |

CÂd. dimensionamiento: (0) = As constante
CÂd. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
CÂd. dimensionamiento: (2) = Aumentar As solo en zona traccionada

"M..." = Con definido valores para el material a usuario

CaracterÀsticas del material:

| Nom.Mat. | MÂdulo E [kp/cm2] | 0.85*fcd,fyd [kp/cm2] | eps-fc [o/oo] | fct [kp/cm2] | fcv [kp/cm2] | fcw,mÀn [kp/cm2] |
|---|---|---|---|---|---|---|
| "H-300P" | 330000.0 | -170.000 | -3.500 | 0.0 | 7.070 | 270.000 |
| "AEH500" | 2.10E+06 | 4434.700 | | | | |

Leyenda:
fcd,fyd resistencia de c lculo del hormigÂn,acero
eps-fc deformaciÂn al final de la par bola (fig.2.3, cap.2.2)
fct resistencia de c lculo a traccciÂn del hormigÂn
fcv resistencia virtual de c lculo del hormigÂn a esfuerzo cortante

```
L 'cm' Q S
Q 'Pila E-1511.3 y E-1514.2'
K 120.000 0.000 M 'H-300P'
* B 'B1'
P 48.000 60.000 19.220 M 'AEH500'
P 33.900 93.900 19.220 M 'AEH500'
P 0.000 108.000 19.220 M 'AEH500'
P -33.900 93.900 19.220 M 'AEH500'
P -48.000 60.000 19.220 M 'AEH500'
P -33.900 26.100 19.220 M 'AEH500'
P 0.000 12.000 19.220 M 'AEH500'
P 33.900 26.100 19.220 M 'AEH500'
* S 'm' 't' /
-652.850 60.290 280.640 0.000 /
-489.820 77.260 249.120 0.000 /
-504.320 56.340 280.640 0.000 /
-327.250 0.000 132.120 0.000 /
-590.100 55.300 301.750 0.000 /
-451.310 63.780 262.260 0.000 /
-504.320 57.740 301.750 0.000 /
-327.250 0.000 132.120 0.000
*
```

```
"*********************************************************************
"       PROGRAMA  PILAS  v1.1
"       PLANTILLA PARA FICHERO DE ENTRADA
"*********************************************************************

"-------------------- Definicion de la seccion -------------------------
* TITULO
  PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO                          pol
* SECCION

"  Introduzca los comandos de definicion de la seccion de la pila, o bien
"  el comando NOMBRE nombre_fichero, donde nombre_fichero es el nombre
"  del fichero de definicion de la seccion (extension .QS) creado con el
"  programa FAGUS2. nombre_fichero debe introducirse SIN EXTENSION.

NOMBRE  PILA-CAE      "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
                      "de la seccion creado con FAGUS2. Desactive el codigo CREAR
"CREAR  ?             "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
                      "de la seccion que se va a crear con el programa PILAS.
                      "Desactive el codigo NOMBRE

"  Los siguientes codigos se utilizan si se ha seleccionado la opcion CREAR

"Unidad_long   ?       "Unidad de longitud para entrada de la seccion

"--------------
"Parametros            "Activo este codigo para definir parametros constantes
"Dim_trasv     ?       "Dimension transversal de la seccion
"Dim_long      ?       "Dimension longitudinal de la seccion
"Hormigon      ?       "Tipo de hormigon de la seccion
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (B1, B2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"Cuantia_long  ?       "Cuantia longitudinal (por cara) contenida en el
                       "area hormigon; incluya el codigo de dimensionamiento
"Coef_c_tr_ext ?       "Coeficiente cuantia transversal (por cara) contenida
                       "exterior; incluya el codigo de dimensionamiento
"Recubrimiento_ext     "Distancia paramento exterior a eje de redondos
"Cuantia_long_int      "Cuantia longitudinal (por cara) contenida en el
                       "incluya el codigo de dimensionamiento
"Coef_c_tr_int ?       "Coeficiente cuantia transversal (por cara) contenida
                       "interior; incluya el codigo de dimensionamiento
"Recubrimiento_int     "Distancia paramento interior a eje de redondos
"Acero         ?       "Tipo de acero de las armaduras

"--------------
"Circular              "Active este codigo para crear secciones circulares
"Radio         ?       "Radio de la seccion
"Hormigon      ?       "Tipo de hormigon de la seccion
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (B1, B2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"N_redondos    ?       "Numero de redondos a disponer perimetralmente
"Cuantia       ?       ?       "Cuantia de armadura en % area hormigon;     incluya el
                               "codigo de dimensionamiento
"Recubrimiento ?       "Distancia paramento a eje de redondos
"Acero         ?       "Tipo de acero de las armaduras

"--------------
"Circular_Hueca                "Active este codigo para crear secc. circulares huecas
"Radio_ext     ?       "Radio contorno exterior
"Radio_int     ?       "Radio contorno interior
"Hormigon      ?       "Tipo de hormigon de la seccion
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (B1, B2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"N_redondos_ext        ?       "Numero de redondos contorno exterior
"Cuantia_ext   ?       ?       "Cuantia de armadura exterior en % area hormigon;
```

```
                                "incluya el codigo de dimensionamiento
"Recubrimiento_ext     ?        "Distancia paramento exterior a eje de redondos
"N_redondos_int                 ?       "Numero de redondos contorno interior
"Cuantia_int    ?       ?       "Cuantia de armadura interior en % area hormigon;
                                "incluya el codigo de dimensionamiento
   cubrimiento_int      ?       "Distancia paramento interior a eje de redondos
"Acero          ?               "Tipo de acero de las
armaduras


"-------------------------------------------------------------------------


"------------------------- Estados de carga -------------------------------
* EC

"  Introduzca el nombre del grupo de cargas; introduzca tantos grupos como
"  desee.

+ GRUPO normal

"  Introduzca los estados de carga según el siguiente formato:
"  NO OLVIDE LA COMA ANTES DEL NOMBRE OPCIONAL DE GRUPO

"cod       N             Fl             Fm             Ml             Ml             Sl      %N (>,   <=N*e)
pp       614.17          1.1            0.1          24.719          0.0           1.1     1.1%
sc       134.00        1.5*3            0.1          28.313         41.84          1.1     1.1%
sc       127.81          1.5*3          0.1          38.863         85.84          1.1     1.1%
sc       47.81           1.16*          0.1          24.461        140.51          0.0     1.1%
redl       0.          1.1*4            0.1           0.0           0.0           1.1     1.1%
           0.            1.1            19.1*          0.0         111.11          1.1     1.1%

+ COMBINAR

"  Introduzca los estados de carga a combinar, de uno en uno, incluyendo el nombre
"  del estado, según el formato:
"  NO OLVIDE LA COMA ANTES DEL NOMBRE OPCIONAL DE ESTADO

"nombre_grupo, nombre_estado, coef. de mayoración
normal, pp, 1.0

+ FIN

"-------------------------------------------------------------------------


"------------------------- Datos de pandeo --------------------------------
* PANDEO

  E             4834.31       "Peristencia de calculo del acero en kg/cm2
  alfapl          1.00        "Coeficiente de pandeo longitudinal
alfapt            1.00        "Coeficiente de pandeo transversal
lpila            14.10        "Altura de pila en m
hl                1.2         "Canto longitudinal en m
ht                1.2         "Canto transversal en m
inl             0.1114        "Inercia longitudinal
int             0.1028        "Inercia transversal
area              1.131       "Area seccion transversal
plano_pandeo      long        "Plano de pandeo: introduzca (long), (trans) o (ambos)
salida            completa    "Por defecto la salida es reducida; introduzca (completa)
"                              para incluir el calculo de excentricidades

"-------------------------------------------------------------------------


"------------------------- Opciones de control  ---------------------------
* OPCIONES

"  Introduzca los comandos de control del programa. Entre () se indican
"  los valores por defecto

compresiones    positivas       "Introduzca (positivas) o (negativas).
"                       Codigo obligatorio. No hay valor por defecto
acero           AEH500  "Introduzca el tipo de acero de las armaduras.
"                       Código obligatorio
base_pila       b3      "Introduzca el nombre de la armadura de base de pila
                        Código obligatorio

"ndiv             1       "Numero de secciones intermedias de calculo (0)
"solo_base                "Active este codigo para calcular unicamente la base del fuste
solo_cabeza               "Active este codigo para calcular unicamente la cabeza del fuste

"umbral         ?       "Valor umbral para cargas significativas (0)
"salida         ?       "Introduzca (completa) o (reducida). (reducida)
f_hipviento      1        "Factor de reduccion general para hipotesis de viento (0.9)
"f_hipsismo     ?       "Factor de reduccion de cp y sc en hipotesis con sismo (0.8)
c_vsc            0.3     "Factor de concomitancia viento - sobrecarga (0.5)
"c_vsis         ?       "Factor de concomitancia viento - sismo (0.25)

"-------------------------------------------------------------------------


"----------------------METODO COLUMNA MODELO--------------------------------

* COL_MOD

"  Los siguientes códigos definen par metros de entrada para el programa
"  CMOD (Aplicación del método de la Columna Modelo para obtención de
"  excentricidades de 2º Orden en cada pila

"ndiv   ?       " Número de divisiones del diagrama M-N
"completo       " Active este código para calcular el diagrama M-N completo,
                " comenzando desde el valor 0 del momento

"-------------------------------------------------------------------------
```

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

| | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax Mlmax Mtmax | 638.72 | 187.59 | 128.34 | 153.76 |
| 2 | 1 | B1 | 1 | Nmin Mlmax Mtmax | 319.17 | 76.65 | 0.00 | 153.76 |
| 3 | 1 | B1 | 1 | Mlmax Mtmax Nmax | 591.84 | 199.81 | 128.34 | 153.76 |
| 4 | 1 | B1 | 1 | Mlmax Mtmax Nmin | 591.84 | 199.81 | 128.34 | 153.76 |
| 5 | 1 | B1 | 1 | Mtmax Nmax Mlmax | 577.59 | 171.54 | 249.00 | 153.76 |
| 6 | 1 | B1 | 1 | Mtmax Nmin Mlmax | 465.89 | 144.40 | 249.00 | 153.76 |
| 7 | 1 | B1 | 2 | Nmax Mlmax Mtmax | 430.88 | 103.48 | 46.53 | 153.76 |
| 8 | 1 | B1 | 2 | Nmin Mlmax Mtmax | 319.17 | 76.65 | 46.53 | 153.76 |
| 9 | 1 | B1 | 2 | Mlmax Mtmax Nmax | 430.88 | 103.48 | 46.53 | 153.76 |
| 10 | 1 | B1 | 2 | Mlmax Mtmax Nmin | 430.88 | 103.48 | 46.53 | 153.76 |
| 11 | 1 | B1 | 2 | Mtmax Nmax Mlmax | 430.88 | 103.48 | 46.53 | 153.76 |
| 12 | 1 | B1 | 2 | Mtmax Nmin Mlmax | 319.17 | 76.65 | 46.53 | 153.76 |
| 13 | 1 | B1 | 4 | Nmax Mlmax Mtmax | 638.72 | 187.59 | 142.30 | 153.76 |
| 14 | 1 | B1 | 4 | Nmin Mlmax Mtmax | 319.17 | 76.65 | 13.96 | 153.76 |
| 15 | 1 | B1 | 4 | Mlmax Mtmax Nmax | 591.84 | 199.81 | 142.30 | 153.76 |
| 16 | 1 | B1 | 4 | Mlmax Mtmax Nmin | 591.84 | 199.81 | 142.30 | 153.76 |
| 17 | 1 | B1 | 4 | Mtmax Nmax Mlmax | 577.59 | 171.54 | 262.96 | 153.76 |
| 18 | 1 | B1 | 4 | Mtmax Nmin Mlmax | 465.89 | 144.40 | 262.96 | 153.76 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 638.72 | 75.83 | 128.34 | 0.119 | 0.175 | 0.294 | 187.59 |
| 2 | Nmin Mlmax Mtmax | 319.17 | 24.72 | 0.00 | 0.077 | 0.163 | 0.240 | 76.65 |
| 3 | Mlmax Mtmax Nmax | 591.84 | 91.67 | 128.34 | 0.155 | 0.183 | 0.338 | 199.81 |
| 4 | Mlmax Mtmax Nmin | 591.84 | 91.67 | 128.34 | 0.155 | 0.183 | 0.338 | 199.81 |
| 5 | Mtmax Nmax Mlmax | 577.59 | 71.09 | 249.00 | 0.101 | 0.176 | 0.277 | 171.54 |
| 6 | Mtmax Nmin Mlmax | 465.89 | 61.44 | 249.00 | 0.132 | 0.178 | 0.310 | 144.40 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 2 CP + SC + Viento Trans.
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mlpan |
|---|---|---|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 638.72 | 75.83 | 142.30 | 0.119 | 0.175 | 0.294 | 187.59 |
| 14 | Nmin Mlmax Mtmax | 319.17 | 24.72 | 13.96 | 0.077 | 0.163 | 0.240 | 76.65 |
| 15 | Mlmax Mtmax Nmax | 591.84 | 91.67 | 142.30 | 0.155 | 0.183 | 0.338 | 199.81 |
| 16 | Mlmax Mtmax Nmin | 591.84 | 91.67 | 142.30 | 0.155 | 0.183 | 0.338 | 199.81 |
| 17 | Mtmax Nmax Mlmax | 577.59 | 71.09 | 262.96 | 0.101 | 0.176 | 0.277 | 171.54 |
| 18 | Mtmax Nmin Mlmax | 465.89 | 61.44 | 262.96 | 0.132 | 0.178 | 0.310 | 144.40 |

ESFUERZOS ADICIONALES

| N | Ml | Mt | ea_2 | ea_1 | etot_1 | Mlpan |
|---|---|---|---|---|---|---|

```
"*************************************************************************
"       PROGRAMA  PILAS  v1.1
"       PLANTILLA PARA FICHERO DE ENTRADA
"*************************************************************************

   ------------------ Definicion de la seccion ---------------------------
  ,TULO
  PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO                              pct
* SECCION

"  Introduzca los comandos de definicion de la seccion de la pila, o bien
"  el comando NOMBRE nombre_fichero, donde nombre_fichero es el nombre
"  del fichero de definicion de la seccion (extension .QS) creado con el
"  programa FAGUS2. nombre_fichero debe introducirse SIN EXTENSION.

NOMBRE  PILA-CAB      "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
              "de la seccion creado con FAGUS2. Desactive el codigo CREAR
"CREAR  ?     "Introduzca el nombre (SIN EXTENSION) del fichero de definicion
              "de la seccion que se va a crear con el programa PILAS.
              "Desactive el codigo NOMBRE

"  Los siguientes codigos se utilizan si se ha seleccionado la opcion CREAR

"Unidad_long   ?       "Unidad de longitud para entrada de la seccion

"--------------
"Rectangular           "Active este codigo para definir secciones rectangulares
"Dim_trans     ?       "Dimension transversal de la seccion
"Dim_long      ?       "Dimension longitudinal de la seccion
"Hormigon      ?       "Tipo de hormigon de la seccion
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (B1, B2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"Cuantia_long  ?       "Cuantia de armadura en % area hormigon;     incluya el
                       "codigo de dimensionamiento
"Coef_c_tr     ?       "Coeficiente para cuantia transversal (por cara)
                       "incluya el codigo de dimensionamiento
"Recubrimiento ?       "Distancia paramento a eje de redondos
"Acero         ?       "Tipo de acero de las armaduras

"--------------
"Rectangular_Hueca      "Active este codigo para definir secciones huecas
                       "(1 a 5)
"Dim_trans_ext ?       "Dimension transversal contorno exterior
"Dim_long_ext  ?       "Dimension longitudinal contorno exterior
"Hormigon      ?       "Tipo de hormigon de la seccion
"Dim_trans_int ?       "Dimension transversal contorno interior
"Dim_long_int  ?       "Dimension longitudinal contorno interior
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (B1, B2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"Cuantia_long_ext      ?       ?       "Cuantia longitudinal (por cara) contorno exterior;
                               "incluya el codigo de dimensionamiento
"Coef_c_tr_ext ?       ?       "Coeficiente cuantia transversal (por cara) contorno
                       "exterior; incluya el codigo de dimensionamiento
"Recubrimiento_ext     ?       "Distancia paramento exterior a eje de redondos
"Cuantia_long_int      ?       ?       "Cuantia longitudinal (por cara) contorno interior;
                               "incluya el codigo de dimensionamiento
"Coef_c_tr_int ?       ?       "Coeficiente cuantia transversal (por cara) contorno
                       "interior; incluya el codigo de dimensionamiento

"Recubrimiento_int     ?       "Distancia paramento interior a eje de redondos
"Acero         ?       "Tipo de acero de las armaduras

"--------------
"Circular              "Active este codigo para crear secciones circulares
"Radio         ?       "Radio de la seccion
"Hormigon      ?       "Tipo de hormigon de la seccion
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (B1, B2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"N_redondos    ?       "Numero de redondos a disponer perimetralmente
"Cuantia       ?       ?       "Cuantia de armadura en % area hormigon;     incluya el
                       "codigo de dimensionamiento
"Recubrimiento ?       "Distancia paramento a eje de redondos
"Acero         ?       "Tipo de acero de las armaduras

"--------------
"Circular_Hueca                "Active este codigo para crear secc. circulares huecas
"Radio_ext     ?       "Radio contorno exterior
"Radio_int     ?       "Radio contorno interior
"Hormigon      ?       "Tipo de hormigon de la seccion
"Armadura      ?       "Definicion de la armadura; si no se asigna un nombre
                       "se emplearan los nombres por defecto (B1, B2, etc)
                       "Introduzca tantos bloques de definicion de armadura
                       "como secciones se vayan a dimensionar
"N_redondos_ext        ?       "Numero de redondos contorno exterior
"Cuantia_ext   ?       ?       "Cuantia de armadura exterior en % area hormigon;
                               "incluya el codigo de dimensionamiento
"Recubrimiento_ext     ?       "Distancia paramento exterior a eje de redondos
"N_redondos_int        ?       "Numero de redondos contorno interior
"Cuantia_int   ?       ?       "Cuantia de armadura interior en % area hormigon;
                               "incluya el codigo de dimensionamiento
"Recubrimiento_int     ?       "Distancia paramento interior a eje de redondos
"Acero         ?       "Tipo de acero de las
armaduras


"-------------------------------------------------------------------------


"------------------------ Estados de carga -------------------------------
* EC

"  Introduzca el nombre del grupo de pisos; introduzca tantos grupos como
"  desee.

+ GRUPO normal

"  Introduzca los estados de carga segun el siguiente formato:
"  NO OLVIDE LA COMA ANTES DEL CARGO OPCIONAL DE GRUPO

"cod      N          M1          M2          Mt          Qt      Ad [-   Peso
pp      81.[']      .           .           21.[']      [']     1.[-    .
s'      13.[5]      1.[-]       .[']        -0.[']      +0.[+   [']     .
sc      10[']3[]    1.[0]       .[']        3[].[-0]    4[].[']  +[]     [']
sc      2[']2[]     [].[]       .[']        [].[0]      [2].[']  +[]     [']
nuri    [']         [']-[]      ..          ...         [']     +[]     [']
V1      [']         [']         [']-[']     ...         -[].[']  +[]     [']

+ VIENTO

"  Introduzca los estados de carga segun el siguiente formato:
"  NO OLVIDE LA COMA ANTES DEL CARGO OPCIONAL DE GRUPO

"cod      N          M1          M2          Mt          Qt      Ad [-   Peso
pp      [']         .           .           [].[']      [']     [].[-   .
s'      [']         [].[']      .[']        [].[']      [].[+   [']     .
sc      [']         [].[']      .[']        [].[']      [].[']  +[]     [']
nuri    [']         [].[']      ..          ...         [']     +[]     [']
V1      [']         [']         [']-[']     ...         -[].[']  +[]     [']


"-------------------------------------------------------------------------


"------------------------ Datos de pandeo --------------------------------
* PANDEO

fyd             [][][].[']      "Resistencia de calculo del acero en kp/cm2
alfapl          [].[2]      "Coeficiente de pandeo longitudinal
alfapt          [].[2]      "Coeficiente de pandeo transversal
lpila           [][].[3]      "Altura de pila en m
hl              [].[2]      "Canto longitudinal en m
ht              [].[2]      "Canto transversal en m
inl             [].[0]0[]8      "Inercia longitudinal
int             [].[0]0[]8      "Inercia transversal
area            [].[3]3[]      "Area seccion transversal
plano_pandeo    trans       "Plano de pandeo: introduzca (long , (trans  o (ambos
salida          completa    "Por defecto la salida es reducida; introduzca (completa)
"                            para incluir el calculo de excentricidades

"-------------------------------------------------------------------------


"-------------------------- Opciones de control  -------------------------
* OPCIONES

"  Introduzca los comandos de control del programa. Entre ,* se indican
"  los valores por defecto

compresiones    positivas       "Introduzca (positivas) o (negativas).
"                       Codigo obligatorio. No hay valor por defecto
acero           AEH500  "Introduzca el tipo de acero de las armaduras.
"                       Código obligatorio
base_pila       b3      "Introduzca el nombre de la armadura de base de pila
"                       Código obligatorio

"ndiv             1       "Numero de secciones intermedias de calculo (0)
"solo_base              "Active este codigo para calcular unicamente la base del fuste
solo_cabeza             "Active este codigo para calcular unicamente la cabeza del fuste
```

```
"umbral          ?       "Valor umbral para cargas significativas (0)
"salida          ?       "Introduzca (completa) o (reducida). (reducida)
f_hipviento      1         "Factor de reduccion general para hipotesis de viento (0.9)
"f_hipsismo      ?       "Factor de reduccion de cp y sc en hipotesis con sismo (0.8)
f_vsc            0.3       "Factor de concomitancia viento - sobrecarga (0.5)
   'sis          ?       "Factor de concomitancia viento - sismo (0.25)

"-------------------------------------------------------------------------


"---------------------METODO COLUMNA MODELO-------------------------------

* COL_MOD

"  Los siguientes c0digos definen par metros de entrada para el programa
"  CMOD (Aplicaci0n del m,todo de la Columna Modelo para obtenci0n de
"  excentricidades de 2$ orden en base de pila)

"ndiv   ?        " N0mero de divisiones del diagrama M-X
"completo        " Active este c0digo para calcular el diagrama M-X completo,
                 " comenzando desde el valor 0 del momento

"-------------------------------------------------------------------------
```

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

| Num | Cmb | Seccion | Hip | Esfuerzos | N | Ml | Mt | As |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | B1 | 1 | Nmax Mlmax Mtmax | 638.72 | 75.83 | 249.72 | 153.76 |
| 2 | 1 | B1 | 1 | Nmin Mlmax Mtmax | 319.17 | 24.72 | 69.88 | 153.76 |
| 3 | 1 | B1 | 1 | Mlmax Mtmax Nmax | 591.84 | 91.67 | 242.03 | 153.76 |
| 4 | 1 | B1 | 1 | Mlmax Mtmax Nmin | 591.84 | 91.67 | 242.03 | 153.76 |
| 5 | 1 | B1 | 1 | Mtmax Nmax Mlmax | 577.59 | 70.09 | 369.31 | 153.76 |
| 6 | 1 | B1 | 1 | Mtmax Nmin Mlmax | 465.89 | 61.44 | 347.91 | 153.76 |
| 7 | 1 | B1 | 2 | Nmax Mlmax Mtmax | 430.86 | 33.37 | 120.74 | 153.76 |
| 8 | 1 | B1 | 2 | Nmin Mlmax Mtmax | 319.17 | 24.72 | 104.28 | 153.76 |
| 9 | 1 | B1 | 2 | Mlmax Mtmax Nmax | 430.86 | 33.37 | 120.74 | 153.76 |
| 10 | 1 | B1 | 2 | Mlmax Mtmax Nmin | 430.86 | 33.37 | 120.74 | 153.76 |
| 11 | 1 | B1 | 2 | Mtmax Nmax Mlmax | 431.65 | 33.37 | 120.74 | 153.76 |
| 12 | 1 | B1 | 2 | Mtmax Nmin Mlmax | 319.17 | 24.72 | 104.28 | 153.76 |
| 13 | 1 | B1 | 3 | Nmax Mlmax Mtmax | 638.72 | 75.83 | 249.72 | 153.76 |
| 14 | 1 | B1 | 3 | Nmin Mlmax Mtmax | 319.17 | 24.72 | 69.88 | 153.76 |
| 15 | 1 | B1 | 3 | Mlmax Mtmax Nmax | 591.84 | 91.67 | 242.03 | 153.76 |
| 16 | 1 | B1 | 3 | Mlmax Mtmax Nmin | 591.84 | 91.67 | 242.03 | 153.76 |
| 17 | 1 | B1 | 3 | Mtmax Nmax Mlmax | 577.59 | 70.09 | 369.31 | 153.76 |
| 18 | 1 | B1 | 3 | Mtmax Nmin Mlmax | 465.89 | 61.44 | 347.91 | 153.76 |

Y

2$22 + 1$20 por

punto

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP SC SCM

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|
| 1 | Nmax Mlmax Mtmax | 638.72 | 75.83 | 128.34 | 0.201 | 0.190 | 0.391 | 249.72 |
| 2 | Nmin Mlmax Mtmax | 319.17 | 24.72 | 0.00 | 0.060 | 0.156 | 0.216 | 68.83 |
| 3 | Mlmax Mtmax Nmax | 591.84 | 91.67 | 128.34 | 0.217 | 0.192 | 0.409 | 242.03 |
| 4 | Mlmax Mtmax Nmin | 591.84 | 91.67 | 128.34 | 0.217 | 0.192 | 0.409 | 242.03 |
| 5 | Mtmax Nmax Mlmax | 577.59 | 70.09 | 249.00 | 0.431 | 0.208 | 0.639 | 369.31 |
| 6 | Mtmax Nmin Mlmax | 465.89 | 61.44 | 249.00 | 0.534 | 0.213 | 0.747 | 347.91 |

Programa PILAS v1.1 P A C A D A R

PILA P-2 / E-1511.3 / SUBTRAMO XV / NECSO

SECCION: B1 COMBINACION DE CARGAS: 1
HIPOTESIS: 1 CP + SC
Cargas: PP CM TEFLON TERM GRAD REOL VP

| Num | Esfuerzos | N | Ml | Mt | eo | ea | etot | Mtpan |
|---|---|---|---|---|---|---|---|---|
| 13 | Nmax Mlmax Mtmax | 638.72 | 75.83 | 142.37 | 0.228 | 0.191 | 0.419 | 249.42 |
| 14 | Nmin Mlmax Mtmax | 319.17 | 24.72 | 13.04 | 0.060 | 0.156 | 0.216 | 68.83 |
| 15 | Mlmax Mtmax Nmax | 591.84 | 91.67 | 142.37 | 0.240 | 0.193 | 0.433 | 257.01 |
| 16 | Mlmax Mtmax Nmin | 591.84 | 91.67 | 142.37 | 0.240 | 0.193 | 0.433 | 257.01 |
| 17 | Mtmax Nmax Mlmax | 577.59 | 70.09 | 262.96 | 0.455 | 0.210 | 0.665 | 383.89 |
| 18 | Mtmax Nmin Mlmax | 465.89 | 61.44 | 262.96 | 0.564 | 0.215 | 0.779 | 361.31 |

ESFUERZOS ADICIONALES

| N | Ml | Mt | es_t | ea_t | etot_t | Mtpan |
|---|---|---|---|---|---|---|

.TP 14
---
Dimensionamiento : Viga "PILA-CAB"/"B1"
---

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -638.720 | | | | 75.830 | 249.720 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¶n de la resistencia de la seccion ..... 1.52
Factor necesario de minoraci¶n de la resistencia de la seccion .. 1.00
.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |

.TP 14
---
Dimensionamiento : Viga "PILA-CAB"/"B1"
---

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -319.170 | | | | 24.720 | 68.830 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¶n de la resistencia de la seccion ..... 4.59
Factor necesario de minoraci¶n de la resistencia de la seccion .. 1.00
.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 "AEH500" | 33.9 | 26.1 | | 19.22 | - | 19.22 | |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 8
Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.916 | -4434.700 | "AEH500" |
| Hormig¢n-Max | -57.96 | 44.47 | 1.285 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 0.701 | 1471.864 | "AEH500" |

Fibra neutra zn 93.67 cm yn -36.00 cm Angulo -70.31

.TP 14

Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -591.840 | | | | 91.670 | 242.030 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.55
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 14

Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -577.590 | | | | 76.190 | 369.310 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.57
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.1 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 8
Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.697 | -4434.700 | "AEH500" |
| Hormig¢n-Max | -57.96 | 44.47 | 4.015 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 3.211 | 4434.700 | "AEH500" |

Fibra neutra zn 60.80 cm yn 4.02 cm Angulo -78.73

.TP 14

Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9

Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -465.890 | | | | 61.440 | 347.910 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.11
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00

.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuantja arm. 1.38 [o/o] Suma 153.76

.TP 8

Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estad.-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.5 | -170. | "H-3 0P" |
| Armadura-Min | 48.00 | 60.00 | -2.6 | -4434.700 | "AEH500" |
| Hormig¢n-Max | -57.96 | 44.47 | 3.7 | 0. | "H-3 0P" |
| Armadura-Max | -48.00 | 60.00 | 3.1 | 4434. | "AEH500" |

Fibra neutra zn 61.45 cm yn 7.88 cm Angulo -79.56

.TP 14

Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9

Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -315.170 | | | | 31.7 | 134.3 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 4.24
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00

.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuantja arm. 1.38 [o/o] Suma 153.76

.TP 8

Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.877 | -4434.700 | "AEH500" |
| Hormig¢n-Max | -57.96 | 44.47 | 2.116 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 1.492 | 3133.225 | "AEH500" |

Fibra neutra zn 56.53 cm yn -14.38 cm Angulo -76.44

.TP 14

Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9

Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -430.880 | | | | 33.370 | 120.740 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¶n de la resistencia de la secci¶n ..... 2.92
Factor necesario de minoraci¶n de la resistencia de la secci¶n .. 1.00

.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 8

Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II (kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¶n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.593 | -4434.700 | "AEH500" |
| Hormig¶n-Max | -57.96 | 44.47 | 1.787 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 1.180 | 2478.448 | "AEH500" |

Fibra neutra zn 54.77 cm yn -18.72 cm Angulo -74.39

.TP 14

Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9

Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -430.880 | | | | 33.370 | 120.740 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¶n de la resistencia de la secci¶n ..... 2.92
Factor necesario de minoraci¶n de la resistencia de la secci¶n .. 1.00

.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 8

Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II (kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¶n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.593 | -4434.700 | "AEH500" |
| Hormig¶n-Max | -57.96 | 44.47 | 1.787 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 1.180 | 2478.448 | "AEH500" |

Fibra neutra zn 54.77 cm yn -18.72 cm Angulo -74.39

.TP 14

Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -319.170 | | | | 24.720 | 104.290 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 3.56
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 8
Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.782 | -4434.700 | "AEH500" |
| Hormig¢n-Max | -57.96 | 44.47 | 2.713 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 1.995 | 4189.791 | "AEH500" |

Fibra neutra zn 57.93 cm yn -7.31 cm Angulo -73.94

.TP 14
Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -638.720 | | | | 75.830 | 265.460 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.45
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|
| 1 "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 14
Dimensionamiento : Viga "PILA-CAB"/"B1"

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -591.840 | | | | 91.670 | 257.610 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..

.TP 8
Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.916 | -4434.700 | "AEH500" |
| Hormig¢n-Max | -57.96 | 44.47 | 1.285 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 0.701 | 1471.864 | "AEH500" |

Fibra neutra zn 50.67 cm yn -20.06 cm Angulo -70.31

.TP 14
Dimensionamiento : Viga "PILA-CAB"/"B1"

Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.48
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|---|
| 1 | "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 | "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 | "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 | "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 | "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 | "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 | "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 | "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuantja arm. 1.38 [o/o] Suma 153.76

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -591.640 | | | | 91.670 | 384.410 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.48
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|---|
| 1 | "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 | "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 | "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 | "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 | "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 | "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 | "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 | "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 8
Deformaciones y tensiones extremas (Rotura):

| | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.723 | -4434.700 | "AEH500" |

| | | | | | | |
|---|---|---|---|---|---|---|
| Hormig¢n-Max | -57.96 | 44.47 | 2.867 | 0.000 | | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 2.090 | 4389.749 | | "AEH500" |

Fibra neutra zn 58.00 cm yn -5.60 cm Angulo -70.39

.TP 14
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Dimensionamiento : Viga "PILA-CAB"/"B1"
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.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -577.890 | | | | 70.090 | 393.440 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.58
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|---|
| 1 | "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 2 | "AEH500" | 33.9 | 93.9 | | | 19.22 | - | 19.22 |
| 3 | "AEH500" | 0.0 | 108.0 | | | 19.22 | - | 19.22 |
| 4 | "AEH500" | -33.9 | 96.9 | | | 19.22 | - | 19.22 |
| 5 | "AEH500" | -48.0 | 60.0 | | | 19.22 | - | 19.22 |
| 6 | "AEH500" | -33.9 | 26.1 | | | 19.22 | - | 19.22 |
| 7 | "AEH500" | 0.0 | 12.0 | | | 19.22 | - | 19.22 |
| 8 | "AEH500" | 33.9 | 26.1 | | | 19.22 | - | 19.22 |

Cuant¡a arm. 1.38 [o/o] Suma 153.76

.TP 8
Deformaciones y tensiones extremas (Rotura):

| | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig¢n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.723 | -4434.700 | "AEH500" |

| | | | | | | |
|---|---|---|---|---|---|---|
| Hormig¢n-Max | -57.96 | 44.47 | 2.867 | 0.000 | | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 2.090 | 4389.749 | | "AEH500" |

Fibra neutra zn 58.00 cm yn -5.60 cm Angulo -70.39

.TP 14
---
Dimensionamiento : Viga "PILA-CAB"/"B1"
---

.TP 9
Esfuerzos (Rotura) Unidades : [tm]

| N | Vy | Vz | Mx | My | Mz | Alpha |
|---|---|---|---|---|---|---|
| -465.890 | | | | 61.440 | 362.310 | 45.0 |

La armadura m¡nima entrada es suficiente !
Armadura m¡nima definida con las reas entradas ..
Factor actual de minoraci¢n de la resistencia de la secci¢n ..... 1.06
Factor necesario de minoraci¢n de la resistencia de la secci¢n .. 1.00
.TP 8

| Armadura Longitudinal: | | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] | dado (As-min) | dimens. [cm2] | As-nuevo [cm2] |
|---|---|---|---|---|---|---|---|---|
| 1 | "AEH500" | 48.0 | 60.0 | | | 19.22 | - | 19.22 |

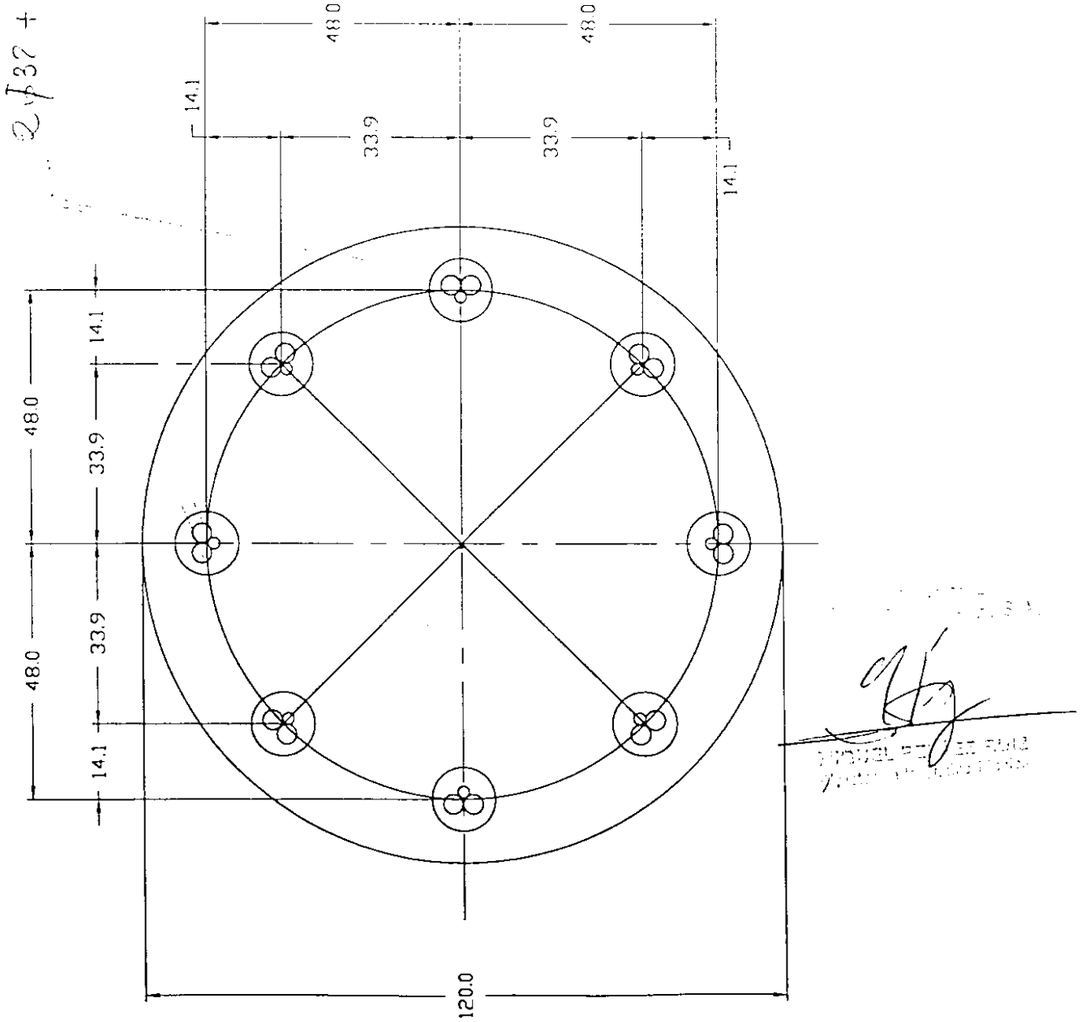
| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | "AEH500" | 33.9 | 93.9 | 19.22 | - | 19.22 |
| 3 | "AEH500" | 0.0 | 108.0 | 19.22 | - | 19.22 |
| 4 | "AEH500" | -33.9 | 96.9 | 19.22 | - | 19.22 |
| 5 | "AEH500" | -48.0 | 60.0 | 19.22 | - | 19.22 |
| 6 | "AEH500" | -33.9 | 26.1 | 19.22 | - | 19.22 |
| 7 | "AEH500" | 0.0 | 12.0 | 19.22 | - | 19.22 |
| 8 | "AEH500" | 33.9 | 26.1 | 19.22 | - | 19.22 |
| | | | | Cuant¡a arm. 1.38 [o/o] | Suma | 153.76 |

.TF 8
Deformaciones y tensiones extremas (Rotura):

| 1 | Coordenadas y [cm] | z [cm] | Eps [o/oo] | Estado-II [kp/cm2] | |
|---|---|---|---|---|---|
| Hormig$n-Min | 57.96 | 75.53 | -3.500 | -170.000 | "H-300P" |
| Armadura-Min | 48.00 | 60.00 | -2.639 | -4434.701 | "AEH500" |
| Hormig$n-Max | -57.96 | 44.47 | 4.747 | 0.000 | "H-300P" |
| Armadura-Max | -48.00 | 60.00 | 3.887 | 4434.701 | "AEH500" |

Fibra neutra xn [illegible] m yn [illegible] Angulo [illegible]

2 ϕ 32 + 1 ϕ 20 por punto
8 puntos según croquis

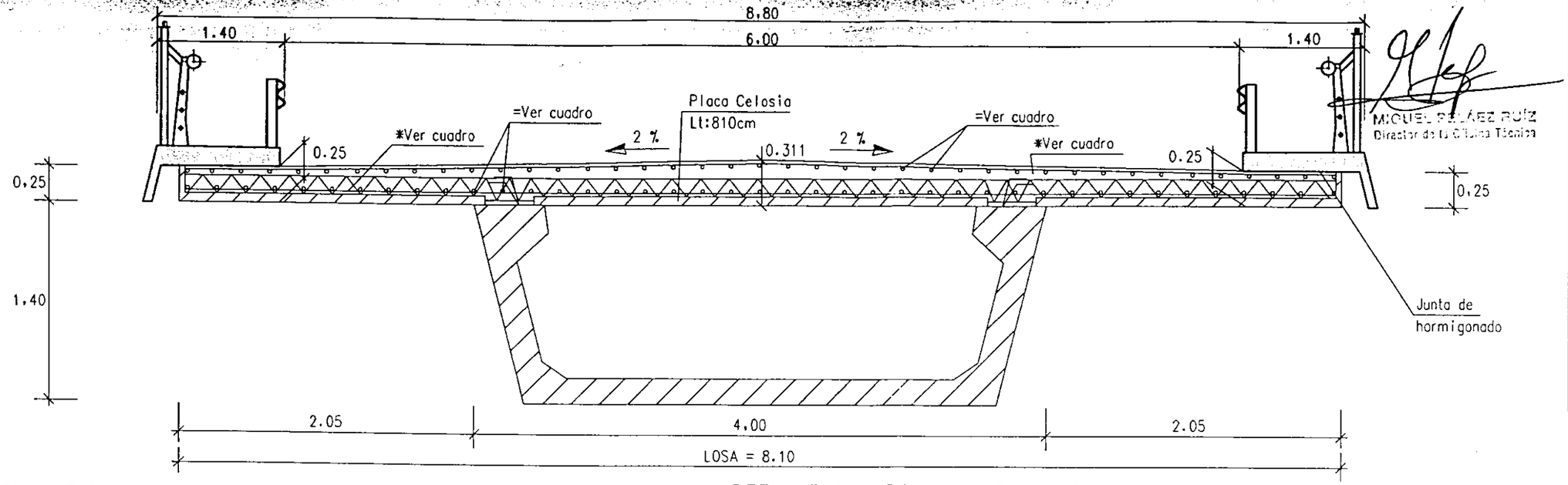



POSICION DE HIERROS SALIENTES DE LA PILA
PARA UNION AL DINTEL

## SECCION TRANSVERSAL VANO TIPO

(VER FASES DE HORMIGONADO DE LA LOSA EN EL PLANO= 6 Fp 0134-00)

PACADAR S.A.




MIGUEL PELÁEZ RUIZ
Director de la Oficina Técnica

Se cuidará el proceso de hormigonado de la losa del tablero para evitar posibles vuelcos o inestabilidades de vigas en fase de construccion.

ARMADO SUPERIOR DE LA LOSA

MALLA ELECTROSOLDADA

| | L/8 | L/4 | L/4 | L/4 | L/8 |
|---|---|---|---|---|---|
| Long | 10a A | 8a A | 8a A | 8a A | 10a A |
| Tran | 16a10 | 16a15 | 16a15 | 16a15 | 16a10 |

(A=12.5 cm.)

O BIEN

REDONDOS CORRUGADOS (pml).

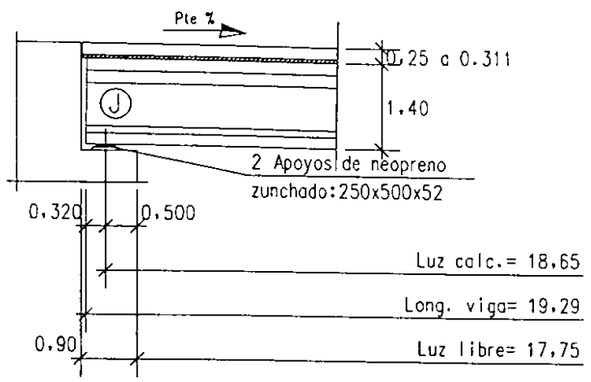
| | L/8 | L/4 | L/4 | L/4 | L/8 |
|---|---|---|---|---|---|
| Long | 7d10 | 7d8 | 7d8 | 7d8 | 7d10 |
| Tran | 9d16 | 6d16 | 6d16 | 6d16 | 9d16 |

ARMADO INFERIOR DE LA LOSA

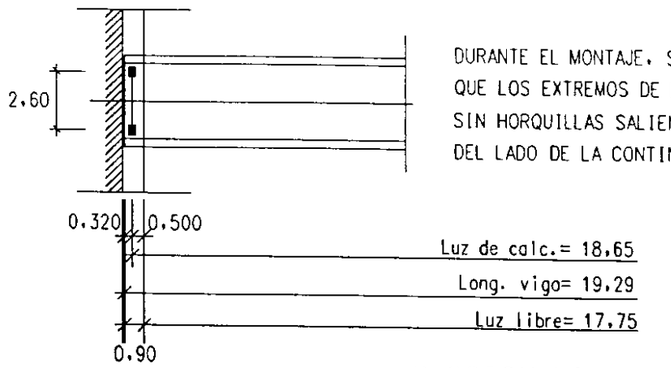
REDONDOS CORRUGADOS (pml).

| | L/8 | L/4 | L/4 | L/4 | L/8 |
|---|---|---|---|---|---|
| Long | 9d8 | 6d8 | 6d8 | 6d8 | 9d8 |
| Tran | 10d12 | 8d10 | 8d10 | 8d10 | 10d12 |

### DETALLE DE APOYO EN ESTRIBO (ALZADO)

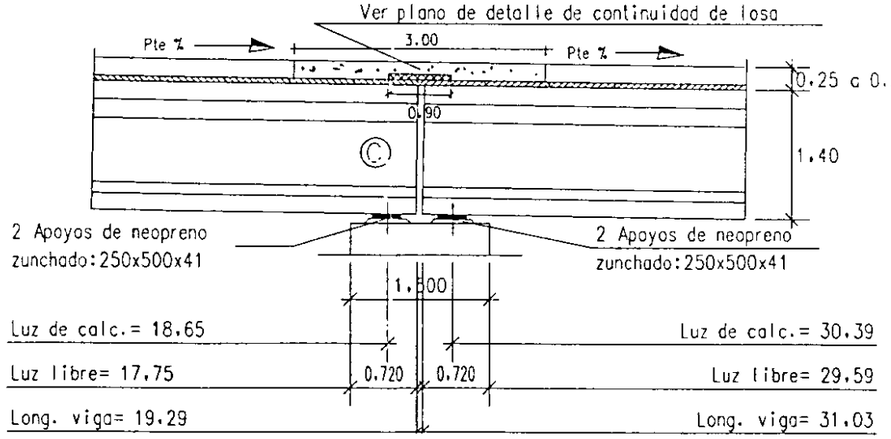



### DETALLE DE APOYO EN ESTRIBO (PLANTA)

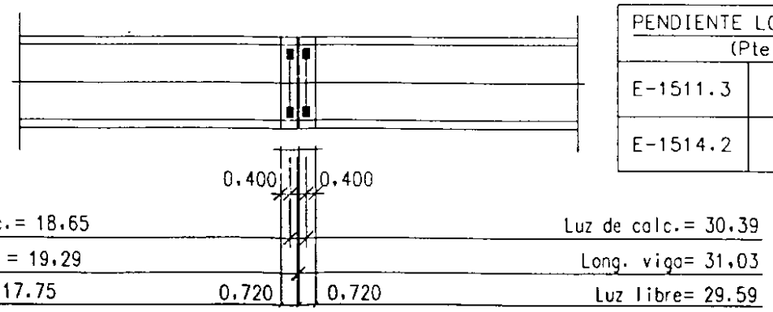



DURANTE EL MONTAJE, SE CUIDARA QUE LOS EXTREMOS DE LAS VIGAS SIN HORQUILLAS SALIENTES, QUEDEN DEL LADO DE LA CONTINUIDAD

### DETALLE DE APOYO EN PILA (ALZADO)




### DETALLE DE APOYO EN PILA (PLANTA)



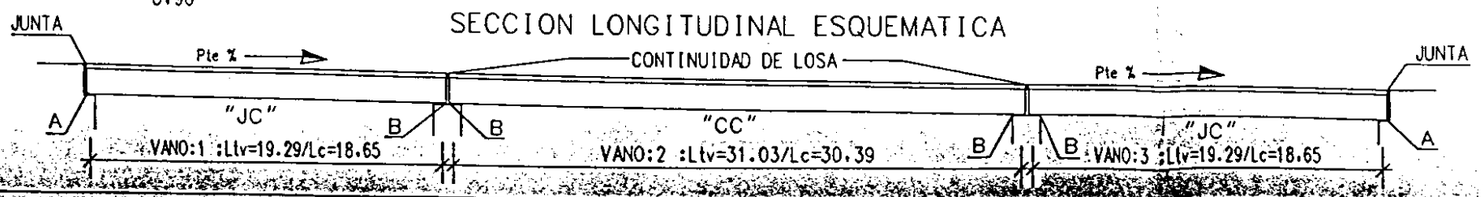

| PENDIENTE LONGITUDINAL (Pte %) | |
|---|---|
| E-1511.3 | 1.30 % |
| E-1514.2 | 1.15 % |

- VER REPLANTEO DE VIGAS, LONGITUDES Y DISTRIBUCION DE LAS MISMAS EN EL PLANO Nº = 5 Fa 0097-00 / 5 Fa 0088-00
- LA PENDIENTE LONGITUDINAL DE CADA VANO SE DARA CON LA MESETA DE MORTERO BAJO APOYOS
- SE HA CONSIDERADO UN PESO DEL CONJUNTO IMPOSTA-BARANDILLA-VALLA-TUBO= 900 Kg/ml

NOTAS: Ver hoja 11Ah 9639-91 para el montaje
* Armado tran. perpendicular a ejes de vigas
= Armado long. paralelo a ejes de vigas
Se debe limpiar y cepillar la superficie superior de la viga para mejorar la union de los hormigones de viga y losa
No hormigonar la zona superior de aceras hasta 7 dias despues de hormigonar la losa
CARGA MUERTA: 207 Kg/m2
SOBRECARGAS: IAP - 98

| CARACTERISTICAS MATERIALES/COEFICIENTES DE SEGURIDAD SEGUN NORMAS EP93 Y EH91 | | | |
|---|---|---|---|
| MATERIALES | TIPO-Kg/cm2 | CONTROL | CF.SEG |
| Hormigon viga | Fck=400 | Intenso | Cc=1.4 |
| Hormigon losa | Fck=250 | Normal | Cc=1.5 |
| Acero pas viga | Fyk=5100 | Intenso | Cc=1.1 |
| Acero pas losa | Fyk=5100 | Normal | Cc=1.15 |
| Acero preten-sado viga | Fmaxk=19000 Fpy=17100 | Intenso | Cs=1.1 |
| Acciones | Cargas permanentes | | Cf=1.35 |
| | Sobrecargas | | Cf=1.50 |

### SECCION LONGITUDINAL ESQUEMATICA

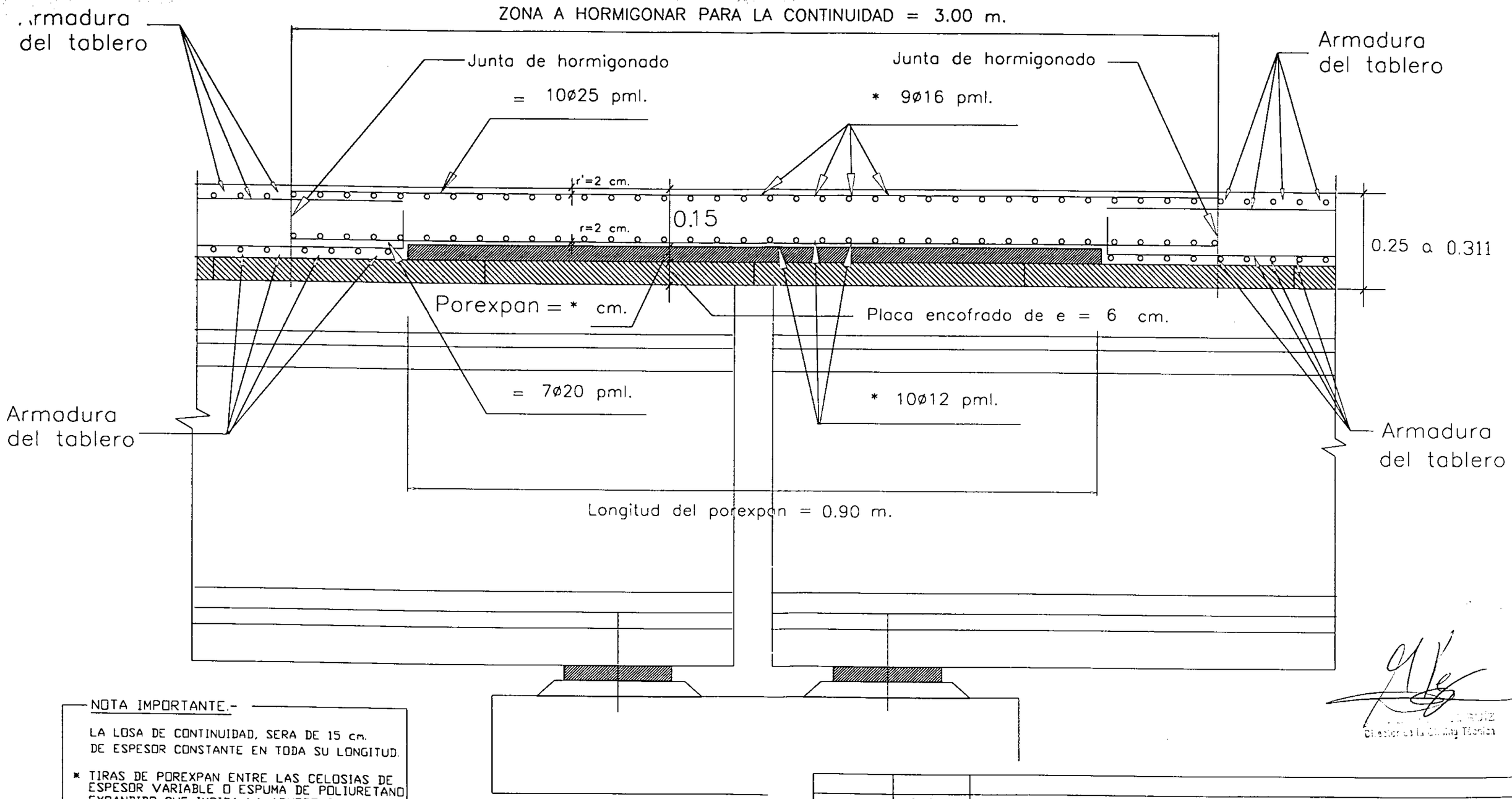



NEOPRENOS
TIPO DIMENSIONES
A = 250x500x52
B = 250x500x41

"E-1511.3" y "E-1514.2" (VANO TIPO)
TRAMO: MADRID-ZARAGOZA (Subtramo xv)
NECSO
PACADAR, S.A.

| | Anula al No: |
|---|---|
| ESTUDIO: 24785 | PLANO: 7 Fp 0142-00 |

## SECCION LONGITUDINAL.-




NOTA IMPORTANTE.-

LA LOSA DE CONTINUIDAD, SERA DE 15 cm. DE ESPESOR CONSTANTE EN TODA SU LONGITUD.

* TIRAS DE POREXPAN ENTRE LAS CELOSIAS DE ESPESOR VARIABLE O ESPUMA DE POLIURETANO EXPANDIDO QUE IMPIDA LA ADHERENCIA ENTRE LA LOSA DE ESPESOR 15cm. Y LA PLACA DE ENCOFRADO

EL HORMIGONADO DE LA ZONA DE CONTINUIDAD DE LA LOSA, SE REALIZARA POSTERIORMENTE AL DE LOS VANOS ADYACENTES, PARA EVITAR EL EFECTO DE RETRACCION EN DICHA ZONA DE CONTINUIDAD.
LA DIRECCION FACULTATIVA DETERMINARA EL TIEMPO QUE DEBE TRANSCURRIR ENTRE AMBAS FASES DE HORMIGONADO.

| | |
|---|---|
| 0 | 6-6-00 |
| EDICION | FECHA |

MODIFICACIONES

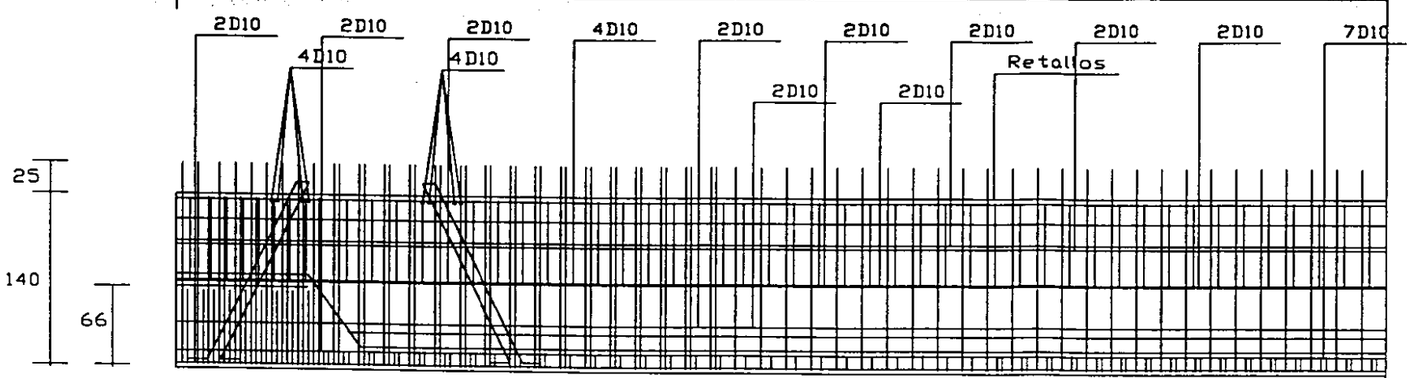
PACADAR

ARMADURA DE LA CONTINUIDAD DE LOSA "E-1511.3"y"E-1514.2" LINEA A. VELOCIDAD TRAMO:ZARAGOZA-LLEIDA (SUBTRAMO:XV) NECSO

| ESCALA S/E | ESTUDIO Nº 24785 | REVISO M.Arando | PLANO Nº 6Fp 0133-00 |
|---|---|---|---|

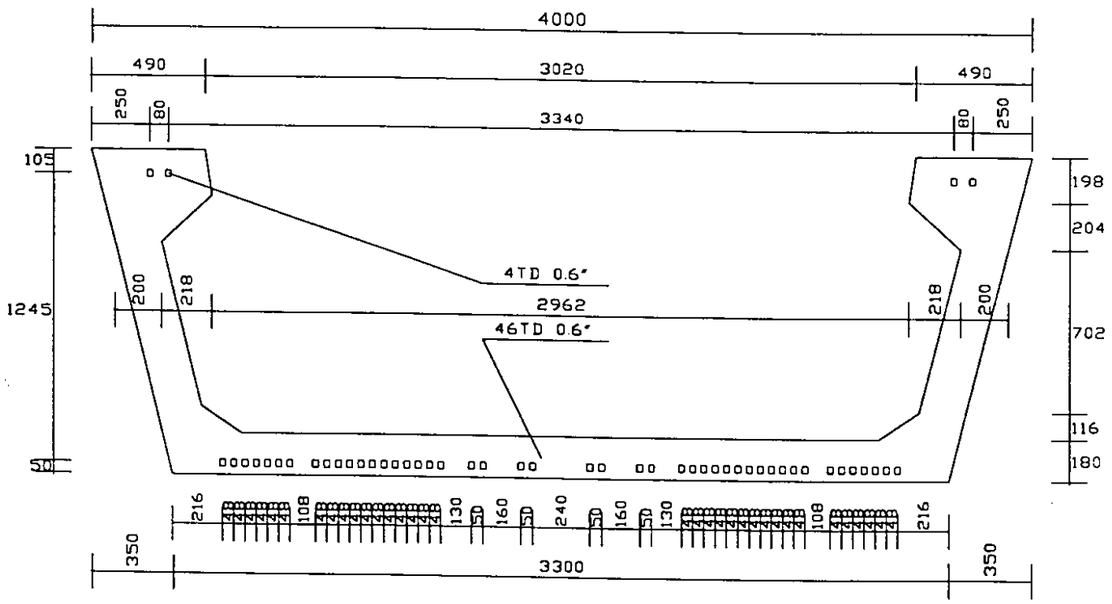
## SECCION LONGITUDINAL (Cotas en cm)

| | | | | | |
|---|---|---|---|---|---|
| CERCOS ALA SUPERIOR | D12a12.5 | D10a20 | D8a20 | D6a20 | D6a20 |
| HORQUILLAS ALMA C | D16+D12a12.5 | 2D12a20 | 2D10a20 | D12a20 | D10a20 |
| LONG. ZONAS ARMADO | 104.5 | 120 | 200 | 200 | 340 |
| SUSP. P.ext 4d1/2 dobl. | 100 | 100 | | 764.5 | |
| PRETENSADO SUPERIOR | | | 4TD 0.6" | | |



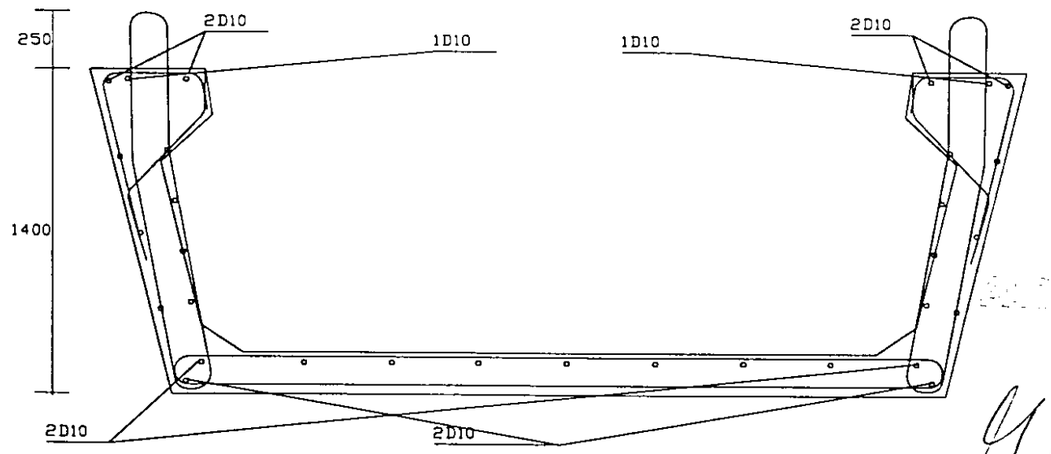

| | | | | | |
|---|---|---|---|---|---|
| CERCOS ALA INFERIOR | 2D16a12.5 | 2D12a20 | D16a20 | D16a20 | 2D10a20 |
| PRETENSADO INFERIOR | | | 46TD 0.6" | | |
| LONG ZONAS PRETENSADO | | | 964.5 | | |
| LONGITUDES DE MOLDES EN EJE | 104.5 | 42 | 818 | | |

SEC.TRANSVERSAL:FORMA Y PRETENSADO: (Cotas en mm)



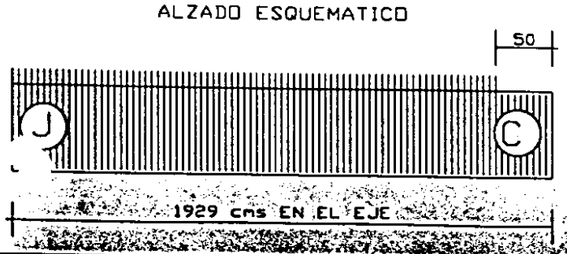

SEC.TRANSVERSAL:ARMADURA PASIVA: (Cotas en mm)

Armadura de piel 21 redondos D 10 (Todos los hierros no indicados)

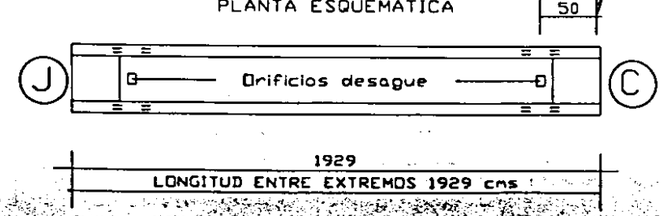



MARCAR EN CADA EXTREMO LA LETRA CORRESPONDIENTE

ALZADO ESQUEMATICO




PLANTA ESQUEMATICA




NOTA IMPORTANTE:

Las horquillas del alma en los 50 cms extremos a un solo lado de la viga NO serán salientes disponiendose horquillas cerradas D16+D12 a 12.5

PESO=72.20 Tn.

VUELO MAXIMO TRANSPORTE 1.50 METROS

| CARACTERISTICAS MATERIALES/COEFICIENTES SEGURIDAD SEGUN NORMAS EP93 Y EH91 | | | |
|---|---|---|---|
| MATERIAL | CALIDAD-kg/cm2 | CONTROL | CF.SEG |
| Hormigon | Fck=400 | Intenso | Cc=1.4 |
| Acero pasivo | Fyk=5100 | Intenso | Cs=1.1 |
| Acero Pretensado | Fmaxk=19000<br>Fpy=17100 | Intenso | Cs=1.1 |
| Acciones | Cargas permanentes | | Cf=1.35 |
| | Sobrecargas | | Cf=1.50 |


MIGUEL PELÁEZ RUÍZ
Director de la Oficina Técnica

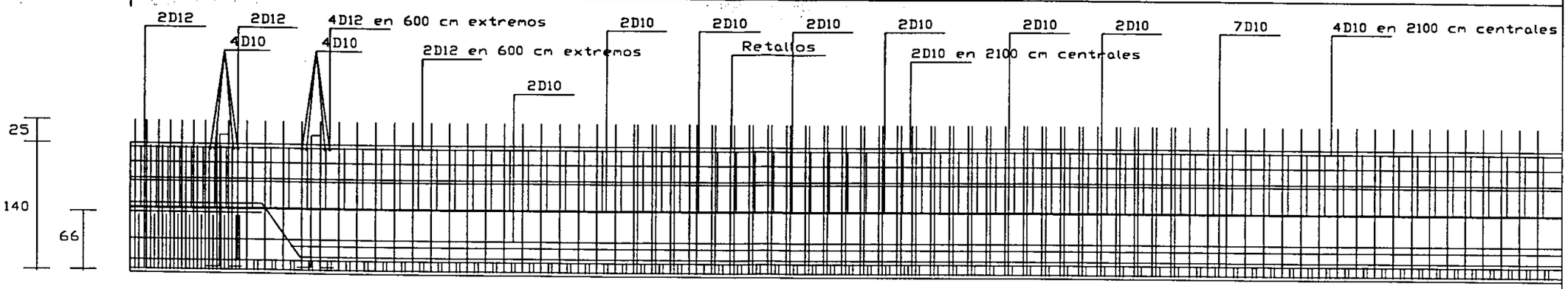

VIGA:"CAJON-330.140.20" (TIPO:"JC")
"E-1511.3"y"E-1514.2" (VANOS LATERALES)
TRAMO:MADRID-ZARAGOZA (SUBTRAMO:XV)
NECSO
PACADAR

| CALCULO | REVISO | ANULA AL |
|---|---|---|
| | | ANULADO POR |

EST.24785 6Fp 0131-00

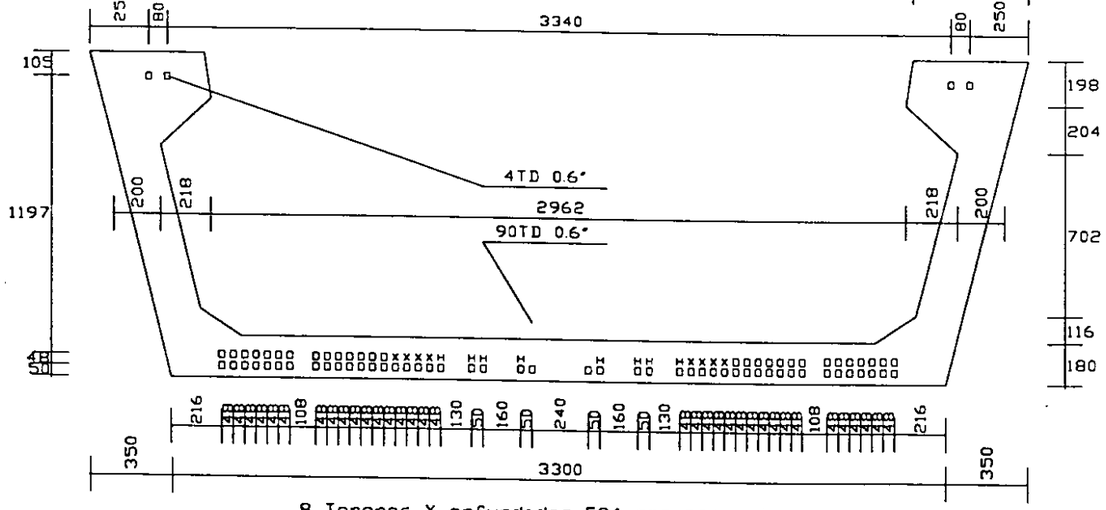
## SECCION LONGITUDINAL (Cotas en cm)

| | | | | | | |
|---|---|---|---|---|---|---|
| CERCOS ALA SUPERIOR | D12a12.5 | D12a20 | D10a20 | D8a20 | D6a20 | D6a20 |
| HORQUILLAS ALMA | 2D16a12.5 | D20a20 | D16a20 | 2D10a20 | 2D10a20 | D12a20 |
| LONG. ZONAS ARMADO | 101.5 | 120 | 300 | 300 | 300 | 430 |
| SUSP. Pext 4 d 26 | 100 | 100 | | | 1351.5 | |
| PRETENSADO SUPERIOR | | | | 4TD 0.6" | | |




| | | | | | | |
|---|---|---|---|---|---|---|
| CERCOS ALA INFERIOR | 2D20a12.5 | D16+D12a20 | D16+D12a20 | D16+D10a20 | D16a20 | 2D10a20 |
| PRETENSADO INFERIOR | | | 74TD 0.6" | 82TD 0.6" | 90TD 0.6" | |
| LONG ZONAS PRETENSADO | | | 594 | 142 | 815.5 | |
| LONGITUDES DE MOLDES EN EJE | 141.5 | 42 | | | 1368 | |

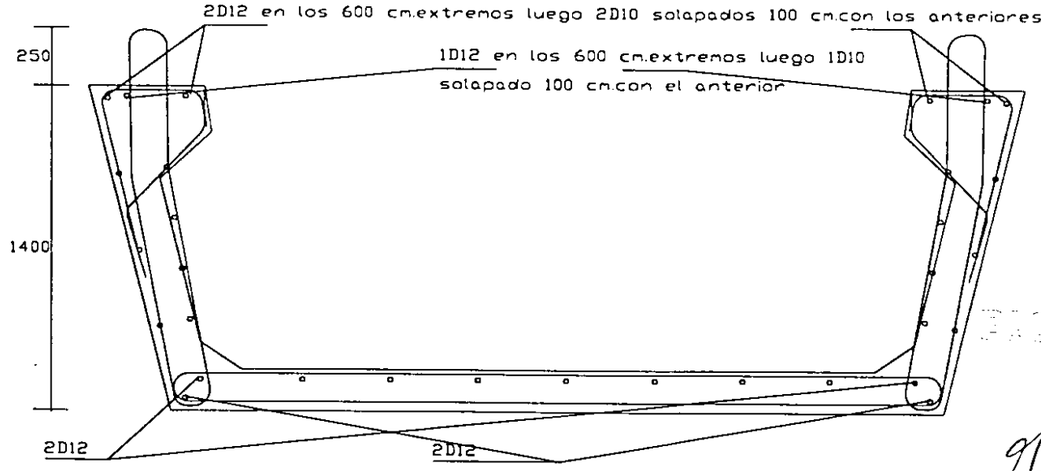
SEC.TRANSVERSAL:FORMA Y PRETENSADO: (Cotas en mm)




8 Torones X enfundados 594 cms por extremo
8 Torones H enfundados 736 cms por extremo

SEC.TRANSVERSAL:ARMADURA PASIVA: (Cotas en mm)

Armadura de piel 21 redondos D 10 (Todos los hierros no indicados)

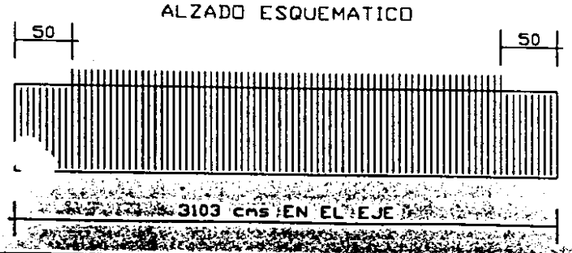



NOTA IMPORTANTE:

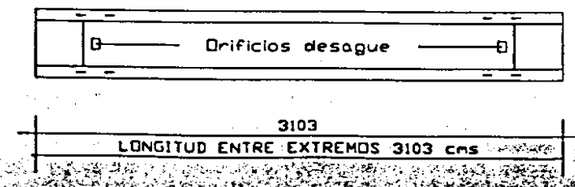
Las horquillas del alma en los 50 cms extremos a ambos lados de la viga NO seran salientes disponiendose horquillas cerradas dobles D16 a 12.5

MANUEL PELAEZ RUIZ
Director de la Oficina Técnica

ALZADO ESQUEMATICO




PLANTA ESQUEMATICA




PESO=112.30 Tn.
VUELO MAXIMO TRANSPORTE 2.50 METROS

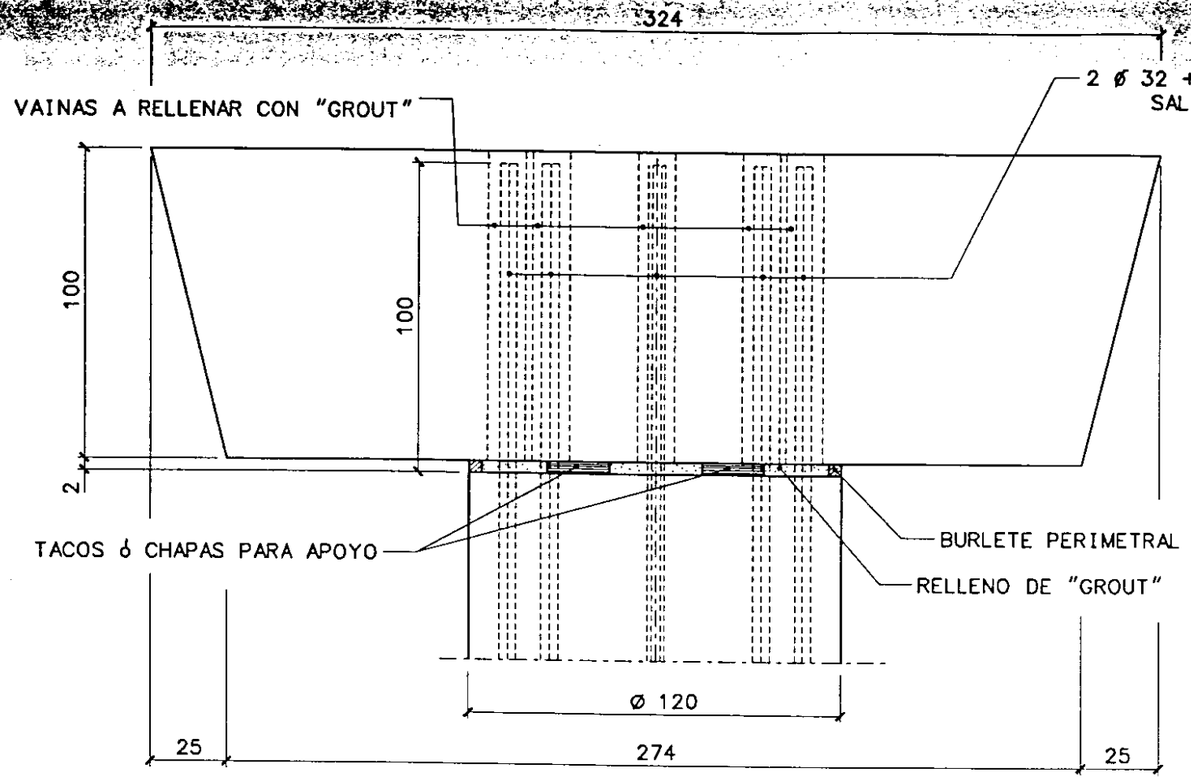
| CARACTERISTICAS MATERIALES/COEFICIENTES SEGURIDAD SEGUN NORMAS EP93 Y EH91 | | | |
|---|---|---|---|
| MATERIAL | CALIDAD-kg/cm2 | CONTROL | CF.SEG |
| Hormigon | Fck=400 | Intenso | Cc=1.4 |
| Acero pasivo | Fyk=5100 | Intenso | Cs=1.1 |
| Acero Pretensado | Fmaxk=19000<br>Fpy=17100 | Intenso | Cs=1.1 |
| Acciones | Cargas permanentes | | Cf=1.35 |
| | Sobrecargas | | Cf=1.50 |

VIGA:"CAJON-330.140.20" (TIPO:"CC")
"E-1511.3"y"E-1514.2" (VANO CENTRAL)
TRAMO:MADRID-ZARAGOZA (SUBTRAMO:XV)
NECSO
PACADAR

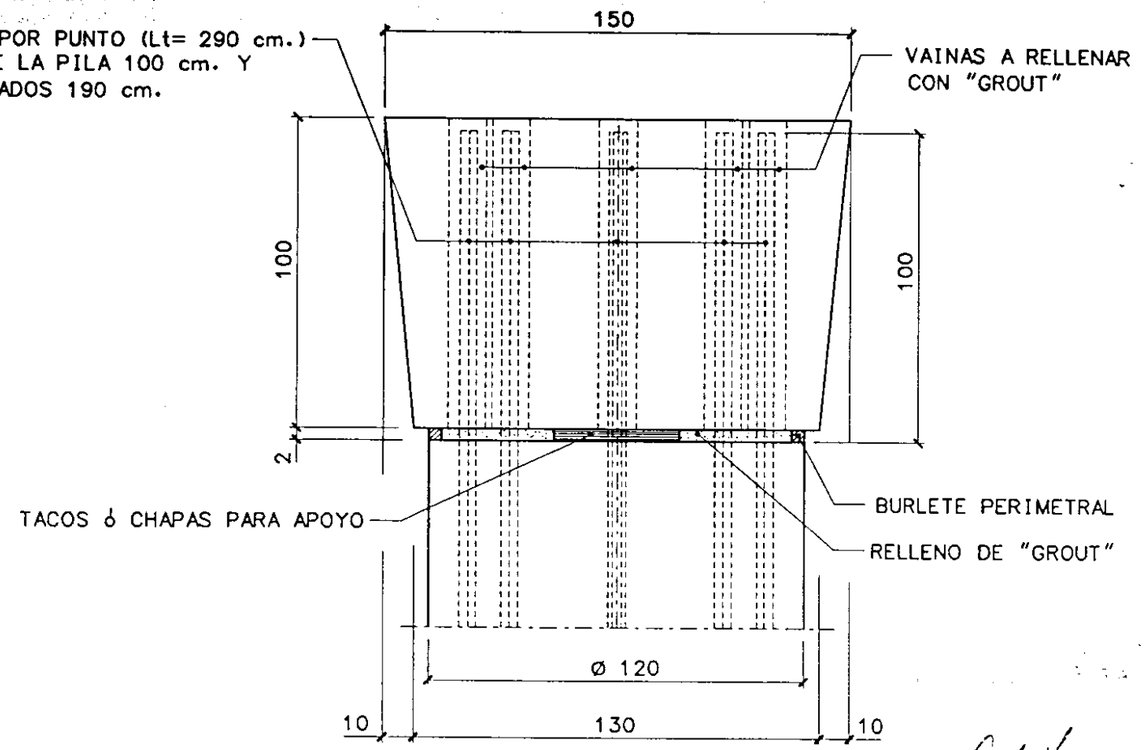
| CALCULO | REVISO | ANULA AL |
|---|---|---|
| | | ANULADO POR |

EST. 24785 6Fp 0132-00

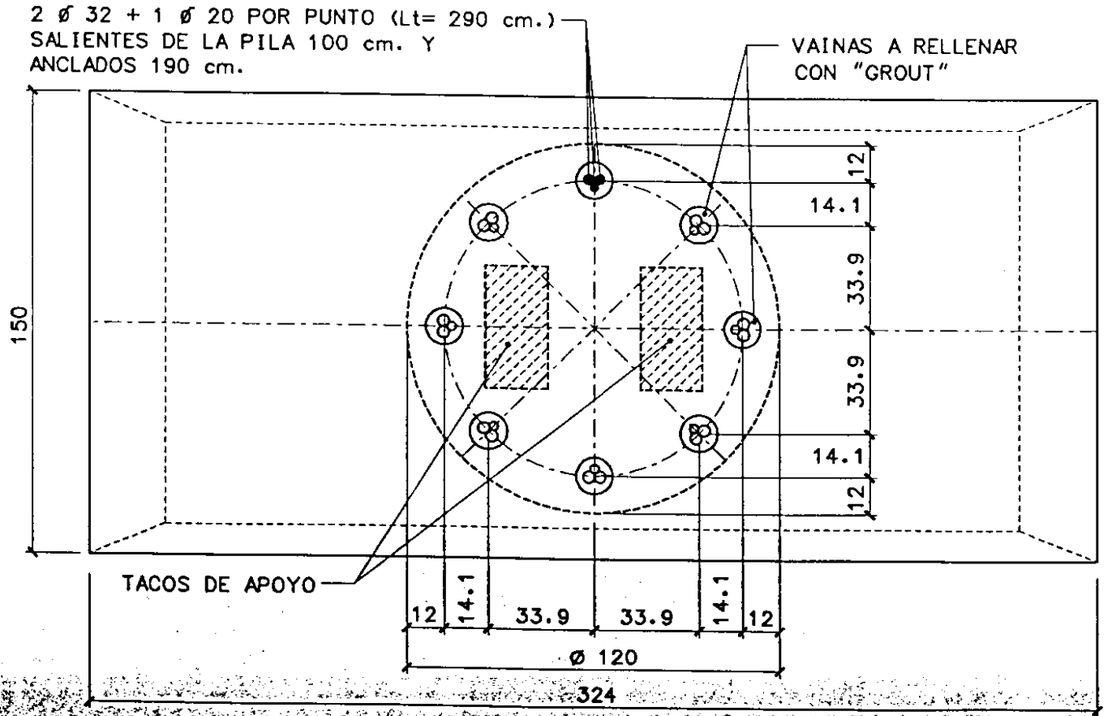
## SECCION TRANSVERSAL
ESCALA 1/20




## SECCION LONGITUDINAL
ESCALA 1/20




## PLANTA
ESCALA 1/20




COTAS EN cm.

NOTAS: .- EL RELLENO DE VAINAS SE HARA CON UN MORTERO TIPO "GROUT" O SIMILAR, LIGERAMENTE EXPANSIVO, QUE NO PRESENTE FENOMENOS DE ENVEJECIMIENTO Y CON LA GRANULOMETRIA ADECUADA, A SUMINISTRAR POR EL CONSTRUCTOR.

.- LA COLOCACION DE LOS HIERROS SALIENTES EN LA PILA SE HARA CON SUMA PRECISION PARA QUE COINCIDAN CON LAS VAINAS DEL DINTEL.

| EDICION | FECHA | MODIFICACIONES |
|---|---|---|
| 0 | 12-6-00 | |

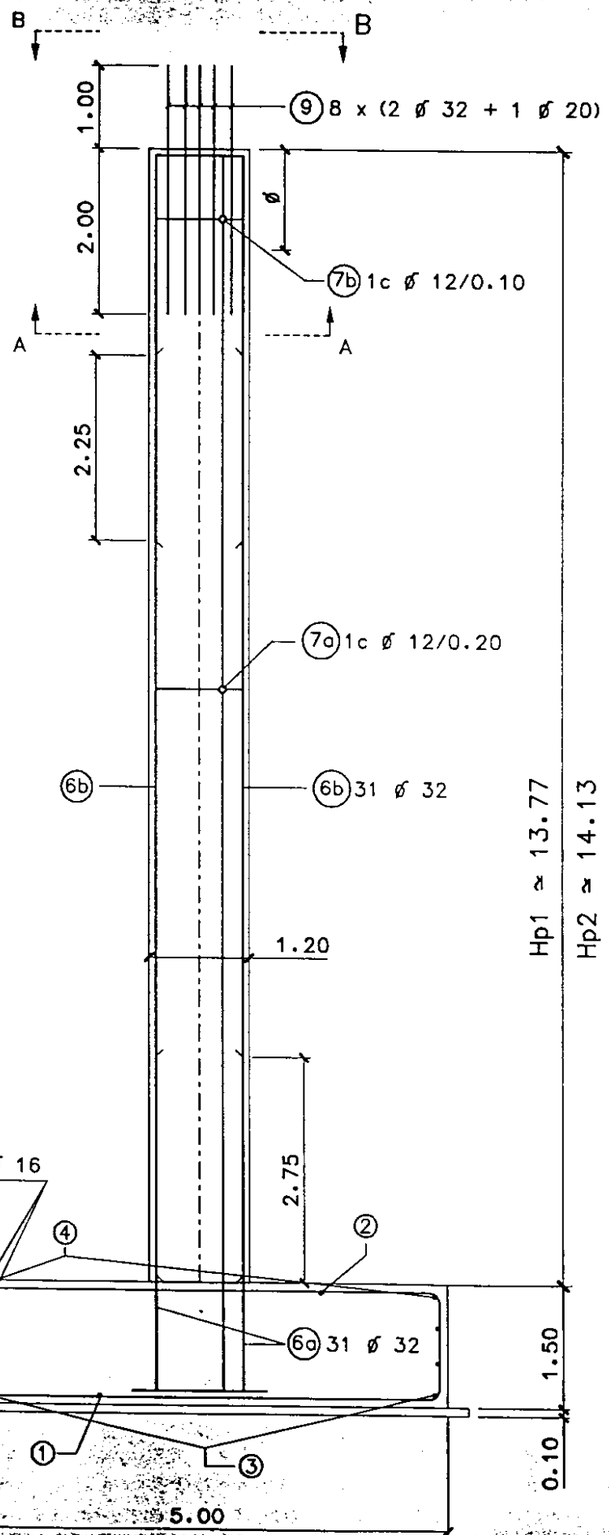
PACADAR

DETALLE DE UNION DE PILA Y DINTEL
ESTRUCTURAS: "E-1511.3" Y E-1514.2"
SUBTRAMO XV . L.A.V. MADRID-ZARAGOZA
NECSO

ESCALA 1/20 | ESTUDIO Nº 24785 | REVISO | PLANO Nº 12 Fp 0208-00

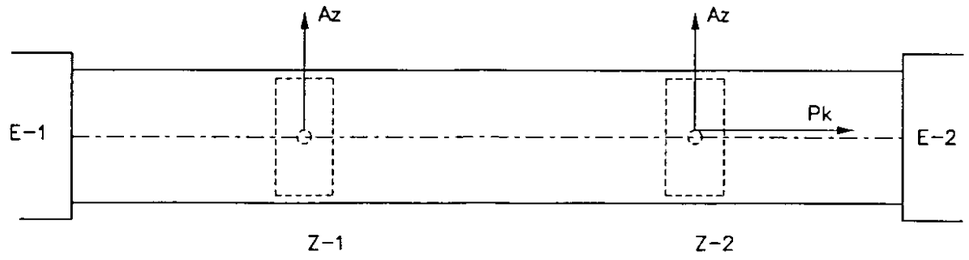
## SECCION C-C

ESCALA 1/75



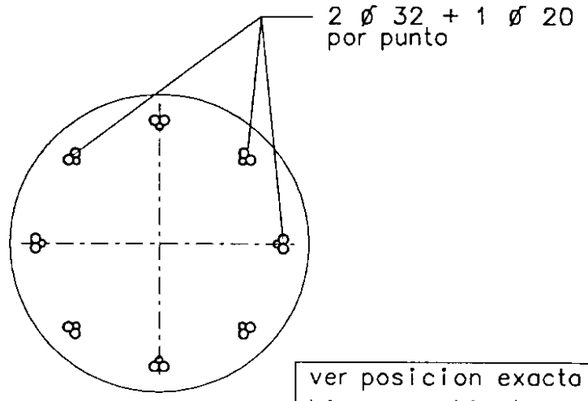

## ESQUEMA PLANTA

S/E




## SECCION B-B

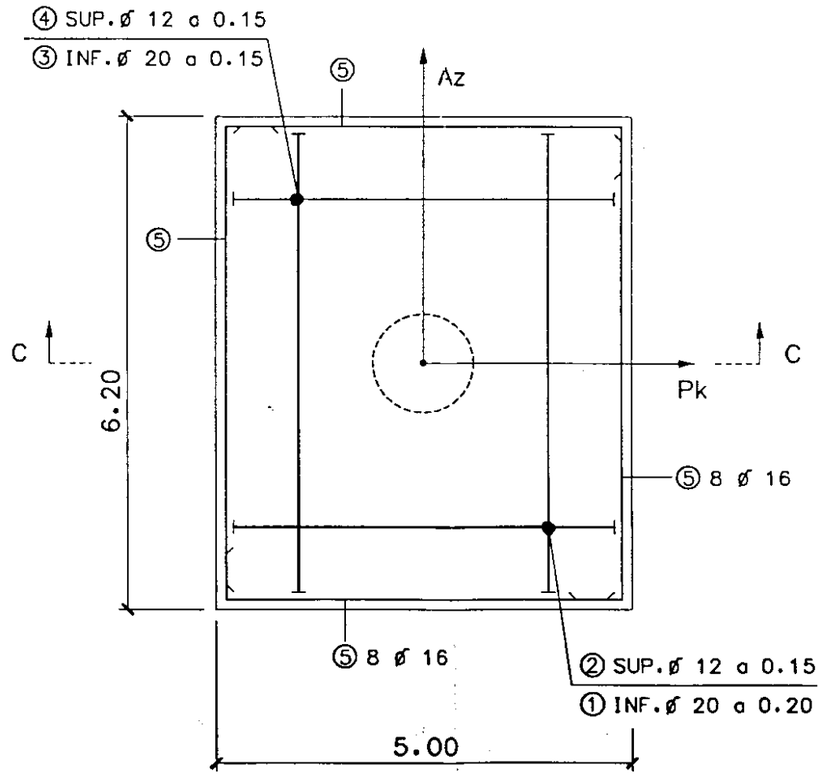
ESCALA 1/50




ver posicion exacta de hierros salientes en plano: 12 Fp 0208-00

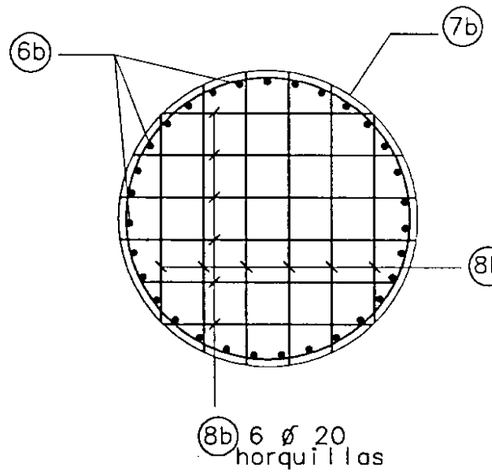
## PLANTA ZAPATA

ESCALA 1/75




## SECCION A-A

ESCALA 1/50




MIGUEL PELÁEZ RUIZ
Director de la Oficina Técnica

| EDICION | FECHA | MODIFICACIONES |
|---|---|---|
| | | |
| | | |
| | | |
| 0 | 14-6-00 | |

# ARMADO DE PILAS Y ZAPATAS "E-1511.3" Y "E-1512.4"

SUBTRAMO XV

NECSO

| ESCALA VARIAS | ESTUDIO Nº 24785 | REVISO | PLANO Nº 14 Fp 0244-00 |
|---|---|---|---|

PASOS SUPERIORES E-1505.0, E-1511.3 Y E-1514.2

3º CALCULO DE PILAS

## DATOS GEOMÉTRICOS DE FUSTES Y NEOPRENOS

**PROYECTO :** **L.A.V. Tramo Madrid-Zaragoza. Subtramo XV**
**ESTRUCTURA:** **Estructura E-1505.0**

| Elemento | Altura del fuste (m.) | Número de apoyos neopreno | Tipo de pila 1=circular 2=prismatica | Dimensiones base de pila | | Dimensiones cabeza de pila | | Dimensiones de neoprenos | | | Desplazamiento maximo admisible neoprenos en (mm.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ancho o diametro(m.) | espesor (m.) | ancho (m.) | espesor (m.) | a (m.) | b (m.) | e (m.) | |
| ESTRIBO 1 | 1.00 | 2 | 2 | 100.00 | 100.00 | 100.00 | 100.00 | 0.35 | 0.45 | 0.077 | 52.40 |
| PILA 1 | 13.90 | 1 | 1 | 1.20 | 1.20 | 1.20 | 1.20 | 0.80 | 0.63 | 0.059 | 41.30 |
| PILA 2 | 14.30 | 1 | 1 | 1.20 | 1.20 | 1.20 | 1.20 | 0.80 | 0.63 | 0.059 | 41.30 |
| ESTRIBO 2 | 1.00 | 2 | 2 | 100.00 | 100.00 | 100.00 | 100.00 | 0.35 | 0.45 | 0.077 | 52.40 |

## DATOS DE ACCIONES SOBRE TABLERO Y MODULOS DE MATERIALES

**PROYECTO :** **L.A.V. Tramo Madrid-Zaragoza. Subtramo XV**
**ESTRUCTURA:** **Estructura E-1505.0**

**Módulos de elásticidad de materiales:**

| | | |
|---|---|---|
| Módulo de deformación del neopreno frente a acciones RAPIDAS --> | Gr(t/m2)= | 160 |
| Módulo de deformación del neopreno frente a acciones LENTAS --> | Gl(t/m2)= | 80 |
| Módulo de deformación del hormigón frente a acciones RAPIDAS --> | Er(t/m2)= | 3,300,000 |
| Módulo de deformación del hormigón frente a acciones LENTAS --> | El(t/m2)= | 1,300,000 |

**Acciones actuantes sobre la estructura:**

Frenado y fuerza centrifuga :

| | |
|---|---|
| RADIO DEL TABLERO (si es recto poner una número alto)(m.): | 1000000000.00 |
| VELOCIDAD CIRCULACION SOBRECARGA(km/h): | 120.00 |
| ANCHO DE TABLERO (para evaluar carga de frenado y fuerza centrifuga)(en m.): | 8.10 |
| VALOR DE LA SOBRECARGA UNIFORME DE USO(t/m2): | 0.40 |
| FUERZA DE FRENADO TOTAL (t.): | 14.19 |
| FUERZA CENTRIFUGA TOTAL | 0.00 |
| DISTANCIA DE C.D.G. DE LA FUERZA CENTRIFUGA(desde el estribo 1) (m.): | 34.55 |

Viento:

| | |
|---|---|
| SOBRECANTO FRENTE AL VIENTO (normalmente 2 x alto barrera + peralte ) (m.): | 2.5 |
| PRESION UNITARIA DEL VIENTO (t/m2): | 0.25 |
| INTEGRAL DE CANTOS (area frente al viento sin considerar barreras) (m2) | 96.74 |
| C.D.G DE LA INTEGRAL DE CANTOS(desde el estribo 1)( m.) | 34.55 |
| AREA TOTAL FRENTE AL VIENTO(Integral de cantos+barreras)(m2): | 269.49 |
| DISTANCIA DE C.D.G. DE CARGA VIENTO TOTAL(desde el estribo 1) (m.): | 34.55 |
| FUERZA TOTAL DEBIDA AL VIENTO (t.): | 67.37 |

Coacciones:

| | |
|---|---|
| DESPLAZ. IMPUESTO POR FLUENCIA+RETR+TEMP(mm/metro) | 1.00 |

# REPARTO DE ACCIONES HORIZONTALES EN PILAS Y ESTRIBOS

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1505.0

## RIGIDECES DE PILAS Y ESTRIBOS

| | | | ESTRIBO 1 | PILA 1 | PILA 2 | ESTRIBO 2 |
|---|---|---|---|---|---|---|
| MUELLES EQUIVALENTES A FUSTES DE PILAS(t/m) | LONGITUDINAL | ACC .LENTAS | 3.250E+13 | 1.478E+02 | 1.358E+02 | 3.250E+13 |
| | | ACC. RAPIDAS | 8.250E+13 | 3.752E+02 | 3.446E+02 | 8.250E+13 |
| | TRANSV. | ACC RAPIDAS | 8.250E+13 | 3.752E+02 | 3.446E+02 | 8.250E+13 |

| | | | | | | |
|---|---|---|---|---|---|---|
| MUELLES EQUIVALENTES A FUSTES + NEOPRENOS (t/m) | LONGITUDINAL | ACC .LENTAS | 327 | 121 | 113 | 327 |
| | | ACC. RAPIDAS | 655 | 294 | 275 | 655 |
| | TRANSV. | ACC.RAPIDAS | 655 | 294 | 275 | 655 |

## REPARTO DE ACCIONES LONGITUDINALES(sin mayorar)

| | | ESTRIBO 1 | PILA 1 | PILA 2 | ESTRIBO 2 |
|---|---|---|---|---|---|
| FUERZAS(ton.): | Viento | 0.00 | 0.00 | 0.00 | 0.00 |
| | Deformaciones | -11.26 | -1.87 | 1.78 | 11.35 |
| | Frenado | 4.95 | 2.22 | 2.08 | 4.95 |
| | Centrífuga | 0.00 | 0.00 | 0.00 | 0.00 |
| | Sismo | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | |
|---|---|---|---|---|---|
| DESPLAZAMIENTOS (mm.) | Viento | 0.00 | 0.00 | 0.00 | 0.00 |
| | Deformaciones | -34.41 | -2.75 | 2.61 | 34.69 |
| | Frenado | 7.56 | 1.63 | 1.52 | 7.56 |
| | Centrífuga | 0.00 | 0.00 | 0.00 | 0.00 |
| | Sismo | 0.00 | 0.00 | 0.00 | 0.00 |

## REPARTO DE ACCIONES TRANSVERSALES(sin mayorar)

| | | ESTRIBO 1 | PILA 1 | PILA 2 | ESTRIBO 2 |
|---|---|---|---|---|---|
| FUERZAS(ton.): | Viento | 24.79 | 11.18 | 10.52 | 25.11 |
| | Deformaciones | 0.00 | 0.00 | 0.00 | 0.00 |
| | Frenado | 0.00 | 0.00 | 0.00 | 0.00 |
| | Centrífuga | 0.00 | 0.00 | 0.00 | 0.00 |
| | Sismo | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | |
|---|---|---|---|---|---|
| DESPLAZAMIENTOS (mm.) | Viento | 37.87 | 8.20 | 7.71 | 38.37 |
| | Deformaciones | 0.00 | 0.00 | 0.00 | 0.00 |
| | Frenado | 0.00 | 0.00 | 0.00 | 0.00 |
| | Centrífuga | 0.00 | 0.00 | 0.00 | 0.00 |
| | Sismo | 0.00 | 0.00 | 0.00 | 0.00 |

## COMPROBACION DE MOVIMIENTOS EN NEOPRENOS

| | | ESTRIBO 1 | PILA 1 | PILA 2 | ESTRIBO 2 |
|---|---|---|---|---|---|
| COMBINACIONES | HIPOTESIS 1 | 26.85 | 1.11 | 4.13 | 42.25 |
| | HIPOTESIS 2 | 51.17 | 8.65 | 8.14 | 51.73 |
| | HIPOTESIS 3 | 29.57 | 3.83 | 5.09 | 41.76 |

| | | | | | |
|---|---|---|---|---|---|
| COMPROBACION | DEPLAZ.. MAXIMO | 51.17 | 8.65 | 8.14 | 51.73 |
| | DEPLAZ. MAX. NEOPRENO | 52.40 | 41.30 | 41.30 | 52.40 |
| | COMPROBACION | VALE | VALE | VALE | VALE |

## COMBINACIONES PARA EL CÁLCULO DE PILAS EN ESTADO LIMITE ÚLTIMO

**PROYECTO :** **L.A.V. Tramo Madrid-Zaragoza. Subtramo XV**
**ESTRUCTURA:** **Estructura E-1505.0**

HIPOTESIS :

**Hipótesis I**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.50 |
| Coeficiente mayoración acciones favorables permanentes = | 0.90 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |

**Hipótesis II**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de viento.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.50 |
| Coeficiente mayoración acciones favorables permanentes = | 0.90 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |

**Hipótesis III**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Sobrecargas de viento / 2.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.35 |
| Coeficiente mayoración acciones favorables permanentes = | 0.81 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |

**Hipótesis IV**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
60% de las sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Sobrecargas de viento / 2.
Sobrecargas accidentales o sísmicas.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.20 |
| Coeficiente mayoración acciones favorables permanentes = | 0.72 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración sobrecarga de viento = | 1.00 |
| Coeficiente mayoración sobrecarga sísmica = | 1.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.00 |
| Coeficiente mayoración pretensado favorable = | 0.70 |

Esquema combinaciones pielsB07.XLS

## COMBINACIONES PARA EL CÁLCULO DE PILAS EN ESTADO LIMITE SERVICIO

**PROYECTO :** **L.A.V. Tramo Madrid-Zaragoza. Subtramo XV**
**ESTRUCTURA:** **Estructura E-1505.0**

HIPOTESIS :

**Hipótesis I**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.00 |
| Coeficiente mayoración acciones favorables permanentes = | 1.00 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.10 |
| Coeficiente mayoración pretensado favorable = | 0.90 |

**Hipótesis II**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de viento.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 1.00 |
| Coeficiente mayoración acciones favorables permanentes = | 1.00 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.10 |
| Coeficiente mayoración pretensado favorable = | 0.90 |

**Hipótesis III**

Cargas permanentes (peso propio, pavimento y barrera rígida).
Acciones reológicas y térmicas.
Sobrecargas de uso (repartida de 0.4 T/m2 y carro 60 T).
Sobrecargas de viento / 2.
Fuerzas de pretensado.

| | |
|---|---|
| Coeficiente mayoración acciones desfavorables = | 0.90 |
| Coeficiente mayoración acciones favorables permanentes = | 0.90 |
| Coeficiente mayoración acciones favorables no permanentes = | 0.00 |
| Coeficiente mayoración pretensado desfavorable = | 1.10 |
| Coeficiente mayoración pretensado favorable = | 0.90 |

| Cálculo de Pilas en Estado Limite Último | PILA Nº 1 |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1505.0 |

**DATOS**

| | | |
|---|---|---|
| Altura pila | 13.90 | m |
| Angulo esviaje pilas | 100.00 | g |

**ESFUERZOS SIN MAYORAR EN CORONACION DE PILAS POR EL TABLERO**

ESFUERZOS HORIZONTALES SEGUN EJES DEL TABLERO

| | Longitudinal ( Ton. ) | Transversal ( Ton. ) |
|---|---|---|
| Viento | 0.00 | 11.18 |
| Deformaciones | 1.87 | 0.00 |
| Frenado | 2.22 | 0.00 |
| Centrífuga | 0.00 | 0.00 |
| Sismo | 0.00 | 0.00 |

ESFUERZOS HORIZONTALES

| | Longitudinal - Z ( Ton. ) | Transversal - Y ( Ton. ) |
|---|---|---|
| Viento | 0.00 | 11.18 |
| Deformaciones | 1.87 | 0.00 |
| Frenado | 2.22 | 0.00 |
| Centrífuga | 0.00 | 0.00 |
| Sismo | 0.00 | 0.00 |

ESFUERZOS VERTICALES

AXIL máximo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 16.85 | 0.00 | 0.00 |
| Temperatura | 7.52 | 0.00 | 0.00 |
| Sobrecarga repartida | 3.67 | 0.00 | 0.00 |
| Carro | 3.88 | 0.00 | 0.00 |

AXIL mínimo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 14.95 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | -96.94 | 0.00 | 0.00 |
| Carro | -56.88 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y máximo

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 16.85 | 0.00 | 0.00 |
| Temperatura | 7.52 | 0.00 | 0.00 |
| Sobrecarga repartida | 3.67 | 0.00 | 0.00 |
| Carro | 3.88 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y mínimo

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 14.95 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | -96.94 | 0.00 | 0.00 |
| Carro | -56.88 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z máximo - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 14.95 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | -96.94 | 0.00 | 0.00 |
| Carro | -56.88 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z mínimo - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 16.85 | 0.00 | 0.00 |
| Temperatura | 7.52 | 0.00 | 0.00 |
| Sobrecarga repartida | 3.67 | 0.00 | 0.00 |
| Carro | 3.88 | 0.00 | 0.00 |

**RESULTADOS**
**CARGAS DE CALCULO EN CORONACION DE PILA**

**Hipótesis I**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy con | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | 1 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy con | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy m | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy mi | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy con | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | 2 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy ma | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy mi | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy con | -424.51 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 3.34 | 0.00 | 3 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy con | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy m | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy mi | -424.51 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy con | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 20.34 | 0.00 | 0.00 | 3.34 | 0.00 | 4 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy ma | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy mi | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 20.34 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy con | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy ma | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy mi | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy ma | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy mi | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy con | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy ma | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy mi | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc | -720.64 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 3.34 | 0.00 | 5 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy ma | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy mi | -720.64 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy con | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | 6 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy con | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy m | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy mi | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy ma | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy mi | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 22.60 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | 7 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy ma | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy mi | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy ma | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -230.73 | 0.00 | 0.00 | -3.34 | 0.00 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy mi | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | -230.73 | 0.00 | 0.00 | 3.34 | 0.00 | |

Hipótesis II

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy con | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | 8 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy con | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy m | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy mi | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy con | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | 9 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy ma | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy mi | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy con | -424.51 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | 10 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy con | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy m | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy mi | -424.51 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy con | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | 16.77 | 11 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy ma | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy mi | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy con | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy ma | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy mi | -422.61 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy ma | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy mi | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy con | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy ma | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy mi | -721.97 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc | -720.64 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | 12 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy ma | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy mi | -720.64 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy con | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | 13 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy con | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy m | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy mi | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy ma | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy mi | -715.59 | 0.00 | 0.00 | 2.81 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | 14 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy ma | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy mi | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy ma | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.77 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy mi | -717.48 | 0.00 | 0.00 | 2.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -16.77 | |

**Hipótesis III**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy con | -378.67 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | 7.55 | 15 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy con | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy m | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy mi | -378.67 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy con | -648.72 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | 7.55 | 16 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy ma | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy mi | -648.72 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy con | -380.56 | 0.00 | 0.00 | 2.53 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 7.55 | 17 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy con | -380.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy m | -380.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy mi | -380.56 | 0.00 | 0.00 | 2.53 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy con | -378.67 | 0.00 | 0.00 | 2.53 | 0.00 | 19.06 | 0.00 | 0.00 | 3.00 | 7.55 | 18 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 19.06 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy ma | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 19.06 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy mi | -378.67 | 0.00 | 0.00 | 2.53 | 0.00 | 19.06 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy con | -378.67 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | 7.55 | |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy ma | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy mi | -378.67 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc | -648.72 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | 7.55 | |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy ma | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy mi | -648.72 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy con | -648.72 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | 7.55 | |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy ma | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy mi | -648.72 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc | -647.40 | 0.00 | 0.00 | 2.53 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 7.55 | 19 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc | -647.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy ma | -647.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy mi | -647.40 | 0.00 | 0.00 | 2.53 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy con | -642.34 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | 7.55 | 20 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy con | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy m | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy mi | -642.34 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc | -642.34 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | 7.55 | |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy ma | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy mi | -642.34 | 0.00 | 0.00 | 2.53 | 0.00 | 20.34 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc | -644.24 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | 7.55 | 21 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy ma | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy mi | -644.24 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | -7.55 | |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | -644.24 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | 7.55 | |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | -7.55 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy ma | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -207.66 | 0.00 | 0.00 | -3.00 | 7.55 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy mi | -644.24 | 0.00 | 0.00 | 2.53 | 0.00 | -207.66 | 0.00 | 0.00 | 3.00 | -7.55 | |

| Cálculo de Pilas en Estado Limite Último | PILA Nº 2 |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1505.0 |

**DATOS**

| | | |
|---|---|---|
| Altura pila | 14.30 | m |
| Angulo esviaje pilas | 100.00 | g |

**ESFUERZOS SIN MAYORAR EN CORONACION DE PILAS POR EL TABLERO**

ESFUERZOS HORIZONTALES SEGUN EJES DEL TABLERO

| | Longitudinal ( Ton. ) | Transversal ( Ton. ) |
|---|---|---|
| Viento | 0.00 | 10.52 |
| Deformaciones | 1.78 | 0.00 |
| Frenado | 2.08 | 0.00 |
| Centrífuga | 0.00 | 0.00 |
| Sismo | 0.00 | 0.00 |

ESFUERZOS HORIZONTALES

| | Longitudinal - Z ( Ton. ) | Transversal - Y ( Ton. ) |
|---|---|---|
| Viento | 0.00 | 10.52 |
| Deformaciones | 1.78 | 0.00 |
| Frenado | 2.08 | 0.00 |
| Centrífuga | 0.00 | 0.00 |
| Sismo | 0.00 | 0.00 |

ESFUERZOS VERTICALES

AXIL máximo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 16.85 | 0.00 | 0.00 |
| Temperatura | 7.52 | 0.00 | 0.00 |
| Sobrecarga repartida | 3.67 | 0.00 | 0.00 |
| Carro | 3.88 | 0.00 | 0.00 |

AXIL mínimo - MOMENTO Z concomitante - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 14.95 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | -96.94 | 0.00 | 0.00 |
| Carro | -57.99 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y máximo

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 16.85 | 0.00 | 0.00 |
| Temperatura | 7.52 | 0.00 | 0.00 |
| Sobrecarga repartida | 3.67 | 0.00 | 0.00 |
| Carro | 3.88 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z concomitante - MOMENTO Y mínimo

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 14.95 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | -96.94 | 0.00 | 0.00 |
| Carro | -57.99 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z máximo - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 14.95 | 0.00 | 0.00 |
| Temperatura | 0.00 | 0.00 | 0.00 |
| Sobrecarga repartida | -96.94 | 0.00 | 0.00 |
| Carro | -57.99 | 0.00 | 0.00 |

AXIL concomitante - MOMENTO Z mínimo - MOMENTO Y concomitante

| | AXIL - X ( Ton ) | Momento (mT) Longitudinal - Z | Momento (mT) Transversal - Y |
|---|---|---|---|
| Peso propio | -381.77 | 0.00 | 0.00 |
| Superestructura | -106.52 | 0.00 | 0.00 |
| Pretensado | 16.85 | 0.00 | 0.00 |
| Temperatura | 7.52 | 0.00 | 0.00 |
| Sobrecarga repartida | 3.67 | 0.00 | 0.00 |
| Carro | 3.88 | 0.00 | 0.00 |

**RESULTADOS**
**CARGAS DE CALCULO EN CORONACION DE PILA**

**Hipótesis I**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | 1 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | 2 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | -424.51 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 3.12 | 0.00 | 3 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | -424.51 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 20.34 | 0.00 | 0.00 | 3.12 | 0.00 | 4 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 20.34 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | -720.64 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 3.12 | 0.00 | 5 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | -720.64 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | 6 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 22.60 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 22.60 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | 7 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | -232.40 | 0.00 | 0.00 | -3.12 | 0.00 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | -232.40 | 0.00 | 0.00 | 3.12 | 0.00 | |

Hipótesis II

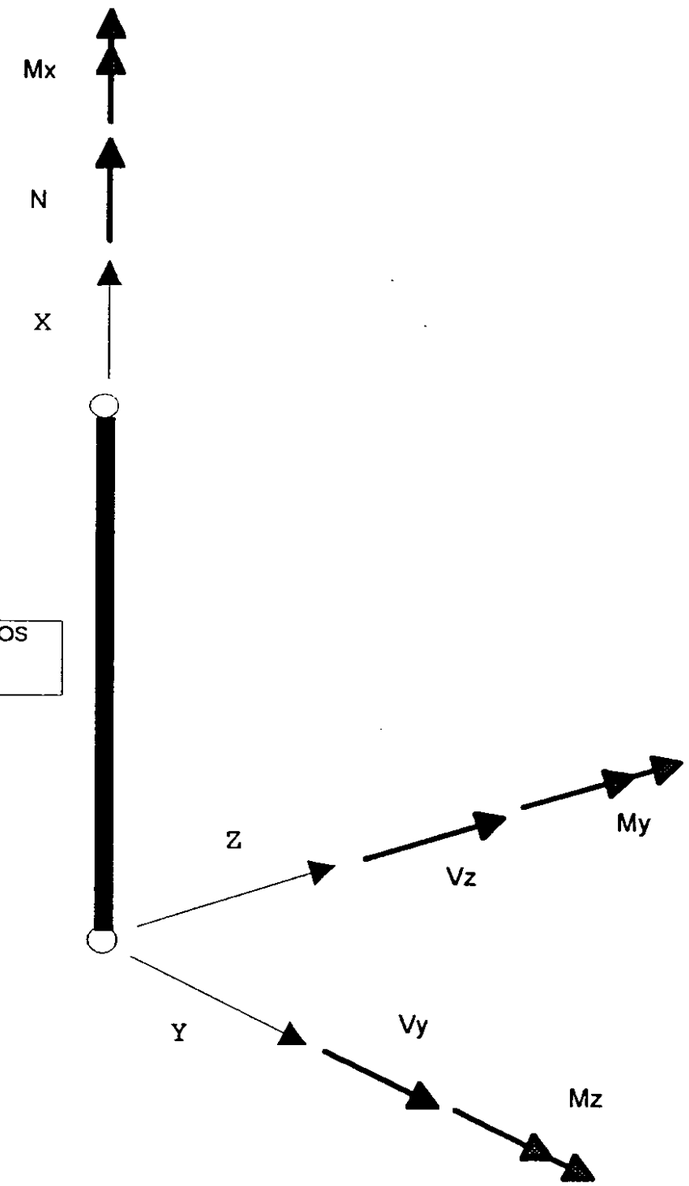
| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | -424.51 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | -424.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | -424.51 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 9.02 | 0.00 | 0.00 | 0.00 | -15.77 |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -422.61 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -422.61 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | -721.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | -721.97 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | -720.64 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | -720.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | -720.64 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | -715.59 | 0.00 | 0.00 | 0.00 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | -715.59 | 0.00 | 0.00 | 2.67 | 0.00 | 11.28 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | -717.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.77 |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | -717.48 | 0.00 | 0.00 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -15.77 |

**Hipótesis III**

| COMBINACION | CARGAS TIPO "G" (con efecto de fluencia) | | | | | CARGAS TIPO "Q" (sin efecto de fluencia) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | AXIL - X | MOMENTOS (mT) | | FUERZAS ( T ) | | |
| | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | ( Ton ) | Longitudinal - Z | Transversal - Y | Longitudinal - Z | Transversal - Y | |
| N max. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -378.67 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | 7.10 | 15 |
| N max. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N max. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -378.67 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N min. + MZ conc.max. + MY conc. + Fz max + Fy conc. | -648.72 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | 7.10 | 16 |
| N min. + MZ conc.max. + MY conc. + Fz min + Fy conc. | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy max | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N min. + MZ conc.max. + MY conc. + Fz conc. + Fy min | -648.72 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc.max. + MZ max. + MY conc. + Fz max + Fy conc. | -380.56 | 0.00 | 0.00 | 2.40 | 0.00 | 0.00 | 0.00 | 0.00 | 2.81 | 7.10 | 17 |
| N conc.max. + MZ max. + MY conc. + Fz min + Fy conc. | -380.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy max | -380.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc.max. + MZ max. + MY conc. + Fz conc. + Fy min | -380.56 | 0.00 | 0.00 | 2.40 | 0.00 | 0.00 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc.max. + MZ min. + MY conc. + Fz max + Fy conc. | -378.67 | 0.00 | 0.00 | 2.40 | 0.00 | 19.06 | 0.00 | 0.00 | 2.81 | 7.10 | 18 |
| N conc.max. + MZ min. + MY conc. + Fz min + Fy conc. | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 19.06 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy max | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 19.06 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc.max. + MZ min. + MY conc. + Fz conc. + Fy min | -378.67 | 0.00 | 0.00 | 2.40 | 0.00 | 19.06 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N max. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -378.67 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | 7.10 | |
| N max. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -378.67 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N max. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -378.67 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N min. + MZ conc.min. + MY conc. + Fz max + Fy conc. | -648.72 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | 7.10 | |
| N min. + MZ conc.min. + MY conc. + Fz min + Fy conc. | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy max | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N min. + MZ conc.min. + MY conc. + Fz conc. + Fy min | -648.72 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc.min. + MZ max. + MY conc. + Fz max + Fy conc. | -648.72 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | 7.10 | |
| N conc.min. + MZ max. + MY conc. + Fz min + Fy conc. | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy max | -648.72 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc.min. + MZ max. + MY conc. + Fz conc. + Fy min | -648.72 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc.min. + MZ min. + MY conc. + Fz max + Fy conc. | -647.40 | 0.00 | 0.00 | 2.40 | 0.00 | 0.00 | 0.00 | 0.00 | 2.81 | 7.10 | 19 |
| N conc.min. + MZ min. + MY conc. + Fz min + Fy conc. | -647.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy max | -647.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc.min. + MZ min. + MY conc. + Fz conc. + Fy min | -647.40 | 0.00 | 0.00 | 2.40 | 0.00 | 0.00 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc. + MZ conc.max. + MY max.+ Fz max + Fy conc. | -642.34 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | 7.10 | 20 |
| N conc. + MZ conc.max. + MY max. + Fz min + Fy conc. | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy max | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc. + MZ conc.max. + MY max. + Fz conc. + Fy min | -642.34 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc. + MZ conc.min. + MY max.+ Fz max + Fy conc. | -642.34 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | 7.10 | |
| N conc. + MZ conc.min. + MY max. + Fz min + Fy conc. | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy max | -642.34 | 0.00 | 0.00 | 0.00 | 0.00 | 20.34 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc. + MZ conc.min. + MY max. + Fz conc. + Fy min | -642.34 | 0.00 | 0.00 | 2.40 | 0.00 | 20.34 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc. + MZ conc.max. + MY min.+ Fz max + Fy conc. | -644.24 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | 7.10 | 21 |
| N conc. + MZ conc.max. + MY min. + Fz min + Fy conc. | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy max | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc. + MZ conc.max. + MY min. + Fz conc. + Fy min | -644.24 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | -7.10 | |
| N conc. + MZ conc.min. + MY min.+ Fz max + Fy conc. | -644.24 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | 7.10 | |
| N conc. + MZ conc.min. + MY min. + Fz min + Fy conc. | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | -7.10 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy max | -644.24 | 0.00 | 0.00 | 0.00 | 0.00 | -209.16 | 0.00 | 0.00 | -2.81 | 7.10 | |
| N conc. + MZ conc.min. + MY min. + Fz conc. + Fy min | -644.24 | 0.00 | 0.00 | 2.40 | 0.00 | -209.16 | 0.00 | 0.00 | 2.81 | -7.10 | |

# RESUMEN DE RESULTADOS DE CÁLCULO EN ROTURA DE PILAS

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** Estructura E-1505.0




CONVENIO DE EJES Y ESFUERZOS EN PILAS

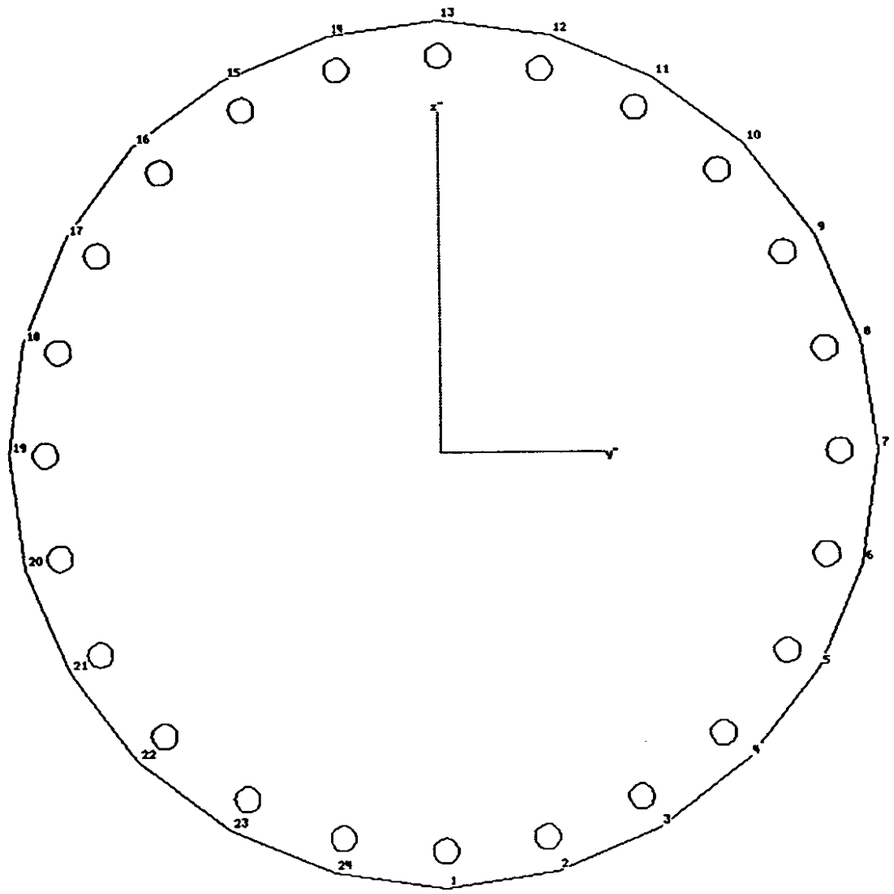
PILA Nº1
Esfuerzos de en base de pila mediante cálculo en 2º orden

| HIPOTESIS Nº | N(t.) | Vy(t.) | Vz(t.) | Mx(m.t.) | My(m.t.) | Mz(m.t.) | (%) agotamiento |
|---|---|---|---|---|---|---|---|
| 1 | -432.44 | 0.00 | -6.14 | 0.00 | 105.76 | 0.00 | 27 |
| 2 | -1006.74 | 0.00 | -6.14 | 0.00 | 163.79 | 0.00 | 53 |
| 3 | -456.93 | 0.00 | -6.14 | 0.00 | 107.10 | 0.00 | 28 |
| 4 | -434.70 | 0.00 | -6.14 | 0.00 | 105.88 | 0.00 | 27 |
| 5 | -774.68 | 0.00 | -6.14 | 0.00 | 135.74 | 0.00 | 42 |
| 6 | -747.03 | 0.00 | -6.14 | 0.00 | 132.87 | 0.00 | 41 |
| 7 | -1002.25 | 0.00 | -6.14 | 0.00 | 162.91 | 0.00 | 53 |
| 8 | -443.76 | -16.78 | -2.81 | -0.23 | 55.59 | 296.85 | 58 |
| 9 | -776.01 | -16.78 | -2.81 | -0.47 | 82.95 | 370.28 | 76 |
| 10 | -456.93 | -16.78 | -2.81 | -0.24 | 56.22 | 298.84 | 58 |
| 11 | -446.02 | -16.78 | -2.81 | -0.24 | 55.70 | 297.18 | 58 |
| 12 | -774.68 | -16.78 | -2.81 | -0.47 | 82.75 | 369.78 | 76 |
| 13 | -758.35 | -16.78 | -2.81 | -0.46 | 80.93 | 364.69 | 75 |
| 14 | -771.52 | -16.78 | -2.81 | -0.47 | 82.29 | 368.60 | 76 |
| 15 | -387.51 | -7.55 | -5.53 | -0.10 | 95.31 | 123.39 | 33 |
| 16 | -905.02 | -7.55 | -5.53 | -0.20 | 135.03 | 152.71 | 55 |
| 17 | -409.74 | -7.55 | -5.53 | -0.10 | 96.30 | 124.14 | 34 |
| 18 | -388.79 | -7.55 | -5.53 | -0.10 | 95.36 | 123.43 | 33 |
| 19 | -696.03 | -7.55 | -5.53 | -0.18 | 116.62 | 138.06 | 45 |
| 20 | -670.64 | -7.55 | -5.53 | -0.17 | 114.69 | 136.72 | 44 |
| 21 | -900.53 | -7.55 | -5.53 | -0.20 | 134.40 | 152.30 | 55 |

PILA Nº2
Esfuerzos de en base de pila mediante cálculo en 2º orden

| HIPOTESIS Nº | N(t.) | Vy(t.) | Vz(t.) | Mx(m.t.) | My(m.t.) | Mz(m.t.) | (%) agotamiento |
|---|---|---|---|---|---|---|---|
| 1 | -433.37 | 0.00 | -5.78 | 0.00 | 104.04 | 0.00 | 27 |
| 2 | -1009.96 | 0.00 | -5.78 | 0.00 | 169.38 | 0.00 | 54 |
| 3 | -457.87 | 0.00 | -5.78 | 0.00 | 105.48 | 0.00 | 28 |
| 4 | -435.63 | 0.00 | -5.78 | 0.00 | 104.17 | 0.00 | 27 |
| 5 | -776.24 | 0.00 | -5.78 | 0.00 | 137.46 | 0.00 | 43 |
| 6 | -748.58 | 0.00 | -5.78 | 0.00 | 134.25 | 0.00 | 41 |
| 7 | -1005.47 | 0.00 | -5.78 | 0.00 | 168.34 | 0.00 | 54 |
| 8 | -444.70 | -15.78 | -2.67 | -0.24 | 55.71 | 291.67 | 57 |
| 9 | -777.56 | -15.78 | -2.67 | -0.51 | 87.39 | 373.80 | 77 |
| 10 | -457.87 | -15.78 | -2.67 | -0.24 | 56.39 | 293.78 | 58 |
| 11 | -446.95 | -15.78 | -2.67 | -0.24 | 55.82 | 292.02 | 57 |
| 12 | -776.24 | -15.78 | -2.67 | -0.51 | 87.15 | 373.20 | 77 |
| 13 | -759.91 | -15.78 | -2.67 | -0.50 | 84.92 | 367.03 | 76 |
| 14 | -773.08 | -15.78 | -2.67 | -0.51 | 86.58 | 371.78 | 77 |
| 15 | -388.35 | -7.10 | -5.21 | -0.10 | 93.64 | 120.46 | 33 |
| 16 | -907.92 | -7.10 | -5.21 | -0.21 | 137.93 | 152.34 | 55 |
| 17 | -410.58 | -7.10 | -5.21 | -0.11 | 94.70 | 121.24 | 33 |
| 18 | -389.63 | -7.10 | -5.21 | -0.10 | 93.70 | 120.50 | 33 |
| 19 | -697.43 | -7.10 | -5.21 | -0.18 | 117.10 | 136.08 | 45 |
| 20 | -672.04 | -7.10 | -5.21 | -0.18 | 114.95 | 134.62 | 44 |
| 21 | -903.43 | -7.10 | -5.21 | -0.21 | 137.19 | 151.88 | 55 |

Mstb. 1 : 8.0




Sección :"PILA" Armadura :"B1"
Tipo : tipo viga/ Círculo/tubo Unidades :[cm]
Material :"H300PIL"

Diámetro exterior = 120.000 cm

Características mecánicas de la sección:
Area : Ax= 1.118 [m2]
Momentos de inercia : Iy= 0.099487 [m4] Iz= 0.099487 [m4]
Inercia a torsión : Ix= 0.203575 [m4]

Posición del centro de gravedad: ys= 0.000 [m] zs= 0.600000 [m]

| | I: | R=dist.borde [m] | W=I/R [m3] | W/Ax [m] |
|---|---|---|---|---|
| izq. | Iz | -0.600 | -0.165812 | 0.148 |
| dch. | Iz | 0.600 | 0.165812 | -0.148 |
| abajo | Iy | -0.600 | -0.165812 | 0.148 |
| arriba | Iy | 0.600 | 0.165812 | -0.148 |



Armadura: "B1"

| Nº | Nom.mat | Cod.dim. | Area [cm2] | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] |
|---|---|---|---|---|---|---|---|
| 1 | AEH500 | (2) | 9.38 | 0.00 | 5.00 | | |
| 2 | AEH500 | (2) | 9.38 | 14.24 | 6.87 | | |
| 3 | AEH500 | (2) | 9.38 | 27.50 | 12.37 | | |
| 4 | AEH500 | (2) | 9.38 | 38.89 | 21.11 | | |
| 5 | AEH500 | (2) | 9.38 | 47.63 | 32.50 | | |
| 6 | AEH500 | (2) | 9.38 | 53.13 | 45.77 | | |
| 7 | AEH500 | (2) | 9.38 | 55.00 | 60.00 | | |
| 8 | AEH500 | (2) | 9.38 | 53.13 | 74.23 | | |
| 9 | AEH500 | (2) | 9.38 | 47.63 | 87.50 | | |
| 10 | AEH500 | (2) | 9.38 | 38.89 | 98.89 | | |
| 11 | AEH500 | (2) | 9.38 | 27.50 | 107.63 | | |
| 12 | AEH500 | (2) | 9.38 | 14.24 | 113.13 | | |
| 13 | AEH500 | (2) | 9.38 | 0.00 | 115.00 | | |
| 14 | AEH500 | (2) | 9.38 | -14.24 | 113.13 | | |
| 15 | AEH500 | (2) | 9.38 | -27.50 | 107.63 | | |
| 16 | AEH500 | (2) | 9.38 | -38.89 | 98.89 | | |
| 17 | AEH500 | (2) | 9.38 | -47.63 | 87.50 | | |
| 18 | AEH500 | (2) | 9.38 | -53.13 | 74.23 | | |
| 19 | AEH500 | (2) | 9.38 | -55.00 | 60.00 | | |
| 20 | AEH500 | (2) | 9.38 | -53.13 | 45.77 | | |
| 21 | AEH500 | (2) | 9.38 | -47.63 | 32.50 | | |
| 22 | AEH500 | (2) | 9.38 | -38.89 | 21.11 | | |
| 23 | AEH500 | (2) | 9.38 | -27.50 | 12.37 | | |
| 24 | AEH500 | (2) | 9.38 | -14.24 | 6.87 | | |

Total: 225.07 Cuantía de armadura: 2.013 [o/o] → 28 ø 32

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

¡No se han definido valores para el cálculo a cortante!

Características del material:

| Nom.Mat. | Módulo E [ kp/cm2] | 0.85*fcd,fyd [ kp/cm2] | eps-fc [o/oo] | fct [ kp/cm2] | fcv [ kp/cm2] | fcw,mín [ kp/cm2] |
|---|---|---|---|---|---|---|
| "H300PIL" | 310000.0 | -153.000 | -2.000 | 0.0 | 6.700 | 270.000 |
| "AEH500" | 2.10E+06 | 4434.700 | | | | |

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Pila ''2U9'
**********

Título : 'Estructura E-1505.0 PILA N| 1 PILA N| 2 9'
Altura de la pila : 14.300 (m)
Long. max. de barra: Altura pila / 6

NUDOS x Apoyo
Nu [m] d-xyz r-xyz

| Nu | [m] | d-xyz | r-xyz |
|---|---|---|---|
| 2 | 14.300 | | |
| 1 | 0.000 | BBB | BBB |

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

| Ba | Nu | Sección | Tipo | Exc: ey [m] | ez [m] | Arm: Zona | fac |
|---|---|---|---|---|---|---|---|
| 1 | 2-1 | 'PILA' | SecFAGUS | | | 1 | 1.000 |

CARGAS :

| Nu/Ba | | Tipo Car. | Dim. | | Valor | ey[m] | ez[m] |
|---|---|---|---|---|---|---|---|
| | | | | | Val.arriba | Val.abajo | |
| Comp. Carga G1 : | | | | | | | |
| Nudo | 2 | Fuerza | x | [kN] | -7219.682 | | |
| | | Fuerza | y | [kN] | -0.000 | | |
| | | Fuerza | z | [kN] | 26.651 | | |
| Barra | 1 | Fuerza | x | [kN/m] | -42.412 | | |
| Comp. Carga Q1 : | | | | | | | |
| Nudo | 2 | Fuerza | y | [kN] | 157.748 | | |
| | | Fuerza | z | [kN] | 0.000 | | |



D I M E N S I O N A M I E N T O (global) <B.2U9.1>

PARAMETROS DE CALCULO:

| | |
|---|---|
| Norma | EH |
| Criterio de rotura | Agotamiento de secciones o del sistema |
| Rotura de secciones | Limitación de deformaciones según FAGUS-2 |
| - Hormigón (def. centrada) | -2.000 [o/oo] |
| - Hormigón (flexión) | -3.500 [o/oo] |
| - Acero | 10.00 [o/oo] |
| Coef. min. resist. (gamma_r) | 1.000 |
| Coeficiente de fluencia | 2.500 |
| Carga contribuyente a fluencia. | 1.000 * Carga permanente G1 |
| No de elementos | 6 |
| Tolerancia desequi. fuerzas | 0.078 [kN] |
| Tolerancia desequi. momentos | 0.023 [kNm] |
| Mayoración de cargas | 1.000 * Carga permanente G1 |
| | + 1.000 * Carga variable Q1 |

RESULTADOS DEL CALCULO NO LINEAL:
La aramdura mínima (o existente) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

| Nombre | Ancho dy [m] | Canto dz [m] | Materiales Horm. / Acero | Distrib. de la armadura | Armadura fija[cm²] |
|---|---|---|---|---|---|
| PILA | 1.200 | 1.200 | H30OPIL AEH500 | B1 | 0.000 |

DEFORMACIONES sin deformaciones accidentales

| | DX [mm] | DY [mm] | DZ [mm] | RX [o/oo] | RY [o/oo] | RZ [o/oo] |
|---|---|---|---|---|---|---|
| Mínima | -12.25 | 0.00 | 0.00 | -0.075 | -6.953 | 0.000 |
| Máxima | 0.00 | 198.76 | 66.12 | 0.000 | 0.000 | 20.181 |

ESFUERZOS (global)

| | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| Mínima | -7775.63 | -157.75 | -26.65 | -5.14 | 0.00 | 0.00 |
| Máxima | -7270.22 | -157.75 | -26.65 | 0.00 | 873.90 | 3738.00 |

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

| | sigHorm. [N/mm²] | sigAcero [N/mm²] | epsHorm. [o/oo] | epsAcero [o/oo] | Ely [kNm²] | Elz [kNm²] |
|---|---|---|---|---|---|---|
| Mínima | -15.2 | -443.5 | -1.858 | -2.374 | 4.714E+4 | 1.223E+6 |
| Máxima | 0.0 | 238.9 | 1.816 | 1.138 | 1.167E+6 | 2.145E+6 |



DIMENSIONAMIENTO SEGUN TEORIA DE 2ª ORDEN

| Zona | Coord-x [m] | Nombre de la sección | Armadura [cm²] | [o/o] | Agotamiento [o/o] |
|---|---|---|---|---|---|
| 1 | 14.30 | PILA | 225.1 | 2.01 | 27 |
| | 11.92 | PILA | 225.1 | 2.01 | 34 |
| | 9.533 | PILA | 225.1 | 2.01 | 43 |
| | 7.150 | PILA | 225.1 | 2.01 | 52 |
| | 4.767 | PILA | 225.1 | 2.01 | 62 |
| | 2.383 | PILA | 225.1 | 2.01 | 70 |
| | 0.000 | PILA | 225.1 | 2.01 | 77 |

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

ESFUERZOS (global)
<B.2U9.1> Carga: 1.00*G1 1.00*Q1

| Coord-x | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| 14.300 | -7270.22 | -157.75 | -26.65 | 0.00 | 0.00 | 0.00 |
| 11.917 | -7270.22 | -157.75 | -26.65 | -1.32 | 182.88 | 723.13 |
| 11.917 | -7371.30 | -157.75 | -26.65 | -1.32 | 182.88 | 723.13 |
| 9.533 | -7371.30 | -157.75 | -26.65 | -2.55 | 360.86 | 1436.21 |
| 9.533 | -7472.38 | -157.75 | -26.65 | -2.55 | 360.86 | 1436.22 |
| 7.150 | -7472.38 | -157.75 | -26.65 | -3.61 | 526.74 | 2120.35 |
| 7.150 | -7573.46 | -157.75 | -26.65 | -3.61 | 526.74 | 2120.35 |
| 4.767 | -7573.46 | -157.75 | -26.65 | -4.43 | 672.62 | 2750.31 |
| 4.767 | -7674.54 | -157.75 | -26.65 | -4.43 | 672.62 | 2750.31 |
| 2.383 | -7674.54 | -157.75 | -26.65 | -4.95 | 790.69 | 3298.56 |
| 2.383 | -7775.63 | -157.75 | -26.65 | -4.95 | 790.69 | 3298.56 |
| 0.000 | -7775.63 | -157.75 | -26.65 | -5.14 | 873.90 | 3738.00 |

| Cálculo de Cimentacion de Pilas | PILA Nº 1 |
|---|---|
| PROYECTO: | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1505.0 |

CARACTERISTICAS DEL TERRENO

| | | |
|---|---|---|
| Tensión cobaricentrica admisible = | 3.0 | Kp/cm² |
| Coeficiente de rozamiento zapata-terreno = | 0.58 | |

DIMENSIONES GEOMETRICAS (en metros)

| | | |
|---|---|---|
| Medida fuste segun Y = | 1.20 | |
| Medida fuste según Z = | 1.20 | |
| Medida zapata según Y = | 5.20 | Vale . Zapata tipo I |
| Medida zapata según Z = | 5.20 | Vale . Zapata tipo I |
| Canto zapata = | 1.50 | |

ACCIONES SOBRE CARA SUPERIOR ZAPATA EN ESTADO LIMITE DE SERVICIO (signos del FAGUS).

| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. |
|---|---|---|---|---|---|---|
| 1 | -490.72 | 0.00 | -4.10 | 72.68 | 0.00 | 1.00 |
| 2 | -664.68 | 0.00 | -4.10 | 80.89 | 0.00 | 1.00 |
| 3 | -507.87 | 0.00 | -4.10 | 73.42 | 0.00 | 1.00 |
| 4 | -489.72 | 0.00 | -4.10 | 72.64 | 0.00 | 1.00 |
| 5 | -509.15 | 0.00 | -4.10 | 73.49 | 0.00 | 1.00 |
| 6 | -490.72 | 0.00 | -4.10 | 72.68 | 0.00 | 1.00 |
| 7 | -661.69 | 0.00 | -4.10 | 80.71 | 0.00 | 1.00 |
| 8 | -498.27 | -11.18 | -1.87 | 38.01 | 194.50 | 1.00 |
| 9 | -510.86 | -11.18 | -1.87 | 38.41 | 195.40 | 1.00 |
| 10 | -507.87 | -11.18 | -1.87 | 38.30 | 195.15 | 1.00 |
| 11 | -497.27 | -11.18 | -1.87 | 37.99 | 194.44 | 1.00 |
| 12 | -509.15 | -11.18 | -1.87 | 38.35 | 195.26 | 1.00 |
| 13 | -498.27 | -11.18 | -1.87 | 38.01 | 194.50 | 1.00 |
| 14 | -507.87 | -11.18 | -1.87 | 38.30 | 195.15 | 1.00 |
| 15 | -439.79 | -5.03 | -3.69 | 63.96 | 81.34 | 0.90 |
| 16 | -596.87 | -5.03 | -3.69 | 69.62 | 86.04 | 0.90 |
| 17 | -455.44 | -5.03 | -3.69 | 64.46 | 81.72 | 0.90 |
| 18 | -438.14 | -5.03 | -3.69 | 63.91 | 81.31 | 0.90 |
| 19 | -456.72 | -5.03 | -3.69 | 64.51 | 81.75 | 0.90 |
| 20 | -439.79 | -5.03 | -3.69 | 63.96 | 81.34 | 0.90 |
| 21 | -593.88 | -5.03 | -3.69 | 69.48 | 85.93 | 0.90 |

ACCIONES SOBRE CARA SUPERIOR ZAPATA EN ESTADO LIMITE ULTIMO (signos del FAGUS).

| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. |
|---|---|---|---|---|---|---|
| 1 | -432.44 | 0.00 | -6.14 | 105.76 | 0.00 | 0.90 |
| 2 | -1006.74 | 0.00 | -6.14 | 163.79 | 0.00 | 1.50 |
| 3 | -456.93 | 0.00 | -6.14 | 107.10 | 0.00 | 0.90 |
| 4 | -434.70 | 0.00 | -6.14 | 105.88 | 0.00 | 0.90 |
| 5 | -774.68 | 0.00 | -6.14 | 135.74 | 0.00 | 1.50 |
| 6 | -747.03 | 0.00 | -6.14 | 132.87 | 0.00 | 1.50 |
| 7 | -1002.25 | 0.00 | -6.14 | 162.91 | 0.00 | 1.50 |
| 8 | -443.76 | -16.78 | -2.81 | 55.59 | 298.85 | 0.90 |
| 9 | -776.01 | -16.78 | -2.81 | 82.95 | 370.28 | 1.50 |
| 10 | -456.93 | -16.78 | -2.81 | 56.22 | 298.84 | 0.90 |
| 11 | -446.02 | -16.78 | -2.81 | 55.70 | 297.18 | 0.90 |
| 12 | -774.68 | -16.78 | -2.81 | 82.75 | 369.78 | 1.50 |
| 13 | -758.35 | -16.78 | -2.81 | 80.93 | 364.89 | 1.50 |
| 14 | -771.52 | -16.78 | -2.81 | 82.29 | 368.80 | 1.50 |
| 15 | -387.51 | -7.55 | -5.53 | 95.31 | 123.39 | 0.81 |
| 16 | -905.02 | -7.55 | -5.53 | 135.03 | 152.71 | 1.35 |
| 17 | -409.74 | -7.55 | -5.53 | 96.30 | 124.14 | 0.81 |
| 18 | -388.79 | -7.55 | -5.53 | 95.36 | 123.43 | 0.81 |
| 19 | -696.03 | -7.55 | -5.53 | 116.62 | 138.06 | 1.35 |
| 20 | -670.64 | -7.55 | -5.53 | 114.69 | 136.72 | 1.35 |
| 21 | -900.53 | -7.55 | -5.53 | 134.40 | 152.30 | 1.35 |

**RESULTADOS**

ACCIONES EN BASE DE ZAPATA SIN MAYORAR

| FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) |
|---|---|---|---|---|
| -592.12 | 0.00 | -4.10 | 78.82 | 0.00 |
| -766.08 | 0.00 | -4.10 | 87.03 | 0.00 |
| -609.27 | 0.00 | -4.10 | 79.57 | 0.00 |
| -591.12 | 0.00 | -4.10 | 78.78 | 0.00 |
| -610.55 | 0.00 | -4.10 | 79.63 | 0.00 |
| -592.12 | 0.00 | -4.10 | 78.82 | 0.00 |
| -763.09 | 0.00 | -4.10 | 86.85 | 0.00 |
| -599.87 | -11.18 | -1.87 | 40.82 | 211.28 |
| -612.26 | -11.18 | -1.87 | 41.22 | 212.17 |
| -609.27 | -11.18 | -1.87 | 41.11 | 211.92 |
| -598.67 | -11.18 | -1.87 | 40.79 | 211.21 |
| -610.55 | -11.18 | -1.87 | 41.15 | 212.03 |
| -599.87 | -11.18 | -1.87 | 40.82 | 211.28 |
| -609.27 | -11.18 | -1.87 | 41.11 | 211.92 |
| -531.05 | -5.03 | -3.69 | 69.49 | 88.89 |
| -668.13 | -5.03 | -3.69 | 75.15 | 93.59 |
| -546.70 | -5.03 | -3.69 | 69.99 | 89.27 |
| -529.40 | -5.03 | -3.69 | 69.44 | 88.85 |
| -547.98 | -5.03 | -3.69 | 70.04 | 89.30 |
| -531.05 | -5.03 | -3.69 | 69.49 | 88.89 |
| -685.14 | -5.03 | -3.69 | 75.01 | 93.48 |



COMPROBACION TENSIONES SOBRE EL TERRENO

| eY (m) | eZ (m) | Z (m) | Y (m) | σcob (Kp/cm²) | |
|---|---|---|---|---|---|
| 0.00 | -0.13 | 4.93 | 5.20 | 2.31 | Vale |
| 0.00 | -0.11 | 4.97 | 5.20 | 2.96 | Vale |
| 0.00 | -0.13 | 4.94 | 5.20 | 2.37 | Vale |
| 0.00 | -0.13 | 4.93 | 5.20 | 2.30 | Vale |
| 0.00 | -0.13 | 4.94 | 5.20 | 2.38 | Vale |
| 0.00 | -0.13 | 4.93 | 5.20 | 2.31 | Vale |
| 0.00 | -0.11 | 4.97 | 5.20 | 2.95 | Vale |
| 0.35 | -0.07 | 5.06 | 4.50 | 2.63 | Vale |
| 0.35 | -0.07 | 5.07 | 4.51 | 2.68 | Vale |
| 0.35 | -0.07 | 5.07 | 4.50 | 2.67 | Vale |
| 0.35 | -0.07 | 5.06 | 4.49 | 2.63 | Vale |
| 0.35 | -0.07 | 5.07 | 4.51 | 2.68 | Vale |
| 0.35 | -0.07 | 5.06 | 4.50 | 2.63 | Vale |
| 0.35 | -0.07 | 5.07 | 4.50 | 2.67 | Vale |
| 0.17 | -0.13 | 4.94 | 4.87 | 2.21 | Vale |
| 0.14 | -0.11 | 4.98 | 4.93 | 2.80 | Vale |
| 0.16 | -0.13 | 4.94 | 4.87 | 2.27 | Vale |
| 0.17 | -0.13 | 4.94 | 4.86 | 2.20 | Vale |
| 0.16 | -0.13 | 4.94 | 4.87 | 2.27 | Vale |
| 0.17 | -0.13 | 4.94 | 4.87 | 2.21 | Vale |
| 0.14 | -0.11 | 4.98 | 4.93 | 2.79 | Vale |

COMPROBACION ESTABILIDAD

- Al deslizamiento

| FYdesl.(Ton) | FZdesl.(Ton) | TOTALdesl. | TOTALres | COEFICIENTE | |
|---|---|---|---|---|---|
| 0.00 | -4.10 | 4.10 | 343.43 | 83.87 | Vale |
| 0.00 | -4.10 | 4.10 | 444.33 | 108.50 | Vale |
| 0.00 | -4.10 | 4.10 | 353.38 | 86.29 | Vale |
| 0.00 | -4.10 | 4.10 | 342.85 | 83.72 | Vale |
| 0.00 | -4.10 | 4.10 | 354.12 | 86.48 | Vale |
| 0.00 | -4.10 | 4.10 | 343.43 | 83.87 | Vale |
| 0.00 | -4.10 | 4.10 | 442.59 | 108.08 | Vale |
| -11.18 | -1.87 | 11.34 | 347.81 | 30.68 | Vale |
| -11.18 | -1.87 | 11.34 | 355.11 | 31.32 | Vale |
| -11.18 | -1.87 | 11.34 | 353.38 | 31.17 | Vale |
| -11.18 | -1.87 | 11.34 | 347.23 | 30.62 | Vale |
| -11.18 | -1.87 | 11.34 | 354.12 | 31.23 | Vale |
| -11.18 | -1.87 | 11.34 | 347.81 | 30.68 | Vale |
| -11.18 | -1.87 | 11.34 | 353.38 | 31.17 | Vale |
| -5.03 | -3.69 | 6.24 | 306.01 | 49.38 | Vale |
| -5.03 | -3.69 | 6.24 | 399.11 | 63.99 | Vale |
| -5.03 | -3.69 | 6.24 | 317.08 | 50.84 | Vale |
| -5.03 | -3.69 | 6.24 | 307.05 | 49.23 | Vale |
| -5.03 | -3.69 | 6.24 | 317.83 | 50.96 | Vale |
| -5.03 | -3.69 | 6.24 | 306.01 | 49.38 | Vale |
| -5.03 | -3.69 | 6.24 | 397.38 | 63.71 | Vale |

- Al vuelco

| MYvolc.(mT) | MZvolc.(mT) | MYres.(mT) | MZres.(mT) | COEF. Y | COEF. X | |
|---|---|---|---|---|---|---|
| 78.82 | 0.00 | 1539.50 | 1539.50 | 19.53 | 109107313.96 | Vale |
| 87.03 | 0.00 | 1991.81 | 1991.81 | 22.89 | 130781707.16 | Vale |
| 79.57 | 0.00 | 1584.10 | 1584.10 | 19.91 | 111477607.32 | Vale |
| 78.78 | 0.00 | 1536.90 | 1536.90 | 19.51 | 109000297.87 | Vale |
| 79.63 | 0.00 | 1587.44 | 1587.44 | 19.94 | 111712906.40 | Vale |
| 78.82 | 0.00 | 1539.50 | 1539.50 | 19.53 | 109107313.96 | Vale |
| 86.85 | 0.00 | 1984.03 | 1984.03 | 22.84 | 130442393.16 | Vale |
| 40.82 | 211.28 | 1559.13 | 1559.13 | 38.19 | 7.38 | Vale |
| 41.22 | 212.17 | 1591.87 | 1591.87 | 38.62 | 7.50 | Vale |
| 41.11 | 211.92 | 1584.10 | 1584.10 | 38.54 | 7.47 | Vale |
| 40.79 | 211.21 | 1556.53 | 1556.53 | 38.16 | 7.37 | Vale |
| 41.15 | 212.03 | 1587.44 | 1587.44 | 38.57 | 7.49 | Vale |
| 40.82 | 211.28 | 1559.13 | 1559.13 | 38.19 | 7.38 | Vale |
| 41.11 | 211.92 | 1584.10 | 1584.10 | 38.54 | 7.47 | Vale |
| 69.49 | 88.89 | 1380.74 | 1380.74 | 19.87 | 15.53 | Vale |
| 75.15 | 93.59 | 1789.13 | 1789.13 | 23.81 | 19.12 | Vale |
| 69.99 | 89.27 | 1421.41 | 1421.41 | 20.31 | 15.92 | Vale |
| 69.44 | 88.85 | 1376.44 | 1376.44 | 19.82 | 15.49 | Vale |
| 70.04 | 89.30 | 1424.75 | 1424.75 | 20.34 | 15.95 | Vale |
| 69.49 | 88.89 | 1380.74 | 1380.74 | 19.87 | 15.53 | Vale |
| 75.01 | 93.48 | 1781.35 | 1781.35 | 23.75 | 19.06 | Vale |

ACCIONES EN BASE DE ZAPATA MAYORADAS (sin el peso propio de la zapata)

| FX (Ton) | MY (mT) | MZ (mT) | eY (m) | eZ (m) | Z (m) | Y (m) | σ calc (T/m²) |
|---|---|---|---|---|---|---|---|
| -432.44 | 114.97 | 0.00 | 0.00 | 0.27 | 4.67 | 5.20 | 17.81 |
| -1006.74 | 173.00 | 0.00 | 0.00 | 0.17 | 4.86 | 5.20 | 39.87 |
| -456.93 | 116.31 | 0.00 | 0.00 | 0.25 | 4.69 | 5.20 | 18.73 |
| -434.70 | 115.09 | 0.00 | 0.00 | 0.26 | 4.67 | 5.20 | 17.90 |
| -774.68 | 144.95 | 0.00 | 0.00 | 0.19 | 4.83 | 5.20 | 30.87 |
| -747.03 | 142.08 | 0.00 | 0.00 | 0.19 | 4.82 | 5.20 | 29.81 |
| -1002.25 | 172.13 | 0.00 | 0.00 | 0.17 | 4.86 | 5.20 | 39.69 |
| -443.76 | 59.80 | 322.01 | 0.73 | 0.13 | 4.93 | 3.75 | 24.01 |
| -776.01 | 87.16 | 395.44 | 0.51 | 0.11 | 4.98 | 4.18 | 37.31 |
| -456.93 | 60.43 | 324.00 | 0.71 | 0.13 | 4.94 | 3.78 | 24.48 |
| -446.02 | 59.91 | 322.34 | 0.72 | 0.13 | 4.93 | 3.75 | 24.09 |
| -774.68 | 86.96 | 394.94 | 0.51 | 0.11 | 4.98 | 4.18 | 37.25 |
| -758.35 | 85.14 | 389.86 | 0.51 | 0.11 | 4.98 | 4.17 | 36.54 |
| -771.52 | 86.50 | 393.76 | 0.51 | 0.11 | 4.98 | 4.18 | 37.10 |
| -387.51 | 103.60 | 134.72 | 0.35 | 0.27 | 4.67 | 4.50 | 18.44 |
| -905.02 | 143.32 | 164.03 | 0.18 | 0.16 | 4.88 | 4.64 | 38.31 |
| -409.74 | 104.59 | 135.46 | 0.33 | 0.26 | 4.69 | 4.54 | 19.25 |
| -388.79 | 103.65 | 134.76 | 0.35 | 0.27 | 4.67 | 4.51 | 18.49 |
| -696.03 | 124.91 | 149.39 | 0.21 | 0.18 | 4.84 | 4.77 | 30.14 |
| -670.64 | 122.98 | 148.04 | 0.22 | 0.18 | 4.83 | 4.76 | 29.16 |
| -900.53 | 142.69 | 163.62 | 0.18 | 0.16 | 4.88 | 4.84 | 38.13 |

| Cálculo de Cimentacion de Pilas | PILA Nº 2 |
|---|---|
| PROYECTO : | L.A.V. Tramo Madrid-Zaragoza. Subtramo XV |
| ESTRUCTURA: | Estructura E-1505.0 |

CARACTERISTICAS DEL TERRENO

| | | |
|---|---|---|
| Tensión cobaricentrica admisible = | 3.0 | Kp/cm² |
| Coeficiente de rozamiento zapata-terreno = | 0.58 | |

DIMENSIONES GEOMETRICAS (en metros)

| | |
|---|---|
| Medida fuste segun Y = | 1.20 |
| Medida fuste según Z = | 1.20 |
| Medida zapata según Y = | 5.20 |
| Medida zapata según Z = | 5.20 |
| Canto zapata = | 1.50 |

Vale . Zapata tipo I
Vale . Zapata tipo I

ACCIONES SOBRE CARA SUPERIOR ZAPATA EN ESTADO LIMITE DE SERVICIO (signos del FAGUS).

| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. |
|---|---|---|---|---|---|---|
| 1 | -491.75 | 0.00 | -3.86 | 71.75 | 0.00 | 1.00 |
| 2 | -666.83 | 0.00 | -3.86 | 80.63 | 0.00 | 1.00 |
| 3 | -508.91 | 0.00 | -3.86 | 72.55 | 0.00 | 1.00 |
| 4 | -490.75 | 0.00 | -3.86 | 71.71 | 0.00 | 1.00 |
| 5 | -510.19 | 0.00 | -3.86 | 72.61 | 0.00 | 1.00 |
| 6 | -491.75 | 0.00 | -3.86 | 71.75 | 0.00 | 1.00 |
| 7 | -663.84 | 0.00 | -3.86 | 80.43 | 0.00 | 1.00 |
| 8 | -499.30 | -10.52 | -1.78 | 38.18 | 190.73 | 1.00 |
| 9 | -511.90 | -10.52 | -1.78 | 38.61 | 191.68 | 1.00 |
| 10 | -508.91 | -10.52 | -1.78 | 38.49 | 191.41 | 1.00 |
| 11 | -498.30 | -10.52 | -1.78 | 38.15 | 190.67 | 1.00 |
| 12 | -510.19 | -10.52 | -1.78 | 38.54 | 191.53 | 1.00 |
| 13 | -499.30 | -10.52 | -1.78 | 38.18 | 190.73 | 1.00 |
| 14 | -508.91 | -10.52 | -1.78 | 38.49 | 191.41 | 1.00 |
| 15 | -440.73 | -4.73 | -3.47 | 62.94 | 79.39 | 0.90 |
| 16 | -596.80 | -4.73 | -3.47 | 69.07 | 84.45 | 0.90 |
| 17 | -456.37 | -4.73 | -3.47 | 63.48 | 79.79 | 0.90 |
| 18 | -439.07 | -4.73 | -3.47 | 62.89 | 79.35 | 0.90 |
| 19 | -457.66 | -4.73 | -3.47 | 63.53 | 79.83 | 0.90 |
| 20 | -440.73 | -4.73 | -3.47 | 62.94 | 79.39 | 0.90 |
| 21 | -595.81 | -4.73 | -3.47 | 68.91 | 84.33 | 0.90 |

ACCIONES SOBRE CARA SUPERIOR ZAPATA EN ESTADO LIMITE ULTIMO (signos del FAGUS).

| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. |
|---|---|---|---|---|---|---|
| 1 | -433.37 | 0.00 | -5.78 | 104.04 | 0.00 | 0.90 |
| 2 | -1009.96 | 0.00 | -5.78 | 169.38 | 0.00 | 1.50 |
| 3 | -457.87 | 0.00 | -5.78 | 105.48 | 0.00 | 0.90 |
| 4 | -435.63 | 0.00 | -5.78 | 104.17 | 0.00 | 0.90 |
| 5 | -776.24 | 0.00 | -5.78 | 137.46 | 0.00 | 1.50 |
| 6 | -748.58 | 0.00 | -5.78 | 134.25 | 0.00 | 1.50 |
| 7 | -1005.47 | 0.00 | -5.78 | 168.34 | 0.00 | 1.50 |
| 8 | -444.70 | -15.78 | -2.67 | 55.71 | 291.67 | 0.90 |
| 9 | -777.56 | -15.78 | -2.67 | 87.39 | 373.80 | 1.50 |
| 10 | -457.87 | -15.78 | -2.67 | 56.39 | 293.78 | 0.90 |
| 11 | -446.95 | -15.78 | -2.67 | 55.82 | 292.02 | 0.90 |
| 12 | -776.24 | -15.78 | -2.67 | 87.15 | 373.20 | 1.50 |
| 13 | -759.91 | -15.78 | -2.67 | 84.92 | 367.03 | 1.50 |
| 14 | -773.08 | -15.78 | -2.67 | 86.58 | 371.78 | 1.50 |
| 15 | -388.35 | -7.10 | -5.21 | 93.64 | 120.46 | 0.81 |
| 16 | -907.92 | -7.10 | -5.21 | 137.93 | 152.34 | 1.35 |
| 17 | -410.58 | -7.10 | -5.21 | 94.70 | 121.24 | 0.81 |
| 18 | -389.63 | -7.10 | -5.21 | 93.70 | 120.50 | 0.81 |
| 19 | -697.43 | -7.10 | -5.21 | 117.10 | 136.08 | 1.35 |
| 20 | -672.04 | -7.10 | -5.21 | 114.95 | 134.62 | 1.35 |
| 21 | -903.43 | -7.10 | -5.21 | 137.19 | 151.88 | 1.35 |

**RESULTADOS**

ACCIONES EN BASE DE ZAPATA SIN MAYORAR

| FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) |
|---|---|---|---|---|
| -593.15 | 0.00 | -3.86 | 77.53 | 0.00 |
| -768.23 | 0.00 | -3.86 | 86.41 | 0.00 |
| -610.31 | 0.00 | -3.86 | 78.33 | 0.00 |
| -592.15 | 0.00 | -3.86 | 77.49 | 0.00 |
| -611.59 | 0.00 | -3.86 | 78.40 | 0.00 |
| -593.15 | 0.00 | -3.86 | 77.53 | 0.00 |
| -765.24 | 0.00 | -3.86 | 86.21 | 0.00 |
| -600.70 | -10.52 | -1.78 | 40.85 | 208.51 |
| -613.30 | -10.52 | -1.78 | 41.28 | 207.45 |
| -610.31 | -10.52 | -1.78 | 41.16 | 207.19 |
| -599.70 | -10.52 | -1.78 | 40.82 | 206.44 |
| -611.59 | -10.52 | -1.78 | 41.21 | 207.30 |
| -600.70 | -10.52 | -1.78 | 40.85 | 208.51 |
| -610.31 | -10.52 | -1.78 | 41.16 | 207.19 |
| -531.99 | -4.73 | -3.47 | 68.15 | 86.49 |
| -690.06 | -4.73 | -3.47 | 74.28 | 91.54 |
| -547.63 | -4.73 | -3.47 | 68.68 | 86.89 |
| -530.33 | -4.73 | -3.47 | 68.09 | 86.45 |
| -546.92 | -4.73 | -3.47 | 68.73 | 86.93 |
| -531.99 | -4.73 | -3.47 | 68.15 | 86.49 |
| -687.07 | -4.73 | -3.47 | 74.12 | 91.43 |

COMPROBACION TENSIONES SOBRE EL TERRENO

| eY (m) | eZ (m) | Z (m) | Y (m) | σcob (Kp/cm²) | |
|---|---|---|---|---|---|
| 0.00 | -0.13 | 4.94 | 5.20 | 2.31 | Vale |
| 0.00 | -0.11 | 4.98 | 5.20 | 2.97 | Vale |
| 0.00 | -0.13 | 4.94 | 5.20 | 2.37 | Vale |
| 0.00 | -0.13 | 4.94 | 5.20 | 2.31 | Vale |
| 0.00 | -0.13 | 4.94 | 5.20 | 2.38 | Vale |
| 0.00 | -0.13 | 4.94 | 5.20 | 2.31 | Vale |
| 0.00 | -0.11 | 4.97 | 5.20 | 2.96 | Vale |
| 0.34 | -0.07 | 5.06 | 4.51 | 2.63 | Vale |
| 0.34 | -0.07 | 5.07 | 4.52 | 2.68 | Vale |
| 0.34 | -0.07 | 5.07 | 4.52 | 2.67 | Vale |
| 0.34 | -0.07 | 5.06 | 4.51 | 2.63 | Vale |
| 0.34 | -0.07 | 5.07 | 4.52 | 2.67 | Vale |
| 0.34 | -0.07 | 5.06 | 4.51 | 2.63 | Vale |
| 0.34 | -0.07 | 5.07 | 4.52 | 2.67 | Vale |
| 0.16 | -0.13 | 4.94 | 4.87 | 2.21 | Vale |
| 0.13 | -0.11 | 4.98 | 4.93 | 2.81 | Vale |
| 0.16 | -0.13 | 4.95 | 4.88 | 2.27 | Vale |
| 0.16 | -0.13 | 4.94 | 4.87 | 2.20 | Vale |
| 0.16 | -0.13 | 4.95 | 4.88 | 2.27 | Vale |
| 0.16 | -0.13 | 4.94 | 4.87 | 2.21 | Vale |
| 0.13 | -0.11 | 4.98 | 4.93 | 2.79 | Vale |

COMPROBACION ESTABILIDAD

- Al deslizamiento

| FYdesl.(Ton) | FZdesl.(Ton) | TOTALdesl. | TOTALres | COEFICIENTE | |
|---|---|---|---|---|---|
| 0.00 | -3.86 | 3.86 | 344.03 | 89.24 | Vale |
| 0.00 | -3.86 | 3.86 | 445.57 | 115.58 | Vale |
| 0.00 | -3.86 | 3.86 | 353.98 | 91.82 | Vale |
| 0.00 | -3.86 | 3.86 | 343.45 | 89.09 | Vale |
| 0.00 | -3.86 | 3.86 | 354.72 | 92.02 | Vale |
| 0.00 | -3.86 | 3.86 | 344.03 | 89.24 | Vale |
| 0.00 | -3.86 | 3.86 | 443.84 | 115.13 | Vale |
| -10.52 | -1.78 | 10.67 | 348.41 | 32.67 | Vale |
| -10.52 | -1.78 | 10.67 | 355.71 | 33.35 | Vale |
| -10.52 | -1.78 | 10.67 | 353.98 | 33.19 | Vale |
| -10.52 | -1.78 | 10.67 | 347.83 | 32.61 | Vale |
| -10.52 | -1.78 | 10.67 | 354.72 | 33.26 | Vale |
| -10.52 | -1.78 | 10.67 | 348.41 | 32.67 | Vale |
| -10.52 | -1.78 | 10.67 | 353.98 | 33.19 | Vale |
| -4.73 | -3.47 | 5.87 | 308.55 | 52.58 | Vale |
| -4.73 | -3.47 | 5.87 | 400.23 | 68.21 | Vale |
| -4.73 | -3.47 | 5.87 | 317.63 | 54.13 | Vale |
| -4.73 | -3.47 | 5.87 | 307.59 | 52.42 | Vale |
| -4.73 | -3.47 | 5.87 | 318.37 | 54.26 | Vale |
| -4.73 | -3.47 | 5.87 | 308.55 | 52.58 | Vale |
| -4.73 | -3.47 | 5.87 | 398.50 | 67.91 | Vale |

- Al vuelco

| MYvolc (mT) | MZvolc (mT) | MYres.(mT) | MZres (mT) | COEF. Y | COEF. X | |
|---|---|---|---|---|---|---|
| 77.53 | 0.00 | 1542.20 | 1542.20 | 19.89 | 111834691.81 | Vale |
| 86.41 | 0.00 | 1997.39 | 1997.39 | 23.11 | 133336955.94 | Vale |
| 78.33 | 0.00 | 1586.79 | 1586.79 | 20.26 | 114239956.80 | Vale |
| 77.49 | 0.00 | 1539.60 | 1539.60 | 19.87 | 111727169.81 | Vale |
| 78.40 | 0.00 | 1590.13 | 1590.13 | 20.28 | 114398129.50 | Vale |
| 77.53 | 0.00 | 1542.20 | 1542.20 | 19.89 | 111834691.81 | Vale |
| 86.21 | 0.00 | 1989.61 | 1989.61 | 23.08 | 132995387.70 | Vale |
| 40.85 | 206.51 | 1561.83 | 1561.83 | 38.24 | 7.56 | Vale |
| 41.28 | 207.45 | 1594.57 | 1594.57 | 38.63 | 7.69 | Vale |
| 41.16 | 207.19 | 1586.79 | 1586.79 | 38.56 | 7.66 | Vale |
| 40.82 | 206.44 | 1559.23 | 1559.23 | 38.20 | 7.55 | Vale |
| 41.21 | 207.30 | 1590.13 | 1590.13 | 38.59 | 7.67 | Vale |
| 40.85 | 206.51 | 1561.83 | 1561.83 | 38.24 | 7.56 | Vale |
| 41.16 | 207.19 | 1586.79 | 1586.79 | 38.56 | 7.66 | Vale |
| 68.15 | 86.49 | 1383.16 | 1383.16 | 20.30 | 15.99 | Vale |
| 74.28 | 91.54 | 1794.15 | 1794.15 | 24.16 | 19.60 | Vale |
| 68.68 | 86.89 | 1423.84 | 1423.84 | 20.73 | 16.39 | Vale |
| 68.09 | 86.45 | 1378.87 | 1378.87 | 20.25 | 15.95 | Vale |
| 68.73 | 86.93 | 1427.18 | 1427.18 | 20.76 | 16.42 | Vale |
| 68.15 | 86.49 | 1383.16 | 1383.16 | 20.30 | 15.99 | Vale |
| 74.12 | 91.43 | 1786.37 | 1786.37 | 24.10 | 19.54 | Vale |

ACCIONES EN BASE DE ZAPATA MAYORADAS (sin el peso propio de la zapata)

| FX (Ton) | MY (mT) | MZ (mT) | eY (m) | eZ (m) | Z (m) | Y (m) | σ calc. (T/m²) |
|---|---|---|---|---|---|---|---|
| -433.37 | 112.72 | 0.00 | 0.00 | 0.26 | 4.68 | 5.20 | 17.81 |
| -1009.96 | 178.05 | 0.00 | 0.00 | 0.18 | 4.85 | 5.20 | 40.07 |
| -457.87 | 114.15 | 0.00 | 0.00 | 0.25 | 4.70 | 5.20 | 18.73 |
| -435.63 | 112.84 | 0.00 | 0.00 | 0.26 | 4.68 | 5.20 | 17.89 |
| -776.24 | 146.14 | 0.00 | 0.00 | 0.19 | 4.82 | 5.20 | 30.95 |
| -748.58 | 142.92 | 0.00 | 0.00 | 0.19 | 4.82 | 5.20 | 29.88 |
| -1005.47 | 177.01 | 0.00 | 0.00 | 0.18 | 4.85 | 5.20 | 39.89 |
| -444.70 | 59.71 | 315.33 | 0.71 | 0.13 | 4.93 | 3.78 | 23.84 |
| -777.56 | 91.39 | 397.46 | 0.51 | 0.12 | 4.96 | 4.18 | 37.49 |
| -457.87 | 60.39 | 317.44 | 0.69 | 0.13 | 4.94 | 3.81 | 24.32 |
| -446.95 | 59.82 | 315.68 | 0.71 | 0.13 | 4.93 | 3.79 | 23.93 |
| -776.24 | 91.15 | 396.86 | 0.51 | 0.12 | 4.97 | 4.18 | 37.42 |
| -759.91 | 88.91 | 390.69 | 0.51 | 0.12 | 4.97 | 4.17 | 36.68 |
| -773.08 | 90.58 | 395.45 | 0.51 | 0.12 | 4.97 | 4.18 | 37.27 |
| -388.35 | 101.45 | 131.11 | 0.34 | 0.26 | 4.68 | 4.52 | 18.35 |
| -907.92 | 145.74 | 162.99 | 0.18 | 0.16 | 4.88 | 4.84 | 38.44 |
| -410.58 | 102.50 | 131.89 | 0.32 | 0.25 | 4.70 | 4.56 | 19.16 |
| -389.63 | 101.51 | 131.15 | 0.34 | 0.26 | 4.68 | 4.53 | 18.40 |
| -697.43 | 124.91 | 146.73 | 0.21 | 0.18 | 4.84 | 4.78 | 30.14 |
| -672.04 | 122.76 | 145.27 | 0.22 | 0.18 | 4.83 | 4.77 | 29.16 |
| -903.43 | 145.00 | 162.53 | 0.18 | 0.16 | 4.88 | 4.84 | 38.26 |

CALCULO DE SECCIONES (con esfuerzos de diseño)

| Calculo armadura flexión en Z | | Calculo armadura flexión en Y | | Calculo armadura cortante Y | | | Calculo armadura cortante Z | | |
|---|---|---|---|---|---|---|---|---|---|
| MYd (mT/m) | Canto (m) | MZd (mT/m) | Canto (m) | VYXd (T) | Canto (m) | Ancho (m) | VZXd (T) | Canto (m) | Ancho (m) |
| 42.32 | 1.50 | 42.32 | 1.50 | 118.07 | 1.50 | 2.65 | 118.07 | 1.50 | 2.65 |
| 95.21 | 1.50 | 95.21 | 1.50 | 265.65 | 1.50 | 2.65 | 265.65 | 1.50 | 2.65 |
| 44.50 | 1.50 | 44.50 | 1.50 | 124.17 | 1.50 | 2.65 | 124.17 | 1.50 | 2.65 |
| 42.52 | 1.50 | 42.52 | 1.50 | 118.63 | 1.50 | 2.65 | 118.63 | 1.50 | 2.65 |
| 73.54 | 1.50 | 73.54 | 1.50 | 205.18 | 1.50 | 2.65 | 205.18 | 1.50 | 2.65 |
| 71.00 | 1.50 | 71.00 | 1.50 | 198.09 | 1.50 | 2.65 | 198.09 | 1.50 | 2.65 |
| 94.78 | 1.50 | 94.78 | 1.50 | 264.44 | 1.50 | 2.65 | 264.44 | 1.50 | 2.65 |
| 56.66 | 1.50 | 56.66 | 1.50 | 158.09 | 1.50 | 2.65 | 158.09 | 1.50 | 2.65 |
| 89.08 | 1.50 | 89.08 | 1.50 | 248.54 | 1.50 | 2.65 | 248.54 | 1.50 | 2.65 |
| 57.80 | 1.50 | 57.80 | 1.50 | 161.27 | 1.50 | 2.65 | 161.27 | 1.50 | 2.65 |
| 56.85 | 1.50 | 56.85 | 1.50 | 158.63 | 1.50 | 2.65 | 158.63 | 1.50 | 2.65 |
| 88.93 | 1.50 | 88.93 | 1.50 | 248.12 | 1.50 | 2.65 | 248.12 | 1.50 | 2.65 |
| 87.16 | 1.50 | 87.16 | 1.50 | 243.19 | 1.50 | 2.65 | 243.19 | 1.50 | 2.65 |
| 88.57 | 1.50 | 88.57 | 1.50 | 247.11 | 1.50 | 2.65 | 247.11 | 1.50 | 2.65 |
| 43.60 | 1.50 | 43.60 | 1.50 | 121.65 | 1.50 | 2.65 | 121.65 | 1.50 | 2.65 |
| 91.34 | 1.50 | 91.34 | 1.50 | 254.86 | 1.50 | 2.65 | 254.86 | 1.50 | 2.65 |
| 45.54 | 1.50 | 45.54 | 1.50 | 127.06 | 1.50 | 2.65 | 127.06 | 1.50 | 2.65 |
| 43.71 | 1.50 | 43.71 | 1.50 | 121.96 | 1.50 | 2.65 | 121.96 | 1.50 | 2.65 |
| 71.62 | 1.50 | 71.62 | 1.50 | 199.82 | 1.50 | 2.65 | 199.82 | 1.50 | 2.65 |
| 69.28 | 1.50 | 69.28 | 1.50 | 193.30 | 1.50 | 2.65 | 193.30 | 1.50 | 2.65 |
| 90.90 | 1.50 | 90.90 | 1.50 | 253.64 | 1.50 | 2.65 | 253.64 | 1.50 | 2.65 |

- Armadura resultante

| AsY inf. (cm²/m) | | AsZ inf (cm²/m) | | AsYXcte.(cm²) | | AsZXcte.(cm²) | |
|---|---|---|---|---|---|---|---|
| 6.71 | Vale | 6.71 | Vale | 0.00 | Vale | 0.00 | Vale |
| 15.25 | Vale | 15.25 | Vale | 0.00 | Vale | 0.00 | Vale |
| 7.06 | Vale | 7.06 | Vale | 0.00 | Vale | 0.00 | Vale |
| 6.74 | Vale | 6.74 | Vale | 0.00 | Vale | 0.00 | Vale |
| 11.73 | Vale | 11.73 | Vale | 0.00 | Vale | 0.00 | Vale |
| 11.32 | Vale | 11.32 | Vale | 0.00 | Vale | 0.00 | Vale |
| 15.18 | Vale | 15.18 | Vale | 0.00 | Vale | 0.00 | Vale |
| 9.01 | Vale | 9.01 | Vale | 0.00 | Vale | 0.00 | Vale |
| 14.26 | Vale | 14.26 | Vale | 0.00 | Vale | 0.00 | Vale |
| 9.19 | Vale | 9.19 | Vale | 0.00 | Vale | 0.00 | Vale |
| 9.04 | Vale | 9.04 | Vale | 0.00 | Vale | 0.00 | Vale |
| 14.23 | Vale | 14.23 | Vale | 0.00 | Vale | 0.00 | Vale |
| 13.94 | Vale | 13.94 | Vale | 0.00 | Vale | 0.00 | Vale |
| 14.17 | Vale | 14.17 | Vale | 0.00 | Vale | 0.00 | Vale |
| 6.91 | Vale | 6.91 | Vale | 0.00 | Vale | 0.00 | Vale |
| 14.62 | Vale | 14.62 | Vale | 0.00 | Vale | 0.00 | Vale |
| 7.22 | Vale | 7.22 | Vale | 0.00 | Vale | 0.00 | Vale |
| 6.93 | Vale | 6.93 | Vale | 0.00 | Vale | 0.00 | Vale |
| 11.42 | Vale | 11.42 | Vale | 0.00 | Vale | 0.00 | Vale |
| 11.05 | Vale | 11.05 | Vale | 0.00 | Vale | 0.00 | Vale |
| 14.55 | Vale | 14.55 | Vale | 0.00 | Vale | 0.00 | Vale |

**VALORES MAXIMOS**

| AsYinf.(cm²/m) | AsYsup.(cm²/m) | AsZinf.(cm²/m) | AsZsup.(cm²/m) | AsYXcte.(cm²) | AsZXcte.(cm²) | As piel(cm²) |
|---|---|---|---|---|---|---|
| 15.25 | 0.00 | 15.25 | 0.00 | 0.00 | 0.00 | 0.00 |

**ARMADURAS MINIMAS**

| AsYinf.(cm²/m) | AsYsup.(cm²/m) | AsZinf.(cm²/m) | AsZsup.(cm²/m) | AsYXcte.(cm²) | AsZXcte.(cm²) | As piel(cm²) |
|---|---|---|---|---|---|---|
| 8.42 | 8.42 | 8.42 | 8.42 | 0.00 | 0.00 | 12.63 |

**TOTAL ARMADURAS**

| **AsYinf.(cm²/m)** | **AsYsup.(cm²/m)** | **AsZinf.(cm²/m)** | **AsZsup.(cm²/m)** | **AsYXcte.(cm²)** | **AsZXcte.(cm²)** | **As piel(cm²)** |
|---|---|---|---|---|---|---|
| **15.25** | **8.42** | **15.25** | **8.42** | **0.00** | **0.00** | **12.63** |

# 4º CALCULO DE ESTRIBOS

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1505.0 ESTRIBO 1

## CALCULO ESTRIBOS CERRADOS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 1.77
H2= 8.43
H3= 1.60
Htierras= 10.2
B1= 1.80
B2= 1.55
B3= 4.15

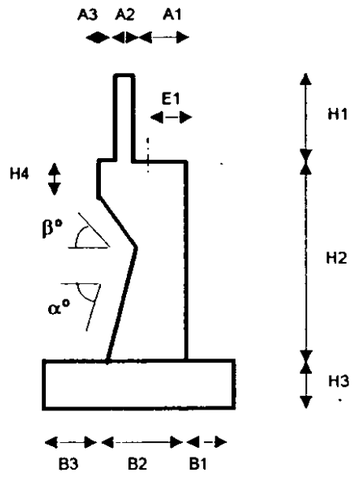
A1= 1.05
A2= 0.3
A3= 0.01

H4= 0.5
α(grados)= 90
β(grados)= 45
E1= 0.5

Longitud= 1
Recubrim.= 0.05

Puntera
Zapata tipo I

Talón
Zapata tipo III




**CARACTERISTICAS DE TERRENO**

| | |
|---|---|
| Peso tierras(T/m3) | γ= 2 |
| Angulo rozamiento interno | φ= 30 |
| Coef.rozamiento zapata-terreno | μ= 0.58 |
| Angulo. rozamiento tierras muro | δ= 0 |
| Tension admisible.(T/m2) | σ= 32 |

**COEFICIENTES DE SEGURIDAD**

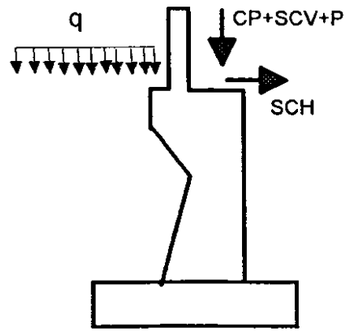
| | |
|---|---|
| Mayoracion de cargas | γf= 1.5 |
| Seguridad al deslizamiento | Csd= 1.5 |
| Seguridad al vuelco | Csv= 1.5 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.5 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γη= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hgon. ciment. (T/m2) | Fck1= 2500 |
| Resistencia hgon. alzado (T/m2) | Fck2= 2500 |

**CARGAS TRANSMITIDAS POR LA ESTRUCTURA(valores sin mayorar)**

Cargas verticales(ton/m)
Cargas permanentes CP= 15.03
Sobrecargas SCV= 10.93
Pretensado P= 0.00
Cargas horizontales(ton/m)
Sobrecargas horizontales SCH= 2.01
Sobrecarga(ton/m2) q= 1.00






NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

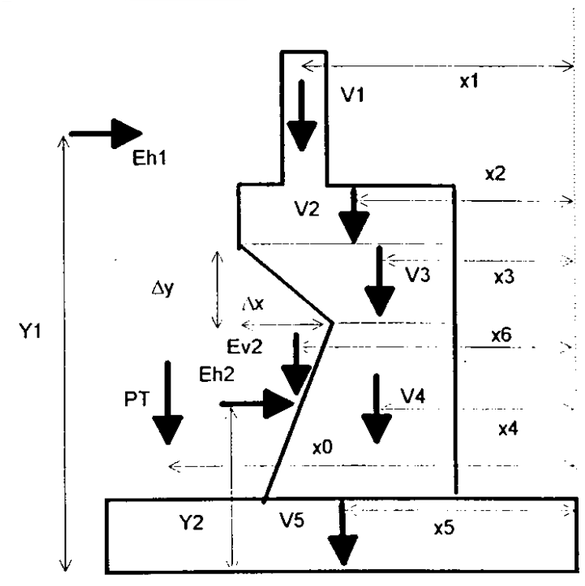
DESIGNACION ESTRIBO: E-1505.0 ESTRIBO 1

CALCULO ESTRIBOS CERRADOS

### CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)

Resultados intermedios:

Δx= -0.190
Δy= -0.190




**COEFICIENTES EMPUJE ACTIVO ALZADO MURO**

Coef. empuje activo λh= 0.333
Coef. empuje activo λv= 0.000

**COEFICIENTES EMPUJE ACTIVO MURETE**

Coef. empuje activo λh= 0.333
Coef. empuje activo λv= 0.000

**PESO TIERRAS TRASDOS**

| | | | |
|---|---|---|---|
| PT= | **85.525** | x0= | 5.403 |

**PESO PROPIO**

| | | | |
|---|---|---|---|
| V1= | 1.328 | x1= | 3.000 |
| V2= | 1.700 | x2= | 2.480 |
| V3= | -0.691 | x3= | 2.529 |
| V4= | 31.465 | x4= | 2.575 |
| V5= | 30.000 | x5= | 3.750 |
| TOTAL PP= | **63.801** | | **3.134** |

**EMPUJES**

| | | | |
|---|---|---|---|
| Eh1= | 2.135 | Y1= | 10.526 |
| Eh2= | 35.945 | Y2= | 4.833 |
| Eh3= | 12.267 | Y3= | 0.781 |
| Empuje hor. | **50.347** | | **4.087** |
| Ev2= | **0.000** | x6= | 3.350 |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1505.0 ESTRIBO 1

## CALCULO ESTRIBOS CERRADOS

### COMPROBACIONES

### 1) SEGURIDAD AL DESLIZAMIENTO

$$C_{SD} = \frac{\sum_i \text{Fuerzas} - \text{opuestas}}{\sum_i \text{Fuerzas} - \text{deslizantes}}$$

1,A) En construccion:

| | | | |
|---|---|---|---|
| Fuerzas opuestas | | | |
| | Peso propio | 37.005 | |
| | Peso tierras | 49.604 | |
| | Ev2 | 0.000 | |
| | TOTAL | | 86.609 |
| Fuerzas deslizantes | | | |
| | Empuje horizontal | 50.347 | |
| | TOTAL | | 50.347 |

**Csd= 1.72**

1,B) En Servicio:

| | | | |
|---|---|---|---|
| Fuerzas opuestas | | | |
| | Peso propio | 37.005 | |
| | Peso tierras | 49.604 | |
| | Ev2 | 0.000 | |
| | Carga perma | 8.716 | |
| | TOTAL | | 95.325 |
| Fuerzas deslizantes | | | |
| | Empuje horiz | 50.347 | |
| | Sobrecarga h | 2.012 | |
| | TOTAL | | 52.359 |

**Csd= 1.82**

### 2) SEGURIDAD AL VUELCO

$$C_{SV} = \frac{\sum_i \text{Momentos} - \text{estabilizadores}}{\sum_i \text{Momentos} - \text{volcadores}}$$

2,A) En construccion:

| | | | |
|---|---|---|---|
| Mom.estabilizadores | | | |
| | Peso propio | 199.973 | |
| | Peso tierras | 462.092 | |
| | M Ev2 | 0.000 | |
| | TOTAL | | 662.065 |
| Mom. volcadores | | | |
| | Empuje horizontal | 205.766 | |
| | TOTAL | | 205.766 |

**Csv= 3.22**

2.B.) En Servicio:

| | | | |
|---|---|---|---|
| Mom.estabilizadores | | | |
| | Peso propio | 199.973 | |
| | Peso tierras | 462.092 | |
| | M Ev2 | 0.000 | |
| | Carga perma | 34.562 | |
| | TOTAL | | 696.627 |
| Mom. volcadores | | | |
| | Empuje horiz | 205.766 | |
| | Sobrecarga h | 20.184 | |
| | TOTAL | | 225.950 |

**Csv= 3.08**

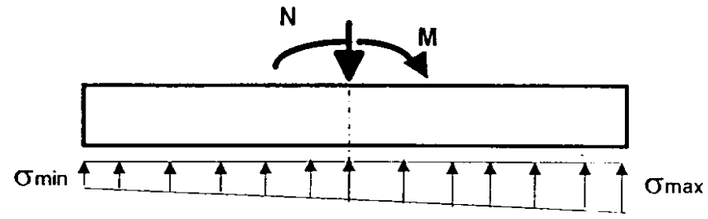


NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1505.0 ESTRIBO 1

CALCULO ESTRIBOS CERRADOS

### 3) TENSIONES MAXIMAS Y MINIMAS EN CIMENTACION




3,A) En construccion:

| | | | |
|---|---|---|---|
| Carga vertical N. (t/m) | | | |
| | Peso propio | 63.801 | |
| | Peso tierras | 85.525 | |
| | Ev2 | 0.000 | |
| | TOTAL | | 149.326 |
| Momento M. (m.t/m) | | | |
| | Peso propio | 39.282 | |
| | Peso tierras | -141.373 | |
| | M Ev2 | 0.000 | |
| | Empuje horizontal | 205.766 | |
| | TOTAL | | 103.675 |

| | |
|---|---|
| **Ancho zapata=** | **7.50** |
| **σmax=** | **30.97 (ton/m2)** |
| **σmin=** | **8.85 (ton/m2)** |
| **σcob=** | **24.43 (ton/m2)** |
| **σmed=** | **19.91 (ton/m2)** |

3,B) En Servicio:

| | | | |
|---|---|---|---|
| Carga vertical N. (t/m) | | | |
| | Peso propio | 63.801 | |
| | Peso tierras | 85.525 | |
| | Ev2 | 0.000 | |
| | Carga perma | 15.027 | |
| | Sc. vertical | 10.931 | |
| | Pretensado | 0.000 | |
| | TOTAL | | 175.284 |
| Momento M. (m.t/m) | | | |
| | Peso propio | 39.282 | |
| | Peso tierras | -141.373 | |
| | M Ev2 | 0.000 | |
| | Carga perma | 21.789 | |
| | Sc. vertical | 15.850 | |
| | Pretensado | 0.000 | |
| | Empuje horiz | 205.766 | |
| | Sobrecarga h | 20.184 | |
| | TOTAL | | 161.498 |

| | |
|---|---|
| **Ancho zapata (m)=** | **7.50** |
| **σmax=** | **40.60 (ton/m2)** |
| **σmin=** | **6.14 (ton/m2)** |
| **σcob=** | **30.98 (ton/m2)** |
| **σmed=** | **23.37 (ton/m2)** |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1505.0 ESTRIBO 1

## CALCULO ESTRIBOS CERRADOS

## CALCULOS

### 4) ESFUERZOS DE DISEÑO

#### 4,A) Esfuerzos en el muro.

| Seccion | Base | 1/3 H2 |
|---|---|---|
| h(m) | 0 | 2.81 |
| Canto (m.) | 1.55 | 1.55 |
| M cargas verti | 7.138 | 7.138 |
| M cargas horiz | 16.964 | 11.309 |
| M peso propio | -0.435 | -0.435 |
| M empuje hori | 135.252 | 53.945 |
| M empuje vert | 0.000 | 0.000 |
| **Md (mt/m)** | **238.380** | **107.936** |
| V cargas horiz | 2.012 | 2.012 |
| V empuje hori | 50.347 | 20.667 |
| **Vd (t/m)** | **78.539** | **34.020** |
| Ndmax(t/m) | 89.64 | 73.31 |
| Ndmin(t/m) | 30.42 | 20.62 |

#### 4,B) Esfuerzos en el murete.

| Seccion | Base murete |
|---|---|
| h(m) | 8.43 |
| Canto (m.) | 0.3 |
| M empuje horizontal | 1.138 |
| **Md (mt/m)** | **1.707** |
| V empuje horizontal | 1.634 |
| **Vd (t/m)** | **2.451** |
| Nd (t/m) | 1.33 |

#### 4,C) Esfuerzos en la puntera.

(momentos (+) implica tracciones en cara inferior)

| Seccion | Cara intrados |
|---|---|
| Distancia a vuelco | 1.8 |
| M peso propio | -6.480 |
| M tens.terreno | 61.303 |
| **Md puntera(mt/m)** | **82.235** |
| Posicion seccion S2 cortante | 1.025 |
| Canto util seccion S2 | 1.538 |
| V peso propio | -4.100 |
| V tens.terreno | 39.199 |
| **Vd en puntera(t/m)** | **52.649** |

#### 4,D) Esfuerzos en el talon

(momentos (+) implica tracciones en cara superior)

| Seccion | Cara trasdos |
|---|---|
| Distancia a vuelco | 3.35 |
| M tierras | 175.58 |
| M peso propio | 34.45 |
| M tens.terreno | -107.636 |
| **Md talon(mt/m)** | **153.588** |
| Posicion seccion S2 cortant | 4.900 |
| Canto util seccion S2 | 1.550 |
| V tierras | 53.58 |
| V peso propio | 10.40 |
| V tens.terreno | -31.503 |
| **Vd en talon(t/m)** | **48.718** |
| Cortante base | 78.539 |
| Area comp.cim.talon/total | 0.416 |
| **Traccion superior d. (t/m)** | **32.676** |



NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1505.0 ESTRIBO 1

CALCULO ESTRIBOS CERRADOS

### 5) CALCULO DE SECCIONES

| Elementos | Seccion | | | Esfuerzos de diseño | | |
|---|---|---|---|---|---|---|
| | Designacion | b(m.) | d(m.) | Md(m.ton) | Nd(ton.) | Vd(ton.) |
| MURO | 0-0 | 1.00 | 1.55 | 238.38 | - | 78.54 |
| | 1-1 | 1.00 | 1.55 | 107.94 | - | 34.02 |
| PUNTERA | 2-2 | 1.00 | 1.60 | 82.23 | - | 52.65 |
| TALÓN | 3-3 | 1.00 | 1.60 | 153.59 | - | 48.72 |
| MURETE | 4-4 | 1.00 | 0.30 | 1.71 | - | 2.45 |

| Elementos | Designacion armaduras | Nombre Seccion | ARMADURA(cm2/m) | | |
|---|---|---|---|---|---|
| | | | Necesaria | Minima | Adoptada |
| MURO | Asv1 | 0-0 | 32.42 | 9.30 | 32.42 |
| | Asv1 | 1-1 | 14.36 | 9.30 | 14.36 |
| | Asv3 | - | 0.00 | 4.65 | 4.65 |
| | Ash1 | - | 0.00 | 12.40 | 12.40 |
| | Ash2 | - | 0.00 | 12.40 | 12.40 |
| | Cortante | 0-0 | 0.00 | 0.00 | 0.00 |
| PUNTERA | As inf L. | 2-2 | 2.11 | 11.58 | 11.58 |
| | As inf T. | - | 10.53 | 11.58 | 11.58 |
| | Cortante | S2 | 0.00 | 0.00 | 0.00 |
| TALÓN | As sup L. | 3-3 | 5.26 | 11.58 | 11.58 |
| | As sup T. | - | 26.30 | 11.58 | 26.30 |
| | Cortante | S2 | 0.00 | 0.00 | 0.00 |
| MURETE | Asv2 | 4-4 | 1.35 | 1.35 | 1.35 |
| | Asv4 | - | 0.00 | 1.35 | 1.35 |
| | Ash3 | - | 0.00 | 2.40 | 2.40 |
| | Ash4 | - | 0.00 | 2.40 | 2.40 |

NOTA: las armaduras longitudinales en talón y puntera que aparecen en las casillas de armadura "necesaria" han sido obtenidas multiplicando la armadura transversal por el coeficiente de poisson.

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 4.50

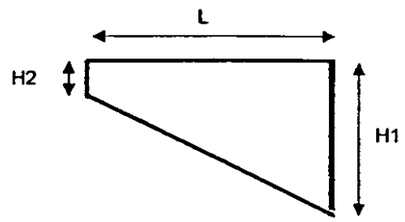
## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 3.50
H2= 0.50
L= 4.5

Espesor= 0.35
Recubrim.= 0.05




**CARACTERISTICAS DE TERRENO**

| | |
|---|---|
| Peso tierras(T/m3) | γ= 2.0 |
| Angulo rozamiento interno (°) | φ= 30 |
| Ang. rozamiento tierras muro (°) | δ= 0 |

**COEFICIENTES DE SEGURIDAD**

| | |
|---|---|
| Mayoracion de cargas | γf= 1.50 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.50 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γη= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hormigon (T/m2) | Fck= 2500 |

**CARGAS (valores sin mayorar)**

Cargas verticales

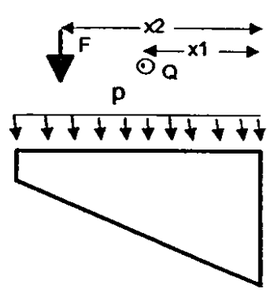
| | |
|---|---|
| Sobrecarga vertical (t/m) | p= 1.24 |
| Carga vertical (t.) | F= 0.00 |
| Situacion x2 (m) | x2= 0 |

Cargas horizontales

| | |
|---|---|
| Carga horizontal (t.) | Q= 0 |
| Posicion x1 (m) | x1= 0 |

Sobrecarga sobre terreno (ton/m2)

q= 1.00




**CUANTIAS MINIMAS**

| | |
|---|---|
| LONGITUDINAL SUPERIOR | 0.400 o/oo |
| LONGITUDINAL INFERIOR | 0.400 o/oo |
| CORTANTE | 2.778 CM2/M |
| HORIZONTAL MUROS ALETA | 0.900 o/oo |
| VERTICAL MUROS ALETA | 1.600 o/oo |
| CORTANTE MUROS | 0.000 CM2/M |

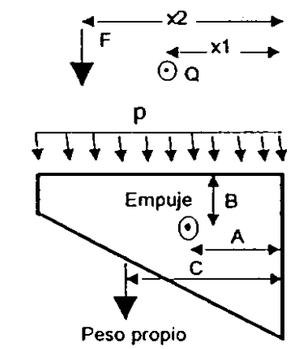
ALETA4-50.xls CALCULOS

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 4.50

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)




**COEFICIENTES EMPUJE ACTIVO ALETA**

| | |
|---|---|
| Coef. empuje activo λh= | 0.333 |
| Coef. empuje activo λv= | 0.000 |

**PESO PROPIO**

| | Peso | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Peso aux. 1 | 1.969 | 2.250 | 0.250 |
| Peso aux. 2 | 5.906 | 1.500 | 1.500 |
| **Peso propio** | **7.875** | **1.688** | **1.188** |

**EMPUJE DE TIERRAS**

HORIZONTAL

| | Empuje. | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Auxiliar | 0.125 | 3.375 | - |
| Auxiliar | 0.875 | 2.250 | - |
| Auxiliar | 6.125 | 1.125 | - |
| Auxiliar | 0.375 | 3.000 | - |
| Auxiliar | 2.625 | 1.500 | - |
| Empuje hor. | **10.125** | **1.417** | **1.586** |

VERTICAL

| | Empuje. | Dist.emp. |
|---|---|---|
| Empuje aux.1 | 0.000 | 3.375 |
| Empuje aux.2 | 0.000 | 2.250 |
| Empuje aux.3 | 0.000 | 1.125 |
| Empuje aux.4 | 0.000 | 3.000 |
| Empuje aux.5 | 0.000 | 1.500 |
| Empuje vert. | **0.000** | **0.000** |

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 4.50

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### CALCULOS

**ESFUERZOS DE DISEÑO**

**(Para cargas verticales, momentos positivos implica tracciones en cara superior)**

| Acciones | Verticales | Horizontales |
|---|---|---|
| M peso propio | 13.289 | 0.000 |
| M empuje hor. | 0.000 | 14.344 |
| M empuje vert. | 0.000 | 0.000 |
| M sobrec.vert. | 12.580 | 0.000 |
| M carga vert. | 0.000 | 0.000 |
| M carga hor. | 0.000 | 0.000 |
| **Md (mt)** | **38.804** | **21.516** |
| V peso propio | 7.875 | 0.000 |
| V empuje hor. | 0.000 | 10.125 |
| V empuje vert. | 0.000 | 0.000 |
| V sobrec.vert. | 5.591 | 0.000 |
| V carga vert. | 0.000 | 0.000 |
| V carga hor. | 0.000 | 0.000 |
| **Vd (mt)** | **20.199** | **15.188** |

**CALCULO DE SECCIONES**

| | | | |
|---|---|---|---|
| Fcd | 1666.67 | | |
| 0,85*Fcd | 1416.67 | | |
| Fcv | 64.55 | | |
| Es | 21000000 | | |
| Fyd | 44347.83 | | |
| FYAD | 42000.00 | | |
| Acciones | Verticales | Horizontales | |
| Md(m.t) | 38.804 | 21.516 | |
| Md max/Md med | 1.000 | 1.556 | |
| Md a usar calculo | 38.804 | 33.481 | |
| Canto seccion | 3.500 | 0.350 | |
| Canto util | 3.450 | 0.300 | |
| ancho seccion | 0.350 | 3.500 | |
| Ancho calculo | 0.350 | 3.454 | |
| Def acero | 0.010 | 0.010 | |
| Tension acero | 44348 | 44348 | |
| X | 0.023 | 0.024 | |
| **As (cm.2)** | **2.545** | **26.202** | |
| Prof. fibra neutra | 0.247 | 0.042 | |
| Def. hormigon | 0.001 | 0.002 | |
| Comentarios | VALE | VALE | |
| Vd | 20.199 | 15.188 | |
| Vd compuesto | | | 25.272 |

ALETA4-50.xls CALCULOS

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 4.50

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

| | |
|---|---|
| Vu1 | 518.172 |
| Vsu | 0.000 |
| Vcu | 66.896 |
| Vu2 | 66.896 |
| Comentarios | |
| **As (cm.2)** | **0.000** |

### ARMADO

| | Calculo | Minima | total |
|---|---|---|---|
| Long. superior | 2.545 | 4.900 | **4.900** |
| Long inferior | 0.000 | 4.900 | **4.900** |
| Cortante | 0.000 | 12.500 | **12.500** |
| Horizontal trasdos | 26.202 | 7.350 | **26.202** |
| Vertical trasdos | 0.000 | 12.600 | **12.600** |
| Horizontal intrados | 0.000 | 3.675 | **3.675** |
| Vertical intrados | 0.000 | 12.600 | **12.600** |
| Cortante transversal | | NO | |

**TOTAL ENVOLVENTE ARMADURA**

| | cm2 | cm2/m |
|---|---|---|
| **Long. superior** | **4.900** | --- |
| **Long inferior** | **4.900** | --- |
| **Horizontal trasdos** | **26.202** | **7.486** |
| **Horizontal intrados** | **3.675** | **1.050** |
| **Estribos por rama (2 ramas)** | **18.850** | **4.189** |

| DATOS ARMADO | |
|---|---|
| Separacion maxima barras | 0.3 |
| Separacion minima barras | 0.1 |

**TOTAL ARMADURAS**

| | TOTAL | DIAMETRO | A.REAL | AREAL/ANEC | |
|---|---|---|---|---|---|
| **Long. superior** | 3.0 | 16 | 6.03 | 1.23 | VALE |
| **Long inferior** | 3.0 | 16 | 6.03 | 1.23 | VALE |
| **Horizontal trasdos** | 34.0 | 10 | 26.70 | 1.02 | VALE |
| **Horizontal intrados** | 16.0 | 10 | 12.57 | 3.42 | VALE |
| **Estribos** | 17.0 | 12 | 19.23 | 1.02 | VALE |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1511.3 E-1 y E-2 ; E-1505.0 E-2

## CALCULO ESTRIBOS CERRADOS

### DATOS REQUERIDOS:

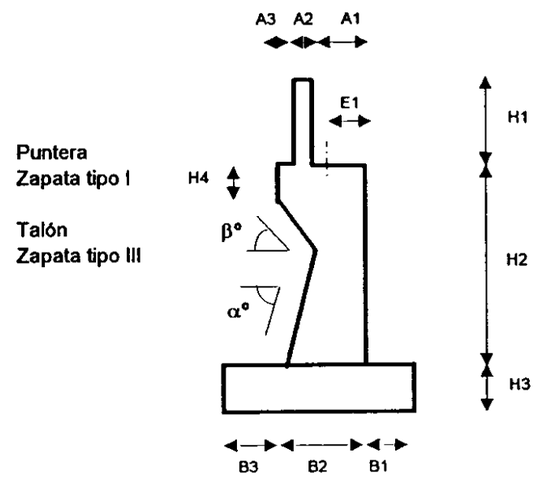
**DIMENSIONES(en metros)**

H1= 1.77
H2= 5.38
H3= 1.00
Htierras= 7.15
B1= 0.70
B2= 0.90
B3= 3.50

A1= 1.05
A2= 0.3
A3= 0.01

H4= 0.55
α(grados)= 90
β(grados)= 45
E1= 0.5

Longitud= 1
Recubrim.= 0.05




Puntera
Zapata tipo I

Talón
Zapata tipo III

**CARACTERISTICAS DE TERRENO**

| | | |
|---|---|---|
| Peso tierras(T/m3) | γ= | 2 |
| Angulo rozamiento interno | φ= | 30 |
| Coef.rozamiento zapata-terreno | μ= | 0.58 |
| Angulo. rozamiento tierras muro | δ= | 0 |
| Tension admisible.(T/m2) | σ= | 32 |

**COEFICIENTES DE SEGURIDAD**

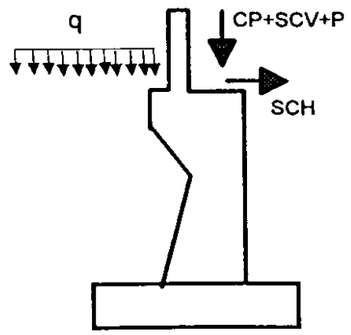
| | |
|---|---|
| Mayoracion de cargas | γf= 1.5 |
| Seguridad al deslizamiento | Csd= 1.5 |
| Seguridad al vuelco | Csv= 1.5 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.5 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γη= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hgon. ciment. (T/m2) | Fck1= 2500 |
| Resistencia hgon. alzado (T/m2) | Fck2= 2500 |

**CARGAS TRANSMITIDAS POR LA ESTRUCTURA(valores sin mayorar)**

Cargas verticales(ton/m)
Cargas permanentes CP= 15.03
Sobrecargas SCV= 10.93
Pretensado P= 0.00
Cargas horizontales(ton/m)
Sobrecargas horizontales SCH= 2.01
Sobrecarga(ton/m2) q= 1.00






NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

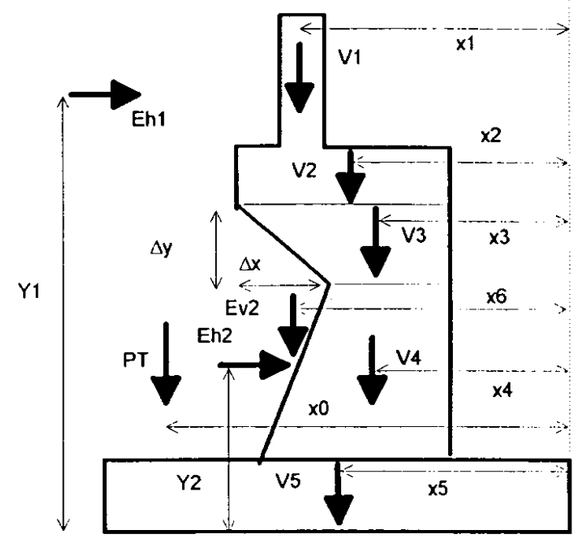
DESIGNACION ESTRIBO: E-1511.3 E-1 y E-2 ; E-1505.0 E-2

CALCULO ESTRIBOS CERRADOS

### CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)

Resultados intermedios:

Δx= 0.460
Δy= 0.460




**COEFICIENTES EMPUJE ACTIVO ALZADO MURO**

Coef. empuje activo λh= 0.333
Coef. empuje activo λv= 0.000

**COEFICIENTES EMPUJE ACTIVO MURETE**

Coef. empuje activo λh= 0.333
Coef. empuje activo λv= 0.000

**PESO TIERRAS TRASDOS**

| | | | |
|---|---|---|---|
| PT= | **47.740** | x0= | 3.424 |

**PESO PROPIO**

| | | | |
|---|---|---|---|
| V1= | 1.328 | x1= | 1.900 |
| V2= | 1.870 | x2= | 1.380 |
| V3= | 1.300 | x3= | 1.273 |
| V4= | 9.833 | x4= | 1.150 |
| V5= | 12.750 | x5= | 2.550 |
| TOTAL PP= | **27.080** | | **1.868** |

**EMPUJES**

| | | | |
|---|---|---|---|
| Eh1= | 3.503 | Y1= | 6.419 |
| Eh2= | 15.921 | Y2= | 2.894 |
| Eh3= | 5.433 | Y3= | 0.490 |
| Empuje hor. | **24.858** | | **2.865** |
| Ev2= | **0.000** | x6= | 1.600 |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1511.3 E-1 y E-2 ; E-1505.0 E-2

## CALCULO ESTRIBOS CERRADOS

### COMPROBACIONES

### 1) SEGURIDAD AL DESLIZAMIENTO

$$C_{SD} = \frac{\sum_i \text{Fuerzas} - \text{opuestas}}{\sum_i \text{Fuerzas} - \text{deslizantes}}$$

1,A) En construccion:

| | | |
|---|---|---|
| Fuerzas opuestas | | |
| Peso propio | 15.706 | |
| Peso tierras | 27.689 | |
| Ev2 | 0.000 | |
| TOTAL | | 43.395 |
| Fuerzas deslizantes | | |
| Empuje horizontal | 24.858 | |
| TOTAL | | 24.858 |

**Csd= 1.75**

1,B) En Servicio:

| | | |
|---|---|---|
| Fuerzas opuestas | | |
| Peso propio | 15.706 | |
| Peso tierras | 27.689 | |
| Ev2 | 0.000 | |
| Carga perma | 8.716 | |
| TOTAL | | 52.111 |
| Fuerzas deslizantes | | |
| Empuje horiz | 24.858 | |
| Sobrecarga h | 2.012 | |
| TOTAL | | 26.870 |

**Csd= 1.94**

### 2) SEGURIDAD AL VUELCO

$$C_{SV} = \frac{\sum_i \text{Momentos} - \text{estabilizadores}}{\sum_i \text{Momentos} - \text{volcadores}}$$

2,A) En construccion:

| | | |
|---|---|---|
| Mom.estabilizadores | | |
| Peso propio | 50.577 | |
| Peso tierras | 163.465 | |
| M Ev2 | 0.000 | |
| TOTAL | | 214.041 |
| Mom. volcadores | | |
| Empuje horizontal | 71.220 | |
| TOTAL | | 71.220 |

**Csv= 3.01**

2.B.) En Servicio:

| | | |
|---|---|---|
| Mom.estabilizadores | | |
| Peso propio | 50.577 | |
| Peso tierras | 163.465 | |
| M Ev2 | 0.000 | |
| Carga perma | 18.033 | |
| TOTAL | | 232.074 |
| Mom. volcadores | | |
| Empuje horiz | 71.220 | |
| Sobrecarga h | 12.839 | |
| TOTAL | | 84.058 |

**Csv= 2.76**

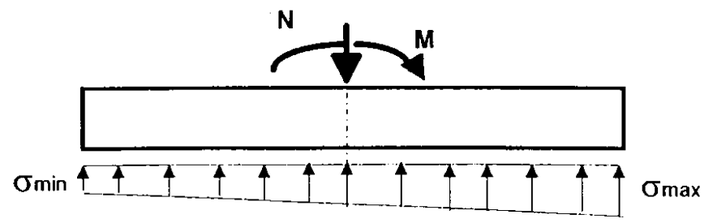


NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1511.3 E-1 y E-2 ; E-1505.0 E-2

CALCULO ESTRIBOS CERRADOS

### 3) TENSIONES MAXIMAS Y MINIMAS EN CIMENTACION




3,A) En construccion:

| | | |
|---|---|---|
| Carga vertical N. (t/m) | | |
| Peso propio | 27.080 | |
| Peso tierras | 47.740 | |
| Ev2 | 0.000 | |
| TOTAL | | 74.820 |
| Momento M. (m.t/m) | | |
| Peso propio | 18.476 | |
| Peso tierras | -41.727 | |
| M Ev2 | 0.000 | |
| Empuje horizontal | 71.220 | |
| TOTAL | | 47.969 |

| | |
|---|---|
| Ancho zapata= | 5.10 |
| σmax= | 25.74 (ton/m2) |
| σmin= | 3.61 (ton/m2) |
| σcob= | 19.60 (ton/m2) |
| σmed= | 14.67 (ton/m2) |

3,B) En Servicio:

| | | |
|---|---|---|
| Carga vertical N. (t/m) | | |
| Peso propio | 27.080 | |
| Peso tierras | 47.740 | |
| Ev2 | 0.000 | |
| Carga perma | 15.027 | |
| Sc. vertical | 10.931 | |
| Pretensado | 0.000 | |
| TOTAL | | 100.778 |
| Momento M. (m.t/m) | | |
| Peso propio | 18.476 | |
| Peso tierras | -41.727 | |
| M Ev2 | 0.000 | |
| Carga perma | 20.287 | |
| Sc. vertical | 14.757 | |
| Pretensado | 0.000 | |
| Empuje horiz | 71.220 | |
| Sobrecarga h | 12.839 | |
| TOTAL | | 95.851 |

| | |
|---|---|
| Ancho zapata (m)= | 4.80 |
| σmax= | 42.02 (ton/m2) |
| σmin= | 0.00 (ton/m2) |
| σcob= | 31.51 (ton/m2) |
| σmed= | 21.01 (ton/m2) |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1511.3 E-1 y E-2 ; E-1505.0 E-2

CALCULO ESTRIBOS CERRADOS

CALCULOS

## 4) ESFUERZOS DE DISEÑO

### 4,A) Esfuerzos en el muro.

| Seccion | Base | 1/3 H2 |
|---|---|---|
| h(m) | 0 | 1.79 |
| Canto (m.) | 0.9 | 0.9 |
| M cargas verti | -1.298 | -1.298 |
| M cargas horiz | 10.826 | 7.218 |
| M peso propio | -1.585 | -1.585 |
| M empuje hori | 49.134 | 21.860 |
| M empuje vert | 0.000 | 0.000 |
| **Md (mt/m)** | **85.616** | **39.292** |
| V cargas horiz | 2.012 | 2.012 |
| V empuje hori | 24.858 | 11.350 |
| **Vd (t/m)** | **40.305** | **20.044** |
| Ndmax(t/m) | 60.43 | 54.38 |
| Ndmin(t/m) | 12.90 | 9.27 |

### 4,B) Esfuerzos en el murete.

| Seccion | Base murete |
|---|---|
| h(m) | 5.38 |
| Canto (m.) | 0.3 |
| M empuje horizontal | 1.138 |
| **Md (mt/m)** | **1.707** |
| V empuje horizontal | 1.634 |
| **Vd (t/m)** | **2.451** |
| Nd (t/m) | 1.33 |

### 4,C) Esfuerzos en la puntera.

(momentos (+) implica tracciones en cara inferior)

| Seccion | Cara intrados |
|---|---|
| Distancia a vuelco | 0.7 |
| M peso propio | -0.613 |
| M tens.terreno | 9.794 |
| **Md puntera(mt/m)** | **13.772** |
| Posicion seccion S2 cortante | 0.225 |
| Canto util seccion S2 | 0.338 |
| V peso propio | -0.563 |
| V tens.terreno | 9.233 |
| **Vd en puntera(t/m)** | **13.005** |

### 4,D) Esfuerzos en el talon

(momentos (+) implica tracciones en cara superior)

| Seccion | Cara trasdos |
|---|---|
| Distancia a vuelco | 1.6 |
| M tierras | 87.08 |
| M peso propio | 15.31 |
| M tens.terreno | -47.693 |
| **Md talon(mt/m)** | **82.049** |
| Posicion seccion S2 cortant | 2.550 |
| Canto util seccion S2 | 0.950 |
| V tierras | 34.78 |
| V peso propio | 6.38 |
| V tens.terreno | -22.109 |
| **Vd en talon(t/m)** | **28.573** |
| Cortante base | 40.305 |
| Area comp.cim.talon/total | 0.524 |
| **Traccion superior d. (t/m)** | **21.115** |



NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1511.3 E-1 y E-2 ; E-1505.0 E-2

CALCULO ESTRIBOS CERRADOS

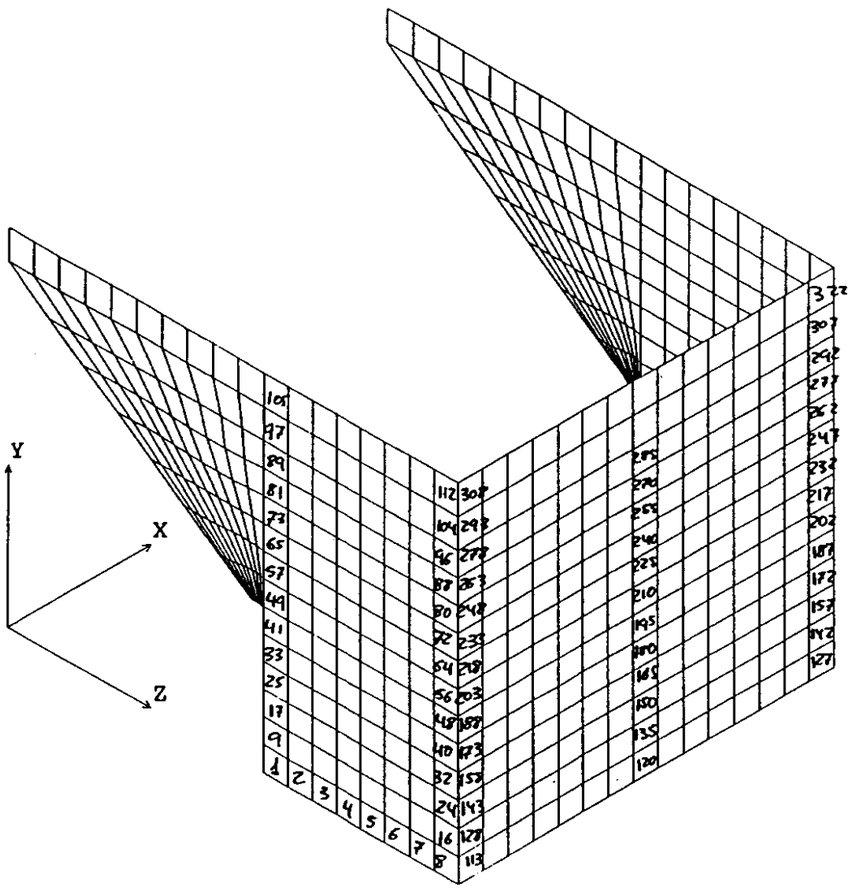
## 5) CALCULO DE SECCIONES

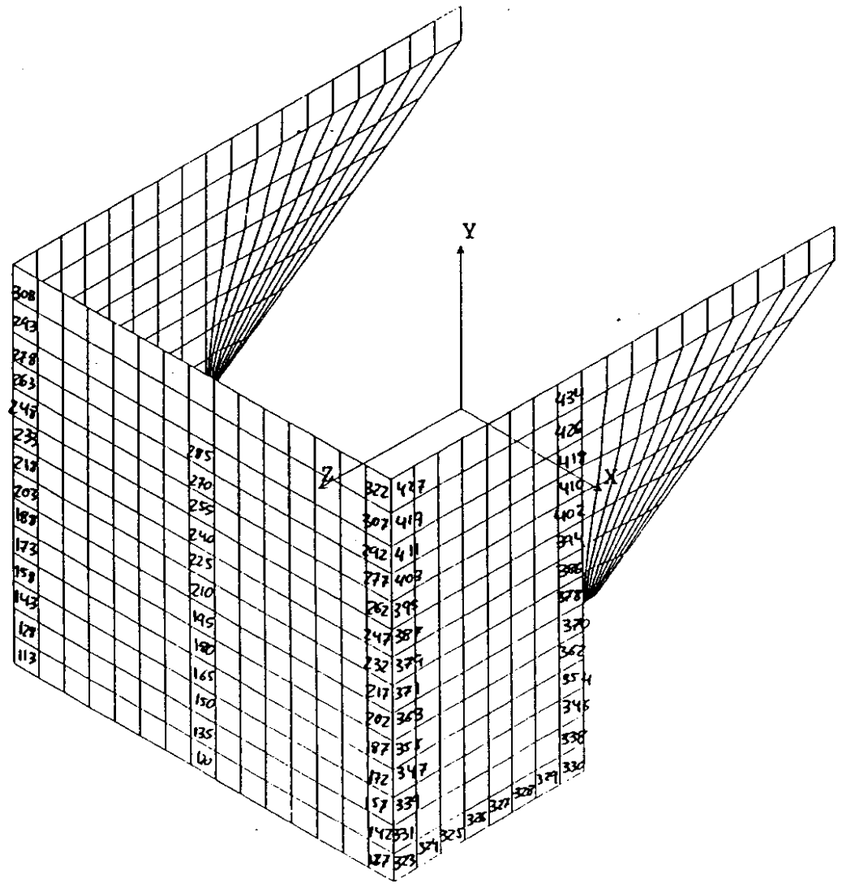
| Elementos | Seccion: Designacion | b(m.) | d(m.) | Esfuerzos de diseño: Md(m.ton) | Nd(ton.) | Vd(ton.) |
|---|---|---|---|---|---|---|
| MURO | 0-0 | 1.00 | 0.90 | 85.62 | - | 40.30 |
| | 1-1 | 1.00 | 0.90 | 39.29 | - | 20.04 |
| PUNTERA | 2-2 | 1.00 | 1.00 | 13.77 | - | 13.01 |
| TALÓN | 3-3 | 1.00 | 1.00 | 82.05 | - | 28.57 |
| MURETE | 4-4 | 1.00 | 0.30 | 1.71 | - | 2.45 |

| Elementos | Designacion armaduras | Nombre Seccion | ARMADURA(cm2/m): Necesaria | Minima | Adoptada |
|---|---|---|---|---|---|
| MURO | Asv1 | 0-0 | 20.65 | 5.40 | 20.65 |
| | Asv1 | 1-1 | 9.24 | 5.40 | 9.24 |
| | Asv3 | - | 0.00 | 2.70 | 2.70 |
| | Ash1 | - | 0.00 | 7.20 | 7.20 |
| | Ash2 | - | 0.00 | 7.20 | 7.20 |
| | Cortante | 0-0 | 0.00 | 0.00 | 0.00 |
| PUNTERA | As inf L. | 2-2 | 0.57 | 7.24 | 7.24 |
| | As inf T. | - | 2.86 | 7.24 | 7.24 |
| | Cortante | S2 | 0.00 | 0.00 | 0.00 |
| TALÓN | As sup L. | 3-3 | 4.33 | 7.24 | 7.24 |
| | As sup T. | - | 21.66 | 7.24 | 21.66 |
| | Cortante | S2 | 0.00 | 0.00 | 0.00 |
| MURETE | Asv2 | 4-4 | 1.35 | 1.35 | 1.35 |
| | Asv4 | - | 0.00 | 1.35 | 1.35 |
| | Ash3 | - | 0.00 | 2.40 | 2.40 |
| | Ash4 | - | 0.00 | 2.40 | 2.40 |

NOTA: las armaduras longitudinales en talón y puntera que aparecen en las casillas de armadura "necesaria" han sido obtenidas multiplicando la armadura transversal por el coeficiente de poisson.

**ESTRIBO**
**MODELO TRIDIMENSIONAL**
**NUMERACION DE ELEMENTOS**



## CALCULO DE ARMADURAS EN ESTRIBOS (modelo 3-D)

**Proyecto :** Línea de Alta Velocidad = Madrid - Barcelona - Frontera Francesa
**Nombre obra :** Estribos

----->(ver espacio a la derecha para pasar a FAGUS2 )

| | |
|---|---|
| Directorio del grupo: | G:\GIF\fagus |
| Nombre obra: | ESTRIO |

### CALCULO ARMADURAS VERTICALES

| ZONA | FAJA | Elemento Nº | Ny,d ( T/m ) | My,d ( mT/m ) | Vy,d ( T/m ) | Canto elemento (m ) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BORDE | 1 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |
| | | 9 | 32.69 | -37.14 | 50.27 | 0.62 | 6.30 | Vale | 19.25 | 1.00 |
| | | 17 | 21.11 | -25.73 | 47.30 | 0.60 | 5.76 | Vale | 13.51 | 1.00 |
| | | 25 | 10.95 | -18.10 | 46.04 | 0.58 | 6.02 | Vale | 9.32 | 1.00 |
| | | 33 | 0.99 | -12.69 | 46.33 | 0.56 | 7.12 | Vale | 6.95 | 1.00 |
| | | 41 | -10.14 | -9.00 | 47.46 | 0.54 | 8.77 | Vale | 5.07 | 1.00 |
| | | 49 | -9.90 | -2.85 | 22.85 | 0.52 | 0.00 | Vale | 1.00 | 1.00 |
| | | 57 | -8.38 | 0.12 | 14.80 | 0.49 | 0.00 | Vale | 1.00 | 1.00 |
| | | 65 | -7.00 | 1.08 | 9.97 | 0.47 | 0.00 | Vale | 1.00 | 1.00 |
| | | 73 | -5.78 | 1.29 | 6.50 | 0.45 | 0.00 | Vale | 1.00 | 1.00 |
| | | 81 | -4.60 | 1.16 | 3.93 | 0.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 89 | -3.49 | 0.85 | 2.07 | 0.41 | 0.00 | Vale | 1.00 | 1.00 |
| MURO IZQUIERDO | BASE | 1 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |
| | | 2 | 21.62 | -47.82 | 37.06 | 0.64 | 0.00 | Vale | 21.85 | 1.00 |
| | | 3 | 9.18 | -37.59 | 24.05 | 0.64 | 0.00 | Vale | 16.17 | 1.00 |
| | | 4 | 1.24 | -27.81 | 14.89 | 0.64 | 0.00 | Vale | 11.24 | 1.00 |
| | | 5 | -5.08 | -19.19 | 8.29 | 0.64 | 0.00 | Vale | 7.00 | 1.00 |
| | | 6 | -11.58 | -12.01 | 3.25 | 0.64 | 0.00 | Vale | 3.35 | 1.00 |
| | | 7 | -20.46 | -6.52 | -0.59 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 8 | -37.01 | -3.37 | -3.46 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BORDE | 330 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |
| | | 338 | 32.69 | -37.14 | 50.27 | 0.62 | 6.30 | Vale | 19.26 | 1.00 |
| | | 346 | 21.11 | -25.73 | 47.30 | 0.60 | 5.76 | Vale | 13.51 | 1.00 |
| | | 354 | 10.95 | -18.10 | 46.04 | 0.58 | 6.02 | Vale | 9.32 | 1.00 |
| | | 362 | 0.99 | -12.69 | 46.33 | 0.56 | 7.12 | Vale | 6.95 | 1.00 |
| | | 370 | -10.14 | -9.00 | 47.46 | 0.54 | 8.77 | Vale | 5.07 | 1.00 |
| | | 378 | -9.90 | -2.85 | 22.85 | 0.52 | 0.00 | Vale | 1.00 | 1.00 |
| | | 386 | -8.38 | 0.12 | 14.80 | 0.49 | 0.00 | Vale | 1.00 | 1.00 |
| | | 394 | -7.00 | 1.08 | 9.97 | 0.47 | 0.00 | Vale | 1.00 | 1.00 |
| | | 402 | -5.78 | 1.29 | 6.50 | 0.45 | 0.00 | Vale | 1.00 | 1.00 |
| | | 410 | -4.60 | 1.16 | 3.93 | 0.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 418 | -3.49 | 0.85 | 2.07 | 0.41 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BASE | 323 | -37.01 | -3.37 | -3.46 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 324 | -20.46 | -6.52 | -0.59 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 325 | -11.58 | -12.01 | 3.25 | 0.64 | 0.00 | Vale | 3.35 | 1.00 |
| | | 326 | -5.08 | -19.19 | 8.29 | 0.64 | 0.00 | Vale | 7.00 | 1.00 |
| | | 327 | 1.24 | -27.81 | 14.89 | 0.64 | 0.00 | Vale | 11.24 | 1.00 |
| | | 328 | 9.18 | -37.59 | 24.05 | 0.64 | 0.00 | Vale | 16.17 | 1.00 |
| | | 329 | 21.62 | -47.82 | 37.06 | 0.64 | 0.00 | Vale | 21.85 | 1.00 |
| | | 330 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |





## CALCULO DE ARMADURAS EN ESTRIBOS (modelo 3-D)

**Proyecto :** Línea de Alta Velocidad = Madrid - Barcelona - Frontera Francesa
**Nombre obra :** Estribos

### CALCULO DE ARMADURAS HORIZONTALES

| ZONA MURO FRONTAL | FAJA BIS.IZDA | Elemento | Nx ( T/m ) | Mx ( mT/m ) | Vx ( T/m ) | Canto elemento (m ) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BISAGRA | 8 | -6.54 | -1.63 | 2.26 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 16 | 0.10 | -3.76 | 2.79 | 0.62 | 0.00 | Vale | 1.51 | 1.00 |
| | | 24 | 5.23 | -6.81 | -0.29 | 0.60 | 0.00 | Vale | 3.47 | 1.00 |
| | | 32 | 9.06 | -10.49 | -4.11 | 0.58 | 0.00 | Vale | 6.68 | 1.00 |
| | | 40 | 11.82 | -14.21 | -7.62 | 0.56 | 0.00 | Vale | 7.84 | 1.00 |
| | | 48 | 13.65 | -17.56 | -10.35 | 0.54 | 0.00 | Vale | 10.10 | 1.00 |
| | | 56 | 14.81 | -20.28 | -12.14 | 0.52 | 0.00 | Vale | 12.04 | 1.00 |
| | | 64 | 15.56 | -22.29 | -13.00 | 0.49 | 0.00 | Vale | 13.75 | 1.00 |
| | | 72 | 15.94 | -23.68 | -13.16 | 0.47 | 0.00 | Vale | 15.23 | 1.00 |
| | | 80 | 15.36 | -24.86 | -14.41 | 0.45 | 0.00 | Vale | 16.65 | 1.00 |
| | | 88 | 12.92 | -25.72 | -17.80 | 0.43 | 0.00 | Vale | 17.84 | 1.00 |
| | | 96 | 7.52 | -25.29 | -24.45 | 0.41 | 0.83 | Vale | 17.99 | 1.00 |
| MURO IZQUIERDO | BISAGRA | 104 | 9.75 | -17.77 | -10.06 | 0.39 | 0.00 | Vale | 13.83 | 1.00 |
| | | 112 | 6.91 | -10.39 | 0.78 | 0.36 | 0.00 | Vale | 8.72 | 1.00 |
| MURO DERECHO | BISAGRA | 323 | -6.54 | -1.63 | -2.26 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 331 | 0.10 | -3.76 | -2.79 | 0.62 | 0.00 | Vale | 1.51 | 1.00 |
| | | 339 | 5.23 | -6.81 | 0.29 | 0.60 | 0.00 | Vale | 3.47 | 1.00 |
| | | 347 | 9.06 | -10.49 | 4.11 | 0.58 | 0.00 | Vale | 6.68 | 1.00 |
| | | 355 | 11.82 | -14.21 | 7.62 | 0.56 | 0.00 | Vale | 7.84 | 1.00 |
| | | 363 | 13.65 | -17.56 | 10.35 | 0.54 | 0.00 | Vale | 10.10 | 1.00 |
| | | 371 | 14.81 | -20.28 | 12.14 | 0.52 | 0.00 | Vale | 12.04 | 1.00 |
| | | 379 | 15.56 | -22.29 | 13.00 | 0.49 | 0.00 | Vale | 13.75 | 1.00 |
| | | 387 | 15.94 | -23.68 | 13.16 | 0.47 | 0.00 | Vale | 15.23 | 1.00 |
| | | 395 | 15.36 | -24.86 | 14.41 | 0.45 | 0.00 | Vale | 16.65 | 1.00 |
| | | 403 | 12.92 | -25.72 | 17.80 | 0.43 | 0.00 | Vale | 17.84 | 1.00 |
| | | 411 | 7.52 | -25.29 | 24.45 | 0.41 | 0.83 | Vale | 17.99 | 1.00 |
| MURO DERECHO | BISAGRA | 419 | 9.75 | -17.77 | 10.06 | 0.39 | 0.00 | Vale | 13.83 | 1.00 |
| | | 427 | 6.91 | -10.39 | -0.78 | 0.36 | 0.00 | Vale | 8.72 | 1.00 |
| MURO FRONTAL | BIS.IZDA | 113 | -10.55 | -2.21 | -0.41 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 128 | -4.67 | -3.33 | 0.75 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 143 | 0.22 | -6.01 | 4.17 | 0.90 | 0.00 | Vale | 1.63 | 1.00 |
| | | 158 | 5.21 | -9.47 | 7.84 | 0.90 | 0.00 | Vale | 3.16 | 1.00 |
| | | 173 | 9.60 | -13.09 | 10.97 | 0.90 | 0.00 | Vale | 4.65 | 1.00 |
| | | 188 | 12.89 | -16.38 | 13.35 | 0.90 | 0.00 | Vale | 6.93 | 1.00 |
| | | 203 | 14.96 | -19.04 | 15.06 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 218 | 15.90 | -20.89 | 16.31 | 0.90 | 0.00 | Vale | 7.51 | 1.00 |
| | | 233 | 15.94 | -21.62 | 17.06 | 0.90 | 0.00 | Vale | 7.72 | 1.00 |
| | | 248 | 15.45 | -18.83 | 14.32 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 263 | 18.69 | -30.69 | 10.94 | 1.16 | 0.00 | Vale | 8.48 | 1.00 |
| | | 278 | 28.83 | -51.26 | 9.04 | 1.36 | 0.00 | Vale | 12.31 | 1.00 |
| MURO FRONTAL | BIS IZDA | 293 | 6.43 | -3.34 | 9.45 | 0.30 | 0.00 | Vale | 3.86 | 1.00 |
| | | 308 | 5.97 | -6.62 | 10.90 | 0.30 | 0.00 | Vale | 6.99 | 1.00 |
| MURO FRONTAL | BIS DCHA | 127 | -10.55 | -2.21 | 0.41 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 142 | -4.67 | -3.33 | -0.75 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 157 | 0.22 | -6.01 | -4.17 | 0.90 | 0.00 | Vale | 1.63 | 1.00 |
| | | 172 | 5.21 | -9.47 | -7.84 | 0.90 | 0.00 | Vale | 3.16 | 1.00 |
| | | 187 | 9.60 | -13.09 | -10.97 | 0.90 | 0.00 | Vale | 4.65 | 1.00 |
| | | 202 | 12.89 | -16.38 | -13.35 | 0.90 | 0.00 | Vale | 6.93 | 1.00 |
| | | 217 | 14.96 | -19.04 | -15.06 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 232 | 15.90 | -20.89 | -16.31 | 0.90 | 0.00 | Vale | 7.51 | 1.00 |
| | | 247 | 15.94 | -21.62 | -17.06 | 0.90 | 0.00 | Vale | 7.72 | 1.00 |
| | | 262 | 15.45 | -18.83 | -14.32 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 277 | 18.69 | -30.69 | -10.94 | 1.16 | 0.00 | Vale | 8.48 | 1.00 |
| | | 292 | 28.83 | -51.26 | -9.04 | 1.36 | 0.00 | Vale | 12.31 | 1.00 |
| MURO FRONTAL | BIS DCHA | 307 | 6.43 | -3.34 | -9.45 | 0.30 | 0.00 | Vale | 3.86 | 1.00 |
| | | 322 | 5.97 | -6.62 | -10.90 | 0.30 | 0.00 | Vale | 6.99 | 1.00 |
| MURO FRONTAL | CENTRAL | 120 | -3.27 | -1.48 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 135 | -2.36 | -0.19 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 150 | -0.59 | 0.76 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 165 | 1.85 | 1.41 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 180 | 4.66 | 1.79 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.02 |
| | | 195.00 | 7.60 | 1.89 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.39 |
| | | 210.00 | 10.44 | 1.76 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.67 |
| | | 225.00 | 13.10 | 1.44 | 0.00 | 0.90 | 0.00 | Vale | 1.88 | 1.88 |
| | | 240.00 | 15.55 | 0.95 | 0.00 | 0.90 | 0.00 | Vale | 2.02 | 2.02 |
| | | 255.00 | 17.88 | 0.28 | 0.00 | 0.90 | 0.00 | Vale | 2.09 | 2.09 |
| | | 270.00 | 26.71 | -0.59 | 0.00 | 1.16 | 0.00 | Vale | 3.14 | 3.14 |
| | | 285.00 | 35.78 | -1.57 | 0.00 | 1.36 | 0.00 | Vale | 4.32 | 4.32 |

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 3.00

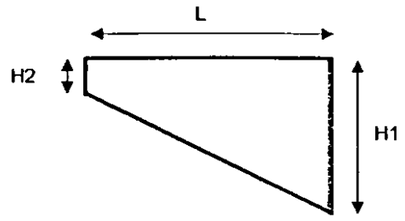
## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 2.50
H2= 0.50
L= 3

Espesor= 0.35
Recubrim.= 0.05




**CARACTERISTICAS DE TERRENO**

| | |
|---|---|
| Peso tierras(T/m3) | γ= 2.0 |
| Angulo rozamiento interno (°) | φ= 30 |
| Ang. rozamiento tierras muro (°) | δ= 0 |

**COEFICIENTES DE SEGURIDAD**

| | |
|---|---|
| Mayoracion de cargas | γf= 1.50 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.50 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γη= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hormigon (T/m2) | Fck= 2500 |

**CARGAS (valores sin mayorar)**

Cargas verticales

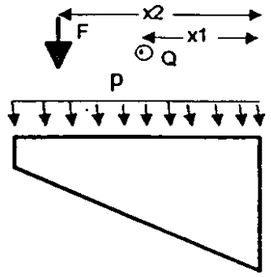
| | |
|---|---|
| Sobrecarga vertical (t/m) | p= 1.24 |
| Carga vertical (t.) | F= 0.00 |
| Situacion x2 (m) | x2= 0 |

Cargas horizontales

| | |
|---|---|
| Carga horizontal (t.) | Q= 0 |
| Posicion x1 (m) | x1= 0 |

Sobrecarga sobre terreno (ton/m2)

q= 1.00




**CUANTIAS MINIMAS**

| | |
|---|---|
| LONGITUDINAL SUPERIOR | 0.400 o/oo |
| LONGITUDINAL INFERIOR | 0.400 o/oo |
| CORTANTE | 2.778 CM2/M |
| HORIZONTAL MUROS ALETA | 0.900 o/oo |
| VERTICAL MUROS ALETA | 1.600 o/oo |
| CORTANTE MUROS | 0.000 CM2/M |

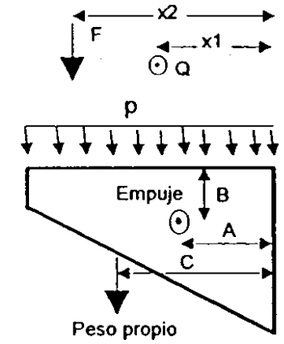
ALETA3-00.xls CALCULOS

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 3.00

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)




**COEFICIENTES EMPUJE ACTIVO ALETA**

| | |
|---|---|
| Coef. empuje activo λh= | 0.333 |
| Coef. empuje activo λv= | 0.000 |

**PESO PROPIO**

| | Peso | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Peso aux. 1 | 1.313 | 1.500 | 0.250 |
| Peso aux. 2 | 2.625 | 1.000 | 1.167 |
| Peso propio | **3.938** | **1.167** | **0.861** |

**EMPUJE DE TIERRAS**

HORIZONTAL

| | Empuje. | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Auxiliar | 0.083 | 2.250 | - |
| Auxiliar | 0.417 | 1.500 | - |
| Auxiliar | 2.083 | 0.750 | - |
| Auxiliar | 0.250 | 2.000 | - |
| Auxiliar | 1.250 | 1.000 | - |
| Empuje hor. | **4.083** | **1.010** | **1.112** |

VERTICAL

| | Empuje. | Dist.emp. |
|---|---|---|
| Empuje aux.1 | 0.000 | 2.250 |
| Empuje aux.2 | 0.000 | 1.500 |
| Empuje aux.3 | 0.000 | 0.750 |
| Empuje aux.4 | 0.000 | 2.000 |
| Empuje aux.5 | 0.000 | 1.000 |
| Empuje vert. | **0.000** | **0.000** |

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 3.00

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### CALCULOS

**ESFUERZOS DE DISEÑO**

**(Para cargas verticales, momentos positivos implica tracciones en cara superior)**

| Acciones | Verticales | Horizontales |
|---|---|---|
| M peso propio | 4.594 | 0.000 |
| M empuje hor. | 0.000 | 4.125 |
| M empuje vert. | 0.000 | 0.000 |
| M sobrec.vert. | 5.591 | 0.000 |
| M carga vert. | 0.000 | 0.000 |
| M carga hor. | 0.000 | 0.000 |
| **Md (mt)** | **15.278** | **6.188** |
| V peso propio | 3.938 | 0.000 |
| V empuje hor. | 0.000 | 4.083 |
| V empuje vert. | 0.000 | 0.000 |
| V sobrec.vert. | 3.728 | 0.000 |
| V carga vert. | 0.000 | 0.000 |
| V carga hor. | 0.000 | 0.000 |
| **Vd (mt)** | **11.498** | **6.125** |

**CALCULO DE SECCIONES**

| | | | |
|---|---|---|---|
| Fcd | 1666.67 | | |
| 0,85*Fcd | 1416.67 | | |
| Fcv | 64.55 | | |
| Es | 21000000 | | |
| Fyd | 44347.83 | | |
| FYAD | 42000.00 | | |
| Acciones | Verticales | Horizontales | |
| Md(m.t) | 15.278 | 6.188 | |
| Md max/Md med | 1.000 | 1.610 | |
| Md a usar calculo | 15.278 | 9.961 | |
| Canto seccion | 2.500 | 0.350 | |
| Canto util | 2.450 | 0.300 | |
| ancho seccion | 0.350 | 2.500 | |
| Ancho calculo | 0.350 | 2.475 | |
| Def acero | 0.010 | 0.010 | |
| Tension acero | 44348 | 44348 | |
| X | 0.013 | 0.010 | |
| As (cm.2) | 1.410 | 7.609 | |
| Prof. fibra neutra | 0.172 | 0.029 | |
| Def. hormigon | 0.001 | 0.001 | |
| Comentarios | VALE | VALE | |
| Vd | 11.498 | 6.125 | |
| Vd compuesto | | | 13.027 |

ALETA3-00.xls CALCULOS

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 3.00

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

| | |
|---|---|
| Vu1 | 371.217 |
| Vsu | 0.000 |
| Vcu | 47.924 |
| Vu2 | 47.924 |
| Comentarios | |
| **As (cm.2)** | **0.000** |

### ARMADO

| | Calculo | Minima | total |
|---|---|---|---|
| Long. superior | 1.410 | 3.500 | **3.500** |
| Long inferior | 0.000 | 3.500 | **3.500** |
| Cortante | 0.000 | 8.333 | **8.333** |
| Horizontal trasdos | 7.609 | 3.938 | **7.609** |
| Vertical trasdos | 0.000 | 8.400 | **8.400** |
| Horizontal intrados | 0.000 | 3.938 | **3.938** |
| Vertical intrados | 0.000 | 8.400 | **8.400** |
| Cortante transversal | | NO | |

**TOTAL ENVOLVENTE ARMADURA**

| | cm2 | cm2/m |
|---|---|---|
| **Long. superior** | **3.500** | — |
| **Long inferior** | **3.500** | — |
| **Horizontal trasdos** | **7.609** | **3.044** |
| **Horizontal intrados** | **3.938** | **1.575** |
| **Estribos por rama (2 ramas)** | **12.567** | **4.189** |

| DATOS ARMADO | |
|---|---|
| Separacion maxima barras | 0.3 |
| Separacion minima barras | 0.1 |

**TOTAL ARMADURAS**

| | TOTAL | DIAMETRO | A.REAL | AREAL/ANEC | |
|---|---|---|---|---|---|
| **Long. superior** | 2.0 | 16 | 4.02 | 1.15 | VALE |
| **Long inferior** | 2.0 | 16 | 4.02 | 1.15 | VALE |
| **Horizontal trasdos** | 11.0 | 10 | 8.64 | 1.14 | VALE |
| **Horizontal intrados** | 11.0 | 10 | 8.64 | 2.19 | VALE |
| **Estribos** | 17.0 | 10 | 13.35 | 1.06 | VALE |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1514.2 E-1 y E-2

## CALCULO ESTRIBOS CERRADOS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 1.77
H2= 5.38
H3= 1.00
Htierras= 7.15
B1= 0.70
B2= 0.90
B3= 3.50

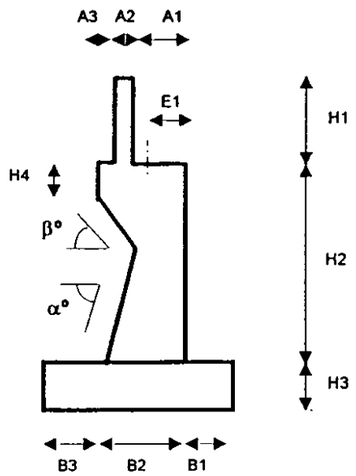
A1= 1.05
A2= 0.3
A3= 0.01

H4= 0.55
α(grados)= 90
β(grados)= 45
E1= 0.5

Longitud= 1
Recubrim.= 0.05

Puntera
Zapata tipo I

Talón
Zapata tipo III




**CARACTERISTICAS DE TERRENO**

| | | |
|---|---|---|
| Peso tierras(T/m3) | γ= | 2 |
| Angulo rozamiento interno | φ= | 30 |
| Coef.rozamiento zapata-terreno | μ= | 0.58 |
| Angulo. rozamiento tierras muro | δ= | 0 |
| Tension admisible.(T/m2) | σ= | 32 |

**COEFICIENTES DE SEGURIDAD**

| | | |
|---|---|---|
| Mayoracion de cargas | γf= | 1.5 |
| Seguridad al deslizamiento | Csd= | 1.5 |
| Seguridad al vuelco | Csv= | 1.5 |
| Minoracion acero | gs= | 1.15 |
| Minoracion hormigon | gc= | 1.5 |

**CARACTERISTICAS DE LOS MATERIALES**

| | | |
|---|---|---|
| Peso especifico hgon(T/m3) | γη= | 2.5 |
| Resistencia acero (T/m2) | Fyk= | 51000 |
| Resistencia hgon. ciment. (T/m2) | Fck1= | 2500 |
| Resistencia hgon. alzado (T/m2) | Fck2= | 2500 |

**CARGAS TRANSMITIDAS POR LA ESTRUCTURA(valores sin mayorar)**

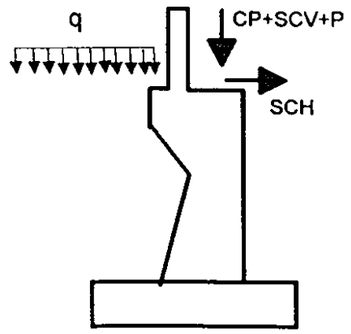
Cargas verticales(ton/m)

| | | |
|---|---|---|
| Cargas permanentes | CP= | 15.03 |
| Sobrecargas | SCV= | 10.93 |
| Pretensado | P= | 0.00 |

Cargas horizontales(ton/m)

| | | |
|---|---|---|
| Sobrecargas horizontales | SCH= | 2.01 |

Sobrecarga(ton/m2) q= 1.00






NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

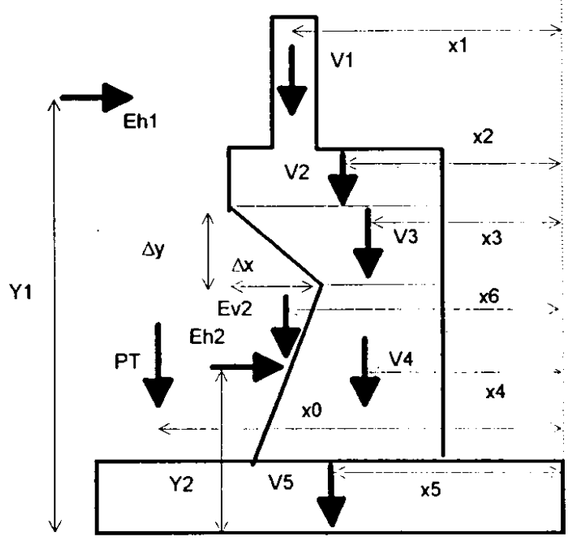
DESIGNACION ESTRIBO: E-1514.2 E-1 y E-2

CALCULO ESTRIBOS CERRADOS

### CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)

Resultados intermedios:

Δx= 0.460
Δy= 0.460




**COEFICIENTES EMPUJE ACTIVO ALZADO MURO**

Coef. empuje activo λh= 0.333
Coef. empuje activo λv= 0.000

**COEFICIENTES EMPUJE ACTIVO MURETE**

Coef. empuje activo λh= 0.333
Coef. empuje activo λv= 0.000

**PESO TIERRAS TRASDOS**

| | | | |
|---|---|---|---|
| PT= | **47.740** | x0= | 3.424 |

**PESO PROPIO**

| | | | |
|---|---|---|---|
| V1= | 1.328 | x1= | 1.900 |
| V2= | 1.870 | x2= | 1.380 |
| V3= | 1.300 | x3= | 1.273 |
| V4= | 9.833 | x4= | 1.150 |
| V5= | 12.750 | x5= | 2.550 |
| TOTAL PP= | **27.080** | | **1.868** |

**EMPUJES**

| | | | |
|---|---|---|---|
| Eh1= | 3.503 | Y1= | 6.419 |
| Eh2= | 15.921 | Y2= | 2.894 |
| Eh3= | 5.433 | Y3= | 0.490 |
| Empuje hor. | **24.858** | | **2.865** |
| Ev2= | **0.000** | x6= | 1.600 |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1514.2 E-1 y E-2

## CALCULO ESTRIBOS CERRADOS

### COMPROBACIONES

#### 1) SEGURIDAD AL DESLIZAMIENTO

$$C_{SD} = \frac{\sum_i \text{Fuerzas} - \text{opuestas}}{\sum_i \text{Fuerzas} - \text{deslizantes}}$$

1.A) En construccion:

| | | |
|---|---|---|
| Fuerzas opuestas | | |
| Peso propio | 15.706 | |
| Peso tierras | 27.689 | |
| Ev2 | 0.000 | |
| TOTAL | | 43.395 |
| Fuerzas deslizantes | | |
| Empuje horizontal | 24.858 | |
| TOTAL | | 24.858 |

**Csd= 1.75**

1.B) En Servicio:

| | | |
|---|---|---|
| Fuerzas opuestas | | |
| Peso propio | 15.706 | |
| Peso tierras | 27.689 | |
| Ev2 | 0.000 | |
| Carga perma | 8.716 | |
| TOTAL | | 52.111 |
| Fuerzas deslizantes | | |
| Empuje horiz | 24.858 | |
| Sobrecarga h | 2.012 | |
| TOTAL | | 26.870 |

**Csd= 1.94**

#### 2) SEGURIDAD AL VUELCO

$$C_{SV} = \frac{\sum_i \text{Momentos} - \text{estabilizadores}}{\sum_i \text{Momentos} - \text{volcadores}}$$

2.A) En construccion:

| | | |
|---|---|---|
| Mom.estabilizadores | | |
| Peso propio | 50.577 | |
| Peso tierras | 163.465 | |
| M Ev2 | 0.000 | |
| TOTAL | | 214.041 |
| Mom. volcadores | | |
| Empuje horizontal | 71.220 | |
| TOTAL | | 71.220 |

**Csv= 3.01**

2.B.) En Servicio:

| | | |
|---|---|---|
| Mom.estabilizadores | | |
| Peso propio | 50.577 | |
| Peso tierras | 163.465 | |
| M Ev2 | 0.000 | |
| Carga perma | 18.033 | |
| TOTAL | | 232.074 |
| Mom. volcadores | | |
| Empuje horiz | 71.220 | |
| Sobrecarga h | 12.839 | |
| TOTAL | | 84.058 |

**Csv= 2.76**

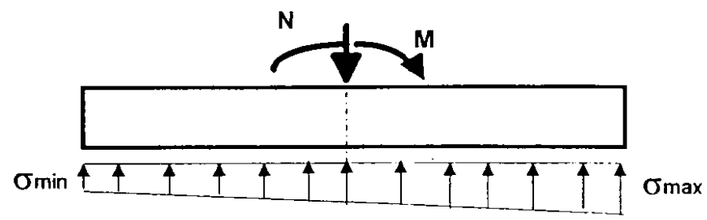


NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1514.2 E-1 y E-2

CALCULO ESTRIBOS CERRADOS

#### 3) TENSIONES MAXIMAS Y MINIMAS EN CIMENTACION




3,A) En construccion:

| | | |
|---|---|---|
| Carga vertical N. (t/m) | | |
| Peso propio | 27.080 | |
| Peso tierras | 47.740 | |
| Ev2 | 0.000 | |
| TOTAL | | 74.820 |
| Momento M. (m.t/m) | | |
| Peso propio | 18.476 | |
| Peso tierras | -41.727 | |
| M Ev2 | 0.000 | |
| Empuje horizontal | 71.220 | |
| TOTAL | | 47.969 |

| | |
|---|---|
| **Ancho zapata=** | **5.10** |
| **σmax=** | **25.74 (ton/m2)** |
| **σmin=** | **3.61 (ton/m2)** |
| **σcob=** | **19.60 (ton/m2)** |
| **σmed=** | **14.67 (ton/m2)** |

3,B) En Servicio:

| | | |
|---|---|---|
| Carga vertical N. (t/m) | | |
| Peso propio | 27.080 | |
| Peso tierras | 47.740 | |
| Ev2 | 0.000 | |
| Carga perma | 15.027 | |
| Sc. vertical | 10.931 | |
| Pretensado | 0.000 | |
| TOTAL | | 100.778 |
| Momento M. (m.t/m) | | |
| Peso propio | 18.476 | |
| Peso tierras | -41.727 | |
| M Ev2 | 0.000 | |
| Carga perma | 20.287 | |
| Sc. vertical | 14.757 | |
| Pretensado | 0.000 | |
| Empuje horiz | 71.220 | |
| Sobrecarga h | 12.839 | |
| TOTAL | | 95.851 |

| | |
|---|---|
| **Ancho zapata (m)=** | **4.80** |
| **σmax=** | **42.02 (ton/m2)** |
| **σmin=** | **0.00 (ton/m2)** |
| **σcob=** | **31.51 (ton/m2)** |
| **σmed=** | **21.01 (ton/m2)** |

NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1514.2 E-1 y E-2

CALCULO ESTRIBOS CERRADOS

CALCULOS

## 4) ESFUERZOS DE DISEÑO

### 4,A) Esfuerzos en el muro.

| Seccion | Base | 1/3 H2 |
|---|---|---|
| h(m) | 0 | 1.79 |
| Canto (m.) | 0.9 | 0.9 |
| M cargas verti | -1.298 | -1.298 |
| M cargas horiz | 10.826 | 7.218 |
| M peso propio | -1.585 | -1.585 |
| M empuje hori | 49.134 | 21.860 |
| M empuje vert | 0.000 | 0.000 |
| **Md (mt/m)** | **85.616** | **39.292** |
| V cargas horiz | 2.012 | 2.012 |
| V empuje hori | 24.858 | 11.350 |
| **Vd (t/m)** | **40.305** | **20.044** |
| Ndmax(t/m) | 60.43 | 54.38 |
| Ndmin(t/m) | 12.90 | 9.27 |

### 4,B) Esfuerzos en el murete.

| Seccion | Base murete |
|---|---|
| h(m) | 5.38 |
| Canto (m.) | 0.3 |
| M empuje horizontal | 1.138 |
| **Md (mt/m)** | **1.707** |
| V empuje horizontal | 1.634 |
| **Vd (t/m)** | **2.451** |
| Nd (t/m) | 1.33 |

### 4,C) Esfuerzos en la puntera.

(momentos (+) implica tracciones en cara inferior)

| Seccion | Cara intrados |
|---|---|
| Distancia a vuelco | 0.7 |
| M peso propio | -0.613 |
| M tens.terreno | 9.794 |
| **Md puntera(mt/m)** | **13.772** |
| Posicion seccion S2 cortante | 0.225 |
| Canto util seccion S2 | 0.338 |
| V peso propio | -0.563 |
| V tens.terreno | 9.233 |
| **Vd en puntera(t/m)** | **13.005** |

### 4,D) Esfuerzos en el talon

(momentos (+) implica tracciones en cara superior)

| Seccion | Cara trasdos |
|---|---|
| Distancia a vuelco | 1.6 |
| M tierras | 87.08 |
| M peso propio | 15.31 |
| M tens.terreno | -47.693 |
| **Md talon(mt/m)** | **82.049** |
| Posicion seccion S2 cortant | 2.550 |
| Canto util seccion S2 | 0.950 |
| V tierras | 34.78 |
| V peso propio | 6.38 |
| V tens.terreno | -22.109 |
| **Vd en talon(t/m)** | **28.573** |
| Cortante base | 40.305 |
| Area comp.cim.talon/total | 0.524 |
| **Traccion superior d. (t/m)** | **21.115** |



NOMBRE PROYECTO : LINEA DE ALTA VELOCIDAD MADRID - BARCELONA - FRONT. FRANCESA

DESIGNACION ESTRIBO: E-1514.2 E-1 y E-2

CALCULO ESTRIBOS CERRADOS

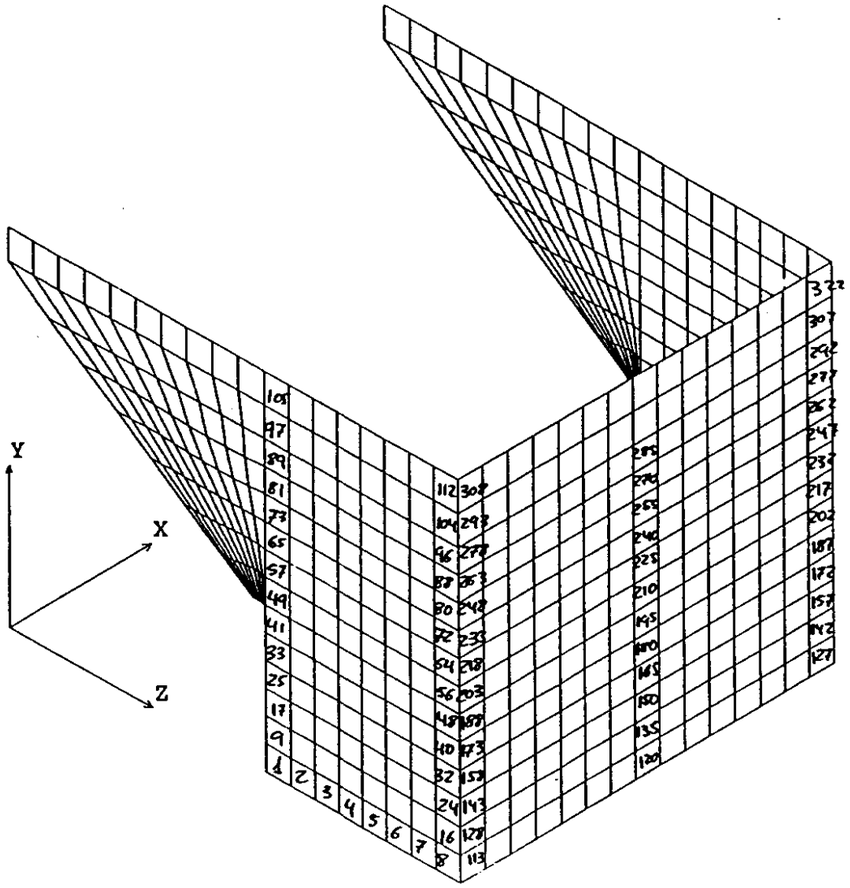
## 5) CALCULO DE SECCIONES

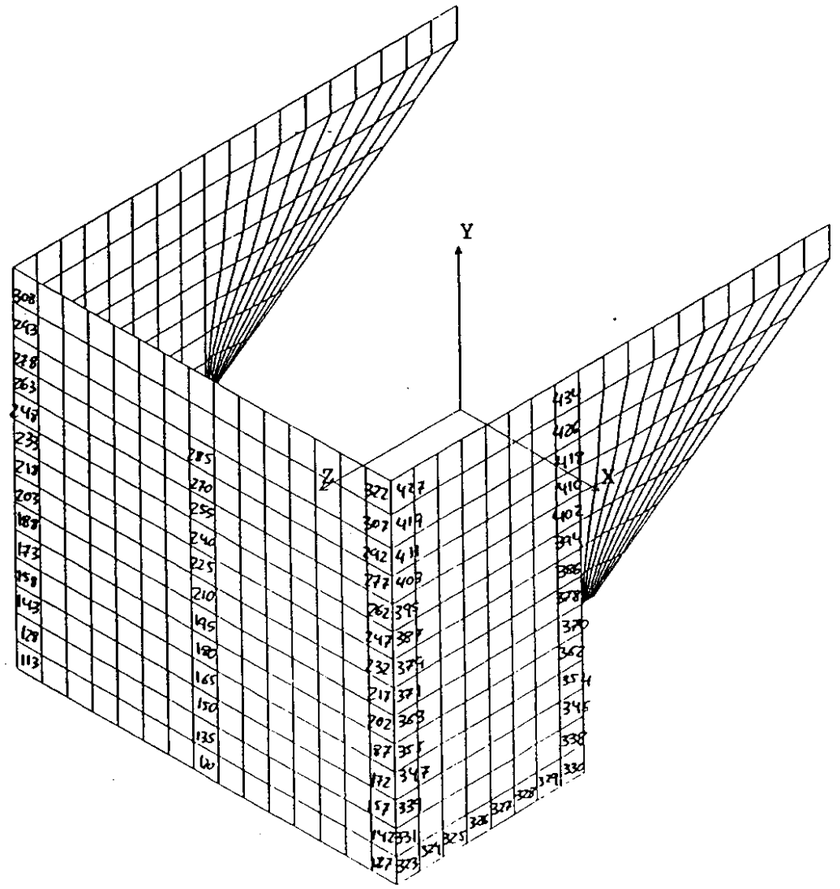
| Elementos | Seccion: Designacion | b(m.) | d(m.) | Esfuerzos de diseño: Md(m.ton) | Nd(ton.) | Vd(ton.) |
|---|---|---|---|---|---|---|
| MURO | 0-0 | 1.00 | 0.90 | 85.62 | - | 40.30 |
| | 1-1 | 1.00 | 0.90 | 39.29 | - | 20.04 |
| PUNTERA | 2-2 | 1.00 | 1.00 | 13.77 | - | 13.01 |
| TALÓN | 3-3 | 1.00 | 1.00 | 82.05 | - | 28.57 |
| MURETE | 4-4 | 1.00 | 0.30 | 1.71 | - | 2.45 |

| Elementos | Designacion armaduras | Nombre Seccion | ARMADURA(cm2/m): Necesaria | Minima | Adoptada |
|---|---|---|---|---|---|
| MURO | Asv1 | 0-0 | 20.65 | 5.40 | 20.65 |
| | Asv1 | 1-1 | 9.24 | 5.40 | 9.24 |
| | Asv3 | - | 0.00 | 2.70 | 2.70 |
| | Ash1 | - | 0.00 | 7.20 | 7.20 |
| | Ash2 | - | 0.00 | 7.20 | 7.20 |
| | Cortante | 0-0 | 0.00 | 0.00 | 0.00 |
| PUNTERA | As inf L. | 2-2 | 0.57 | 7.24 | 7.24 |
| | As inf T. | - | 2.86 | 7.24 | 7.24 |
| | Cortante | S2 | 0.00 | 0.00 | 0.00 |
| TALÓN | As sup L. | 3-3 | 4.33 | 7.24 | 7.24 |
| | As sup T. | - | 21.66 | 7.24 | 21.66 |
| | Cortante | S2 | 0.00 | 0.00 | 0.00 |
| MURETE | Asv2 | 4-4 | 1.35 | 1.35 | 1.35 |
| | Asv4 | - | 0.00 | 1.35 | 1.35 |
| | Ash3 | - | 0.00 | 2.40 | 2.40 |
| | Ash4 | - | 0.00 | 2.40 | 2.40 |

NOTA: las armaduras longitudinales en talón y puntera que aparecen en las casillas de armadura "necesaria" han sido obtenidas multiplicando la armadura transversal por el coeficiente de poisson.

**ESTRIBO**
**MODELO TRIDIMENSIONAL**
**NUMERACION DE ELEMENTOS**



## CALCULO DE ARMADURAS EN ESTRIBOS (modelo 3-D)

Proyecto : Línea de Alta Velocidad = Madrid - Barcelona - Frontera Francesa
Nombre obra : Estribos

—>(ver espacio a la derecha para pasar a FAGUS2 )

| | |
|---|---|
| Directorio del grupo: | G:\GIF\fagus |
| Nombre obra: | ESTRID |

### CALCULO ARMADURAS VERTICALES

| ZONA | FAJA | Elemento Nº | Ny,d (T/m) | My,d (mT/m) | Vy,d (T/m) | Canto elemento (m.) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BORDE | 1 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |
| | | 9 | 32.69 | -37.14 | 50.27 | 0.62 | 6.30 | Vale | 18.25 | 1.00 |
| | | 17 | 21.11 | -25.73 | 47.30 | 0.60 | 6.76 | Vale | 13.61 | 1.00 |
| | | 25 | 10.95 | -18.10 | 46.04 | 0.58 | 6.02 | Vale | 9.32 | 1.00 |
| | | 33 | 0.99 | -12.69 | 46.33 | 0.56 | 7.12 | Vale | 6.95 | 1.00 |
| | | 41 | -10.14 | -9.00 | 47.46 | 0.54 | 8.77 | Vale | 3.07 | 1.00 |
| | | 49 | -8.90 | -2.85 | 22.85 | 0.52 | 0.00 | Vale | 1.00 | 1.00 |
| | | 57 | -8.38 | 0.12 | 14.80 | 0.49 | 0.00 | Vale | 1.00 | 1.00 |
| | | 65 | -7.00 | 1.08 | 9.97 | 0.47 | 0.00 | Vale | 1.00 | 1.00 |
| | | 73 | -5.78 | 1.29 | 6.50 | 0.45 | 0.00 | Vale | 1.00 | 1.00 |
| | | 81 | -4.60 | 1.16 | 3.93 | 0.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 89 | -3.49 | 0.85 | 2.07 | 0.41 | 0.00 | Vale | 1.00 | 1.00 |
| MURO IZQUIERDO | BASE | 1 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |
| | | 2 | 21.62 | -47.82 | 37.06 | 0.64 | 0.00 | Vale | 21.85 | 1.00 |
| | | 3 | 9.18 | -37.59 | 24.05 | 0.64 | 0.00 | Vale | 16.17 | 1.00 |
| | | 4 | 1.24 | -27.81 | 14.89 | 0.64 | 0.00 | Vale | 11.24 | 1.00 |
| | | 5 | -5.08 | -19.19 | 8.29 | 0.64 | 0.00 | Vale | 7.00 | 1.00 |
| | | 6 | -11.58 | -12.01 | 3.25 | 0.64 | 0.00 | Vale | 3.35 | 1.00 |
| | | 7 | -20.46 | -6.52 | -0.59 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 8 | -37.01 | -3.37 | -3.46 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BORDE | 330 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |
| | | 338 | 32.69 | -37.14 | 50.27 | 0.62 | 6.30 | Vale | 18.25 | 1.00 |
| | | 346 | 21.11 | -25.73 | 47.30 | 0.60 | 6.76 | Vale | 13.61 | 1.00 |
| | | 354 | 10.95 | -18.10 | 46.04 | 0.58 | 6.02 | Vale | 9.32 | 1.00 |
| | | 362 | 0.99 | -12.69 | 46.33 | 0.56 | 7.12 | Vale | 6.95 | 1.00 |
| | | 370 | -10.14 | -9.00 | 47.46 | 0.54 | 8.77 | Vale | 3.07 | 1.00 |
| | | 378 | -8.90 | -2.85 | 22.85 | 0.52 | 0.00 | Vale | 1.00 | 1.00 |
| | | 386 | -8.38 | 0.12 | 14.80 | 0.49 | 0.00 | Vale | 1.00 | 1.00 |
| | | 394 | -7.00 | 1.08 | 9.97 | 0.47 | 0.00 | Vale | 1.00 | 1.00 |
| | | 402 | -5.78 | 1.29 | 6.50 | 0.45 | 0.00 | Vale | 1.00 | 1.00 |
| | | 410 | -4.60 | 1.16 | 3.93 | 0.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 418 | -3.49 | 0.85 | 2.07 | 0.41 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BASE | 323 | -37.01 | -3.37 | -3.46 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 324 | -20.46 | -6.52 | -0.59 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 325 | -11.58 | -12.01 | 3.25 | 0.64 | 0.00 | Vale | 3.35 | 1.00 |
| | | 326 | -5.08 | -19.19 | 8.29 | 0.64 | 0.00 | Vale | 7.00 | 1.00 |
| | | 327 | 1.24 | -27.81 | 14.89 | 0.64 | 0.00 | Vale | 11.24 | 1.00 |
| | | 328 | 9.18 | -37.59 | 24.05 | 0.64 | 0.00 | Vale | 16.17 | 1.00 |
| | | 329 | 21.62 | -47.82 | 37.06 | 0.64 | 0.00 | Vale | 21.85 | 1.00 |
| | | 330 | 46.89 | -54.87 | 56.27 | 0.64 | 8.17 | Vale | 27.64 | 1.00 |





## CALCULO DE ARMADURAS EN ESTRIBOS (modelo 3-D)

Proyecto : Línea de Alta Velocidad = Madrid - Barcelona - Frontera Francesa
Nombre obra : Estribos

### CALCULO DE ARMADURAS HORIZONTALES

| ZONA MURO FRONTAL | FAJA BIS.IZDA | Elemento | Nx (T/m) | Mx (mT/m) | Vx (T/m) | Canto elemento (m.) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BISAGRA | 8 | -6.54 | -1.63 | 2.26 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 16 | 0.10 | -3.76 | 2.79 | 0.62 | 0.00 | Vale | 1.51 | 1.00 |
| | | 24 | 5.23 | -6.81 | -0.29 | 0.60 | 0.00 | Vale | 3.47 | 1.00 |
| | | 32 | 9.08 | -10.49 | -4.11 | 0.58 | 0.00 | Vale | 6.68 | 1.00 |
| | | 40 | 11.82 | -14.21 | -7.62 | 0.56 | 0.00 | Vale | 7.84 | 1.00 |
| | | 48 | 13.65 | -17.56 | -10.35 | 0.54 | 0.00 | Vale | 10.10 | 1.00 |
| | | 56 | 14.81 | -20.28 | -12.14 | 0.52 | 0.00 | Vale | 12.04 | 1.00 |
| | | 64 | 15.56 | -22.29 | -13.00 | 0.49 | 0.00 | Vale | 13.75 | 1.00 |
| | | 72 | 15.94 | -23.68 | -13.16 | 0.47 | 0.00 | Vale | 15.23 | 1.00 |
| | | 80 | 15.36 | -24.86 | -14.41 | 0.45 | 0.00 | Vale | 16.65 | 1.00 |
| | | 88 | 12.92 | -25.72 | -17.80 | 0.43 | 0.00 | Vale | 17.84 | 1.00 |
| | | 96 | 7.52 | -25.29 | -24.45 | 0.41 | 0.00 | Vale | 17.99 | 1.00 |
| MURO IZQUIERDO | BISAGRA | 104 | 9.75 | -17.77 | -10.06 | 0.39 | 0.00 | Vale | 13.83 | 1.00 |
| | | 112 | 6.91 | -10.39 | 0.78 | 0.36 | 0.00 | Vale | 8.72 | 1.00 |
| MURO DERECHO | BISAGRA | 323 | -6.54 | -1.63 | -2.26 | 0.64 | 0.00 | Vale | 1.00 | 1.00 |
| | | 331 | 0.10 | -3.76 | -2.79 | 0.62 | 0.00 | Vale | 1.51 | 1.00 |
| | | 339 | 5.23 | -6.81 | 0.29 | 0.60 | 0.00 | Vale | 3.47 | 1.00 |
| | | 347 | 9.08 | -10.49 | 4.11 | 0.58 | 0.00 | Vale | 6.68 | 1.00 |
| | | 355 | 11.82 | -14.21 | 7.62 | 0.56 | 0.00 | Vale | 7.84 | 1.00 |
| | | 363 | 13.65 | -17.56 | 10.35 | 0.54 | 0.00 | Vale | 10.10 | 1.00 |
| | | 371 | 14.81 | -20.28 | 12.14 | 0.52 | 0.00 | Vale | 12.04 | 1.00 |
| | | 379 | 15.56 | -22.29 | 13.00 | 0.49 | 0.00 | Vale | 13.75 | 1.00 |
| | | 387 | 15.94 | -23.68 | 13.16 | 0.47 | 0.00 | Vale | 15.23 | 1.00 |
| | | 395 | 15.36 | -24.86 | 14.41 | 0.45 | 0.00 | Vale | 16.65 | 1.00 |
| | | 403 | 12.92 | -25.72 | 17.80 | 0.43 | 0.00 | Vale | 17.84 | 1.00 |
| | | 411 | 7.52 | -25.29 | 24.45 | 0.41 | 0.00 | Vale | 17.99 | 1.00 |
| MURO DERECHO | BISAGRA | 419 | 9.75 | -17.77 | 10.06 | 0.39 | 0.00 | Vale | 13.83 | 1.00 |
| | | 427 | 6.91 | -10.39 | -0.78 | 0.36 | 0.00 | Vale | 8.72 | 1.00 |
| MURO FRONTAL | BIS.IZDA | 113 | -10.55 | -2.21 | -0.41 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 128 | -4.67 | -3.33 | 0.75 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 143 | 0.22 | -6.01 | 4.17 | 0.90 | 0.00 | Vale | 1.63 | 1.00 |
| | | 158 | 5.21 | -9.47 | 7.84 | 0.90 | 0.00 | Vale | 3.16 | 1.00 |
| | | 173 | 9.60 | -13.09 | 10.97 | 0.90 | 0.00 | Vale | 4.65 | 1.00 |
| | | 188 | 12.89 | -16.38 | 13.35 | 0.90 | 0.00 | Vale | 6.93 | 1.00 |
| | | 203 | 14.96 | -19.04 | 15.06 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 218 | 15.90 | -20.89 | 16.31 | 0.90 | 0.00 | Vale | 7.51 | 1.00 |
| | | 233 | 15.94 | -21.62 | 17.06 | 0.90 | 0.00 | Vale | 7.72 | 1.00 |
| | | 248 | 15.45 | -18.83 | 14.32 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 263 | 18.69 | -30.69 | 10.94 | 1.16 | 0.00 | Vale | 8.48 | 1.00 |
| | | 278 | 28.83 | -51.26 | 9.04 | 1.36 | 0.00 | Vale | 12.31 | 1.00 |
| MURO FRONTAL | BIS IZDA | 293 | 6.43 | -3.34 | 9.45 | 0.30 | 0.00 | Vale | 3.86 | 1.00 |
| | | 308 | 5.97 | -6.62 | 10.90 | 0.30 | 0.00 | Vale | 6.99 | 1.00 |
| MURO FRONTAL | BIS DCHA | 127 | -10.55 | -2.21 | 0.41 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 142 | -4.67 | -3.33 | -0.75 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 157 | 0.22 | -6.01 | -4.17 | 0.90 | 0.00 | Vale | 1.63 | 1.00 |
| | | 172 | 5.21 | -9.47 | -7.84 | 0.90 | 0.00 | Vale | 3.16 | 1.00 |
| | | 187 | 9.60 | -13.09 | -10.97 | 0.90 | 0.00 | Vale | 4.65 | 1.00 |
| | | 202 | 12.89 | -16.38 | -13.35 | 0.90 | 0.00 | Vale | 6.93 | 1.00 |
| | | 217 | 14.96 | -19.04 | -15.06 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 232 | 15.90 | -20.89 | -16.31 | 0.90 | 0.00 | Vale | 7.51 | 1.00 |
| | | 247 | 15.94 | -21.62 | -17.06 | 0.90 | 0.00 | Vale | 7.72 | 1.00 |
| | | 262 | 15.45 | -18.83 | -14.32 | 0.90 | 0.00 | Vale | 6.90 | 1.00 |
| | | 277 | 18.69 | -30.69 | -10.94 | 1.16 | 0.00 | Vale | 8.48 | 1.00 |
| | | 292 | 28.83 | -51.26 | -9.04 | 1.36 | 0.00 | Vale | 12.31 | 1.00 |
| MURO FRONTAL | BIS DCHA | 307 | 6.43 | -3.34 | -9.45 | 0.30 | 0.00 | Vale | 3.86 | 1.00 |
| | | 322 | 5.97 | -6.62 | -10.90 | 0.30 | 0.00 | Vale | 6.99 | 1.00 |
| MURO FRONTAL | CENTRAL | 120 | -3.27 | -1.48 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 135 | -2.36 | -0.19 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 150 | -0.59 | 0.76 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 165 | 1.85 | 1.41 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.00 |
| | | 180 | 4.66 | 1.79 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.02 |
| | | 195.00 | 7.60 | 1.89 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.39 |
| | | 210.00 | 10.44 | 1.76 | 0.00 | 0.90 | 0.00 | Vale | 1.00 | 1.67 |
| | | 225.00 | 13.10 | 1.44 | 0.00 | 0.90 | 0.00 | Vale | 1.88 | 1.88 |
| | | 240.00 | 15.55 | 0.95 | 0.00 | 0.90 | 0.00 | Vale | 2.02 | 2.02 |
| | | 255.00 | 17.88 | 0.28 | 0.00 | 0.90 | 0.00 | Vale | 2.09 | 2.09 |
| | | 270.00 | 26.71 | -0.59 | 0.00 | 1.16 | 0.00 | Vale | 3.14 | 3.14 |
| | | 285.00 | 35.78 | -1.57 | 0.00 | 1.36 | 0.00 | Vale | 4.32 | 4.32 |

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 5.2

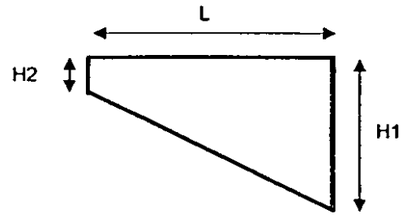
## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 3.97
H2= 0.50
L= 5.2

Espesor= 0.35
Recubrim.= 0.05




**CARACTERISTICAS DE TERRENO**

| | |
|---|---|
| Peso tierras(T/m3) | γ= 2.0 |
| Angulo rozamiento interno (°) | φ= 30 |
| Ang. rozamiento tierras muro (°) | δ= 0 |

**COEFICIENTES DE SEGURIDAD**

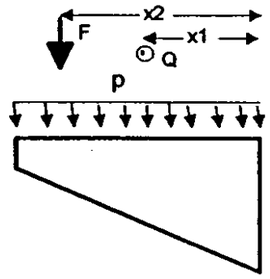
| | |
|---|---|
| Mayoracion de cargas | γf= 1.50 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.50 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γη= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hormigon (T/m2) | Fck= 2500 |

**CARGAS (valores sin mayorar)**

| | |
|---|---|
| Cargas verticales | |
| Sobrecarga vertical (t/m) | p= 1.24 |
| Carga vertical (t.) | F= 0.00 |
| Situacion x2 (m) | x2= 0 |
| Cargas horizontales | |
| Carga horizontal (t.) | Q= 0 |
| Posicion x1 (m) | x1= 0 |
| Sobrecarga sobre terreno (ton/m2) | |
| | q= 1.00 |




**CUANTIAS MINIMAS**

| | |
|---|---|
| LONGITUDINAL SUPERIOR | 0.400 o/oo |
| LONGITUDINAL INFERIOR | 0.400 o/oo |
| CORTANTE | 2.778 CM2/M |
| HORIZONTAL MUROS ALETA | 0.900 o/oo |
| VERTICAL MUROS ALETA | 1.600 o/oo |
| CORTANTE MUROS | 0.000 CM2/M |

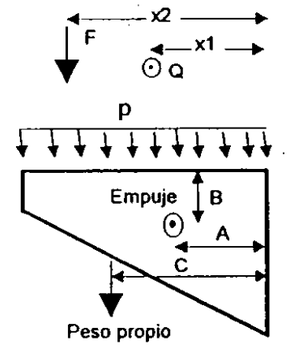
ALETA5-20.xls CALCULOS

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 5.2

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)




**COEFICIENTES EMPUJE ACTIVO ALETA**

| | |
|---|---|
| Coef. empuje activo λh= | 0.333 |
| Coef. empuje activo λv= | 0.000 |

**PESO PROPIO**

| | Peso | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Peso aux. 1 | 2.275 | 2.600 | 0.250 |
| Peso aux. 2 | 7.887 | 1.733 | 1.656 |
| Peso propio | **10.162** | **1.927** | **1.341** |

**EMPUJE DE TIERRAS**

HORIZONTAL

| | Empuje. | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Auxiliar | 0.144 | 3.900 | - |
| Auxiliar | 1.146 | 2.600 | - |
| Auxiliar | 9.091 | 1.300 | - |
| Auxiliar | 0.433 | 3.467 | - |
| Auxiliar | 3.438 | 1.733 | - |
| Empuje hor. | **14.252** | **1.601** | **1.811** |

VERTICAL

| | Empuje. | Dist.emp. |
|---|---|---|
| Empuje aux.1 | 0.000 | 3.900 |
| Empuje aux.2 | 0.000 | 2.600 |
| Empuje aux.3 | 0.000 | 1.300 |
| Empuje aux.4 | 0.000 | 3.467 |
| Empuje aux.5 | 0.000 | 1.733 |
| Empuje vert. | **0.000** | **0.000** |

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 5.2

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

### CALCULOS

**ESFUERZOS DE DISEÑO**
**(Para cargas verticales, momentos positivos implica tracciones en cara superior)**

| Acciones | Verticales | Horizontales |
|---|---|---|
| M peso propio | 19.585 | 0.000 |
| M empuje hor. | 0.000 | 22.822 |
| M empuje vert. | 0.000 | 0.000 |
| M sobrec.vert. | 16.799 | 0.000 |
| M carga vert. | 0.000 | 0.000 |
| M carga hor. | 0.000 | 0.000 |
| **Md (mt)** | **54.576** | **34.233** |
| V peso propio | 10.162 | 0.000 |
| V empuje hor. | 0.000 | 14.252 |
| V empuje vert. | 0.000 | 0.000 |
| V sobrec.vert. | 6.461 | 0.000 |
| V carga vert. | 0.000 | 0.000 |
| V carga hor. | 0.000 | 0.000 |
| **Vd (mt)** | **24.934** | **21.379** |

**CALCULO DE SECCIONES**

| | | | |
|---|---|---|---|
| Fcd | 1666.67 | | |
| 0,85*Fcd | 1416.67 | | |
| Fcv | 64.55 | | |
| Es | 21000000 | | |
| Fyd | 44347.83 | | |
| FYAD | 42000.00 | | |
| **Acciones** | **Verticales** | **Horizontales** | |
| **Md(m.t)** | 54.576 | 34.233 | |
| **Md max/Md med** | 1.000 | 1.542 | |
| **Md a usar calculo** | 54.576 | 52.775 | |
| **Canto seccion** | 3.967 | 0.350 | |
| **Canto util** | 3.917 | 0.300 | |
| **ancho seccion** | 0.350 | 3.967 | |
| **Ancho calculo** | 0.350 | 3.910 | |
| **Def acero** | 0.010 | 0.010 | |
| **Tension acero** | 44348 | 44348 | |
| X | 0.028 | 0.034 | |
| **As (cm.2)** | 3.153 | **42.024** | |
| **Prof. fibra neutra** | 0.283 | 0.051 | |
| **Def. hormigon** | 0.001 | 0.002 | |
| Comentarios | VALE | VALE | |
| Vd | 24.934 | 21.379 | |
| Vd compuesto | | | 32.844 |

ALETA5-20.xls CALCULOS

**NOMBRE PROYECTO :** LAV: MADRID - BARCELONA - FRONTERA FRANCESA

**DESIGNACION ESTRIBO:** ALETA L = 5.2

## HOJA DE CALCULO DE ALETAS DE ESTRIBOS

| | |
|---|---|
| Vu1 | 586.539 |
| Vsu | 0.000 |
| Vcu | 75.722 |
| Vu2 | 75.722 |
| Comentarios | |
| **As (cm.2)** | **0.000** |

### ARMADO

| | Calculo | Minima | total |
|---|---|---|---|
| Long. superior | 3.153 | 5.553 | **5.553** |
| Long inferior | 0.000 | 5.553 | **5.553** |
| Cortante | 0.000 | 14.444 | **14.444** |
| Horizontal trasdos | 42.024 | 8.330 | **42.024** |
| Vertical trasdos | 0.000 | 14.560 | **14.560** |
| Horizontal intrados | 0.000 | 4.165 | **4.165** |
| Vertical intrados | 0.000 | 14.560 | **14.560** |
| Cortante transversal | | NO | |

**TOTAL ENVOLVENTE ARMADURA**

| | cm2 | cm2/m |
|---|---|---|
| **Long. superior** | 5.553 | — |
| **Long inferior** | 5.553 | — |
| **Horizontal trasdos** | 42.024 | 10.594 |
| **Horizontal intrados** | 4.165 | 1.050 |
| **Estribos por rama (2 ramas)** | 21.782 | 4.189 |

| DATOS ARMADO | |
|---|---|
| Separacion maxima barras | 0.3 |
| Separacion minima barras | 0.1 |

**TOTAL ARMADURAS**

| | TOTAL | DIAMETRO | A.REAL | AREAL/ANEC | |
|---|---|---|---|---|---|
| **Long. superior** | 3.0 | 16 | 6.03 | 1.09 | VALE |
| **Long inferior** | 3.0 | 16 | 6.03 | 1.09 | VALE |
| **Horizontal trasdos** | 21.0 | 16 | 42.22 | 1.00 | VALE |
| **Horizontal intrados** | 18.0 | 10 | 14.14 | 3.39 | VALE |
| **Estribos** | 28.0 | 10 | 21.99 | 1.01 | VALE |

## 5º PROYECTO DE PRUEBA DE CARGA

**PRUEBA DE CARGA**

OBJETO DE LA PRUEBA

El objeto de la prueba es comprobar la respuesta estructural, frente a situaciones de carga estática, de manera tal que confrontando la respuesta real con la teórica, determinar la fiabilidad del comportamiento en servicio del puente.

CARGA DE PRUEBA

La prueba se realizará empleando camiones, el la disposición que se adjunta a continuación, de tres ejes separados 3.825 y 1.36 m. con cargas por eje de 6.5, 11.75 y 11.75 T.

APARATOS DE MEDIDA Y MEDICIONES

Para la realización de las mediciones se colocarán flexímetros en el centro del vano (medidas f1) y apoyos (medidas f2). Los valores de los desplazamientos que se adjuntan son los descensos relativos esperados entre los puntos de los vanos y los fijos de los apoyos. Estos valores deben ser del orden de la magnitud del valor f1-f2 medido en obra.

La apreciación mínima de cualquiera de los flexímetros será del orden del 3% de los valores máximos esperados de las magnitudes a medir.

El rango de los aparatos deberá ser como mínimo superior en un 50% a los esperados de dicha magnitud.

Las medidas se realizarán inmediatamente antes de la carga, inmediatamente después de su colocación y a los quince minutos de haberla retirado.

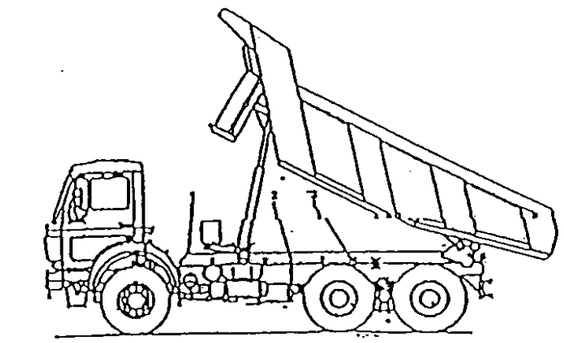
Durante la realización de la prueba se deberá anotar las condiciones climatológicas existentes a lo largo de la misma.

ANALISIS

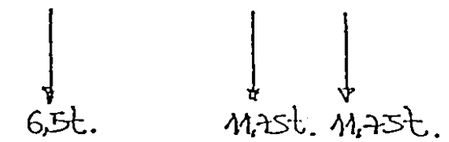
Para obtener las solicitaciones y desplazamientos verticales en los puntos a medir se procesó la estructura mediante los programas PUENTE y PRETENSA de Julián Díaz del Valle. El modelo es el mismo usado en el cálculo del tablero. Bajo esta geometría, la carga de prueba debe producir en las secciones críticas esfuerzos del orden del 70 - 80% de los calculados en el proyecto del tablero.

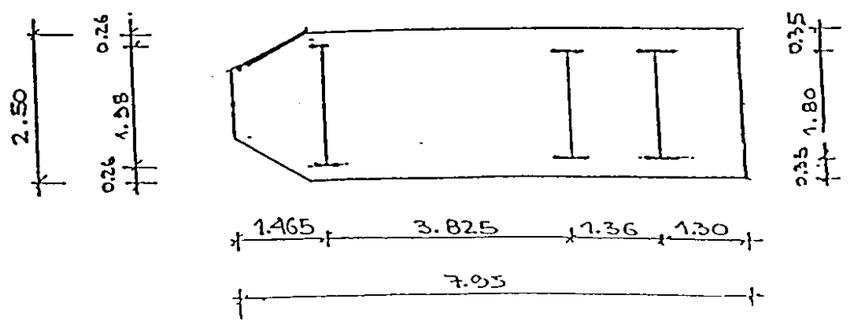


CAMION VOLQUETE DE 30.0 Ton.




ALZADO




PLANTA

IBM

Ordenador Personal

PROGRAMA

PRETENSA

PRETENSADO DE TABLEROS DE PUENTES

(C) Copyright J.Diaz del Valle, 1985

PROYECTO :

Referencia ..... : E-1505.0

Fecha ..... :

## PRUEBA DE CARGA

NUMERO DE EJES DE LA SOBRECARGA REAL ..... = 6

EJE Nº 1 . . . ABSCISA = 28.07 . . . CARGA = 13.00

EJE Nº 2 . . . ABSCISA = 31.89 . . . CARGA = 23.50

EJE Nº 3 . . . ABSCISA = 33.25 . . . CARGA = 23.50

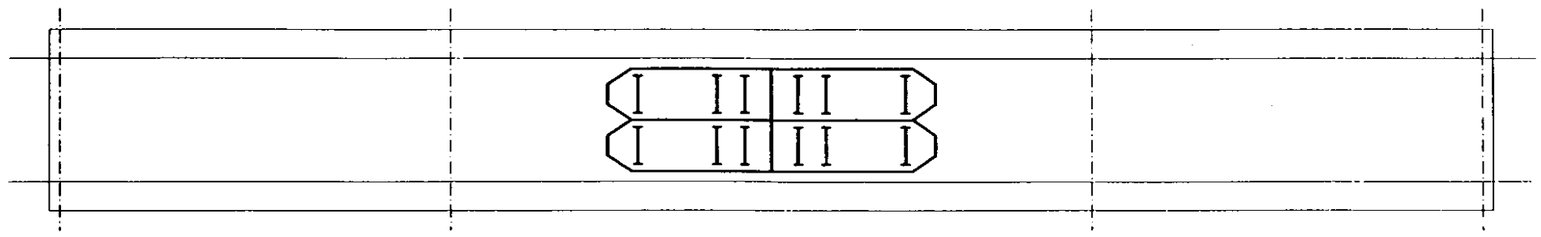
EJE Nº 4 . . . ABSCISA = 35.85 . . . CARGA = 23.50

EJE Nº 5 . . . ABSCISA = 37.21 . . . CARGA = 23.50

EJE Nº 6 . . . ABSCISA = 41.03 . . . CARGA = 13.00

## RESULTADOS CALCULADOS

| VANO | SECC. | ABSCISA (m) | FLECTOR (mxt) | CORTANTE (t) | FLECHA (mm) | GIRO(x1000) (RAD) |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.00 | 0.00 | -16.74 | 0.00 | -0.29 |
| 1 | 2 | 0.95 | -15.90 | -16.74 | -0.28 | -0.29 |
| 1 | 3 | 1.90 | -31.81 | -16.74 | -0.55 | -0.28 |
| 1 | 4 | 2.85 | -47.71 | -16.74 | -0.81 | -0.27 |
| 1 | 5 | 3.80 | -63.62 | -16.74 | -1.07 | -0.26 |
| 1 | 6 | 4.75 | -79.52 | -16.74 | -1.30 | -0.24 |
| 1 | 7 | 5.70 | -95.43 | -16.74 | -1.52 | -0.21 |
| 1 | 8 | 6.65 | -111.33 | -16.74 | -1.71 | -0.19 |
| 1 | 9 | 7.60 | -127.24 | -16.74 | -1.87 | -0.15 |
| 1 | 10 | 8.55 | -143.14 | -16.74 | -1.99 | -0.11 |
| 1 | 11 | 9.50 | -159.05 | -16.74 | -2.08 | -0.07 |
| 1 | 12 | 10.45 | -174.95 | -16.74 | -2.13 | -0.03 |
| 1 | 13 | 11.40 | -190.86 | -16.74 | -2.13 | 0.02 |
| 1 | 14 | 12.35 | -206.76 | -16.74 | -2.08 | 0.08 |
| 1 | 15 | 13.30 | -222.66 | -16.74 | -1.98 | 0.14 |
| 1 | 16 | 14.25 | -238.57 | -16.74 | -1.82 | 0.20 |
| 1 | 17 | 15.20 | -254.47 | -16.74 | -1.60 | 0.27 |
| 1 | 18 | 16.15 | -270.38 | -16.74 | -1.31 | 0.34 |
| 1 | 19 | 17.10 | -286.28 | -16.74 | -0.95 | 0.42 |
| 1 | 20 | 18.05 | -302.19 | -16.74 | -0.52 | 0.49 |
| 1 | 21 | 19.00 | -318.09 | -16.74 | 0.00 | 0.57 |
| 2 | 1 | 19.00 | -318.09 | 60.00 | 0.00 | 0.57 |
| 2 | 2 | 20.56 | -224.79 | 60.00 | 0.98 | 0.68 |
| 2 | 3 | 22.11 | -131.49 | 60.00 | 2.11 | 0.76 |
| 2 | 4 | 23.67 | -38.19 | 60.00 | 3.33 | 0.80 |
| 2 | 5 | 25.22 | 55.11 | 60.00 | 4.57 | 0.80 |
| 2 | 6 | 26.78 | 148.41 | 60.00 | 5.78 | 0.75 |
| 2 | 7 | 28.33 | 238.26 | 47.00 | 6.88 | 0.66 |
| 2 | 8 | 29.89 | 311.35 | 47.00 | 7.82 | 0.54 |
| 2 | 9 | 31.44 | 384.43 | 47.00 | 8.54 | 0.38 |
| 2 | 10 | 33.00 | 431.55 | 23.50 | 8.99 | 0.20 |
| 2 | 11 | 34.55 | 437.54 | 0.00 | 9.14 | -0.00 |
| 2 | 12 | 36.11 | 431.55 | -23.50 | 8.99 | -0.20 |
| 2 | 13 | 37.66 | 384.43 | -47.00 | 8.54 | -0.38 |
| 2 | 14 | 39.22 | 311.35 | -47.00 | 7.82 | -0.54 |
| 2 | 15 | 40.77 | 238.26 | -47.00 | 6.88 | -0.66 |
| 2 | 16 | 42.33 | 148.41 | -60.00 | 5.78 | -0.75 |
| 2 | 17 | 43.88 | 55.11 | -60.00 | 4.57 | -0.80 |
| 2 | 18 | 45.44 | -38.19 | -60.00 | 3.33 | -0.80 |
| 2 | 19 | 46.99 | -131.49 | -60.00 | 2.11 | -0.76 |
| 2 | 20 | 48.55 | -224.79 | -60.00 | 0.98 | -0.68 |
| 2 | 21 | 50.10 | -318.09 | -60.00 | 0.00 | -0.57 |
| 3 | 1 | 50.10 | -318.09 | 16.74 | 0.00 | -0.57 |
| 3 | 2 | 51.05 | -302.19 | 16.74 | -0.50 | -0.49 |
| 3 | 3 | 52.00 | -286.28 | 16.74 | -0.93 | -0.42 |
| 3 | 4 | 52.95 | -270.38 | 16.74 | -1.29 | -0.34 |
| 3 | 5 | 53.90 | -254.47 | 16.74 | -1.58 | -0.27 |
| 3 | 6 | 54.85 | -238.57 | 16.74 | -1.81 | -0.20 |
| 3 | 7 | 55.80 | -222.66 | 16.74 | -1.97 | -0.14 |
| 3 | 8 | 56.75 | -206.76 | 16.74 | -2.07 | -0.08 |
| 3 | 9 | 57.70 | -190.86 | 16.74 | -2.12 | -0.02 |
| 3 | 10 | 58.65 | -174.95 | 16.74 | -2.12 | 0.03 |
| 3 | 11 | 59.60 | -159.05 | 16.74 | -2.07 | 0.07 |
| 3 | 12 | 60.55 | -143.14 | 16.74 | -1.98 | 0.11 |
| 3 | 13 | 61.50 | -127.24 | 16.74 | -1.85 | 0.15 |
| 3 | 14 | 62.45 | -111.33 | 16.74 | -1.69 | 0.19 |
| 3 | 15 | 63.40 | -95.43 | 16.74 | -1.50 | 0.21 |
| 3 | 16 | 64.35 | -79.52 | 16.74 | -1.29 | 0.24 |
| 3 | 17 | 65.30 | -63.62 | 16.74 | -1.05 | 0.26 |
| 3 | 18 | 66.25 | -47.71 | 16.74 | -0.80 | 0.27 |
| 3 | 19 | 67.20 | -31.81 | 16.74 | -0.54 | 0.28 |
| 3 | 20 | 68.15 | -15.90 | 16.74 | -0.26 | 0.29 |
| 3 | 21 | 69.10 | 0.00 | 16.74 | 0.00 | 0.29 |



DISPOSICION CAMIONES EN PRUEBA DE CARGA



## PRUEBA DE CARGA. Comparación solicitaciones

| | |
|---|---|
| Proyecto : | L.A.V. Madrid - Zaragoza. Subtramo XV. |
| Obra : | E-1505.0 |

| | CAMIONES | | CARRO + SOBRECARGA UNIFORME | | RELACION MOMENTOS | RELACION CORTANTES |
|---|---|---|---|---|---|---|
| Sección | M (mT) | Q (T) | Mmax (mT) | Qmax (T) | | |
| Pila 1 | -318.1 | 60.0 | -466.5 | 166.5 | **68%** | **36%** |
| Centro vano 2 | 437.5 | --- | 527.0 | --- | **83%** | --- |

## *4.3.3 Paso superior E-1518.7*

## 4.3.3 PASO SUPERIOR E-1518.7

## ÍNDICE


1. DEFINICIÓN GEOMÉTRICA
2. CÁLCULO DEL TABLERO
3. CÁLCULO DE ESTRIBOS
4. PROYECTO DE PRUEBA DE CARGA

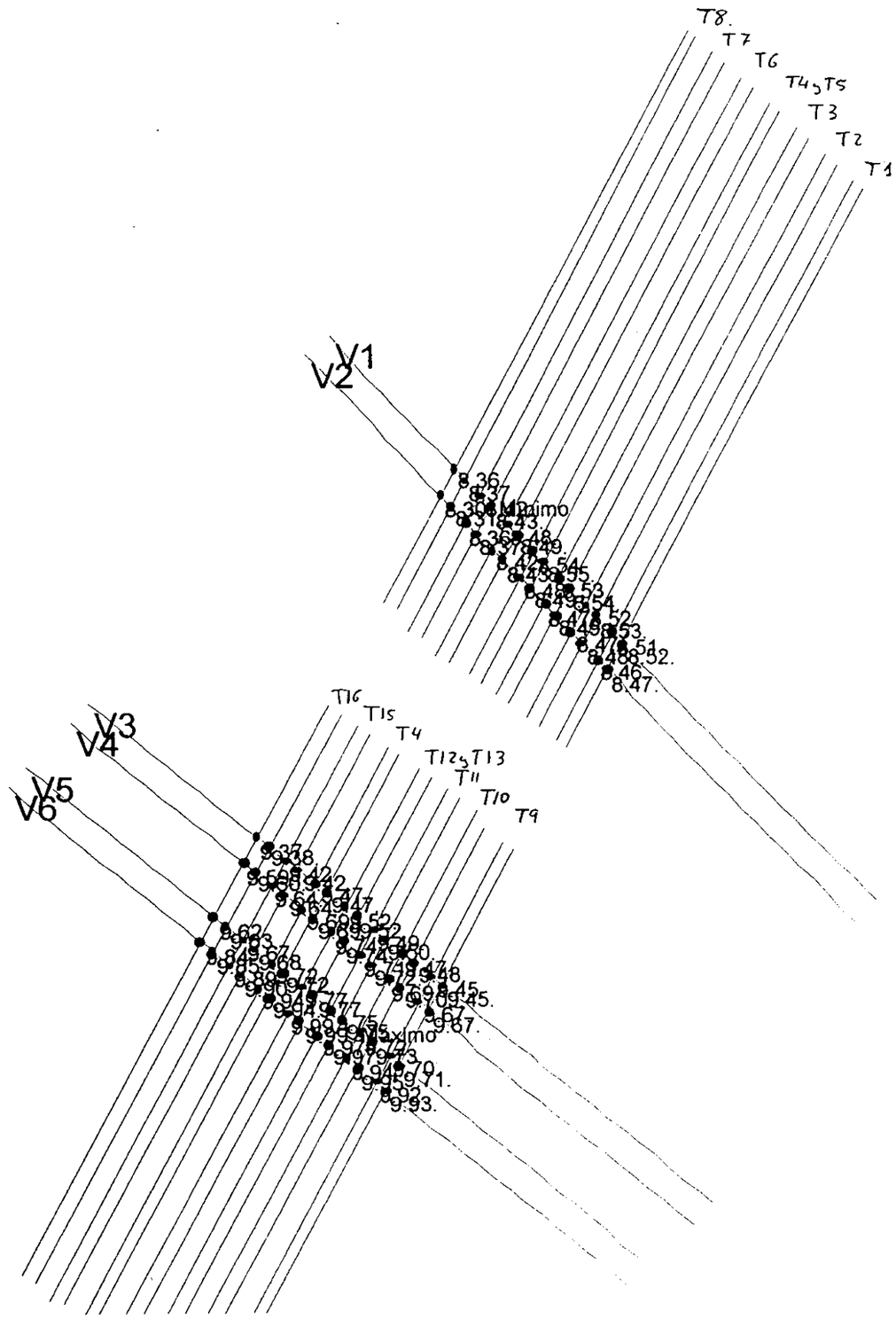
## PASO SUPERIOR E-1518.7

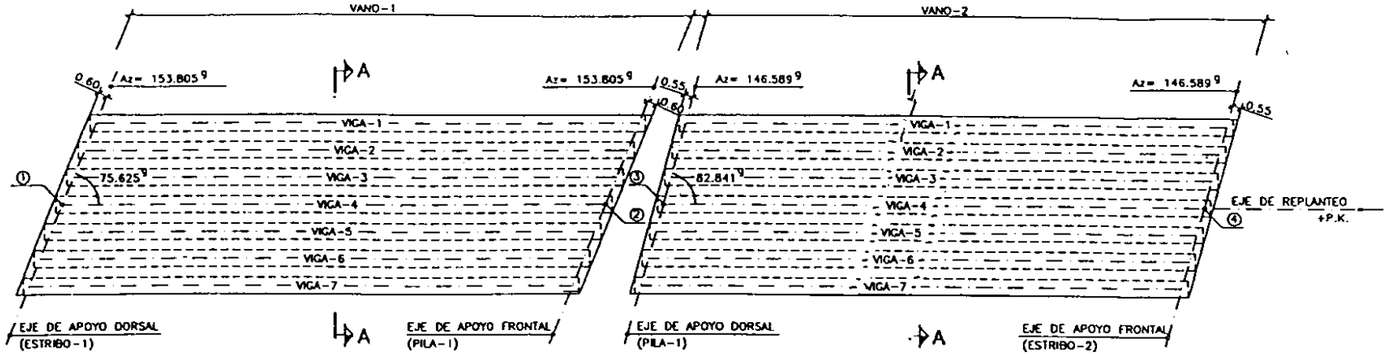
## 1º DEFINICION GEOMETRICA

# GalibZ1518-7.xls

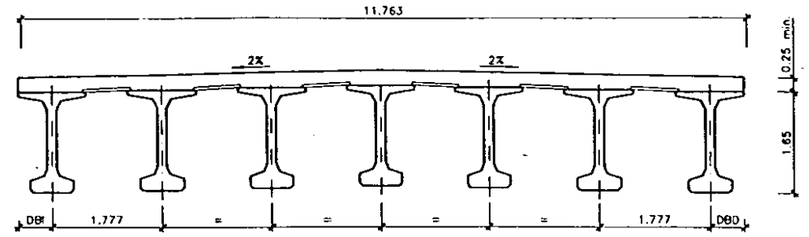
| | |
|---|---|
| Proyecto : | L.A.Z. MADRID - ZARAGOZA Subtramo XV |
| Nombre obra : | E - 1518.7 |

| GALIBOS | | | | | | SITUACION PUNTO | | |
|---|---|---|---|---|---|---|---|---|
| Punto Nº | X | Y | Z inf. tablero | Z vial inf. | Gálibo (m) | Nº polig.tab. | Nº polig.vial | Dcha.o Izda. |
| 1 | 681951.330 | 4606375.907 | 243.379 | 234.865 | 8.514 | 1 | 1 | Derecha |
| 2 | 681951.828 | 4606375.337 | 243.395 | 234.871 | 8.524 | 1 | 1 | Izquierda |
| 3 | 681950.067 | 4606377.357 | 243.374 | 234.850 | 8.524 | 2 | 1 | Derecha |
| 4 | 681950.564 | 4606376.785 | 243.390 | 234.856 | 8.534 | 2 | 1 | Izquierda |
| 5 | 681948.805 | 4606378.809 | 243.368 | 234.835 | 8.533 | 3 | 1 | Derecha |
| 6 | 681949.302 | 4606378.237 | 243.384 | 234.841 | 8.543 | 3 | 1 | Izquierda |
| 7 | 681947.543 | 4606380.261 | 243.362 | 234.820 | 8.543 | 4 | 1 | Derecha |
| 8 | 681948.040 | 4606379.689 | 243.379 | 234.826 | 8.553 | 4 | 1 | Izquierda |
| 9 | 681947.543 | 4606380.261 | 243.362 | 234.820 | 8.543 | 5 | 1 | Derecha |
| 10 | 681948.040 | 4606379.689 | 243.379 | 234.826 | 8.553 | 5 | 1 | Izquierda |
| 11 | 681946.282 | 4606381.713 | 243.285 | 234.805 | 8.480 | 6 | 1 | Derecha |
| 12 | 681946.779 | 4606381.142 | 243.302 | 234.811 | 8.490 | 6 | 1 | Izquierda |
| 13 | 681945.021 | 4606383.169 | 243.209 | 234.790 | 8.419 | 7 | 1 | Derecha |
| 14 | 681945.517 | 4606382.595 | 243.225 | 234.796 | 8.429 | 7 | 1 | Izquierda |
| 15 | 681943.762 | 4606384.626 | 243.132 | 234.776 | 8.356 | 8 | 1 | Derecha |
| 16 | 681944.258 | 4606384.051 | 243.148 | 234.782 | 8.366 | 8 | 1 | Izquierda |
| 17 | 681950.637 | 4606374.517 | 243.466 | 235.010 | 8.456 | 1 | 2 | Derecha |
| 18 | 681951.135 | 4606373.946 | 243.482 | 235.016 | 8.466 | 1 | 2 | Izquierda |
| 19 | 681949.374 | 4606375.967 | 243.461 | 234.994 | 8.466 | 2 | 2 | Derecha |
| 20 | 681949.872 | 4606375.396 | 243.477 | 235.000 | 8.476 | 2 | 2 | Izquierda |
| 21 | 681948.112 | 4606377.418 | 243.455 | 234.980 | 8.475 | 3 | 2 | Derecha |
| 22 | 681948.609 | 4606376.846 | 243.471 | 234.986 | 8.485 | 3 | 2 | Izquierda |
| 23 | 681946.850 | 4606378.870 | 243.449 | 234.965 | 8.485 | 4 | 2 | Derecha |
| 24 | 681947.347 | 4606378.298 | 243.466 | 234.971 | 8.495 | 4 | 2 | Izquierda |
| 25 | 681946.850 | 4606378.870 | 243.449 | 234.965 | 8.485 | 5 | 2 | Derecha |
| 26 | 681947.347 | 4606378.298 | 243.466 | 234.971 | 8.495 | 5 | 2 | Izquierda |
| 27 | 681945.589 | 4606380.324 | 243.372 | 234.950 | 8.422 | 6 | 2 | Derecha |
| 28 | 681946.086 | 4606379.751 | 243.388 | 234.956 | 8.433 | 6 | 2 | Izquierda |
| 29 | 681944.328 | 4606381.778 | 243.296 | 234.935 | 8.361 | 7 | 2 | Derecha |
| 30 | 681944.824 | 4606381.204 | 243.312 | 234.941 | 8.371 | 7 | 2 | Izquierda |
| 31 | 681943.068 | 4606383.234 | 243.218 | 234.920 | 8.298 | **Mínimo** 8 | 2 | Derecha |
| 32 | 681943.564 | 4606382.660 | 243.235 | 234.926 | 8.309 | 8 | 2 | Izquierda |
| 33 | 681942.376 | 4606357.938 | 244.501 | 235.053 | 9.448 | 9 | 3 | Derecha |
| 34 | 681942.916 | 4606357.453 | 244.512 | 235.058 | 9.454 | 9 | 3 | Izquierda |
| 35 | 681941.004 | 4606359.169 | 244.509 | 235.038 | 9.471 | 10 | 3 | Derecha |
| 36 | 681941.544 | 4606358.684 | 244.520 | 235.044 | 9.476 | 10 | 3 | Izquierda |
| 37 | 681939.632 | 4606360.400 | 244.518 | 235.024 | 9.494 | 11 | 3 | Derecha |
| 38 | 681940.173 | 4606359.915 | 244.529 | 235.029 | 9.500 | 11 | 3 | Izquierda |
| 39 | 681938.259 | 4606361.630 | 244.526 | 235.010 | 9.517 | 12 | 3 | Derecha |
| 40 | 681938.800 | 4606361.146 | 244.537 | 235.015 | 9.522 | 12 | 3 | Izquierda |
| 41 | 681938.259 | 4606361.630 | 244.526 | 235.010 | 9.517 | 13 | 3 | Derecha |
| 42 | 681938.800 | 4606361.146 | 244.537 | 235.015 | 9.522 | 13 | 3 | Izquierda |
| 43 | 681936.886 | 4606362.860 | 244.463 | 234.996 | 9.468 | 14 | 3 | Derecha |
| 44 | 681937.427 | 4606362.376 | 244.474 | 235.001 | 9.473 | 14 | 3 | Izquierda |
| 45 | 681935.514 | 4606364.090 | 244.401 | 234.981 | 9.419 | 15 | 3 | Derecha |
| 46 | 681936.055 | 4606363.605 | 244.411 | 234.987 | 9.424 | 15 | 3 | Izquierda |
| 47 | 681934.141 | 4606365.319 | 244.338 | 234.967 | 9.370 | 16 | 3 | Derecha |
| 48 | 681934.682 | 4606364.835 | 244.348 | 234.973 | 9.376 | 16 | 3 | Izquierda |
| 49 | 681941.712 | 4606356.605 | 244.585 | 234.916 | 9.669 | 9 | 4 | Derecha |
| 50 | 681942.252 | 4606356.120 | 244.595 | 234.921 | 9.674 | 9 | 4 | Izquierda |
| 51 | 681940.340 | 4606357.837 | 244.593 | 234.901 | 9.691 | 10 | 4 | Derecha |
| 52 | 681940.880 | 4606357.352 | 244.603 | 234.907 | 9.696 | 10 | 4 | Izquierda |
| 53 | 681938.968 | 4606359.068 | 244.601 | 234.887 | 9.714 | 11 | 4 | Derecha |
| 54 | 681939.509 | 4606358.583 | 244.612 | 234.892 | 9.720 | 11 | 4 | Izquierda |
| 55 | 681937.596 | 4606360.299 | 244.609 | 234.873 | 9.737 | 12 | 4 | Derecha |
| 56 | 681938.136 | 4606359.814 | 244.620 | 234.879 | 9.742 | 12 | 4 | Izquierda |
| 57 | 681937.596 | 4606360.299 | 244.609 | 234.873 | 9.737 | 13 | 4 | Derecha |
| 58 | 681938.136 | 4606359.814 | 244.620 | 234.879 | 9.742 | 13 | 4 | Izquierda |
| 59 | 681936.223 | 4606361.529 | 244.547 | 234.858 | 9.688 | 14 | 4 | Derecha |
| 60 | 681936.764 | 4606361.045 | 244.557 | 234.864 | 9.693 | 14 | 4 | Izquierda |
| 61 | 681934.850 | 4606362.758 | 244.484 | 234.844 | 9.639 | 15 | 4 | Derecha |
| 62 | 681935.391 | 4606362.274 | 244.494 | 234.850 | 9.644 | 15 | 4 | Izquierda |
| 63 | 681933.477 | 4606363.988 | 244.421 | 234.831 | 9.590 | 16 | 4 | Derecha |
| 64 | 681934.018 | 4606363.504 | 244.432 | 234.836 | 9.596 | 16 | 4 | Izquierda |
| 65 | 681940.294 | 4606353.759 | 244.762 | 235.062 | 9.701 | 9 | 5 | Derecha |
| 66 | 681940.834 | 4606353.274 | 244.773 | 235.068 | 9.706 | 9 | 5 | Izquierda |
| 67 | 681938.922 | 4606354.991 | 244.770 | 235.048 | 9.722 | 10 | 5 | Derecha |
| 68 | 681939.462 | 4606354.506 | 244.781 | 235.054 | 9.727 | 10 | 5 | Izquierda |
| 69 | 681937.550 | 4606356.222 | 244.779 | 235.033 | 9.746 | 11 | 5 | Derecha |
| 70 | 681938.091 | 4606355.737 | 244.790 | 235.039 | 9.751 | 11 | 5 | Izquierda |
| 71 | 681936.178 | 4606357.453 | 244.787 | 235.020 | 9.768 | 12 | 5 | Derecha |
| 72 | 681936.718 | 4606356.968 | 244.798 | 235.025 | 9.773 | 12 | 5 | Izquierda |
| 73 | 681936.178 | 4606357.453 | 244.787 | 235.020 | 9.768 | 13 | 5 | Derecha |
| 74 | 681936.718 | 4606356.968 | 244.798 | 235.025 | 9.773 | 13 | 5 | Izquierda |
| 75 | 681934.805 | 4606358.684 | 244.724 | 235.005 | 9.719 | 14 | 5 | Derecha |
| 76 | 681935.346 | 4606358.199 | 244.735 | 235.011 | 9.724 | 14 | 5 | Izquierda |
| 77 | 681933.433 | 4606359.913 | 244.661 | 234.991 | 9.670 | 15 | 5 | Derecha |
| 78 | 681933.974 | 4606359.429 | 244.672 | 234.996 | 9.676 | 15 | 5 | Izquierda |
| 79 | 681932.060 | 4606361.143 | 244.599 | 234.976 | 9.622 | 16 | 5 | Derecha |
| 80 | 681932.600 | 4606360.658 | 244.609 | 234.982 | 9.627 | 16 | 5 | Izquierda |
| 81 | 681939.630 | 4606352.426 | 244.846 | 234.925 | 9.921 | 9 | 6 | Derecha |
| 82 | 681940.170 | 4606351.941 | 244.856 | 234.931 | 9.926 | 9 | 6 | Izquierda |
| 83 | 681938.258 | 4606353.659 | 244.854 | 234.911 | 9.942 | 10 | 6 | Derecha |
| 84 | 681938.798 | 4606353.173 | 244.864 | 234.917 | 9.948 | 10 | 6 | Izquierda |
| 85 | 681936.887 | 4606354.890 | 244.862 | 234.896 | 9.966 | 11 | 6 | Derecha |
| 86 | 681937.427 | 4606354.405 | 244.873 | 234.902 | 9.971 | 11 | 6 | Izquierda |
| 87 | 681935.514 | 4606356.121 | 244.870 | 234.883 | 9.988 | 12 | 6 | Derecha |
| 88 | 681936.055 | 4606355.636 | 244.881 | 234.888 | 9.993 | **Máximo** 12 | 6 | Izquierda |
| 89 | 681935.514 | 4606356.121 | 244.870 | 234.883 | 9.988 | 13 | 6 | Derecha |
| 90 | 681936.055 | 4606355.636 | 244.881 | 234.888 | 9.993 | **Máximo** 13 | 6 | Izquierda |
| 91 | 681934.141 | 4606357.351 | 244.807 | 234.868 | 9.939 | 14 | 6 | Derecha |
| 92 | 681934.682 | 4606356.867 | 244.818 | 234.874 | 9.944 | 14 | 6 | Izquierda |
| 93 | 681932.769 | 4606358.581 | 244.745 | 234.854 | 9.891 | 15 | 6 | Derecha |
| 94 | 681933.310 | 4606358.097 | 244.755 | 234.859 | 9.896 | 15 | 6 | Izquierda |
| 95 | 681931.396 | 4606359.811 | 244.682 | 234.839 | 9.842 | 16 | 6 | Derecha |
| 96 | 681931.937 | 4606359.327 | 244.692 | 234.845 | 9.847 | 16 | 6 | Izquierda |






PLANTA
ESCALA 1:200




SECCION A-A
ESCALA 1:50

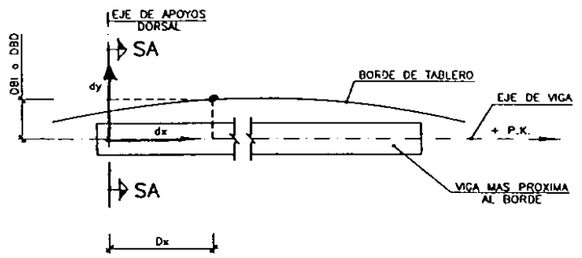
| PUNTO | P.K. | X | Y |
|---|---|---|---|
| 1 | 175,590 | 681959,968 | 4606404,411 |
| 2 | 210,590 | 681944,358 | 4606373,084 |
| 3 | 214,305 | 681942,701 | 4606369,759 |
| 4 | 249,305 | 681927,091 | 4606338,433 |

| | | VANO N 1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DX(m.) | 0,000 | 3,500 | 7,000 | 10,500 | 14,000 | 17,500 | 21,000 | 24,500 | 28,000 | 31,500 | 35,000 |
| VIGA N 1 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | DBI(m.) | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 |
| | CI(m.) | 243,758 | 243,953 | 244,149 | 244,345 | 244,540 | 244,736 | 244,932 | 245,127 | 245,323 | 245,519 | 245,714 |
| VIGA N 2 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| VIGA N 3 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| VIGA N 4 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| VIGA N 5 | RI(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| VIGA N 6 | RI(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| VIGA N 7 | RI(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | DBD(m.) | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 |
| | CD(m.) | 243,518 | 243,713 | 243,909 | 244,105 | 244,300 | 244,496 | 244,692 | 244,887 | 245,083 | 245,279 | 245,474 |

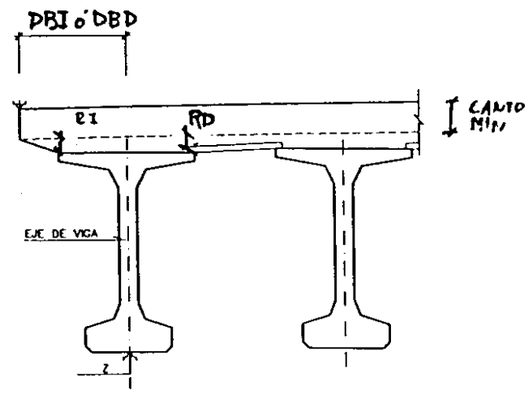
| | | VANO N 2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DX(m.) | 0,000 | 3,500 | 7,000 | 10,500 | 14,000 | 17,500 | 21,000 | 24,500 | 28,000 | 31,500 | 35,000 |
| VIGA N 1 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | DBI(m.) | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 |
| | CI(m.) | 245,884 | 246,080 | 246,276 | 246,471 | 246,667 | 246,863 | 247,058 | 247,254 | 247,450 | 247,645 | 247,841 |
| VIGA N 2 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| VIGA N 3 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| VIGA N 4 | RI(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| VIGA N 5 | RI(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| VIGA N 6 | RI(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| VIGA N 7 | RI(m.) | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 | 0,022 |
| | RD(m.) | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| | DBD(m.) | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 | 0,550 |
| | CD(m.) | 245,720 | 245,915 | 246,111 | 246,307 | 246,502 | 246,698 | 246,894 | 247,089 | 247,285 | 247,481 | 247,676 |

| | VANO N 1 | | | | | |
|---|---|---|---|---|---|---|
| | APOYOS EJE DORSAL | | | APOYOS EJE FRONTAL | | |
| VIGA N | X | Y | Z | X | Y | Z |
| 1 | 681963,782 | 4606400,112 | 241,858 | 681948,172 | 4606368,785 | 243,814 |
| 2 | 681962,511 | 4606401,545 | 241,853 | 681946,901 | 4606370,218 | 243,810 |
| 3 | 681961,239 | 4606402,978 | 241,849 | 681945,629 | 4606371,651 | 243,805 |
| 4 | 681959,968 | 4606404,411 | 241,844 | 681944,358 | 4606373,084 | 243,801 |
| 5 | 681958,697 | 4606405,844 | 241,789 | 681943,087 | 4606374,517 | 243,725 |
| 6 | 681957,425 | 4606407,277 | 241,693 | 681941,815 | 4606375,950 | 243,650 |
| 7 | 681956,154 | 4606408,710 | 241,618 | 681940,544 | 4606377,383 | 243,574 |

| | VANO N 2 | | | | | |
|---|---|---|---|---|---|---|
| | APOYOS EJE DORSAL | | | APOYOS EJE FRONTAL | | |
| VIGA N | X | Y | Z | X | Y | Z |
| 1 | 681946,816 | 4606366,063 | 243,984 | 681931,206 | 4606334,737 | 245,941 |
| 2 | 681945,444 | 4606367,295 | 243,992 | 681929,834 | 4606335,969 | 245,949 |
| 3 | 681944,073 | 4606368,527 | 244,001 | 681928,463 | 4606337,201 | 245,957 |
| 4 | 681942,701 | 4606369,759 | 244,009 | 681927,091 | 4606338,433 | 245,965 |
| 5 | 681941,329 | 4606370,991 | 243,946 | 681925,719 | 4606339,665 | 245,902 |
| 6 | 681939,958 | 4606372,223 | 243,883 | 681924,348 | 4606340,897 | 245,839 |
| 7 | 681938,586 | 4606373,455 | 243,820 | 681922,976 | 4606342,129 | 245,776 |




PLANTA ESQUEMATICA DE REPLANTEO
SIN ESCALA




SECCION SA-SA
ESCALA 1:25

# PASO SUPERIOR E-1518.7

## 2º CALCULO DEL TABLERO

PUENTE NERVADO CARRETERA

CALCULO DE PUENTES NERVADOS DE CARRETERA

(c) RESEARCH & CONCRETE S.A.

CLIENTE : GINPROSA

OBRA : E-1518-7

Fecha : 18/06/98

PUENTE NERVADO

(c) RESEARCH & CONCRETE S.A.

DATOS GEOMETRICOS

Solucion ..... = 7 N- 165
Luz de Calculo .....[m] = 35
Intereje .....[m] = 1.7771
Dis. eje V.Borde a Ex.Tablero [m] = .55

Ancho del Tablero .....[m] = 11.763
Ancho de las Aceras .....[m] = 2.413
Ancho Eficaz [ BO ] .....[m] = 12.216

Angulo de Esviaje .....[g] = 82
Espesor de la Losa .....[m] = .24
Canto Total .....[m] = 1.89
Espesor del Pavimento .....[cm] = 8

Peso del Carro .....[Tn] = 60
Distan. del carro a la Acera [m] = .5
Peso Aceras y Barandillas [Tn/ml] = 1.6

CARGAS [Tn/ml]

P1 = 1.2547
P2 = 1.0663
P3 = 0.3412
P3'= 1.1367
P4 = 0.6722

CARACTERISTICAS MECANICAS

[ INICIALES ]

Val ... [m] = .866544
Vbl .... [m] = .783456
AREA .. [m2] = .526763
INERCIA [m4] = .2027684

[ FINALES ]

VIGA No. 1

VaF ..... [m] = 0.535872
VbF ..... [m] = 1.114128
VcF ..... [m] = 0.775872
INER.FIN. [m4] = 0.375885
K (rasante)... = 0.481938

VIGA CENTRAL

VaF ..... [m] = 0.487918
VbF ..... [m] = 1.162081
VcF ..... [m] = 0.727919
INER.FIN. [m4] = 0.401105
K (rasante)... = 0.517130



PUENTE NERVADO

(c) RESEARCH & CONCRETE S.A.

REPARTO TRANSVERSAL
K (Flexion) = 0.652924
K (Torsion) = 0.315472

| | CARGA ACERA | CARRO EXCENTRI. | CARRO CENTRADO | CARRO OPCIONAL |
|---|---|---|---|---|
| Y1 | .7839258 | | | |
| Y2 | -.7839258 | | | |
| Y3 | | .4859931 | .1637167 | |
| Y4 | | .1585597 | -.1637167 | |

COEFICIENTES de EXCENTRICIDAD

| Num. VIGA | CARGA ACERA | CARRO EXCENTRICO | CARRO CENTRADO | CARRO OPCIONAL |
|---|---|---|---|---|
| 1 | 1.35713 | 1.33338 | .521 | |
| 2 | 1.0654 | 1.56389 | .95153 | |
| 3 | .7566 | 1.53759 | 1.30197 | |
| 4 | .64191 | 1.26479 | 1.45075 | |
| 5 | .75655 | .84786 | 1.30203 | |
| 6 | 1.06531 | .4243 | .95161 | |
| 7 | 1.35706 | .02815 | .52108 | |

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

COEFICIENTES MAS DESFAVORABLES

| Numero de VIGA | Y3 | Y4 | COEFICIENTE NAS DESFAVORABLE |
|---|---|---|---|
| 1 | .48599 | .15855 | 1.33448 |
| 2 | .48599 | .15855 | 1.59249 |
| 3 | .48599 | .15855 | 1.56571 |
| 4 | .16371 | -.16372 | 1.47728 |
| 5 | -.15856 | -.486 | 1.56571 |
| 6 | -.15856 | -.486 | 1.59249 |
| 7 | -.15856 | -.486 | 1.33448 |



P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

ESFUERZOS LONGITUDINALES [MTn.]

| | [ VIGA DE BORDE ] | [ VIGA NO. 2 ] |
|---|---|---|
| M1 = | 192.1240 | 192.1240 |
| M2 = | 132.1668 | 163.2711 |
| M3 = | 52.2467 | 52.2467 |
| M3'= | 67.4912 | 52.9832 |
| M4 = | 102.9262 | 102.9262 |
| M5 = | 94.2890 | 112.6118 |

TENSIONES

TENSIONES DE FLEXION DEBIDO A LAS CARGAS EXTERIORES SIN PRETENSADO [Tn/m2]

Resumen

| | EN FABRICA | | EN SERVICIO | | | CON CARGAS MAXIMAS | | | |
|---|---|---|---|---|---|---|---|---|---|
| PUNTO | SA | SB | SA | SB | SC | SA | SB | SC | |
| 17.50 | 821.0 | 742.4- | 1646.8 | 1678.1- | 190.9 | 1908.9 | 2302.6- | 582.1 | L/2 |
| 16.50 | 818.3 | 740.0- | 1641.4 | 1672.6- | 190.3 | 1902.7 | 2295.0- | 580.2 | |
| 15.50 | 810.3 | 732.7- | 1625.3 | 1656.2- | 188.4 | 1884.0 | 2272.5- | 574.5 | |
| 14.50 | 796.9 | 720.6- | 1598.4 | 1628.8- | 185.3 | 1852.8 | 2234.9- | 565.0 | |
| 13.50 | 778.1 | 703.6- | 1560.7 | 1590.4- | 180.9 | 1809.2 | 2182.3- | 551.7 | |
| 12.50 | 754.0 | 681.8- | 1512.3 | 1541.1- | 175.3 | 1753.1 | 2114.6- | 534.6 | |
| 11.50 | 724.5 | 655.1- | 1453.2 | 1480.8- | 168.5 | 1684.5 | 2031.9- | 513.6 | |
| 10.50 | 689.6 | 623.6- | 1383.3 | 1409.6- | 160.4 | 1603.5 | 1934.2- | 488.9 | |
| 9.50 | 649.4 | 587.2- | 1302.6 | 1327.4- | 151.0 | 1510.0 | 1821.4- | 460.4 | |
| 8.50 | 603.8 | 546.0- | 1211.2 | 1234.3- | 140.4 | 1404.0 | 1693.6- | 428.1 | |
| 7.50 | 552.9 | 500.0- | 1109.0 | 1130.2- | 128.6 | 1285.6 | 1550.7- | 392.0 | |
| 6.50 | 496.6 | 449.1- | 996.1 | 1015.1- | 115.5 | 1154.7 | 1392.8- | 352.1 | |
| 5.50 | 434.9 | 393.3- | 872.4 | 889.1- | 101.1 | 1011.3 | 1219.9- | 308.4 | |
| 4.50 | 367.9 | 332.7- | 738.0 | 752.1- | 85.5 | 855.5 | 1031.9- | 260.8 | |
| 3.50 | 295.5 | 267.3- | 592.8 | 604.1- | 68.7 | 687.2 | 829.0- | 209.5 | |
| 2.50 | 217.8 | 197.0- | 436.9 | 445.2- | 50.6 | 506.4 | 610.9- | 154.4 | |
| 1.50 | 134.7 | 121.9- | 270.2 | 275.4- | 31.3 | 313.2 | 377.8- | 95.5 | |
| 0.50 | 46.2 | 41.9- | 92.7 | 94.6- | 10.7 | 107.5 | 129.7- | 32.7 | |
| 0.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | APOYO |

PUENTE NERVADO

(c) RESEARCH & CONCRETE S.A.

CUADRO DE PRETENSADOS

| FILA -> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIPO DE CABLE-> | 0.6 | 0.6 | 0.6 | 0.6 | | | | | | |
| TRAZADO | RECTO | RECTO | RECTO | RECTO | | | | | N | EX |
| COTA-> | 4 | 9 | 14 | 161 | | | | | (TN) | (Cm) |
| X | Num. | Num. | Num. | Num. | | | | | | |
| 17.5 | 13 | 13 | 4 | 4 | | | | | 666 | 53 |
| 2.5 | 13 | 13 | 3 | 4 | | | | | 647 | 52 |
| 1.5 | 13 | 13 | 2 | 4 | | | | | 627 | 52 |
| .5 | 13 | 13 | 2 | 4 | | | | | 627 | 52 |
| 0 | 13 | 13 | 2 | 4 | | | | | 627 | 52 |

No se consideran los entubados cuya longitud es menor de 0.5 metros



PUENTE NERVADO

(c) RESEARCH & CONCRETE S.A.

TENSIONES EN DIFERENTES PUNTOS A LO LARGO DE LA VIGA [Tn/m2]

FABRICA ..... = Peso Propio + Pretensado con Perdidas a Corto Plazo
SERVICIO ..... = Cargas Permanentes + Pretensado con Perdidas Totales
CARGAS MAXIMAS = Servicio + Sobrecargas Maximas

VIGA MAS DESFAVORABLE = VIGA n. 2

Resumen

| | EN FABRICA | | EN SERVICIO | | | CON CARGAS MAXIMAS | | | |
|---|---|---|---|---|---|---|---|---|---|
| PUNTO | SA | SB | SA | SB | SC | SA | SB | SC | |
| 17.50 | 594.6 | 1750.5 | 1456.1 | 421.2 | 190.9 | 1718.2 | 203.3- | 582.1 | L/2 |
| 16.50 | 591.9 | 1752.9 | 1450.7 | 426.7 | 190.3 | 1712.0 | 195.7- | 580.2 | |
| 15.50 | 583.9 | 1760.2 | 1434.6 | 443.1 | 188.4 | 1693.3 | 173.2- | 574.5 | |
| 14.50 | 570.5 | 1772.3 | 1407.7 | 470.5 | 185.3 | 1662.1 | 135.6- | 565.0 | |
| 13.50 | 551.7 | 1789.3 | 1370.0 | 508.9 | 180.9 | 1618.5 | 83.0- | 551.7 | |
| 12.50 | 527.6 | 1811.1 | 1321.6 | 558.2 | 175.3 | 1562.4 | 15.3- | 534.6 | |
| 11.50 | 498.1 | 1837.8 | 1262.5 | 618.5 | 168.5 | 1493.8 | 67.4 | 513.6 | |
| 10.50 | 463.2 | 1869.3 | 1192.6 | 689.7 | 160.4 | 1412.8 | 165.1 | 488.9 | |
| 9.50 | 423.0 | 1905.7 | 1111.9 | 771.9 | 151.0 | 1319.3 | 277.9 | 460.4 | |
| 8.50 | 377.4 | 1946.9 | 1020.5 | 865.0 | 140.4 | 1213.3 | 405.7 | 428.1 | |
| 7.50 | 326.5 | 1992.9 | 918.3 | 969.1 | 128.6 | 1094.9 | 548.6 | 392.0 | |
| 6.50 | 270.2 | 2043.8 | 805.4 | 1084.2 | 115.5 | 964.0 | 706.5 | 352.1 | |
| 5.50 | 208.5 | 2099.6 | 681.7 | 1210.2 | 101.1 | 820.6 | 879.4 | 308.4 | |
| 4.50 | 141.5 | 2160.2 | 547.3 | 1347.2 | 85.5 | 664.8 | 1067.4 | 260.8 | |
| 3.50 | 69.1 | 2225.6 | 402.1 | 1495.2 | 68.7 | 496.5 | 1270.3 | 209.5 | |
| 2.50 | 7.2 | 2214.3 | 259.6 | 1585.4 | 50.6 | 329.1 | 1419.7 | 154.4 | |
| 1.50 | 60.0- | 2207.7 | 106.2 | 1686.4 | 31.3 | 149.2 | 1584.0 | 95.5 | |
| 0.50 | 148.5- | 2287.7 | 71.3- | 1867.2 | 10.7 | 56.5- | 1832.1 | 32.7 | |
| 0.00 | 194.7- | 2329.6 | 164.0- | 1961.8 | 0.0 | 164.0- | 1961.8 | 0.0 | APOYO |

Calculo de las tensiones con el entubado real

RESISTENCIA DE HORMIGONES [Tn/m2]

AL DESTESAR .. = 3727.49
A LOS 28 DIAS = 2749.45 se dispone Hormigon de 4500
EN LOSA ..... = 931.39 '' '' '' '' 2500

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

ARMADURAS DE CORTANTES [EP-93]

Acero Fy ..... [Kg/cm2] >= 5100
Espesor del Alma ... [cm] = 15.0
Fct'K .....[Kg/cm2] = 264.2536
Vcuo ..... [Tn] = 24.7412
Armadura Minima..[cm2/ml] = 2.9118

ARMADURAS DE CORTANTES

| PTO | X | U | URD | SIGMA | COTAG | Z | VCU | A90 | Diam | S |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 94.32 | 150.92 | -209.95 | 1.66 | AB | 24.74 | 10.92 | 12 | 20 |
| 2 | 3.5 | 76.96 | 123.14 | -77.32 | 2.05 | AB | 24.74 | 6.89 | 10 | 20 |
| 3 | 7.5 | 53.28 | 85.26 | 38.16 | 2.33 | C | 0 | 6.12 | 8 | 15 |
| 4 | 11.5 | 31.93 | 51.09 | 115.15 | 2.51 | C | 7.71 | 3.11 | 6 | 15 |
| 5 | 15.5 | 16.68 | 26.7 | 153.64 | 2.59 | C | 15.84 | 2.91 | 6 | 15 |

S I M B O L O G I A

PTO = Punto numero
X = Distancia al apoyo en m.
U = Cortante en seccion considerada en Tn.
URD = Cortante mayorado en Tn.
SIGMA = Tension normal en fibra extrema en Kg/cm2 (Art. 48.1.3.3)
COTAG = Cotangente (Art. 48.1.2)
Z = Zona de comprobacion (Art. 48.1.3.3)
VCU = Contribucion hormigon resistencia esfuerzo cortante (Art. 48.1.3.4)
A90 = Area necesaria en estribos por metro lineal en cm2/ml.
Diam. = Diametro de la barra en estribos en mm.
S = Separacion entre estribos en cm.



P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

ARMADURAS DE RASANTE

ARMADURAS DE RASANTE

| Punto | X | E.R. | C.M.N. | C.M.E.E. | C.M.S. | Diam. | S |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 53.71 | 41.66 | 52.39 | 0 | -- | -- |
| 2 | 3.5 | 44.47 | 34.49 | 36.62 | 0 | -- | -- |
| 3 | 7.5 | 30.08 | 23.33 | 30.9 | 0 | -- | -- |
| 4 | 11.5 | 18 | 13.96 | 17.3 | 0 | -- | -- |
| 5 | 15.5 | 12.04 | 9.34 | 17.3 | 0 | -- | -- |

S I M B O L O G I A

Punto = Punto numero
X = Distancia al apoyo en m.
E.R. = Esfuerzo de rasante en T.
C.M.N. = Capacidad mecanica necesaria en T.
C.M.E.E. = Capacidad mecanica existente estribos de cortante en T.
C.M.S. = Capacidad mecanica suplementaria en T.
Diam. = Diametro de las barras en mm.
S = Separacion entre barras en cm

FLEXION TRANSVERSAL LOSA REPARTO

M O M E N T O S

| | POSITIVOS [MTn.] | NEGATIVOS [MTn.] |
|---|---|---|
| DEFORMACION TRANSVERSAL | 3.37445 | -.33745 |
| FLEXION LOCALIZADA | 1.67725 | -1.00445 |
| T O T A L E S | 5.0517 | -1.34189 |

DEFORMACION TRANSVERSAL : Obtenida con el desarrollo en serie de la carga con siete terminos.
FLEXION LOCALIZADA .... : Obtenida por el metodo de Westergaard.

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

ARMADO LOSA

Res. Caract. del Hormigon [Tn/m2] = 2500
Res. Acero de la Losa [Tn/m2] = 51000
Recubrimiento ..... [cm] = 4.0
Armadura Minima ..... [Tn] = 13.3333

[ CARA SUPERIOR ]
Armadura Principal= 13.33333 Tn/ml se dispone 5 10 por ml
Armadura Reparto = 3.333333 Tn/ml se dispone 5 10 por ml

[ CARA INFERIOR ]
Armadura Principal= 43.95399 Tn/ml se dispone 5 16 por ml
Armadura Reparto = 10.9885 Tn/ml se dispone 5 10 por ml

PLACAS DE APOYO DE NEOPRENO

Modulo Elasticidad Hormigon [Tn/m2] = 3000000
Carga Minima en Apoyo..... [Tn] = 52.6429
Carga Maxima en Apoyo..... [Tn] = 94.3270
Carga de Frenado en Apoyo..... [Tn] = 0.8108
Giro de Apoyo..... [Min.] = 0.9084
Des. Hori.[Retra. Fluen. Temp.] [cm]= 1.2250

—— APOYO de 200 mm X 500 mm. en Planta y 43 mm. de Altura ——

[ COMPROBACION ]

Tension Minima de Compresion [Kg/cm2] = 52.6429
Tension Maxima de Compresion [Kg/cm2] = 94.3270
Giro por Cargas Lentas TG ..... = 0.4083
Giro de Frenado TG..... = 0.0405
Giro Total TG..... = 0.4489
Fuerza Horizontal Carga Lenta [Kg] = 3266.6665
Coeficiente 1 = 0.0621
Coeficiente 2 = 0.0432
Giro Admisible de Apoyo .....[Min] = 77.3325

[ PLACA VALIDA ]



P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

CALCULO A ROTURA

Pasiva en Traccion ..... [Tn] = 0.00
Armadura Activa ..... [Tn] = 652.91
Capacidad total en traccion N.. [Tn] = 652.91
Pasiva en Compresion ..... [Tn] = 0.00
Recubrimiento Pasiva Compresion [cm] = 0.00
Zona ..... = II
Ancho Eficaz ..... [m] = 1.78
Capa Compresion ..... [cm] = 24.00
Ancho del Ala ..... [m] = 1.10
Profundidad del Ala ..... [m] = 0.07
Dis. CDG Compre. a Fibra Super. [cm] = 12.96
Profundidad de Compresiones ... [cm] = 25.62
Dis. CDG Trac. a Fibra Inferior [cm] = 7.50
Canto Resistente ..... [m] = 1.69
Momento de Rotura ( MR+ ) .. [MTn.] =1100.44

COEFICIENTE DE SEGURIDAD A ROTURA = [ 1.63 ]

[ MOMENTOS [MTn.] ]

M1 ... = 192.124
M2 ... = 163.271
M3 ... = 52.246
M3'... = 52.983
M4 ... = 102.926
M5 ... = 112.611
M TOTAL= 676.163

[ VOLUMEN DE TRACCIONES ]

SA [Tn/m2] = 1718.41216
SB [Tn/m2] = -203.09720
X [m] = 0.17439

Ancho Cabeza Inferior [cm] = 70.0
Volumen de Tracciones [Tn] = 12.4

PASO SUPERIOR E-1518.7

3º CALCULO DE ESTRIBOS

**CALCULO DE ARMADURAS**

| Elemento | Sección | | |
|---|---|---|---|
| | Designacion | Ancho (b)(m) | Canto (h)(m) |
| MURO | 0-0 | 1.00 | 1.35 |
| | 1-1 | 1.00 | 1.35 |
| MURETE | 4-4 | 1.00 | 0.35 |
| PUNTERA | 2-2 (+) | 1.00 | 1.30 |
| | 2-2 (-) | 1.00 | 1.30 |
| TALÓN | 3-3 (+) | 1.00 | 1.30 |
| | 3-3 (-) | 1.00 | 1.30 |

| Elemento | Sección | Armadura de flexión | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Nd (T) | Md (mT) | As (cm²/m) | Control cálculo | |
| MURO | 0-0 | 1.00 | 1.35 | 84.22 | 134.58 | 33.455 | Vale | Dominio 2. |
| | 1-1 | 1.00 | 1.35 | 79.66 | 85.88 | 24.270 | Vale | Dominio 2. |
| MURETE | 4-4 | 1.00 | 0.35 | 1.58 | 2.37 | 2.001 | Vale | Dominio 2. |
| PUNTERA | 2-2 (+) | 1.00 | 1.30 | --- | 71.24 | 13.065 | Vale | --- |
| | 2-2 (-) | 1.00 | 1.30 | --- | 20.48 | 3.711 | Vale | --- |
| TALÓN | 3-3 (+) | 1.00 | 1.30 | --- | -53.92 | 9.848 | Vale | --- |
| | 3-3 (-) | 1.00 | 1.30 | --- | -68.77 | 12.605 | Vale | --- |

| Elemento | Sección | Armadura de cortante | | | | |
|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Vd (T) | As (cm²/m²) | Control cálculo |
| MURO | 0-0 | 1.00 | 1.35 | 38.31 | 0.00 | Vale. As min = 7.94 |
| | 1-1 | 1.00 | 1.35 | 27.00 | 0.00 | Vale. As min = 7.94 |
| MURETE | 4-4 | 1.00 | 0.35 | 3.03 | 0.00 | Vale. As min = 7.94 |
| PUNTERA | 2-2 (+) | 1.00 | 1.30 | 43.89 | 0.00 | Vale. As min = 0.00 |
| | 2-2 (-) | 1.00 | 1.30 | 12.65 | 0.00 | Vale. As min = 0.00 |
| TALÓN | 3-3 (+) | 1.00 | 1.30 | 11.65 | 0.00 | Vale. As min = 7.94 |
| | 3-3 (-) | 1.00 | 1.30 | -30.68 | 0.00 | Vale. As min = 7.94 |

| Designacion armaduras | Sección Designacion | Armadura de cálculo(cm²/m) | | |
|---|---|---|---|---|
| | | Necesaria | Minima | **Adoptada** |
| Vert. trasdos | 0-0 | 33.5 | 8.1 | **33.5** |
| Vert. trasdos | 1-1 | 24.3 | 8.1 | **24.3** |
| Vert. trasdos | 4-4 | 2.0 | 2.0 | **2.0** |
| Vert. intrados | 0-0 1-1 | 0.0 | 4.1 | **4.1** |
| Vert. intrados | 4-4 | 0.0 | 1.1 | **1.1** |
| Hor. trasdos | 0-0 1-1 | 6.7 | 10.8 | **10.8** |
| Hor. trasdos | 4-4 | 0.4 | 2.8 | **2.8** |
| Hor, intrados | 0-0 1-1 | 0.0 | 10.8 | **10.8** |
| Hor, intrados | 4-4 | 0.0 | 2.8 | **2.8** |
| Cortante alzado | 0-0 1-1 | 0.0 | 7.9 | **7.9** |
| Cortante muret | 4-4 | 0.0 | 7.9 | **7.9** |
| As inf L. | 2-2 3-3 | 2.6 | 9.6 | **9.6** |
| As inf T. | 2-2 3-3 | 13.1 | 9.6 | **13.1** |
| As sup L. | 2-2 3-3 | 2.5 | 9.2 | **9.2** |
| As sup T. | 2-2 3-3 | 12.6 | 9.2 | **12.6** |
| Cortante cim | 2-2 3-3 | 0.0 | 7.9 | **7.9** |

NOTA: las armaduras longitudinales en talón y puntera y horizontales de muro que aparecen en las casillas de armadura "necesaria" han sido obtenidas multiplicando la armadura transversal o vertical por el coeficiente de poisson.

# CALCULO ESTRIBOS CERRADOS

| | |
|---|---|
| **NOMBRE PROYECTO :** | **L.A.V. MADRID - ZARAGOZA. Subtramo XV.** |
| **NOMBRE OBRA :** | **E-1518.7. Estribo 2.** |

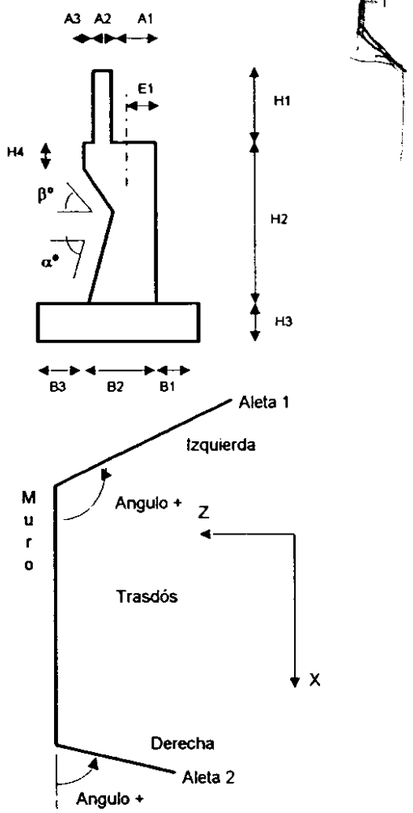
## DATOS REQUERIDOS:

### GESTION FICHEROS

| | |
|---|---|
| Directorio fichero generación modelo (.GEO) : | |
| Directorio fichero listados ( LIS) : | |

### MURO FRONTAL

| | | |
|---|---|---|
| H1. Altura murete (m) : | 2.011 | |
| H2. Altura muro frontal (m) : | 5.78 | |
| H3. Canto zapata (m) : | 1.30 | |
| Altura tierras en trasdós (superior zapata)(m) : | 7.79 | |
| B1. Puntera zapata (m) : | 1.50 | Zapata tipo I |
| B2. Canto muro en base (m) : | 1.35 | |
| B3. Talón zapata (m) : | 3.50 | Zapata tipo III |
| A1 (m) : | 1.00 | |
| A2. Canto murete de guarda (m) : | 0.35 | |
| A3. Vuelo ménsula apoyo losa transición (m) : | 0.00 | |
| H4. Canto min. apoyo losa transición (m) : | 0.30 | |
| α . Angulo trasdós muro (°) : | 90.00 | |
| β . Angulo inferior apoyo losa transición (°) : | 45.00 | |
| E1. Distancia apoyo tablero (m) : | 0.40 | |
| Longitud (m) : | 12.20 | |




### MUROS EN VUELTA (intradós vertical)

| | Izquierdo (1) | Derecho (2) |
|---|---|---|
| Longitud (m) : | | |
| Canto en base (m) : | | |
| Canto coronación (m) : | | |
| Angulo ( ° ) : | | |

### ALETAS

| | Izquierda (1) | Derecha (2) |
|---|---|---|
| Canto aleta en empotramiento (m) : | | |
| Canto aleta en extremo (m) : | | |
| Longitud aleta (m) : | | |
| Espesor aleta (m) : | | |

### CARACTERISTICAS DE TERRENO

| | |
|---|---|
| Peso especifico (T/m³) : | 2.00 |
| Angulo rozamiento interno (°) : | 30.00 |
| Coeficiente rozamiento zapata-terreno : | 0.58 |
| Angulo. rozamiento tierras muro (°) : | 0.00 |
| Tension admisible (T / m²) : | 30.00 |

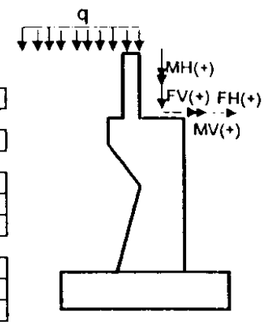
### CARACTERISTICAS DE LOS MATERIALES

| | |
|---|---|
| Peso especifico hormigón (T / m³) : | 2.50 |
| Límite elástico acero (T / m²) : | 51000.00 |
| Resistencia hormigón. cimientos (T / m²) : | 2500.00 |
| Resistencia hormigón. alzado (T / m²) : | 2500.00 |
| Mod. Elasticidad Hormigón alzado (T / m² ) : | 3000000 |



### CARGAS SOBRE EL ESTRIBO (Carga total sobre el estribo sin mayorar)

| | |
|---|---|
| q (Sobrecarga de tráfico (T / m²) | 1.00 |
| Peso barrera en muros en vuelta y aletas (T / m) : | 1.00 |




| | FV (T) | MV (mT) | FH (T) | MH (mT) |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio y carga muerta tablero : | 384.00 | | --- | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero : | 0.00 | | --- | --- |
| Retracción y fluencia tablero : | --- | --- | 22.041 | |
| Asientos estructura : | 0.00 | | --- | --- |
| **Acciones Variables (Q)** | | | | |
| Sobrecarga de uso máxima tablero : | 145.38 | | 10.90 | |
| Sobrecarga de uso mínima tablero : | 0.00 | | 3.89 | |
| Efectos térmicos tablero : | 0.00 | | 0.00 | |

### COEFICIENTES DE SEGURIDAD

| | | |
|---|---|---|
| Seguridad al deslizamiento | Csd= | 1.50 |
| Seguridad al vuelco | Csv= | 1.80 |
| Minoracion acero | γs= | 1.15 |
| Minoracion hormigon | γc= | 1.50 |

| | Estado Límite Ultimo | |
|---|---|---|
| | Favorable | Desfavorable |
| **Acciones permanentes (G)** | | |
| Peso propio, cargas muertas : | 0.90 | 1.50 |
| **Acciones permanentes de valor no constante (G*)** | | |
| Pretensado : | 0.00 | 1.00 |
| Reológicas (retracción y fluencia) : | 0.00 | 1.50 |
| Terreno (pesopropio, empujes y asientos) : | 0.00 | 1.50 |
| **Acciones variables (Q)** | | |
| Sobrecargas, viento, temperatura : | 0.00 | 1.50 |

| | | |
|---|---|---|
| ¹Ψo (coeficiente valor de combinación variables) : | 1.00 | (poner 1 según antigua instrucción) |

### DATOS VARIOS

| | | |
|---|---|---|
| Número de apoyos : | 2.00 | |
| Separación apoyos (m) : | 9.500 | |
| Recubrimiento armadura (m) : | 0.05 | |
| Distancia sección 1-1 (a superior zapata) (m) : | 1.50 | Vale |
| Tamaño medio elementos mallado (m) : | 1.00 | |

NOMBRE PROYECTO : **L.A.V. MADRID - ZARAGOZA. Subtramo XV.**

DESIGNACION ALETA: **Aleta 4.5m. E-1518.7**

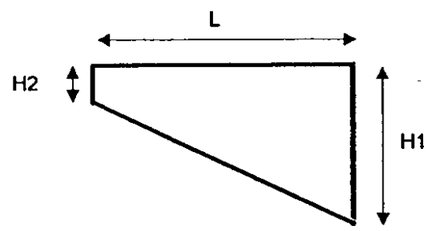
## HOJA DE CALCULO DE ALETAS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 3.50
H2= 0.5
L= 4.5

Espesor= 0.35
Recubrim.= 0.05




**CARACTERISTICAS DE TERRENO**

| | | |
|---|---|---|
| Peso tierras(T/m3) | γ= 2 | |
| Angulo rozamiento interno (°) | φ= 30 | |
| Ang. rozamiento tierras muro (°) | δ= 0 | |

**COEFICIENTES DE SEGURIDAD**

| | |
|---|---|
| Mayoracion de cargas | γf= 1.5 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.5 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γh= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hormigon (T/m2) | Fck= 2500 |

**CARGAS (valores sin mayorar)**

Cargas verticales

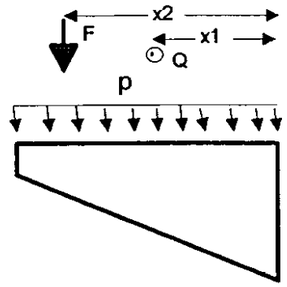
| | |
|---|---|
| Sobrecarga vertical (t/m) | p= 1 |
| Carga vertical (t.) | F= 0.00 |
| Situacion x2 (m) | x2= 0 |

Cargas horizontales

| | |
|---|---|
| Carga horizontal (t.) | Q= 0 |
| Posicion x1 (m) | x1= 0 |

Sobrecarga sobre terreno (ton/m2)

q= 1




**CUANTIAS MINIMAS**

| | |
|---|---|
| LONGITUDINAL SUPERIOR | 0.400 o/oo |
| LONGITUDINAL INFERIOR | 0.400 o/oo |
| CORTANTE | 2.778 CM2/M |
| HORIZONTAL MUROS ALETA | 0.900 o/oo |
| VERTICAL MUROS ALETA | 1.600 o/oo |
| CORTANTE MUROS | 0.000 CM2/M |

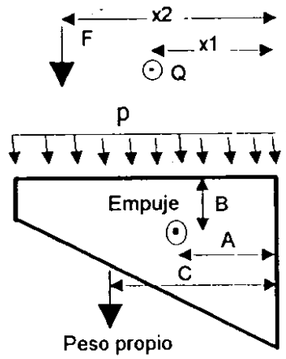
AletZ11.xls CALCULOS

NOMBRE PROYECTO : **L.A.V. MADRID - ZARAGOZA. Subtramo XV.**

DESIGNACION ALETA: **Aleta 4.5m. E-1518.7**

## HOJA DE CALCULO DE ALETAS

### CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)




**COEFICIENTES EMPUJE ACTIVO ALETA**

| | |
|---|---|
| Coef. empuje activo λh= | 0.333 |
| Coef. empuje activo λv= | 0.000 |

**PESO PROPIO**

| | Peso | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Peso aux. 1 | 1.969 | 2.250 | 0.250 |
| Peso aux. 2 | 5.906 | 1.500 | 1.500 |
| Peso propio | **7.875** | **1.688** | **1.188** |

**EMPUJE DE TIERRAS**

HORIZONTAL

| | Empuje. | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Auxiliar | 0.125 | 3.375 | - |
| Auxiliar | 0.875 | 2.250 | - |
| Auxiliar | 6.125 | 1.125 | - |
| Auxiliar | 0.375 | 3.000 | - |
| Auxiliar | 2.625 | 1.500 | - |
| Empuje hor. | **10.125** | **1.417** | **1.586** |

VERTICAL

| | Empuje. | Dist.emp. |
|---|---|---|
| Empuje aux.1 | 0.000 | 3.375 |
| Empuje aux.2 | 0.000 | 2.250 |
| Empuje aux.3 | 0.000 | 1.125 |
| Empuje aux.4 | 0.000 | 3.000 |
| Empuje aux.5 | 0.000 | 1.500 |
| Empuje vert. | **0.000** | **0.000** |

NOMBRE PROYECTO : L.A.V. MADRID - ZARAGOZA. Subtramo XV.

DESIGNACION ALETA: Aleta 4.5m. E-1518.7

## HOJA DE CALCULO DE ALETAS

### CALCULOS

**ESFUERZOS DE DISEÑO**

**(Para cargas verticales, momentos positivos implica tracciones en cara superior)**

| Acciones | Verticales | Horizontales |
|---|---|---|
| M peso propio | 13.289 | 0.000 |
| M empuje hor. | 0.000 | 14.344 |
| M empuje vert. | 0.000 | 0.000 |
| M sobrec.vert. | 10.125 | 0.000 |
| M carga vert. | 0.000 | 0.000 |
| M carga hor. | 0.000 | 0.000 |
| **Md (mt)** | **35.121** | **21.516** |
| V peso propio | 7.875 | 0.000 |
| V empuje hor. | 0.000 | 10.125 |
| V empuje vert. | 0.000 | 0.000 |
| V sobrec.vert. | 4.500 | 0.000 |
| V carga vert. | 0.000 | 0.000 |
| V carga hor. | 0.000 | 0.000 |
| **Vd (mt)** | **18.563** | **15.188** |

AletZ11.xls CALCULOS

NOMBRE PROYECTO : L.A.V. MADRID - ZARAGOZA. Subtramo XV.

DESIGNACION ALETA: Aleta 4.5m. E-1518.7

HOJA DE CALCULO DE ALETAS

**CALCULO DE SECCIONES**

| | | |
|---|---|---|
| Fcd | 1666.67 | |
| 0,85*Fcd | 1416.67 | |
| Fcv | 64.55 | |
| Es | 21000000 | |
| Fyd | 44347.83 | |
| FYAD | 42000.00 | |
| Acciones | Verticales | Horizontales |
| Md(m.t) | 35.121 | 21.516 |
| Md max/Md med | 1.000 | 1.556 |
| Md a usar calculo | 35.121 | 33.481 |
| Canto seccion | 3.500 | 0.350 |
| Canto util | 3.450 | 0.300 |
| ancho seccion | 0.350 | 3.500 |
| Ancho calculo | 0.350 | 3.459 |
| Def acero | 0.010 | 0.010 |
| Tension acero | 44348 | 44348 |
| X | 0.021 | 0.024 |
| **As (cm.2)** | **2.302** | **26.201** |
| Prof. fibra neutra | 0.245 | 0.042 |
| Def. hormigon | 0.001 | 0.002 |
| Comentarios | VALE | VALE |
| Vd | 18.563 | 15.188 |
| Vd compuesto | | 23.984 |
| Vu1 | | 518.822 |
| Vsu | | 0.000 |
| Vcu | | 66.980 |
| Vu2 | | 66.980 |
| Comentarios | | |
| **As (cm.2)** | | **0.000** |

### ARMADO

| | Calculo | Minima | total | |
|---|---|---|---|---|
| Long. superior | 2.302 | 4.900 | **4.900** | 7 ϕ 20 |
| Long inferior | 0.000 | 4.900 | **4.900** | |
| Cortante | 0.000 | 12.500 | **12.500** | |
| Horizontal trasdos | 26.201 | 7.350 | **26.201** | |
| Vertical trasdos | 0.000 | 12.600 | **12.600** | |
| Horizontal intrados | 0.000 | 3.675 | **3.675** | |
| Vertical intrados | 0.000 | 12.600 | **12.600** | |
| Cortante transversal | | | NO | |

**TOTAL ENVOLVENTE ARMADURA**

| | |
|---|---|
| **Long. superior** | **4.900 cm²** |
| **Long inferior** | **4.900 cm²** |
| **Horizontal trasdos** | **7.486 cm²/m** |
| **Horizontal intrados** | **1.050 cm²/m** |
| **Estribos** | **8.378 cm²/m** |

PASO SUPERIOR E-1518.7

# 4º PROYECTO DE PRUEBA DE CARGA

**PRUEBA DE CARGA**

OBJETO DE LA PRUEBA

El objeto de la prueba es comprobar la respuesta estructural, frente a situaciones de carga estática, de manera tal que confrontando la respuesta real con la teórica, determinar la fiabilidad del comportamiento en servicio del puente.

CARGA DE PRUEBA

La prueba se realizará empleando camiones, el la disposición que se adjunta a continuación, de tres ejes separados 3.825 y 1.36 m. con cargas por eje de 7.6, 13.7 y 13.7 T.

APARATOS DE MEDIDA Y MEDICIONES

Para la realización de las mediciones se colocarán flexímetros en el centro del vano (medidas f1) y apoyos (medidas f2). Los valores de los desplazamientos que se adjuntan son los descensos relativos esperados entre los puntos de los vanos y los fijos de los apoyos. Estos valores deben ser del orden de la magnitud del valor f1-f2 medido en obra.

La apreciación mínima de cualquiera de los flexímetros será del orden del 3% de los valores máximos esperados de las magnitudes a medir.

El rango de los aparatos deberá ser como mínimo superior en un 50% a los esperados de dicha magnitud.

Las medidas se realizarán inmediatamente antes de la carga, inmediatamente después de su colocación y a los quince minutos de haberla retirado.

Durante la realización de la prueba se deberá anotar las condiciones climatológicas existentes a lo largo de la misma.

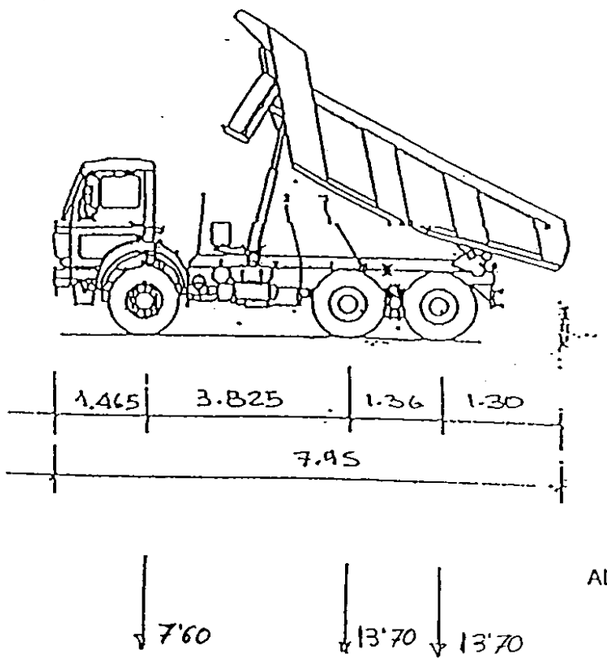
ANALISIS

Para obtener las solicitaciones y desplazamientos verticales en los puntos a medir se procesó la estructura mediante el programa de elementos finitos COSMOS/M. Sobre el modelo la carga de prueba debe producir en las secciones críticas esfuerzos del orden del 70 - 80% de los calculados en el proyecto del tablero.

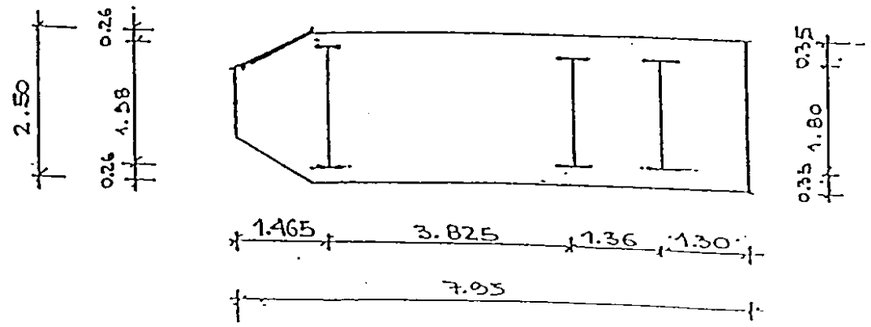
Se adjunta la definición del modelo de cálculo, de la carga empleada y el listado de esfuerzos y deformaciones obtenidos con la comparación con los calculados en el proyecto del tablero.

| ASUNTO | FECHA |
|---|---|
| DEFINICION TREN DE CARGAS | PAG. 1 |

CAMION VOLQUETE DE 35 Ton.

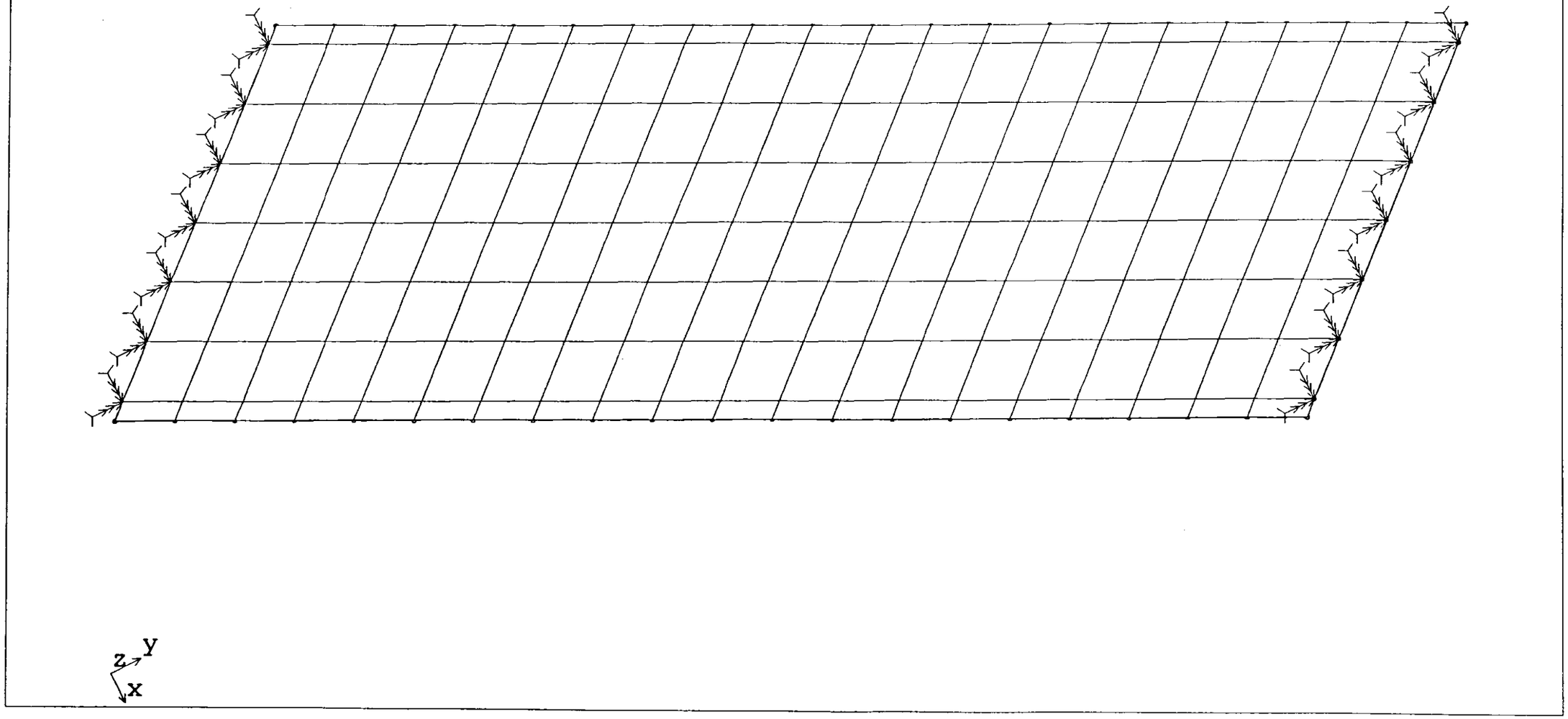



ALZADO




PLANTA

GeoStar 2.0 (64K Version): Pru15187 - [Main]



```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**  CCCC   OOOO   SSSS   M     M   OOOO   SSSS     / M     M  **
**  C      O  O   S      MM   MM   O  O   S       /  MM   MM  **
**  C      O  O   SSSS   M M M M   O  O   SSSS   /   M M M M  **
**  C      O  O      S   M  M  M   O  O      S  /    M  M  M  **
**  CCCC   OOOO   SSSS   M     M   OOOO   SSSS /     M     M  **
**                                                                  **
**                                                                  **
**                        VERSION: 2.00                             **
**                      DISTRIBUTED BY:                             **
**       STRUCTURAL  RESEARCH  AND  ANALYSIS  CORPORATION           **
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**                 TEL. NO.   (310)  207-2800                       **
**                COPYRIGHT  1988   S. R. A. C.                     **
**                                                                  **
**********************************************************************
**********************************************************************
```

Element group data

Element group number= 1
Element name:
BEAM3D Three dimensional Elastic Beam elements
Type of beam element = . . . . . 0
EQ. 0 ; Symmetric beam element
EQ. 1 , Unsymmetric beam element
EQ. 2 ; Symmetric tapered beam element
Element group number= 2
Element name:
SHELL4T Four node thick shell elements
Type of Shell element= . . . . . 2
EQ. 0 ; QUAD 2 element
EQ. 1 ; QUAD 4 element
Element group number= 3
Element name:
SHELL3T Three node thick shell elements

Real constant data

Real constant set 1
Associated with :
SHELL4T Four node thick shell elements
Thickness of the plate = .25000
Temperature Gradient = .00000
Real constant set 2
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+07
Moment of Inertia about element Y-axis = .10000E+07
Moment of Inertia about element Z-axis = .10000E+07
Depth of beam (y-axis) = 10.000
Width of beam (z-axis) = 10.000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .10000E+07
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 3
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .50187
Moment of Inertia about element Y-axis = .16362E-01
Moment of Inertia about element Z-axis = .18824
Depth of beam (y-axis) = 1.6500
Width of beam (z-axis) = .00000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .25505E-02
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 4
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .94150
Moment of Inertia about element Z-axis = .94150
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 5
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .94150
Moment of Inertia about element Z-axis = .94150
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000

Material propery data

Material property set 1

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .30000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |

Material property set 2

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Material property set 3

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |

Material property set 4

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | 100.00 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |

Material property set 5

| | Value | Temp curve no. |
|---|---|---|
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Nodal input data

NODE BOUNDARY CONDITION CODES (0 = FREE ; 1 = FIXED) NODAL POINT COORDINATES

| | X | Y | Z | XX | YY | ZZ | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 64.175 | 99.667 | .00000 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 63.395 | 98.101 | .00000 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 62.614 | 96.535 | .00000 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 61.834 | 94.968 | .00000 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 61.053 | 93.402 | .00000 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 60.273 | 91.836 | .00000 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 59.492 | 90.269 | .00000 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 58.712 | 88.703 | .00000 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 57.931 | 87.137 | .00000 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 57.151 | 85.571 | .00000 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 56.371 | 84.005 | .00000 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 55.590 | 82.438 | .00000 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 54.810 | 80.872 | .00000 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 54.029 | 79.306 | .00000 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 53.249 | 77.740 | .00000 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 52.468 | 76.173 | .00000 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 51.688 | 74.607 | .00000 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 50.907 | 73.041 | .00000 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 50.127 | 71.475 | .00000 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 49.346 | 69.908 | .00000 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 48.566 | 68.342 | .00000 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 63.783 | 100.11 | .00000 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 63.002 | 98.545 | .00000 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 62.222 | 96.978 | .00000 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 61.442 | 95.412 | .00000 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 60.661 | 93.846 | .00000 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 59.881 | 92.279 | .00000 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 59.100 | 90.713 | .00000 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 58.319 | 89.147 | .00000 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 57.539 | 87.580 | .00000 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 56.758 | 86.014 | .00000 |
| 32 | 0 | 0 | 0 | 0 | 0 | 0 | 55.978 | 84.448 | .00000 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 55.197 | 82.881 | .00000 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 54.417 | 81.315 | .00000 |
| 35 | 0 | 0 | 0 | 0 | 0 | 0 | 53.637 | 79.748 | .00000 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 | 52.856 | 78.182 | .00000 |
| 37 | 0 | 0 | 0 | 0 | 0 | 0 | 52.075 | 76.616 | .00000 |
| 38 | 0 | 0 | 0 | 0 | 0 | 0 | 51.295 | 75.049 | .00000 |
| 39 | 0 | 0 | 0 | 0 | 0 | 0 | 50.514 | 73.483 | .00000 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 | 49.734 | 71.917 | .00000 |
| 41 | 0 | 0 | 0 | 0 | 0 | 0 | 48.953 | 70.350 | .00000 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0 | 48.173 | 68.784 | .00000 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 | 62.511 | 101.54 | .00000 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | 61.731 | 99.978 | .00000 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 60.950 | 98.412 | .00000 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 60.170 | 96.845 | .00000 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 59.389 | 95.279 | .00000 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 58.609 | 93.713 | .00000 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 57.828 | 92.146 | .00000 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 57.048 | 90.580 | .00000 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 56.267 | 89.014 | .00000 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 55.487 | 87.447 | .00000 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 54.706 | 85.881 | .00000 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 53.926 | 84.314 | .00000 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 | 53.145 | 82.748 | .00000 |
| 56 | 0 | 0 | 0 | 0 | 0 | 0 | 52.365 | 81.182 | .00000 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 51.584 | 79.615 | .00000 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 50.804 | 78.049 | .00000 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 50.023 | 76.483 | .00000 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 49.243 | 74.916 | .00000 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 48.462 | 73.350 | .00000 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 47.682 | 71.784 | .00000 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 46.902 | 70.217 | .00000 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 61.240 | 102.98 | .00000 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 60.459 | 101.41 | .00000 |
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 59.679 | 99.845 | .00000 |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 58.898 | 98.279 | .00000 |
| 68 | 0 | 0 | 0 | 0 | 0 | 0 | 58.118 | 96.712 | .00000 |
| 69 | 0 | 0 | 0 | 0 | 0 | 0 | 57.337 | 95.146 | .00000 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0 | 56.557 | 93.580 | .00000 |
| 71 | 0 | 0 | 0 | 0 | 0 | 0 | 55.776 | 92.013 | .00000 |
| 72 | 0 | 0 | 0 | 0 | 0 | 0 | 54.996 | 90.447 | .00000 |
| 73 | 0 | 0 | 0 | 0 | 0 | 0 | 54.215 | 88.881 | .00000 |
| 74 | 0 | 0 | 0 | 0 | 0 | 0 | 53.435 | 87.314 | .00000 |
| 75 | 0 | 0 | 0 | 0 | 0 | 0 | 52.654 | 85.748 | .00000 |
| 76 | 0 | 0 | 0 | 0 | 0 | 0 | 51.874 | 84.181 | .00000 |
| 77 | 0 | 0 | 0 | 0 | 0 | 0 | 51.093 | 82.615 | .00000 |
| 78 | 0 | 0 | 0 | 0 | 0 | 0 | 50.313 | 81.049 | .00000 |
| 79 | 0 | 0 | 0 | 0 | 0 | 0 | 49.532 | 79.482 | .00000 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0 | 48.752 | 77.916 | .00000 |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 47.971 | 76.350 | .00000 |
| 82 | 0 | 0 | 0 | 0 | 0 | 0 | 47.191 | 74.783 | .00000 |
| 83 | 0 | 0 | 0 | 0 | 0 | 0 | 46.410 | 73.217 | .00000 |
| 84 | 0 | 0 | 0 | 0 | 0 | 0 | 45.630 | 71.651 | .00000 |
| 85 | 0 | 0 | 0 | 0 | 0 | 0 | 59.968 | 104.41 | .00000 |
| 86 | 0 | 0 | 0 | 0 | 0 | 0 | 59.188 | 102.84 | .00000 |
| 87 | 0 | 0 | 0 | 0 | 0 | 0 | 58.407 | 101.28 | .00000 |
| 88 | 0 | 0 | 0 | 0 | 0 | 0 | 57.627 | 99.712 | .00000 |
| 89 | 0 | 0 | 0 | 0 | 0 | 0 | 56.846 | 98.146 | .00000 |
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 56.066 | 96.579 | .00000 |
| 91 | 0 | 0 | 0 | 0 | 0 | 0 | 55.285 | 95.013 | .00000 |
| 92 | 0 | 0 | 0 | 0 | 0 | 0 | 54.505 | 93.447 | .00000 |
| 93 | 0 | 0 | 0 | 0 | 0 | 0 | 53.724 | 91.880 | .00000 |
| 94 | 0 | 0 | 0 | 0 | 0 | 0 | 52.944 | 90.314 | .00000 |
| 95 | 0 | 0 | 0 | 0 | 0 | 0 | 52.163 | 88.747 | .00000 |
| 96 | 0 | 0 | 0 | 0 | 0 | 0 | 51.383 | 87.181 | .00000 |
| 97 | 0 | 0 | 0 | 0 | 0 | 0 | 50.602 | 85.615 | .00000 |
| 98 | 0 | 0 | 0 | 0 | 0 | 0 | 49.822 | 84.048 | .00000 |
| 99 | 0 | 0 | 0 | 0 | 0 | 0 | 49.041 | 82.482 | .00000 |
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 48.261 | 80.916 | .00000 |
| 101 | 0 | 0 | 0 | 0 | 0 | 0 | 47.480 | 79.349 | .00000 |
| 102 | 0 | 0 | 0 | 0 | 0 | 0 | 46.700 | 77.783 | .00000 |
| 103 | 0 | 0 | 0 | 0 | 0 | 0 | 45.919 | 76.217 | .00000 |
| 104 | 0 | 0 | 0 | 0 | 0 | 0 | 45.139 | 74.650 | .00000 |
| 105 | 0 | 0 | 0 | 0 | 0 | 0 | 44.358 | 73.084 | .00000 |
| 106 | 0 | 0 | 0 | 0 | 0 | 0 | 58.696 | 105.84 | .00000 |
| 107 | 0 | 0 | 0 | 0 | 0 | 0 | 57.916 | 104.28 | .00000 |
| 108 | 0 | 0 | 0 | 0 | 0 | 0 | 57.135 | 102.71 | .00000 |
| 109 | 0 | 0 | 0 | 0 | 0 | 0 | 56.355 | 101.15 | .00000 |
| 110 | 0 | 0 | 0 | 0 | 0 | 0 | 55.574 | 99.579 | .00000 |
| 111 | 0 | 0 | 0 | 0 | 0 | 0 | 54.794 | 98.013 | .00000 |
| 112 | 0 | 0 | 0 | 0 | 0 | 0 | 54.014 | 96.446 | .00000 |
| 113 | 0 | 0 | 0 | 0 | 0 | 0 | 53.233 | 94.880 | .00000 |
| 114 | 0 | 0 | 0 | 0 | 0 | 0 | 52.453 | 93.314 | .00000 |
| 115 | 0 | 0 | 0 | 0 | 0 | 0 | 51.672 | 91.747 | .00000 |
| 116 | 0 | 0 | 0 | 0 | 0 | 0 | 50.892 | 90.181 | .00000 |
| 117 | 0 | 0 | 0 | 0 | 0 | 0 | 50.111 | 88.614 | .00000 |
| 118 | 0 | 0 | 0 | 0 | 0 | 0 | 49.331 | 87.048 | .00000 |
| 119 | 0 | 0 | 0 | 0 | 0 | 0 | 48.550 | 85.482 | .00000 |
| 120 | 0 | 0 | 0 | 0 | 0 | 0 | 47.770 | 83.915 | .00000 |
| 121 | 0 | 0 | 0 | 0 | 0 | 0 | 46.989 | 82.349 | .00000 |
| 122 | 0 | 0 | 0 | 0 | 0 | 0 | 46.209 | 80.783 | .00000 |
| 123 | 0 | 0 | 0 | 0 | 0 | 0 | 45.428 | 79.216 | .00000 |
| 124 | 0 | 0 | 0 | 0 | 0 | 0 | 44.648 | 77.650 | .00000 |
| 125 | 0 | 0 | 0 | 0 | 0 | 0 | 43.867 | 76.084 | .00000 |
| 126 | 0 | 0 | 0 | 0 | 0 | 0 | 43.087 | 74.517 | .00000 |
| 127 | 0 | 0 | 0 | 0 | 0 | 0 | 57.425 | 107.28 | .00000 |
| 128 | 0 | 0 | 0 | 0 | 0 | 0 | 56.644 | 105.71 | .00000 |
| 129 | 0 | 0 | 0 | 0 | 0 | 0 | 55.864 | 104.14 | .00000 |
| 130 | 0 | 0 | 0 | 0 | 0 | 0 | 55.083 | 102.58 | .00000 |
| 131 | 0 | 0 | 0 | 0 | 0 | 0 | 54.303 | 101.01 | .00000 |
| 132 | 0 | 0 | 0 | 0 | 0 | 0 | 53.522 | 99.446 | .00000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 133 | 0 | 0 | 0 | 0 | 0 | 0 | 52.742 | 97.880 | .00000 |
| 134 | 0 | 0 | 0 | 0 | 0 | 0 | 51.961 | 96.313 | .00000 |
| 135 | 0 | 0 | 0 | 0 | 0 | 0 | 51.181 | 94.747 | .00000 |
| 136 | 0 | 0 | 0 | 0 | 0 | 0 | 50.401 | 93.181 | .00000 |
| 137 | 0 | 0 | 0 | 0 | 0 | 0 | 49.620 | 91.614 | .00000 |
| 138 | 0 | 0 | 0 | 0 | 0 | 0 | 48.840 | 90.048 | .00000 |
| 139 | 0 | 0 | 0 | 0 | 0 | 0 | 48.059 | 88.481 | .00000 |
| 140 | 0 | 0 | 0 | 0 | 0 | 0 | 47.279 | 86.915 | .00000 |
| 141 | 0 | 0 | 0 | 0 | 0 | 0 | 46.498 | 85.349 | .00000 |
| 142 | 0 | 0 | 0 | 0 | 0 | 0 | 45.718 | 83.782 | .00000 |
| 143 | 0 | 0 | 0 | 0 | 0 | 0 | 44.937 | 82.216 | .00000 |
| 144 | 0 | 0 | 0 | 0 | 0 | 0 | 44.157 | 80.650 | .00000 |
| 145 | 0 | 0 | 0 | 0 | 0 | 0 | 43.376 | 79.083 | .00000 |
| 146 | 0 | 0 | 0 | 0 | 0 | 0 | 42.596 | 77.517 | .00000 |
| 147 | 0 | 0 | 0 | 0 | 0 | 0 | 41.816 | 75.951 | .00000 |
| 148 | 0 | 0 | 0 | 0 | 0 | 0 | 56.153 | 108.71 | .00000 |
| 149 | 0 | 0 | 0 | 0 | 0 | 0 | 55.373 | 107.14 | .00000 |
| 150 | 0 | 0 | 0 | 0 | 0 | 0 | 54.592 | 105.58 | .00000 |
| 151 | 0 | 0 | 0 | 0 | 0 | 0 | 53.812 | 104.01 | .00000 |
| 152 | 0 | 0 | 0 | 0 | 0 | 0 | 53.031 | 102.45 | .00000 |
| 153 | 0 | 0 | 0 | 0 | 0 | 0 | 52.251 | 100.88 | .00000 |
| 154 | 0 | 0 | 0 | 0 | 0 | 0 | 51.470 | 99.313 | .00000 |
| 155 | 0 | 0 | 0 | 0 | 0 | 0 | 50.690 | 97.747 | .00000 |
| 156 | 0 | 0 | 0 | 0 | 0 | 0 | 49.909 | 96.180 | .00000 |
| 157 | 0 | 0 | 0 | 0 | 0 | 0 | 49.129 | 94.614 | .00000 |
| 158 | 0 | 0 | 0 | 0 | 0 | 0 | 48.348 | 93.048 | .00000 |
| 159 | 0 | 0 | 0 | 0 | 0 | 0 | 47.568 | 91.481 | .00000 |
| 160 | 0 | 0 | 0 | 0 | 0 | 0 | 46.788 | 89.915 | .00000 |
| 161 | 0 | 0 | 0 | 0 | 0 | 0 | 46.007 | 88.348 | .00000 |
| 162 | 0 | 0 | 0 | 0 | 0 | 0 | 45.227 | 86.782 | .00000 |
| 163 | 0 | 0 | 0 | 0 | 0 | 0 | 44.446 | 85.216 | .00000 |
| 164 | 0 | 0 | 0 | 0 | 0 | 0 | 43.666 | 83.649 | .00000 |
| 165 | 0 | 0 | 0 | 0 | 0 | 0 | 42.885 | 82.083 | .00000 |
| 166 | 0 | 0 | 0 | 0 | 0 | 0 | 42.105 | 80.517 | .00000 |
| 167 | 0 | 0 | 0 | 0 | 0 | 0 | 41.324 | 78.950 | .00000 |
| 168 | 0 | 0 | 0 | 0 | 0 | 0 | 40.544 | 77.384 | .00000 |
| 169 | 0 | 0 | 0 | 0 | 0 | 0 | 55.760 | 109.15 | .00000 |
| 170 | 0 | 0 | 0 | 0 | 0 | 0 | 54.980 | 107.59 | .00000 |
| 171 | 0 | 0 | 0 | 0 | 0 | 0 | 54.199 | 106.02 | .00000 |
| 172 | 0 | 0 | 0 | 0 | 0 | 0 | 53.419 | 104.45 | .00000 |
| 173 | 0 | 0 | 0 | 0 | 0 | 0 | 52.638 | 102.89 | .00000 |
| 174 | 0 | 0 | 0 | 0 | 0 | 0 | 51.858 | 101.32 | .00000 |
| 175 | 0 | 0 | 0 | 0 | 0 | 0 | 51.077 | 99.756 | .00000 |
| 176 | 0 | 0 | 0 | 0 | 0 | 0 | 50.297 | 98.189 | .00000 |
| 177 | 0 | 0 | 0 | 0 | 0 | 0 | 49.516 | 96.623 | .00000 |
| 178 | 0 | 0 | 0 | 0 | 0 | 0 | 48.736 | 95.057 | .00000 |
| 179 | 0 | 0 | 0 | 0 | 0 | 0 | 47.955 | 93.491 | .00000 |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 | 47.175 | 91.924 | .00000 |
| 181 | 0 | 0 | 0 | 0 | 0 | 0 | 46.395 | 90.358 | .00000 |
| 182 | 0 | 0 | 0 | 0 | 0 | 0 | 45.614 | 88.792 | .00000 |
| 183 | 0 | 0 | 0 | 0 | 0 | 0 | 44.834 | 87.226 | .00000 |
| 184 | 0 | 0 | 0 | 0 | 0 | 0 | 44.053 | 85.659 | .00000 |
| 185 | 0 | 0 | 0 | 0 | 0 | 0 | 43.273 | 84.093 | .00000 |
| 186 | 0 | 0 | 0 | 0 | 0 | 0 | 42.492 | 82.527 | .00000 |
| 187 | 0 | 0 | 0 | 0 | 0 | 0 | 41.712 | 80.961 | .00000 |
| 188 | 0 | 0 | 0 | 0 | 0 | 0 | 40.931 | 79.394 | .00000 |
| 189 | 0 | 0 | 0 | 0 | 0 | 0 | 40.151 | 77.828 | .00000 |
| 190 | 0 | 0 | 0 | 0 | 0 | 0 | 63.783 | 100.11 | -.96594 |
| 191 | 0 | 0 | 0 | 0 | 0 | 0 | 63.002 | 98.545 | -.96594 |
| 192 | 0 | 0 | 0 | 0 | 0 | 0 | 62.222 | 96.978 | -.96594 |
| 193 | 0 | 0 | 0 | 0 | 0 | 0 | 61.442 | 95.412 | -.96594 |
| 194 | 0 | 0 | 0 | 0 | 0 | 0 | 60.661 | 93.846 | -.96594 |
| 195 | 0 | 0 | 0 | 0 | 0 | 0 | 59.881 | 92.279 | -.96594 |
| 196 | 0 | 0 | 0 | 0 | 0 | 0 | 59.100 | 90.713 | -.96594 |
| 197 | 0 | 0 | 0 | 0 | 0 | 0 | 58.319 | 89.147 | -.96594 |
| 198 | 0 | 0 | 0 | 0 | 0 | 0 | 57.539 | 87.580 | -.96594 |
| 199 | 0 | 0 | 0 | 0 | 0 | 0 | 56.758 | 86.014 | -.96594 |
| 200 | 0 | 0 | 0 | 0 | 0 | 0 | 55.978 | 84.448 | -.96594 |
| 201 | 0 | 0 | 0 | 0 | 0 | 0 | 55.197 | 82.881 | -.96594 |
| 202 | 0 | 0 | 0 | 0 | 0 | 0 | 54.417 | 81.315 | -.96594 |
| 203 | 0 | 0 | 0 | 0 | 0 | 0 | 53.637 | 79.748 | -.96594 |
| 204 | 0 | 0 | 0 | 0 | 0 | 0 | 52.856 | 78.182 | -.96594 |
| 205 | 0 | 0 | 0 | 0 | 0 | 0 | 52.075 | 76.616 | -.96594 |
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| 207 | 0 | 0 | 0 | 0 | 0 | 0 | 50.514 | 73.483 | -.96594 |
| 208 | 0 | 0 | 0 | 0 | 0 | 0 | 49.734 | 71.917 | -.96594 |
| 209 | 0 | 0 | 0 | 0 | 0 | 0 | 48.953 | 70.350 | -.96594 |
| 210 | 0 | 0 | 0 | 0 | 0 | 0 | 48.173 | 68.784 | -.96594 |
| 211 | 0 | 0 | 0 | 0 | 0 | 0 | 62.511 | 101.54 | -.96594 |
| 212 | 0 | 0 | 0 | 0 | 0 | 0 | 61.731 | 99.978 | -.96594 |
| 213 | 0 | 0 | 0 | 0 | 0 | 0 | 60.950 | 98.412 | -.96594 |
| 214 | 0 | 0 | 0 | 0 | 0 | 0 | 60.170 | 96.845 | -.96594 |
| 215 | 0 | 0 | 0 | 0 | 0 | 0 | 59.389 | 95.279 | -.96594 |
| 216 | 0 | 0 | 0 | 0 | 0 | 0 | 58.609 | 93.713 | -.96594 |
| 217 | 0 | 0 | 0 | 0 | 0 | 0 | 57.828 | 92.146 | -.96594 |
| 218 | 0 | 0 | 0 | 0 | 0 | 0 | 57.048 | 90.580 | -.96594 |
| 219 | 0 | 0 | 0 | 0 | 0 | 0 | 56.267 | 89.014 | -.96594 |
| 220 | 0 | 0 | 0 | 0 | 0 | 0 | 55.487 | 87.447 | -.96594 |
| 221 | 0 | 0 | 0 | 0 | 0 | 0 | 54.706 | 85.881 | -.96594 |
| 222 | 0 | 0 | 0 | 0 | 0 | 0 | 53.926 | 84.314 | -.96594 |
| 223 | 0 | 0 | 0 | 0 | 0 | 0 | 53.145 | 82.748 | -.96594 |
| 224 | 0 | 0 | 0 | 0 | 0 | 0 | 52.365 | 81.182 | -.96594 |
| 225 | 0 | 0 | 0 | 0 | 0 | 0 | 51.584 | 79.615 | -.96594 |
| 226 | 0 | 0 | 0 | 0 | 0 | 0 | 50.804 | 78.049 | -.96594 |
| 227 | 0 | 0 | 0 | 0 | 0 | 0 | 50.023 | 76.483 | -.96594 |
| 228 | 0 | 0 | 0 | 0 | 0 | 0 | 49.243 | 74.916 | -.96594 |
| 229 | 0 | 0 | 0 | 0 | 0 | 0 | 48.462 | 73.350 | -.96594 |
| 230 | 0 | 0 | 0 | 0 | 0 | 0 | 47.682 | 71.784 | -.96594 |
| 231 | 0 | 0 | 0 | 0 | 0 | 0 | 46.902 | 70.217 | -.96594 |
| 232 | 0 | 0 | 0 | 0 | 0 | 0 | 61.240 | 102.98 | -.96594 |
| 233 | 0 | 0 | 0 | 0 | 0 | 0 | 60.459 | 101.41 | -.96594 |
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| 236 | 0 | 0 | 0 | 0 | 0 | 0 | 58.118 | 96.712 | -.96594 |
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| 239 | 0 | 0 | 0 | 0 | 0 | 0 | 55.776 | 92.013 | -.96594 |
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| 241 | 0 | 0 | 0 | 0 | 0 | 0 | 54.215 | 88.881 | -.96594 |
| 242 | 0 | 0 | 0 | 0 | 0 | 0 | 53.435 | 87.314 | -.96594 |
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| 244 | 0 | 0 | 0 | 0 | 0 | 0 | 51.874 | 84.181 | -.96594 |
| 245 | 0 | 0 | 0 | 0 | 0 | 0 | 51.093 | 82.615 | -.96594 |
| 246 | 0 | 0 | 0 | 0 | 0 | 0 | 50.313 | 81.049 | -.96594 |
| 247 | 0 | 0 | 0 | 0 | 0 | 0 | 49.532 | 79.482 | -.96594 |
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| 250 | 0 | 0 | 0 | 0 | 0 | 0 | 47.191 | 74.783 | -.96594 |
| 251 | 0 | 0 | 0 | 0 | 0 | 0 | 46.410 | 73.217 | -.96594 |
| 252 | 0 | 0 | 0 | 0 | 0 | 0 | 45.630 | 71.651 | -.96594 |
| 253 | 0 | 0 | 0 | 0 | 0 | 0 | 59.968 | 104.41 | -.96594 |
| 254 | 0 | 0 | 0 | 0 | 0 | 0 | 59.188 | 102.84 | -.96594 |
| 255 | 0 | 0 | 0 | 0 | 0 | 0 | 58.407 | 101.28 | -.96594 |
| 256 | 0 | 0 | 0 | 0 | 0 | 0 | 57.627 | 99.712 | -.96594 |
| 257 | 0 | 0 | 0 | 0 | 0 | 0 | 56.846 | 98.146 | -.96594 |
| 258 | 0 | 0 | 0 | 0 | 0 | 0 | 56.066 | 96.579 | -.96594 |
| 259 | 0 | 0 | 0 | 0 | 0 | 0 | 55.285 | 95.013 | -.96594 |
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| 262 | 0 | 0 | 0 | 0 | 0 | 0 | 52.944 | 90.314 | -.96594 |
| 263 | 0 | 0 | 0 | 0 | 0 | 0 | 52.163 | 88.747 | -.96594 |
| 264 | 0 | 0 | 0 | 0 | 0 | 0 | 51.383 | 87.181 | -.96594 |
| 265 | 0 | 0 | 0 | 0 | 0 | 0 | 50.602 | 85.615 | -.96594 |
| 266 | 0 | 0 | 0 | 0 | 0 | 0 | 49.822 | 84.048 | -.96594 |
| 267 | 0 | 0 | 0 | 0 | 0 | 0 | 49.041 | 82.482 | -.96594 |
| 268 | 0 | 0 | 0 | 0 | 0 | 0 | 48.261 | 80.916 | -.96594 |
| 269 | 0 | 0 | 0 | 0 | 0 | 0 | 47.480 | 79.349 | -.96594 |
| 270 | 0 | 0 | 0 | 0 | 0 | 0 | 46.700 | 77.783 | -.96594 |
| 271 | 0 | 0 | 0 | 0 | 0 | 0 | 45.919 | 76.217 | -.96594 |
| 272 | 0 | 0 | 0 | 0 | 0 | 0 | 45.139 | 74.650 | -.96594 |
| 273 | 0 | 0 | 0 | 0 | 0 | 0 | 44.358 | 73.084 | -.96594 |
| 274 | 0 | 0 | 0 | 0 | 0 | 0 | 58.696 | 105.84 | -.96594 |
| 275 | 0 | 0 | 0 | 0 | 0 | 0 | 57.916 | 104.28 | -.96594 |
| 276 | 0 | 0 | 0 | 0 | 0 | 0 | 57.135 | 102.71 | -.96594 |
| 277 | 0 | 0 | 0 | 0 | 0 | 0 | 56.355 | 101.15 | -.96594 |
| 278 | 0 | 0 | 0 | 0 | 0 | 0 | 55.574 | 99.579 | -.96594 |
| 279 | 0 | 0 | 0 | 0 | 0 | 0 | 54.794 | 98.013 | -.96594 |
| 280 | 0 | 0 | 0 | 0 | 0 | 0 | 54.014 | 96.446 | -.96594 |
| 281 | 0 | 0 | 0 | 0 | 0 | 0 | 53.233 | 94.880 | -.96594 |
| 282 | 0 | 0 | 0 | 0 | 0 | 0 | 52.453 | 93.314 | -.96594 |
| 283 | 0 | 0 | 0 | 0 | 0 | 0 | 51.672 | 91.747 | -.96594 |
| 284 | 0 | 0 | 0 | 0 | 0 | 0 | 50.892 | 90.181 | -.96594 |
| 285 | 0 | 0 | 0 | 0 | 0 | 0 | 50.111 | 88.614 | -.96594 |
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| 287 | 0 | 0 | 0 | 0 | 0 | 0 | 48.550 | 85.482 | -.96594 |
| 288 | 0 | 0 | 0 | 0 | 0 | 0 | 47.770 | 83.915 | -.96594 |
| 289 | 0 | 0 | 0 | 0 | 0 | 0 | 46.989 | 82.349 | -.96594 |
| 290 | 0 | 0 | 0 | 0 | 0 | 0 | 46.209 | 80.783 | -.96594 |
| 291 | 0 | 0 | 0 | 0 | 0 | 0 | 45.428 | 79.216 | -.96594 |
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| 293 | 0 | 0 | 0 | 0 | 0 | 0 | 43.867 | 76.084 | -.96594 |
| 294 | 0 | 0 | 0 | 0 | 0 | 0 | 43.087 | 74.517 | -.96594 |
| 295 | 0 | 0 | 0 | 0 | 0 | 0 | 57.425 | 107.28 | -.96594 |
| 296 | 0 | 0 | 0 | 0 | 0 | 0 | 56.644 | 105.71 | -.96594 |
| 297 | 0 | 0 | 0 | 0 | 0 | 0 | 55.864 | 104.14 | -.96594 |
| 298 | 0 | 0 | 0 | 0 | 0 | 0 | 55.083 | 102.58 | -.96594 |
| 299 | 0 | 0 | 0 | 0 | 0 | 0 | 54.303 | 101.01 | -.96594 |
| 300 | 0 | 0 | 0 | 0 | 0 | 0 | 53.522 | 99.446 | -.96594 |
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| 303 | 0 | 0 | 0 | 0 | 0 | 0 | 51.181 | 94.747 | -.96594 |
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| 305 | 0 | 0 | 0 | 0 | 0 | 0 | 49.620 | 91.614 | -.96594 |
| 306 | 0 | 0 | 0 | 0 | 0 | 0 | 48.840 | 90.048 | -.96594 |
| 307 | 0 | 0 | 0 | 0 | 0 | 0 | 48.059 | 88.481 | -.96594 |
| 308 | 0 | 0 | 0 | 0 | 0 | 0 | 47.279 | 86.915 | -.96594 |
| 309 | 0 | 0 | 0 | 0 | 0 | 0 | 46.498 | 85.349 | -.96594 |
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| 312 | 0 | 0 | 0 | 0 | 0 | 0 | 44.157 | 80.650 | -.96594 |
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| 316 | 0 | 0 | 0 | 0 | 0 | 0 | 56.153 | 108.71 | -.96594 |
| 317 | 0 | 0 | 0 | 0 | 0 | 0 | 55.373 | 107.14 | -.96594 |
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| 319 | 0 | 0 | 0 | 0 | 0 | 0 | 53.812 | 104.01 | -.96594 |
| 320 | 0 | 0 | 0 | 0 | 0 | 0 | 53.031 | 102.45 | -.96594 |
| 321 | 0 | 0 | 0 | 0 | 0 | 0 | 52.251 | 100.88 | -.96594 |
| 322 | 0 | 0 | 0 | 0 | 0 | 0 | 51.470 | 99.313 | -.96594 |
| 323 | 0 | 0 | 0 | 0 | 0 | 0 | 50.690 | 97.747 | -.96594 |
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| 325 | 0 | 0 | 0 | 0 | 0 | 0 | 49.129 | 94.614 | -.96594 |
| 326 | 0 | 0 | 0 | 0 | 0 | 0 | 48.348 | 93.048 | -.96594 |
| 327 | 0 | 0 | 0 | 0 | 0 | 0 | 47.568 | 91.481 | -.96594 |
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| 330 | 0 | 0 | 0 | 0 | 0 | 0 | 45.227 | 86.782 | -.96594 |
| 331 | 0 | 0 | 0 | 0 | 0 | 0 | 44.446 | 85.216 | -.96594 |
| 332 | 0 | 0 | 0 | 0 | 0 | 0 | 43.666 | 83.649 | -.96594 |
| 333 | 0 | 0 | 0 | 0 | 0 | 0 | 42.885 | 82.083 | -.96594 |
| 334 | 0 | 0 | 0 | 0 | 0 | 0 | 42.105 | 80.517 | -.96594 |
| 335 | 0 | 0 | 0 | 0 | 0 | 0 | 41.324 | 78.950 | -.96594 |
| 336 | 0 | 0 | 0 | 0 | 0 | 0 | 40.544 | 77.384 | -.96594 |
| 337 | 1 | 1 | 1 | 1 | 1 | 1 | 63.783 | 100.11 | -1.7750 |
| 338 | 1 | 1 | 1 | 1 | 1 | 1 | 62.511 | 101.54 | -1.7750 |
| 339 | 1 | 1 | 1 | 1 | 1 | 1 | 61.240 | 102.98 | -1.7750 |
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| 341 | 1 | 1 | 1 | 1 | 1 | 1 | 58.696 | 105.84 | -1.7750 |
| 342 | 1 | 1 | 1 | 1 | 1 | 1 | 57.425 | 107.28 | -1.7750 |
| 343 | 1 | 1 | 1 | 1 | 1 | 1 | 56.153 | 108.71 | -1.7750 |
| 344 | 1 | 1 | 1 | 1 | 1 | 1 | 48.173 | 68.784 | -1.7750 |
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| 346 | 1 | 1 | 1 | 1 | 1 | 1 | 45.630 | 71.651 | -1.7750 |
| 347 | 1 | 1 | 1 | 1 | 1 | 1 | 44.358 | 73.084 | -1.7750 |
| 348 | 1 | 1 | 1 | 1 | 1 | 1 | 43.087 | 74.517 | -1.7750 |
| 349 | 1 | 1 | 1 | 1 | 1 | 1 | 41.816 | 75.951 | -1.7750 |
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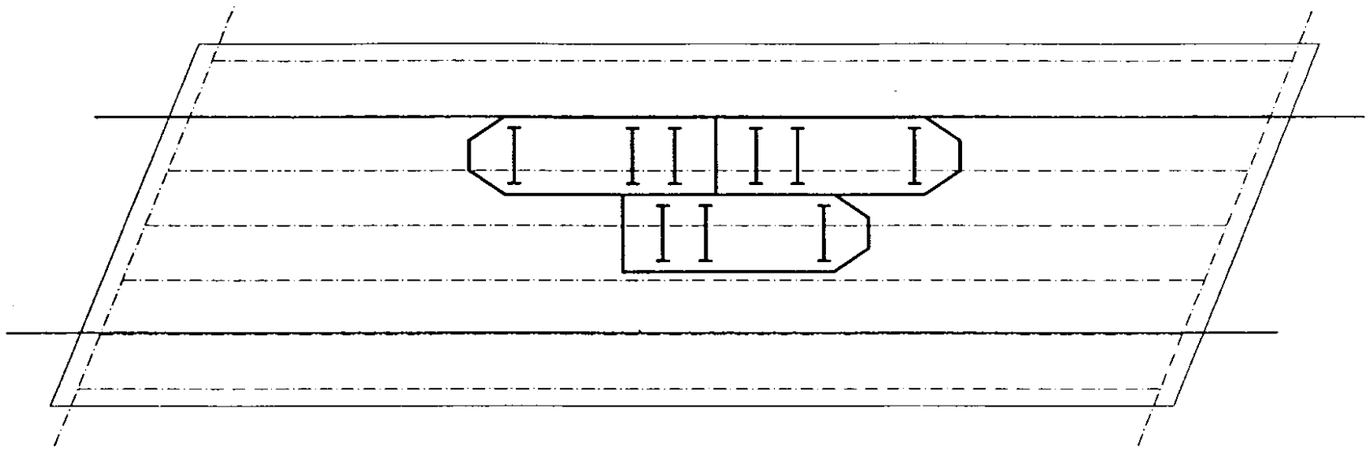
Element input data

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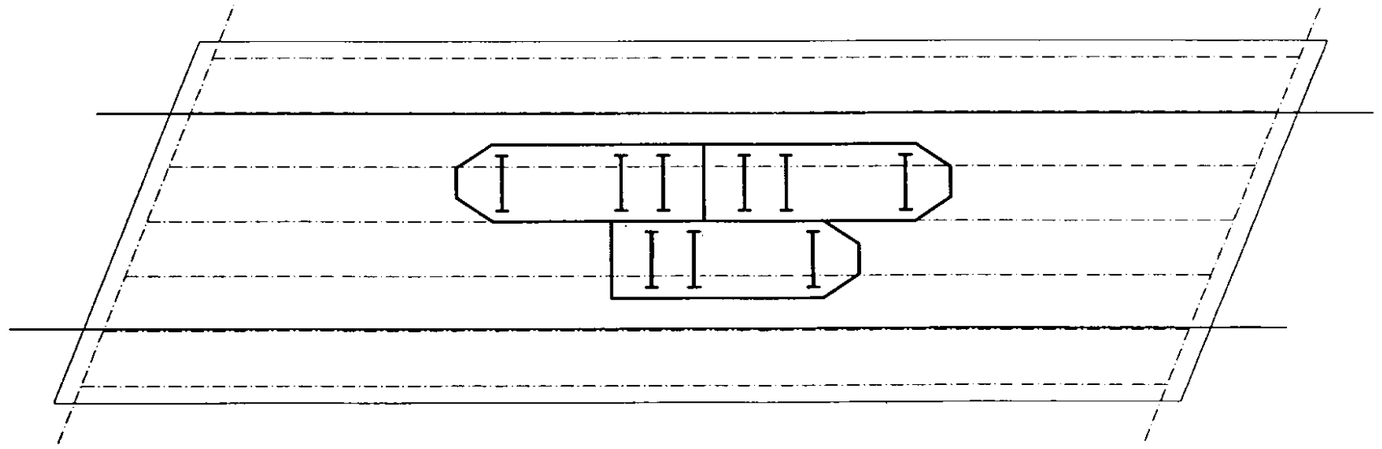
ELEM EGRP MP REAL ECS NODE 1 NODE 2 NODE 3 NODE 4 NODE 5 NODE 6
NODE 7 NODE 8 NODE 9 NODE10 NODE11 NODE12
NODE13 NODE14 NODE15 NODE16 NODE17 NODE18
NODE19 NODE20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 1 | -1 | 1 | 2 | 23 | 22 |
| 2 | 2 | 1 | 1 | -1 | 2 | 3 | 24 | 23 |
| 3 | 2 | 1 | 1 | -1 | 3 | 4 | 25 | 24 |
| 4 | 2 | 1 | 1 | -1 | 4 | 5 | 26 | 25 |
| 5 | 2 | 1 | 1 | -1 | 5 | 6 | 27 | 26 |
| 6 | 2 | 1 | 1 | -1 | 6 | 7 | 28 | 27 |
| 7 | 2 | 1 | 1 | -1 | 7 | 8 | 29 | 28 |
| 8 | 2 | 1 | 1 | -1 | 8 | 9 | 30 | 29 |
| 9 | 2 | 1 | 1 | -1 | 9 | 10 | 31 | 30 |
| 10 | 2 | 1 | 1 | -1 | 10 | 11 | 32 | 31 |
| 11 | 2 | 1 | 1 | -1 | 11 | 12 | 33 | 32 |
| 12 | 2 | 1 | 1 | -1 | 12 | 13 | 34 | 33 |
| 13 | 2 | 1 | 1 | -1 | 13 | 14 | 35 | 34 |
| 14 | 2 | 1 | 1 | -1 | 14 | 15 | 36 | 35 |
| 15 | 2 | 1 | 1 | -1 | 15 | 16 | 37 | 36 |
| 16 | 2 | 1 | 1 | -1 | 16 | 17 | 38 | 37 |
| 17 | 2 | 1 | 1 | -1 | 17 | 18 | 39 | 38 |
| 18 | 2 | 1 | 1 | -1 | 18 | 19 | 40 | 39 |
| 19 | 2 | 1 | 1 | -1 | 19 | 20 | 41 | 40 |
| 20 | 2 | 1 | 1 | -1 | 20 | 21 | 42 | 41 |
| 21 | 2 | 1 | 1 | -1 | 22 | 23 | 44 | 43 |
| 22 | 2 | 1 | 1 | -1 | 23 | 24 | 45 | 44 |
| 23 | 2 | 1 | 1 | -1 | 24 | 25 | 46 | 45 |
| 24 | 2 | 1 | 1 | -1 | 25 | 26 | 47 | 46 |
| 25 | 2 | 1 | 1 | -1 | 26 | 27 | 48 | 47 |
| 26 | 2 | 1 | 1 | -1 | 27 | 28 | 49 | 48 |
| 27 | 2 | 1 | 1 | -1 | 28 | 29 | 50 | 49 |
| 28 | 2 | 1 | 1 | -1 | 29 | 30 | 51 | 50 |
| 29 | 2 | 1 | 1 | -1 | 30 | 31 | 52 | 51 |
| 30 | 2 | 1 | 1 | -1 | 31 | 32 | 53 | 52 |
| 31 | 2 | 1 | 1 | -1 | 32 | 33 | 54 | 53 |
| 32 | 2 | 1 | 1 | -1 | 33 | 34 | 55 | 54 |
| 33 | 2 | 1 | 1 | -1 | 34 | 35 | 56 | 55 |
| 34 | 2 | 1 | 1 | -1 | 35 | 36 | 57 | 56 |
| 35 | 2 | 1 | 1 | -1 | 36 | 37 | 58 | 57 |
| 36 | 2 | 1 | 1 | -1 | 37 | 38 | 59 | 58 |
| 37 | 2 | 1 | 1 | -1 | 38 | 39 | 60 | 59 |
| 38 | 2 | 1 | 1 | -1 | 39 | 40 | 61 | 60 |
| 39 | 2 | 1 | 1 | -1 | 40 | 41 | 62 | 61 |
| 40 | 2 | 1 | 1 | -1 | 41 | 42 | 63 | 62 |
| 41 | 2 | 1 | 1 | -1 | 43 | 44 | 65 | 64 |
| 42 | 2 | 1 | 1 | -1 | 44 | 45 | 66 | 65 |
| 43 | 2 | 1 | 1 | -1 | 45 | 46 | 67 | 66 |
| 44 | 2 | 1 | 1 | -1 | 46 | 47 | 68 | 67 |
| 45 | 2 | 1 | 1 | -1 | 47 | 48 | 69 | 68 |
| 46 | 2 | 1 | 1 | -1 | 48 | 49 | 70 | 69 |
| 47 | 2 | 1 | 1 | -1 | 49 | 50 | 71 | 70 |
| 48 | 2 | 1 | 1 | -1 | 50 | 51 | 72 | 71 |
| 49 | 2 | 1 | 1 | -1 | 51 | 52 | 73 | 72 |
| 50 | 2 | 1 | 1 | -1 | 52 | 53 | 74 | 73 |
| 51 | 2 | 1 | 1 | -1 | 53 | 54 | 75 | 74 |
| 52 | 2 | 1 | 1 | -1 | 54 | 55 | 76 | 75 |
| 53 | 2 | 1 | 1 | -1 | 55 | 56 | 77 | 76 |
| 54 | 2 | 1 | 1 | -1 | 56 | 57 | 78 | 77 |
| 55 | 2 | 1 | 1 | -1 | 57 | 58 | 79 | 78 |
| 56 | 2 | 1 | 1 | -1 | 58 | 59 | 80 | 79 |
| 57 | 2 | 1 | 1 | -1 | 59 | 60 | 81 | 80 |
| 58 | 2 | 1 | 1 | -1 | 60 | 61 | 82 | 81 |
| 59 | 2 | 1 | 1 | -1 | 61 | 62 | 83 | 82 |
| 60 | 2 | 1 | 1 | -1 | 62 | 63 | 84 | 83 |
| 61 | 2 | 1 | 1 | -1 | 64 | 65 | 86 | 85 |
| 62 | 2 | 1 | 1 | -1 | 65 | 66 | 87 | 86 |
| 63 | 2 | 1 | 1 | -1 | 66 | 67 | 88 | 87 |
| 64 | 2 | 1 | 1 | -1 | 67 | 68 | 89 | 88 |
| 65 | 2 | 1 | 1 | -1 | 68 | 69 | 90 | 89 |
| 66 | 2 | 1 | 1 | -1 | 69 | 70 | 91 | 90 |
| 67 | 2 | 1 | 1 | -1 | 70 | 71 | 92 | 91 |
| 68 | 2 | 1 | 1 | -1 | 71 | 72 | 93 | 92 |
| 69 | 2 | 1 | 1 | -1 | 72 | 73 | 94 | 93 |
| 70 | 2 | 1 | 1 | -1 | 73 | 74 | 95 | 94 |
| 71 | 2 | 1 | 1 | -1 | 74 | 75 | 96 | 95 |
| 72 | 2 | 1 | 1 | -1 | 75 | 76 | 97 | 96 |
| 73 | 2 | 1 | 1 | -1 | 76 | 77 | 98 | 97 |
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| 75 | 2 | 1 | 1 | -1 | 78 | 79 | 100 | 99 |
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| 77 | 2 | 1 | 1 | -1 | 80 | 81 | 102 | 101 |
| 78 | 2 | 1 | 1 | -1 | 81 | 82 | 103 | 102 |
| 79 | 2 | 1 | 1 | -1 | 82 | 83 | 104 | 103 |
| 80 | 2 | 1 | 1 | -1 | 83 | 84 | 105 | 104 |
| 81 | 2 | 1 | 1 | -1 | 85 | 86 | 107 | 106 |
| 82 | 2 | 1 | 1 | -1 | 86 | 87 | 108 | 107 |
| 83 | 2 | 1 | 1 | -1 | 87 | 88 | 109 | 108 |
| 84 | 2 | 1 | 1 | -1 | 88 | 89 | 110 | 109 |
| 85 | 2 | 1 | 1 | -1 | 89 | 90 | 111 | 110 |
| 86 | 2 | 1 | 1 | -1 | 90 | 91 | 112 | 111 |
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| 88 | 2 | 1 | 1 | -1 | 92 | 93 | 114 | 113 |
| 89 | 2 | 1 | 1 | -1 | 93 | 94 | 115 | 114 |
| 90 | 2 | 1 | 1 | -1 | 94 | 95 | 116 | 115 |
| 91 | 2 | 1 | 1 | -1 | 95 | 96 | 117 | 116 |
| 92 | 2 | 1 | 1 | -1 | 96 | 97 | 118 | 117 |
| 93 | 2 | 1 | 1 | -1 | 97 | 98 | 119 | 118 |
| 94 | 2 | 1 | 1 | -1 | 98 | 99 | 120 | 119 |
| 95 | 2 | 1 | 1 | -1 | 99 | 100 | 121 | 120 |
| 96 | 2 | 1 | 1 | -1 | 100 | 101 | 122 | 121 |
| 97 | 2 | 1 | 1 | -1 | 101 | 102 | 123 | 122 |
| 98 | 2 | 1 | 1 | -1 | 102 | 103 | 124 | 123 |
| 99 | 2 | 1 | 1 | -1 | 103 | 104 | 125 | 124 |
| 100 | 2 | 1 | 1 | -1 | 104 | 105 | 126 | 125 |
| 101 | 2 | 1 | 1 | -1 | 106 | 107 | 128 | 127 |
| 102 | 2 | 1 | 1 | -1 | 107 | 108 | 129 | 128 |
| 103 | 2 | 1 | 1 | -1 | 108 | 109 | 130 | 129 |
| 104 | 2 | 1 | 1 | -1 | 109 | 110 | 131 | 130 |
| 105 | 2 | 1 | 1 | -1 | 110 | 111 | 132 | 131 |
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| 112 | 2 | 1 | 1 | -1 | 117 | 118 | 139 | 138 |
| 113 | 2 | 1 | 1 | -1 | 118 | 119 | 140 | 139 |
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| 115 | 2 | 1 | 1 | -1 | 120 | 121 | 142 | 141 |
| 116 | 2 | 1 | 1 | -1 | 121 | 122 | 143 | 142 |
| 117 | 2 | 1 | 1 | -1 | 122 | 123 | 144 | 143 |
| 118 | 2 | 1 | 1 | -1 | 123 | 124 | 145 | 144 |
| 119 | 2 | 1 | 1 | -1 | 124 | 125 | 146 | 145 |
| 120 | 2 | 1 | 1 | -1 | 125 | 126 | 147 | 146 |
| 121 | 2 | 1 | 1 | -1 | 127 | 128 | 149 | 148 |
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| 124 | 2 | 1 | 1 | -1 | 130 | 131 | 152 | 151 |
| 125 | 2 | 1 | 1 | -1 | 131 | 132 | 153 | 152 |
| 126 | 2 | 1 | 1 | -1 | 132 | 133 | 154 | 153 |
| 127 | 2 | 1 | 1 | -1 | 133 | 134 | 155 | 154 |
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| 129 | 2 | 1 | 1 | -1 | 135 | 136 | 157 | 156 |
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| 132 | 2 | 1 | 1 | -1 | 138 | 139 | 160 | 159 |
| 133 | 2 | 1 | 1 | -1 | 139 | 140 | 161 | 160 |
| 134 | 2 | 1 | 1 | -1 | 140 | 141 | 162 | 161 |
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| 136 | 2 | 1 | 1 | -1 | 142 | 143 | 164 | 163 |
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| 138 | 2 | 1 | 1 | -1 | 144 | 145 | 166 | 165 |
| 139 | 2 | 1 | 1 | -1 | 145 | 146 | 167 | 166 |
| 140 | 2 | 1 | 1 | -1 | 146 | 147 | 168 | 167 |
| 141 | 2 | 1 | 1 | -1 | 148 | 149 | 170 | 169 |
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| 144 | 2 | 1 | 1 | -1 | 151 | 152 | 173 | 172 |
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| 147 | 2 | 1 | 1 | -1 | 154 | 155 | 176 | 175 |
| 148 | 2 | 1 | 1 | -1 | 155 | 156 | 177 | 176 |
| 149 | 2 | 1 | 1 | -1 | 156 | 157 | 178 | 177 |
| 150 | 2 | 1 | 1 | -1 | 157 | 158 | 179 | 178 |
| 151 | 2 | 1 | 1 | -1 | 158 | 159 | 180 | 179 |
| 152 | 2 | 1 | 1 | -1 | 159 | 160 | 181 | 180 |
| 153 | 2 | 1 | 1 | -1 | 160 | 161 | 182 | 181 |
| 154 | 2 | 1 | 1 | -1 | 161 | 162 | 183 | 182 |
| 155 | 2 | 1 | 1 | -1 | 162 | 163 | 184 | 183 |
| 156 | 2 | 1 | 1 | -1 | 163 | 164 | 185 | 184 |
| 157 | 2 | 1 | 1 | -1 | 164 | 165 | 186 | 185 |
| 158 | 2 | 1 | 1 | -1 | 165 | 166 | 187 | 186 |
| 159 | 2 | 1 | 1 | -1 | 166 | 167 | 188 | 187 |
| 160 | 2 | 1 | 1 | -1 | 167 | 168 | 189 | 188 |
| 161 | 1 | 3 | 2 | -1 | 22 | 190 | 42 | |
| 162 | 1 | 3 | 2 | -1 | 23 | 191 | 42 | |
| 163 | 1 | 3 | 2 | -1 | 24 | 192 | 42 | |
| 164 | 1 | 3 | 2 | -1 | 25 | 193 | 42 | |
| 165 | 1 | 3 | 2 | -1 | 26 | 194 | 42 | |
| 166 | 1 | 3 | 2 | -1 | 27 | 195 | 42 | |
| 167 | 1 | 3 | 2 | -1 | 28 | 196 | 42 | |
| 168 | 1 | 3 | 2 | -1 | 29 | 197 | 42 | |
| 169 | 1 | 3 | 2 | -1 | 30 | 198 | 42 | |
| 170 | 1 | 3 | 2 | -1 | 31 | 199 | 42 | |
| 171 | 1 | 3 | 2 | -1 | 32 | 200 | 22 | |
| 172 | 1 | 3 | 2 | -1 | 33 | 201 | 22 | |
| 173 | 1 | 3 | 2 | -1 | 34 | 202 | 22 | |
| 174 | 1 | 3 | 2 | -1 | 35 | 203 | 22 | |
| 175 | 1 | 3 | 2 | -1 | 36 | 204 | 22 | |
| 176 | 1 | 3 | 2 | -1 | 37 | 205 | 22 | |
| 177 | 1 | 3 | 2 | -1 | 38 | 206 | 22 | |
| 178 | 1 | 3 | 2 | -1 | 39 | 207 | 22 | |
| 179 | 1 | 3 | 2 | -1 | 40 | 208 | 22 | |
| 180 | 1 | 3 | 2 | -1 | 41 | 209 | 22 | |
| 181 | 1 | 3 | 2 | -1 | 42 | 210 | 22 | |
| 182 | 1 | 3 | 2 | -1 | 43 | 211 | 63 | |
| 183 | 1 | 3 | 2 | -1 | 44 | 212 | 63 | |
| 184 | 1 | 3 | 2 | -1 | 45 | 213 | 63 | |
| 185 | 1 | 3 | 2 | -1 | 46 | 214 | 63 | |
| 186 | 1 | 3 | 2 | -1 | 47 | 215 | 63 | |
| 187 | 1 | 3 | 2 | -1 | 48 | 216 | 63 | |
| 188 | 1 | 3 | 2 | -1 | 49 | 217 | 63 | |
| 189 | 1 | 3 | 2 | -1 | 50 | 218 | 63 | |
| 190 | 1 | 3 | 2 | -1 | 51 | 219 | 63 | |
| 191 | 1 | 3 | 2 | -1 | 52 | 220 | 63 | |
| 192 | 1 | 3 | 2 | -1 | 53 | 221 | 43 | |
| 193 | 1 | 3 | 2 | -1 | 54 | 222 | 43 | |
| 194 | 1 | 3 | 2 | -1 | 55 | 223 | 43 | |
| 195 | 1 | 3 | 2 | -1 | 56 | 224 | 43 | |
| 196 | 1 | 3 | 2 | -1 | 57 | 225 | 43 | |
| 197 | 1 | 3 | 2 | -1 | 58 | 226 | 43 | |
| 198 | 1 | 3 | 2 | -1 | 59 | 227 | 43 | |
| 199 | 1 | 3 | 2 | -1 | 60 | 228 | 43 | |
| 200 | 1 | 3 | 2 | -1 | 61 | 229 | 43 | |
| 201 | 1 | 3 | 2 | -1 | 62 | 230 | 43 | |
| 202 | 1 | 3 | 2 | -1 | 63 | 231 | 43 | |
| 203 | 1 | 3 | 2 | -1 | 64 | 232 | 84 | |
| 204 | 1 | 3 | 2 | -1 | 65 | 233 | 84 | |
| 205 | 1 | 3 | 2 | -1 | 66 | 234 | 84 | |
| 206 | 1 | 3 | 2 | -1 | 67 | 235 | 84 | |
| 207 | 1 | 3 | 2 | -1 | 68 | 236 | 84 | |
| 208 | 1 | 3 | 2 | -1 | 69 | 237 | 84 | |
| 209 | 1 | 3 | 2 | -1 | 70 | 238 | 84 | |
| 210 | 1 | 3 | 2 | -1 | 71 | 239 | 84 | |
| 211 | 1 | 3 | 2 | -1 | 72 | 240 | 84 | |
| 212 | 1 | 3 | 2 | -1 | 73 | 241 | 84 | |
| 213 | 1 | 3 | 2 | -1 | 74 | 242 | 64 | |
| 214 | 1 | 3 | 2 | -1 | 75 | 243 | 64 | |
| 215 | 1 | 3 | 2 | -1 | 76 | 244 | 64 | |
| 216 | 1 | 3 | 2 | -1 | 77 | 245 | 64 | |
| 217 | 1 | 3 | 2 | -1 | 78 | 246 | 64 | |
| 218 | 1 | 3 | 2 | -1 | 79 | 247 | 64 | |
| 219 | 1 | 3 | 2 | -1 | 80 | 248 | 64 | |
| 220 | 1 | 3 | 2 | -1 | 81 | 249 | 64 | |
| 221 | 1 | 3 | 2 | -1 | 82 | 250 | 64 | |
| 222 | 1 | 3 | 2 | -1 | 83 | 251 | 64 | |
| 223 | 1 | 3 | 2 | -1 | 84 | 252 | 64 | |
| 224 | 1 | 3 | 2 | -1 | 85 | 253 | 105 | |
| 225 | 1 | 3 | 2 | -1 | 86 | 254 | 105 | |
| 226 | 1 | 3 | 2 | -1 | 87 | 255 | 105 | |
| 227 | 1 | 3 | 2 | -1 | 88 | 256 | 105 | |
| 228 | 1 | 3 | 2 | -1 | 89 | 257 | 105 | |
| 229 | 1 | 3 | 2 | -1 | 90 | 258 | 105 | |
| 230 | 1 | 3 | 2 | -1 | 91 | 259 | 105 | |
| 231 | 1 | 3 | 2 | -1 | 92 | 260 | 105 | |
| 232 | 1 | 3 | 2 | -1 | 93 | 261 | 105 | |
| 233 | 1 | 3 | 2 | -1 | 94 | 262 | 105 | |
| 234 | 1 | 3 | 2 | -1 | 95 | 263 | 85 | |
| 235 | 1 | 3 | 2 | -1 | 96 | 264 | 85 | |
| 236 | 1 | 3 | 2 | -1 | 97 | 265 | 85 | |
| 237 | 1 | 3 | 2 | -1 | 98 | 266 | 85 | |
| 238 | 1 | 3 | 2 | -1 | 99 | 267 | 85 | |
| 239 | 1 | 3 | 2 | -1 | 100 | 268 | 85 | |
| 240 | 1 | 3 | 2 | -1 | 101 | 269 | 85 | |
| 241 | 1 | 3 | 2 | -1 | 102 | 270 | 85 | |
| 242 | 1 | 3 | 2 | -1 | 103 | 271 | 85 | |
| 243 | 1 | 3 | 2 | -1 | 104 | 272 | 85 | |
| 244 | 1 | 3 | 2 | -1 | 105 | 273 | 85 | |
| 245 | 1 | 3 | 2 | -1 | 106 | 274 | 126 | |
| 246 | 1 | 3 | 2 | -1 | 107 | 275 | 126 | |
| 247 | 1 | 3 | 2 | -1 | 108 | 276 | 126 | |
| 248 | 1 | 3 | 2 | -1 | 109 | 277 | 126 | |
| 249 | 1 | 3 | 2 | -1 | 110 | 278 | 126 | |
| 250 | 1 | 3 | 2 | -1 | 111 | 279 | 126 | |
| 251 | 1 | 3 | 2 | -1 | 112 | 280 | 126 | |
| 252 | 1 | 3 | 2 | -1 | 113 | 281 | 126 | |
| 253 | 1 | 3 | 2 | -1 | 114 | 282 | 126 | |
| 254 | 1 | 3 | 2 | -1 | 115 | 283 | 126 | |
| 255 | 1 | 3 | 2 | -1 | 116 | 284 | 106 | |
| 256 | 1 | 3 | 2 | -1 | 117 | 285 | 106 | |
| 257 | 1 | 3 | 2 | -1 | 118 | 286 | 106 | |
| 258 | 1 | 3 | 2 | -1 | 119 | 287 | 106 | |
| 259 | 1 | 3 | 2 | -1 | 120 | 288 | 106 | |
| 260 | 1 | 3 | 2 | -1 | 121 | 289 | 106 | |
| 261 | 1 | 3 | 2 | -1 | 122 | 290 | 106 | |
| 262 | 1 | 3 | 2 | -1 | 123 | 291 | 106 | |
| 263 | 1 | 3 | 2 | -1 | 124 | 292 | 106 | |
| 264 | 1 | 3 | 2 | -1 | 125 | 293 | 106 | |
| 265 | 1 | 3 | 2 | -1 | 126 | 294 | 106 | |
| 266 | 1 | 3 | 2 | -1 | 127 | 295 | 147 | |
| 267 | 1 | 3 | 2 | -1 | 128 | 296 | 147 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 268 | 1 | 3 | 2 | -1 | 129 | 297 | 147 |
| 269 | 1 | 3 | 2 | -1 | 130 | 298 | 147 |
| 270 | 1 | 3 | 2 | -1 | 131 | 299 | 147 |
| 271 | 1 | 3 | 2 | -1 | 132 | 300 | 147 |
| 272 | 1 | 3 | 2 | -1 | 133 | 301 | 147 |
| 273 | 1 | 3 | 2 | -1 | 134 | 302 | 147 |
| 274 | 1 | 3 | 2 | -1 | 135 | 303 | 147 |
| 275 | 1 | 3 | 2 | -1 | 136 | 304 | 147 |
| 276 | 1 | 3 | 2 | -1 | 137 | 305 | 127 |
| 277 | 1 | 3 | 2 | -1 | 138 | 306 | 127 |
| 278 | 1 | 3 | 2 | -1 | 139 | 307 | 127 |
| 279 | 1 | 3 | 2 | -1 | 140 | 308 | 127 |
| 280 | 1 | 3 | 2 | -1 | 141 | 309 | 127 |
| 281 | 1 | 3 | 2 | -1 | 142 | 310 | 127 |
| 282 | 1 | 3 | 2 | -1 | 143 | 311 | 127 |
| 283 | 1 | 3 | 2 | -1 | 144 | 312 | 127 |
| 284 | 1 | 3 | 2 | -1 | 145 | 313 | 127 |
| 285 | 1 | 3 | 2 | -1 | 146 | 314 | 127 |
| 286 | 1 | 3 | 2 | -1 | 147 | 315 | 127 |
| 287 | 1 | 3 | 2 | -1 | 148 | 316 | 168 |
| 288 | 1 | 3 | 2 | -1 | 149 | 317 | 168 |
| 289 | 1 | 3 | 2 | -1 | 150 | 318 | 168 |
| 290 | 1 | 3 | 2 | -1 | 151 | 319 | 168 |
| 291 | 1 | 3 | 2 | -1 | 152 | 320 | 168 |
| 292 | 1 | 3 | 2 | -1 | 153 | 321 | 168 |
| 293 | 1 | 3 | 2 | -1 | 154 | 322 | 168 |
| 294 | 1 | 3 | 2 | -1 | 155 | 323 | 168 |
| 295 | 1 | 3 | 2 | -1 | 156 | 324 | 168 |
| 296 | 1 | 3 | 2 | -1 | 157 | 325 | 168 |
| 297 | 1 | 3 | 2 | -1 | 158 | 326 | 148 |
| 298 | 1 | 3 | 2 | -1 | 159 | 327 | 148 |
| 299 | 1 | 3 | 2 | -1 | 160 | 328 | 148 |
| 300 | 1 | 3 | 2 | -1 | 161 | 329 | 148 |
| 301 | 1 | 3 | 2 | -1 | 162 | 330 | 148 |
| 302 | 1 | 3 | 2 | -1 | 163 | 331 | 148 |
| 303 | 1 | 3 | 2 | -1 | 164 | 332 | 148 |
| 304 | 1 | 3 | 2 | -1 | 165 | 333 | 148 |
| 305 | 1 | 3 | 2 | -1 | 166 | 334 | 148 |
| 306 | 1 | 3 | 2 | -1 | 167 | 335 | 148 |
| 307 | 1 | 3 | 2 | -1 | 168 | 336 | 148 |
| 308 | 1 | 2 | 3 | -1 | 190 | 191 | 42 |
| 309 | 1 | 2 | 3 | -1 | 191 | 192 | 42 |
| 310 | 1 | 2 | 3 | -1 | 192 | 193 | 42 |
| 311 | 1 | 2 | 3 | -1 | 193 | 194 | 42 |
| 312 | 1 | 2 | 3 | -1 | 194 | 195 | 42 |
| 313 | 1 | 2 | 3 | -1 | 195 | 196 | 42 |
| 314 | 1 | 2 | 3 | -1 | 196 | 197 | 42 |
| 315 | 1 | 2 | 3 | -1 | 197 | 198 | 42 |
| 316 | 1 | 2 | 3 | -1 | 198 | 199 | 42 |
| 317 | 1 | 2 | 3 | -1 | 199 | 200 | 42 |
| 318 | 1 | 2 | 3 | -1 | 200 | 201 | 42 |
| 319 | 1 | 2 | 3 | -1 | 201 | 202 | 42 |
| 320 | 1 | 2 | 3 | -1 | 202 | 203 | 42 |
| 321 | 1 | 2 | 3 | -1 | 203 | 204 | 42 |
| 322 | 1 | 2 | 3 | -1 | 204 | 205 | 42 |
| 323 | 1 | 2 | 3 | -1 | 205 | 206 | 42 |
| 324 | 1 | 2 | 3 | -1 | 206 | 207 | 42 |
| 325 | 1 | 2 | 3 | -1 | 207 | 208 | 42 |
| 326 | 1 | 2 | 3 | -1 | 208 | 209 | 42 |
| 327 | 1 | 2 | 3 | -1 | 209 | 210 | 42 |
| 328 | 1 | 2 | 3 | -1 | 211 | 212 | 63 |
| 329 | 1 | 2 | 3 | -1 | 212 | 213 | 63 |
| 330 | 1 | 2 | 3 | -1 | 213 | 214 | 63 |
| 331 | 1 | 2 | 3 | -1 | 214 | 215 | 63 |
| 332 | 1 | 2 | 3 | -1 | 215 | 216 | 63 |
| 333 | 1 | 2 | 3 | -1 | 216 | 217 | 63 |
| 334 | 1 | 2 | 3 | -1 | 217 | 218 | 63 |
| 335 | 1 | 2 | 3 | -1 | 218 | 219 | 63 |
| 336 | 1 | 2 | 3 | -1 | 219 | 220 | 63 |
| 337 | 1 | 2 | 3 | -1 | 220 | 221 | 63 |
| 338 | 1 | 2 | 3 | -1 | 221 | 222 | 63 |
| 339 | 1 | 2 | 3 | -1 | 222 | 223 | 63 |
| 340 | 1 | 2 | 3 | -1 | 223 | 224 | 63 |
| 341 | 1 | 2 | 3 | -1 | 224 | 225 | 63 |
| 342 | 1 | 2 | 3 | -1 | 225 | 226 | 63 |
| 343 | 1 | 2 | 3 | -1 | 226 | 227 | 63 |
| 344 | 1 | 2 | 3 | -1 | 227 | 228 | 63 |
| 345 | 1 | 2 | 3 | -1 | 228 | 229 | 63 |
| 346 | 1 | 2 | 3 | -1 | 229 | 230 | 63 |
| 347 | 1 | 2 | 3 | -1 | 230 | 231 | 63 |
| 348 | 1 | 2 | 3 | -1 | 232 | 233 | 84 |
| 349 | 1 | 2 | 3 | -1 | 233 | 234 | 84 |
| 350 | 1 | 2 | 3 | -1 | 234 | 235 | 84 |
| 351 | 1 | 2 | 3 | -1 | 235 | 236 | 84 |
| 352 | 1 | 2 | 3 | -1 | 236 | 237 | 84 |
| 353 | 1 | 2 | 3 | -1 | 237 | 238 | 84 |
| 354 | 1 | 2 | 3 | -1 | 238 | 239 | 84 |
| 355 | 1 | 2 | 3 | -1 | 239 | 240 | 84 |
| 356 | 1 | 2 | 3 | -1 | 240 | 241 | 84 |
| 357 | 1 | 2 | 3 | -1 | 241 | 242 | 84 |
| 358 | 1 | 2 | 3 | -1 | 242 | 243 | 84 |
| 359 | 1 | 2 | 3 | -1 | 243 | 244 | 84 |
| 360 | 1 | 2 | 3 | -1 | 244 | 245 | 84 |
| 361 | 1 | 2 | 3 | -1 | 245 | 246 | 84 |
| 362 | 1 | 2 | 3 | -1 | 246 | 247 | 84 |
| 363 | 1 | 2 | 3 | -1 | 247 | 248 | 84 |
| 364 | 1 | 2 | 3 | -1 | 248 | 249 | 84 |
| 365 | 1 | 2 | 3 | -1 | 249 | 250 | 84 |
| 366 | 1 | 2 | 3 | -1 | 250 | 251 | 84 |
| 367 | 1 | 2 | 3 | -1 | 251 | 252 | 84 |
| 368 | 1 | 2 | 3 | -1 | 253 | 254 | 105 |
| 369 | 1 | 2 | 3 | -1 | 254 | 255 | 105 |
| 370 | 1 | 2 | 3 | -1 | 255 | 256 | 105 |
| 371 | 1 | 2 | 3 | -1 | 256 | 257 | 105 |
| 372 | 1 | 2 | 3 | -1 | 257 | 258 | 105 |
| 373 | 1 | 2 | 3 | -1 | 258 | 259 | 105 |
| 374 | 1 | 2 | 3 | -1 | 259 | 260 | 105 |
| 375 | 1 | 2 | 3 | -1 | 260 | 261 | 105 |
| 376 | 1 | 2 | 3 | -1 | 261 | 262 | 105 |
| 377 | 1 | 2 | 3 | -1 | 262 | 263 | 105 |
| 378 | 1 | 2 | 3 | -1 | 263 | 264 | 105 |
| 379 | 1 | 2 | 3 | -1 | 264 | 265 | 105 |
| 380 | 1 | 2 | 3 | -1 | 265 | 266 | 105 |
| 381 | 1 | 2 | 3 | -1 | 266 | 267 | 105 |
| 382 | 1 | 2 | 3 | -1 | 267 | 268 | 105 |
| 383 | 1 | 2 | 3 | -1 | 268 | 269 | 105 |
| 384 | 1 | 2 | 3 | -1 | 269 | 270 | 105 |
| 385 | 1 | 2 | 3 | -1 | 270 | 271 | 105 |
| 386 | 1 | 2 | 3 | -1 | 271 | 272 | 105 |
| 387 | 1 | 2 | 3 | -1 | 272 | 273 | 105 |
| 388 | 1 | 2 | 3 | -1 | 274 | 275 | 126 |
| 389 | 1 | 2 | 3 | -1 | 275 | 276 | 126 |
| 390 | 1 | 2 | 3 | -1 | 276 | 277 | 126 |
| 391 | 1 | 2 | 3 | -1 | 277 | 278 | 126 |
| 392 | 1 | 2 | 3 | -1 | 278 | 279 | 126 |
| 393 | 1 | 2 | 3 | -1 | 279 | 280 | 126 |
| 394 | 1 | 2 | 3 | -1 | 280 | 281 | 126 |
| 395 | 1 | 2 | 3 | -1 | 281 | 282 | 126 |
| 396 | 1 | 2 | 3 | -1 | 282 | 283 | 126 |
| 397 | 1 | 2 | 3 | -1 | 283 | 284 | 126 |
| 398 | 1 | 2 | 3 | -1 | 284 | 285 | 126 |
| 399 | 1 | 2 | 3 | -1 | 285 | 286 | 126 |
| 400 | 1 | 2 | 3 | -1 | 286 | 287 | 126 |
| 401 | 1 | 2 | 3 | -1 | 287 | 288 | 126 |
| 402 | 1 | 2 | 3 | -1 | 288 | 289 | 126 |
| 403 | 1 | 2 | 3 | -1 | 289 | 290 | 126 |
| 404 | 1 | 2 | 3 | -1 | 290 | 291 | 126 |
| 405 | 1 | 2 | 3 | -1 | 291 | 292 | 126 |
| 406 | 1 | 2 | 3 | -1 | 292 | 293 | 126 |
| 407 | 1 | 2 | 3 | -1 | 293 | 294 | 126 |
| 408 | 1 | 2 | 3 | -1 | 295 | 296 | 147 |
| 409 | 1 | 2 | 3 | -1 | 296 | 297 | 147 |
| 410 | 1 | 2 | 3 | -1 | 297 | 298 | 147 |
| 411 | 1 | 2 | 3 | -1 | 298 | 299 | 147 |
| 412 | 1 | 2 | 3 | -1 | 299 | 300 | 147 |
| 413 | 1 | 2 | 3 | -1 | 300 | 301 | 147 |
| 414 | 1 | 2 | 3 | -1 | 301 | 302 | 147 |
| 415 | 1 | 2 | 3 | -1 | 302 | 303 | 147 |
| 416 | 1 | 2 | 3 | -1 | 303 | 304 | 147 |
| 417 | 1 | 2 | 3 | -1 | 304 | 305 | 147 |
| 418 | 1 | 2 | 3 | -1 | 305 | 306 | 147 |
| 419 | 1 | 2 | 3 | -1 | 306 | 307 | 147 |
| 420 | 1 | 2 | 3 | -1 | 307 | 308 | 147 |
| 421 | 1 | 2 | 3 | -1 | 308 | 309 | 147 |
| 422 | 1 | 2 | 3 | -1 | 309 | 310 | 147 |
| 423 | 1 | 2 | 3 | -1 | 310 | 311 | 147 |
| 424 | 1 | 2 | 3 | -1 | 311 | 312 | 147 |
| 425 | 1 | 2 | 3 | -1 | 312 | 313 | 147 |
| 426 | 1 | 2 | 3 | -1 | 313 | 314 | 147 |
| 427 | 1 | 2 | 3 | -1 | 314 | 315 | 147 |
| 428 | 1 | 2 | 3 | -1 | 316 | 317 | 168 |
| 429 | 1 | 2 | 3 | -1 | 317 | 318 | 168 |
| 430 | 1 | 2 | 3 | -1 | 318 | 319 | 168 |
| 431 | 1 | 2 | 3 | -1 | 319 | 320 | 168 |
| 432 | 1 | 2 | 3 | -1 | 320 | 321 | 168 |
| 433 | 1 | 2 | 3 | -1 | 321 | 322 | 168 |
| 434 | 1 | 2 | 3 | -1 | 322 | 323 | 168 |
| 435 | 1 | 2 | 3 | -1 | 323 | 324 | 168 |
| 436 | 1 | 2 | 3 | -1 | 324 | 325 | 168 |
| 437 | 1 | 2 | 3 | -1 | 325 | 326 | 168 |
| 438 | 1 | 2 | 3 | -1 | 326 | 327 | 168 |
| 439 | 1 | 2 | 3 | -1 | 327 | 328 | 168 |
| 440 | 1 | 2 | 3 | -1 | 328 | 329 | 168 |
| 441 | 1 | 2 | 3 | -1 | 329 | 330 | 168 |
| 442 | 1 | 2 | 3 | -1 | 330 | 331 | 168 |
| 443 | 1 | 2 | 3 | -1 | 331 | 332 | 168 |
| 444 | 1 | 2 | 3 | -1 | 332 | 333 | 168 |
| 445 | 1 | 2 | 3 | -1 | 333 | 334 | 168 |
| 446 | 1 | 2 | 3 | -1 | 334 | 335 | 168 |
| 447 | 1 | 2 | 3 | -1 | 335 | 336 | 168 |
| 448 | 1 | 4 | 4 | -1 | 190 | 337 | 42 |
| 449 | 1 | 4 | 4 | -1 | 211 | 338 | 63 |
| 450 | 1 | 4 | 4 | -1 | 232 | 339 | 84 |
| 451 | 1 | 4 | 4 | -1 | 253 | 340 | 105 |
| 452 | 1 | 4 | 4 | -1 | 274 | 341 | 126 |
| 453 | 1 | 4 | 4 | -1 | 295 | 342 | 147 |
| 454 | 1 | 4 | 4 | -1 | 316 | 343 | 168 |
| 455 | 1 | 4 | 5 | -1 | 210 | 344 | 22 |
| 456 | 1 | 4 | 5 | -1 | 231 | 345 | 43 |
| 457 | 1 | 4 | 5 | -1 | 252 | 346 | 64 |
| 458 | 1 | 4 | 5 | -1 | 273 | 347 | 85 |
| 459 | 1 | 4 | 5 | -1 | 294 | 348 | 106 |
| 460 | 1 | 4 | 5 | -1 | 315 | 349 | 127 |
| 461 | 1 | 4 | 5 | -1 | 336 | 350 | 148 |



DISPOSICION CAMIONES EN PRUEBA DE CARGA. Combinacion 1.



DISPOSICION CAMIONES EN PRUEBA DE CARGA. Combinacion 2.

# DATOS PARA LA REALIZACION DE LA PRUEBA DE CARGA

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** E-1518.7

**DATOS:**

(Dejar vacios los datos que no existan)

**DEFINICION DE HIPOTESIS SIMPLES**

| Hipotesis de carga número | Vano que se carga | Tipo de carro | Posicion relativa cdg longitudinal | Posicion relativa cdg transversal |
|---|---|---|---|---|
| 1 | 1 | 1 | 0.50 | 0.31 |
| 2 | 1 | 2 | 0.57 | 0.52 |
| 3 | 1 | 1 | 0.50 | 0.39 |
| 4 | 1 | 2 | 0.57 | 0.61 |
| 5 | | | | |
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**DEFINICION DE TIPOS DE CARROS**

| Carro Tipo | Numero de ejes (maximo 6 | Separacion longitudinal entre ejes consecutivos(en metros) | | | | | Cargas en ejes (en toneladas) | | | | | | Separacion transvesal de ejes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 1 | 2 | 3 | 4 | 5 | 6 | |
| 1 | 6 | 3.83 | 1.36 | 2.60 | 1.36 | 3.83 | 7.60 | 13.70 | 13.70 | 13.70 | 13.70 | 7.60 | 1.80 |
| 2 | 3 | 1.36 | 3.83 | | | | 13.70 | 13.70 | 7.60 | | | | 1.80 |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |

(todos los valores serán positivos)

**COMBINACIONES DE HIPOTESIS SIMPLES PARA EL CALCULO DE FLECHAS**

| Combinacion numero | Vano en el que se utilizará | HIPOTESIS DE CARGA SIMPLES QUE SE SUMAN | | | | | | | | | | | Situación del carro de la Instrucción para obtener esfuerzos de referencia | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Posicion relativa cdg longitudinal | Posicion relativa cdg transversal |
| 1 | 1 | 1 | 2 | | | | | | | | | | 0.50 | 0.33 |
| 2 | 1 | 3 | 4 | | | | | | | | | | 0.50 | 0.50 |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | |

**ESFUERZOS DE REFERENCIA**

| VANO Nº | Momento (m.t.) | Cortante (t.) |
|---|---|---|
| 1 | 215.54 | 62.88 |
| 2 | | |
| 3 | | |
| 4 | | |
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**RESULTADOS:**

| Combinac. Nº | Vano Nº | Viga Nº | FLECHA (mm.) | Momento (m.t.) | M/Mref (%) | Cortante (t.) | V/Vref. (%) |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | -12.6 | 135.8 | 63% | 9.8 | 16% |
| | | 2 | -13.0 | 144.2 | 67% | 12.6 | 20% |
| | | 3 | -12.5 | 149.6 | 69% | 10.4 | 17% |
| | | 4 | -10.9 | 148.6 | 69% | 12.2 | 19% |
| | | 5 | -8.4 | 135.3 | 63% | 6.5 | 10% |
| | | 6 | -5.5 | 106.0 | 49% | 9.8 | 16% |
| | | 7 | -2.6 | 61.0 | 28% | 3.2 | 5% |
| 2 | 1 | 1 | -7.2 | 116.6 | 54% | 3.7 | 6% |
| | | 2 | -9.7 | 140.0 | 65% | 13.3 | 21% |
| | | 3 | -11.8 | 153.7 | 71% | 9.8 | 16% |
| | | 4 | -12.3 | 154.0 | 71% | 13.6 | 22% |
| | | 5 | -10.8 | 141.2 | 66% | 9.6 | 15% |
| | | 6 | -8.2 | 117.8 | 55% | 12.7 | 20% |
| | | 7 | -5.3 | 86.5 | 40% | 2.7 | 4% |

## *4.3.4 Paso superior ED2-1.3*

# INDICE

1º DEFINICION GEOMETRICA

2º CALCULO DEL TABLERO

3º CALCULO DE ESTRIBOS

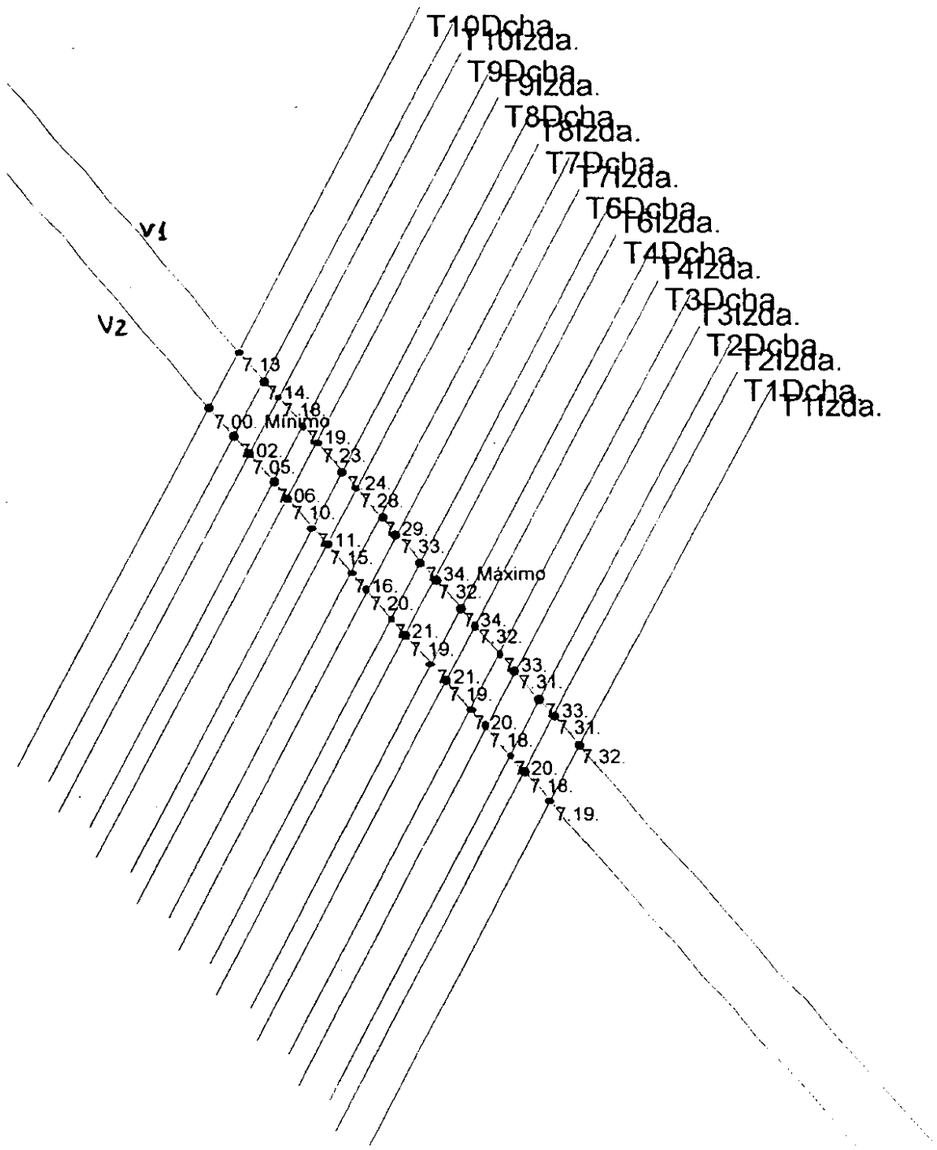
4º PROYECTO DE PRUEBA DE CARGA

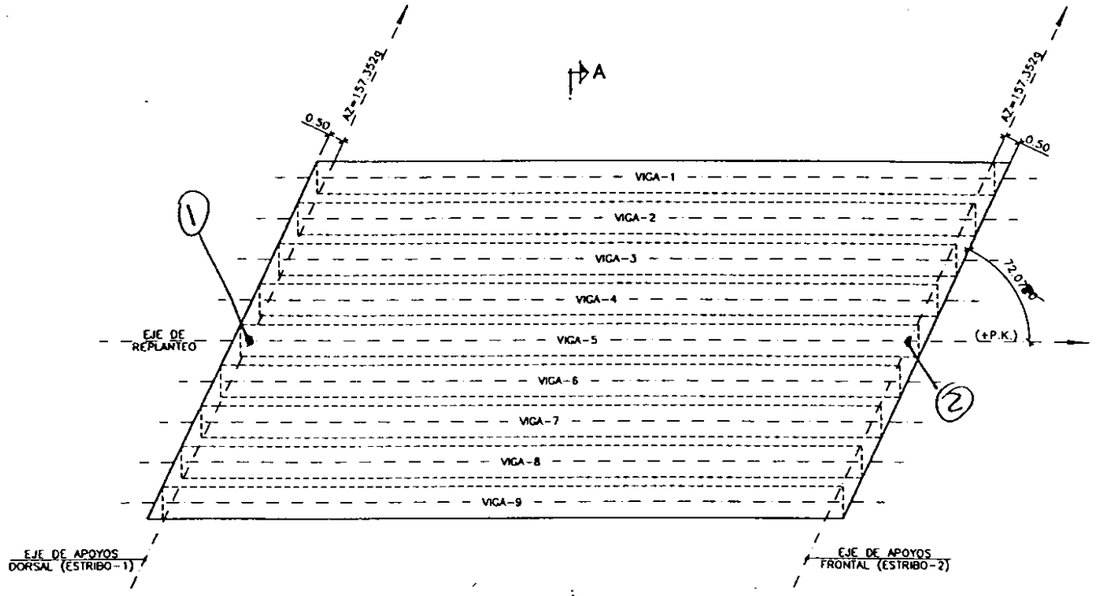
# PASO SUPERIOR ED2-1.3

## 1º DEFINICION GEOMETRICA

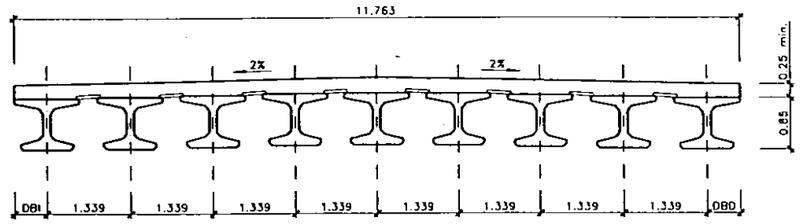
| | |
|---|---|
| Proyecto : | L.A.Z. MADRID - ZARAGOZA. Subtramo XV |
| Nombre obra : | ED2 - 1.3 |

| GALIBOS | | | | | | | SITUACION PUNTO | | |
|---|---|---|---|---|---|---|---|---|---|
| Punto Nº | X | Y | Z inf. tablero | Z vial inf. | Gálibo (m) | | Nº polig.tab. | Nº polig.vial | Dcha.o Izda. |
| 1 | 681877.370 | 4606227.595 | 250.334 | 243.027 | 7.307 | | 1 | 1 | Derecha |
| 2 | 681877.953 | 4606226.859 | 250.334 | 243.013 | 7.321 | | 1 | 1 | Izquierda |
| 3 | 681876.453 | 4606228.756 | 250.361 | 243.049 | 7.312 | | 2 | 1 | Derecha |
| 4 | 681877.035 | 4606228.018 | 250.361 | 243.035 | 7.326 | | 2 | 1 | Izquierda |
| 5 | 681875.536 | 4606229.916 | 250.387 | 243.070 | 7.317 | | 3 | 1 | Derecha |
| 6 | 681876.118 | 4606229.179 | 250.387 | 243.056 | 7.331 | | 3 | 1 | Izquierda |
| 7 | 681874.618 | 4606231.080 | 250.413 | 243.091 | 7.322 | | 4 | 1 | Derecha |
| 8 | 681875.200 | 4606230.342 | 250.413 | 243.078 | 7.336 | | 4 | 1 | Izquierda |
| 9 | 681873.702 | 4606232.243 | 250.439 | 243.113 | 7.326 | | 5 | 1 | Derecha |
| 10 | 681874.284 | 4606231.504 | 250.439 | 243.099 | 7.340 | **Máximo** | 5 | 1 | Izquierda |
| 11 | 681873.702 | 4606232.243 | 250.439 | 243.113 | 7.326 | | 6 | 1 | Derecha |
| 12 | 681874.284 | 4606231.504 | 250.439 | 243.099 | 7.340 | **Máximo** | 6 | 1 | Izquierda |
| 13 | 681872.786 | 4606233.406 | 250.411 | 243.134 | 7.277 | | 7 | 1 | Derecha |
| 14 | 681873.368 | 4606232.667 | 250.412 | 243.121 | 7.291 | | 7 | 1 | Izquierda |
| 15 | 681871.870 | 4606234.572 | 250.383 | 243.157 | 7.226 | | 8 | 1 | Derecha |
| 16 | 681872.451 | 4606233.832 | 250.383 | 243.143 | 7.241 | | 8 | 1 | Izquierda |
| 17 | 681870.955 | 4606235.737 | 250.354 | 243.177 | 7.177 | | 9 | 1 | Derecha |
| 18 | 681871.536 | 4606234.997 | 250.355 | 243.164 | 7.191 | | 9 | 1 | Izquierda |
| 19 | 681870.041 | 4606236.904 | 250.326 | 243.199 | 7.127 | | 10 | 1 | Derecha |
| 20 | 681870.622 | 4606236.163 | 250.327 | 243.185 | 7.142 | | 10 | 1 | Izquierda |
| 21 | 681876.663 | 4606226.177 | 250.334 | 243.157 | 7.177 | | 1 | 2 | Derecha |
| 22 | 681877.246 | 4606225.440 | 250.334 | 243.144 | 7.190 | | 1 | 2 | Izquierda |
| 23 | 681875.745 | 4606227.337 | 250.361 | 243.178 | 7.183 | | 2 | 2 | Derecha |
| 24 | 681876.328 | 4606226.600 | 250.361 | 243.165 | 7.196 | | 2 | 2 | Izquierda |
| 25 | 681874.828 | 4606228.497 | 250.388 | 243.200 | 7.188 | | 3 | 2 | Derecha |
| 26 | 681875.411 | 4606227.760 | 250.388 | 243.187 | 7.201 | | 3 | 2 | Izquierda |
| 27 | 681873.910 | 4606229.659 | 250.414 | 243.222 | 7.193 | | 4 | 2 | Derecha |
| 28 | 681874.493 | 4606228.922 | 250.415 | 243.208 | 7.207 | | 4 | 2 | Izquierda |
| 29 | 681872.994 | 4606230.822 | 250.441 | 243.243 | 7.198 | | 5 | 2 | Derecha |
| 30 | 681873.576 | 4606230.084 | 250.441 | 243.229 | 7.212 | | 5 | 2 | Izquierda |
| 31 | 681872.994 | 4606230.822 | 250.441 | 243.243 | 7.198 | | 6 | 2 | Derecha |
| 32 | 681873.576 | 4606230.084 | 250.441 | 243.229 | 7.212 | | 6 | 2 | Izquierda |
| 33 | 681872.078 | 4606231.985 | 250.413 | 243.264 | 7.149 | | 7 | 2 | Derecha |
| 34 | 681872.660 | 4606231.247 | 250.414 | 243.251 | 7.163 | | 7 | 2 | Izquierda |
| 35 | 681871.162 | 4606233.150 | 250.386 | 243.286 | 7.099 | | 8 | 2 | Derecha |
| 36 | 681871.743 | 4606232.411 | 250.386 | 243.272 | 7.114 | | 8 | 2 | Izquierda |
| 37 | 681870.247 | 4606234.316 | 250.358 | 243.308 | 7.050 | | 9 | 2 | Derecha |
| 38 | 681870.828 | 4606233.576 | 250.359 | 243.295 | 7.064 | | 9 | 2 | Izquierda |
| 39 | 681869.332 | 4606235.481 | 250.330 | 243.329 | 7.001 | **Mínimo** | 10 | 2 | Derecha |
| 40 | 681869.913 | 4606234.741 | 250.331 | 243.315 | 7.015 | | 10 | 2 | Izquierda |

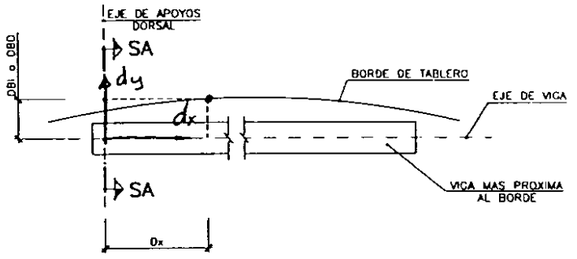





PLANTA
ESCALA 1:100




SECCION A-A
ESCALA 1:50

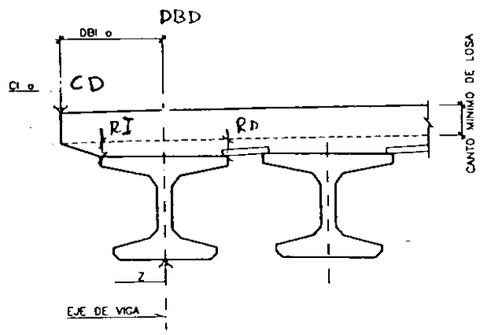



PLANTA ESQUEMATICA DE REPLANTEO
SIN ESCALA

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DX(m.) | 0,000 | 2,150 | 4,300 | 6,450 | 8,600 | 10,750 | 12,900 | 15,050 | 17,200 | 19,350 | 21,500 |
| VIGA N° 1 | RI(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| | RD(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| | DBI(m.) | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 |
| | CI(m.) | 251,435 | 251,445 | 251,453 | 251,459 | 251,462 | 251,463 | 251,461 | 251,458 | 251,452 | 251,443 | 251,433 |
| VIGA N° 2 | RI(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| | RD(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| VIGA N° 3 | RI(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| | RD(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| VIGA N° 4 | RI(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| | RD(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| VIGA N° 5 | RI(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| | RD(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| VIGA N° 6 | RI(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| | RD(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| VIGA N° 7 | RI(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| | RD(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| VIGA N° 8 | RI(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| | RD(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| VIGA N° 9 | RI(m.) | 0,020 | 0,031 | 0,039 | 0,045 | 0,048 | 0,049 | 0,048 | 0,045 | 0,039 | 0,031 | 0,020 |
| | RD(m.) | 0,000 | 0,010 | 0,018 | 0,024 | 0,028 | 0,029 | 0,028 | 0,024 | 0,018 | 0,010 | 0,000 |
| | DBD(m.) | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 | 0,525 |
| | CD(m.) | 251,402 | 251,418 | 251,431 | 251,442 | 251,451 | 251,457 | 251,461 | 251,463 | 251,462 | 251,459 | 251,454 |

| PUNTO | P.K | X | Y |
|---|---|---|---|
| 1 | 358,413 | 681876,430 | 4606240,777 |
| 2 | 379,915 | 681868,840 | 4606221,533 |

| VIGA N° | APOYOS EJE DORSAL | | | APOYOS EJE FRONTAL | | |
|---|---|---|---|---|---|---|
| | X | Y | Z | X | Y | Z |
| 1 | 681882,103 | 4606236,140 | 250,335 | 681872,513 | 4606216,896 | 250,333 |
| 2 | 681881,185 | 4606237,299 | 250,359 | 681871,595 | 4606218,055 | 250,363 |
| 3 | 681880,267 | 4606238,458 | 250,382 | 681870,677 | 4606219,214 | 250,393 |
| 4 | 681879,348 | 4606239,618 | 250,405 | 681869,758 | 4606220,374 | 250,423 |
| 5 | 681878,430 | 4606240,777 | 250,428 | 681868,840 | 4606221,533 | 250,452 |
| 6 | 681877,512 | 4606241,936 | 250,397 | 681867,922 | 4606222,692 | 250,428 |
| 7 | 681876,593 | 4606243,096 | 250,365 | 681867,003 | 4606223,852 | 250,404 |
| 8 | 681875,675 | 4606244,255 | 250,334 | 681866,085 | 4606225,011 | 250,379 |
| 9 | 681874,757 | 4606245,414 | 250,303 | 681865,167 | 4606226,170 | 250,354 |




SECCION SA-SA
ESCALA 1:25

# PASO SUPERIOR ED2-1.3

## 2º CALCULO DEL TABLERO

Oficina Técnica
A L V I S A

PUENTE NERVADO DE CARRETERA

**CLIENTE: GINPROSA**

**OBRA : ED2-1.3-- SUBTRAMO XV**

**HUESCA a 10/09/98**



P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

DATOS GEOMETRICOS

```
Solucion ..................... = 9  H- 85
Luz de Calculo .............[m] = 21.5
Intereje ...................[m] = 1.339
Dis. eje V.Borde a Ex.Tablero [m] = .525

Ancho del Tablero ..........[m] = 11.763
Ancho de las Aceras ........[m] = 2
Ancho Eficaz [ B0 ] ........[m] = 11.952

Angulo de Esviaje ..........[g] = 72.07
Espesor de la Losa .........[m] = .25
Canto Total ................[m] = 1.1
Espesor del Pavimento ......[cm] = 8

Peso del Carro .............[Tn] = 60
Distan. del carro a la Acera  [m] = .5
Peso Aceras y Barandillas [Tn/ml] = 1.8
```

CARGAS [Tn/ml]

```
P1 =  0.8353
P2 =  0.8369
P3 =  0.2571
P3'=  1.4160
P4 =  0.5228
```

CARACTERISTICAS MECANICAS

[ INICIALES ]

```
VaI ...  [m] = .419485
VbI .... [m] = .430515
AREA .. [m2] = .3503855
INERCIA [m4] = 3.698758E-02
```

[ FINALES ]

VIGA No. 1

```
VaF ..... [m] =  0.203875
VbF ..... [m] =  0.646125
VcF ..... [m] =  0.453875
INER.FIN. [m4] =  0.079318
K (rasante)... =  0.990550
```

VIGA CENTRAL

```
VaF ..... [m] = 0.188841
VbF ..... [m] = 0.661159
VcF ..... [m] = 0.438841
INER.FIN. [m4] = 0.082331
K (rasante)... = 1.020842
```

P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

REPARTO TRANSVERSAL
K (Flexion) = 0.728692
K (Torsion) = 0.385207

| | CARGA ACERA | CARRO EXCENTRI. | CARRO CENTRADO | CARRO OPCIONAL |
|---|---|---|---|---|
| Y1 | .8247302 | | | |
| Y2 | -.8247302 | | | |
| Y3 | | .5657995 | .1673221 | |
| Y4 | | .2311554 | -.1673221 | |

COEFICIENTES de EXCENTRICIDAD

| Num. VIGA | C A R G A A C E R A | C A R R O EXCENTRICO | C A R R O C E N T R A D O | C A R R O OPCIONAL |
|---|---|---|---|---|
| 1 | 1.59242 | 1.52134 | .41958 | |
| 2 | 1.22981 | 1.6855 | .77986 | |
| 3 | .84417 | 1.68386 | 1.12568 | |
| 4 | .58601 | 1.51395 | 1.4133 | |
| 5 | .49615 | 1.18861 | 1.52219 | |
| 6 | .58587 | .81909 | 1.41347 | |
| 7 | .84392 | .47822 | 1.12593 | |
| 8 | 1.22949 | .18366 | .78012 | |
| 9 | 1.59212 | -.07427 | .41982 | |



P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

COEFICIENTES MAS DESFAVORABLES

| Numero de VIGA | Y3 | Y4 | COEFICIENTE MAS DESFAVORABLE |
|---|---|---|---|
| 1 | .56579 | .23115 | 1.52286 |
| 2 | .56579 | .23115 | 1.69931 |
| 3 | .56579 | .23115 | 1.69766 |
| 4 | .46618 | .13153 | 1.55374 |
| 5 | .16732 | -.16733 | 1.53467 |
| 6 | -.13154 | -.46619 | 1.55374 |
| 7 | -.23116 | -.5658 | 1.69766 |
| 8 | -.23116 | -.5658 | 1.69931 |
| 9 | -.23116 | -.5658 | 1.52286 |

P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

ESFUERZOS LONGITUDINALES [MTn.]

| | [ VIGA DE BORDE ] | [ VIGA NO. 2 ] |
|---|---|---|
| M1 = | 48.2618 | 48.2618 |
| M2 = | 43.1373 | 48.3557 |
| M3 = | 14.8549 | 14.8549 |
| M3'= | 28.9531 | 22.3602 |
| M4 = | 30.2080 | 30.2080 |
| M5 = | 49.4436 | 55.2276 |

TENSIONES

TENSIONES DE FLEXION DEBIDO A LAS CARGAS EXTERIORES SIN PRETENSADO [Tn/m2]

Resumen

| | EN FABRICA | | EN SERVICIO | | | CON CARGAS MAXIMAS | | | |
|---|---|---|---|---|---|---|---|---|---|
| PUNTO | SA | SB | SA | SB | SC | SA | SB | SC | |
| 10.75 | 547.3 | 561.8- | 1181.1 | 1423.5- | 198.3 | 1377.0 | 2109.6- | 653.7 | L/2 |
| 9.75 | 542.6 | 556.9- | 1170.9 | 1411.2- | 196.6 | 1365.1 | 2091.3- | 648.0 | |
| 8.75 | 528.4 | 542.3- | 1140.2 | 1374.2- | 191.4 | 1329.4 | 2036.6- | 631.1 | |
| 7.75 | 504.7 | 518.0- | 1089.1 | 1312.6- | 182.9 | 1269.8 | 1945.3- | 602.8 | |
| 6.75 | 471.5 | 484.0- | 1017.5 | 1226.4- | 170.9 | 1186.4 | 1817.5- | 563.2 | |
| 5.75 | 428.9 | 440.3- | 925.6 | 1115.5- | 155.4 | 1079.1 | 1653.2- | 512.3 | |
| 4.75 | 376.8 | 386.8- | 813.1 | 980.1- | 136.5 | 948.0 | 1452.4- | 450.0 | |
| 3.75 | 315.2 | 323.6- | 680.3 | 819.9- | 114.2 | 793.1 | 1215.1- | 376.5 | |
| 2.75 | 244.2 | 250.7- | 527.0 | 635.2- | 88.5 | 614.4 | 941.3- | 291.6 | |
| 1.75 | 163.7 | 168.1- | 353.2 | 425.8- | 59.3 | 411.8 | 631.0- | 195.5 | |
| 0.75 | 73.7 | 75.7- | 159.0 | 191.7- | 26.7 | 185.4 | 284.1- | 88.0 | |
| 0.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | APOYO |



P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

CUADRO DE PRETENSADOS

| FILA -> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIPO DE CABLE-> | 0.6 | 0.6 | 0.5 | | | | | | | |
| TRAZADO | RECTO | RECTO | RECTO | | | | | | N | EX |
| COTA-> | 4 | 9 | 81 | | | | | | (TN) | (Cm) |
| X | Num. | Num. | Num. | | | | | | | |
| 10.75 | 15 | 6 | 4 | | | | | | 468 | 28 |
| 6.75 | 15 | 5 | 4 | | | | | | 449 | 28 |
| 3.75 | 15 | 4 | 4 | | | | | | 429 | 28 |
| 1.75 | 15 | 3 | 4 | | | | | | 410 | 28 |
| .75 | 15 | 3 | 4 | | | | | | 410 | 28 |
| 0 | 15 | 3 | 4 | | | | | | 410 | 28 |

No se consideran los entubados cuya longitud es menor de 0.5 metros

P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

TENSIONES EN DIFERENTES PUNTOS A LO LARGO DE LA VIGA [Tn/m2]

FABRICA ..... = Peso Propio + Pretensado con Perdidas a Corto Plazo
SERVICIO ..... = Cargas Permanentes + Pretensado con Perdidas Totales
CARGAS MAXIMAS = Servicio + Sobrecargas Maximas

VIGA MAS DESFAVORABLE = VIGA n. 2

Resumen

| | EN FABRICA | | EN SERVICIO | | | CON CARGAS MAXIMAS | | | |
|---|---|---|---|---|---|---|---|---|---|
| PUNTO | SA | SB | SA | SB | SC | SA | SB | SC | |
| 10.75 | 381.3 | 2181.9 | 1041.3 | 887.0 | 198.3 | 1237.2 | 200.9 | 653.7 | L/2 |
| 9.75 | 376.6 | 2186.8 | 1031.1 | 899.3 | 196.6 | 1225.3 | 219.2 | 648.0 | |
| 8.75 | 362.4 | 2201.4 | 1000.4 | 936.3 | 191.4 | 1189.6 | 273.9 | 631.1 | |
| 7.75 | 338.7 | 2225.7 | 949.3 | 997.9 | 182.9 | 1130.0 | 365.2 | 602.8 | |
| 6.75 | 324.3 | 2132.8 | 893.5 | 977.2 | 170.9 | 1062.4 | 386.1 | 563.2 | |
| 5.75 | 281.7 | 2176.5 | 801.6 | 1088.1 | 155.4 | 955.1 | 550.4 | 512.3 | |
| 4.75 | 229.6 | 2230.0 | 689.1 | 1223.5 | 136.5 | 824.0 | 751.2 | 450.0 | |
| 3.75 | 186.7 | 2166.3 | 572.1 | 1276.9 | 114.2 | 684.9 | 881.7 | 376.5 | |
| 2.75 | 115.7 | 2239.2 | 418.8 | 1461.6 | 88.5 | 506.2 | 1155.5 | 291.6 | |
| 1.75 | 54.0 | 2194.9 | 260.8 | 1564.1 | 59.3 | 319.4 | 1358.9 | 195.5 | |
| 0.75 | 36.0- | 2287.3 | 66.6 | 1798.2 | 26.7 | 93.0 | 1705.8 | 88.0 | |
| 0.00 | 109.7- | 2363.0 | 92.4- | 1989.9 | 0.0 | 92.4- | 1989.9 | 0.0 | APOYO |

Calculo de las tensiones con el entubado real

RESISTENCIA DE HORMIGONES [Tn/m2]

AL DESTESAR .. = 3780.84
A LOS 28 DIAS = 1979.82 se dispone Hormigon de 4500
EN LOSA ..... = 1046.00 '' '' '' '' 2500



P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

ARMADURAS DE CORTANTES [EP-93]

Acero Fy ..... [Kg/cm2] >= 5100
Espesor del Alma ... [cm] = 12.0
Fct'K .....[Kg/cm2] = 264.2536
Vcuo ..... [Tn] = 11.2949
Armadura Minima..[cm2/ml] = 2.3294

ARMADURAS DE CORTANTES

| PTO | X | U | URD | SIGMA | COTAG | Z | VCU | A90 | Diam | S |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 51.96 | 83.15 | -231.07 | 1.54 | AB | 11.29 | 11.68 | 10 | 10 |
| 2 | 1.75 | 44.53 | 71.25 | -130.12 | 1.86 | AB | 11.29 | 8.08 | 10 | 15 |
| 3 | 3.74 | 33.45 | 53.52 | -36.66 | 2.12 | AB | 11.29 | 5.01 | 8 | 15 |
| 4 | 5.75 | 22.1 | 35.36 | 33.44 | 2.29 | C | 0 | 4.45 | 8 | 20 |
| 5 | 7.75 | 15.7 | 25.12 | 80.17 | 2.4 | C | 2.92 | 2.79 | 6 | 20 |

S I M B O L O G I A

PTO = Punto numero
X = Distancia al apoyo en m.
U = Cortante en seccion considerada en Tn.
URD = Cortante mayorado en Tn.
SIGMA = Tension normal en fibra extrema en Kg/cm2 (Art. 48.1.3.3)
COTAG = Cotangente (Art. 48.1.2)
Z = Zona de comprobacion (Art. 48.1.3.3)
VCU = Contribucion hormigon resistencia esfuerzo cortante (Art. 48.1.3.4)
A90 = Area necesaria en estribos por metro lineal en cm2/ml.
Diam. = Diametro de la barra en estribos en mm.
S = Separacion entre estribos en cm.

P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

ARMADURAS DE RASANTE

ARMADURAS DE RASANTE

| Punto | X | E.R. | C.M.N. | C.M.E.E. | C.M.S. | Diam. | S |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 33.99 | 52.05 | 73.25 | 0 | -- | -- |
| 2 | 1.75 | 29.48 | 45.15 | 48.83 | 0 | -- | -- |
| 3 | 3.74 | 21.74 | 33.3 | 30.9 | 2.39 | 6 | 30 |
| 4 | 5.75 | 13.74 | 21.04 | 23.18 | 0 | -- | -- |
| 5 | 7.75 | 10.68 | 16.36 | 12.98 | 3.38 | 6 | 30 |

S I M B O L O G I A

Punto = Punto numero
X = Distancia al apoyo en m.
E.R. = Esfuerzo de rasante en T.
C.M.N. = Capacidad mecanica necesaria en T.
C.M.E.E. = Capacidad mecanica existente estribos de cortante en T.
C.M.S. = Capacidad mecanica suplementaria en T.
Diam. = Diametro de las barras en mm.
S = Separacion entre barras en cm

FLEXION TRANSVERSAL LOSA REPARTO

M O M E N T O S

| | POSITIVOS [MTn.] | NEGATIVOS [MTn.] |
|---|---|---|
| DEFORMACION TRANSVERSAL | 4.02565 | -.40257 |
| FLEXION LOCALIZADA | 1.1376 | -.8827 |
| T O T A L E S | 5.16325 | -1.28525 |

DEFORMACION TRANSVERSAL : Obtenida con el desarrollo en serie de la carga con siete terminos.
FLEXION LOCALIZADA .... : Obtenida por el metodo de Westergaard.



P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

ARMADO LOSA

Res. Caract. del Hormigon [Tn/m2] = 2500
Res. Acero de la Losa [Tn/m2] = 51000
Recubrimiento ..... [cm] = 4.0
Armadura Minima ..... [Tn] = 14.0000

[ CARA SUPERIOR ]
Armadura Principal= 14 Tn/ml se dispone 4 Φ 10 por ml
Armadura Reparto = 3.5 Tn/ml se dispone 4 Φ 8 por ml

[ CARA INFERIOR ]
Armadura Principal= 42.44783 Tn/ml se dispone 5 Φ 16 por ml
Armadura Reparto = 10.61196 Tn/ml se dispone 4 Φ 10 por ml

PLACAS DE APOYO DE NEOPRENO

Modulo Elasticidad Hormigon [Tn/m2] = 3000000
Carga Minima en Apoyo..... [Tn] = 24.8991
Carga Maxima en Apoyo..... [Tn] = 51.9700
Carga de Frenado en Apoyo..... [Tn] = 0.4542
Giro de Apoyo..... [Min.] = 0.8002
Des. Hori.[Retra. Fluen. Temp.] [cm]= 0.7525

APOYO de 200 mm X 300 mm. en Planta y 31 mm. de Altura

[ COMPROBACION ]

Tension Minima de Compresion [Kg/cm2] = 41.4985
Tension Maxima de Compresion [Kg/cm2] = 86.6166
Giro por Cargas Lentas TG ..... = 0.3762
Giro de Frenado TG..... = 0.0379
Giro Total TG..... = 0.4141
Fuerza Horizontal Carga Lenta [Kg] = 1806.0000
Coeficiente 1 = 0.0725
Coeficiente 2 = 0.0435
Giro Admisible de Apoyo .....[Min] = 51.5550

[ PLACA VALIDA ]

P U E N T E  N E R V A D O

(c) Oficina Técnica ALVISA

CALCULO A ROTURA

| | | |
|---|---|---|
| Pasiva en Traccion ..... | [Tn] = | 0.00 |
| Armadura Activa ..... | [Tn] = | 457.04 |
| Capacidad total en traccion N.. | [Tn] = | 457.04 |
| Pasiva en Compresion ..... | [Tn] = | 0.00 |
| Recubrimiento Pasiva Compresion | [cm] = | 5.00 |
| Zona ..... | = | I |
| Ancho Eficaz ..... | [m] = | 1.34 |
| Capa Compresion ..... | [cm] = | 25.00 |
| Dis. CDG Compre. a Fibra Super. | [cm] = | 12.05 |
| Profundidad de Compresiones ... | [cm] = | 24.09 |
| Dis. CDG Trac. a Fibra Inferior | [cm] = | 5.43 |
| Canto Resistente ..... | [m] = | 0.93 |
| Momento de Rotura ( MR+ ) .. | [MTn.] = | 422.87 |

COEFICIENTE DE SEGURIDAD A ROTURA = [ 1.93 ]

[ MOMENTOS [MTn.] ]

| | |
|---|---|
| M1 ... = | 48.261 |
| M2 ... = | 48.355 |
| M3 ... = | 14.854 |
| M3'... = | 22.360 |
| M4 ... = | 30.208 |
| M5 ... = | 55.227 |
| M TOTAL= | 219.268 |

PASO SUPERIOR ED2-1.3

# 3º CALCULO DE ESTRIBOS

# CALCULO ESTRIBOS CERRADOS

| | |
|---|---|
| **NOMBRE PROYECTO :** | **L.A.V. MADRID - ZARAGOZA. Subtramo XV.** |
| **NOMBRE OBRA :** | **ED2-1.3. Estribos 1 y 2.** |

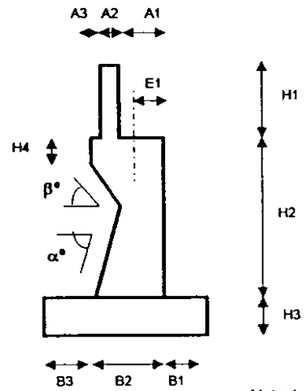
## DATOS REQUERIDOS:

### GESTION FICHEROS

| | |
|---|---|
| Directorio fichero generación modelo (.GEO) : | G:\MAZAX\ED2-1.3\ESTRIBOS |
| Directorio fichero listados (.LIS) : | G:\MAZAX\ED2-1.3\ESTRIBOS\COSMOS |

### MURO FRONTAL

| | | |
|---|---|---|
| H1. Altura murete (m) : | 2.010 | |
| H2. Altura muro frontal (m) : | 9.29 | |
| H3. Canto zapata (m) : | 1.50 | |
| Altura tierras en trasdós (superior zapata)(m) : | 11.30 | |
| B1. Puntera zapata (m) : | 1.50 | Zapata tipo I |
| B2. Canto muro en base (m) : | 1.40 | |
| B3. Talón zapata (m) : | 3.75 | Zapata tipo III |
| A1 (m) : | 1.05 | |
| A2. Canto murete de guarda (m) : | 0.35 | |
| A3. Vuelo ménsula apoyo losa transición (m) : | 0.00 | |
| H4. Canto min. apoyo losa transición (m) : | 0.30 | |
| α. Angulo trasdós muro (°) : | 90.00 | |
| β. Angulo inferior apoyo losa transición (°) : | 45.00 | |
| E1. Distancia apoyo tablero (m) : | 0.50 | |
| Longitud (m) : | 12.99 | |

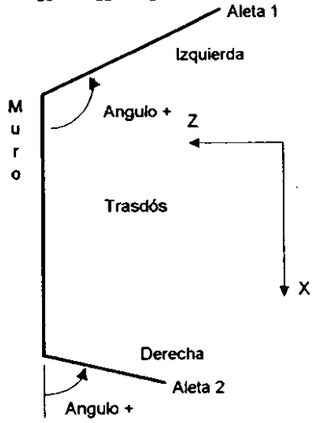



### MUROS EN VUELTA (intradós vertical)

| | Izquierdo (1) | Derecho (2) |
|---|---|---|
| Longitud (m) : | 7.85 | 7.85 |
| Canto en base (m) : | 1.48 | 1.48 |
| Canto coronación (m) : | 0.35 | 0.35 |
| Angulo (°) : | 115.13 | 115.13 |

### ALETAS

| | Izquierda (1) | Derecha (2) |
|---|---|---|
| Canto aleta en empotramiento (m) : | 3.83 | 3.83 |
| Canto aleta en extremo (m) : | 0.50 | 0.50 |
| Longitud aleta (m) : | 5.00 | 5.00 |
| Espesor aleta (m) : | 0.35 | 0.35 |




### CARACTERISTICAS DE TERRENO

| | |
|---|---|
| Peso específico (T/m³) : | 2.00 |
| Angulo rozamiento interno (°) : | 30.00 |
| Coeficiente rozamiento zapata-terreno : | 0.58 |
| Angulo. rozamiento tierras muro (°) : | 0.00 |
| Tension admisible (T / m²) : | 45.00 |

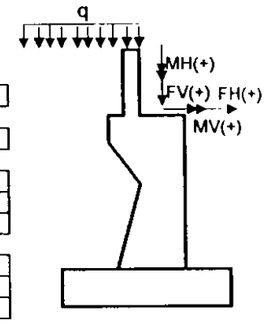
### CARACTERISTICAS DE LOS MATERIALES

| | |
|---|---|
| Peso especifico hormigón (T / m³) : | 2.50 |
| Límite elástico acero (T / m²) : | 51000.00 |
| Resistencia hormigón. cimientos (T / m²) : | 2500.00 |
| Resistencia hormigón. alzado (T / m²) : | 2500.00 |
| Mod. Elasticidad Hormigón alzado (T / m²) : | 3000000 |



### CARGAS SOBRE EL ESTRIBO (Carga total sobre el estribo sin mayorar)

| | |
|---|---|
| q (Sobrecarga de tráfico (T / m²) : | 1.00 |
| Peso barrera en muros en vuelta y aletas (T / m) : | 1.00 |




| | FV (T) | MV (mT) | FH (T) | MH (mT) |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio y carga muerta tablero : | 221.00 | | --- | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero : | 0.00 | | --- | --- |
| Retracción y fluencia tablero : | --- | --- | 14.716 | |
| Asientos estructura : | 0.00 | | --- | --- |
| **Acciones Variables (Q)** | | | | |
| Sobrecarga de uso máxima tablero : | 114.00 | | 10.00 | |
| Sobrecarga de uso mínima tablero : | 0.00 | | 5.00 | |
| Efectos térmicos tablero : | 0.00 | | 0.00 | |

### COEFICIENTES DE SEGURIDAD

| | | |
|---|---|---|
| Seguridad al deslizamiento | Csd= | 1.50 |
| Seguridad al vuelco | Csv= | 1.80 |
| Minoracion acero | γs= | 1.15 |
| Minoracion hormigon | γc= | 1.50 |

| | Estado Límite Último | |
|---|---|---|
| | Favorable | Desfavorable |
| **Acciones permanentes (G)** | | |
| Peso propio, cargas muertas : | 0.90 | 1.50 |
| **Acciones permanentes de valor no constante (G*)** | | |
| Pretensado : | 0.00 | 1.00 |
| Reológicas (retracción y fluencia) : | 0.00 | 1.50 |
| Terreno (pesopropio, empujes y asientos) : | 0.00 | 1.50 |
| **Acciones variables (Q)** | | |
| Sobrecargas, viento, temperatura : | 0.00 | 1.50 |

| | | |
|---|---|---|
| Ψo (coeficiente valor de combinación variables) : | 1.00 | (poner 1 según antigua instrucción) |

### DATOS VARIOS

| | | |
|---|---|---|
| Número de apoyos : | 2.00 | |
| Separación apoyos (m) : | 9.500 | |
| Recubrimiento armadura (m) : | 0.05 | |
| Distancia sección 1-1 (a superior zapata) (m) : | 2.55 | Vale |
| Tamaño medio elementos mallado (m) : | 1.00 | |

## RESUMEN ACCIONES SOBRE EL ESTRIBO

| | | F.vertical (T / m) | X ( m ) | F. Horizontal (T / m) | Y ( m ) |
|---|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | | |
| Peso propio estribo | Base murete (ΣV i, i=1..1) | 1.759 | 2.725 | --- | --- |
| | Sección 1 (ΣV' i, i=1..6) | 25.349 | 2.236 | --- | --- |
| | Base muro (ΣV i, i=1..5) | 34.274 | 2.227 | --- | --- |
| | Inf. cimentación (ΣV i, i=1..6) | 59.211 | 2.689 | --- | --- |
| Carga permanente tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 17.009 | 2.000 | --- | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | | |
| Pretensado tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 2.000 | --- | --- |
| Retracción y fluencia tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | --- | --- | 1.133 | 10.790 |
| Tierras | Base murete (ΣE i, i=1..1) | 0.000 | 2.900 | 1.347 | 11.460 |
| | Sección 1 (ΣE' i, i=1..4) | 0.000 | 2.900 | 25.521 | 6.967 |
| | Base muro (ΣE i, i=1..3) | 0.000 | 2.900 | 42.563 | 5.267 |
| | Inf. cimentación (ΣE i+Pt j, i=1..4, j=1..6) | 84.750 | 4.775 | 54.613 | 4.267 |
| Asientos estructura | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 2.000 | --- | --- |
| **Acciones variables (Q)** | | | | | |
| Sobrecarga de tráfico | Base murete (ΣEsc i, i=1..1) | 0.000 | 2.900 | 0.670 | 11.795 |
| | Sección 1 (ΣEsc' i, i=1..4) | 0.000 | 2.900 | 2.917 | 8.425 |
| | Base muro (ΣEsc i, i=1..3) | 0.000 | 2.900 | 3.767 | 7.150 |
| | Inf. cimentación (ΣEsc i + Psc, i=1..4) | 4.100 | 4.600 | 4.267 | 6.400 |
| Efectos térmicos tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 2.000 | 0.000 | 10.790 |
| Sobrecarga de uso tablero máxima | Base murete | --- | --- | --- | --- |
| | Resto secciones | 8.774 | 2.000 | 0.770 | 10.790 |
| Sobrecarga de uso tablero mínima | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 2.000 | 0.385 | 10.790 |

## COMPROBACIONES

### SEGURIDAD AL DESLIZAMIENTO (Planteamiento clásico)

$$C_{SD} = \frac{\sum_i \text{Fuerzas} - \text{opuestas}}{\sum_i \text{Fuerzas} - \text{deslizantes}}$$

| | Fuerzas en construcción (T / m) Opuestas | Deslizantes | Fuerzas en servicio (T / m) Opuestas | Deslizantes |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 34.343 | --- | 34.343 | --- |
| Carga permanente tablero | --- | --- | 9.865 | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 0.000 | --- |
| Retracción y fluencia tablero | --- | --- | --- | 1.133 |
| Tierras | 49.155 | 54.613 | 49.155 | 54.613 |
| Asientos estructura | --- | --- | 0.000 | --- |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 2.378 | 4.267 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | --- | --- |
| Sobrecarga de uso tablero mínima | --- | --- | 0.000 | 0.385 |
| **TOTAL** | **83.498** | **54.613** | **95.741** | **60.397** |
| **Csd=** | **1.5** | VALE | **1.6** | VALE |

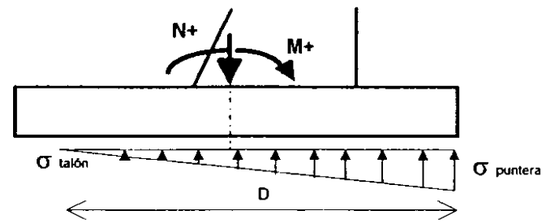


### SEGURIDAD AL VUELCO (Planteamiento clásico)

$$C_{SV} = \frac{\sum_i \text{Momentos} - \text{estabilizadores}}{\sum_i \text{Momentos} - \text{volcadores}}$$

| | Momentos construcción (mT / m) Estabilizadores | Volcadores | Momentos servicio (mT / m) Estabilizadores | Volcadores |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 159.243 | --- | 159.243 | --- |
| Carga permanente tablero | --- | --- | 34.019 | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 0.000 | --- |
| Retracción y fluencia tablero | --- | --- | --- | 12.221 |
| Tierras | 404.681 | 233.017 | 404.681 | 233.017 |
| Asientos estructura | --- | --- | 0.000 | --- |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 18.860 | 27.307 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | --- | --- |
| Sobrecarga de uso tablero mínima | --- | --- | 0.000 | 4.152 |
| **TOTAL** | **563.924** | **233.017** | **616.803** | **276.697** |
| **Csv=** | **2.4** | VALE | **2.2** | VALE |

### TENSIONES MAXIMAS Y MINIMAS EN CIMENTACION




| | Construcción N (T / m) | M (mT / m) | Servicio N (T / m) | M (mT / m) |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 59.211 | 37.635 | 59.211 | 37.635 |
| Carga permanente tablero | --- | --- | 17.009 | 22.537 |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 0.000 | 0.000 |
| Retracción y fluencia tablero | --- | --- | 0.000 | 12.221 |
| Tierras | 84.750 | 110.129 | 84.750 | 110.129 |
| Asientos estructura | --- | --- | 0.000 | 0.000 |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 4.100 | 22.079 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | 8.774 | 19.930 |
| Sobrecarga de uso tablero mínima | --- | --- | --- | --- |
| **TOTAL** | **143.961** | **147.764** | **173.845** | **224.532** |
| **D =** | **6.65 (m)** | | **6.10 (m)** | |
| **σ puntera=** | **41.70 (T / m²)** | | **57.00 (T / m²)** | |
| **σ talón=** | **1.60 (T / m²)** | | **0.00 (T / m²)** | |
| **σmed=** | **21.65 (T / m²)** | | **28.50 (T / m²)** | |
| **σcob=** | **31 (T / m²)** VALE | | **42.75 (T / m²)** VALE | |

**CALCULO DE ARMADURAS**

| Elemento | Sección | | |
|---|---|---|---|
| | Designacion | Ancho (b)(m) | Canto (h)(m) |
| MURO | 0-0 | 1.00 | 1.40 |
| | 1-1 | 1.00 | 1.40 |
| MURETE | 4-4 | 1.00 | 0.35 |
| PUNTERA | 2-2 (+) | 1.00 | 1.50 |
| | 2-2 (-) | 1.00 | 1.50 |
| TALÓN | 3-3 (+) | 1.00 | 1.50 |
| | 3-3 (-) | 1.00 | 1.50 |

| Elemento | Sección | Armadura de flexión | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Nd (T) | Md (mT) | As (cm²/m) | Control cálculo | |
| MURO | 0-0 | 1.00 | 1.40 | 59.32 | 303.78 | 60.219 | Vale | Dominio 2. |
| | 1-1 | 1.00 | 1.40 | 51.28 | 154.89 | 32.369 | Vale | Dominio 2. |
| MURETE | 4-4 | 1.00 | 0.35 | 1.58 | 2.36 | 1.999 | Vale | Dominio 2. |
| PUNTERA | 2-2 (+) | 1.00 | 1.50 | --- | 105.09 | 16.642 | Vale | --- |
| | 2-2 (-) | 1.00 | 1.50 | --- | 19.05 | 2.972 | Vale | --- |
| TALÓN | 3-3 (+) | 1.00 | 1.50 | --- | -192.44 | 30.962 | Vale | --- |
| | 3-3 (-) | 1.00 | 1.50 | --- | -214.03 | 34.574 | Vale | --- |

| Elemento | Sección | Armadura de cortante | | | | |
|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Vd (T) | As (cm²/m²) | Control cálculo |
| MURO | 0-0 | 1.00 | 1.40 | 72.35 | 0.00 | Vale. As min = 7.94 |
| | 1-1 | 1.00 | 1.40 | 45.51 | 0.00 | Vale. As min = 7.94 |
| MURETE | 4-4 | 1.00 | 0.35 | 3.03 | 0.00 | Vale. As min = 7.94 |
| PUNTERA | 2-2 (+) | 1.00 | 1.21 | 57.69 | 0.00 | Vale. As min = 0.00 |
| | 2-2 (-) | 1.00 | 1.21 | 10.41 | 0.00 | Vale. As min = 0.00 |
| TALÓN | 3-3 (+) | 1.00 | 1.50 | 13.18 | 0.00 | Vale. As min = 7.94 |
| | 3-3 (-) | 1.00 | 1.50 | -86.36 | 0.00 | Vale. As min = 7.94 |

| Designacion armaduras | Sección Designacion | Armadura de cálculo(cm²/m) | | |
|---|---|---|---|---|
| | | Necesaria | Minima | Adoptada |
| Vert. trasdos | 0-0 | 60.2 | 8.4 | **60.2** |
| Vert. trasdos | 1-1 | 32.4 | 8.4 | **32.4** |
| Vert. trasdos | 4-4 | 2.0 | 2.0 | **2.0** |
| Vert. intrados | 0-0 1-1 | 0.0 | 4.2 | **4.2** |
| Vert. intrados | 4-4 | 0.0 | 1.2 | **1.2** |
| Hor. trasdos | 0-0 1-1 | 12.0 | 11.2 | **12.0** |
| Hor. trasdos | 4-4 | 0.4 | 2.8 | **2.8** |
| Hor, intrados | 0-0 1-1 | 0.0 | 11.2 | **11.2** |
| Hor, intrados | 4-4 | 0.0 | 2.8 | **2.8** |
| Cortante alzado | 0-0 1-1 | 0.0 | 7.9 | **7.9** |
| Cortante muret | 4-4 | 0.0 | 7.9 | **7.9** |
| As inf L. | 2-2 3-3 | 3.3 | 7.1 | **7.1** |
| As inf T. | 2-2 3-3 | 16.6 | 7.1 | **16.6** |
| As sup L. | 2-2 3-3 | 6.9 | 14.7 | **14.7** |
| As sup T. | 2-2 3-3 | 34.6 | 14.7 | **34.6** |
| Cortante cim | 2-2 3-3 | 0.0 | 7.9 | **7.9** |

NOTA: las armaduras longitudinales en talón y puntera y horizontales de muro que aparecen en las casillas de armadura "necesaria" han sido obtenidas multiplicando la armadura transversal o vertical por el coeficiente de poisson.

## CALCULO DE ARMADURAS EN ESTRIBOS (modelo 3-D)

**Proyecto :** L.A.V. MADRID - ZARAGOZA. Subtramo XV.
**Nombre obra :** ED2-1.3. Estribos 1 y 2.

——>(ver espacio a la derecha para pasar a FAGUS2 )

| | |
|---|---|
| Directorio del grupo: | G:\MAZAXV\FAGUS |
| Nombre obra: | ED2-1-3 |

### CALCULO ARMADURAS VERTICALES

| ZONA | FAJA | Elemento N° | Ny,d ( T/m ) | My,d ( mT/m ) | Vy,d ( T/m ) | Canto elemento (m.) | rmadura cortante (cm2/m) | Vu1>Vd | rmadur interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BORDE | 1 | 140.80 | -190.50 | 81.92 | 1.43 | 0.00 | Vale | 48.13 | 1.00 |
| | | 9 | 104.00 | -128.00 | 70.08 | 1.33 | 0.00 | Vale | 35.13 | 1.00 |
| | | 17 | 75.03 | -86.67 | 60.28 | 1.22 | 0.00 | Vale | 25.71 | 1.00 |
| | | 25 | 51.00 | -59.04 | 51.39 | 1.12 | 0.00 | Vale | 18.64 | 1.00 |
| | | 33 | 30.74 | -40.55 | 43.54 | 1.02 | 0.00 | Vale | 13.26 | 1.00 |
| | | 41 | 13.88 | -27.91 | 37.02 | 0.91 | 0.00 | Vale | 9.10 | 1.00 |
| | | 49 | -0.18 | -18.74 | 32.05 | 0.81 | 0.00 | Vale | 5.69 | 1.00 |
| | | 57 | -4.51 | -9.14 | 19.21 | 0.71 | 0.00 | Vale | 2.67 | 1.00 |
| | | 65 | -4.15 | -3.07 | 10.15 | 0.60 | 0.00 | Vale | 1.00 | 1.00 |
| MURO IZQUIERDO | BASE | 1 | 140.80 | -190.50 | 81.92 | 1.43 | 0.00 | Vale | 48.13 | 1.00 |
| | | 2 | 70.30 | -176.50 | 72.58 | 1.43 | 0.00 | Vale | 37.90 | 1.00 |
| | | 3 | 33.12 | -153.50 | 60.88 | 1.43 | 0.00 | Vale | 29.81 | 1.00 |
| | | 4 | 7.22 | -127.60 | 49.66 | 1.43 | 0.00 | Vale | 22.46 | 1.00 |
| | | 5 | -15.63 | -100.90 | 38.94 | 1.43 | 0.00 | Vale | 15.32 | 1.00 |
| | | 6 | -41.43 | -75.51 | 28.50 | 1.43 | 0.00 | Vale | 8.08 | 1.00 |
| | | 7 | -79.07 | -54.03 | 19.21 | 1.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 8 | -150.90 | -40.78 | 12.76 | 1.43 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BORDE | 239 | 37.05 | -182.40 | 84.66 | 1.43 | 0.00 | Vale | 35.29 | 1.00 |
| | | 247 | 24.04 | -120.50 | 71.43 | 1.33 | 0.00 | Vale | 24.82 | 1.00 |
| | | 255 | 13.79 | -80.64 | 60.83 | 1.22 | 0.00 | Vale | 17.60 | 1.00 |
| | | 263 | 5.56 | -54.79 | 51.54 | 1.12 | 0.00 | Vale | 12.55 | 1.00 |
| | | 271 | -1.19 | -37.85 | 43.51 | 1.02 | 0.00 | Vale | 8.96 | 1.00 |
| | | 279 | -6.94 | -26.36 | 36.92 | 0.91 | 0.00 | Vale | 6.28 | 1.00 |
| | | 287 | -12.49 | -17.96 | 31.94 | 0.81 | 0.00 | Vale | 4.02 | 1.00 |
| | | 295 | -9.95 | -8.81 | 19.06 | 0.71 | 0.00 | Vale | 1.91 | 1.00 |
| | | 303 | -6.37 | -2.97 | 10.07 | 0.60 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BASE | 232 | -42.45 | -9.68 | -11.55 | 1.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 233 | -24.28 | -26.45 | 3.82 | 1.43 | 0.00 | Vale | 1.63 | 1.00 |
| | | 234 | -16.60 | -52.03 | 18.98 | 1.43 | 0.00 | Vale | 6.83 | 1.00 |
| | | 235 | -11.64 | -81.42 | 32.94 | 1.43 | 0.00 | Vale | 12.41 | 1.00 |
| | | 236 | -6.68 | -111.60 | 45.74 | 1.43 | 0.00 | Vale | 18.16 | 1.00 |
| | | 237 | 0.21 | -140.70 | 58.35 | 1.43 | 0.00 | Vale | 23.97 | 1.00 |
| | | 238 | 12.00 | -166.60 | 71.60 | 1.43 | 0.00 | Vale | 29.79 | 1.00 |
| | | 239 | 37.05 | -182.40 | 84.66 | 1.43 | 0.00 | Vale | 35.29 | 1.00 |

### CALCULO DE ARMADURAS HORIZONTALES

| ZONA MURO FRONTAL | FAJA BIS.IZDA | Elemento | Nx ( T/m ) | Mx ( mT/m ) | Vx ( T/m ) | Canto elemento (m.) | rmadura cortante (cm2/m) | Vu1>Vd | rmadur interior (cm2/m) | rmadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BISAGRA | 8 | -26.79 | -12.79 | 4.35 | 1.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 16 | 0.83 | -18.78 | 2.68 | 1.33 | 0.00 | Vale | 3.46 | 1.00 |
| | | 24 | 22.51 | -28.69 | -7.99 | 1.22 | 0.00 | Vale | 8.21 | 1.00 |
| | | 32 | 38.03 | -39.66 | -18.70 | 1.12 | 0.00 | Vale | 12.93 | 1.00 |
| | | 40 | 47.32 | -48.50 | -26.65 | 1.02 | 0.00 | Vale | 17.09 | 1.00 |
| | | 48 | 51.13 | -53.21 | -31.02 | 0.91 | 0.00 | Vale | 20.27 | 1.00 |
| | | 56 | 51.12 | -52.91 | -32.09 | 0.81 | 0.00 | Vale | 22.23 | 1.00 |
| | | 64 | 49.34 | -47.61 | -31.11 | 0.71 | 0.00 | Vale | 22.82 | 1.00 |
| | | 72 | 44.43 | -37.17 | -28.69 | 0.60 | 0.00 | Vale | 21.11 | 1.00 |
| MURO IZQUIERDO | BISAGRA | 80 | 27.93 | -19.83 | -11.66 | 0.50 | 0.00 | Vale | 13.70 | 1.00 |
| | | 88 | 11.01 | -8.72 | -3.97 | 0.40 | 0.00 | Vale | 7.17 | 1.00 |
| MURO DERECHO | BISAGRA | 232 | -8.31 | -8.66 | -1.18 | 1.43 | 0.00 | Vale | 1.00 | 1.00 |
| | | 240 | 4.78 | -21.22 | 5.54 | 1.33 | 0.00 | Vale | 4.36 | 1.00 |
| | | 248 | 13.52 | -34.98 | 16.85 | 1.22 | 0.00 | Vale | 8.42 | 1.00 |
| | | 256 | 18.53 | -47.85 | 26.40 | 1.12 | 0.00 | Vale | 12.49 | 1.00 |
| | | 264 | 20.66 | -56.93 | 32.61 | 1.02 | 0.00 | Vale | 16.11 | 1.00 |
| | | 272 | 20.90 | -60.68 | 35.19 | 0.91 | 0.00 | Vale | 18.90 | 1.00 |
| | | 280 | 20.47 | -58.81 | 34.72 | 0.81 | 0.00 | Vale | 20.64 | 1.00 |
| | | 288 | 20.57 | -51.83 | 32.79 | 0.71 | 0.00 | Vale | 21.13 | 1.00 |
| | | 296 | 20.38 | -39.80 | 29.99 | 0.60 | 0.00 | Vale | 19.52 | 1.00 |
| MURO DERECHO | BISAGRA | 304 | 15.44 | -20.88 | 11.75 | 0.50 | 0.00 | Vale | 12.79 | 1.00 |
| | | 312 | 4.70 | -8.97 | 2.99 | 0.40 | 0.00 | Vale | 6.57 | 1.00 |
| MURO FRONTAL | BIS.IZDA | 89 | -29.32 | -11.07 | -0.43 | 1.40 | 0.00 | Vale | 1.00 | 1.00 |
| | | 102 | -6.75 | -15.79 | 4.14 | 1.40 | 0.00 | Vale | 1.90 | 1.00 |
| | | 115 | 16.23 | -25.01 | 13.58 | 1.40 | 0.00 | Vale | 6.10 | 1.00 |
| | | 128 | 35.77 | -35.79 | 22.14 | 1.40 | 0.00 | Vale | 10.18 | 1.00 |
| | | 141 | 49.13 | -44.99 | 27.97 | 1.40 | 0.00 | Vale | 13.28 | 1.00 |
| | | 154 | 55.78 | -50.57 | 30.59 | 1.40 | 0.00 | Vale | 15.00 | 1.00 |
| | | 167 | 56.80 | -51.85 | 29.87 | 1.40 | 0.00 | Vale | 15.33 | 1.00 |
| | | 180 | 55.02 | -50.40 | 26.67 | 1.40 | 0.00 | Vale | 14.88 | 1.00 |
| | | 193 | 61.37 | -57.18 | 38.45 | 1.40 | 0.00 | Vale | 16.76 | 1.00 |
| MURO FRONTAL | BIS.IZDA | 206 | 16.74 | -3.46 | 8.18 | 0.35 | 0.00 | Vale | 4.74 | 1.00 |
| | | 219 | 14.22 | -6.55 | 8.10 | 0.35 | 0.00 | Vale | 6.87 | 1.00 |
| MURO FRONTAL | BIS.DCHA | 101 | -6.85 | -8.86 | -0.50 | 1.40 | 0.00 | Vale | 1.00 | 1.00 |
| | | 114 | 4.67 | -19.26 | -7.92 | 1.40 | 0.00 | Vale | 3.80 | 1.00 |
| | | 127 | 13.88 | -32.15 | -18.90 | 1.40 | 0.00 | Vale | 7.05 | 1.00 |
| | | 140 | 21.77 | -44.73 | -27.90 | 1.40 | 0.00 | Vale | 10.11 | 1.00 |
| | | 153 | 26.99 | -54.08 | -33.31 | 1.40 | 0.00 | Vale | 12.31 | 1.00 |
| | | 166 | 28.93 | -58.61 | -34.88 | 1.40 | 0.00 | Vale | 13.31 | 1.00 |
| | | 179 | 27.82 | -58.19 | -32.71 | 1.40 | 0.00 | Vale | 13.11 | 1.00 |
| | | 192 | 24.81 | -54.94 | -28.10 | 1.40 | 0.00 | Vale | 12.21 | 1.00 |
| | | 205 | 24.41 | -60.73 | -40.89 | 1.40 | 0.00 | Vale | 13.16 | 1.00 |
| MURO FRONTAL | BIS.DCHA | 218 | 4.25 | -3.59 | -8.16 | 0.35 | 0.00 | Vale | 3.26 | 1.00 |
| | | 231 | 4.71 | -6.73 | -8.15 | 0.35 | 0.00 | Vale | 5.82 | 1.00 |
| MURO FRONTAL | CENTRAL | 95 | -5.15 | -9.75 | 0.85 | 1.40 | 0.00 | Vale | 1.05 | 1.00 |
| | | 108 | -0.50 | 0.35 | 1.16 | 1.40 | 0.00 | Vale | 1.00 | 1.00 |
| | | 121 | 6.45 | 8.65 | 0.70 | 1.40 | 0.00 | Vale | 1.00 | 2.20 |
| | | 134 | 14.79 | 15.47 | 0.27 | 1.40 | 0.00 | Vale | 1.00 | 4.32 |
| | | 147 | 23.56 | 20.85 | -0.03 | 1.40 | 0.00 | Vale | 1.00 | 6.24 |
| | | 160 | 32.18 | 24.97 | -0.22 | 1.40 | 0.00 | Vale | 1.00 | 7.93 |
| | | 173 | 40.48 | 28.21 | -0.32 | 1.40 | 0.00 | Vale | 1.00 | 9.44 |
| | | 186 | 48.79 | 30.95 | -0.50 | 1.40 | 0.00 | Vale | 1.00 | 10.87 |
| | | 199 | 57.72 | 32.67 | -2.33 | 1.40 | 0.00 | Vale | 1.00 | 12.17 |

PASO SUPERIOR ED2-1.3

# 4º PROYECTO DE PRUEBA DE CARGA

**PRUEBA DE CARGA**

OBJETO DE LA PRUEBA

El objeto de la prueba es comprobar la respuesta estructural, frente a situaciones de carga estática, de manera tal que confrontando la respuesta real con la teórica, determinar la fiabilidad del comportamiento en servicio del puente.

CARGA DE PRUEBA

La prueba se realizará empleando camiones, el la disposición que se adjunta a continuación, de tres ejes separados 3.825 y 1.36 m. con cargas por eje de 6.5, 11.75 y 11.75 T.

APARATOS DE MEDIDA Y MEDICIONES

Para la realización de las mediciones se colocarán flexímetros en el centro del vano (medidas f1) y apoyos (medidas f2). Los valores de los desplazamientos que se adjuntan son los descensos relativos esperados entre los puntos de los vanos y los fijos de los apoyos. Estos valores deben ser del orden de la magnitud del valor f1-f2 medido en obra.

La apreciación mínima de cualquiera de los flexímetros será del orden del 3% de los valores máximos esperados de las magnitudes a medir.

El rango de los aparatos deberá ser como mínimo superior en un 50% a los esperados de dicha magnitud.

Las medidas se realizarán inmediatamente antes de la carga, inmediatamente después de su colocación y a los quince minutos de haberla retirado.

Durante la realización de la prueba se deberá anotar las condiciones climatológicas existentes a lo largo de la misma.

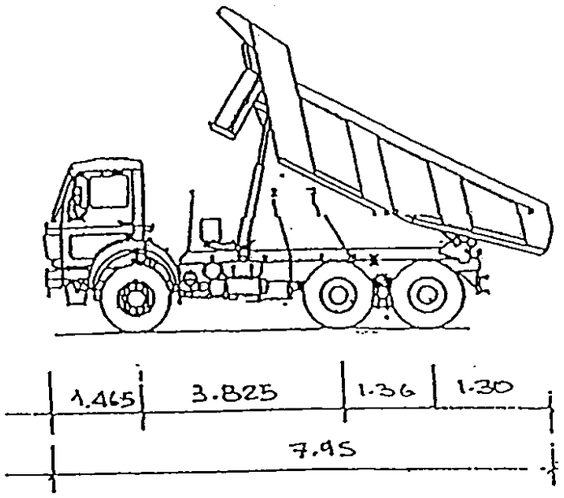
ANALISIS

Para obtener las solicitaciones y desplazamientos verticales en los puntos a medir se procesó la estructura mediante el programa de elementos finitos COSMOS/M. Sobre el modelo la carga de prueba debe producir en las secciones críticas esfuerzos del orden del 70 - 80% de los calculados en el proyecto del tablero.

Se adjunta la definición del modelo de cálculo, de la carga empleada y el listado de esfuerzos y deformaciones obtenidos con la comparación con los calculados en el proyecto del tablero.

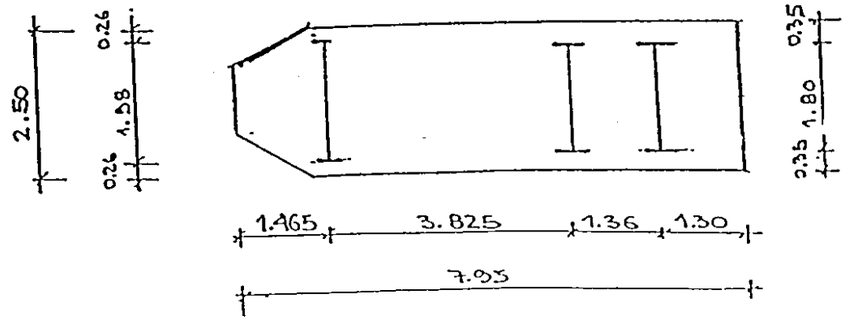
DEFINICION TREN DE CARGAS

CAMION VOLQUETE DE 30.0 Ton.



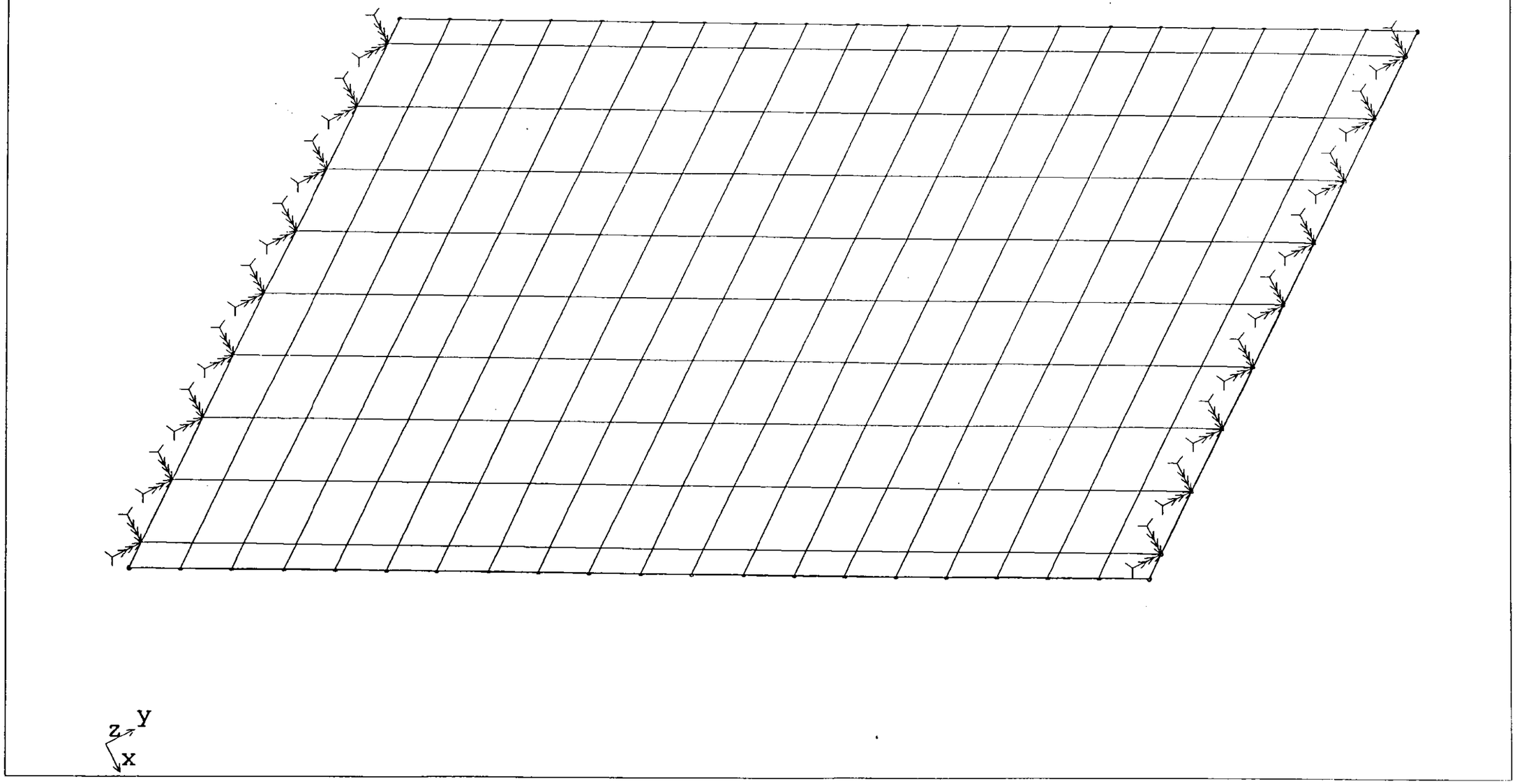

ALZADO




PLANTA

GeoStar 2.0 (64K Version) : Prud213 - [Main]



```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**  CCCC   OOOO   SSSS   M     M   OOOO   SSSS     / M     M  **
**  C      O  O   S      MM   MM   O  O   S       /  MM   MM  **
**  C      O  O   SSSS   M M M M   O  O   SSSS   /   M M M M  **
**  C      O  O      S   M  M  M   O  O      S  /    M  M  M  **
**  CCCC   OOOO   SSSS   M     M   OOOO   SSSS /     M     M  **
**                                                                  **
**                                                                  **
**                        VERSION: 2.00                             **
**                      DISTRIBUTED BY:                             **
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**                 TEL. NO.   (310)  207-2800                       **
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**                                                                  **
**********************************************************************
**********************************************************************
```

Element group data

Element group number= 1
Element name:
BEAM3D Three dimensional Elastic Beam elements
Type of beam element = . . . . . 0
EQ. 0 ; Symmetric beam element
EQ. 1 ; Unsymmetric beam element
EQ. 2 ; Symmetric tapered beam element
Element group number= 2
Element name:
SHELL4T Four node thick shell elements
Type of Shell element= . . . . . 2
EQ. 0 ; QUAD 2 element
EQ. 1 ; QUAD 4 element
Element group number= 3
Element name:
SHELL3T Three node thick shell elements

Real constant data

Real constant set 1
Associated with :
SHELL4T Four node thick shell elements
Thickness of the plate = .25000
Temperature Gradient = .00000
Real constant set 2
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+07
Moment of Inertia about element Y-axis = .10000E+07
Moment of Inertia about element Z-axis = .10000E+07
Depth of beam (y-axis) = 10.000
Width of beam (z-axis) = 10.000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .10000E+07
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 3
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .33410
Moment of Inertia about element Y-axis = .15485E-01
Moment of Inertia about element Z-axis = .34306E-01
Depth of beam (y-axis) = .85000
Width of beam (z-axis) = .00000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .72046E-03
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 4
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .13830
Moment of Inertia about element Z-axis = .13830
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 5
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .13830
Moment of Inertia about element Z-axis = .13830
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000

Material propery data

Material property set 1

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .30000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |

Material property set 2

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Material property set 3

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |

Material property set 4

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | 100.00 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |

Material property set 5

| | Value | Temp curve no. |
|---|---|---|
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Nodal input data

| NODE | BOUNDARY CONDITION CODES (0 = FREE ; 1 = FIXED) | | | | | | NODAL POINT COORDINATES | | |
|---|---|---|---|---|---|---|---|---|---|
| | X | Y | Z | XX | YY | ZZ | X | Y | Z |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 82.463 | 35.685 | .00000 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 81.983 | 34.723 | .00000 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 81.504 | 33.761 | .00000 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 81.024 | 32.798 | .00000 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 80.545 | 31.836 | .00000 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 80.065 | 30.874 | .00000 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 79.586 | 29.912 | .00000 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 79.106 | 28.949 | .00000 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 78.627 | 27.987 | .00000 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 78.147 | 27.025 | .00000 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 77.668 | 26.063 | .00000 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 77.188 | 25.100 | .00000 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 76.709 | 24.138 | .00000 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 76.229 | 23.176 | .00000 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 75.750 | 22.213 | .00000 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 75.271 | 21.251 | .00000 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 74.791 | 20.289 | .00000 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 74.311 | 19.327 | .00000 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 73.832 | 18.364 | .00000 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 73.353 | 17.402 | .00000 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 72.873 | 16.440 | .00000 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 82.103 | 36.139 | .00000 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 81.623 | 35.177 | .00000 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 81.144 | 34.215 | .00000 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 80.665 | 33.252 | .00000 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 80.185 | 32.290 | .00000 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 79.705 | 31.328 | .00000 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 79.226 | 30.365 | .00000 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 78.746 | 29.403 | .00000 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 78.267 | 28.441 | .00000 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 77.787 | 27.479 | .00000 |
| 32 | 0 | 0 | 0 | 0 | 0 | 0 | 77.308 | 26.517 | .00000 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 76.828 | 25.554 | .00000 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 76.349 | 24.592 | .00000 |
| 35 | 0 | 0 | 0 | 0 | 0 | 0 | 75.869 | 23.630 | .00000 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 | 75.390 | 22.667 | .00000 |
| 37 | 0 | 0 | 0 | 0 | 0 | 0 | 74.910 | 21.705 | .00000 |
| 38 | 0 | 0 | 0 | 0 | 0 | 0 | 74.431 | 20.743 | .00000 |
| 39 | 0 | 0 | 0 | 0 | 0 | 0 | 73.951 | 19.781 | .00000 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 | 73.472 | 18.818 | .00000 |
| 41 | 0 | 0 | 0 | 0 | 0 | 0 | 72.993 | 17.856 | .00000 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0 | 72.513 | 16.894 | .00000 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 | 81.185 | 37.299 | .00000 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | 80.705 | 36.336 | .00000 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 80.226 | 35.374 | .00000 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 79.746 | 34.412 | .00000 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 79.267 | 33.450 | .00000 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 78.787 | 32.487 | .00000 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 78.308 | 31.525 | .00000 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 77.828 | 30.563 | .00000 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 77.349 | 29.601 | .00000 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 76.869 | 28.638 | .00000 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 76.390 | 27.676 | .00000 |
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| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 74.472 | 23.827 | .00000 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 73.992 | 22.865 | .00000 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 73.513 | 21.903 | .00000 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 73.033 | 20.940 | .00000 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 72.554 | 19.978 | .00000 |
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| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 71.595 | 18.054 | .00000 |
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| 76 | 0 | 0 | 0 | 0 | 0 | 0 | 74.513 | 26.911 | .00000 |
| 77 | 0 | 0 | 0 | 0 | 0 | 0 | 74.033 | 25.949 | .00000 |
| 78 | 0 | 0 | 0 | 0 | 0 | 0 | 73.554 | 24.987 | .00000 |
| 79 | 0 | 0 | 0 | 0 | 0 | 0 | 73.074 | 24.024 | .00000 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0 | 72.595 | 23.062 | .00000 |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 72.115 | 22.100 | .00000 |
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| 97 | 0 | 0 | 0 | 0 | 0 | 0 | 73.594 | 28.071 | .00000 |
| 98 | 0 | 0 | 0 | 0 | 0 | 0 | 73.115 | 27.109 | .00000 |
| 99 | 0 | 0 | 0 | 0 | 0 | 0 | 72.635 | 26.146 | .00000 |
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| 103 | 0 | 0 | 0 | 0 | 0 | 0 | 70.717 | 22.297 | .00000 |
| 104 | 0 | 0 | 0 | 0 | 0 | 0 | 70.238 | 21.335 | .00000 |
| 105 | 0 | 0 | 0 | 0 | 0 | 0 | 69.758 | 20.373 | .00000 |
| 106 | 0 | 0 | 0 | 0 | 0 | 0 | 78.430 | 40.778 | .00000 |
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| 108 | 0 | 0 | 0 | 0 | 0 | 0 | 77.471 | 38.853 | .00000 |
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| 111 | 0 | 0 | 0 | 0 | 0 | 0 | 76.033 | 35.966 | .00000 |
| 112 | 0 | 0 | 0 | 0 | 0 | 0 | 75.553 | 35.004 | .00000 |
| 113 | 0 | 0 | 0 | 0 | 0 | 0 | 75.073 | 34.042 | .00000 |
| 114 | 0 | 0 | 0 | 0 | 0 | 0 | 74.594 | 33.079 | .00000 |
| 115 | 0 | 0 | 0 | 0 | 0 | 0 | 74.115 | 32.117 | .00000 |
| 116 | 0 | 0 | 0 | 0 | 0 | 0 | 73.635 | 31.155 | .00000 |
| 117 | 0 | 0 | 0 | 0 | 0 | 0 | 73.155 | 30.193 | .00000 |
| 118 | 0 | 0 | 0 | 0 | 0 | 0 | 72.676 | 29.230 | .00000 |
| 119 | 0 | 0 | 0 | 0 | 0 | 0 | 72.197 | 28.268 | .00000 |
| 120 | 0 | 0 | 0 | 0 | 0 | 0 | 71.717 | 27.306 | .00000 |
| 121 | 0 | 0 | 0 | 0 | 0 | 0 | 71.237 | 26.344 | .00000 |
| 122 | 0 | 0 | 0 | 0 | 0 | 0 | 70.758 | 25.381 | .00000 |
| 123 | 0 | 0 | 0 | 0 | 0 | 0 | 70.278 | 24.419 | .00000 |
| 124 | 0 | 0 | 0 | 0 | 0 | 0 | 69.799 | 23.457 | .00000 |
| 125 | 0 | 0 | 0 | 0 | 0 | 0 | 69.319 | 22.495 | .00000 |
| 126 | 0 | 0 | 0 | 0 | 0 | 0 | 68.840 | 21.532 | .00000 |
| 127 | 0 | 0 | 0 | 0 | 0 | 0 | 77.512 | 41.937 | .00000 |
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| 130 | 0 | 0 | 0 | 0 | 0 | 0 | 76.073 | 39.050 | .00000 |
| 131 | 0 | 0 | 0 | 0 | 0 | 0 | 75.594 | 38.088 | .00000 |
| 132 | 0 | 0 | 0 | 0 | 0 | 0 | 75.114 | 37.126 | .00000 |

| | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 409 | 0 | 0 | 0 | 0 | 0 | 0 | 70.441 | 36.756 | -.53285 |
| 410 | 0 | 0 | 0 | 0 | 0 | 0 | 69.962 | 35.793 | -.53285 |
| 411 | 0 | 0 | 0 | 0 | 0 | 0 | 69.483 | 34.831 | -.53285 |
| 412 | 0 | 0 | 0 | 0 | 0 | 0 | 69.003 | 33.869 | -.53285 |
| 413 | 0 | 0 | 0 | 0 | 0 | 0 | 68.524 | 32.907 | -.53285 |
| 414 | 0 | 0 | 0 | 0 | 0 | 0 | 68.044 | 31.944 | -.53285 |
| 415 | 0 | 0 | 0 | 0 | 0 | 0 | 67.564 | 30.982 | -.53285 |
| 416 | 0 | 0 | 0 | 0 | 0 | 0 | 67.085 | 30.020 | -.53285 |
| 417 | 0 | 0 | 0 | 0 | 0 | 0 | 66.605 | 29.058 | -.53285 |
| 418 | 0 | 0 | 0 | 0 | 0 | 0 | 66.126 | 28.095 | -.53285 |
| 419 | 0 | 0 | 0 | 0 | 0 | 0 | 65.646 | 27.133 | -.53285 |
| 420 | 0 | 0 | 0 | 0 | 0 | 0 | 65.167 | 26.171 | -.53285 |
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| 422 | 1 | 1 | 1 | 1 | 1 | 1 | 81.185 | 37.299 | -.97500 |
| 423 | 1 | 1 | 1 | 1 | 1 | 1 | 80.267 | 38.458 | -.97500 |
| 424 | 1 | 1 | 1 | 1 | 1 | 1 | 79.348 | 39.618 | -.97500 |
| 425 | 1 | 1 | 1 | 1 | 1 | 1 | 78.430 | 40.778 | -.97500 |
| 426 | 1 | 1 | 1 | 1 | 1 | 1 | 77.512 | 41.937 | -.97500 |
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| 435 | 1 | 1 | 1 | 1 | 1 | 1 | 67.922 | 22.692 | -.97500 |
| 436 | 1 | 1 | 1 | 1 | 1 | 1 | 67.003 | 23.852 | -.97500 |
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Element input data

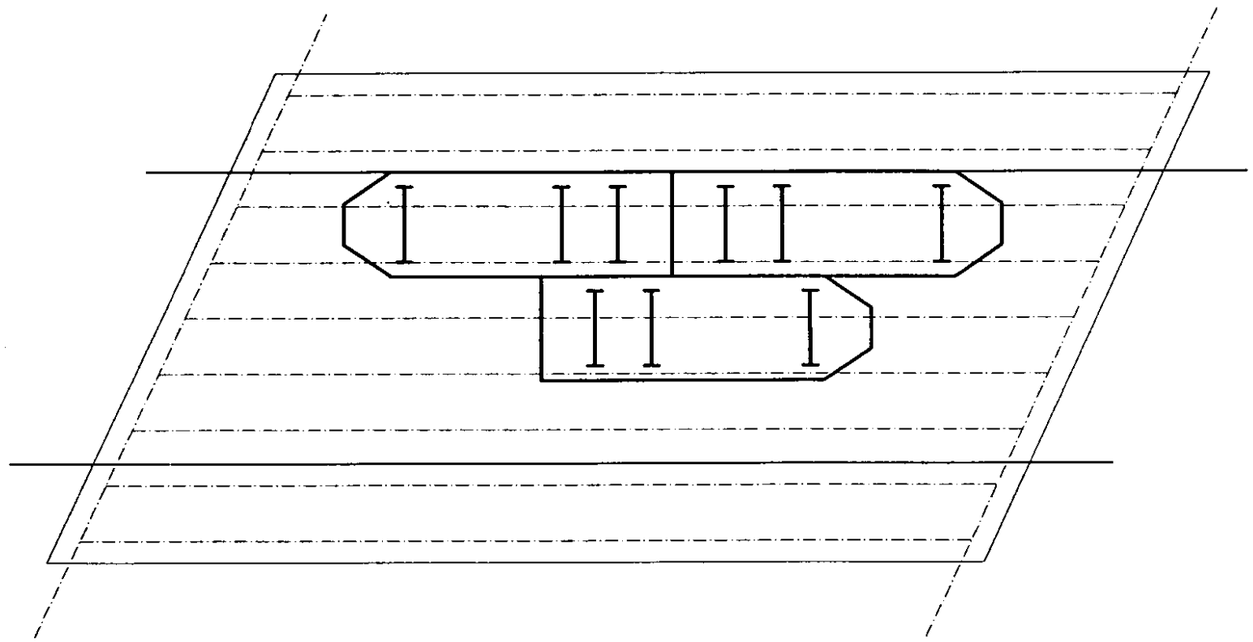
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ELEM EGRP MP REAL ECS NODE 1 NODE 2 NODE 3 NODE 4 NODE 5 NODE 6
NODE 7 NODE 8 NODE 9 NODE10 NODE11 NODE12
NODE13 NODE14 NODE15 NODE16 NODE17 NODE18
NODE19 NODE20

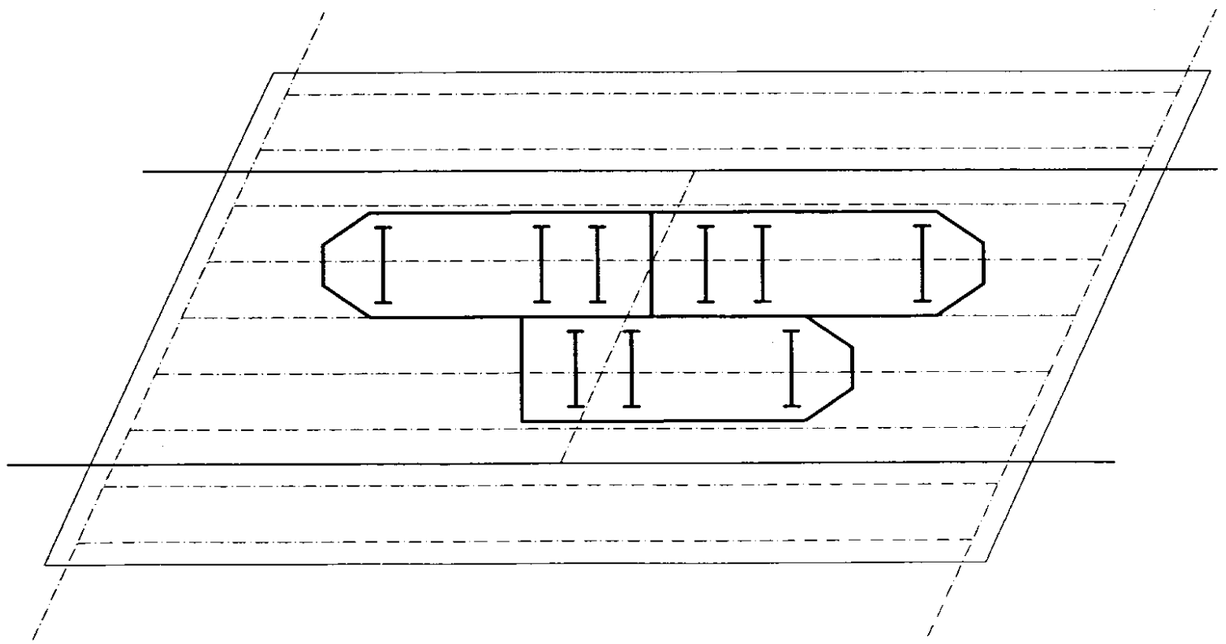
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|---|---|---|---|---|---|---|---|---|---|
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| 2 | 2 | 1 | 1 | -1 | 2 | 3 | 24 | 23 | |
| 3 | 2 | 1 | 1 | -1 | 3 | 4 | 25 | 24 | |
| 4 | 2 | 1 | 1 | -1 | 4 | 5 | 26 | 25 | |
| 5 | 2 | 1 | 1 | -1 | 5 | 6 | 27 | 26 | |
| 6 | 2 | 1 | 1 | -1 | 6 | 7 | 28 | 27 | |
| 7 | 2 | 1 | 1 | -1 | 7 | 8 | 29 | 28 | |
| 8 | 2 | 1 | 1 | -1 | 8 | 9 | 30 | 29 | |
| 9 | 2 | 1 | 1 | -1 | 9 | 10 | 31 | 30 | |
| 10 | 2 | 1 | 1 | -1 | 10 | 11 | 32 | 31 | |
| 11 | 2 | 1 | 1 | -1 | 11 | 12 | 33 | 32 | |
| 12 | 2 | 1 | 1 | -1 | 12 | 13 | 34 | 33 | |
| 13 | 2 | 1 | 1 | -1 | 13 | 14 | 35 | 34 | |
| 14 | 2 | 1 | 1 | -1 | 14 | 15 | 36 | 35 | |
| 15 | 2 | 1 | 1 | -1 | 15 | 16 | 37 | 36 | |
| 16 | 2 | 1 | 1 | -1 | 16 | 17 | 38 | 37 | |
| 17 | 2 | 1 | 1 | -1 | 17 | 18 | 39 | 38 | |
| 18 | 2 | 1 | 1 | -1 | 18 | 19 | 40 | 39 | |
| 19 | 2 | 1 | 1 | -1 | 19 | 20 | 41 | 40 | |
| 20 | 2 | 1 | 1 | -1 | 20 | 21 | 42 | 41 | |
| 21 | 2 | 1 | 1 | -1 | 22 | 23 | 44 | 43 | |
| 22 | 2 | 1 | 1 | -1 | 23 | 24 | 45 | 44 | |
| 23 | 2 | 1 | 1 | -1 | 24 | 25 | 46 | 45 | |
| 24 | 2 | 1 | 1 | -1 | 25 | 26 | 47 | 46 | |
| 25 | 2 | 1 | 1 | -1 | 26 | 27 | 48 | 47 | |
| 26 | 2 | 1 | 1 | -1 | 27 | 28 | 49 | 48 | |
| 27 | 2 | 1 | 1 | -1 | 28 | 29 | 50 | 49 | |
| 28 | 2 | 1 | 1 | -1 | 29 | 30 | 51 | 50 | |
| 29 | 2 | 1 | 1 | -1 | 30 | 31 | 52 | 51 | |
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| 31 | 2 | 1 | 1 | -1 | 32 | 33 | 54 | 53 | |
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| 34 | 2 | 1 | 1 | -1 | 35 | 36 | 57 | 56 | |
| 35 | 2 | 1 | 1 | -1 | 36 | 37 | 58 | 57 | |
| 36 | 2 | 1 | 1 | -1 | 37 | 38 | 59 | 58 | |
| 37 | 2 | 1 | 1 | -1 | 38 | 39 | 60 | 59 | |
| 38 | 2 | 1 | 1 | -1 | 39 | 40 | 61 | 60 | |
| 39 | 2 | 1 | 1 | -1 | 40 | 41 | 62 | 61 | |
| 40 | 2 | 1 | 1 | -1 | 41 | 42 | 63 | 62 | |
| 41 | 2 | 1 | 1 | -1 | 43 | 44 | 65 | 64 | |
| 42 | 2 | 1 | 1 | -1 | 44 | 45 | 66 | 65 | |
| 43 | 2 | 1 | 1 | -1 | 45 | 46 | 67 | 66 | |
| 44 | 2 | 1 | 1 | -1 | 46 | 47 | 68 | 67 | |
| 45 | 2 | 1 | 1 | -1 | 47 | 48 | 69 | 68 | |
| 46 | 2 | 1 | 1 | -1 | 48 | 49 | 70 | 69 | |
| 47 | 2 | 1 | 1 | -1 | 49 | 50 | 71 | 70 | |
| 48 | 2 | 1 | 1 | -1 | 50 | 51 | 72 | 71 | |
| 49 | 2 | 1 | 1 | -1 | 51 | 52 | 73 | 72 | |
| 50 | 2 | 1 | 1 | -1 | 52 | 53 | 74 | 73 | |
| 51 | 2 | 1 | 1 | -1 | 53 | 54 | 75 | 74 | |
| 52 | 2 | 1 | 1 | -1 | 54 | 55 | 76 | 75 | |
| 53 | 2 | 1 | 1 | -1 | 55 | 56 | 77 | 76 | |
| 54 | 2 | 1 | 1 | -1 | 56 | 57 | 78 | 77 | |
| 55 | 2 | 1 | 1 | -1 | 57 | 58 | 79 | 78 | |
| 56 | 2 | 1 | 1 | -1 | 58 | 59 | 80 | 79 | |
| 57 | 2 | 1 | 1 | -1 | 59 | 60 | 81 | 80 | |
| 58 | 2 | 1 | 1 | -1 | 60 | 61 | 82 | 81 | |
| 59 | 2 | 1 | 1 | -1 | 61 | 62 | 83 | 82 | |
| 60 | 2 | 1 | 1 | -1 | 62 | 63 | 84 | 83 | |
| 61 | 2 | 1 | 1 | -1 | 64 | 65 | 86 | 85 | |
| 62 | 2 | 1 | 1 | -1 | 65 | 66 | 87 | 86 | |
| 63 | 2 | 1 | 1 | -1 | 66 | 67 | 88 | 87 | |
| 64 | 2 | 1 | 1 | -1 | 67 | 68 | 89 | 88 | |
| 65 | 2 | 1 | 1 | -1 | 68 | 69 | 90 | 89 | |
| 66 | 2 | 1 | 1 | -1 | 69 | 70 | 91 | 90 | |
| 67 | 2 | 1 | 1 | -1 | 70 | 71 | 92 | 91 | |
| 68 | 2 | 1 | 1 | -1 | 71 | 72 | 93 | 92 | |
| 69 | 2 | 1 | 1 | -1 | 72 | 73 | 94 | 93 | |
| 70 | 2 | 1 | 1 | -1 | 73 | 74 | 95 | 94 | |
| 71 | 2 | 1 | 1 | -1 | 74 | 75 | 96 | 95 | |
| 72 | 2 | 1 | 1 | -1 | 75 | 76 | 97 | 96 | |
| 73 | 2 | 1 | 1 | -1 | 76 | 77 | 98 | 97 | |
| 74 | 2 | 1 | 1 | -1 | 77 | 78 | 99 | 98 | |
| 75 | 2 | 1 | 1 | -1 | 78 | 79 | 100 | 99 | |
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| 77 | 2 | 1 | 1 | -1 | 80 | 81 | 102 | 101 | |
| 78 | 2 | 1 | 1 | -1 | 81 | 82 | 103 | 102 | |
| 79 | 2 | 1 | 1 | -1 | 82 | 83 | 104 | 103 | |
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| 82 | 2 | 1 | 1 | -1 | 86 | 87 | 108 | 107 | |
| 83 | 2 | 1 | 1 | -1 | 87 | 88 | 109 | 108 | |
| 84 | 2 | 1 | 1 | -1 | 88 | 89 | 110 | 109 | |
| 85 | 2 | 1 | 1 | -1 | 89 | 90 | 111 | 110 | |
| 86 | 2 | 1 | 1 | -1 | 90 | 91 | 112 | 111 | |
| 87 | 2 | 1 | 1 | -1 | 91 | 92 | 113 | 112 | |
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| 89 | 2 | 1 | 1 | -1 | 93 | 94 | 115 | 114 | |
| 90 | 2 | 1 | 1 | -1 | 94 | 95 | 116 | 115 | |
| 91 | 2 | 1 | 1 | -1 | 95 | 96 | 117 | 116 | |
| 92 | 2 | 1 | 1 | -1 | 96 | 97 | 118 | 117 | |
| 93 | 2 | 1 | 1 | -1 | 97 | 98 | 119 | 118 | |
| 94 | 2 | 1 | 1 | -1 | 98 | 99 | 120 | 119 | |
| 95 | 2 | 1 | 1 | -1 | 99 | 100 | 121 | 120 | |
| 96 | 2 | 1 | 1 | -1 | 100 | 101 | 122 | 121 | |
| 97 | 2 | 1 | 1 | -1 | 101 | 102 | 123 | 122 | |
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| 101 | 2 | 1 | 1 | -1 | 106 | 107 | 128 | 127 | |
| 102 | 2 | 1 | 1 | -1 | 107 | 108 | 129 | 128 | |
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| 111 | 2 | 1 | 1 | -1 | 116 | 117 | 138 | 137 | |
| 112 | 2 | 1 | 1 | -1 | 117 | 118 | 139 | 138 | |
| 113 | 2 | 1 | 1 | -1 | 118 | 119 | 140 | 139 | |
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| 115 | 2 | 1 | 1 | -1 | 120 | 121 | 142 | 141 | |
| 116 | 2 | 1 | 1 | -1 | 121 | 122 | 143 | 142 | |
| 117 | 2 | 1 | 1 | -1 | 122 | 123 | 144 | 143 | |
| 118 | 2 | 1 | 1 | -1 | 123 | 124 | 145 | 144 | |
| 119 | 2 | 1 | 1 | -1 | 124 | 125 | 146 | 145 | |
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| 121 | 2 | 1 | 1 | -1 | 127 | 128 | 149 | 148 | |
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| 123 | 2 | 1 | 1 | -1 | 129 | 130 | 151 | 150 | |
| 124 | 2 | 1 | 1 | -1 | 130 | 131 | 152 | 151 | |
| 125 | 2 | 1 | 1 | -1 | 131 | 132 | 153 | 152 | |
| 126 | 2 | 1 | 1 | -1 | 132 | 133 | 154 | 153 | |
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| 130 | 2 | 1 | 1 | -1 | 136 | 137 | 158 | 157 | |
| 131 | 2 | 1 | 1 | -1 | 137 | 138 | 159 | 158 | |
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| 134 | 2 | 1 | 1 | -1 | 140 | 141 | 162 | 161 | |
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| 139 | 2 | 1 | 1 | -1 | 145 | 146 | 167 | 166 | |
| 140 | 2 | 1 | 1 | -1 | 146 | 147 | 168 | 167 | |
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| 142 | 2 | 1 | 1 | -1 | 149 | 150 | 171 | 170 | |
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| 146 | 2 | 1 | 1 | -1 | 153 | 154 | 175 | 174 | |
| 147 | 2 | 1 | 1 | -1 | 154 | 155 | 176 | 175 | |
| 148 | 2 | 1 | 1 | -1 | 155 | 156 | 177 | 176 | |
| 149 | 2 | 1 | 1 | -1 | 156 | 157 | 178 | 177 | |
| 150 | 2 | 1 | 1 | -1 | 157 | 158 | 179 | 178 | |
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| 154 | 2 | 1 | 1 | -1 | 161 | 162 | 183 | 182 | |
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| 157 | 2 | 1 | 1 | -1 | 164 | 165 | 186 | 185 | |
| 158 | 2 | 1 | 1 | -1 | 165 | 166 | 187 | 186 | |
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| 160 | 2 | 1 | 1 | -1 | 167 | 168 | 189 | 188 | |
| 161 | 2 | 1 | 1 | -1 | 169 | 170 | 191 | 190 | |
| 162 | 2 | 1 | 1 | -1 | 170 | 171 | 192 | 191 | |
| 163 | 2 | 1 | 1 | -1 | 171 | 172 | 193 | 192 | |
| 164 | 2 | 1 | 1 | -1 | 172 | 173 | 194 | 193 | |
| 165 | 2 | 1 | 1 | -1 | 173 | 174 | 195 | 194 | |
| 166 | 2 | 1 | 1 | -1 | 174 | 175 | 196 | 195 | |
| 167 | 2 | 1 | 1 | -1 | 175 | 176 | 197 | 196 | |
| 168 | 2 | 1 | 1 | -1 | 176 | 177 | 198 | 197 | |
| 169 | 2 | 1 | 1 | -1 | 177 | 178 | 199 | 198 | |
| 170 | 2 | 1 | 1 | -1 | 178 | 179 | 200 | 199 | |
| 171 | 2 | 1 | 1 | -1 | 179 | 180 | 201 | 200 | |
| 172 | 2 | 1 | 1 | -1 | 180 | 181 | 202 | 201 | |
| 173 | 2 | 1 | 1 | -1 | 181 | 182 | 203 | 202 | |
| 174 | 2 | 1 | 1 | -1 | 182 | 183 | 204 | 203 | |
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| 569 | 1 | 2 | 3 | -1 | 419 | 420 | 210 |
| 570 | 1 | 4 | 4 | -1 | 232 | 421 | 42 |
| 571 | 1 | 4 | 4 | -1 | 253 | 422 | 63 |
| 572 | 1 | 4 | 4 | -1 | 274 | 423 | 84 |
| 573 | 1 | 4 | 4 | -1 | 295 | 424 | 105 |
| 574 | 1 | 4 | 4 | -1 | 316 | 425 | 126 |
| 575 | 1 | 4 | 4 | -1 | 337 | 426 | 147 |
| 576 | 1 | 4 | 4 | -1 | 358 | 427 | 168 |
| 577 | 1 | 4 | 4 | -1 | 379 | 428 | 189 |
| 578 | 1 | 4 | 4 | -1 | 400 | 429 | 210 |
| 579 | 1 | 4 | 5 | -1 | 252 | 430 | 22 |
| 580 | 1 | 4 | 5 | -1 | 273 | 431 | 43 |
| 581 | 1 | 4 | 5 | -1 | 294 | 432 | 64 |
| 582 | 1 | 4 | 5 | -1 | 315 | 433 | 85 |
| 583 | 1 | 4 | 5 | -1 | 336 | 434 | 106 |
| 584 | 1 | 4 | 5 | -1 | 357 | 435 | 127 |
| 585 | 1 | 4 | 5 | -1 | 378 | 436 | 148 |
| 586 | 1 | 4 | 5 | -1 | 399 | 437 | 169 |
| 587 | 1 | 4 | 5 | -1 | 420 | 438 | 190 |



DISPOSICION CAMIONES EN PRUEBA DE CARGA. Combinacion 1.



DISPOSICION CAMIONES EN PRUEBA DE CARGA. Combinacion 2.

# DATOS PARA LA REALIZACION DE LA PRUEBA DE CARGA

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** ED2-1.3

**DATOS:**

(Dejar vacios los datos que no existan)

**DEFINICION DE HIPOTESIS SIMPLES**

| Hipotesis de carga número | Vano que se carga | Tipo de carro | Posicion relativa cdg longitudinal | Posicion relativa cdg transversal |
|---|---|---|---|---|
| 1 | 1 | 1 | 0.50 | 0.31 |
| 2 | 1 | 2 | 0.59 | 0.52 |
| 3 | 1 | 1 | 0.50 | 0.39 |
| 4 | 1 | 2 | 0.59 | 0.61 |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | |
| 18 | | | | |
| 19 | | | | |
| 20 | | | | |
| 21 | | | | |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |
| 25 | | | | |
| 26 | | | | |
| 27 | | | | |
| 28 | | | | |
| 29 | | | | |
| 30 | | | | |

**DEFINICION DE TIPOS DE CARROS**

| Carro Tipo | Numero de ejes (maximo 6 | Separacion longitudinal entre ejes consecutivos(en metros) | | | | | Cargas en ejes (en toneladas) | | | | | | Separacion transvesal de ejes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 1 | 2 | 3 | 4 | 5 | 6 | |
| 1 | 6 | 3.83 | 1.36 | 2.60 | 1.36 | 3.83 | 6.50 | 11.75 | 11.75 | 11.75 | 11.75 | 6.50 | 1.80 |
| 2 | 3 | 1.36 | 3.83 | | | | 11.75 | 11.75 | 6.50 | | | | 1.80 |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |

(todos los valores serán positivos)

**COMBINACIONES DE HIPOTESIS SIMPLES PARA EL CALCULO DE FLECHAS**

| Combinacion numero | Vano en el que se utilizará | HIPOTESIS DE CARGA SIMPLES QUE SE SUMAN | | | | | | | | | | | | Situación del carro de la Instrucción para obtener esfuerzos de referencia | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Posicion relativa cdg longitudinal | Posicion relativa cdg transversal |
| 1 | 1 | 1 | 2 | | | | | | | | | | | 0.50 | 0.33 |
| 2 | 1 | 3 | 4 | | | | | | | | | | | 0.50 | 0.50 |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | |

**ESFUERZOS DE REFERENCIA**

| VANO Nº | Momento (m.t.) | Cortante (t.) |
|---|---|---|
| 1 | 131.20 | 32.43 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |

**RESULTADOS:**

| Combinac. Nº | Vano Nº | Viga Nº | FLECHA (mm.) | Momento (m.t.) | M/Mref (%) | Cortante (t.) | V/Vref. (%) |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | -6.6 | 74.3 | 57% | 3.5 | 11% |
| | | 2 | -8.0 | 84.1 | 64% | 10.7 | 33% |
| | | 3 | -9.0 | 92.1 | 70% | 7.8 | 24% |
| | | 4 | -9.3 | 98.0 | 75% | 9.0 | 28% |
| | | 5 | -8.5 | 100.8 | 77% | 8.6 | 26% |
| | | 6 | -6.9 | 97.5 | 74% | 8.4 | 26% |
| | | 7 | -5.1 | 85.4 | 65% | 3.5 | 11% |
| | | 8 | -3.3 | 65.5 | 50% | 6.9 | 21% |
| | | 9 | -1.6 | 38.5 | 29% | 4.4 | 14% |
| 2 | 1 | 1 | -5.0 | 83.2 | 63% | 2.6 | 8% |
| | | 2 | -6.4 | 92.5 | 71% | 9.6 | 30% |
| | | 3 | -7.6 | 96.8 | 74% | 6.7 | 21% |
| | | 4 | -8.4 | 96.9 | 74% | 8.5 | 26% |
| | | 5 | -8.5 | 94.5 | 72% | 8.3 | 25% |
| | | 6 | -7.7 | 88.5 | 67% | 8.9 | 27% |
| | | 7 | -6.4 | 80.6 | 61% | 4.9 | 15% |
| | | 8 | -4.8 | 69.4 | 53% | 8.3 | 26% |
| | | 9 | -3.3 | 54.2 | 41% | 2.2 | 7% |

## *4.3.5 Paso superior E-1520.4*

# INDICE

1º DEFINICION GEOMETRICA

2º CALCULO DEL TABLERO

3º CALCULO DE PILAS

4º CALCULO DE ESTRIBOS

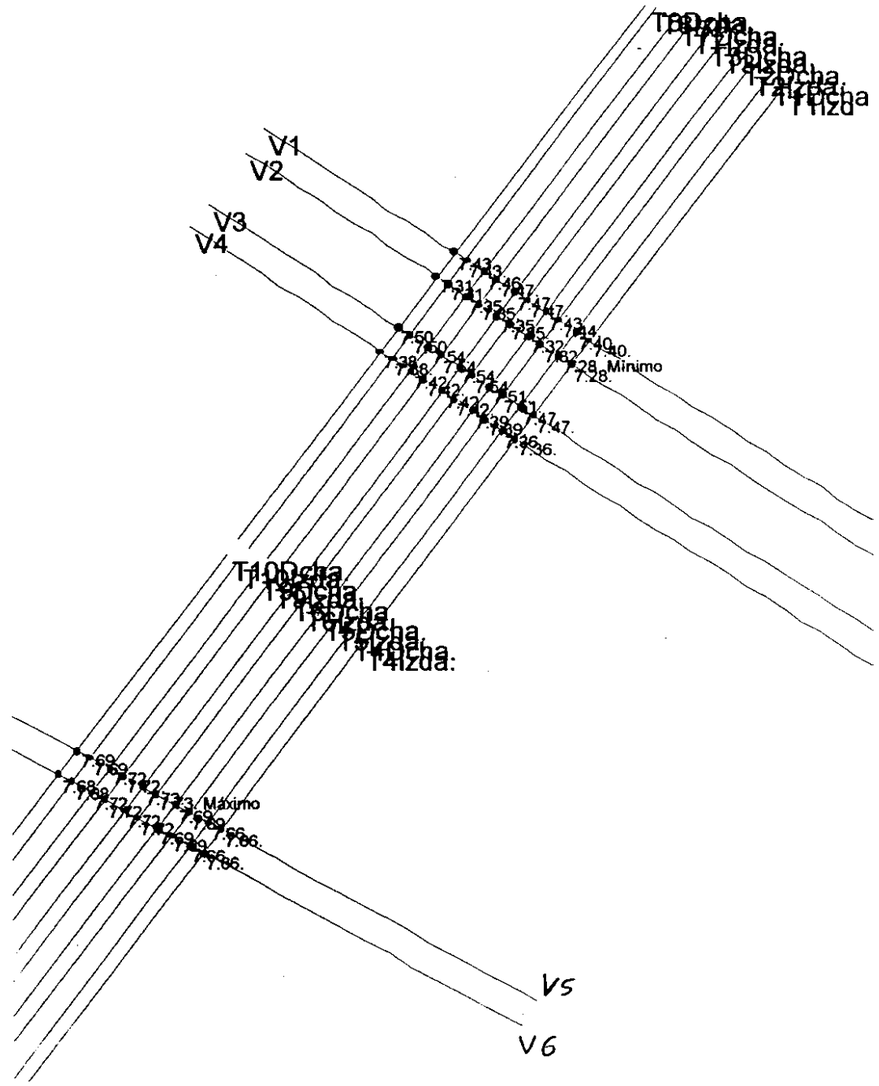
5º PROYECTO DE PRUEBA DE CARGA

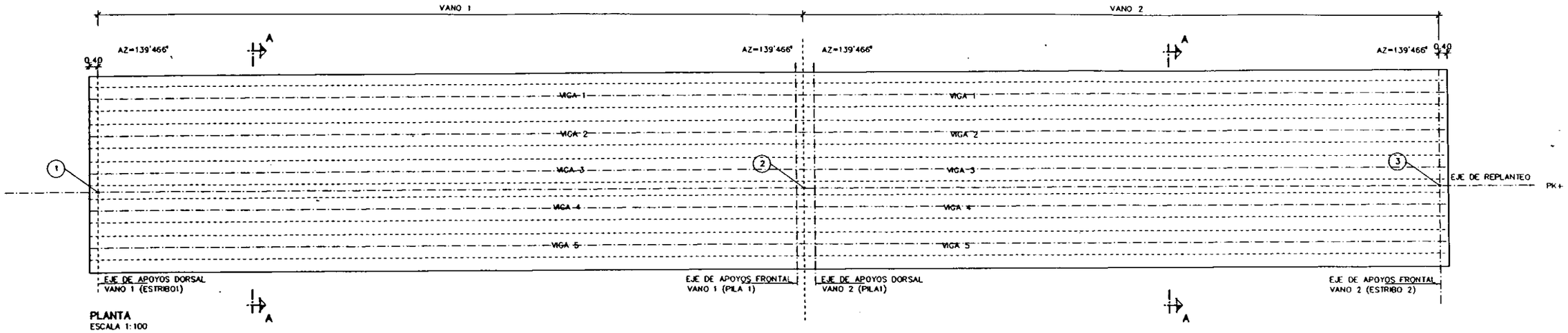
## PASO SUPERIOR E-1520.4

## 1º DEFINICION GEOMETRICA

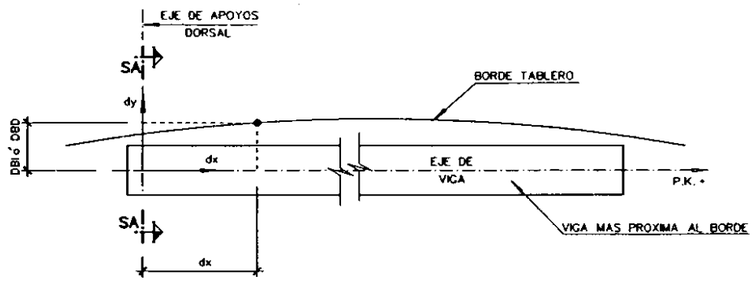
| | |
|---|---|
| Proyecto : | L.A.Z. MADRID - ZARAGOZA. Subtramo XV |
| Nombre obra : | E - 1520.4 |

| GALIBOS | | | | | | SITUACION PUNTO | | |
|---|---|---|---|---|---|---|---|---|
| Punto Nº | X | Y | Z inf. tablero | Z vial inf. | Gálibo (m) | Nº polig.tab. | Nº polig.vial | Dcha.o Izda. |
| 1 | 683190.998 | 4605288.938 | 249.308 | 241.907 | 7.401 | 1 | 1 | Derecha |
| 2 | 683191.571 | 4605288.537 | 249.308 | 241.907 | 7.402 | 1 | 1 | Izquierda |
| 3 | 683189.584 | 4605289.928 | 249.343 | 241.908 | 7.435 | 2 | 1 | Derecha |
| 4 | 683190.158 | 4605289.526 | 249.343 | 241.907 | 7.435 | 2 | 1 | Izquierda |
| 5 | 683188.172 | 4605290.917 | 249.378 | 241.910 | 7.468 | 3 | 1 | Derecha |
| 6 | 683188.745 | 4605290.515 | 249.378 | 241.909 | 7.469 | 3 | 1 | Izquierda |
| 7 | 683186.760 | 4605291.908 | 249.376 | 241.911 | 7.465 | 7 | 1 | Derecha |
| 8 | 683187.333 | 4605291.506 | 249.375 | 241.910 | 7.465 | 7 | 1 | Izquierda |
| 9 | 683185.347 | 4605292.899 | 249.341 | 241.912 | 7.429 | 8 | 1 | Derecha |
| 10 | 683185.920 | 4605292.497 | 249.341 | 241.912 | 7.430 | 8 | 1 | Izquierda |
| 11 | 683190.164 | 4605287.770 | 249.331 | 242.047 | 7.284 | **Mínimo** | 1 | 2 | Derecha |
| 12 | 683190.737 | 4605287.369 | 249.331 | 242.047 | 7.284 | 1 | 2 | Izquierda |
| 13 | 683188.751 | 4605288.760 | 249.366 | 242.048 | 7.318 | 2 | 2 | Derecha |
| 14 | 683189.324 | 4605288.358 | 249.366 | 242.047 | 7.318 | 2 | 2 | Izquierda |
| 15 | 683187.338 | 4605289.749 | 249.401 | 242.050 | 7.351 | 3 | 2 | Derecha |
| 16 | 683187.911 | 4605289.348 | 249.401 | 242.049 | 7.351 | 3 | 2 | Izquierda |
| 17 | 683185.926 | 4605290.740 | 249.399 | 242.051 | 7.348 | 7 | 2 | Derecha |
| 18 | 683186.499 | 4605290.338 | 249.398 | 242.050 | 7.348 | 7 | 2 | Izquierda |
| 19 | 683184.513 | 4605291.730 | 249.364 | 242.052 | 7.312 | 8 | 2 | Derecha |
| 20 | 683185.086 | 4605291.328 | 249.364 | 242.052 | 7.312 | 8 | 2 | Izquierda |
| 21 | 683188.383 | 4605285.275 | 249.380 | 241.907 | 7.473 | 1 | 3 | Derecha |
| 22 | 683188.956 | 4605284.874 | 249.380 | 241.907 | 7.473 | 1 | 3 | Izquierda |
| 23 | 683186.970 | 4605286.265 | 249.415 | 241.908 | 7.507 | 2 | 3 | Derecha |
| 24 | 683187.543 | 4605285.863 | 249.415 | 241.908 | 7.508 | 2 | 3 | Izquierda |
| 25 | 683185.557 | 4605287.255 | 249.450 | 241.910 | 7.540 | 3 | 3 | Derecha |
| 26 | 683186.131 | 4605286.853 | 249.450 | 241.909 | 7.540 | 3 | 3 | Izquierda |
| 27 | 683184.145 | 4605288.245 | 249.448 | 241.911 | 7.537 | 7 | 3 | Derecha |
| 28 | 683184.718 | 4605287.843 | 249.448 | 241.910 | 7.538 | 7 | 3 | Izquierda |
| 29 | 683182.733 | 4605289.236 | 249.413 | 241.912 | 7.501 | 8 | 3 | Derecha |
| 30 | 683183.306 | 4605288.833 | 249.413 | 241.912 | 7.501 | 8 | 3 | Izquierda |
| 31 | 683187.549 | 4605284.107 | 249.403 | 242.047 | 7.356 | 1 | 4 | Derecha |
| 32 | 683188.123 | 4605283.706 | 249.403 | 242.047 | 7.356 | 1 | 4 | Izquierda |
| 33 | 683186.136 | 4605285.097 | 249.438 | 242.048 | 7.390 | 2 | 4 | Derecha |
| 34 | 683186.710 | 4605284.695 | 249.438 | 242.048 | 7.391 | 2 | 4 | Izquierda |
| 35 | 683184.723 | 4605286.086 | 249.473 | 242.050 | 7.423 | 3 | 4 | Derecha |
| 36 | 683185.297 | 4605285.685 | 249.473 | 242.049 | 7.423 | 3 | 4 | Izquierda |
| 37 | 683183.311 | 4605287.077 | 249.471 | 242.051 | 7.420 | 7 | 4 | Derecha |
| 38 | 683183.884 | 4605286.675 | 249.471 | 242.050 | 7.421 | 7 | 4 | Izquierda |
| 39 | 683181.899 | 4605288.068 | 249.436 | 242.052 | 7.384 | 8 | 4 | Derecha |
| 40 | 683182.472 | 4605287.665 | 249.436 | 242.052 | 7.384 | 8 | 4 | Izquierda |
| 41 | 683173.826 | 4605264.882 | 249.571 | 241.911 | 7.660 | 4 | 5 | Derecha |
| 42 | 683174.430 | 4605264.524 | 249.571 | 241.910 | 7.661 | 4 | 5 | Izquierda |
| 43 | 683172.337 | 4605265.765 | 249.605 | 241.911 | 7.693 | 5 | 5 | Derecha |
| 44 | 683172.941 | 4605265.407 | 249.605 | 241.911 | 7.694 | 5 | 5 | Izquierda |
| 45 | 683170.847 | 4605266.647 | 249.639 | 241.913 | 7.726 | 6 | 5 | Derecha |
| 46 | 683171.452 | 4605266.289 | 249.639 | 241.912 | 7.727 | **Máximo** | 6 | 5 | Izquierda |
| 47 | 683169.358 | 4605267.529 | 249.636 | 241.915 | 7.721 | 9 | 5 | Derecha |
| 48 | 683169.962 | 4605267.171 | 249.636 | 241.914 | 7.722 | 9 | 5 | Izquierda |
| 49 | 683167.868 | 4605268.412 | 249.602 | 241.915 | 7.686 | 10 | 5 | Derecha |
| 50 | 683168.472 | 4605268.054 | 249.602 | 241.915 | 7.687 | 10 | 5 | Izquierda |
| 51 | 683172.989 | 4605263.710 | 249.568 | 241.911 | 7.657 | 4 | 6 | Derecha |
| 52 | 683173.594 | 4605263.352 | 249.568 | 241.910 | 7.658 | 4 | 6 | Izquierda |
| 53 | 683171.500 | 4605264.592 | 249.602 | 241.911 | 7.690 | 5 | 6 | Derecha |
| 54 | 683172.104 | 4605264.234 | 249.602 | 241.911 | 7.691 | 5 | 6 | Izquierda |
| 55 | 683170.010 | 4605265.474 | 249.636 | 241.913 | 7.723 | 6 | 6 | Derecha |
| 56 | 683170.615 | 4605265.117 | 249.637 | 241.912 | 7.724 | 6 | 6 | Izquierda |
| 57 | 683168.521 | 4605266.357 | 249.633 | 241.915 | 7.718 | 9 | 6 | Derecha |
| 58 | 683169.126 | 4605265.999 | 249.633 | 241.914 | 7.719 | 9 | 6 | Izquierda |
| 59 | 683167.032 | 4605267.240 | 249.599 | 241.916 | 7.683 | 10 | 6 | Derecha |
| 60 | 683167.636 | 4605266.882 | 249.599 | 241.915 | 7.684 | 10 | 6 | Izquierda |

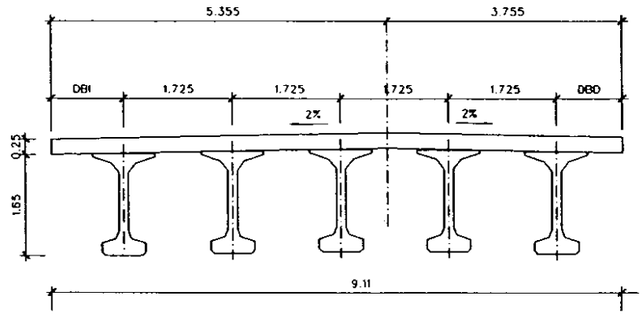





**PLANTA**
ESCALA 1:100




**PLANTA ESQUEMATICA DE REPLANTEO**




**SECCION A-A**
ESCALA 1:50

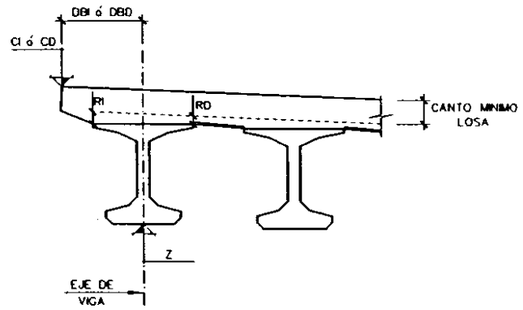
| | VANO Nº 1 | | | | | |
|---|---|---|---|---|---|---|
| | APOYOS EJE DORSAL | | | APOYOS EJE FRONTAL | | |
| VIGA Nº | X | Y | Z | X | Y | Z |
| 1 | 683200,126 | 4605301,124 | 249,065 | 683181,157 | 4605274,550 | 249,587 |
| 2 | 683198,722 | 4605302,126 | 249,099 | 683179,753 | 4605275,552 | 249,622 |
| 3 | 683197,318 | 4605303,128 | 249,134 | 683178,349 | 4605276,554 | 249,656 |
| 4 | 683195,914 | 4605304,130 | 249,131 | 683176,945 | 4605277,556 | 249,654 |
| 5 | 683194,510 | 4605305,133 | 249,097 | 683175,541 | 4605278,558 | 249,619 |

| | VANO Nº 2 | | | | | |
|---|---|---|---|---|---|---|
| | APOYOS EJE DORSAL | | | APOYOS EJE FRONTAL | | |
| VIGA Nº | X | Y | Z | X | Y | Z |
| 1 | 683180,662 | 4605273,857 | 249,593 | 683163,814 | 4605250,253 | 249,536 |
| 2 | 683179,258 | 4605274,859 | 249,627 | 683162,410 | 4605251,255 | 249,570 |
| 3 | 683177,854 | 4605275,861 | 249,662 | 683161,006 | 4605252,257 | 249,605 |
| 4 | 683176,450 | 4605276,863 | 249,659 | 683159,602 | 4605253,259 | 249,602 |
| 5 | 683175,046 | 4605277,865 | 249,625 | 683158,198 | 4605254,262 | 249,568 |

| PUNTO | P.K. | X | Y |
|---|---|---|---|
| 1 | 40,420 | 683196,667 | 4605303,593 |
| 2 | 73,496 | 683177,450 | 4605276,672 |
| 3 | 102,922 | 683160,355 | 4605252,722 |

| | | VANO Nº 1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DX(m.) | 0,000 | 3,260 | 6,530 | 9,790 | 13,060 | 16,320 | 19,590 | 22,850 | 26,120 | 29,380 | 32,650 |
| VIGA Nº 1 | RI(m.) | 0,000 | 0,015 | 0,030 | 0,046 | 0,060 | 0,068 | 0,068 | 0,062 | 0,048 | 0,028 | 0,000 |
| | RD(m.) | 0,022 | 0,037 | 0,052 | 0,068 | 0,082 | 0,090 | 0,090 | 0,084 | 0,070 | 0,050 | 0,022 |
| | DBI(m.) | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 |
| | CI(m.) | 250,954 | 251,021 | 251,089 | 251,156 | 251,222 | 251,282 | 251,335 | 251,381 | 251,420 | 251,452 | 251,476 |
| VIGA Nº 2 | RI(m.) | 0,000 | 0,015 | 0,030 | 0,046 | 0,060 | 0,068 | 0,068 | 0,062 | 0,048 | 0,028 | 0,000 |
| | RD(m.) | 0,022 | 0,037 | 0,052 | 0,068 | 0,082 | 0,090 | 0,090 | 0,084 | 0,070 | 0,050 | 0,022 |
| VIGA Nº 3 | RI(m.) | 0,000 | 0,015 | 0,030 | 0,046 | 0,060 | 0,068 | 0,068 | 0,062 | 0,048 | 0,028 | 0,000 |
| | RD(m.) | 0,022 | 0,037 | 0,052 | 0,068 | 0,082 | 0,090 | 0,090 | 0,084 | 0,070 | 0,050 | 0,022 |
| VIGA Nº 4 | RI(m.) | 0,022 | 0,037 | 0,052 | 0,068 | 0,082 | 0,090 | 0,090 | 0,084 | 0,070 | 0,050 | 0,022 |
| | RD(m.) | 0,000 | 0,015 | 0,030 | 0,046 | 0,060 | 0,068 | 0,068 | 0,062 | 0,048 | 0,028 | 0,000 |
| VIGA Nº 5 | RI(m.) | 0,022 | 0,037 | 0,052 | 0,068 | 0,082 | 0,090 | 0,090 | 0,084 | 0,070 | 0,050 | 0,022 |
| | RD(m.) | 0,000 | 0,015 | 0,030 | 0,046 | 0,060 | 0,068 | 0,068 | 0,062 | 0,048 | 0,028 | 0,000 |
| | DBD(m.) | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 |
| | CD(m.) | 250,986 | 251,053 | 251,121 | 251,188 | 251,254 | 251,314 | 251,367 | 251,413 | 251,452 | 251,484 | 251,508 |

| | | VANO Nº 2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DX(m.) | 0,000 | 2,900 | 5,800 | 8,700 | 11,600 | 14,500 | 17,400 | 20,300 | 23,200 | 26,100 | 29,000 |
| VIGA Nº 1 | RI(m.) | 0,000 | 0,020 | 0,034 | 0,043 | 0,046 | 0,043 | 0,035 | 0,027 | 0,018 | 0,009 | 0,000 |
| | RD(m.) | 0,022 | 0,042 | 0,056 | 0,065 | 0,068 | 0,065 | 0,057 | 0,049 | 0,040 | 0,031 | 0,022 |
| | DBI(m.) | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 |
| | CI(m.) | 251,481 | 251,496 | 251,504 | 251,507 | 251,505 | 251,496 | 251,483 | 251,468 | 251,454 | 251,439 | 251,425 |
| VIGA Nº 2 | RI(m.) | 0,000 | 0,020 | 0,034 | 0,043 | 0,046 | 0,043 | 0,035 | 0,027 | 0,018 | 0,009 | 0,000 |
| | RD(m.) | 0,022 | 0,042 | 0,056 | 0,065 | 0,068 | 0,065 | 0,057 | 0,049 | 0,040 | 0,031 | 0,022 |
| VIGA Nº 3 | RI(m.) | 0,000 | 0,020 | 0,034 | 0,043 | 0,046 | 0,043 | 0,035 | 0,027 | 0,018 | 0,009 | 0,000 |
| | RD(m.) | 0,022 | 0,042 | 0,056 | 0,065 | 0,068 | 0,065 | 0,057 | 0,049 | 0,040 | 0,031 | 0,022 |
| VIGA Nº 4 | RI(m.) | 0,022 | 0,042 | 0,056 | 0,065 | 0,068 | 0,065 | 0,057 | 0,049 | 0,040 | 0,031 | 0,022 |
| | RD(m.) | 0,000 | 0,020 | 0,034 | 0,043 | 0,046 | 0,043 | 0,035 | 0,027 | 0,018 | 0,009 | 0,000 |
| VIGA Nº 5 | RI(m.) | 0,022 | 0,042 | 0,056 | 0,065 | 0,068 | 0,065 | 0,057 | 0,049 | 0,040 | 0,031 | 0,022 |
| | RD(m.) | 0,000 | 0,020 | 0,034 | 0,043 | 0,046 | 0,043 | 0,035 | 0,027 | 0,018 | 0,009 | 0,000 |
| | DBD(m.) | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 | 1,105 |
| | CD(m.) | 251,513 | 251,528 | 251,536 | 251,539 | 251,537 | 251,528 | 251,515 | 251,500 | 251,486 | 251,471 | 251,457 |




**SECCION ESQUEMATICA DE REPLANTEO "SA-SA"**

# PASO SUPERIOR E-1520.4

## 2º CALCULO DEL TABLERO

PUENTE NERVADO CARRETERA

CALCULO DE PUENTES NERVADOS DE CARRETERA

(c) RESEARCH & CONCRETE S.A.

CLIENTE : GINPROSA

OBRA : E-1520.4

Fecha : 18/06/98

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

DATOS GEOMETRICOS

Solucion ..... = 5 N- 165
Luz de Calculo .....[m] = 32.75
Intereje .....[m] = 1.725
Dis. eje V.Borde a Ex.Tablero [m] = 1.55

Ancho del Tablero .....[m] = 10
Ancho de las Aceras .....[m] = 1
Ancho Eficaz [ B0 ] .....[m] = 8.992

Angulo de Esviaje .....[g] = 0
Espesor de la Losa .....[m] = .24
Canto Total .....[m] = 1.89
Espesor del Pavimento .....[cm] = 8

Peso del Carro .....[Tn] = 60
Distan. del carro a la Acera [m] = .5
Peso Aceras y Barandillas [Tn/ml] = 1.1

CARGAS [Tn/ml]

P1 = 1.2547
P2 = 1.0350
P3 = 0.3312
P3'= 0.9080
P4 = 0.8000

CARACTERISTICAS MECANICAS

[ INICIALES ]

VaI ... [m] = .866544
VbI .... [m] = .783456
AREA .. [m2] = .526763
INERCIA [m4] = .2027684

[ FINALES ]

| VIGA No. 1 | | VIGA CENTRAL | |
|---|---|---|---|
| VaF ..... [m] = | 0.414564 | VaF ..... [m] = | 0.494837 |
| VbF ..... [m] = | 1.235436 | VbF ..... [m] = | 1.155164 |
| VcF ..... [m] = | 0.654564 | VcF ..... [m] = | 0.734837 |
| INER.FIN. [m4] = | 0.439789 | INER.FIN. [m4] = | 0.397464 |
| K (rasante)... = | 0.563020 | K (rasante)... = | 0.512333 |



P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

COEFICIENTES EXCENTRICIDAD SIN AJUSTAR

| | CARGA ACERA | CARRO EXCENTRI. | CARRO CENTRADO | CARRO OPCIONAL |
|---|---|---|---|---|
| Y1 | .9448209 | | | |
| Y2 | -.9448209 | | | |
| Y3 | | .7784367 | .2224105 | |
| Y4 | | .3336157 | -.2224105 | |

COEFICIENTES de EXCENTRICIDAD

| Num. VIGA | C A R G A A C E R A | C A R R O EXCENTRICO | C A R R O C E N T R A D O | C A R R O OPCIONAL |
|---|---|---|---|---|
| 1 | 1.31742 | 2.17617 | .90787 | |
| 2 | .80275 | 1.47139 | 1.04472 | |
| 3 | .65963 | .93386 | 1.14265 | |
| 4 | .80275 | .43002 | 1.04472 | |
| 5 | 1.31742 | -.01458 | .90787 | |

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

REPARTO TRANSVERSAL
K (Flexion) = 0.516294
K (Torsion) = 0.326857

| | CARGA ACERA | CARRO EXCENTRI. | CARRO CENTRADO | CARRO OPCIONAL |
|---|---|---|---|---|
| Y1 | .9448209 | | | |
| Y2 | -.9448209 | | | |
| Y3 | | .7784367 | .2224105 | |
| Y4 | | .3336157 | -.2224105 | |

COEFICIENTES de EXCENTRICIDAD

| Num. VIGA | C A R G A A C E R A | C A R R O EXCENTRICO | C A R R O C E N T R A D O | C A R R O OPCIONAL |
|---|---|---|---|---|
| 1 | 1.34431 | 2.17752 | .89926 | |
| 2 | .81913 | 1.4723 | 1.03481 | |
| 3 | .67309 | .93444 | 1.13181 | |
| 4 | .81913 | .43028 | 1.03481 | |
| 5 | 1.34431 | -.01459 | .89926 | |



P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

COEFICIENTES MAS DESFAVORABLES

| Numero de VIGA | Y3 | Y4 | COEFICIENTE MAS DESFAVORABLE |
|---|---|---|---|
| 1 | .77843 | .33361 | 2.31096 |
| 2 | .77843 | .33361 | 1.47139 |
| 3 | .22241 | -.22242 | 1.14265 |
| 4 | -.33362 | -.77844 | 1.47139 |
| 5 | -.33362 | -.77844 | 2.31096 |

PUENTE NERVADO

(c) RESEARCH & CONCRETE S.A.

ESFUERZOS LONGITUDINALES [MTn.]

| | [ VIGA DE BORDE ] | [ VIGA NO. 2 ] |
|---|---|---|
| M1 = | 168.2164 | 168.2164 |
| M2 = | 194.0668 | 138.7628 |
| M3 = | 44.4041 | 44.4041 |
| M3'= | 65.4603 | 39.8870 |
| M4 = | 107.2562 | 107.2562 |
| M5 = | 200.8762 | 135.7357 |

TENSIONES

TENSIONES DE FLEXION DEBIDO A LAS CARGAS EXTERIORES SIN PRETENSADO [Tn/m2]

Resumen

| | EN FABRICA | | EN SERVICIO | | | CON CARGAS MAXIMAS | | | |
|---|---|---|---|---|---|---|---|---|---|
| PUNTO | SA | SB | SA | SB | SC | SA | SB | SC | |
| 16.37 | 718.8 | 650.0- | 1651.8 | 1708.5- | 163.5 | 1942.2 | 2574.1- | 622.1 | L/2 |
| 15.37 | 716.2 | 647.6- | 1645.6 | 1702.1- | 162.9 | 1935.0 | 2564.5- | 619.8 | |
| 14.37 | 708.1 | 640.3- | 1627.1 | 1683.0- | 161.0 | 1913.2 | 2535.7- | 612.8 | |
| 13.37 | 694.7 | 628.2- | 1596.3 | 1651.1- | 158.0 | 1877.0 | 2487.7- | 601.2 | |
| 12.37 | 675.9 | 611.2- | 1553.2 | 1606.5- | 153.7 | 1826.3 | 2420.5- | 585.0 | |
| 11.37 | 651.8 | 589.4- | 1497.7 | 1549.2- | 148.2 | 1761.1 | 2334.1- | 564.1 | |
| 10.37 | 622.3 | 562.7- | 1430.0 | 1479.1- | 141.5 | 1681.4 | 2228.5- | 538.6 | |
| 9.37 | 587.5 | 531.2- | 1349.9 | 1396.3- | 133.6 | 1587.3 | 2103.7- | 508.4 | |
| 8.37 | 547.3 | 494.9- | 1257.5 | 1300.7- | 124.4 | 1478.6 | 1959.7- | 473.6 | |
| 7.37 | 501.7 | 453.7- | 1152.8 | 1192.4- | 114.1 | 1355.5 | 1796.5- | 434.1 | |
| 6.37 | 450.7 | 407.6- | 1035.7 | 1071.3- | 102.5 | 1217.9 | 1614.1- | 390.1 | |
| 5.37 | 394.4 | 356.7- | 906.4 | 937.5- | 89.7 | 1065.8 | 1412.5- | 341.3 | |
| 4.37 | 332.8 | 301.0- | 764.7 | 791.0- | 75.7 | 899.2 | 1191.7- | 288.0 | |
| 3.37 | 265.7 | 240.4- | 610.7 | 631.7- | 60.4 | 718.1 | 951.7- | 230.0 | |
| 2.37 | 193.4 | 174.9- | 444.4 | 459.7- | 43.9 | 522.5 | 692.6- | 167.3 | |
| 1.37 | 115.6 | 104.6- | 265.7 | 274.9- | 26.3 | 312.4 | 414.2- | 100.0 | |
| 0.37 | 32.5 | 29.5- | 74.7 | 77.4- | 7.4 | 87.9 | 116.6- | 28.1 | |
| 0.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | APOYO |



PUENTE NERVADO

(c) RESEARCH & CONCRETE S.A.

CUADRO DE PRETENSADOS

| FILA -> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIPO DE CABLE-> | 0.6 | 0.6 | 0.6 | 0.6 | | | | | | |
| TRAZADO | RECTO | RECTO | RECTO | RECTO | | | | | N | EX |
| COTA-> | 4 | 9 | 14 | 161 | | | | | (TN) | (Cm) |
| X | Num. | Num. | Num. | Num. | | | | | | |
| 16.375 | 13 | 13 | 9 | 6 | | | | | 804 | 48 |
| 11.37 | 13 | 13 | 8 | 6 | | | | | 784 | 47 |
| 8.37 | 13 | 13 | 7 | 6 | | | | | 764 | 47 |
| 6.37 | 13 | 13 | 6 | 6 | | | | | 745 | 46 |
| 5.37 | 13 | 13 | 5 | 6 | | | | | 725 | 46 |
| 3.37 | 13 | 13 | 4 | 6 | | | | | 706 | 45 |
| 2.37 | 13 | 13 | 3 | 6 | | | | | 686 | 45 |
| 1.37 | 13 | 13 | 2 | 6 | | | | | 666 | 44 |
| .37 | 13 | 13 | 2 | 6 | | | | | 666 | 44 |
| 0 | 13 | 13 | 2 | 6 | | | | | 666 | 44 |

No se consideran los entubados cuya longitud es menor de 0.5 metros

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

TENSIONES EN DIFERENTES PUNTOS A LO LARGO DE LA VIGA [Tn/m2]

FABRICA ..... = Peso Propio + Pretensado con Perdidas a Corto Plazo
SERVICIO ..... = Cargas Permanentes + Pretensado con Perdidas Totales
CARGAS MAXIMAS = Servicio + Sobrecargas Maximas

VIGA MAS DESFAVORABLE = VIGA DE BORDE

Resumen

| | EN FABRICA | | EN SERVICIO | | | CON CARGAS MAXIMAS | | | |
|---|---|---|---|---|---|---|---|---|---|
| PUNTO | SA | SB | SA | SB | SC | SA | SB | SC | |
| 16.37 | 615.4 | 2202.9 | 1564.7 | 693.9 | 163.5 | 1855.1 | 171.7- | 622.1 | L/2 |
| 15.37 | 612.8 | 2205.3 | 1558.5 | 700.3 | 162.9 | 1847.9 | 162.1- | 619.8 | |
| 14.37 | 604.7 | 2212.6 | 1540.0 | 719.4 | 161.0 | 1826.1 | 133.3- | 612.8 | |
| 13.37 | 591.3 | 2224.7 | 1509.2 | 751.3 | 158.0 | 1789.9 | 85.3- | 601.2 | |
| 12.37 | 572.5 | 2241.7 | 1466.1 | 795.9 | 153.7 | 1739.2 | 18.1- | 585.0 | |
| 11.37 | 564.2 | 2181.9 | 1423.9 | 784.5 | 148.2 | 1687.3 | 0.4- | 564.1 | |
| 10.37 | 534.7 | 2208.6 | 1356.2 | 854.6 | 141.5 | 1607.6 | 105.2 | 538.6 | |
| 9.37 | 499.9 | 2240.1 | 1276.1 | 937.4 | 133.6 | 1513.5 | 230.0 | 508.4 | |
| 8.37 | 475.5 | 2194.7 | 1197.1 | 964.2 | 124.4 | 1418.2 | 305.2 | 473.6 | |
| 7.37 | 429.9 | 2235.9 | 1092.4 | 1072.5 | 114.1 | 1295.1 | 468.4 | 434.1 | |
| 6.37 | 394.8 | 2200.4 | 988.6 | 1124.9 | 102.5 | 1170.8 | 582.1 | 390.1 | |
| 5.37 | 354.4 | 2169.7 | 872.7 | 1190.0 | 89.7 | 1032.1 | 715.0 | 341.3 | |
| 4.37 | 292.8 | 2225.4 | 731.0 | 1336.5 | 75.7 | 865.5 | 935.8 | 288.0 | |
| 3.37 | 241.5 | 2204.3 | 590.3 | 1427.0 | 60.4 | 697.7 | 1107.0 | 230.0 | |
| 2.37 | 185.1 | 2188.2 | 437.4 | 1530.3 | 43.9 | 515.5 | 1297.4 | 167.3 | |
| 1.37 | 123.1 | 2176.9 | 272.1 | 1646.3 | 26.3 | 318.8 | 1507.0 | 100.0 | |
| 0.37 | 40.1 | 2252.0 | 81.0 | 1843.8 | 7.4 | 94.3 | 1804.6 | 28.1 | |
| 0.00 | 7.6 | 2281.5 | 6.4 | 1921.2 | 0.0 | 6.4 | 1921.2 | 0.0 | APOYO |

Calculo de las tensiones con el entubado real

RESISTENCIA DE HORMIGONES [Tn/m2]

AL DESTESAR .. = 3650.43
A LOS 28 DIAS = 2968.36 se dispone Hormigon de 4500
EN LOSA ..... = 995.40 '' '' '' '' 2500



P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

ARMADURAS DE CORTANTES [EP-93]

Acero Ey ..... [Kg/cm2] >= 5100
Espesor del Alma ... [cm] = 15.0
Fct'K .....[Kg/cm2] = 264.2536
Vcuo ..... [Tn] = 24.7412
Armadura Minima..[cm2/ml] = 2.9118

ARMADURAS DE CORTANTES

| PTO | X | U | URD | SIGMA | COTAG | Z | VCU | A90 | Diam | S |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 104.87 | 167.79 | -233.38 | 1.68 | AB | 24.74 | 12.19 | 12 | 15 |
| 2 | 2.37 | 92.85 | 148.56 | -122.58 | 2.03 | AB | 24.74 | 8.72 | 10 | 15 |
| 3 | 5.37 | 75.11 | 120.18 | -7.39 | 2.35 | AB | 24.74 | 5.83 | 8 | 15 |
| 4 | 8.37 | 54.73 | 87.57 | 80.16 | 2.56 | C | 0 | 6.29 | 8 | 15 |
| 5 | 11.37 | 39.7 | 63.52 | 140.06 | 2.69 | C | 3.56 | 4.31 | 8 | 20 |

S I M B O L O G I A

PTO = Punto numero
X = Distancia al apoyo en m.
U = Cortante en seccion considerada en Tn.
URD = Cortante mayorado en Tn.
SIGMA = Tension normal en fibra extrema en Kg/cm2 (Art. 48.1.3.3)
COTAG = Cotangente (Art. 48.1.2)
Z = Zona de comprobacion (Art. 48.1.3.3)
VCU = Contribucion hormigon resistencia esfuerzo cortante (Art. 48.1.3.4)
A90 = Area necesaria en estribos por metro lineal en cm2/ml.
Diam. = Diametro de la barra en estribos en mm.
S = Separacion entre estribos en cm.

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

ARMADURAS DE RASANTE

ARMADURAS DE RASANTE

| Punto | X | E.R. | C.M.N. | C.M.E.E. | C.M.S. | Diam. | S |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 60.62 | 46.58 | 69.85 | 0 | -- | -- |
| 2 | 2.37 | 55.02 | 42.28 | 48.83 | 0 | -- | -- |
| 3 | 5.37 | 45.39 | 34.88 | 30.9 | 3.98 | 6 | 30 |
| 4 | 8.37 | 33.11 | 25.45 | 30.9 | 0 | -- | -- |
| 5 | 11.37 | 26.19 | 20.13 | 23.18 | 0 | -- | -- |

S I M B O L O G I A

Punto = Punto numero
X = Distancia al apoyo en m.
E.R. = Esfuerzo de rasante en T.
C.M.N. = Capacidad mecanica necesaria en T.
C.M.E.E. = Capacidad mecanica existente estribos de cortante en T.
C.M.S. = Capacidad mecanica suplementaria en T.
Diam. = Diametro de las barras en mm.
S = Separacion entre barras en cm

FLEXION TRANSVERSAL LOSA REPARTO

M O M E N T O S

| | POSITIVOS [MTn.] | NEGATIVOS [MTn.] |
|---|---|---|
| DEFORMACION TRANSVERSAL | 2.35193 | -.2352 |
| FLEXION LOCALIZADA | 1.61619 | -.99097 |
| T O T A L E S | 3.96812 | -1.22616 |

DEFORMACION TRANSVERSAL : Obtenida con el desarrollo en serie de la carga con siete terminos.
FLEXION LOCALIZADA .... : Obtenida por el metodo de Westergaard.



P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

ARMADO LOSA

Res. Caract. del Hormigon [Tn/m2] = 2500
Res. Acero de la Losa [Tn/m2] = 51000
Recubrimiento ..... [cm] = 4.0
Armadura Minima ..... [Tn] = 13.3333

[ CARA SUPERIOR ]
Armadura Principal= 13.33333 Tn/ml se dispone 5 10 por ml
Armadura Reparto = 3.333333 Tn/ml se dispone 5 10 por ml

[ CARA INFERIOR ]
Armadura Principal= 33.72514 Tn/ml se dispone 4 16 por ml
Armadura Reparto = 8.431286 Tn/ml se dispone 5 10 por ml

PLACAS DE APOYO DE NEOPRENO

Modulo Elasticidad Hormigon [Tn/m2] = 3000000
Carga Minima en Apoyo..... [Tn] = 50.9122
Carga Maxima en Apoyo..... [Tn] = 104.8717
Carga de Frenado en Apoyo..... [Tn] = 0.9650
Giro de Apoyo..... [Min.] = 1.5568
Des. Hori.[Retra. Fluen. Temp.] [cm]= 1.1463

—— APOYO de 250 mm X 500 mm. en Planta y 43 mm. de Altura ——

[ COMPROBACION ]

Tension Minima de Compresion [Kg/cm2] = 40.7297
Tension Maxima de Compresion [Kg/cm2] = 83.8974
Giro por Cargas Lentas TG ..... = 0.3821
Giro de Frenado TG..... = 0.0386
Giro Total TG..... = 0.4207
Fuerza Horizontal Carga Lenta [Kg] = 3820.8333
Coeficiente 1 = 0.0750
Coeficiente 2 = 0.0456
Giro Admisible de Apoyo .....[Min] = 49.4928

[ PLACA VALIDA ]

P U E N T E  N E R V A D O

(c) RESEARCH & CONCRETE S.A.

CALCULO A ROTURA

Pasiva en Traccion ..... [Tn] = 0.00
Armadura Activa ..... [Tn] = 761.73
Capacidad total en traccion N.. [Tn] = 761.73
Pasiva en Compresion ..... [Tn] = 0.00
Recubrimiento Pasiva Compresion [cm] = 0.00
Zona ..... = II
Ancho Eficaz ..... [m] = 1.73
Capa Compresion ..... [cm] = 24.00
Ancho del Ala ..... [m] = 1.10
Profundidad del Ala ..... [m] = 0.07
Dis. CDG Compre. a Fibra Super. [cm] = 15.43
Profundidad de Compresiones ... [cm] = 29.83
Dis. CDG Trac. a Fibra Inferior [cm] = 8.43
Canto Resistente ..... [m] = 1.65
Momento de Rotura ( MR+ ) .. [MTn.] =1257.92

COEFICIENTE DE SEGURIDAD A ROTURA = [ 1.61 ]

[ MOMENTOS [MTn.] ]

M1 ... = 168.216
M2 ... = 194.066
M3 ... = 44.404
M3'... = 65.460
M4 ... = 107.256
M5 ... = 200.876
M TOTAL= 780.279

[ VOLUMEN DE TRACCIONES ]

SA [Tn/m2] = 1855.22832
SB [Tn/m2] = -171.46912
X [m] = 0.13959

Ancho Cabeza Inferior [cm] = 70.0
Volumen de Tracciones [Tn] = 8.4

PASO SUPERIOR E-1520.4

3º CALCULO DE PILAS

## CARGAS SOBRE LA PILA



| | |
|---|---|
| **Nombre proyecto :** | **L.A.V. MADRID - ZARAGOZA. Subtramo XV.** |
| **Nombre obra :** | **E-1520.4. Pila 1.** |

### DATOS BASICOS :

**Geometría**

| | |
|---|---|
| Luz vano 1 (m) : | 32.650 |
| Luz vano 2 (m) : | 29.000 |
| Entrega viga (m) : | 0.400 |
| Distancia extremos vigas (m) : | 0.050 |
| Número vigas : | 5 |
| Canto viga (m) : | 1.650 |
| Canto losa (m) : | 0.250 |
| Distancia ejes pila-camino (m) : | 0.800 |
| Ancho neopreno (m) : | 0.250 |
| Largo neopreno (m) : | 0.400 |
| Alto neto neopreno (m) : | 0.045 |

**Cargas**

| | |
|---|---|
| Peso específico hormigón (T/m³) : | 2.500 |
| Peso viga (T/m) : | 1.255 |
| Peso acera izda (T/m) : | 4.100 |
| Ancho acera izda (m) : | 2.940 |
| Peso acera dcha (T/m) : | 1.200 |
| Ancho acera dcha (m) : | 1.400 |
| Ancho para sobrecarga (m) : | 9.340 |
| Ancho tablero (m) : | 9.110 |
| Sobreespesor tablero por recrecid | 0.043 |
| Peso pavimento (T/m) : | 1.080 |
| Sobrecarga repartida (T/m²) : | 0.400 |
| Movimientos impuestos (mm/m) : | 0.700 |
| Presión viento (T/m²) : | 0.250 |
| Sobrecanto viento (T/m²) : | 2.500 |

### FUERZAS VERTICALES

**Acciones permanentes :**

| | F (T) | ML (mT) | MT (mT) |
|---|---|---|---|
| Peso propio vigas : | 198.397 | 0.000 | 2.576 |
| Peso propio losa : | 211.669 | 0.000 | 2.744 |
| Carga muerta pavimento : | 34.209 | -27.367 | 0.443 |
| Carga muerta aceras izda : | 129.868 | 415.576 | 1.684 |
| Carga muerta aceras dcha : | 38.010 | -150.900 | 0.493 |
| **TOTAL permanente =** | **612.153** | **237.309** | **7.940** |

**Acciones variables :**

| | Fmax (T) | MLconc (mT) | MTconc(mT/m) | Fconc (T) | MLmax (mT) | MTconc(mT/m) | Fconc (T) | MLconc (mT) | MTmax(mT/m) |
|---|---|---|---|---|---|---|---|---|---|
| Sobrecarga repartida : | 118.338 | 0.000 | 1.534 | 59.169 | 138.159 | 0.767 | 62.578 | 0.000 | 14.080 |
| Carro : | 60.000 | 13.800 | 13.500 | 60.000 | 13.800 | 13.500 | 60.000 | 13.800 | 13.500 |

| | F (T) | ML (mT) | MT (mT) |
|---|---|---|---|
| **TOTAL variable =** | **178.338** | **151.959** | **27.580** |

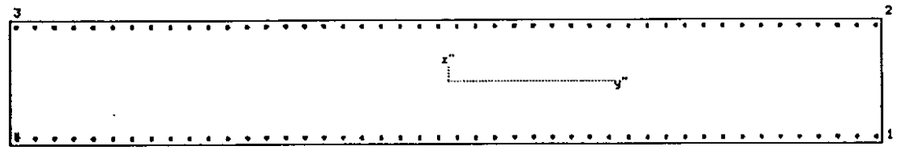
### FUERZAS HORIZONTALES

| | FL (T) | FT (T) | |
|---|---|---|---|
| Movimientos impuestos : | 20.316 | 0.000 | (Como si solo existiese el vano más largo) |
| Frenado : | 7.417 | 0.000 | |
| Viento : | 0.000 | 34.843 | |

### RESUMEN

| | FX | FL | FT | ML | MT | CoefPP |
|---|---|---|---|---|---|---|
| **E.L.U.** | **-1185.74** | **41.60** | **52.26** | **583.90** | **53.28** | **1.5** |
| **E.L.S.** | **-790.49** | **27.73** | **34.84** | **389.27** | **35.52** | **1** |

Mstb. 1 : 50.0




Sección :"PILAINF" Armadura :"B1"
Tipo : tipo viga/ Genérico Unidades :[cm]

Sección parcial 1: Hormigón = H300

| Pto | Coord-Y | Coord-Z | Pto | Coord-Y | Coord-Z |
|---|---|---|---|---|---|
| 1 | 350.00 | -50.00 | 2 | 350.00 | 50.00 |
| 3 | -350.00 | 50.00 | 4 | -350.00 | -50.00 |

Características mecánicas de la sección:
Area : Ax= 7.000 [m2]
Momentos de inercia : Iy= 0.583333 [m4] Iz= 28.583 [m4]
Inercia a torsión : Ix= 7.799 [m4] (de un círculo del mismo área)

Posición del centro de gravedad: ys= 0.000 [m] zs= 0.000 [m]

| | I: | R=dist.borde [m] | W=I/R [m3] | W/Ax [m] |
|---|---|---|---|---|
| izq. | Iz | -3.500 | -8.167 | 1.167 |
| dch. | Iz | 3.500 | 8.167 | -1.167 |
| abajo | Iy | -0.500 | -1.167 | 0.167 |
| arriba | Iy | 0.500 | 1.167 | -0.167 |

Armadura: "B1"

| Nº | Nom.mat | Cod.dim. | Area [cm2] | y1 [cm] | z1 [cm] | y2 [cm] | z2 [cm] |
|---|---|---|---|---|---|---|---|
| 1 | AEH500 | (2) | 144.51 | -345.00 | -45.00 | 345.00 | -45.00 |
| 2 | AEH500 | (2) | 144.51 | -345.00 | 45.00 | 345.00 | 45.00 |
| | Total: | | 289.03 | Cuantía de armadura: 0.413 [o/o] | | | |

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

¡No se han definido valores para el cálculo a cortante!

Características del material:

| Nom.Mat. | Módulo E [ kp/cm2] | 0.85*fcd,fyd [ kp/cm2] | eps-fc [o/oo] | fct [ kp/cm2] | fcv [ kp/cm2] | fcw,mín [ kp/cm2] |
|---|---|---|---|---|---|---|
| "H300" | 330000.0 | -170.000 | -2.000 | 0.0 | 7.070 | 300.000 |
| "AEH500" | 2.10E+06 | 4434.700 | | | | |

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Pila ''P1ELU'
**********

Título : 'PILA 1. E-1520.4. E.L.U.'
Altura de la pila : 10.600 [m]
Long. max. de barra: Altura pila / 6

NUDOS x Apoyo

| Nu | [m] | d-xyz | r-xyz |
|---|---|---|---|
| 2 | 10.600 | | |
| 1 | 0.000 | BBB | BBB |

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

| Ba | Nu | Sección | Tipo | Exc: ey [m] | ez [m] | Arm: Zona | fac |
|---|---|---|---|---|---|---|---|
| 1 | 2-1 | 'PILAINF' | SecFAGUS | | | 1 | 1.000 |

CARGAS :

| Nu/Ba | Tipo Car. | Dim. | Valor Val.arriba | Valor Val.abajo | ey[m] | ez[m] |
|---|---|---|---|---|---|---|
| Comp. Carga G1 : | | | | | | |
| Nudo 2 | Fuerza | x [kN] | -9182.295 | | | |
| | Fuerza | z [kN] | 304.740 | | | |
| | Momento | y [kNm] | 119.100 | | | |
| | Momento | z [kNm] | 3559.635 | | | |
| Barra 1 | Fuerza | x [kN/m] | -262.500 | | | |
| Comp. Carga Q1 : | | | | | | |
| Nudo 2 | Fuerza | x [kN] | -2675.070 | | | |
| | Fuerza | y [kN] | 522.645 | | | |
| | Fuerza | z [kN] | 111.255 | | | |
| | Momento | y [kNm] | 413.700 | | | |
| | Momento | z [kNm] | 2279.385 | | | |



D I M E N S I O N A M I E N T O (global) <B.P1ELU.1>

PARAMETROS DE CALCULO:
Norma..... EH
Criterio de rotura..... Agotamiento de secciones o del sistema
Rotura de secciones..... Limitación de deformaciones según FAGUS-2
- Hormigón (def. centrada).... -2.000 [o/oo]
- Hormigón (flexión)..... -3.500 [o/oo]
- Acero ..... 10.00 [o/oo]
Coef. min. resist. (gamma_r)... 1.000
Coeficiente de fluencia..... 2.500
Carga contribuyente a fluencia. 1.000 * Carga permanente G1
No de elementos ..... 6
Tolerancia desequi. fuerzas.... 0.144 [kN]
Tolerancia desequi. momentos... 0.114 [kNm]
Mayoración de cargas..... 1.000 * Carga permanente G1
+ 1.000 * Carga variable Q1

RESULTADOS DEL CALCULO NO LINEAL:
La aramdura mínima (o existente) es suficiente.

DATOS DE LA SECCION

| Nombre | Ancho dy [m] | Canto dz [m] | Materiales Horm. | / Acero | Distrib. de la armadura | Armadura fija[cm²] |
|---|---|---|---|---|---|---|
| PILAINF | 7.000 | 1.000 | H300 | AEH500 | B1 | 0.000 |

DEFORMACIONES sin deformaciones accidentales

| | DX [mm] | DY [mm] | DZ [mm] | RX [o/oo] | RY [o/oo] | RZ [o/oo] |
|---|---|---|---|---|---|---|
| Mínima | -3.12 | 0.00 | 0.00 | -6.183E-4 | -5.099 | 0.000 |
| Máxima | 0.00 | 2.22 | 37.71 | 4.765E-3 | 0.000 | 0.379 |

ESFUERZOS (global)

| | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| Mínima | -14407.63 | -522.60 | -416.00 | -18.79 | -532.80 | 5839.00 |
| Máxima | -12088.88 | -522.60 | -416.00 | -0.00 | 4364.47 | 11407.02 |

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

| | sigHorm. [N/mm²] | sigAcero [N/mm²] | epsHorm. [o/oo] | epsAcero [o/oo] | EIy [kNm²] | EIz [kNm²] |
|---|---|---|---|---|---|---|
| Mínima | -6.3 | -203.0 | -0.412 | -0.966 | 2.869E+6 | 2.143E+8 |
| Máxima | 0.0 | 79.3 | 0.230 | 0.378 | 7.744E+6 | 2.594E+8 |

DIMENSIONAMIENTO SEGUN TEORIA DE 2ª ORDEN

| Zona | Coord-x [m] | Nombre de la sección | Armadura [cm²] | [o/o] | Agotamiento [o/o] |
|---|---|---|---|---|---|
| 1 | 10.60 | PILAINF | 289.0 | 0.41 | 11 |
| | 8.833 | PILAINF | 289.0 | 0.41 | 12 |
| | 7.067 | PILAINF | 289.0 | 0.41 | 14 |
| | 5.300 | PILAINF | 289.0 | 0.41 | 16 |
| | 3.533 | PILAINF | 289.0 | 0.41 | 19 |
| | 1.767 | PILAINF | 289.0 | 0.41 | 23 |
| | 0.000 | PILAINF | 289.0 | 0.41 | 26 |

(≤) : Armadura ≤ $\mu$_min = 0.40%
(≥) : Armadura ≥ $\mu$_max = 8.00%

ESFUERZOS (global)
<B.P1ELU.1> Carga: 1.00*G1 1.00*Q1

| Coord-x | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| 10.600 | -12088.88 | -522.60 | -416.00 | 0.00 | -532.80 | 5839.00 |
| 8.833 | -12088.88 | -522.60 | -416.00 | -4.46 | 311.20 | 6769.81 |
| 8.833 | -12552.63 | -522.60 | -416.00 | -4.46 | 311.20 | 6769.81 |
| 7.067 | -12552.63 | -522.60 | -416.00 | -8.77 | 1155.14 | 7699.76 |
| 7.067 | -13016.38 | -522.60 | -416.00 | -8.77 | 1155.14 | 7699.76 |
| 5.300 | -13016.38 | -522.60 | -416.00 | -12.66 | 1991.50 | 8628.70 |
| 5.300 | -13480.13 | -522.60 | -416.00 | -12.66 | 1991.50 | 8628.70 |
| 3.533 | -13480.13 | -522.60 | -416.00 | -15.84 | 2811.88 | 9556.43 |
| 3.533 | -13943.88 | -522.60 | -416.00 | -15.84 | 2811.88 | 9556.43 |
| 1.767 | -13943.88 | -522.60 | -416.00 | -17.99 | 3606.64 | 10482.66 |
| 1.767 | -14407.63 | -522.60 | -416.00 | -17.99 | 3606.64 | 10482.66 |
| 0.000 | -14407.63 | -522.60 | -416.00 | -18.79 | 4364.47 | 11407.02 |

Pila ''P1ELS'
**********

Título : 'PILA 1. E-1520.4. E.L.S.'
Altura de la pila : 10.600 [m]
Long. max. de barra: Altura pila / 6

| NUDOS Nu | x [m] | Apoyo d-xyz | Apoyo r-xyz |
|---|---|---|---|
| 2 | 10.600 | | |
| 1 | 0.000 | BBB | BBB |

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

| Ba | Nu | Sección | Tipo | Exc: ey [m] | ez [m] | Arm: Zona | fac |
|---|---|---|---|---|---|---|---|
| 1 | 2-1 | 'PILAINF' | SecFAGUS | | | 1 | 1.000 |

CARGAS :

| Nu/Ba | Tipo Car. | Dim. | Valor Val.arriba | Valor Val.abajo | ey[m] | ez[m] |
|---|---|---|---|---|---|---|
| Comp. Carga G1 : | | | | | | |
| Nudo 2 | Fuerza | x [kN] | -6121.530 | | | |
| | Fuerza | z [kN] | 203.160 | | | |
| | Momento | y [kNm] | 79.400 | | | |
| | Momento | z [kNm] | 2373.090 | | | |
| Barra 1 | Fuerza | x [kN/m] | -175.000 | | | |
| Comp. Carga Q1 : | | | | | | |
| Nudo 2 | Fuerza | x [kN] | -1783.380 | | | |
| | Fuerza | y [kN] | 348.430 | | | |
| | Fuerza | z [kN] | 74.170 | | | |
| | Momento | y [kNm] | 275.800 | | | |
| | Momento | z [kNm] | 1519.590 | | | |



D I M E N S I O N A M I E N T O (global) <B.P1ELS.1>

PARAMETROS DE CALCULO:

| | |
|---|---|
| Norma | EH |
| Criterio de rotura | Agotamiento de secciones o del sistema |
| Rotura de secciones | Limitación de deformaciones según FAGUS-2 |
| - Hormigón (def. centrada) | -2.000 [o/oo] |
| - Hormigón (flexión) | -3.500 [o/oo] |
| - Acero | 10.00 [o/oo] |
| Coef. min. resist. (gamma_r) | 1.000 |
| Coeficiente de fluencia | 2.500 |
| Carga contribuyente a fluencia. | 1.000 * Carga permanente G1 |
| No de elementos | 6 |
| Tolerancia desequi. fuerzas | 0.096 [kN] |
| Tolerancia desequi. momentos | 0.076 [kNm] |
| Mayoración de cargas | 1.000 * Carga permanente G1 |
| | + 1.000 * Carga variable Q1 |

RESULTADOS DEL CALCULO NO LINEAL:
La aramdura mínima (o existente) es suficiente.

DATOS DE LA SECCION

| Nombre | Ancho dy [m] | Canto dz [m] | Materiales Horm. / Acero | | Distrib. de la armadura | Armadura fija[cm²] |
|---|---|---|---|---|---|---|
| PILAINF | 7.000 | 1.000 | H300 | AEH500 | B1 | 0.000 |

DEFORMACIONES sin deformaciones accidentales

| | DX [mm] | DY [mm] | DZ [mm] | RX [o/oo] | RY [o/oo] | RZ [o/oo] |
|---|---|---|---|---|---|---|
| Mínima | -2.05 | 0.00 | 0.00 | -2.428E-4 | -3.165 | 0.000 |
| Máxima | 0.00 | 1.43 | 23.44 | 1.937E-3 | 0.000 | 0.245 |

ESFUERZOS (global)

| | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| Mínima | -9605.43 | -348.44 | -277.38 | -7.77 | -355.21 | 3892.97 |
| Máxima | -8059.58 | -348.41 | -277.37 | -0.00 | 2786.97 | 7598.24 |

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

| | sigHorm. [N/mm²] | sigAcero [N/mm²] | epsHorm. [o/oo] | epsAcero [o/oo] | EIy [kNm²] | EIz [kNm²] |
|---|---|---|---|---|---|---|
| Mínima | -4.1 | -129.6 | -0.260 | -0.617 | 2.724E+6 | 2.168E+8 |
| Máxima | 0.0 | 46.7 | 0.137 | 0.222 | 7.838E+6 | 2.645E+8 |

DIMENSIONAMIENTO SEGUN TEORIA DE 2ª ORDEN

| Zona | Coord-x [m] | Nombre de la sección | Armadura [cm²] | [o/o] | Agotamiento [o/o] |
|---|---|---|---|---|---|
| 1 | 10.60 | PILAINF | 289.0 | 0.41 | 8 |
| | 8.833 | PILAINF | 289.0 | 0.41 | 8 |
| | 7.067 | PILAINF | 289.0 | 0.41 | 9 |
| | 5.300 | PILAINF | 289.0 | 0.41 | 11 |
| | 3.533 | PILAINF | 289.0 | 0.41 | 13 |
| | 1.767 | PILAINF | 289.0 | 0.41 | 15 |
| | 0.000 | PILAINF | 289.0 | 0.41 | 17 |

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

ESFUERZOS (global)
<B.P1ELS.1> Carga: 1.00*G1 1.00*Q1

| Coord-x | N [kN] | Vy [kN] | Vz [kN] | Mx [kNm] | My [kNm] | Mz [kNm] |
|---|---|---|---|---|---|---|
| 10.600 | -8059.58 | -348.44 | -277.38 | -0.00 | -355.21 | 3892.97 |
| 8.833 | -8059.58 | -348.44 | -277.38 | -1.84 | 180.00 | 4511.80 |
| 8.833 | -8368.75 | -348.44 | -277.38 | -1.84 | 179.99 | 4511.73 |
| 7.067 | -8368.75 | -348.44 | -277.38 | -3.63 | 715.20 | 5130.19 |
| 7.067 | -8677.92 | -348.44 | -277.38 | -3.63 | 715.19 | 5130.12 |
| 5.300 | -8677.92 | -348.44 | -277.38 | -5.24 | 1247.26 | 5748.13 |
| 5.300 | -8987.08 | -348.43 | -277.38 | -5.24 | 1247.25 | 5748.07 |
| 3.533 | -8987.08 | -348.43 | -277.38 | -6.55 | 1772.68 | 6365.53 |
| 3.533 | -9296.25 | -348.42 | -277.37 | -6.55 | 1772.67 | 6365.49 |
| 1.767 | -9296.25 | -348.42 | -277.37 | -7.44 | 2287.48 | 6982.29 |
| 1.767 | -9605.43 | -348.41 | -277.37 | -7.44 | 2287.47 | 6982.26 |
| 0.000 | -9605.43 | -348.41 | -277.37 | -7.77 | 2786.97 | 7598.24 |

CimpiZ1520-4.xls Cimen-P1

| Cálculo de Cimentacion de Pilas | PILA Nº 1 |
|---|---|
| PROYECTO : | L.A.V. MADRID - ZARAGOZA. Subtramo XV. |
| ESTRUCTURA: | E-1520.4 |

**CARACTERISTICAS DEL TERRENO**

| | | |
|---|---|---|
| Tensión media admisible = | 3.0 | Kp/cm² |
| Coeficiente de rozamiento zapata-terreno = | 0.58 | |

**DIMENSIONES GEOMETRICAS (en metros)**

| | | |
|---|---|---|
| Medida fuste segun Y = | 8.00 | |
| Medida fuste según Z = | 1.00 | |
| Medida zapata según Y = | 9.50 | Vale . Zapata tipo I |
| Medida zapata según Z = | 4.50 | Vale . Zapata tipo I |
| Canto zapata = | 1.20 | |

**ACCIONES SOBRE CARA SUPERIOR ZAPATA EN E.L.U. SERVICIO (signos del FAGUS)**

| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. |
|---|---|---|---|---|---|---|
| 1 | -960.54 | 34.84 | 27.74 | 278.70 | 759.82 | 1.00 |

**ACCIONES SOBRE CARA SUPERIOR ZAPATA EN ESTADO LIMITE ULTIMO (signos del FAGUS)**

| Hipótesis | FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) | Coef. PP. |
|---|---|---|---|---|---|---|
| 1 | -1440.76 | 52.26 | 41.60 | 436.45 | 1140.70 | 1.50 |

**RESULTADOS**

**ACCIONES EN BASE DE ZAPATA SIN MAYORAR**

| FX (Ton) | FY (Ton) | FZ (Ton) | MY (mT) | MZ (mT) |
|---|---|---|---|---|
| -1088.79 | 34.84 | 27.74 | 245.41 | 718.01 |

**COMPROBACION TENSIONES SOBRE EL TERRENO**

| eY (m) | eZ (m) | Z (m) | Y (m) | σcob (Kp/cm²) | |
|---|---|---|---|---|---|
| 0.66 | -0.23 | 4.05 | 8.18 | 3 | Vale |

**COMPROBACION ESTABILIDAD (con esfuerzos E.L.U. + peso zapata)**

- Al deslizamiento

| FYdesl.(Ton) | FZdesl.(Ton) | TOTALdesl. | TOTALres. | COEFICIENTE | |
|---|---|---|---|---|---|
| 52.26 | 41.60 | 66.80 | 947.22 | 14.18 | Vale |

- Al vuelco

| MYvolc.(mT) | MZvolc.(mT) | MYres.(mT) | MZres.(mT) | COEF. Y | COEF. X | |
|---|---|---|---|---|---|---|
| 386.53 | 1077.99 | 3674.56 | 7757.41 | 9.51 | 7.20 | Vale |

**ACCIONES EN BASE DE ZAPATA MAYORADAS (si el peso propio de la zapata)**

| FX (Ton) | MY (mT) | MZ (mT) | eY (m) | eZ (m) | Z (m) | Y (m) | σ calc. (T/m²) |
|---|---|---|---|---|---|---|---|
| -1440.76 | 386.53 | 1077.99 | 0.75 | 0.27 | 3.96 | 8.00 | 45.42 |

**CALCULO DE SECCIONES (con esfuerzos de diseño)**

| Calculo armadura flexión en Z | | Calculo armadura flexión en Y | | Calculo armadura cortante Y | | |
|---|---|---|---|---|---|---|
| MYd (mT/m) | Canto (m) | MZd (mT/m) | Canto (m) | VYXd (T) | Canto (m) | Ancho (m) |
| 81.98 | 1.20 | 86.35 | 1.18 | 35.77 | 0.31 | 2.15 |

| Calculo armadura cortante Z | | |
|---|---|---|
| VZXd (T) | Canto (m) | Ancho (m) |
| 506.99 | 1.20 | 9.15 |

- Armadura resultante.

| AsY inf. (cm²/m) | | AsZ inf. (cm²/m) | | AsYXcte.(cm²) | | AsZXcte.(cm²) | |
|---|---|---|---|---|---|---|---|
| 17.98 | Vale | 16.66 | Vale | 0.00 | Vale | 0.00 | Vale |

**VALORES MAXIMOS**

| AsYinf.(cm²/m) | AsYsup.(cm²/m) | AsZinf.(cm²/m) | AsZsup.(cm²/m) | AsYXcte.(cm²) | AsZXcte.(cm²) | As piel(cm²) |
|---|---|---|---|---|---|---|
| 17.98 | 0.00 | 16.66 | 0.00 | 0.00 | 0.00 | 0.00 |

**ARMADURAS MINIMAS**

| AsYinf.(cm²/m) | AsYsup.(cm²/m) | AsZinf.(cm²/m) | AsZsup.(cm²/m) | AsYXcte.(cm²) | AsZXcte.(cm²) | As piel(cm²) |
|---|---|---|---|---|---|---|
| 6.85 | 6.85 | 7.71 | 7.71 | 0.00 | 0.00 | 9.25 |

**TOTAL ARMADURAS**

| AsYinf.(cm²/m) | AsYsup.(cm²/m) | AsZinf.(cm²/m) | AsZsup.(cm²/m) | AsYXcte.(cm²) | AsZXcte.(cm²) | As piel(cm²) |
|---|---|---|---|---|---|---|
| 17.98 | 6.85 | 16.66 | 7.71 | 0.00 | 0.00 | 9.25 |

# PASO SUPERIOR E-1520.4

## 4º CALCULO DE ESTRIBOS

# CALCULO ESTRIBOS CERRADOS

| | |
|---|---|
| **NOMBRE PROYECTO :** | L.A.V. MADRID - ZARAGOZA. Subtramo XV. |
| **NOMBRE OBRA :** | E-1520.4. Estribo 2. |

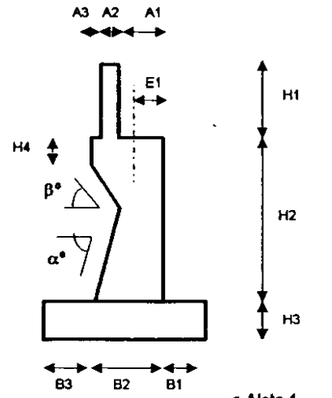
**DATOS REQUERIDOS:**

## GESTION FICHEROS

| | |
|---|---|
| Directorio fichero generación modelo (.GEO) : | G:\MAZAXV\E-1520.4\ESTRIBOS |
| Directorio fichero listados (.LIS) : | G:\MAZAXV\E-1520.4\ESTRIBOS\COSMOS |

## MURO FRONTAL

| | | |
|---|---|---|
| H1. Altura murete (m) : | 2.011 | |
| H2. Altura muro frontal (m) : | 5.29 | |
| H3. Canto zapata (m) : | 1.20 | |
| Altura tierras en trasdós (superior zapata)(m) : | 7.30 | |
| B1. Puntera zapata (m) : | 1.25 | Zapata tipo I |
| B2. Canto muro en base (m) : | 1.30 | |
| B3. Talón zapata (m) : | 3.50 | Zapata tipo III |
| A1 (m) : | 0.95 | |
| A2. Canto murete de guarda (m) : | 0.35 | |
| A3. Vuelo ménsula apoyo losa transición (m) : | 0.00 | |
| H4. Canto min. apoyo losa transición (m) : | 0.30 | |
| α . Angulo trasdós muro (°) : | 90.00 | |
| β . Angulo inferior apoyo losa transición (°) : | 45.00 | |
| E1. Distancia apoyo tablero (m) : | 0.50 | |
| Longitud (m) : | 9.11 | |

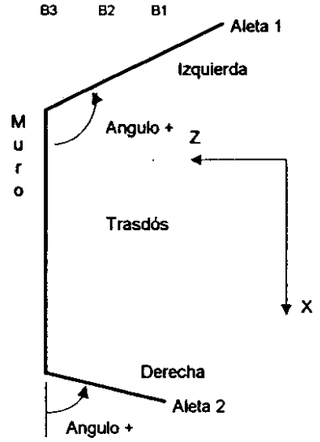



## MUROS EN VUELTA (intradós vertical)

| | Izquierdo (1) | Derecho (2) |
|---|---|---|
| Longitud (m) : | 4.50 | 4.50 |
| Canto en base (m) : | 1.20 | 1.20 |
| Canto coronación (m) : | 0.35 | 0.35 |
| Angulo ( ° ) : | 100.00 | 100.00 |

## ALETAS

| | Izquierda (1) | Derecha (2) |
|---|---|---|
| Canto aleta en empotramiento (m) : | 2.17 | 2.17 |
| Canto aleta en extremo (m) : | 0.50 | 0.50 |
| Longitud aleta (m) : | 2.50 | 2.50 |
| Espesor aleta (m) : | 0.35 | 0.35 |




## CARACTERISTICAS DE TERRENO

| | |
|---|---|
| Peso específico (T/m³) : | 2.00 |
| Angulo rozamiento interno (°) : | 30.00 |
| Coeficiente rozamiento zapata-terreno : | 0.58 |
| Angulo. rozamiento tierras muro (°) : | 0.00 |
| Tension admisible (T / m²) : | 30.00 |

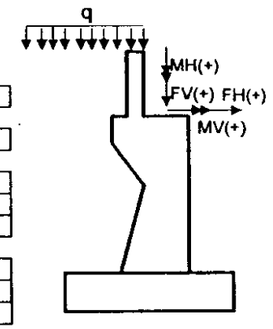
## CARACTERISTICAS DE LOS MATERIALES

| | |
|---|---|
| Peso especifico hormigón (T / m³) : | 2.50 |
| Límite elástico acero (T / m²) : | 51000.00 |
| Resistencia hormigón. cimientos (T / m²) : | 2500.00 |
| Resistencia hormigón. alzado (T / m²) : | 2500.00 |
| Mod. Elasticidad Hormigón alzado (T / m² ) : | 3000000 |



## CARGAS SOBRE EL ESTRIBO (Carga total sobre el estribo sin mayorar)

| | |
|---|---|
| q (Sobrecarga de tráfico (T / m²) : | 1.00 |
| Peso barrera en muros en vuelta y aletas (T / m) : | 1.00 |




| | FV (T) | MV (mT) | FH (T) | MH (mT) |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio y carga muerta tablero : | 279.00 | | --- | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero : | 0.00 | | --- | --- |
| Retracción y fluencia tablero : | --- | --- | 19.444 | |
| Asientos estructura : | 0.00 | | --- | --- |
| **Acciones Variables (Q)** | | | | |
| Sobrecarga de uso máxima tablero : | 115.00 | | 4.00 | |
| Sobrecarga de uso mínima tablero : | 0.00 | | 0.00 | |
| Efectos térmicos tablero : | 0.00 | | 0.00 | |

## COEFICIENTES DE SEGURIDAD

| | | |
|---|---|---|
| Seguridad al deslizamiento | Csd= | 1.50 |
| Seguridad al vuelco | Csv= | 1.80 |
| Minoracion acero | γs= | 1.15 |
| Minoracion hormigon | γc= | 1.50 |

| | Estado Límite Ultimo | |
|---|---|---|
| | Favorable | Desfavorable |
| **Acciones permanentes (G)** | | |
| Peso propio, cargas muertas : | 0.90 | 1.50 |
| **Acciones permanentes de valor no constante (G*)** | | |
| Pretensado : | 0.00 | 1.00 |
| Reológicas (retracción y fluencia) : | 0.00 | 1.50 |
| Terreno (pesopropio, empujes y asientos) : | 0.00 | 1.50 |
| **Acciones variables (Q)** | | |
| Sobrecargas, viento, temperatura : | 0.00 | 1.50 |

| | | |
|---|---|---|
| Ψo (coeficiente valor de combinación variables) : | 1.00 | (poner 1 según antigua instrucción) |

## DATOS VARIOS

| | | |
|---|---|---|
| Número de apoyos : | 5.00 | |
| Separación apoyos (m) : | 1.725 | |
| Recubrimiento armadura (m) : | 0.05 | |
| Distancia sección 1-1 (a superior zapata) (m) : | 2.10 | Vale |
| Tamaño medio elementos mallado (m) : | 1.00 | |

## RESUMEN ACCIONES SOBRE EL ESTRIBO

| | | F.vertical (T / m) | X (m) | F. Horizontal (T / m) | Y (m) |
|---|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | | |
| Peso propio estribo | Base murete (ΣV i, i=1..1) | 1.760 | 2.375 | --- | --- |
| | Sección 1 (ΣV' i, i=1..6) | 10.661 | 1.978 | --- | --- |
| | Base muro (ΣV i, i=1..5) | 18.949 | 1.944 | --- | --- |
| | Inf. cimentación (ΣV i, i=1..6) | 37.099 | 2.473 | --- | --- |
| Carga permanente tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 30.626 | 1.750 | --- | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | | |
| Pretensado tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 1.750 | --- | --- |
| Retracción y fluencia tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | --- | --- | 2.134 | 6.489 |
| Tierras | Base murete (ΣE i, i=1..1) | 0.000 | 2.550 | 1.348 | 7.159 |
| | Sección 1 (ΣE' i, i=1..4) | 0.000 | 2.550 | 7.521 | 5.333 |
| | Base muro (ΣE i, i=1..3) | 0.000 | 2.550 | 17.763 | 3.633 |
| | Inf. cimentación (ΣE i+Pt j, i=1..4, j=1..6) | 51.100 | 4.300 | 24.083 | 2.833 |
| Asientos estructura | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 1.750 | --- | --- |
| **Acciones variables (Q)** | | | | | |
| Sobrecarga de tráfico | Base murete (ΣEsc i, i=1..1) | 0.000 | 2.550 | 0.670 | 7.495 |
| | Sección 1 (ΣEsc' i, i=1..4) | 0.000 | 2.550 | 1.583 | 6.125 |
| | Base muro (ΣEsc i, i=1..3) | 0.000 | 2.550 | 2.433 | 4.850 |
| | Inf. cimentación (ΣEsc i + Psc, i=1..4) | 3.850 | 4.125 | 2.833 | 4.250 |
| Efectos térmicos tablero | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 1.750 | 0.000 | 6.489 |
| Sobrecarga de uso tablero máxima | Base murete | --- | --- | --- | --- |
| | Resto secciones | 12.623 | 1.750 | 0.439 | 6.489 |
| Sobrecarga de uso tablero mínima | Base murete | --- | --- | --- | --- |
| | Resto secciones | 0.000 | 1.750 | 0.000 | 6.489 |

## COMPROBACIONES

### SEGURIDAD AL DESLIZAMIENTO (Planteamiento clásico)

$$C_{SD} = \frac{\sum_i \text{Fuerzas} - \text{opuestas}}{\sum_i \text{Fuerzas} - \text{deslizantes}}$$

| | Fuerzas en construcción (T / m) Opuestas | Deslizantes | Fuerzas en servicio (T / m) Opuestas | Deslizantes |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 21.517 | --- | 21.517 | --- |
| Carga permanente tablero | --- | --- | 17.763 | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 0.000 | --- |
| Retracción y fluencia tablero | --- | --- | --- | 2.134 |
| Tierras | 29.638 | 24.083 | 29.638 | 24.083 |
| Asientos estructura | --- | --- | 0.000 | --- |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 2.233 | 2.833 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | --- | --- |
| Sobrecarga de uso tablero mínima | --- | --- | 0.000 | 0.000 |
| **TOTAL** | **51.155** | **24.083** | **71.151** | **29.051** |
| **Csd=** | **2.1** | VALE | **2.4** | VALE |

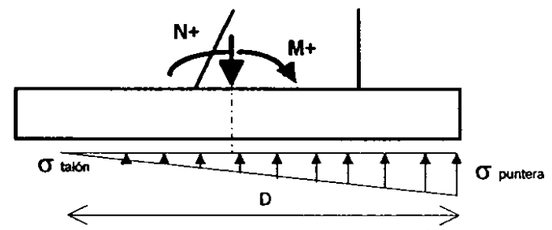


### SEGURIDAD AL VUELCO (Planteamiento clásico)

$$C_{SV} = \frac{\sum_i \text{Momentos} - \text{estabilizadores}}{\sum_i \text{Momentos} - \text{volcadores}}$$

| | Momentos construcción (mT / m) Estabilizadores | Volcadores | Momentos servicio (mT / m) Estabilizadores | Volcadores |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 91.742 | --- | 91.742 | --- |
| Carga permanente tablero | --- | --- | 53.595 | --- |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 0.000 | --- |
| Retracción y fluencia tablero | --- | --- | --- | 13.850 |
| Tierras | 219.730 | 68.236 | 219.730 | 68.236 |
| Asientos estructura | --- | --- | 0.000 | --- |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 0.000 | 0.000 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | --- | --- |
| Sobrecarga de uso tablero mínima | --- | --- | 0.000 | 0.000 |
| **TOTAL** | **311.472** | **68.236** | **365.067** | **82.086** |
| **Csv=** | **4.6** | VALE | **4.4** | VALE |

### TENSIONES MAXIMAS Y MINIMAS EN CIMENTACION




| | Construcción N (T / m) | M (mT / m) | Servicio N (T / m) | M (mT / m) |
|---|---|---|---|---|
| **Acciones permanentes (G)** | | | | |
| Peso propio estribo | 37.099 | 20.482 | 37.099 | 20.482 |
| Carga permanente tablero | --- | --- | 30.626 | 39.048 |
| **Acciones permanentes de valor no constante (G*)** | | | | |
| Pretensado tablero | --- | --- | 0.000 | 0.000 |
| Retracción y fluencia tablero | --- | --- | 0.000 | 13.850 |
| Tierras | 51.100 | 3.084 | 51.100 | 3.084 |
| Asientos estructura | --- | --- | 0.000 | 0.000 |
| **Acciones variables (Q)** | | | | |
| Sobrecarga de tráfico | --- | --- | 3.850 | 7.807 |
| Efectos térmicos tablero | --- | --- | 0.000 | 0.000 |
| Sobrecarga de uso tablero máxima | --- | --- | 12.623 | 18.944 |
| Sobrecarga de uso tablero mínima | --- | --- | --- | --- |
| **TOTAL** | **88.199** | **23.565** | **135.298** | **103.214** |
| **D =** | **6.05 (m)** | | **6.05 (m)** | |
| **σ puntera=** | **18.44 (T / m²)** | | **39.28 (T / m²)** | |
| **σ talón=** | **10.72 (T / m²)** | | **5.44 (T / m²)** | |
| **σmed=** | **14.58 (T / m²)** | | **22.36 (T / m²)** | |
| **σcob=** | **16 (T / m²) VALE** | | **29.9 (T / m²) VALE** | |

**CALCULO DE ARMADURAS**

| Elemento | Sección | | |
|---|---|---|---|
| | Designacion | Ancho (b)(m) | Canto (h)(m) |
| MURO | 0-0 | 1.00 | 1.30 |
| | 1-1 | 1.00 | 1.30 |
| MURETE | 4-4 | 1.00 | 0.35 |
| PUNTERA | 2-2 (+) | 1.00 | 1.20 |
| | 2-2 (-) | 1.00 | 1.20 |
| TALÓN | 3-3 (+) | 1.00 | 1.20 |
| | 3-3 (-) | 1.00 | 1.20 |

| Elemento | Sección | Armadura de flexión | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Nd (T) | Md (mT) | As (cm²/m) | Control cálculo | |
| MURO | 0-0 | 1.00 | 1.30 | 63.55 | 104.80 | 26.543 | Vale | Dominio 2. |
| | 1-1 | 1.00 | 1.30 | 57.41 | 48.73 | 15.530 | Vale | Dominio 2. |
| MURETE | 4-4 | 1.00 | 0.35 | 1.58 | 2.37 | 2.001 | Vale | Dominio 2. |
| PUNTERA | 2-2 (+) | 1.00 | 1.20 | --- | 52.60 | 10.463 | Vale | --- |
| | 2-2 (-) | 1.00 | 1.20 | --- | 15.41 | 3.034 | Vale | --- |
| TALÓN | 3-3 (+) | 1.00 | 1.20 | --- | -46.60 | 9.255 | Vale | --- |
| | 3-3 (-) | 1.00 | 1.20 | --- | -59.87 | 11.933 | Vale | --- |

| Elemento | Sección | Armadura de cortante | | | | |
|---|---|---|---|---|---|---|
| | Designacion | b cálculo(m) | h cálculo (m) | Vd (T) | As (cm²/m²) | Control cálculo |
| MURO | 0-0 | 1.00 | 1.30 | 34.16 | 0.00 | Vale. As min = 7.94 |
| | 1-1 | 1.00 | 1.30 | 19.98 | 0.00 | Vale. As min = 7.94 |
| MURETE | 4-4 | 1.00 | 0.35 | 3.03 | 0.00 | Vale. As min = 7.94 |
| PUNTERA | 2-2 (+) | 1.00 | 1.06 | 34.82 | 0.00 | Vale. As min = 0.00 |
| | 2-2 (-) | 1.00 | 1.06 | 10.24 | 0.00 | Vale. As min = 0.00 |
| TALÓN | 3-3 (+) | 1.00 | 1.20 | 10.76 | 0.00 | Vale. As min = 7.94 |
| | 3-3 (-) | 1.00 | 1.20 | -26.40 | 0.00 | Vale. As min = 7.94 |

| Designacion armaduras | Sección Designacion | Armadura de cálculo(cm²/m) | | |
|---|---|---|---|---|
| | | Necesaria | Minima | **Adoptada** |
| Vert. trasdos | 0-0 | 26.5 | 7.8 | **26.5** |
| Vert. trasdos | 1-1 | 15.5 | 7.8 | **15.5** |
| Vert. trasdos | 4-4 | 2.0 | 2.0 | **2.0** |
| Vert. intrados | 0-0 1-1 | 0.0 | 3.9 | **3.9** |
| Vert. intrados | 4-4 | 0.0 | 1.1 | **1.1** |
| Hor. trasdos | 0-0 1-1 | 5.3 | 10.4 | **10.4** |
| Hor. trasdos | 4-4 | 0.4 | 2.8 | **2.8** |
| Hor, intrados | 0-0 1-1 | 0.0 | 10.4 | **10.4** |
| Hor, intrados | 4-4 | 0.0 | 2.8 | **2.8** |
| Cortante alzado | 0-0 1-1 | 0.0 | 7.9 | **7.9** |
| Cortante muret | 4-4 | 0.0 | 7.9 | **7.9** |
| As inf L. | 2-2 3-3 | 2.1 | 8.1 | **8.1** |
| As inf T. | 2-2 3-3 | 10.5 | 8.1 | **10.5** |
| As sup L. | 2-2 3-3 | 2.4 | 9.3 | **9.3** |
| As sup T. | 2-2 3-3 | 11.9 | 9.3 | **11.9** |
| Cortante cim | 2-2 3-3 | 0.0 | 7.9 | **7.9** |

NOTA: las armaduras longitudinales en talón y puntera y horizontales de muro que aparecen en las casillas de armadura "necesaria" han sido obtenidas multiplicando la armadura transversal o vertical por el coeficiente de poisson.

# CALCULO DE ARMADURAS EN ESTRIBOS (modelo 3-D)

**Proyecto :** L.A.V. MADRID - ZARAGOZA. Subtramo XV.
**Nombre obra :** E-1520.4. Estribo 2.

——>(ver espacio a la derecha para pasar a FAGUS2 )

| | |
|---|---|
| Directorio del grupo: | G:\MAZAXV\FAGUS |
| Nombre obra: | E-1520-4 |

## CALCULO ARMADURAS VERTICALES

| ZONA | FAJA | Elemento Nº | Ny,d ( T/m ) | My,d ( mT/m ) | Vy,d ( T/m ) | Canto elemento (m.) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BORDE | 1 | 46.05 | -35.69 | 29.45 | 1.14 | 0.00 | Vale | 12.86 | 1.00 |
| | | 6 | 28.63 | -17.27 | 20.24 | 1.02 | 0.00 | Vale | 7.43 | 1.00 |
| | | 11 | 14.28 | -8.43 | 14.04 | 0.89 | 0.00 | Vale | 3.96 | 1.00 |
| | | 16 | 3.23 | -4.30 | 9.74 | 0.77 | 0.00 | Vale | 1.74 | 1.00 |
| | | 21 | -4.37 | -2.12 | 6.94 | 0.65 | 0.00 | Vale | 1.00 | 1.00 |
| MURO IZQUIERDO | BASE | 1 | 46.05 | -35.69 | 29.45 | 1.14 | 0.00 | Vale | 12.86 | 1.00 |
| | | 2 | 15.38 | -29.95 | 20.97 | 1.14 | 0.00 | Vale | 8.10 | 1.00 |
| | | 3 | -2.42 | -21.70 | 14.27 | 1.14 | 0.00 | Vale | 4.30 | 1.00 |
| | | 4 | -19.16 | -13.99 | 7.65 | 1.14 | 0.00 | Vale | 1.00 | 1.00 |
| | | 5 | -46.26 | -8.91 | 2.00 | 1.14 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BORDE | 103 | 31.13 | -33.72 | 29.53 | 1.14 | 0.00 | Vale | 10.72 | 1.00 |
| | | 108 | 18.49 | -15.93 | 20.02 | 1.02 | 0.00 | Vale | 5.93 | 1.00 |
| | | 113 | 8.04 | -7.72 | 13.78 | 0.89 | 0.00 | Vale | 3.03 | 1.00 |
| | | 118 | -0.05 | -4.02 | 9.56 | 0.77 | 0.00 | Vale | 1.26 | 1.00 |
| | | 123 | -5.72 | -2.05 | 6.84 | 0.65 | 0.00 | Vale | 1.00 | 1.00 |
| MURO DERECHO | BASE | 99 | -32.74 | -5.12 | -1.34 | 1.14 | 0.00 | Vale | 1.00 | 1.00 |
| | | 100 | -14.52 | -10.64 | 5.33 | 1.14 | 0.00 | Vale | 1.00 | 1.00 |
| | | 101 | -3.38 | -18.84 | 12.81 | 1.14 | 0.00 | Vale | 3.58 | 1.00 |
| | | 102 | 8.94 | -27.62 | 20.13 | 1.14 | 0.00 | Vale | 6.87 | 1.00 |
| | | 103 | 31.13 | -33.72 | 29.53 | 1.14 | 0.00 | Vale | 10.72 | 1.00 |

## CALCULO DE ARMADURAS HORIZONTALES

| ZONA MURO FRONTAL | FAJA BIS.IZDA | Elemento | Nx ( T/m ) | Mx ( mT/m ) | Vx ( T/m ) | Canto elemento (m.) | Armadura cortante (cm2/m) | Vu1>Vd | Armadura interior (cm2/m) | Armadura exterior (cm2/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| MURO IZQUIERDO | BISAGRA | 5 | -7.86 | -4.70 | -0.05 | 1.14 | 0.00 | Vale | 1.00 | 1.00 |
| | | 10 | 4.94 | -8.84 | -4.64 | 1.02 | 0.00 | Vale | 2.67 | 1.00 |
| | | 15 | 13.06 | -13.05 | -10.61 | 0.89 | 0.00 | Vale | 5.08 | 1.00 |
| | | 20 | 18.07 | -15.26 | -14.40 | 0.77 | 0.00 | Vale | 7.01 | 1.00 |
| | | 25 | 20.80 | -13.57 | -14.68 | 0.65 | 0.00 | Vale | 7.73 | 1.00 |
| MURO IZQUIERDO | BISAGRA | 30 | 14.10 | -7.37 | -7.06 | 0.53 | 0.00 | Vale | 5.27 | 1.00 |
| | | 35 | 5.34 | -3.34 | -3.50 | 0.41 | 0.00 | Vale | 2.77 | 1.00 |
| MURO DERECHO | BISAGRA | 99 | -6.10 | -4.35 | 0.57 | 1.14 | 0.00 | Vale | 1.00 | 1.00 |
| | | 104 | 3.71 | -9.53 | 6.03 | 1.02 | 0.00 | Vale | 2.68 | 1.00 |
| | | 109 | 9.66 | -14.17 | 11.95 | 0.89 | 0.00 | Vale | 4.99 | 1.00 |
| | | 114 | 13.71 | -16.39 | 15.43 | 0.77 | 0.00 | Vale | 6.87 | 1.00 |
| | | 119 | 16.91 | -14.38 | 15.42 | 0.65 | 0.00 | Vale | 7.59 | 1.00 |
| MURO DERECHO | BISAGRA | 124 | 11.89 | -7.75 | 7.27 | 0.53 | 0.00 | Vale | 5.19 | 1.00 |
| | | 129 | 3.66 | -3.46 | 3.32 | 0.41 | 0.00 | Vale | 2.64 | 1.00 |
| MURO FRONTAL | BIS.IZDA | 36 | -8.72 | -5.18 | 0.13 | 1.30 | 0.00 | Vale | 1.00 | 1.00 |
| | | 45 | 5.11 | -7.96 | 3.99 | 1.30 | 0.00 | Vale | 2.04 | 1.00 |
| | | 54 | 14.74 | -11.65 | 9.32 | 1.30 | 0.00 | Vale | 3.83 | 1.00 |
| | | 63 | 20.34 | -14.38 | 12.58 | 1.30 | 0.00 | Vale | 4.98 | 1.00 |
| | | 72 | 26.79 | -18.33 | 24.24 | 1.30 | 0.00 | Vale | 6.45 | 1.00 |
| MURO FRONTAL | BIS.IZDA | 81 | 8.61 | -1.51 | 4.22 | 0.35 | 0.00 | Vale | 2.18 | 1.00 |
| | | 90 | 8.20 | -2.93 | 4.50 | 0.35 | 0.00 | Vale | 3.24 | 1.00 |
| MURO FRONTAL | BIS.DCHA | 44 | -5.25 | -4.86 | -0.33 | 1.30 | 0.00 | Vale | 1.00 | 1.00 |
| | | 53 | 6.19 | -8.62 | -4.90 | 1.30 | 0.00 | Vale | 2.29 | 1.00 |
| | | 62 | 12.79 | -12.71 | -10.49 | 1.30 | 0.00 | Vale | 3.80 | 1.00 |
| | | 71 | 15.85 | -15.43 | -13.64 | 1.30 | 0.00 | Vale | 4.65 | 1.00 |
| | | 80 | 18.62 | -19.30 | -25.95 | 1.30 | 0.00 | Vale | 5.68 | 1.00 |
| MURO FRONTAL | BIS.DCHA | 89 | 5.52 | -1.55 | -4.36 | 0.35 | 0.00 | Vale | 1.82 | 1.00 |
| | | 98 | 5.77 | -2.99 | -4.57 | 0.35 | 0.00 | Vale | 2.98 | 1.00 |
| MURO FRONTAL | CENTRAL | 40 | -2.37 | -3.79 | 0.20 | 1.30 | 0.00 | Vale | 1.00 | 1.00 |
| | | 49 | 1.88 | 2.00 | 0.25 | 1.30 | 0.00 | Vale | 1.00 | 1.00 |
| | | 58 | 8.65 | 6.95 | 0.16 | 1.30 | 0.00 | Vale | 1.00 | 2.27 |
| | | 67 | 16.79 | 11.54 | 0.33 | 1.30 | 0.00 | Vale | 1.00 | 4.05 |
| | | 76 | 25.55 | 14.86 | 1.70 | 1.30 | 0.00 | Vale | 1.00 | 5.67 |

NOMBRE PROYECTO : L.A.V. MADRID - ZARAGOZA. Subtramo XV.

DESIGNACION ALETA: Aleta 2.5m. E-1520.4

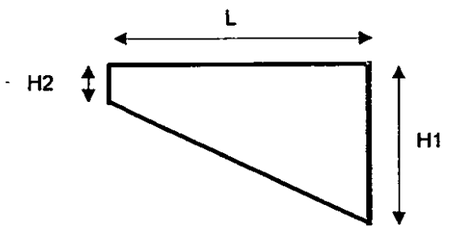
## HOJA DE CALCULO DE ALETAS

### DATOS REQUERIDOS:

**DIMENSIONES(en metros)**

H1= 2.17
H2= 0.5
L= 2.5

Espesor= 0.35
Recubrim.= 0.05




**CARACTERISTICAS DE TERRENO**

| | |
|---|---|
| Peso tierras(T/m3) | γ= 2 |
| Angulo rozamiento interno (°) | φ= 30 |
| Ang. rozamiento tierras muro (°) | δ= 0 |

**COEFICIENTES DE SEGURIDAD**

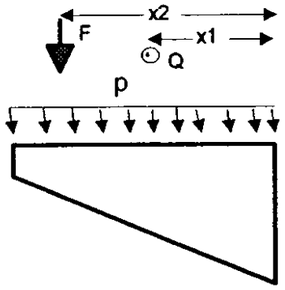
| | |
|---|---|
| Mayoracion de cargas | γf= 1.5 |
| Minoracion acero | gs= 1.15 |
| Minoracion hormigon | gc= 1.5 |

**CARACTERISTICAS DE LOS MATERIALES**

| | |
|---|---|
| Peso especifico hgon(T/m3) | γh= 2.5 |
| Resistencia acero (T/m2) | Fyk= 51000 |
| Resistencia hormigon (T/m2) | Fck= 2500 |

**CARGAS (valores sin mayorar)**

| | |
|---|---|
| Cargas verticales | |
| Sobrecarga vertical (t/m) | p= 1 |
| Carga vertical (t.) | F= 0.00 |
| Situacion x2 (m) | x2= 0 |
| Cargas horizontales | |
| Carga horizontal (t.) | Q= 0 |
| Posicion x1 (m) | x1= 0 |
| Sobrecarga sobre terreno (ton/m2) | |
| | q= 1 |




**CUANTIAS MINIMAS**

| | |
|---|---|
| LONGITUDINAL SUPERIOR | 0.400 o/oo |
| LONGITUDINAL INFERIOR | 0.400 o/oo |
| CORTANTE | 2.778 CM2/M |
| HORIZONTAL MUROS ALETA | 0.900 o/oo |
| VERTICAL MUROS ALETA | 1.600 o/oo |
| CORTANTE MUROS | 0.000 CM2/M |

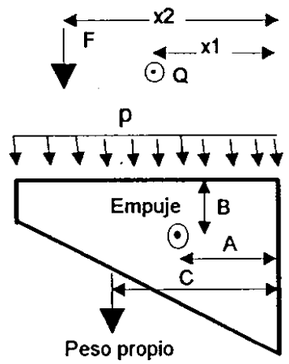
Alet1520-4.xls CALCULOS

NOMBRE PROYECTO : L.A.V. MADRID - ZARAGOZA. Subtramo XV.

DESIGNACION ALETA: Aleta 2.5m. E-1520.4

HOJA DE CALCULO DE ALETAS

**CARGAS DE PESO PROPIO Y EMPUJES DE TIERRAS SOBRE ESTRIBO(ton/m. sin mayorar)**




**COEFICIENTES EMPUJE ACTIVO ALETA**

| | |
|---|---|
| Coef. empuje activo λh= | 0.333 |
| Coef. empuje activo λv= | 0.000 |

**PESO PROPIO**

| | Peso | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Peso aux. 1 | 1.094 | 1.250 | 0.250 |
| Peso aux. 2 | 1.827 | 0.833 | 1.057 |
| Peso propio | **2.920** | **0.989** | **0.755** |

**EMPUJE DE TIERRAS**

HORIZONTAL

| | Empuje. | Dist.emp. | Dist. vert. |
|---|---|---|---|
| Auxiliar | 0.069 | 1.875 | - |
| Auxiliar | 0.301 | 1.250 | - |
| Auxiliar | 1.308 | 0.625 | - |
| Auxiliar | 0.208 | 1.667 | - |
| Auxiliar | 0.904 | 0.833 | - |
| Empuje hor. | **2.791** | **0.869** | **0.960** |

VERTICAL

| | Empuje. | Dist.emp. |
|---|---|---|
| Empuje aux.1 | 0.000 | 1.875 |
| Empuje aux.2 | 0.000 | 1.250 |
| Empuje aux.3 | 0.000 | 0.625 |
| Empuje aux.4 | 0.000 | 1.667 |
| Empuje aux.5 | 0.000 | 0.833 |
| Empuje vert. | **0.000** | **0.000** |

NOMBRE PROYECTO : L.A.V. MADRID - ZARAGOZA. Subtramo XV.

DESIGNACION ALETA: Aleta 2.5m. E-1520.4

## HOJA DE CALCULO DE ALETAS

## CALCULOS

### ESFUERZOS DE DISEÑO

**(Para cargas verticales, momentos positivos implica tracciones en cara superior)**

| Acciones | Verticales | Horizontales |
|---|---|---|
| M peso propio | 2.889 | 0.000 |
| M empuje hor. | 0.000 | 2.425 |
| M empuje vert. | 0.000 | 0.000 |
| M sobrec.vert. | 3.125 | 0.000 |
| M carga vert. | 0.000 | 0.000 |
| M carga hor. | 0.000 | 0.000 |
| **Md (mt)** | **9.021** | **3.638** |
| V peso propio | 2.920 | 0.000 |
| V empuje hor. | 0.000 | 2.791 |
| V empuje vert. | 0.000 | 0.000 |
| V sobrec.vert. | 2.500 | 0.000 |
| V carga vert. | 0.000 | 0.000 |
| V carga hor. | 0.000 | 0.000 |
| **Vd (mt)** | **8.130** | **4.187** |

Alet1520-4.xls CALCULOS

NOMBRE PROYECTO : L.A.V. MADRID - ZARAGOZA. Subtramo XV.

DESIGNACION ALETA: Aleta 2.5m. E-1520.4

HOJA DE CALCULO DE ALETAS

### CALCULO DE SECCIONES

| | | |
|---|---|---|
| Fcd | 1666.67 | |
| 0,85*Fcd | 1416.67 | |
| Fcv | 64.55 | |
| Es | 21000000 | |
| Fyd | 44347.83 | |
| FYAD | 42000.00 | |
| Acciones | Verticales | Horizontales |
| Md(m.t) | 9.021 | 3.638 |
| Md max/Md med | 1.000 | 1.643 |
| Md a usar calculo | 9.021 | 5.978 |
| Canto seccion | 2.170 | 0.350 |
| Canto util | 2.120 | 0.300 |
| ancho seccion | 0.350 | 2.170 |
| Ancho calculo | 0.350 | 2.153 |
| Def acero | 0.010 | 0.010 |
| Tension acero | 44348 | 44348 |
| X | 0.009 | 0.007 |
| **As (cm.2)** | **0.962** | **4.543** |
| Prof. fibra neutra | 0.147 | 0.026 |
| Def. hormigon | 0.001 | 0.001 |
| Comentarios | VALE | VALE |
| Vd | 8.130 | 4.187 |
| Vd compuesto | | 9.145 |
| Vu1 | | 322.920 |
| Vsu | | 0.000 |
| Vcu | | 41.689 |
| Vu2 | | 41.689 |
| Comentarios | | |
| **As (cm.2)** | | **0.000** |

### ARMADO

| | Calculo | Minima | total |
|---|---|---|---|
| Long. superior | 0.962 | 3.038 | **3.038** |
| Long inferior | 0.000 | 3.038 | **3.038** |
| Cortante | 0.000 | 6.944 | **6.944** |
| Horizontal trasdos | 4.543 | 3.418 | **4.543** |
| Vertical trasdos | 0.000 | 7.000 | **7.000** |
| Horizontal intrados | 0.000 | 3.418 | **3.418** |
| Vertical intrados | 0.000 | 7.000 | **7.000** |
| Cortante transversal | | NO | |

### TOTAL ENVOLVENTE ARMADURA

| | |
|---|---|
| **Long. superior** | **3.038 cm²** |
| **Long inferior** | **3.038 cm²** |
| **Horizontal trasdos** | **2.094 cm²/m** |
| **Horizontal intrados** | **1.575 cm²/m** |
| **Estribos** | **8.378 cm²/m** |

PASO SUPERIOR E-1520.4

5º PROYECTO DE PRUEBA E CARGA

**PRUEBA DE CARGA**

OBJETO DE LA PRUEBA

El objeto de la prueba es comprobar la respuesta estructural, frente a situaciones de carga estática, de manera tal que confrontando la respuesta real con la teórica, determinar la fiabilidad del comportamiento en servicio del puente.

CARGA DE PRUEBA

La prueba se realizará empleando camiones, el la disposición que se adjunta a continuación, de tres ejes separados 3.825 y 1.36 m. con cargas por eje de 6.5, 11.75 y 11.75 T.

APARATOS DE MEDIDA Y MEDICIONES

Para la realización de las mediciones se colocarán flexímetros en el centro del vano (medidas f1) y apoyos (medidas f2). Los valores de los desplazamientos que se adjuntan son los descensos relativos esperados entre los puntos de los vanos y los fijos de los apoyos. Estos valores deben ser del orden de la magnitud del valor f1-f2 medido en obra.

La apreciación mínima de cualquiera de los flexímetros será del orden del 3% de los valores máximos esperados de las magnitudes a medir.

El rango de los aparatos deberá ser como mínimo superior en un 50% a los esperados de dicha magnitud.

Las medidas se realizarán inmediatamente antes de la carga, inmediatamente después de su colocación y a los quince minutos de haberla retirado.

Durante la realización de la prueba se deberá anotar las condiciones climatológicas existentes a lo largo de la misma.

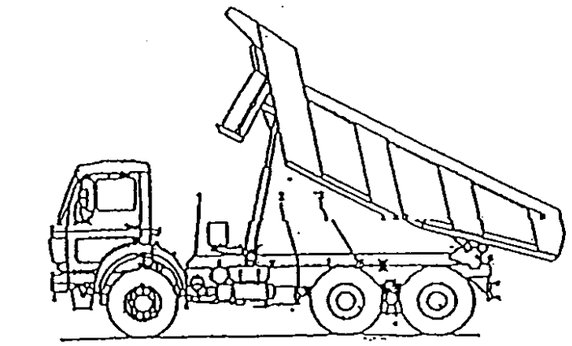
ANALISIS

Para obtener las solicitaciones y desplazamientos verticales en los puntos a medir se procesó la estructura mediante el programa de elementos finitos COSMOS/M. Sobre el modelo la carga de prueba debe producir en las secciones críticas esfuerzos del orden del 70 - 80% de los calculados en el proyecto del tablero.

Se adjunta la definición del modelo de cálculo, de la carga empleada y el listado de esfuerzos y deformaciones obtenidos con la comparación con los calculados en el proyecto del tablero.

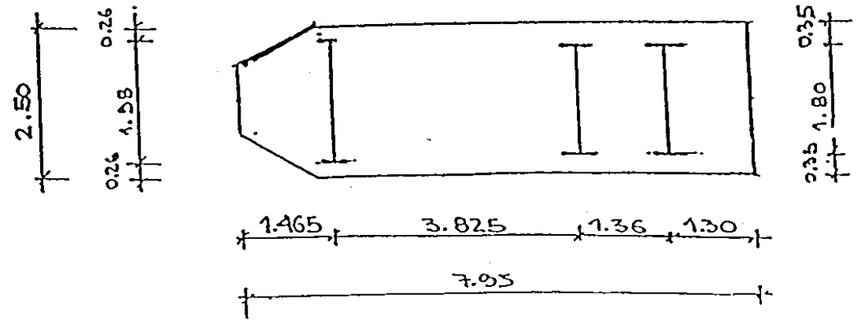
DEFINICION TREN DE CARGAS

CAMION VOLQUETE DE 30.0 Ton.



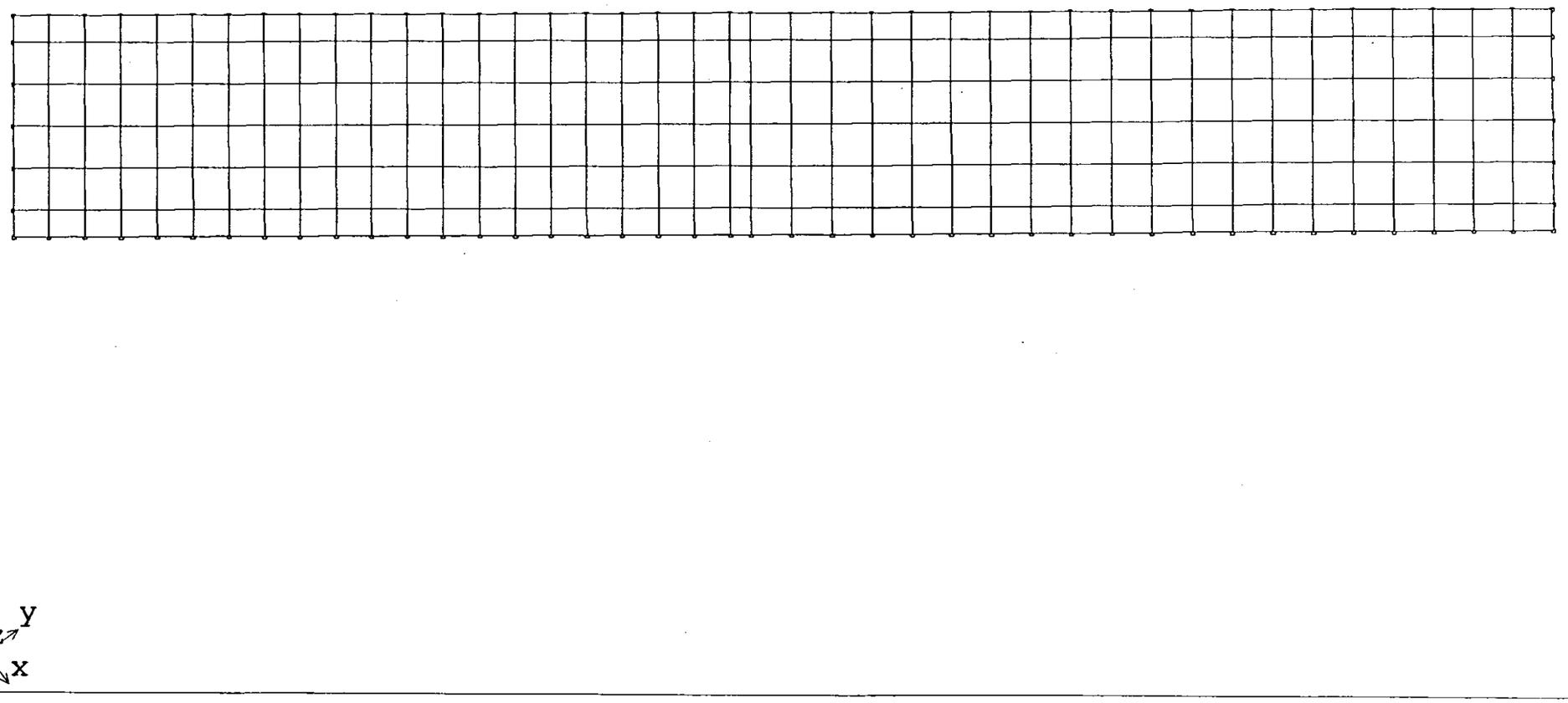

ALZADO




PLANTA

GeoStar 2.0 (64K Version): Pru15204 - [Main]



```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**  CCCC   OOOO   SSSS   M     M   OOOO   SSSS     / M     M  **
**  C      O  O   S      MM   MM   O  O   S       /  MM   MM  **
**  C      O  O   SSSS   M M M M   O  O   SSSS   /   M M M M  **
**  C      O  O      S   M  M  M   O  O      S  /    M  M  M  **
**  CCCC   OOOO   SSSS   M     M   OOOO   SSSS /     M     M  **
**                                                                  **
**                                                                  **
**                        VERSION: 2.00                             **
**                      DISTRIBUTED BY:                             **
**       STRUCTURAL  RESEARCH  AND  ANALYSIS  CORPORATION           **
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**              TEL. NO.    (310)  207-2800                         **
**            COPYRIGHT  1988   S. R. A. C.                         **
**                                                                  **
**********************************************************************
**********************************************************************
```

Element group data

Element group number= 1
Element name:
BEAM3D Three dimensional Elastic Beam elements
Type of beam element = . . . . . 0
EQ. 0 ; Symmetric beam element
EQ. 1 ; Unsymmetric beam element
EQ. 2 ; Symmetric tapered beam element
Element group number= 2
Element name:
SHELL4T Four node thick shell elements
Type of Shell element= . . . . . 2
EQ. 0 ; QUAD 2 element
EQ. 1 ; QUAD 4 element
Element group number= 3
Element name:
SHELL3T Three node thick shell elements

Real constant data

Real constant set 1
Associated with :
SHELL4T Four node thick shell elements
Thickness of the plate = .25000
Temperature Gradient = .00000
Real constant set 2
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+07
Moment of Inertia about element Y-axis = .10000E+07
Moment of Inertia about element Z-axis = .10000E+07
Depth of beam (y-axis) = 10.000
Width of beam (z-axis) = 10.000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .10000E+07
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 3
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .50187
Moment of Inertia about element Y-axis = .16362E-01
Moment of Inertia about element Z-axis = .18824
Depth of beam (y-axis) = 1.6500
Width of beam (z-axis) = .00000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .25505E-02
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 4
Associated with :
SHELL4T Four node thick shell elements
Thickness of the plate = .25000
Temperature Gradient = .00000
Real constant set 5
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+07
Moment of Inertia about element Y-axis = .10000E+07
Moment of Inertia about element Z-axis = .10000E+07
Depth of beam (y-axis) = 10.000
Width of beam (z-axis) = 10.000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .10000E+07
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 6
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .50187
Moment of Inertia about element Y-axis = .16362E-01
Moment of Inertia about element Z-axis = .18824
Depth of beam (y-axis) = 1.6500
Width of beam (z-axis) = .00000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .25505E-02
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 7
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .62767
Moment of Inertia about element Z-axis = .62767
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 8
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .62767
Moment of Inertia about element Z-axis = .62767
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 9
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .62767
Moment of Inertia about element Z-axis = .62767
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 10
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+06
Moment of Inertia about element Y-axis = .62767
Moment of Inertia about element Z-axis = .62767
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 11
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = .10000E+07
Moment of Inertia about element Y-axis = .83333E+11
Moment of Inertia about element Z-axis = .83333E+11
Depth of beam (y-axis) = 1000.0
Width of beam (z-axis) = 1000.0
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .33333E+12
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 12
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 1000.0
Moment of Inertia about element Y-axis = 1000.0
Moment of Inertia about element Z-axis = 1000.0
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 0
End release code (J-node) [000000] = 0
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000
Real constant set 13
Associated with :
BEAM3D Three dimensional Elastic Beam elements
Area = 1.0000
Moment of Inertia about element Y-axis = 1.0000
Moment of Inertia about element Z-axis = 1.0000
Depth of beam (y-axis) = 1.0000
Width of beam (z-axis) = 1.0000
End release code (I-node) [000000] = 111
End release code (J-node) [000000] = 111
Moment of inertia about element x-axis = .00000
Shear factor in the element y-axis = .00000
Shear factor in the element z-axis = .00000
Temp. difference in the element y-axis = .00000
Temp. difference in the element z-axis = .00000
Orientation angle = .00000
Torsion const for max shear stress = .00000

Material propery data

Material property set 1

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .30000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |

Material property set 2

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Material property set 3

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |

Material property set 4

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | 100.00 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |

Material property set 5

| | Value | Temp curve no. |
|---|---|---|
| EX : X Elastic Modulus | .35000E+07 | 0 |
| NUXY : Poisson Ratio | .20000 | 0 |
| ALPX : X thermal expansion | .10000E-04 | 0 |
| DENS : Mass Density | 2.5000 | 0 |

Nodal input data

| NODE | BOUNDARY CONDITION CODES (0 = FREE ; 1 = FIXED) | | | | | | NODAL POINT COORDINATES | | |
|---|---|---|---|---|---|---|---|---|---|
| | X | Y | Z | XX | YY | ZZ | X | Y | Z |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 101.03 | 100.48 | .00000 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 100.08 | 99.153 | .00000 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 99.128 | 97.825 | .00000 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 98.180 | 96.496 | .00000 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 97.231 | 95.167 | .00000 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 96.283 | 93.838 | .00000 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 95.334 | 92.509 | .00000 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 94.386 | 91.181 | .00000 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 93.437 | 89.852 | .00000 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 92.489 | 88.523 | .00000 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 91.541 | 87.195 | .00000 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 90.592 | 85.866 | .00000 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 89.644 | 84.537 | .00000 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 88.695 | 83.208 | .00000 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 87.747 | 81.879 | .00000 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 86.798 | 80.551 | .00000 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 85.850 | 79.222 | .00000 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 84.901 | 77.893 | .00000 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 83.953 | 76.564 | .00000 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 83.004 | 75.236 | .00000 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 82.056 | 73.907 | .00000 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 100.13 | 101.12 | .00000 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 99.177 | 99.795 | .00000 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 98.229 | 98.466 | .00000 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 97.280 | 97.138 | .00000 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 96.332 | 95.809 | .00000 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 95.384 | 94.480 | .00000 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 94.435 | 93.151 | .00000 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 93.486 | 91.823 | .00000 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 92.538 | 90.494 | .00000 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 91.590 | 89.165 | .00000 |
| 32 | 0 | 0 | 0 | 0 | 0 | 0 | 90.641 | 87.837 | .00000 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 89.692 | 86.508 | .00000 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 88.744 | 85.179 | .00000 |
| 35 | 0 | 0 | 0 | 0 | 0 | 0 | 87.796 | 83.850 | .00000 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 | 86.847 | 82.521 | .00000 |
| 37 | 0 | 0 | 0 | 0 | 0 | 0 | 85.898 | 81.193 | .00000 |
| 38 | 0 | 0 | 0 | 0 | 0 | 0 | 84.950 | 79.864 | .00000 |
| 39 | 0 | 0 | 0 | 0 | 0 | 0 | 84.001 | 78.535 | .00000 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 | 83.053 | 77.206 | .00000 |
| 41 | 0 | 0 | 0 | 0 | 0 | 0 | 82.104 | 75.878 | .00000 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0 | 81.156 | 74.549 | .00000 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 | 98.722 | 102.13 | .00000 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | 97.774 | 100.80 | .00000 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 96.825 | 99.469 | .00000 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 95.877 | 98.140 | .00000 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 94.928 | 96.811 | .00000 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 93.980 | 95.483 | .00000 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 93.031 | 94.154 | .00000 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 92.083 | 92.825 | .00000 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 91.134 | 91.496 | .00000 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 90.186 | 90.168 | .00000 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 89.237 | 88.839 | .00000 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 88.288 | 87.510 | .00000 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 | 87.340 | 86.181 | .00000 |
| 56 | 0 | 0 | 0 | 0 | 0 | 0 | 86.392 | 84.853 | .00000 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 85.443 | 83.524 | .00000 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 84.494 | 82.195 | .00000 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 83.546 | 80.866 | .00000 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 82.597 | 79.537 | .00000 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 81.649 | 78.209 | .00000 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 80.701 | 76.880 | .00000 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 79.752 | 75.551 | .00000 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 97.318 | 103.13 | .00000 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 96.369 | 101.80 | .00000 |
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 95.421 | 100.47 | .00000 |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 94.472 | 99.142 | .00000 |
| 68 | 0 | 0 | 0 | 0 | 0 | 0 | 93.524 | 97.813 | .00000 |
| 69 | 0 | 0 | 0 | 0 | 0 | 0 | 92.576 | 96.485 | .00000 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0 | 91.627 | 95.156 | .00000 |
| 71 | 0 | 0 | 0 | 0 | 0 | 0 | 90.678 | 93.827 | .00000 |
| 72 | 0 | 0 | 0 | 0 | 0 | 0 | 89.730 | 92.498 | .00000 |
| 73 | 0 | 0 | 0 | 0 | 0 | 0 | 88.781 | 91.170 | .00000 |
| 74 | 0 | 0 | 0 | 0 | 0 | 0 | 87.833 | 89.841 | .00000 |
| 75 | 0 | 0 | 0 | 0 | 0 | 0 | 86.884 | 88.512 | .00000 |
| 76 | 0 | 0 | 0 | 0 | 0 | 0 | 85.936 | 87.183 | .00000 |
| 77 | 0 | 0 | 0 | 0 | 0 | 0 | 84.987 | 85.855 | .00000 |
| 78 | 0 | 0 | 0 | 0 | 0 | 0 | 84.039 | 84.526 | .00000 |
| 79 | 0 | 0 | 0 | 0 | 0 | 0 | 83.090 | 83.197 | .00000 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0 | 82.142 | 81.868 | .00000 |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 81.193 | 80.540 | .00000 |
| 82 | 0 | 0 | 0 | 0 | 0 | 0 | 80.245 | 79.211 | .00000 |
| 83 | 0 | 0 | 0 | 0 | 0 | 0 | 79.296 | 77.882 | .00000 |
| 84 | 0 | 0 | 0 | 0 | 0 | 0 | 78.348 | 76.553 | .00000 |
| 85 | 0 | 0 | 0 | 0 | 0 | 0 | 95.914 | 104.13 | .00000 |
| 86 | 0 | 0 | 0 | 0 | 0 | 0 | 94.965 | 102.80 | .00000 |
| 87 | 0 | 0 | 0 | 0 | 0 | 0 | 94.017 | 101.47 | .00000 |
| 88 | 0 | 0 | 0 | 0 | 0 | 0 | 93.068 | 100.14 | .00000 |
| 89 | 0 | 0 | 0 | 0 | 0 | 0 | 92.120 | 98.816 | .00000 |
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 91.172 | 97.487 | .00000 |
| 91 | 0 | 0 | 0 | 0 | 0 | 0 | 90.223 | 96.158 | .00000 |
| 92 | 0 | 0 | 0 | 0 | 0 | 0 | 89.274 | 94.829 | .00000 |
| 93 | 0 | 0 | 0 | 0 | 0 | 0 | 88.326 | 93.501 | .00000 |
| 94 | 0 | 0 | 0 | 0 | 0 | 0 | 87.378 | 92.172 | .00000 |
| 95 | 0 | 0 | 0 | 0 | 0 | 0 | 86.429 | 90.843 | .00000 |
| 96 | 0 | 0 | 0 | 0 | 0 | 0 | 85.480 | 89.514 | .00000 |
| 97 | 0 | 0 | 0 | 0 | 0 | 0 | 84.532 | 88.186 | .00000 |
| 98 | 0 | 0 | 0 | 0 | 0 | 0 | 83.584 | 86.857 | .00000 |
| 99 | 0 | 0 | 0 | 0 | 0 | 0 | 82.635 | 85.528 | .00000 |
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 81.686 | 84.199 | .00000 |
| 101 | 0 | 0 | 0 | 0 | 0 | 0 | 80.738 | 82.871 | .00000 |
| 102 | 0 | 0 | 0 | 0 | 0 | 0 | 79.789 | 81.542 | .00000 |
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| 104 | 0 | 0 | 0 | 0 | 0 | 0 | 77.893 | 78.884 | .00000 |
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| 106 | 0 | 0 | 0 | 0 | 0 | 0 | 94.510 | 105.13 | .00000 |
| 107 | 0 | 0 | 0 | 0 | 0 | 0 | 93.562 | 103.80 | .00000 |
| 108 | 0 | 0 | 0 | 0 | 0 | 0 | 92.613 | 102.48 | .00000 |
| 109 | 0 | 0 | 0 | 0 | 0 | 0 | 91.664 | 101.15 | .00000 |
| 110 | 0 | 0 | 0 | 0 | 0 | 0 | 90.716 | 99.818 | .00000 |
| 111 | 0 | 0 | 0 | 0 | 0 | 0 | 89.768 | 98.489 | .00000 |
| 112 | 0 | 0 | 0 | 0 | 0 | 0 | 88.819 | 97.160 | .00000 |
| 113 | 0 | 0 | 0 | 0 | 0 | 0 | 87.870 | 95.832 | .00000 |
| 114 | 0 | 0 | 0 | 0 | 0 | 0 | 86.922 | 94.503 | .00000 |
| 115 | 0 | 0 | 0 | 0 | 0 | 0 | 85.974 | 93.174 | .00000 |
| 116 | 0 | 0 | 0 | 0 | 0 | 0 | 85.025 | 91.846 | .00000 |
| 117 | 0 | 0 | 0 | 0 | 0 | 0 | 84.076 | 90.517 | .00000 |
| 118 | 0 | 0 | 0 | 0 | 0 | 0 | 83.128 | 89.188 | .00000 |
| 119 | 0 | 0 | 0 | 0 | 0 | 0 | 82.180 | 87.859 | .00000 |
| 120 | 0 | 0 | 0 | 0 | 0 | 0 | 81.231 | 86.531 | .00000 |
| 121 | 0 | 0 | 0 | 0 | 0 | 0 | 80.282 | 85.202 | .00000 |
| 122 | 0 | 0 | 0 | 0 | 0 | 0 | 79.334 | 83.873 | .00000 |
| 123 | 0 | 0 | 0 | 0 | 0 | 0 | 78.385 | 82.544 | .00000 |
| 124 | 0 | 0 | 0 | 0 | 0 | 0 | 77.437 | 81.215 | .00000 |
| 125 | 0 | 0 | 0 | 0 | 0 | 0 | 76.489 | 79.887 | .00000 |
| 126 | 0 | 0 | 0 | 0 | 0 | 0 | 75.540 | 78.558 | .00000 |
| 127 | 0 | 0 | 0 | 0 | 0 | 0 | 93.611 | 105.78 | .00000 |
| 128 | 0 | 0 | 0 | 0 | 0 | 0 | 92.662 | 104.45 | .00000 |
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| 130 | 0 | 0 | 0 | 0 | 0 | 0 | 90.765 | 101.79 | .00000 |
| 131 | 0 | 0 | 0 | 0 | 0 | 0 | 89.817 | 100.46 | .00000 |
| 132 | 0 | 0 | 0 | 0 | 0 | 0 | 88.869 | 99.131 | .00000 |
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| 135 | 0 | 0 | 0 | 0 | 0 | 0 | 86.023 | 95.145 | .00000 |
| 136 | 0 | 0 | 0 | 0 | 0 | 0 | 85.075 | 93.816 | .00000 |
| 137 | 0 | 0 | 0 | 0 | 0 | 0 | 84.126 | 92.488 | .00000 |
| 138 | 0 | 0 | 0 | 0 | 0 | 0 | 83.177 | 91.159 | .00000 |
| 139 | 0 | 0 | 0 | 0 | 0 | 0 | 82.229 | 89.830 | .00000 |
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| 143 | 0 | 0 | 0 | 0 | 0 | 0 | 78.435 | 84.515 | .00000 |
| 144 | 0 | 0 | 0 | 0 | 0 | 0 | 77.486 | 83.186 | .00000 |
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| 146 | 0 | 0 | 0 | 0 | 0 | 0 | 75.590 | 80.529 | .00000 |
| 147 | 0 | 0 | 0 | 0 | 0 | 0 | 74.641 | 79.200 | .00000 |
| 148 | 0 | 0 | 0 | 0 | 0 | 0 | 100.13 | 101.12 | -.96594 |
| 149 | 0 | 0 | 0 | 0 | 0 | 0 | 99.177 | 99.795 | -.96594 |
| 150 | 0 | 0 | 0 | 0 | 0 | 0 | 98.229 | 98.466 | -.96594 |
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| 152 | 0 | 0 | 0 | 0 | 0 | 0 | 96.332 | 95.809 | -.96594 |
| 153 | 0 | 0 | 0 | 0 | 0 | 0 | 95.384 | 94.480 | -.96594 |
| 154 | 0 | 0 | 0 | 0 | 0 | 0 | 94.435 | 93.151 | -.96594 |
| 155 | 0 | 0 | 0 | 0 | 0 | 0 | 93.486 | 91.823 | -.96594 |
| 156 | 0 | 0 | 0 | 0 | 0 | 0 | 92.538 | 90.494 | -.96594 |
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| 162 | 0 | 0 | 0 | 0 | 0 | 0 | 86.847 | 82.521 | -.96594 |
| 163 | 0 | 0 | 0 | 0 | 0 | 0 | 85.898 | 81.193 | -.96594 |
| 164 | 0 | 0 | 0 | 0 | 0 | 0 | 84.950 | 79.864 | -.96594 |
| 165 | 0 | 0 | 0 | 0 | 0 | 0 | 84.001 | 78.535 | -.96594 |
| 166 | 0 | 0 | 0 | 0 | 0 | 0 | 83.053 | 77.206 | -.96594 |
| 167 | 0 | 0 | 0 | 0 | 0 | 0 | 82.104 | 75.878 | -.96594 |
| 168 | 0 | 0 | 0 | 0 | 0 | 0 | 81.156 | 74.549 | -.96594 |
| 169 | 0 | 0 | 0 | 0 | 0 | 0 | 98.722 | 102.13 | -.96594 |
| 170 | 0 | 0 | 0 | 0 | 0 | 0 | 97.774 | 100.80 | -.96594 |
| 171 | 0 | 0 | 0 | 0 | 0 | 0 | 96.825 | 99.469 | -.96594 |
| 172 | 0 | 0 | 0 | 0 | 0 | 0 | 95.877 | 98.140 | -.96594 |
| 173 | 0 | 0 | 0 | 0 | 0 | 0 | 94.928 | 96.811 | -.96594 |
| 174 | 0 | 0 | 0 | 0 | 0 | 0 | 93.980 | 95.483 | -.96594 |
| 175 | 0 | 0 | 0 | 0 | 0 | 0 | 93.031 | 94.154 | -.96594 |
| 176 | 0 | 0 | 0 | 0 | 0 | 0 | 92.083 | 92.825 | -.96594 |
| 177 | 0 | 0 | 0 | 0 | 0 | 0 | 91.134 | 91.496 | -.96594 |
| 178 | 0 | 0 | 0 | 0 | 0 | 0 | 90.186 | 90.168 | -.96594 |
| 179 | 0 | 0. | 0 | 0 | 0 | 0 | 89.237 | 88.839 | -.96594 |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 | 88.288 | 87.510 | -.96594 |
| 181 | 0 | 0 | 0 | 0 | 0 | 0 | 87.340 | 86.181 | -.96594 |
| 182 | 0 | 0 | 0 | 0 | 0 | 0 | 86.392 | 84.853 | -.96594 |
| 183 | 0 | 0 | 0 | 0 | 0 | 0 | 85.443 | 83.524 | -.96594 |
| 184 | 0 | 0 | 0 | 0 | 0 | 0 | 84.494 | 82.195 | -.96594 |
| 185 | 0 | 0 | 0 | 0 | 0 | 0 | 83.546 | 80.866 | -.96594 |
| 186 | 0 | 0 | 0 | 0 | 0 | 0 | 82.597 | 79.537 | -.96594 |
| 187 | 0 | 0 | 0 | 0 | 0 | 0 | 81.649 | 78.209 | -.96594 |
| 188 | 0 | 0 | 0 | 0 | 0 | 0 | 80.701 | 76.880 | -.96594 |
| 189 | 0 | 0 | 0 | 0 | 0 | 0 | 79.752 | 75.551 | -.96594 |
| 190 | 0 | 0 | 0 | 0 | 0 | 0 | 97.318 | 103.13 | -.96594 |
| 191 | 0 | 0 | 0 | 0 | 0 | 0 | 96.369 | 101.80 | -.96594 |
| 192 | 0 | 0 | 0 | 0 | 0 | 0 | 95.421 | 100.47 | -.96594 |
| 193 | 0 | 0 | 0 | 0 | 0 | 0 | 94.472 | 99.142 | -.96594 |
| 194 | 0 | 0 | 0 | 0 | 0 | 0 | 93.524 | 97.813 | -.96594 |
| 195 | 0 | 0 | 0 | 0 | 0 | 0 | 92.576 | 96.485 | -.96594 |
| 196 | 0 | 0 | 0 | 0 | 0 | 0 | 91.627 | 95.156 | -.96594 |
| 197 | 0 | 0 | 0 | 0 | 0 | 0 | 90.678 | 93.827 | -.96594 |
| 198 | 0 | 0 | 0 | 0 | 0 | 0 | 89.730 | 92.498 | -.96594 |
| 199 | 0 | 0 | 0 | 0 | 0 | 0 | 88.781 | 91.170 | -.96594 |
| 200 | 0 | 0 | 0 | 0 | 0 | 0 | 87.833 | 89.841 | -.96594 |
| 201 | 0 | 0 | 0 | 0 | 0 | 0 | 86.884 | 88.512 | -.96594 |
| 202 | 0 | 0 | 0 | 0 | 0 | 0 | 85.936 | 87.183 | -.96594 |
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| 204 | 0 | 0 | 0 | 0 | 0 | 0 | 84.039 | 84.526 | -.96594 |
| 205 | 0 | 0 | 0 | 0 | 0 | 0 | 83.090 | 83.197 | -.96594 |
| 206 | 0 | 0 | 0 | 0 | 0 | 0 | 82.142 | 81.868 | -.96594 |
| 207 | 0 | 0 | 0 | 0 | 0 | 0 | 81.193 | 80.540 | -.96594 |
| 208 | 0 | 0 | 0 | 0 | 0 | 0 | 80.245 | 79.211 | -.96594 |
| 209 | 0 | 0 | 0 | 0 | 0 | 0 | 79.296 | 77.882 | -.96594 |
| 210 | 0 | 0 | 0 | 0 | 0 | 0 | 78.348 | 76.553 | -.96594 |
| 211 | 0 | 0 | 0 | 0 | 0 | 0 | 95.914 | 104.13 | -.96594 |
| 212 | 0 | 0 | 0 | 0 | 0 | 0 | 94.965 | 102.80 | -.96594 |
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| 214 | 0 | 0 | 0 | 0 | 0 | 0 | 93.068 | 100.14 | -.96594 |
| 215 | 0 | 0 | 0 | 0 | 0 | 0 | 92.120 | 98.816 | -.96594 |
| 216 | 0 | 0 | 0 | 0 | 0 | 0 | 91.172 | 97.487 | -.96594 |
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| 221 | 0 | 0 | 0 | 0 | 0 | 0 | 86.429 | 90.843 | -.96594 |
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| 224 | 0 | 0 | 0 | 0 | 0 | 0 | 83.584 | 86.857 | -.96594 |
| 225 | 0 | 0 | 0 | 0 | 0 | 0 | 82.635 | 85.528 | -.96594 |
| 226 | 0 | 0 | 0 | 0 | 0 | 0 | 81.686 | 84.199 | -.96594 |
| 227 | 0 | 0 | 0 | 0 | 0 | 0 | 80.738 | 82.871 | -.96594 |
| 228 | 0 | 0 | 0 | 0 | 0 | 0 | 79.789 | 81.542 | -.96594 |
| 229 | 0 | 0 | 0 | 0 | 0 | 0 | 78.841 | 80.213 | -.96594 |
| 230 | 0 | 0 | 0 | 0 | 0 | 0 | 77.893 | 78.884 | -.96594 |
| 231 | 0 | 0 | 0 | 0 | 0 | 0 | 76.944 | 77.556 | -.96594 |
| 232 | 0 | 0 | 0 | 0 | 0 | 0 | 94.510 | 105.13 | -.96594 |
| 233 | 0 | 0 | 0 | 0 | 0 | 0 | 93.562 | 103.80 | -.96594 |
| 234 | 0 | 0 | 0 | 0 | 0 | 0 | 92.613 | 102.48 | -.96594 |
| 235 | 0 | 0 | 0 | 0 | 0 | 0 | 91.664 | 101.15 | -.96594 |
| 236 | 0 | 0 | 0 | 0 | 0 | 0 | 90.716 | 99.818 | -.96594 |
| 237 | 0 | 0 | 0 | 0 | 0 | 0 | 89.768 | 98.489 | -.96594 |
| 238 | 0 | 0 | 0 | 0 | 0 | 0 | 88.819 | 97.160 | -.96594 |
| 239 | 0 | 0 | 0 | 0 | 0 | 0 | 87.870 | 95.832 | -.96594 |
| 240 | 0 | 0 | 0 | 0 | 0 | 0 | 86.922 | 94.503 | -.96594 |
| 241 | 0 | 0 | 0 | 0 | 0 | 0 | 85.974 | 93.174 | -.96594 |
| 242 | 0 | 0 | 0 | 0 | 0 | 0 | 85.025 | 91.846 | -.96594 |
| 243 | 0 | 0 | 0 | 0 | 0 | 0 | 84.076 | 90.517 | -.96594 |
| 244 | 0 | 0 | 0 | 0 | 0 | 0 | 83.128 | 89.188 | -.96594 |
| 245 | 0 | 0 | 0 | 0 | 0 | 0 | 82.180 | 87.859 | -.96594 |
| 246 | 0 | 0 | 0 | 0 | 0 | 0 | 81.231 | 86.531 | -.96594 |
| 247 | 0 | 0 | 0 | 0 | 0 | 0 | 80.282 | 85.202 | -.96594 |
| 248 | 0 | 0 | 0 | 0 | 0 | 0 | 79.334 | 83.873 | -.96594 |
| 249 | 0 | 0 | 0 | 0 | 0 | 0 | 78.385 | 82.544 | -.96594 |
| 250 | 0 | 0 | 0 | 0 | 0 | 0 | 77.437 | 81.215 | -.96594 |
| 251 | 0 | 0 | 0 | 0 | 0 | 0 | 76.489 | 79.887 | -.96594 |
| 252 | 0 | 0 | 0 | 0 | 0 | 0 | 75.540 | 78.558 | -.96594 |
| 253 | 0 | 0 | 0 | 0 | 0 | 0 | 81.562 | 73.215 | .00000 |
| 254 | 0 | 0 | 0 | 0 | 0 | 0 | 80.720 | 72.035 | .00000 |
| 255 | 0 | 0 | 0 | 0 | 0 | 0 | 79.877 | 70.855 | .00000 |
| 256 | 0 | 0 | 0 | 0 | 0 | 0 | 79.035 | 69.674 | .00000 |
| 257 | 0 | 0 | 0 | 0 | 0 | 0 | 78.192 | 68.494 | .00000 |
| 258 | 0 | 0 | 0 | 0 | 0 | 0 | 77.350 | 67.314 | .00000 |
| 259 | 0 | 0 | 0 | 0 | 0 | 0 | 76.507 | 66.134 | .00000 |
| 260 | 0 | 0 | 0 | 0 | 0 | 0 | 75.665 | 64.954 | .00000 |
| 261 | 0 | 0 | 0 | 0 | 0 | 0 | 74.822 | 63.773 | .00000 |
| 262 | 0 | 0 | 0 | 0 | 0 | 0 | 73.980 | 62.593 | .00000 |
| 263 | 0 | 0 | 0 | 0 | 0 | 0 | 73.137 | 61.413 | .00000 |
| 264 | 0 | 0 | 0 | 0 | 0 | 0 | 72.295 | 60.233 | .00000 |
| 265 | 0 | 0 | 0 | 0 | 0 | 0 | 71.453 | 59.053 | .00000 |
| 266 | 0 | 0 | 0 | 0 | 0 | 0 | 70.610 | 57.872 | .00000 |
| 267 | 0 | 0 | 0 | 0 | 0 | 0 | 69.768 | 56.692 | .00000 |
| 268 | 0 | 0 | 0 | 0 | 0 | 0 | 68.925 | 55.512 | .00000 |
| 269 | 0 | 0 | 0 | 0 | 0 | 0 | 68.083 | 54.332 | .00000 |
| 270 | 0 | 0 | 0 | 0 | 0 | 0 | 67.240 | 53.152 | .00000 |

| | | |

Element input data

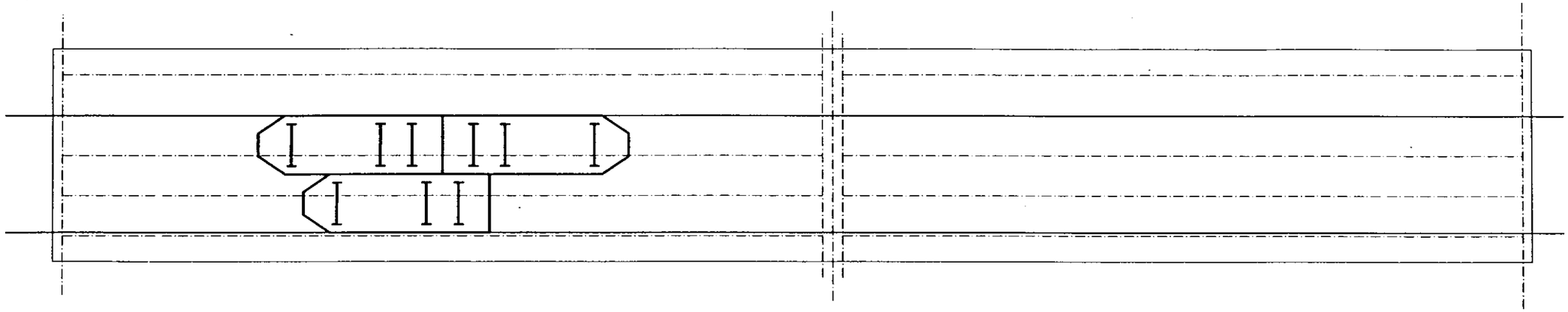
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ELEM EGRP MP REAL ECS NODE 1 NODE 2 NODE 3 NODE 4 NODE 5 NODE 6
NODE 7 NODE 8 NODE 9 NODE10 NODE11 NODE12
NODE13 NODE14 NODE15 NODE16 NODE17 NODE18
NODE19 NODE20

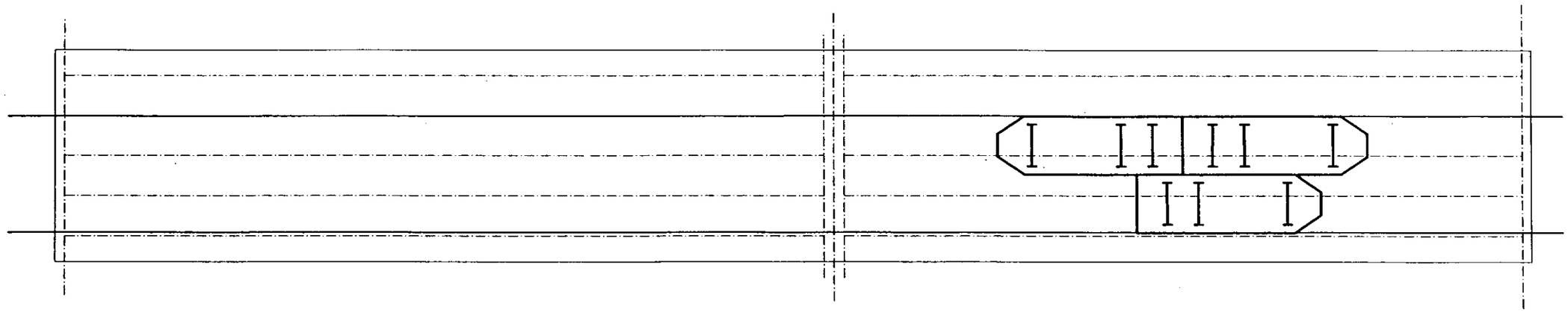
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 1 | -1 | 1 | 2 | 23 | 22 |
| 2 | 2 | 1 | 1 | -1 | 2 | 3 | 24 | 23 |
| 3 | 2 | 1 | 1 | -1 | 3 | 4 | 25 | 24 |
| 4 | 2 | 1 | 1 | -1 | 4 | 5 | 26 | 25 |
| 5 | 2 | 1 | 1 | -1 | 5 | 6 | 27 | 26 |
| 6 | 2 | 1 | 1 | -1 | 6 | 7 | 28 | 27 |
| 7 | 2 | 1 | 1 | -1 | 7 | 8 | 29 | 28 |
| 8 | 2 | 1 | 1 | -1 | 8 | 9 | 30 | 29 |
| 9 | 2 | 1 | 1 | -1 | 9 | 10 | 31 | 30 |
| 10 | 2 | 1 | 1 | -1 | 10 | 11 | 32 | 31 |
| 11 | 2 | 1 | 1 | -1 | 11 | 12 | 33 | 32 |
| 12 | 2 | 1 | 1 | -1 | 12 | 13 | 34 | 33 |
| 13 | 2 | 1 | 1 | -1 | 13 | 14 | 35 | 34 |
| 14 | 2 | 1 | 1 | -1 | 14 | 15 | 36 | 35 |
| 15 | 2 | 1 | 1 | -1 | 15 | 16 | 37 | 36 |
| 16 | 2 | 1 | 1 | -1 | 16 | 17 | 38 | 37 |
| 17 | 2 | 1 | 1 | -1 | 17 | 18 | 39 | 38 |
| 18 | 2 | 1 | 1 | -1 | 18 | 19 | 40 | 39 |
| 19 | 2 | 1 | 1 | -1 | 19 | 20 | 41 | 40 |
| 20 | 2 | 1 | 1 | -1 | 20 | 21 | 42 | 41 |
| 21 | 2 | 1 | 1 | -1 | 22 | 23 | 44 | 43 |
| 22 | 2 | 1 | 1 | -1 | 23 | 24 | 45 | 44 |
| 23 | 2 | 1 | 1 | -1 | 24 | 25 | 46 | 45 |
| 24 | 2 | 1 | 1 | -1 | 25 | 26 | 47 | 46 |
| 25 | 2 | 1 | 1 | -1 | 26 | 27 | 48 | 47 |
| 26 | 2 | 1 | 1 | -1 | 27 | 28 | 49 | 48 |
| 27 | 2 | 1 | 1 | -1 | 28 | 29 | 50 | 49 |
| 28 | 2 | 1 | 1 | -1 | 29 | 30 | 51 | 50 |
| 29 | 2 | 1 | 1 | -1 | 30 | 31 | 52 | 51 |
| 30 | 2 | 1 | 1 | -1 | 31 | 32 | 53 | 52 |
| 31 | 2 | 1 | 1 | -1 | 32 | 33 | 54 | 53 |
| 32 | 2 | 1 | 1 | -1 | 33 | 34 | 55 | 54 |
| 33 | 2 | 1 | 1 | -1 | 34 | 35 | 56 | 55 |
| 34 | 2 | 1 | 1 | -1 | 35 | 36 | 57 | 56 |
| 35 | 2 | 1 | 1 | -1 | 36 | 37 | 58 | 57 |
| 36 | 2 | 1 | 1 | -1 | 37 | 38 | 59 | 58 |
| 37 | 2 | 1 | 1 | -1 | 38 | 39 | 60 | 59 |
| 38 | 2 | 1 | 1 | -1 | 39 | 40 | 61 | 60 |
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| 40 | 2 | 1 | 1 | -1 | 41 | 42 | 63 | 62 |
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| 43 | 2 | 1 | 1 | -1 | 45 | 46 | 67 | 66 |
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| 72 | 2 | 1 | 1 | -1 | 75 | 76 | 97 | 96 |
| 73 | 2 | 1 | 1 | -1 | 76 | 77 | 98 | 97 |
| 74 | 2 | 1 | 1 | -1 | 77 | 78 | 99 | 98 |
| 75 | 2 | 1 | 1 | -1 | 78 | 79 | 100 | 99 |
| 76 | 2 | 1 | 1 | -1 | 79 | 80 | 101 | 100 |
| 77 | 2 | 1 | 1 | -1 | 80 | 81 | 102 | 101 |
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| 87 | 2 | 1 | 1 | -1 | 91 | 92 | 113 | 112 |
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| 89 | 2 | 1 | 1 | -1 | 93 | 94 | 115 | 114 |
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| 420 | 2 | 1 | 4 | -1 | 351 | 352 | 373 | 372 |
| 421 | 2 | 1 | 4 | -1 | 352 | 353 | 374 | 373 |
| 422 | 2 | 1 | 4 | -1 | 353 | 354 | 375 | 374 |
| 423 | 2 | 1 | 4 | -1 | 354 | 355 | 376 | 375 |
| 424 | 2 | 1 | 4 | -1 | 355 | 356 | 377 | 376 |
| 425 | 2 | 1 | 4 | -1 | 356 | 357 | 378 | 377 |
| 426 | 2 | 1 | 4 | -1 | 358 | 359 | 380 | 379 |
| 427 | 2 | 1 | 4 | -1 | 359 | 360 | 381 | 380 |
| 428 | 2 | 1 | 4 | -1 | 360 | 361 | 382 | 381 |
| 429 | 2 | 1 | 4 | -1 | 361 | 362 | 383 | 382 |
| 430 | 2 | 1 | 4 | -1 | 362 | 363 | 384 | 383 |
| 431 | 2 | 1 | 4 | -1 | 363 | 364 | 385 | 384 |
| 432 | 2 | 1 | 4 | -1 | 364 | 365 | 386 | 385 |
| 433 | 2 | 1 | 4 | -1 | 365 | 366 | 387 | 386 |
| 434 | 2 | 1 | 4 | -1 | 366 | 367 | 388 | 387 |
| 435 | 2 | 1 | 4 | -1 | 367 | 368 | 389 | 388 |
| 436 | 2 | 1 | 4 | -1 | 368 | 369 | 390 | 389 |
| 437 | 2 | 1 | 4 | -1 | 369 | 370 | 391 | 390 |
| 438 | 2 | 1 | 4 | -1 | 370 | 371 | 392 | 391 |
| 439 | 2 | 1 | 4 | -1 | 371 | 372 | 393 | 392 |
| 440 | 2 | 1 | 4 | -1 | 372 | 373 | 394 | 393 |
| 441 | 2 | 1 | 4 | -1 | 373 | 374 | 395 | 394 |
| 442 | 2 | 1 | 4 | -1 | 374 | 375 | 396 | 395 |
| 443 | 2 | 1 | 4 | -1 | 375 | 376 | 397 | 396 |
| 444 | 2 | 1 | 4 | -1 | 376 | 377 | 398 | 397 |
| 445 | 2 | 1 | 4 | -1 | 377 | 378 | 399 | 398 |
| 446 | 1 | 3 | 5 | -1 | 274 | 400 | 294 | |
| 447 | 1 | 3 | 5 | -1 | 275 | 401 | 294 | |
| 448 | 1 | 3 | 5 | -1 | 276 | 402 | 294 | |
| 449 | 1 | 3 | 5 | -1 | 277 | 403 | 294 | |
| 450 | 1 | 3 | 5 | -1 | 278 | 404 | 294 | |
| 451 | 1 | 3 | 5 | -1 | 279 | 405 | 294 | |
| 452 | 1 | 3 | 5 | -1 | 280 | 406 | 294 | |
| 453 | 1 | 3 | 5 | -1 | 281 | 407 | 294 | |
| 454 | 1 | 3 | 5 | -1 | 282 | 408 | 294 | |
| 455 | 1 | 3 | 5 | -1 | 283 | 409 | 294 | |
| 456 | 1 | 3 | 5 | -1 | 284 | 410 | 274 | |
| 457 | 1 | 3 | 5 | -1 | 285 | 411 | 274 | |
| 458 | 1 | 3 | 5 | -1 | 286 | 412 | 274 | |
| 459 | 1 | 3 | 5 | -1 | 287 | 413 | 274 | |
| 460 | 1 | 3 | 5 | -1 | 288 | 414 | 274 | |
| 461 | 1 | 3 | 5 | -1 | 289 | 415 | 274 | |
| 462 | 1 | 3 | 5 | -1 | 290 | 416 | 274 | |
| 463 | 1 | 3 | 5 | -1 | 291 | 417 | 274 | |
| 464 | 1 | 3 | 5 | -1 | 292 | 418 | 274 | |
| 465 | 1 | 3 | 5 | -1 | 293 | 419 | 274 | |
| 466 | 1 | 3 | 5 | -1 | 294 | 420 | 274 | |
| 467 | 1 | 3 | 5 | -1 | 295 | 421 | 315 | |
| 468 | 1 | 3 | 5 | -1 | 296 | 422 | 315 | |
| 469 | 1 | 3 | 5 | -1 | 297 | 423 | 315 | |
| 470 | 1 | 3 | 5 | -1 | 298 | 424 | 315 | |
| 471 | 1 | 3 | 5 | -1 | 299 | 425 | 315 | |
| 472 | 1 | 3 | 5 | -1 | 300 | 426 | 315 | |
| 473 | 1 | 3 | 5 | -1 | 301 | 427 | 315 | |
| 474 | 1 | 3 | 5 | -1 | 302 | 428 | 315 | |
| 475 | 1 | 3 | 5 | -1 | 303 | 429 | 315 | |
| 476 | 1 | 3 | 5 | -1 | 304 | 430 | 315 | |
| 477 | 1 | 3 | 5 | -1 | 305 | 431 | 295 | |
| 478 | 1 | 3 | 5 | -1 | 306 | 432 | 295 | |
| 479 | 1 | 3 | 5 | -1 | 307 | 433 | 295 | |
| 480 | 1 | 3 | 5 | -1 | 308 | 434 | 295 | |
| 481 | 1 | 3 | 5 | -1 | 309 | 435 | 295 | |
| 482 | 1 | 3 | 5 | -1 | 310 | 436 | 295 | |
| 483 | 1 | 3 | 5 | -1 | 311 | 437 | 295 | |
| 484 | 1 | 3 | 5 | -1 | 312 | 438 | 295 | |
| 485 | 1 | 3 | 5 | -1 | 313 | 439 | 295 | |
| 486 | 1 | 3 | 5 | -1 | 314 | 440 | 295 | |
| 487 | 1 | 3 | 5 | -1 | 315 | 441 | 295 | |
| 488 | 1 | 3 | 5 | -1 | 316 | 442 | 336 | |
| 489 | 1 | 3 | 5 | -1 | 317 | 443 | 336 | |
| 490 | 1 | 3 | 5 | -1 | 318 | 444 | 336 | |
| 491 | 1 | 3 | 5 | -1 | 319 | 445 | 336 | |
| 492 | 1 | 3 | 5 | -1 | 320 | 446 | 336 | |
| 493 | 1 | 3 | 5 | -1 | 321 | 447 | 336 | |
| 494 | 1 | 3 | 5 | -1 | 322 | 448 | 336 | |
| 495 | 1 | 3 | 5 | -1 | 323 | 449 | 336 | |
| 496 | 1 | 3 | 5 | -1 | 324 | 450 | 336 | |
| 497 | 1 | 3 | 5 | -1 | 325 | 451 | 336 | |
| 498 | 1 | 3 | 5 | -1 | 326 | 452 | 316 | |
| 499 | 1 | 3 | 5 | -1 | 327 | 453 | 316 | |
| 500 | 1 | 3 | 5 | -1 | 328 | 454 | 316 | |
| 501 | 1 | 3 | 5 | -1 | 329 | 455 | 316 | |
| 502 | 1 | 3 | 5 | -1 | 330 | 456 | 316 | |
| 503 | 1 | 3 | 5 | -1 | 331 | 457 | 316 | |
| 504 | 1 | 3 | 5 | -1 | 332 | 458 | 316 | |
| 505 | 1 | 3 | 5 | -1 | 333 | 459 | 316 | |
| 506 | 1 | 3 | 5 | -1 | 334 | 460 | 316 | |
| 507 | 1 | 3 | 5 | -1 | 335 | 461 | 316 | |
| 508 | 1 | 3 | 5 | -1 | 336 | 462 | 316 | |
| 509 | 1 | 3 | 5 | -1 | 337 | 463 | 357 | |
| 510 | 1 | 3 | 5 | -1 | 338 | 464 | 357 | |
| 511 | 1 | 3 | 5 | -1 | 339 | 465 | 357 | |
| 512 | 1 | 3 | 5 | -1 | 340 | 466 | 357 | |
| 513 | 1 | 3 | 5 | -1 | 341 | 467 | 357 | |
| 514 | 1 | 3 | 5 | -1 | 342 | 468 | 357 | |
| 515 | 1 | 3 | 5 | -1 | 343 | 469 | 357 | |
| 516 | 1 | 3 | 5 | -1 | 344 | 470 | 357 | |
| 517 | 1 | 3 | 5 | -1 | 345 | 471 | 357 | |
| 518 | 1 | 3 | 5 | -1 | 346 | 472 | 357 | |
| 519 | 1 | 3 | 5 | -1 | 347 | 473 | 337 | |
| 520 | 1 | 3 | 5 | -1 | 348 | 474 | 337 | |
| 521 | 1 | 3 | 5 | -1 | 349 | 475 | 337 | |
| 522 | 1 | 3 | 5 | -1 | 350 | 476 | 337 | |
| 523 | 1 | 3 | 5 | -1 | 351 | 477 | 337 | |
| 524 | 1 | 3 | 5 | -1 | 352 | 478 | 337 | |
| 525 | 1 | 3 | 5 | -1 | 353 | 479 | 337 | |
| 526 | 1 | 3 | 5 | -1 | 354 | 480 | 337 | |
| 527 | 1 | 3 | 5 | -1 | 355 | 481 | 337 | |
| 528 | 1 | 3 | 5 | -1 | 356 | 482 | 337 | |
| 529 | 1 | 3 | 5 | -1 | 357 | 483 | 337 | |
| 530 | 1 | 3 | 5 | -1 | 358 | 484 | 378 | |
| 531 | 1 | 3 | 5 | -1 | 359 | 485 | 378 | |
| 532 | 1 | 3 | 5 | -1 | 360 | 486 | 378 | |
| 533 | 1 | 3 | 5 | -1 | 361 | 487 | 378 | |
| 534 | 1 | 3 | 5 | -1 | 362 | 488 | 378 | |
| 535 | 1 | 3 | 5 | -1 | 363 | 489 | 378 | |
| 536 | 1 | 3 | 5 | -1 | 364 | 490 | 378 | |
| 537 | 1 | 3 | 5 | -1 | 365 | 491 | 378 | |
| 538 | 1 | 3 | 5 | -1 | 366 | 492 | 378 | |
| 539 | 1 | 3 | 5 | -1 | 367 | 493 | 378 | |
| 540 | 1 | 3 | 5 | -1 | 368 | 494 | 358 | |
| 541 | 1 | 3 | 5 | -1 | 369 | 495 | 358 | |
| 542 | 1 | 3 | 5 | -1 | 370 | 496 | 358 | |
| 543 | 1 | 3 | 5 | -1 | 371 | 497 | 358 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 544 | 1 | 3 | 5 | -1 | 372 | 498 | 358 |
| 545 | 1 | 3 | 5 | -1 | 373 | 499 | 358 |
| 546 | 1 | 3 | 5 | -1 | 374 | 500 | 358 |
| 547 | 1 | 3 | 5 | -1 | 375 | 501 | 358 |
| 548 | 1 | 3 | 5 | -1 | 376 | 502 | 358 |
| 549 | 1 | 3 | 5 | -1 | 377 | 503 | 358 |
| 550 | 1 | 3 | 5 | -1 | 378 | 504 | 358 |
| 551 | 1 | 2 | 6 | -1 | 400 | 401 | 294 |
| 552 | 1 | 2 | 6 | -1 | 401 | 402 | 294 |
| 553 | 1 | 2 | 6 | -1 | 402 | 403 | 294 |
| 554 | 1 | 2 | 6 | -1 | 403 | 404 | 294 |
| 555 | 1 | 2 | 6 | -1 | 404 | 405 | 294 |
| 556 | 1 | 2 | 6 | -1 | 405 | 406 | 294 |
| 557 | 1 | 2 | 6 | -1 | 406 | 407 | 294 |
| 558 | 1 | 2 | 6 | -1 | 407 | 408 | 294 |
| 559 | 1 | 2 | 6 | -1 | 408 | 409 | 294 |
| 560 | 1 | 2 | 6 | -1 | 409 | 410 | 294 |
| 561 | 1 | 2 | 6 | -1 | 410 | 411 | 294 |
| 562 | 1 | 2 | 6 | -1 | 411 | 412 | 294 |
| 563 | 1 | 2 | 6 | -1 | 412 | 413 | 294 |
| 564 | 1 | 2 | 6 | -1 | 413 | 414 | 294 |
| 565 | 1 | 2 | 6 | -1 | 414 | 415 | 294 |
| 566 | 1 | 2 | 6 | -1 | 415 | 416 | 294 |
| 567 | 1 | 2 | 6 | -1 | 416 | 417 | 294 |
| 568 | 1 | 2 | 6 | -1 | 417 | 418 | 294 |
| 569 | 1 | 2 | 6 | -1 | 418 | 419 | 294 |
| 570 | 1 | 2 | 6 | -1 | 419 | 420 | 294 |
| 571 | 1 | 2 | 6 | -1 | 421 | 422 | 315 |
| 572 | 1 | 2 | 6 | -1 | 422 | 423 | 315 |
| 573 | 1 | 2 | 6 | -1 | 423 | 424 | 315 |
| 574 | 1 | 2 | 6 | -1 | 424 | 425 | 315 |
| 575 | 1 | 2 | 6 | -1 | 425 | 426 | 315 |
| 576 | 1 | 2 | 6 | -1 | 426 | 427 | 315 |
| 577 | 1 | 2 | 6 | -1 | 427 | 428 | 315 |
| 578 | 1 | 2 | 6 | -1 | 428 | 429 | 315 |
| 579 | 1 | 2 | 6 | -1 | 429 | 430 | 315 |
| 580 | 1 | 2 | 6 | -1 | 430 | 431 | 315 |
| 581 | 1 | 2 | 6 | -1 | 431 | 432 | 315 |
| 582 | 1 | 2 | 6 | -1 | 432 | 433 | 315 |
| 583 | 1 | 2 | 6 | -1 | 433 | 434 | 315 |
| 584 | 1 | 2 | 6 | -1 | 434 | 435 | 315 |
| 585 | 1 | 2 | 6 | -1 | 435 | 436 | 315 |
| 586 | 1 | 2 | 6 | -1 | 436 | 437 | 315 |
| 587 | 1 | 2 | 6 | -1 | 437 | 438 | 315 |
| 588 | 1 | 2 | 6 | -1 | 438 | 439 | 315 |
| 589 | 1 | 2 | 6 | -1 | 439 | 440 | 315 |
| 590 | 1 | 2 | 6 | -1 | 440 | 441 | 315 |
| 591 | 1 | 2 | 6 | -1 | 442 | 443 | 336 |
| 592 | 1 | 2 | 6 | -1 | 443 | 444 | 336 |
| 593 | 1 | 2 | 6 | -1 | 444 | 445 | 336 |
| 594 | 1 | 2 | 6 | -1 | 445 | 446 | 336 |
| 595 | 1 | 2 | 6 | -1 | 446 | 447 | 336 |
| 596 | 1 | 2 | 6 | -1 | 447 | 448 | 336 |
| 597 | 1 | 2 | 6 | -1 | 448 | 449 | 336 |
| 598 | 1 | 2 | 6 | -1 | 449 | 450 | 336 |
| 599 | 1 | 2 | 6 | -1 | 450 | 451 | 336 |
| 600 | 1 | 2 | 6 | -1 | 451 | 452 | 336 |
| 601 | 1 | 2 | 6 | -1 | 452 | 453 | 336 |
| 602 | 1 | 2 | 6 | -1 | 453 | 454 | 336 |
| 603 | 1 | 2 | 6 | -1 | 454 | 455 | 336 |
| 604 | 1 | 2 | 6 | -1 | 455 | 456 | 336 |
| 605 | 1 | 2 | 6 | -1 | 456 | 457 | 336 |
| 606 | 1 | 2 | 6 | -1 | 457 | 458 | 336 |
| 607 | 1 | 2 | 6 | -1 | 458 | 459 | 336 |
| 608 | 1 | 2 | 6 | -1 | 459 | 460 | 336 |
| 609 | 1 | 2 | 6 | -1 | 460 | 461 | 336 |
| 610 | 1 | 2 | 6 | -1 | 461 | 462 | 336 |
| 611 | 1 | 2 | 6 | -1 | 463 | 464 | 357 |
| 612 | 1 | 2 | 6 | -1 | 464 | 465 | 357 |
| 613 | 1 | 2 | 6 | -1 | 465 | 466 | 357 |
| 614 | 1 | 2 | 6 | -1 | 466 | 467 | 357 |
| 615 | 1 | 2 | 6 | -1 | 467 | 468 | 357 |
| 616 | 1 | 2 | 6 | -1 | 468 | 469 | 357 |
| 617 | 1 | 2 | 6 | -1 | 469 | 470 | 357 |
| 618 | 1 | 2 | 6 | -1 | 470 | 471 | 357 |
| 619 | 1 | 2 | 6 | -1 | 471 | 472 | 357 |
| 620 | 1 | 2 | 6 | -1 | 472 | 473 | 357 |
| 621 | 1 | 2 | 6 | -1 | 473 | 474 | 357 |
| 622 | 1 | 2 | 6 | -1 | 474 | 475 | 357 |
| 623 | 1 | 2 | 6 | -1 | 475 | 476 | 357 |
| 624 | 1 | 2 | 6 | -1 | 476 | 477 | 357 |
| 625 | 1 | 2 | 6 | -1 | 477 | 478 | 357 |
| 626 | 1 | 2 | 6 | -1 | 478 | 479 | 357 |
| 627 | 1 | 2 | 6 | -1 | 479 | 480 | 357 |
| 628 | 1 | 2 | 6 | -1 | 480 | 481 | 357 |
| 629 | 1 | 2 | 6 | -1 | 481 | 482 | 357 |
| 630 | 1 | 2 | 6 | -1 | 482 | 483 | 357 |
| 631 | 1 | 2 | 6 | -1 | 484 | 485 | 378 |
| 632 | 1 | 2 | 6 | -1 | 485 | 486 | 378 |
| 633 | 1 | 2 | 6 | -1 | 486 | 487 | 378 |
| 634 | 1 | 2 | 6 | -1 | 487 | 488 | 378 |
| 635 | 1 | 2 | 6 | -1 | 488 | 489 | 378 |
| 636 | 1 | 2 | 6 | -1 | 489 | 490 | 378 |
| 637 | 1 | 2 | 6 | -1 | 490 | 491 | 378 |
| 638 | 1 | 2 | 6 | -1 | 491 | 492 | 378 |
| 639 | 1 | 2 | 6 | -1 | 492 | 493 | 378 |
| 640 | 1 | 2 | 6 | -1 | 493 | 494 | 378 |
| 641 | 1 | 2 | 6 | -1 | 494 | 495 | 378 |
| 642 | 1 | 2 | 6 | -1 | 495 | 496 | 378 |
| 643 | 1 | 2 | 6 | -1 | 496 | 497 | 378 |
| 644 | 1 | 2 | 6 | -1 | 497 | 498 | 378 |
| 645 | 1 | 2 | 6 | -1 | 498 | 499 | 378 |
| 646 | 1 | 2 | 6 | -1 | 499 | 500 | 378 |
| 647 | 1 | 2 | 6 | -1 | 500 | 501 | 378 |
| 648 | 1 | 2 | 6 | -1 | 501 | 502 | 378 |
| 649 | 1 | 2 | 6 | -1 | 502 | 503 | 378 |
| 650 | 1 | 2 | 6 | -1 | 503 | 504 | 378 |
| 651 | 1 | 4 | 7 | -1 | 148 | 505 | 42 |
| 652 | 1 | 4 | 7 | -1 | 169 | 506 | 63 |
| 653 | 1 | 4 | 7 | -1 | 190 | 507 | 84 |
| 654 | 1 | 4 | 7 | -1 | 211 | 508 | 105 |
| 655 | 1 | 4 | 7 | -1 | 232 | 509 | 126 |
| 656 | 1 | 4 | 8 | -1 | 168 | 510 | 22 |
| 657 | 1 | 4 | 8 | -1 | 189 | 511 | 43 |
| 658 | 1 | 4 | 8 | -1 | 210 | 512 | 64 |
| 659 | 1 | 4 | 8 | -1 | 231 | 513 | 85 |
| 660 | 1 | 4 | 8 | -1 | 252 | 514 | 106 |
| 661 | 1 | 4 | 9 | -1 | 400 | 515 | 294 |
| 662 | 1 | 4 | 9 | -1 | 421 | 516 | 315 |
| 663 | 1 | 4 | 9 | -1 | 442 | 517 | 336 |
| 664 | 1 | 4 | 9 | -1 | 463 | 518 | 357 |
| 665 | 1 | 4 | 9 | -1 | 484 | 519 | 378 |
| 666 | 1 | 4 | 10 | -1 | 420 | 520 | 274 |
| 667 | 1 | 4 | 10 | -1 | 441 | 521 | 295 |
| 668 | 1 | 4 | 10 | -1 | 462 | 522 | 316 |
| 669 | 1 | 4 | 10 | -1 | 483 | 523 | 337 |
| 670 | 1 | 4 | 10 | -1 | 504 | 524 | 358 |
| 671 | 1 | 3 | 5 | -1 | 526 | 515 | 527 |
| 672 | 1 | 3 | 5 | -1 | 526 | 510 | 527 |
| 673 | 1 | 1 | 11 | -1 | 526 | 528 | 529 |
| 674 | 1 | 3 | 5 | -1 | 530 | 516 | 531 |
| 675 | 1 | 1 | 11 | -1 | 528 | 530 | 531 |
| 676 | 1 | 3 | 5 | -1 | 530 | 511 | 531 |
| 677 | 1 | 3 | 5 | -1 | 532 | 517 | 533 |
| 678 | 1 | 1 | 11 | -1 | 530 | 532 | 533 |
| 679 | 1 | 3 | 5 | -1 | 532 | 512 | 533 |
| 680 | 1 | 3 | 5 | -1 | 534 | 518 | 535 |
| 681 | 1 | 1 | 11 | -1 | 532 | 534 | 535 |
| 682 | 1 | 3 | 5 | -1 | 534 | 513 | 535 |
| 683 | 1 | 1 | 11 | -1 | 534 | 536 | 537 |
| 684 | 1 | 3 | 5 | -1 | 538 | 519 | 539 |
| 685 | 1 | 1 | 11 | -1 | 536 | 538 | 539 |
| 686 | 1 | 3 | 5 | -1 | 538 | 514 | 539 |
| 687 | 1 | 5 | 12 | -1 | 528 | 540 | 525 |
| 688 | 1 | 5 | 12 | -1 | 536 | 541 | 525 |
| 689 | 1 | 3 | 13 | -1 | 21 | 274 | 1 |
| 690 | 1 | 3 | 13 | -1 | 42 | 253 | 1 |
| 691 | 1 | 3 | 13 | -1 | 42 | 295 | 1 |
| 692 | 1 | 3 | 13 | -1 | 63 | 274 | 1 |
| 693 | 1 | 3 | 13 | -1 | 63 | 316 | 1 |
| 694 | 1 | 3 | 13 | -1 | 84 | 295 | 1 |
| 695 | 1 | 3 | 13 | -1 | 84 | 337 | 1 |
| 696 | 1 | 3 | 13 | -1 | 105 | 316 | 1 |
| 697 | 1 | 3 | 13 | -1 | 105 | 358 | 1 |
| 698 | 1 | 3 | 13 | -1 | 126 | 337 | 1 |
| 699 | 1 | 3 | 13 | -1 | 126 | 379 | 1 |
| 700 | 1 | 3 | 13 | -1 | 147 | 358 | 1 |



DISPOSICION CAMIONES EN PRUEBA DE CARGA. Combinacion 1.



DISPOSICION CAMIONES EN PRUEBA DE CARGA. Combinacion 2.

# DATOS PARA LA REALIZACION DE LA PRUEBA DE CARGA

**PROYECTO :** L.A.V. Tramo Madrid-Zaragoza. Subtramo XV
**ESTRUCTURA:** E-1520.4

**DATOS:**

(Dejar vacios los datos que no existan)

**DEFINICION DE HIPOTESIS SIMPLES**

| Hipotesis de carga número | Vano que se carga | Tipo de carro | Posicion relativa cdg longitudinal | Posicion relativa cdg transversal |
|---|---|---|---|---|
| 1 | 1 | 1 | 0.50 | 0.45 |
| 2 | 1 | 3 | 0.44 | 0.73 |
| 3 | 2 | 1 | 0.50 | 0.45 |
| 4 | 2 | 2 | 0.57 | 0.73 |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
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| 30 | | | | |

**DEFINICION DE TIPOS DE CARROS**

| Carro Tipo | Numero de ejes (maximo 6 | Separacion longitudinal entre ejes consecutivos(en metros) | | | | | Cargas en ejes (en toneladas) | | | | | | Separacion transvesal de ejes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 1 | 2 | 3 | 4 | 5 | 6 | |
| 1 | 6 | 3.83 | 1.36 | 2.60 | 1.36 | 3.83 | 6.50 | 11.75 | 11.75 | 11.75 | 11.75 | 6.50 | 1.80 |
| 2 | 3 | 1.36 | 3.83 | | | | 11.75 | 11.75 | 6.50 | | | | 1.80 |
| 3 | 3 | 3.83 | 1.36 | | | | 6.50 | 11.75 | 11.75 | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |

(todos los valores serán positivos)

**COMBINACIONES DE HIPOTESIS SIMPLES PARA EL CALCULO DE FLECHAS**

| Combinacion numero | Vano en el que se utilizará | HIPOTESIS DE CARGA SIMPLES QUE SE SUMAN | | | | | | | | | | | | Situación del carro de la Instrucción para obtener esfuerzos de referencia | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Posicion relativa cdg longitudinal | Posicion relativa cdg transversal |
| 1 | 1 | 1 | 2 | | | | | | | | | | | 0.50 | 0.59 |
| 2 | 2 | 3 | 4 | | | | | | | | | | | 0.50 | 0.59 |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | |

**ESFUERZOS DE REFERENCIA**

| VANO Nº | Momento (m.t) | Cortante (t.) |
|---|---|---|
| 1 | 308.13 | 69.91 |
| 2 | 308.13 | 69.91 |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
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| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |

**RESULTADOS:**

| Combinac. Nº | Vano Nº | Viga Nº | FLECHA (mm.) | Momento (m.t.) | M/Mref (%) | Cortante (t.) | V/Vref. (%) |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | -8.0 | 219.2 | 71% | 6.4 | 9% |
| | | 2 | -9.2 | 219.8 | 71% | 11.5 | 17% |
| | | 3 | -9.7 | 206.7 | 67% | 8.8 | 13% |
| | | 4 | -9.3 | 185.0 | 60% | 10.9 | 16% |
| | | 5 | -8.2 | 157.8 | 51% | 6.3 | 9% |
| 2 | 2 | 1 | -4.8 | 209.6 | 68% | 4.9 | 7% |
| | | 2 | -6.0 | 221.1 | 72% | 10.9 | 16% |
| | | 3 | -6.7 | 213.5 | 69% | 9.3 | 13% |
| | | 4 | -6.9 | 203.1 | 66% | 10.7 | 15% |
| | | 5 | -6.8 | 198.0 | 64% | 8.1 | 12% |