

ESCUELA NACIONAL DE INGENIEROS

Departamento de Ingeniería Civil

CALCULO DE UNA ESTRUCTURA DE CONCRETO ARMADO

PROYECTO DE GRADO
Presentado por el ex-alumno

JUAN KOCCHI CH.

Para optar el Título de
INGENIERO CIVIL

PROMOCION

1951

LIMA-PERU

1953

ESCUELA NACIONAL DE INGENIEROS
Departamento de
Ingenieria Civil

ESPECIFICACIONES PARA EL PROYECTO DE
GRADO DEL ALUMNO JUAN KOCCHIU, DE LA
PROMOCION 1951

Tema: Concreto Armado

Proyectar la estructura de concreto armado del edificio cuyos planos arquitectonicos se adjuntan y que consta de sótano (a toda el area) 1er. piso y 4 pisos tipicos, en los que se hará el cambio de la distancia entre los dos ultimos ejes verticales de la derecha a 6.00 mts.

La estructura se proyectará para las siguientes características:

1.- Alturas piso a pisos:

| | |
|--------------|----------|
| sotano | 3.00 mts |
| 1er. piso | 4.20 " |
| pisos tipic. | 3.20 |

2.- Sobrecargas:

| | |
|--------------|-----------------------|
| 1er. piso | 400 Kg/m ² |
| pisos tipic. | 250 " |
| azotea | 100 " |

3.- Muros y tabiques:

perimetricos y a patios de luz, de
lad. cts. de 0.25

interiores, de ladrillo de 6 huecos
de soga.

Se presentará como mínimo:

- a) calculos justificativos;
- b) planos generales y de detalle, a escalas adecuadas;
- c) presupuesto de ejecucion de la estructura de concreto armado.

Lima, 6 de Noviembre de 1951

JUAN SARMIENTO
Prof. de Concreto Armado y
Jefe del Depto. de Ing. Civil

I N D I C E

| | | |
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LOSAS Y ALIGERADOS

LOSA CONTINUA TECHO DEL SOTANO

$(f'c = 210 \text{ Kg/cm}^2)$

$h = 18 \text{ cm.}$

$Pp = 1.00 \times 0.18 \times 2500 = 450 \text{ Kg/m.l.}$

Tabiques 100

Piso acabado 100

a/c. 400

$w = 1050 \text{ Kg/m.l.}$

Momentos de empotramiento perfectos:

$(L = 4.50 \text{ m.}) \quad M = 1050 \times 4.5^2 / 12 = 1770 \text{ Kgm.}$

$(L = 6.00 \text{ "}) \quad M = 1050 \times 6^2 / 12 = 3150 \text{ "}$

Momentos en el centro de la luz:

$(L = 4.50 \text{ m.}) \quad M = 1050 \times 4.5^2 / 8 = 2660 \text{ Kgm.}$

$(L = 6.00 \text{ "}) \quad M = 1050 \times 6^2 / 8 = 4730 \text{ "}$

| 1.00 | 0.5 | 0.5 | 0.57 | 0.43 | 1.00 |
|-------|-------|-------|-------|-------|-------|
| +1770 | -1770 | +1770 | -1770 | +3150 | -3150 |
| -1770 | 0 | 0 | -787 | -593 | +3150 |
| 0 | -885 | -393 | 0 | +1575 | -297 |
| 0 | +639 | +639 | -898 | -678 | +297 |
| +319 | 0 | -449 | +319 | +148 | -339 |
| -319 | +224 | +224 | -266 | -200 | +339 |
| +112 | -159 | -133 | +114 | +169 | -100 |
| -112 | +146 | +146 | -161 | -122 | +100 |
| +73 | -56 | -81 | +73 | +50 | -61 |
| -73 | +68 | +68 | -70 | -53 | +61 |
| 0 | -1793 | +1791 | -3446 | +3446 | 0 |

Para el cálculo de los demás tramos que tienen la misma luz se emplearán los momentos y esfuerzos cortantes que se especifican en el "reglamento del A.C.I.

Momentos negativos:

Apoyo extremo: $M = 1/24(wl^2) = 1050 \times 4.5^2 / 24 = 890$

$As = 89000 / 1400 \times 0.866 \times 15 = 4.4 \text{ cm}^2$

Primer apoyo interior:

$M = 1/10(wl^2) = 1050 \times 4.5^2 / 10 = 2130$

$$A_s = 213000/1400 \times 0.866 \times 15 = 11.7 \text{ cm}^2$$

Otros apoyos:

$$M = 1/11(wl^2) = 1050 \times 4.5^2 / 11 = 1940 \text{ Kgm.}$$

$$A_s = 194000/1400 \times 0.866 \times 15 = 10.7 \text{ cm}^2$$

Momentos positivos:

Tramo extremo:

$$M = 1/14(wl^2) = 1050 \times 4.5^2 / 14 = 1520 \text{ Kgm.}$$

$$A_s = 152000/1400 \times 0.866 \times 15 = 8.35 \text{ cm}^2$$

Otros tramos:

$$M = 1/16(wl^2) = 1050 \times 4.5^2 / 16 = 1330 \text{ Kgm.}$$

$$A_s = 133000/1400 \times 0.866 \times 15 = 7.32 \text{ cm}^2$$

$$A_{s \text{ temp}} = 0.0025 \times 100 \times 15 = 3.75 \text{ cm}^2$$

- o - o - o -

Comprobacion de la altura útil:

$$d = \sqrt{\frac{344600}{16.6 \times 100}} = 14.5 = \sim 15 \text{ cm.}$$

$$h = 15 + 3 = 18 \text{ cm.}$$

ALIGERADOS TECHOS: 1° - 2° - 3° y 4° PISO

($f_b = 140 \text{ Kg/cm}^2$)

$h = 25 \text{ cm.}$

P_p 365
 T 100
 $Piso$ 100
 a/c 250

$w = 815$

Momentos de empotramiento perfectos:

($L' = 4.2$) $M = 815 \times 4.2^2 / 12 = 1200 \text{ Kgm.}$

($L' = 5.70$) $M = 815 \times 5.7^2 / 12 = 2210 \text{ "}$

Momentos en el centro de la luz:

($L' = 4.2$) $M = 815 \times 4.2^2 / 8 = 1800 \text{ Kgm.}$

($L' = 5.7$) $M = 815 \times 5.7^2 / 8 = 3320 \text{ "}$

| 1.00 | 0.5 | 0.5 | 0.57 | 0.43 | 1.0 |
|-------|-------|-------|-------|-------|-------|
| +1200 | -1200 | +1200 | -1200 | +2210 | -2210 |
| -1200 | 0 | 0 | -575 | -434 | +2210 |
| 0 | -600 | -287 | 0 | +1105 | -217 |
| 0 | +443 | +443 | -630 | -475 | +217 |
| +222 | 0 | -315 | +222 | +108 | -238 |
| -222 | +157 | +157 | -188 | -142 | +238 |
| +78 | -111 | -94 | +78 | +119 | -71 |
| -78 | +103 | +103 | -112 | -85 | +71 |
| 0 | -1208 | +1207 | -2405 | +2406 | 0 |

Los momentos en los demas tramos que tienen la misma luz se puede emplear las formulas que admite el Reglamento del A.C.I.

Momentos negativos:

Apoyo extremo: $M = 1/24(wl^2) = 815 \times 4.2^2 / 24 = 600$

Primer apoyo interior:

$M = 1/10(wl^2) = 815 \times 4.2^2 / 10 = 1440$

$As = \text{XXIX} \quad 144000 / 1400 \times 19.5 \times 2.5 = 2.16$

Otros apoyos:

$$M = 1/11(wl^2) = 815 \times 4.2^2 / 11 = 1310 \text{ Kgm.}$$

$$As = 131000 / 1400(22-2.5)2.5 = 1.97 \text{ cm}^2$$

Momentos positivos:

Tramo extremos:

$$M = 1/14(wl^2) = 815 \times 4.2^2 / 14 = 1030 \text{ Kgm.}$$

$$As = 103000 / 1400 \times 0.866 \times 22 \times 2.5 = 1.55 \text{ cm}^2$$

Otros tramos:

$$M = 1/16(wl^2) = 815 \times 4.2^2 / 16 = 900 \text{ Kgm.}$$

$$As = 90000 / 1400 \times 0.866 \times 22 \times 2.5 = 1.35 \text{ cm}^2$$

Aceros minimos y acero de temperaturas:

$$As_{min} = 0.002 \times 10 \times 22 = 1.1 \text{ cm}^2$$

$$As_{temp} = 0.002 \times 100 \times 5 = 1.0 \text{ cm}^2 \quad \phi 1/4 \text{ a } 0.30$$

Ensanche de las viguetas:-

Primer apoyo interior:

$$b = M/Kd^2 = 144000 / 11 \times 22^2 \times 2.5 = 10.7 = \sim 10 \text{ cm.}$$

Apoyo interior del tramo de 5.70 m. :

$$b = 240000 / 11 \times 22^2 \times 2.5 = 18 \text{ cm.} = \sim 20 \text{ cm.}$$

Distancia del ensanche:

$$M_0 = 11 \times 10 \times 22^2 \times 2.5 = 133000$$

$$M_{max} = 332000$$

$$\frac{M_0}{M_{max}} = \frac{133}{332} = 0.4 \quad x = 0.184$$

$$a = 0.184 \times 5.7 = 1.05 \text{ m.} = \sim 1.20 \text{ m.}$$

Esf. Cort: $V_{max} = 0.575 \times 815 \times 5.7 = 2670 \text{ Kg.}$

$$B = 2670 / 2.5 \times 4.2 \times 0.866 \times 22 = 13.3 = \sim 20 \text{ cm.}$$

$$V_0 = 10 \times 0.866 \times 22 \times 4.2 \times 2.5 = 2000 \text{ Kg.}$$

$$x = \frac{2670 - 2000}{\cancel{22 \times 815}} = 0.83 \text{ m.} = \sim 1.20 \text{ m.}$$

ALIGERADO TECHO 5° PISO ($f'c=140 \text{ Kg/cm}^2$)

$h = 20 \text{ cm.}$

$P_p \quad 300$
 $P_{iso} \quad 100$
 $a/c \quad \underline{100}$

$w = 500$

Momentos de empotramiento perfectos:

$(L = 4.25) \quad M = 500 \times 4.25^2 / 12 = 755 \text{ Kgm.}$

$(L = 5.75) \quad M = 500 \times 5.75^2 / 12 = 1380 \text{ "}$

Momentos isostaticos en el centro de la luz:

$(L = 4.25) \quad M = 500 \times 4.25^2 / 8 = 1130 \text{ Kgm}$

$(L = 5.75) \quad M = 500 \times 5.75^2 / 8 = 2070 \text{ "}$

| 1.00 | 0.5 | 0.5 | 0.57 | 0.43 | 1.0 |
|-------|-------|-------|-------|-------|-------|
| + 755 | - 755 | + 755 | - 755 | +1380 | -1380 |
| - 755 | 0 | 0 | - 356 | - 269 | +1380 |
| 0 | - 378 | - 178 | 0 | + 690 | - 134 |
| 0 | + 278 | + 278 | - 393 | - 297 | + 134 |
| + 139 | 0 | - 197 | + 139 | + 67 | - 148 |
| - 139 | + 98 | + 98 | - 118 | - 88 | + 148 |
| + 49 | - 69 | - 59 | + 49 | + 74 | - 44 |
| - 49 | + 64 | + 64 | - 70 | - 53 | + 44 |
| 0 | - 762 | + 761 | -1504 | +1504 | 0 |

Momentos para los tramos de igual luz segun el "reglamento del A.C.I.

Momentos negativos:

Apoyo extremos: $M = 1/24(wl^2) = 500 \times 4.25^2 / 24 = 377$

$A_s = 0.85 \text{ cm}^2$

Primer apoyo interior:

$M = 500 \times 4.25^2 / 10 = 905 \text{ Kgm.}$

$A_s = 90500 / 1400(17-2.5)2.5 = 1.76 \text{ cm}^2$

Otros apoyos:

$M = 500 \times 4.25^2 / 11 = 822 \text{ Kgm.}$

$$A_s = 82200/1400(17-2.5)2.5 = 1.60 \text{ cm}^2$$

Momentos positivos:

Tramo extremos:

$$M = 500 \times 4.25^2 / 14 = 646 \text{ Kgm.}$$

$$A_s = 64600/1400 \times 0.866 \times 17 \times 2.5 = 1.27 \text{ cm}^2$$

Otros tramos:

$$M = 500 \times 4.25^2 / 16 = 565 \text{ Kgm.}$$

$$A_s = 56500/1400 \times 0.866 \times 17 \times 2.5 = 1.11 \text{ cm}^2$$

Acero minimo y acero de temperaturas:

$$A_{s_{\text{min}}} = 0.005 \times 10 \times 17 = 0.85 \text{ cm}^2$$

$$A_{s_{\text{temp}}} = 0.0025 \times 100 \times 5 = 1.15 \text{ cm}^2$$

Ensanche de las viguetas:

Apoyos interiores de luz $L = 4.25 \text{ m.}$

$$b = 90500/11 \times 17^2 \times 2.5 = 11.4 = \sim 20 \text{ cm.}$$

$$M_0 = 79700$$

$$M_{\text{max}} = 113000$$

$$\frac{M_0}{M_{\text{max}}} = \frac{797}{1130} = 0.71 \quad x = 0.079$$

$$a = 0.079 \times 4.25 = 0.335 = \sim 40 \text{ cm.}$$

Apoyo interior del tramo de luz $L = 5.75 \text{ m.}$

$$b = 151000/11 \times 17^2 \times 2.5 = 19 = \sim 20 \text{ cm.}$$

$$M_0 = 79700$$

$$M_{\text{max}} = 207000$$

$$\frac{M_0}{M_{\text{max}}} = \frac{797}{2070} = 0.29 \quad x = 0.23$$

$$a = 0.23 \times 5.75 = 1.33 = \sim 1.60 \text{ m.}$$

Z A P A T A S

METRADO DE PILARES (1)

| | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | B1 | B2 | B3 |
|------|----------|-----|------|------|------|------|------|-----|------|------|------|
| 5° | Parapeto | 6.2 | 4.7 | 4.5 | 4.5 | 4.5 | 5.4 | 6.2 | 6.1 | --- | --- |
| | Losa | 9.6 | 16.7 | 16.4 | 15.8 | 15.3 | 17.4 | 9.8 | 15.2 | 22.0 | 21.6 |
| Tip. | Muro | 5.3 | 4.3 | 4.1 | 4.1 | 4.1 | 4.9 | 5.2 | 5.5 | --- | --- |
| | Tabique | --- | --- | --- | --- | --- | --- | --- | 5.5 | 6.2 | 11.1 |
| | Losa | 9.6 | 16.7 | 16.4 | 15.8 | 15.3 | 17.4 | 9.8 | 15.2 | 22.0 | 21.6 |
| Sot. | Muro | 5.3 | 7.3 | 7.1 | 4.1 | 4.1 | 4.9 | 5.2 | 7.4 | 5.4 | 3.3 |
| | Tabique | --- | 2.3 | --- | --- | --- | --- | --- | --- | 3.6 | 1.7 |
| | Losa | 9.6 | 16.7 | 16.4 | 15.8 | 15.3 | 17.4 | 9.8 | 15.2 | 22.0 | 21.6 |

CARGA EN PILARES (2)

| | | | | | | | | | | | |
|------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 5° | Parapeto | 3.1 | 2.8 | 2.3 | 2.3 | 2.3 | 2.7 | 3.1 | 3.0 | --- | --- |
| | Losa | 5.9 | 10.0 | 9.8 | 9.6 | 9.2 | 10.4 | 5.8 | 9.1 | 13.2 | 12.9 |
| | a/c. | 0.9 | 1.6 | 1.6 | 1.6 | 1.6 | 1.7 | 1.0 | 1.5 | 2.2 | 2.2 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| | SUMA | 11.2 | 15.3 | 15.0 | 14.8 | 14.4 | 16.1 | 11.2 | 14.9 | 16.7 | 15.4 |
| 4° | Muro | 8.0 | 6.4 | 6.1 | 6.1 | 6.1 | 7.3 | 7.8 | 8.2 | --- | --- |
| | Tabique | --- | --- | --- | --- | --- | --- | --- | 4.1 | 4.6 | 8.3 |
| | Losa | 6.7 | 11.7 | 11.5 | 11.0 | 10.7 | 12.2 | 6.9 | 10.6 | 15.4 | 15.1 |
| | a/c. | 2.4 | 4.2 | 4.1 | 4.0 | 3.8 | 4.4 | 2.4 | 3.8 | 5.5 | 5.4 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 29.6 | 38.9 | 38.0 | 37.2 | 36.3 | 41.3 | 29.6 | 42.9 | 43.5 | 46.5 | |
| 3° | Muro | 7.9 | 6.4 | 6.2 | 6.1 | 6.2 | 7.3 | 7.8 | 8.3 | --- | --- |
| | Tabique | --- | --- | --- | --- | --- | --- | --- | 4.2 | 4.7 | 8.3 |
| | Losa | 6.7 | 11.7 | 11.5 | 11.0 | 10.7 | 12.2 | 6.8 | 10.6 | 15.4 | 15.1 |
| | a/c. | 2.1 | 3.8 | 3.7 | 3.6 | 3.4 | 3.9 | 2.2 | 3.4 | 4.9 | 4.9 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 47.6 | 62.1 | 60.7 | 59.2 | 57.9 | 66.0 | 47.7 | 70.7 | 69.8 | 76.1 | |
| 2° | Muro | 7.9 | 6.4 | 6.1 | 6.2 | 6.1 | 7.3 | 7.8 | 8.2 | --- | --- |
| | Tabique | --- | --- | --- | --- | --- | --- | --- | 4.1 | 4.6 | 8.3 |
| | Losa | 6.8 | 11.8 | 11.5 | 11.0 | 10.7 | 12.4 | 6.9 | 10.6 | 15.5 | 15.1 |
| | a/c. | 1.9 | 3.3 | 3.3 | 3.2 | 3.1 | 3.5 | 1.9 | 3.0 | 4.4 | 4.3 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 65.5 | 84.9 | 82.9 | 80.9 | 79.1 | 90.4 | 65.5 | 97.9 | 95.5 | 105.1 | |
| 1° | Muro | 7.9 | 6.4 | 6.1 | 6.1 | 6.2 | 7.3 | 8.8 | 8.3 | --- | --- |
| | Tabique | --- | --- | --- | --- | --- | --- | --- | 4.2 | 4.6 | 8.3 |
| | Losa | 6.8 | 11.7 | 11.5 | 11.0 | 10.7 | 12.3 | 6.9 | 10.6 | 15.4 | 15.0 |
| | a/c. | 1.6 | 2.9 | 2.8 | 2.8 | 2.7 | 3.0 | 1.7 | 2.6 | 2.9 | 3.8 |
| | p.p. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| SUMA | 84.4 | 108.5 | 106.0 | 103.4 | 101.3 | 115.6 | 84.6 | 126.2 | 121.0 | 134.8 | |
| Sot | Muro | 10.6 | 14.6 | 14.2 | 8.2 | 8.2 | 9.8 | 10.4 | 14.8 | 10.8 | 6.6 |
| | Tabique | --- | 2.3 | --- | --- | --- | --- | --- | --- | 3.6 | 1.7 |
| | losa | 7.7 | 13.4 | 13.1 | 12.6 | 12.2 | 13.9 | 7.8 | 12.2 | 17.7 | 17.3 |
| | a/c. | 3.8 | 6.7 | 6.6 | 6.4 | 6.1 | 6.9 | 3.9 | 6.0 | 8.8 | 8.6 |
| | p.p. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| SUMA | 109.1 | 148.1 | 142.5 | 133.2 | 130.4 | 148.8 | 109.4 | 161.8 | 164.5 | 171.6 | |

METRADO DE PILARES (2)

| | | B4 | B5 | B6 | B7 | C1 | C4 | C5 | C6 | C7 | D1 |
|------|----------|------|------|------|------|------|------|------|------|------|-----|
| 5° | Parapeto | --- | --- | --- | 5.3 | 4.5 | --- | --- | --- | 4.5 | 4.8 |
| | Losa | 25.9 | 25.4 | 29.4 | 16.7 | 11.3 | 20.3 | 20.3 | 24.1 | 13.9 | 6.0 |
| Tip | Muro | --- | --- | --- | 4.8 | 4.0 | --- | --- | --- | 4.0 | 4.0 |
| | Tabique | 8.5 | 14.4 | 5.9 | --- | 2.1 | 6.9 | 8.2 | 13.1 | --- | --- |
| | Losa | 25.9 | 25.4 | 29.4 | 16.7 | 11.3 | 20.3 | 20.3 | 24.1 | 13.9 | 6.0 |
| Sot. | Muro | --- | --- | --- | 4.8 | 4.0 | --- | --- | --- | 4.0 | 4.0 |
| | Tabique | --- | --- | --- | --- | 6.1 | --- | --- | --- | --- | 3.7 |
| | Losa | 25.9 | 25.4 | 29.4 | 16.7 | 11.3 | 20.3 | 20.3 | 24.1 | 13.9 | 6.0 |

CARGA EN PILARES (2)

| | | | | | | | | | | | |
|------|----------|-------|-------|-------|-------|-------|-------|-------|-------|------|-----|
| 5° | Parapeto | --- | --- | --- | 2.6 | 2.2 | --- | --- | --- | 2.2 | 2.4 |
| | Losa | 15.1 | 15.2 | 17.6 | 10.0 | 6.8 | 12.1 | 12.1 | 14.4 | 8.3 | 3.6 |
| | s/c. | 2.6 | 2.5 | 2.9 | 1.6 | 1.1 | 2.0 | 2.0 | 2.4 | 1.4 | 0.6 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| | SUMA | 19.4 | 19.0 | 21.8 | 15.5 | 11.4 | 15.4 | 15.4 | 18.1 | 13.2 | 7.9 |
| 4° | Muro | --- | --- | --- | 8.6 | 6.0 | --- | --- | --- | 6.0 | 6.0 |
| | Tabique | 6.4 | 10.8 | 4.4 | --- | 1.6 | 5.2 | 6.2 | 9.8 | --- | --- |
| | Losa | 18.1 | 17.8 | 20.6 | 11.6 | 7.9 | 14.2 | 14.2 | 16.9 | 9.7 | 4.2 |
| | s/c. | 6.4 | 6.3 | 7.3 | 4.0 | 2.8 | 5.1 | 5.1 | 6.0 | 3.5 | 1.5 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 51.6 | 55.2 | 55.4 | 41.1 | 31.0 | 41.2 | 42.2 | 52.1 | 33.7 | 20.9 | |
| 3° | Muro | --- | --- | --- | 8.7 | 6.0 | --- | --- | --- | 6.0 | 6.0 |
| | Tabique | 6.4 | 10.8 | 4.4 | --- | 15.6 | 5.2 | 6.1 | 9.8 | --- | --- |
| | Losa | 18.1 | 17.8 | 20.6 | 11.7 | 7.9 | 14.2 | 14.2 | 16.9 | 9.7 | 4.2 |
| | s/c. | 5.8 | 5.7 | 6.6 | 3.7 | 2.5 | 4.5 | 4.5 | 5.4 | 3.2 | 1.3 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 83.2 | 90.8 | 88.4 | 66.5 | 50.3 | 66.4 | 68.3 | 85.5 | 53.9 | 33.7 | |
| 2° | Muro | --- | --- | --- | 8.7 | 6.0 | --- | --- | --- | 6.0 | 6.0 |
| | Tabique | 6.4 | 10.8 | 4.4 | --- | 15.7 | 5.2 | 7.3 | 9.8 | --- | --- |
| | Losa | 18.0 | 17.8 | 20.6 | 11.8 | 7.9 | 14.2 | 14.3 | 16.9 | 9.7 | 4.2 |
| | s/c. | 5.2 | 5.1 | 5.8 | 3.3 | 2.3 | 4.0 | 4.1 | 4.8 | 2.8 | 1.2 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 114.1 | 125.8 | 120.5 | 91.5 | 69.3 | 91.1 | 95.3 | 118.3 | 73.7 | 46.4 | |
| 1° | Muro | --- | --- | --- | 8.7 | 6.0 | --- | --- | --- | 6.0 | 6.0 |
| | Tabique | 6.3 | 10.8 | 4.4 | --- | 1.6 | 5.2 | 6.2 | 9.8 | --- | --- |
| | Losa | 18.2 | 17.8 | 20.6 | 11.8 | 7.9 | 14.2 | 14.2 | 16.9 | 9.8 | 4.2 |
| | s/c. | 4.5 | 4.4 | 5.2 | 2.9 | 2.0 | 3.6 | 3.6 | 4.2 | 2.4 | 1.0 |
| | p.p. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| SUMA | 145.7 | 161.4 | 153.3 | 117.5 | 89.4 | 116.7 | 121.9 | 150.8 | 94.5 | 60.2 | |
| Sot | Muro | --- | --- | --- | 9.6 | 8.0 | --- | --- | --- | 8.0 | 8.0 |
| | Tabique | --- | --- | --- | --- | 6.1 | --- | --- | --- | --- | 3.8 |
| | Losa | 20.7 | 20.3 | 23.5 | 13.4 | 9.1 | 16.2 | 16.2 | 19.3 | 11.0 | 4.8 |
| | s/c. | 10.4 | 10.2 | 11.8 | 6.6 | 4.5 | 8.1 | 8.1 | 9.7 | 5.6 | 2.4 |
| | p.p. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| SUMA | 179.4 | 194.5 | 191.2 | 149.7 | 119.7 | 143.6 | 148.8 | 183.4 | 121.7 | 81.8 | |

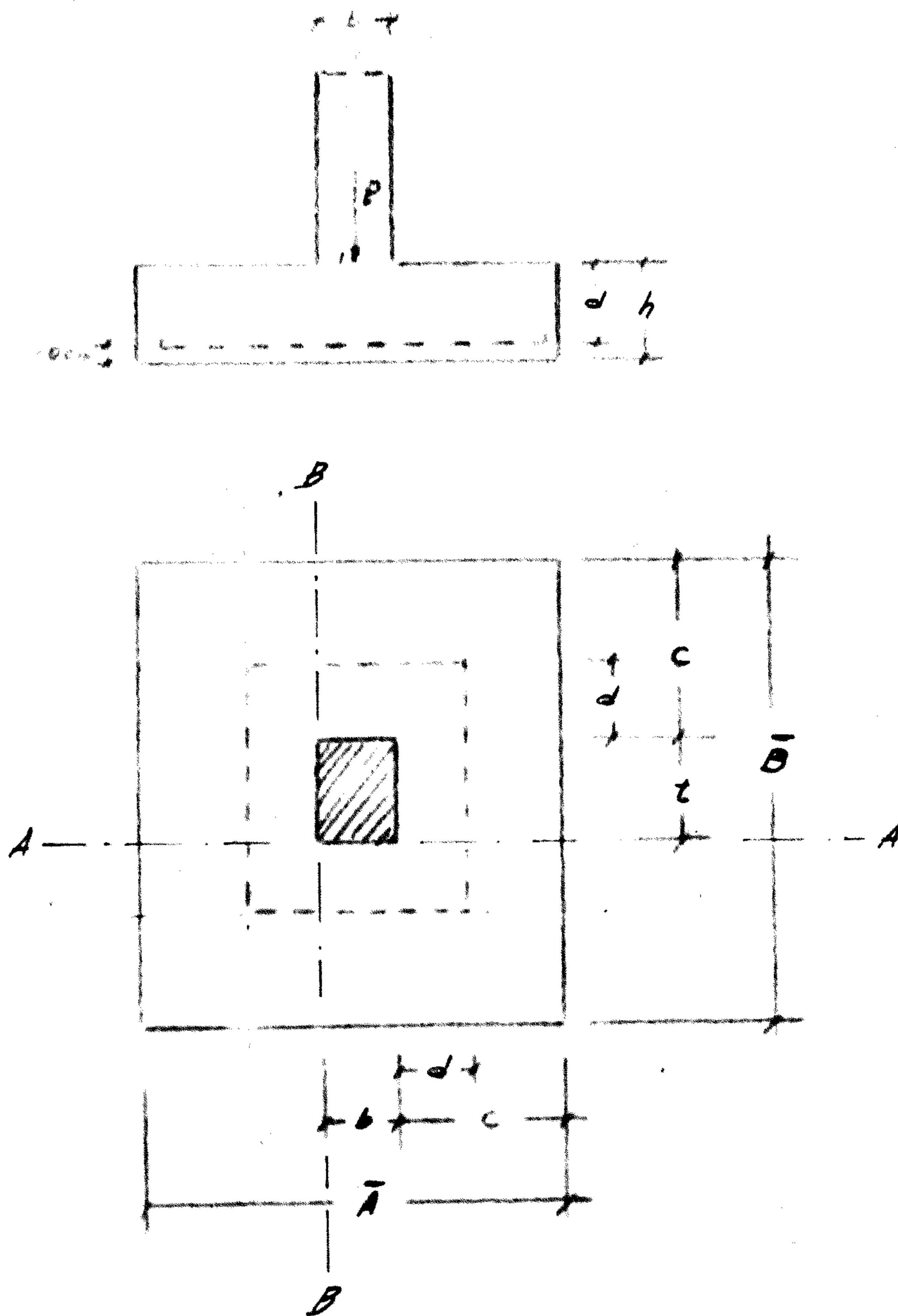
METRADO DE PILARES (3)

| | | D2 | D3 | D4 | D5 | D6 | D7 | E4 | E5 | E6 | E7 |
|------|----------|------|------|------|------|------|------|-----|------|------|-----|
| 5° | Parapeto | 4.7 | 4.5 | 4.5 | --- | --- | 4.5 | 4.8 | 4.5 | 5.4 | 5.4 |
| | Losa | 10.8 | 10.8 | 16.0 | 20.3 | 24.3 | 13.8 | 6.3 | 11.3 | 13.4 | 7.6 |
| Tip. | Muro | 4.3 | 4.1 | 4.1 | --- | --- | 4.0 | 4.1 | 4.1 | 5.0 | 5.0 |
| | Tabique | --- | --- | 12.7 | 8.9 | 7.2 | --- | 5.3 | 6.3 | --- | --- |
| | Losa | 10.8 | 10.8 | 16.0 | 20.3 | 24.3 | 13.8 | 6.3 | 11.3 | 13.4 | 7.6 |
| Sot. | Muro | 4.3 | 4.1 | 4.1 | --- | --- | 4.0 | 4.1 | 4.1 | 5.0 | 5.0 |
| | Tabique | 6.2 | 4.2 | 2.1 | 1.9 | --- | --- | --- | --- | --- | --- |
| | Losa | 10.8 | 10.8 | 16.0 | 20.3 | 24.3 | 13.8 | 6.3 | 11.3 | 13.4 | 7.6 |

CARGA EN PILARES (3)

| | | | | | | | | | | | |
|------|----------|-------|-------|-------|-------|-------|------|-------|-------|------|------|
| 5° | Parapeto | 2.3 | 2.2 | 2.2 | --- | --- | 2.2 | 2.4 | 2.2 | 2.7 | 2.7 |
| | Losa | 6.5 | 6.5 | 9.6 | 12.1 | 14.5 | 8.3 | 3.8 | 6.8 | 8.1 | 4.6 |
| | s/c. | 1.1 | 1.1 | 1.6 | 2.0 | 2.4 | 1.4 | 0.6 | 1.1 | 1.3 | 0.7 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| | SUMA | 11.2 | 11.1 | 14.7 | 15.4 | 18.2 | 13.2 | 8.1 | 11.4 | 13.4 | 9.3 |
| 4° | Muro | 6.4 | 6.2 | 6.2 | --- | --- | 6.0 | 6.1 | 6.2 | 7.5 | 7.5 |
| | Tabique | --- | --- | 9.5 | 6.7 | 5.4 | --- | 4.0 | 4.7 | --- | --- |
| | Losa | 7.6 | 7.6 | 11.2 | 14.2 | 17.0 | 9.7 | 4.4 | 7.9 | 9.4 | 5.3 |
| | s/c. | 2.7 | 2.7 | 4.0 | 5.1 | 6.0 | 3.4 | 1.6 | 2.8 | 3.3 | 1.9 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 29.2 | 28.9 | 46.9 | 42.7 | 47.9 | 33.6 | 25.5 | 34.3 | 34.9 | 25.3 | |
| 3° | Muro | 6.4 | 6.1 | 6.1 | --- | --- | 6.0 | 6.1 | 6.2 | 7.5 | 7.5 |
| | Tabique | --- | --- | 9.5 | 6.7 | 5.4 | --- | 4.0 | 4.7 | --- | --- |
| | Losa | 7.6 | 7.5 | 11.2 | 14.2 | 17.0 | 9.6 | 4.4 | 7.9 | 9.3 | 5.3 |
| | s/c. | 2.4 | 2.4 | 3.6 | 4.5 | 5.5 | 3.1 | 1.4 | 2.5 | 3.0 | 1.7 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 46.9 | 46.2 | 78.6 | 69.4 | 77.1 | 53.6 | 42.7 | 56.9 | 55.0 | 41.1 | |
| 2° | Muro | 6.4 | 6.1 | 6.2 | --- | --- | 6.0 | 6.2 | 6.2 | 7.5 | 7.5 |
| | Tabique | --- | --- | 9.5 | 6.7 | 5.4 | --- | 3.9 | 4.7 | --- | --- |
| | Losa | 7.6 | 7.6 | 11.2 | 14.2 | 17.0 | 9.6 | 4.4 | 7.9 | 9.4 | 5.3 |
| | s/c. | 2.2 | 2.2 | 3.2 | 4.0 | 4.8 | 2.8 | 1.3 | 2.2 | 2.7 | 1.5 |
| | p.p. | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SUMA | 64.4 | 64.4 | 110.0 | 95.6 | 105.6 | 73.3 | 59.8 | 79.2 | 76.9 | 56.7 | |
| 1° | Muro | 6.4 | 6.2 | 6.2 | --- | --- | 6.0 | 6.2 | 6.2 | 7.5 | 7.5 |
| | Tabique | --- | --- | 9.5 | 6.7 | 5.4 | --- | 3.9 | 4.7 | --- | --- |
| | Losa | 7.6 | 7.5 | 11.2 | 14.2 | 17.0 | 9.7 | 4.5 | 7.9 | 9.4 | 5.4 |
| | s/c. | 1.9 | 1.9 | 2.8 | 3.5 | 4.3 | 2.4 | 1.1 | 2.0 | 2.3 | 1.3 |
| | p.p. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| SUMA | 82.9 | 81.6 | 142.3 | 122.7 | 134.9 | 94.0 | 78.1 | 102.6 | 98.7 | 73.5 | |
| Sot. | Muro | 8.6 | 8.2 | 8.2 | --- | --- | 8.0 | 8.2 | 8.2 | 10.0 | 10.0 |
| | Tabique | 6.3 | 4.2 | 2.1 | 1.9 | --- | --- | --- | --- | --- | --- |
| | Losa | 8.6 | 8.6 | 12.8 | 16.2 | 19.4 | 11.1 | 5.1 | 9.1 | 10.7 | 6.1 |
| | s/c. | 4.3 | 4.4 | 6.4 | 8.1 | 9.7 | 5.5 | 2.5 | 4.5 | 5.4 | 3.0 |
| | p.p. | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |
| SUMA | 113.3 | 109.6 | 174.4 | 151.5 | 166.6 | 121.2 | 96.5 | 127.0 | 127.4 | 95.2 | |

ZAPATAS AISLADAS ($f_6 = 210 \text{ Kg/cm}^2$)



Desarrollo de la fórmula simplificada para el cálculo de la altura útil partiendo de la fórmula del esfuerzo cortante unitario: $v_0 = 5.3 \text{ Kg/cm}^2$

$$v = \frac{w A - (b+2d)(t+2d)}{2 (b+2d) + (t+2d)jd}$$

$$v = \frac{w A - bt - 2d(b+t) - 4d^2}{2jd(b+t) + 8jd^2}$$

$$2vj(b+t)d + 8vj d^2 = wA - wbt - 2w(b+t)d - 4wd^2$$

$$(8vj + 4w)d^2 + 2(b+t)(vj + w)d - w(A - bt) = 0$$

Reemplazando en esta ecuación de segundo grado los valores de "v" y "j" se tiene la ecuación simplificada ~~porxxxxxt~~

$$(36.7 + 4w)d^2 + 2(b+t)(4.58 + w)d - w(A - bt) = 0$$

ZAPATAS AISLADAS

($f_c = 210 \text{ Kg/cm}^2$)

A3

$P = 142510$

$bxt = 40x60$

Carga total: $W = 142510 + 0.07x142510 = 152490$

Area: $A = 152490/2.5 = 61000 \text{ cm}^2 = (b+2c)(t+2c)$

$c = 1.00 \text{ mt.}$

Dimensiones: $\bar{A} = 2.40 \text{ m.}$ $\bar{B} = 2.60 \text{ m.}$

Area: $A = 62400 \text{ cm}^2$

Presion neta: $w = 142510/62400 = 2.29 \text{ Kg/cm}^2$

Cálculo de "d" por la ecuación del esfuerzo cortante unitario: $v = V/bjd$

$$(36.7+4x2.29)d^2 + 200(4.58+2.29)d - 2.29(62400-2400) = 0$$

$$45.86d^2 + 1374d - 137500 = 0$$

Altura útil: $d = 42 \text{ cm.}$

$$M_A = 2.29x240x100^2/2 = 2750000 \text{ Kg.cm.}$$

$$As_A = 2750000x0.85/1400x0.866x41 = 47.1 \text{ cm}^2$$

$$Bo_A = 2.29x240x100x0.85/11.8x0.866x42 = 109 \text{ cm.}$$

18 ϕ 3/4

$$M_B = 2.29x260x100^2/2 = 3800000 \text{ Kg cm.}$$

$$As_B = 3800000x0.85/1400x0.866x43 = 61.2 \text{ cm}^2$$

$$Bo_B = 2.29x260x100x0.85/11.8x0.866x42 = 118 \text{ cm}$$

22 ϕ 3/4

A4

$P = 133230$

$bxt = 40x60$

Carga total: $W = 133230 + 0.07x133230 = 142556$

Area: $A = 142556/2.5 = 58000 \text{ cm}^2 = (b+2c)(t+2c)$

$c = 1.00 \text{ mt.}$

Dimensiones: $\bar{A} = 2.40 \text{ m.}$ $\bar{B} = 2.60 \text{ m}$

Area: $A = 62400$

presion neta: $w = 133230/62400 = 2.14 \text{ Kg/cm}^2$

Cálculo de "d" por la ecuación del esfuerzo cortante unitario:

$$(36.7+4x2.14)d^2 + 200(4.58+2.14)d - 2.14(62400-2400) = 0$$

$$45.26d^2 + 1344d - 128400 = 0$$

Altura útil: $d = 41 \text{ cm.}$

$$M_A = 2.14 \times 240 \times 100^2 / 2 = 2570000 \text{ Kg-cm.}$$

$$A_{sA} = 2570000 \times 0.85 / 1400 \times 0.866 \times 40 = 45 \text{ cm}^2$$

$$Eo_A = 2.14 \times 240 \times 100 \times 0.85 / 11.8 \times 0.866 \times 41 = 104 \text{ cm.}$$

18 Ø 3/4

$$M_B = 2.14 \times 260 \times 100^2 / 2 = 2770000 \text{ Kg-cm.}$$

$$A_{sB} = 2770000 \times 0.85 / 1400 \times 0.866 \times 42 = 46.5 \text{ cm}^2$$

$$Eo_A = 2.14 \times 260 \times 100 \times 0.85 / 11.8 \times 0.866 \times 41 = 113 \text{ cm.}$$

19 Ø 3/4

A5

$$P = 130440$$

$$b \times t = 40 \times 60$$

Carga total: $W = 139000$

Area: $A = 139000 / 2.5 = 55700 \text{ cm}^2 = (b+2c)(t+2c)$

$$c = 95 \text{ cm.}$$

Dimensiones: $\bar{A} = 2.90 \text{ m.}$

$$\bar{B} = 2.50 \text{ m.}$$

presión neta: $w = 130440 / 230 \times 250 = 2.26 \text{ Kg/cm}^2$

Cálculo de "d" :

$$(36.7 + 4 \times 2.26)d^2 + 200(4.58 + 2.26)d - 2.26(57000 - 2400) = 0$$

$$45.74d^2 + 1368d - 124200 = 0$$

Altura útil: $d = 40 \text{ cm.}$

$$M_A = 2.26 \times 230 \times 95^2 / 2 = 2350000 \text{ kg-cm}$$

$$A_{sA} = 2350000 \times 0.85 / 1400 \times 0.866 \times 39 = 42.3 \text{ cm}^2$$

$$Eo_A = 2.26 \times 230 \times 95 \times 0.85 / 11.8 \times 0.866 \times 40 = 103 \text{ cm.}$$

17 Ø 3/4

$$M_B = 2.26 \times 250 \times 95^2 / 2 = 2560000 \text{ Kg-cm.}$$

$$A_{sB} = 2560000 \times 0.85 / 1400 \times 0.866 \times 41 = 49.8 \text{ cm}^2$$

$$Eo = 2.26 \times 250 \times 95 \times 0.85 / 11.8 \times 0.866 \times 40 = 112 \text{ cm.}$$

19 Ø 3/4

A6

$$P = 148870$$

$$b \times t = 50 \times 60$$

Carga total: $W = 159000$

$$A = 159000 / 2.5 = 63700 = (b+2c)(t+2c)$$

$$c = 1.00 \text{ mt.}$$

Dimensiones:

$$\bar{A} = 2.50$$

$$\bar{B} = 2.60$$

Area:

$$A = 65000 \text{ cm}^2$$

presión neta: $w = 148870/65000 = 2.29 \text{ Kg/cm}^2$

Cálculo de "d":

$$(36.7 + 4 \times 2.29)d^2 + 220(220(4.58 + 2.29)d - 2.29(65000 - 3000)) = 0$$
$$45.86d^2 + 1510d - 142000 = 0$$

Altura útil: $d = 40 \text{ cm.}$

Momentos y áreas de acero:

$$M_A = 2.29 \times 250 \times 100^2 / 2 = 2860000 \text{ Kg-cm.}$$

$$A_s = 2860000 \times 0.85 / 1400 \times 0.866 \times 40 = 51.5 \text{ cm}^2$$

$$E_o = 2.29 \times 250 \times 100 \times 0.85 / 11.8 \times 0.866 \times 40 = 119 \text{ cm.}$$

20 \emptyset 3/4

$$M_B = 2.29 \times 260 \times 100^2 / 2 = 2970000$$

$$A_s = 2970000 \times 0.85 / 1400 \times 0.866 \times 40 = 50.8 \text{ cm}^2$$

$$E_o = 2.29 \times 260 \times 100 \times 0.85 / 11.8 \times 0.866 \times 40 = 124 \text{ cm.}$$

21 \emptyset 3/4

A7

$$P = 109390$$

$$b \times t = 40 \times 50$$

Carga total: $W = 109390 \times 1.07 = 117000 \text{ Kg.}$

Area: $A = 117000 / 2.5 = 46800 = (b + 2c)(t + 2c)$

$$c = 90 \text{ cm.}$$

Dimensiones: $\bar{A} = 2.20 \text{ m.}$ $\bar{B} = 2.30 \text{ m.}$

Area: $A = 50600 \text{ cm}^2$

presión neta: $w = 2.17 \text{ Kg/cm}^2$

Calculo de "d":

$$(36.7 + 4 \times 2.17)d^2 + 180(4.58 + 2.17)d - 2.17(50600 - 2000) = 0$$
$$45.38d^2 + 1215d - 105300 = 0$$

Altura útil: $d = 37 \text{ cm.}$

Momentos y áreas de acero:

$$M_A = 2.17 \times 220 \times 90^2 / 2 = 1930000 \text{ Kg-cm.}$$

$$A_s = 1930000 \times 0.85 / 1400 \times 0.866 \times 36 = 37.5 \text{ cm}^2$$

$$E_o = 2.17 \times 220 \times 90 \times 0.85 / 11.8 \times 0.866 \times 37 = 99$$

17 \emptyset 3/4

$$M_B = 2.17 \times 230 \times 90^2 / 2 = 2020000 \text{ Kg-cm.}$$

$$A_s = 2020000 \times 0.85 / 1400 \times 0.866 \times 38 = 37.5 \text{ cm}^2$$

$$E_0 = 2.17 \times 230 \times 90 / 11.8 \times 0.866 \times 37 = 101 \text{ cm.}$$

$$17 \text{ } \phi \text{ } 3/4$$

B3

$$P = 171660$$

$$b \times t = 50 \times 60$$

$$\text{Carga total: } W = 171660 \times 1.07 = 183500 \text{ Kg.}$$

$$\text{Area: } A = 183500 / 2.5 = 73500 = (b+2c)(t+2c)$$

$$c = 1.10 \text{ m.}$$

$$\text{Dimensiones: } \bar{A} = 2.70 \text{ m} \quad \bar{B} = 2.80 \text{ m}$$

$$\text{Area: } A = 75600 \text{ cm}^2$$

$$\text{presion neta: } w = 171600 / 75600 = 2.27 \text{ Kg/cm}^2$$

(Calculo de "d":

$$(36.7 + 4 \times 2.27)d^2 + 220(4.58 + 2.27)d - 2.27(75600 - 3000) = 0$$

$$45.78d^2 + 1510d - 164500 = 0$$

$$\text{Altura útil: } d = 46 \text{ cm.}$$

Momentos y areas de aceros:

$$M_A = 2.27 \times 270 \times 110^2 / 2 = 3710000 \text{ Kg-cm.}$$

$$A_s = 3710000 \times 0.85 / 1400 \times 0.866 \times 45 = 52.6 \text{ cm}^2$$

$$E_0 = 227 \times 270 \times 110 / 11.8 \times 0.866 \times 46 = 144 \text{ cm.}$$

$$24 \text{ } \phi \text{ } 3/4$$

$$M_B = 2.27 \times 280 \times 110^2 / 2 = 3850000 \text{ Kg-cm.}$$

$$A_s = 3850000 \times 0.85 / 1400 \times 0.866 \times 47 = 57.4 \text{ cm}^2$$

$$E_0 = 2.27 \times 280 \times 110 / 11.8 \times 0.866 \times 46 = 149 \text{ cm.}$$

$$25 \text{ } \phi \text{ } 3/4$$

B4

$$P = 179430$$

$$b \times t = 60 \times 60$$

$$\text{Carga total: } W = 179430 \times 1.07 = 192000 \text{ Kg.}$$

$$\text{Area: } A = 192000 / 2.5 = 76800 \text{ cm}^2 = (b+2c)(t+2c)$$

$$c = 1.10 \text{ m.}$$

$$\text{Dimensiones: } \bar{A} = 2.80 \text{ m} \quad \bar{B} = 2.80 \text{ m}$$

$$\text{Area: } A = 78400 \text{ cm}^2$$

$$\text{presion neta: } w = 179430 / 78400 = 2.29 \text{ Kg/cm}^2$$

Calculo de "d":

$$(36.7 + 4 \times 2.29)d^2 + 240(4.58 + 2.29)d - 2.29(78400 - 3600) = 0$$

$$45.86d^2 + 1645d - 171500 = 0$$

Altura útil: $d = 46$ cm.

Momentos y areas de acero:

$$M_A = 2.29 \times 280 \times 110^2 / 2 = 388000 \text{ Kg-cm.}$$

$$A_s = 388000 \times 280 \times 0.85 / 1400 \times 0.866 \times 45 = 60.4 \text{ cm}^2$$

$$E_o = 2.29 \times 280 \times 110 \times 0.85 / 11.8 \times 0.866 \times 46 = 12.8 \text{ cm.}$$

22 ϕ 3/4

$$M_B = 388000$$

$$A_s = 388000 \times 0.85 / 1400 \times 0.866 \times 47 = 58.2$$

$$E_o = 12.8 \text{ cm.}$$

22 ϕ 3/4

B5

$$P = 194570$$

$$b \times t = 60 \times 60$$

$$\text{Carga total: } W = 194570 \times 1.07 = 208500 \text{ Kg.}$$

$$\text{Area: } A = 208500 / 2.5 = 83500 = (b + 2c)(t + 2c)$$

$$c = 1.20 \text{ m.}$$

$$\text{Dimensiones: } \bar{A} = 3.00 \text{ m.} \quad \bar{B} = 3.00 \text{ m.}$$

$$\text{Area: } A = 90000 \text{ cm}^2$$

$$\text{presion neta: } w = 194570 / 90000 = 2.16 \text{ Kg/cm}^2$$

Calculo de "d":

$$(36.7 + 4 \times 2.16)d^2 + 240(4.58 + 2.16)d - 2.16(90000 - 3600) = 0$$

$$45.34d^2 + 1620d - 186200 = 0$$

Altura útil: $d = 47$ cm.

Momentos y areas de acero:

$$M_A = 2.16 \times 300 \times 120^2 / 2 = 4670000$$

$$A_s = 4670000 \times 0.85 / 1400 \times 0.866 \times 46 = 71.2 \text{ cm}^2$$

$$E_o = 2.16 \times 3000 \times 120 \times 0.85 / 11.8 \times 0.866 \times 90 = 137 \text{ cm.}$$

M 25 ϕ 3/4

$$M_B = 4670000$$

$$A_s = 4670000 \times 0.85 / 1400 \times 0.866 \times 48 = 68.3$$

$$E_o = 137$$

24 ϕ 3/4

B6

$$P = 191250$$

$$bxt = 60x60$$

Carga total: $W = 191250 \times 1.07 = 205000 \text{ Kg.}$

Area: $A = 205000/2.5 = 82000 = (b+2c)(t+2c)$

$$c = 1.15 \text{ m.}$$

Dimensiones: $\bar{A} = 2.90 \text{ m.}$ $\bar{B} = 2.90 \text{ m.}$

Area: $A = 84000 \text{ cm}^2$

presion neta: $w = 191250/84000 = 2.28 \text{ Kg/cm}^2$

Calculo de "d":

$$(36.7+4x2.28)d^2 + 240(4.58+2.28)d - 2.28(84000-3600) = 0$$

$$45.82d^2 + 1645d - 183000 = 0$$

Altura útil: $d = 50 \text{ cm.}$

Momentos y areas de aceros:

$$M_A = 2.28x290x115^2/2 = 4370000 \text{ Kg-cm.}$$

$$A_s = 4370000x0.85/1400x0.866x59 = 62.5 \text{ cm}^2$$

$$E_s = 2.28x290x115/11.8x0.866x50 = 127 \text{ cm}$$

22 ~~XB~~ $\phi 3/4$

$$M_B = 4370000 \text{ Kg-cm.}$$

$$A_s = 4370000x0.85/1400x0.866x51 = 60 \text{ cm}^2$$

$$E_s = 127 \text{ cm.}$$

21 $\phi 3/4$

B7

$$P = 149720$$

$$bxt = 50x60$$

Carga total: $W = 149720 \times 1.07 = 160000 \text{ Kg.}$

Area: $A = 160000/2.5 = 64000 \text{ cm}^2 = (b+2c)(t+2c)$

$$c = 1.00 \text{ m.}$$

Dimensiones: $\bar{A} = 2.50 \text{ m.}$ $\bar{B} = 2.60$

Area: $A = 65000 \text{ cm}^2$

presion neta: $w = 149720/65000 = 2.3 \text{ Kg/cm}^2$

Calculo de "d":

$$(36.7+4x2.3)d^2 + 220(4.58+2.3)d - 2.3(65000-3000) = 0$$

$$45.9d^2 + 1490d - 142500 = 0$$

Altura útil: $d = 42 \text{ cm.}$

Momentos y areas de aceros:

$$M_A = 2.3 \times 250 \times 100^2 / 2 = 2870000 \text{ Kg-cm.}$$

$$A_s = 2870000 \times 0.85 / 1400 \times 0.866 \times 41 = 47.3 \text{ cm}^2$$

$$E_o = 2.3 \times 250 \times 100 \times 0.85 / 11.8 \times 0.866 \times 42 = 114 \text{ cm}$$

19 ϕ 3/4

$$M_B = 2.3 \times 260 \times 100^2 / 2 = 2980000 \text{ Kg-cm.}$$

$$A_s = 2980000 \times 0.85 / 1400 \times 0.866 \times 43 = 48.6 \text{ cm}^2$$

$$E_o = 2.3 \times 250 \times 100 \times 0.85 / 11.8 \times 0.866 \times 42 = 119$$

20 ϕ 3/4

C4

$$P = 143650$$

$$bxt = 50 \times 50$$

$$\text{Carga total: } W = 143650 \times 1.07 = 154000 \text{ Kg.}$$

$$\text{Area: } A = \text{INDICED} 154000 / 2.5 = 61600 \text{ cm}^2$$

$$c = 1.00 \text{ mts.}$$

$$\text{Dimensiones: } \bar{A} = 2.50 \text{ m} \quad \bar{B} = 2.50 \text{ m.}$$

$$\text{Area: } A = 62500 \text{ cm}^2$$

$$\text{presion neta: } w = 143650 / 64500 = 2.3$$

$$(36.7 + 4 \times 2.3)d^2 + 200(4.58 + 2.3)d - 2.3(62500 - 2500) = 0$$

$$45.9d^2 + 1376d - 138000 = 0$$

$$\text{altura útil: } d = 42 \text{ cm.}$$

Momentos y areas de acero:

$$M_A = 2.3 \times 250 \times 100^2 / 2 = 2870000 \text{ Kg-cm.}$$

$$A_s = 2870000 \times 0.85 / 1400 \times 0.866 \times 41 = 49.1$$

$$E_o = 2.3 \times 250 \times 100 \times 0.85 / 11.8 \times 0.866 \times 42 = 114 \text{ cm.}$$

19 ϕ 3/4

$$M_B = 2870000$$

$$A_s = 2870000 \times 0.85 / 1400 \times 0.866 \times 43 = 46.7 \text{ cm}^2$$

$$E_o = 114 \text{ cm.}$$

19 ϕ 3/4

C5

$$P = 148880$$

$$bxt = 50 \times 60$$

$$\text{Carga total: } W = 148880 \times 1.07 = 159500 \text{ Kg.}$$

Area: $A = 159500/2.5 = 63800 = (b+2c)(t+2c)$

$c = 1.00 \text{ m.}$

Dimensiones: $\bar{A} = 2.50 \text{ m.}$ $\bar{B} = 2.60 \text{ m.}$

Area: $A = 65000 \text{ cm}^2$

presion neta: $w = 148880/65000 = 2.29 \text{ Kg/cm}^2$

Calculo de "d":

$$(36.7+4 \times 2.29)d^2 + 220(4.58+2.29)d - 2.29(65000-3000) = 0$$
$$45.85d^2 + 1510d - 142000 = 0$$

Altura útil: $d = 43 \text{ cm.}$

Momentos y areas de acero:

$$M_A = 2.29 \times 250 \times 100^2 / 2 = 2860000 \text{ Kg-cm.}$$

$$A_s = 2860000 \times 0.85 / 1400 \times 0.866 \times 42 = 47.7 \text{ cm}^2$$

$$E_o = 2.29 \times 250 \times 100 \times 0.85 / 11.8 \times 0.866 \times 43 = 111 \text{ cm.}$$

$$19 \text{ } \phi \text{ } 3/4$$

$$M_B = 2.29 \times 260 \times 100^2 / 2 = 2970000 \text{ Kg-cm.}$$

$$A_s = 2970000 \times 0.85 / 1400 \times 0.866 \times 44 = 47.2 \text{ cm}^2$$

$$E_o = 2.29 \times 260 \times 100 \times 0.85 / 11.8 \times 0.866 \times 43 = 115 \text{ cm.}$$

$$19 \text{ } \phi \text{ } 3/4$$

C6

$$P = 183440$$

$$b \times t = 60 \times 60$$

Carga total: $W = 183440 \times 1.07 = 196000 \text{ Kg.}$

Area: $A = 196000/2.5 = 78500 \text{ cm}^2 = (b+2c)t+2c)$

$c = 1.15 \text{ m.}$

Dimensiones: $\bar{A} = 2.90 \text{ m}$ $\bar{B} = 2.90 \text{ m.}$

Area: $A = 84000$

presion neta: $w = 183440/84000 = 2.19 \text{ Kg/cm}^2$

Calculo de "d":

$$(36.7+4 \times 2.19)d^2 + 240(4.58+2.19)d - 2.19(84000-3600) = 0$$
$$45.46d^2 + 1620d - 176000 = 0$$

Altura útil: $d = 47 \text{ cm.}$

Momentos y areas de acero:

$$M_A = 2.19 \times 290 \times 115^2 / 2 = 4200000 \text{ Kg-cm.}$$

$$A_s = 4200000 \times 0.85 / 1400 \times 0.866 \times 47 = 64 \text{ cm}^2$$

$$Eo = 2.19 \times 290 \times 115 \times 0.85 / 11.8 \times 0.866 \times 47 = 130 \text{ cm.}$$

$$23 \text{ } \phi \text{ } 3/4$$

$$M_B = 4200000 \text{ Kg-cm.}$$

$$As = 4200000 \times 0.85 / 1400 \times 0.866 \times 48 = 61.4 \text{ cm}^2$$

$$Eo = 130 \text{ cm.}$$

$$22 \text{ } \phi \text{ } 3/4$$

C7

$$P = 121760$$

$$bxt = 40 \times 50$$

$$\text{Carga total: } W = 121760 \times 1.07 = 130000 \text{ Kg.}$$

$$\text{Area: } A = 130000 / 2.5 = 52100 \text{ cm}^2$$

$$c = 95 \text{ cm.}$$

$$\text{Dimensiones: } \bar{A} = 2.30 \text{ m.} \quad \bar{B} = 2.40$$

$$\text{Area: } A = 55200 \text{ cm}^2$$

$$\text{presion neta: } w = 121760 / 55200 = 2.2 \text{ Kg/cm}^2$$

Calculo de "d":

$$(36.7 + 4 \times 2.2)d^2 + 180(4.58 + 2.2)d - 2.2(55200 - 2000) = 0$$

$$45.5d^2 + 1235d - 117000 = 0$$

$$\text{altura } \acute{u}\text{til: } d = 39 \text{ cm.}$$

Momentos y areas de acero:

$$M_A = 2.2 \times 230 \times 95^2 / 2 = 2180000 \text{ Kg-cm.}$$

$$As = 2180000 \times 0.85 / 1400 \times 0.866 \times 38 = 42.3 \text{ cm}^2$$

$$Eo = 2.2 \times 230 \times 95 \times 0.85 / 11.8 \times 0.866 \times 39 = 103 \text{ cm.}$$

$$17 \text{ } \phi \text{ } 3/4$$

$$M_B = 2.2 \times 240 \times 95^2 / 2 = 2280000 \text{ Kg-cm.}$$

$$As = 2280000 \times 0.85 / 1400 \times 0.866 \times 40 = 40 \text{ cm}^2$$

$$Eo = 2.2 \times 240 \times 95 \times 0.85 / 11.8 \times 0.866 \times 39 = 107 \text{ cm.}$$

$$18 \text{ } \phi \text{ } 3/4$$

D3

$$P = 109650$$

$$bxt = 40 \times 50$$

$$\text{Carga total: } W = 109650 \times 1.07 = 117000 \text{ Kg.}$$

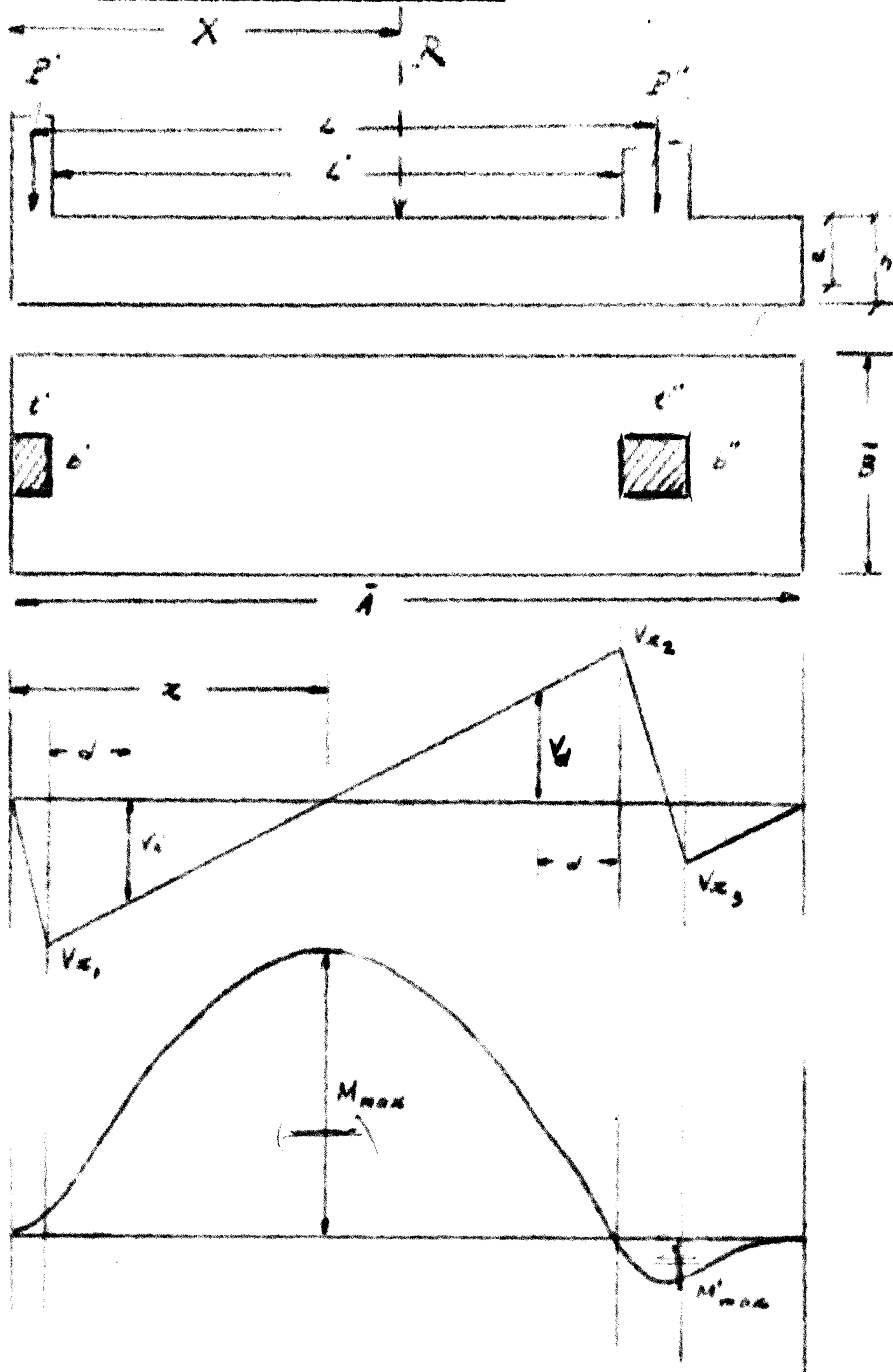
$$\text{Area: } A = 117000 / 2.5 = 47000 \text{ cm}^2 = (b + 2c)(t + 2c)$$

$$c = 90 \text{ cm.}$$

$$\text{Dimensiones } \bar{A} = 2.20 \text{ m.} \quad \bar{B} = 2.30 \text{ m.}$$

ZAPATAS COMBINADAS

($f_b = 210 \text{ Kg/cm}^2$)



Constantes usadas para el cálculo:

$$f_s = 1400 \text{ Kg/cm}^2$$

$$f_b = 210 \text{ "}$$

$$f_c = 0.03f_b = 6.3 \text{ Kg/cm}^2$$

$$v_c = 6.3 \text{ Kg/cm}^2$$

$$u = 0.075f_b = 15.8$$

$$n = 10$$

$$w = 2.5 \text{ Kg/cm}^2$$

$$K = 16.6$$

$$j = 0.866$$

ZAPATAS COMBINADAS ($f_b = 210 \text{ Kg/cm}^2$)

E4 - D4

$P' = 96460 \text{ Kg.}$

$P'' = 174430 \text{ Kg.}$

$b' = 40 \text{ cm.}$

$b'' = 50 \text{ cm.}$

$t' = 40 \text{ ''}$

$t'' = 60 \text{ ''}$

$L = 4.50 \text{ m.}$

$L' = 4.00 \text{ ''}$

Carga total: $W = 96460 + 174430 + 0.10(270890) = 297979 \text{ Kg.}$

Area: $A = 297979/2.5 = 119000 \text{ cm}^2$

Dist. Result. $X = 174430 \times 4.50 / 270890 = 2.90 \text{ m.}$

Dimensiones: $\bar{A} = 2(2.90 + 0.20) = 6.20 \text{ m.}$

$\bar{B} = 119000 / 6.20 = 2.00 \text{ m.}$

Presion neta: $w = 270890 / 6.20 = 43700 \text{ Kg/m.l.}$

Esfuerzos cortantes:

$V_{.4} = -96460 + 43700 \times 0.4 = -79010 \text{ Kg.}$

$V_{4.4} = -96460 + 43700 \times 4.40 = + 96040 \text{ Kg.}$

$V_5 = -(43700 \times 1.2) = -52500 \text{ Kg.}$

Momento Maximo: ($x = 96460 / 43700 = 2.21 \text{ m.}$)

$M_{2.21} = -96460 \times 2.01 + 43700 \times 2.21 \times 1.11 = 87000 \text{ Kgm.}$

$M_5 = -(-43700 \times 1.2 \times 0.6) = 31500 \text{ Kgm.}$

Altura útil:

$d = \sqrt{\frac{8700000}{16.6 \times 200}} = 52 \text{ cm.}$

ACERO NEGATIVO:

$A_s = 8700000 / 1400 \times 0.866 \times 52 = 138 \text{ cm}^2$

$E_o = 96040 / 15.8 \times 0.866 \times 52 = 135 \text{ cm.}$

$17 \phi 1-1/8$

Esf. Cort.:

~~XXXXXXXXXX~~ $V_l = 79010 - 43700 \times 0.52 = 56310 \text{ Kg.}$ $v = 0.03 f_b$

$V_d = 96040 - 43700 \times 0.52 = 73340 \text{ Kg.}$ $v = 0.039 f_b$

Estribos: - ($6 \phi 1/2$) Derecha: ~~XXXXXXXXXXXXXXXXXXXXXXX~~ XXXXXXXXXXXX

$1 \text{ a } 10 ; 2 \text{ a } 20 \text{ cm.}$

ACERO POSITIVO: ($A_{s \text{ min}} = 0.005 \times 200 \times 52 = 52 \text{ cm}^2$)

$A_s = 3150000 / 1400 \times 0.866 \times 52 = 50 \text{ cm}^2$

$$E_o = 52500/15.8 \times 0.866 \times 52 = 75 \text{ cm.}$$

$$14 \text{ } \phi \text{ } 7/8$$

ACERO TRANSVERSAL:

(Exterior) $w' = 96460/2.0 = 48230 \text{ Kg/m.l.}$

$$M' = 48230 \times 0.8 \times 0.4 = 15450 \text{ Kgm.}$$

$$A_s = 1545000/1400 \times 0.866 \times 52 = 25.5 \text{ cm}^2$$

$$A_{s_{min}} = 0.05 \times 92 \times 52 = 23.9 \text{ cm}^2$$

$$E_o = 48230 \times 0.8/15.8 \times 0.866 \times 52 = 54.3 \text{ cm}$$

$$9 \text{ } \phi \text{ } 3/4$$

(Interior) $w'' = 174430/2.0 = 87215 \text{ Kg/m.l.}$

$$M'' = 87215 \times 0.75 \times 0.38 = 24600 \text{ Kgm.}$$

$$A_s = 2460000/1400 \times 0.866 \times 52 = 39 \text{ cm}^2$$

$$A_{s_{min}} = 0.005 \times 154 \times 52 = 40 \text{ cm}^2$$

$$E_o = 87215 \times 0.75/15.8 \times 0.866 \times 52 = 91.8$$

$$15 \text{ } \phi \text{ } 3/4$$

E5 - D5

$$P' = 127000 \text{ Kg}$$

$$P'' = 151550 \text{ Kg.}$$

$$b' = 50 \text{ cm.}$$

$$b'' = 50 \text{ cm.}$$

$$t' = 50 \text{ "}$$

$$t'' = 60 \text{ cm.}$$

$$L = 4.50 \text{ m.}$$

$$L' = 3.95 \text{ m.}$$

Carga total: $W = 127000 + 151550 + 0.1(278550) = 306405 \text{ Kg.}$

Area: $A = 306405/2.5 = 122500 \text{ cm}^2$

Dist. Result. $X = 151550 \times 4.50/278550 = 2.45 \text{ m.}$

Dimensiones: $\bar{A} = 2(2.45 + 0.25) = 5.40 \text{ m.}$

$$\bar{B} = 122500/540 = 2.30 \text{ m.}$$

Presion neta: $w = 278550/5.4 = 51600 \text{ Kg/m.l.}$

Esfuerzos cortantes:

$$V_{.5} = -127000 + 51600 \times 0.5 = -101200 \text{ Kg.}$$

$$V_{4.45} = 127000 + 51600 \times 4.45 = + 102000 \text{ Kg.}$$

$$V_{5.05} = -(51600 \times 0.35) = 18100 \text{ Kg.}$$

Momento máximo: $(x = 127000/51600 = 2.47 \text{ m.})$

$$M_{2.47} = -127000 \times 2.22 + 51600 \times 2.47 \times 1.24 = -126000 \text{ Kgm.}$$

$$M_{5.05} = -(-51600 \times 0.45 \times 0.23) = 5220 \text{ Kgm.}$$

Altura util: $M = Kbd^2$

$$d = 60 \text{ cm.}$$

ACERO NEGATIVO:

$$A_s = 12600000 / 1400 \times 0.866 \times 60 = 174 \text{ cm}^2$$

$$E_o = 102000 / 15.8 \times 0.866 \times 60 = 124 \text{ cm.}$$

$$21 \text{ } \phi \text{ 1-1/8}$$

Esf. Cort.: $V_i = 101200 - 51600 \times 0.6 = 70500 \quad v = 0.028f6$

$$V_d = 102000 - 51600 \times 0.6 = 71000 \quad v = 0.028f6$$

ACERO POSITIVO: ($A_{s_{min}} = 0.005 \times 230 \times 60 = 69 \text{ cm}^2$)

$$A_s = 522000 / 1400 \times 0.866 \times 60 = 7.15 \text{ cm}^2$$

$$E_o = 18100 / 15.8 \times 0.866 \times 60 = 22 \text{ cm.}$$

$$18 \text{ } \phi \text{ 7/8}$$

ACERO TRANSVERSAL:

Col. Ext.: $w' = 127000 / 2.30 = 55300 \text{ Kg/m.l.}$

$$M' = 55300 \times 0.9 \times 0.45 = 22500 \text{ Kgm.}$$

$$A_s' = 2250000 / 1400 \times 0.866 \times 60 = 31 \text{ cm}^2$$

$$E_o = 55300 \times 0.90 / 15.8 \times 0.866 \times 60 = 60.7 \text{ cm}$$

$$12 \text{ } \phi \text{ 3/4}$$

Col. Int.: $w'' = 151550 / 2.30 = 66000 \text{ Kg/m.l.}$

$$M'' = 66000 \times 0.90 \times 0.45 = 26700 \text{ Kgm.}$$

$$A_s'' = 267000 / 1400 \times 0.866 \times 60 = 37 \text{ cm}^2$$

$$E_o = 66000 \times 0.9 / 15.8 \times 0.866 \times 60 = 72.4$$

$$13 \text{ } \phi \text{ 3/4}$$

E6 - D6

$$P' = 127440 \text{ Kg.}$$

$$P'' = 166690 \text{ Kg.}$$

$$b' = 50 \text{ cm.}$$

$$b'' = 50 \text{ cm.}$$

$$t' = 50 \text{ ''}$$

$$t'' = 60 \text{ ''}$$

$$L = 4.50 \text{ m.}$$

$$L' = 3.95 \text{ m.}$$

Carga total: $W = 127440 + 166690 + 0.1(294130) = 323543 \text{ Kg.}$

Area: $A = 323549/2.5 = 129000 \text{ cm}^2$

Dist. Result. $X = 166690 \times 4.50 / 294130 = 2.54 \text{ m.}$

Dimensiones: $\bar{A} = 2(2.54 + 0.25) = 5.60 \text{ m.}$

$$\bar{B} = 129000/560 = 2.30 \text{ m.}$$

presión neta $w = 294130/5.60 = 52700 \text{ Kg/m.l.}$

Esfuerzo cortante:

$$V_{.5} = -127440 + 52700 \times 0.5 = -101090$$

$$V_{4.4} = -127440 + 52700 \times 4.4 = 104560$$

$$V_5 = -(52700 \times 0.6) = -31600$$

Momento maximo: $(x = 127440/52700 = 2.42 \text{ m.})$

$$M_{2.42} = -127440 \times 2.17 + 52700 \times 2.42 \times 1.21 = -122000$$

$$M_5 = -(-52700 \times 0.6 \times 0.3) = 9480 \text{ Kgm.}$$

Altura útil:

$$d = 58 \text{ cm.}$$

ACERO NEGATIVO:

$$A_s = 12200000/1400 \times 0.866 \times 58 = 174 \text{ cm}^2$$

$$E_o = 101090/15.8 \times 0.866 \times 58 = 127 \text{ cm.}$$

$$21 \phi 1-1/8$$

Esf. Cort.: $V_l = 101090 - 52700 \times 0.58 = 70590 \text{ Kg. } v = 0.029 f\acute{o}$

$$V_d = 104560 - 52700 \times 0.58 = 74060 \quad v = 0.03 f\acute{o}$$

ACERO POSITIVO:

$$A_s = 948000/1400 \times 0.866 \times 58 = 13.5 \text{ cm}^2$$

$$A_{s_{min}} = 0.005 \times 230 \times 58 = 65.7 \text{ cm}^2$$

$$E_o = 31600/15.8 \times 0.866 \times 58 = 38.5 \text{ cm.}$$

$$17 \phi 7/8$$

ACERO TRANSVERSAL:

Col. Ext.: $w' = 127440/2.30 = 55500 \text{ Kg/m.l.}$

$$M' = 55500 \times 0.90 \times 0.45 = 22300 \text{ Kgm.}$$

$$A_s = 2230000/1400 \times 0.866 \times 58 = 31.8$$

$$E_o = 55500 \times 0.9/15.8 \times 0.866 \times 58 = 70$$

$$12 \phi 3/4$$

Col. Int.: $w'' = 166690/2.30 = 72500 \text{ Kg/m.l.}$

$$M'' = 72500 \times 0.9 \times 0.45 = 29400 \text{ Kgm.}$$

$$A_s'' = 2940000/1400 \times 0.866 \times 58 = 41.8 \text{ cm}^2$$

$$E_s = 72500 \times 0.90 / 15.8 \times 0.866 \times 58 = 82.3 \text{ cm.}$$

$$15 \text{ } \phi \text{ } 3/4$$

E7 - D7

$$P_B = 95250$$

$$P'' = 121190 \text{ Kg.}$$

$$b' = 40 \text{ cm.}$$

$$B'' = 40 \text{ cm.}$$

$$t' = 40 \text{ ''}$$

$$t'' = 50 \text{ ''}$$

$$L = 4.50 \text{ m.}$$

$$L' = 4.05 \text{ m.}$$

Carga total: $W = 95250 + 121190 + 0.1(216440) = 238084 \text{ Kg.}$

Area: $A = 238084/2.5 = 95300 \text{ cm}^2$

Dist. Result. $X = 121190 \times 4.5 / 216440 = 2.52 \text{ m.}$

Dimensiones: $\bar{A} = 2(2.52 + 0.20) = 5.50 \text{ m.}$

$$\bar{B} = 95300/544 = 1.80 \text{ m.}$$

presion neta $w = 216440/5.5 = 39300 \text{ Kg/m.l.}$

Esfuerzos cortantes:

$$V_{.4} = -95250 + 39300 \times 0.40 = 79550 \text{ Kg.}$$

$$V_{4.45} = -95250 + 39300 \times 4.45 = 79750 \text{ Kg.}$$

$$V_{4.95} = -(39300 \times 0.55) = -21600 \text{ Kg.}$$

Momento Maximo: $(x = 95250/39300 = 2.43 \text{ m.})$

$$M_{2.43} = -95250 \times 2.23 + 39300 \times 2.43 \times 1.22 = -96000 \text{ Kgm.}$$

$$M_{4.95} = -(-39300 \times 0.55 \times 0.28) = + 5950 \text{ Kgm.}$$

Altura útil:

$$d = 58 \text{ cm.}$$

ACERO NEGATIVO:

$$A_s = 9600000/1400 \times 0.866 \times 58 = 137 \text{ cm}^2$$

$$E_s = 79750/15.8 \times 0.866 \times 58 = 100 \text{ cm.}$$

$$17 \phi \text{ } 1-1/8$$

Esf. Cort.: $V_i = 79550 - 39300 \times 0.58 = 56750 \quad v = 0.03 f_6$

$$V_d = 79750 - 39300 \times 0.58 = 56950 \quad v = 0.03 f_6$$

ACERO POSITIVO:

$$A_s = 595000/1400 \times 0.866 \times 58 = 8.46$$

$$A_{s_{min}} = 0.005 \times 180 \times 58 = 52.2 \text{ cm}^2$$

$$E_o = 21600 / 15.8 \times 0.866 \times 58 = 27 \text{ cm}$$

$$14 \text{ } \phi \text{ } 7/8$$

ACERO TRANSVERSAL

$$w' = 95250 / 1.80 = 53000 \text{ Kg/m.l.}$$

$$M' = 53000 \times 0.70 \times 0.35 = 13000 \text{ Kgm.}$$

$$A_s = 1300000 / 1400 \times 0.866 \times 58 = 18.5 \text{ cm}^2$$

$$E_o = 53000 \times 0.7 / 15.8 \times 0.866 \times 58 = 46.7 \text{ cm.}$$

$$8 \text{ } \phi \text{ } 3/4$$

$$w'' = 121190 / 1.80 = 67300 \text{ Kg/m.l.}$$

$$M'' = 67300 \times 0.70 \times 0.35 = 16500$$

$$A_s = 1650000 / 1400 \times 0.866 \times 58 = 23.5 \text{ cm}^2$$

$$E_o = 67300 \times 0.70 / 15.8 \times 0.866 \times 58 = 59.4 \text{ cm.}$$

$$10 \text{ } \phi \text{ } 3/4$$

A1 - A2

$$P' = 109100 \text{ Kg}$$

$$P'' = 148180 \text{ Kg.}$$

$$b' = 50 \text{ cm.}$$

$$b'' = 60 \text{ cm.}$$

$$t'' = 40 \text{ cm}$$

$$t'' = 50 \text{ ''}$$

$$L = 4.50 \text{ m.}$$

$$\begin{aligned} \text{Carga total: } W &= 109100 + 148180 + 0.10(109100 + 148180) \\ &= 283008 \text{ Kg.} \end{aligned}$$

$$\text{Area: } A = 283008 / 2.5 = 113200 \text{ cm}^2$$

$$\text{Dist. result. } X = 148180 \times 4.50 / 257280 = 2.60 \text{ m.}$$

$$\text{Dimensiones: } \bar{A} = 2(2.60 + 0.20) = 5.60 \text{ m.}$$

$$\bar{B} = 11320 / 560 = 2.20 \text{ m.}$$

$$\text{presion neta: } w = 257280 / 5.60 = 46000 \text{ Kg/m.l.}$$

Refuerzos cortantes:

$$V_{.4} = -109100 + 46000 \times 0.4 = -90700 \text{ Kg.}$$

$$V_{4.45} = -109100 + 46000 \times 4.45 = + 115900 \text{ Kg.}$$

$$V_{4.95} = -(46000 \times 0.65) = -29900 \text{ Kg.}$$

$$\text{Momento maximo: } (x = 109100 / 46000 = 2.37 \text{ m.})$$

$$M_{2.37} = -109100 \times 2.17 + 46000 \times 2.37 \times 1.19 = -108000$$

$$M_{4.95} = -(-46000 \times 0.65 \times 0.33) = + 9720$$

Altura útil:

$$d = 55 \text{ cm.}$$

ACERO NEGATIVO:

$$A_s = 10800000 / 1400 \times 0.866 \times 55 = 191 \text{ cm}^2$$

$$E_o = 115900 / 15.8 \times 0.866 \times 55 = \overset{\text{XXXXXX}}{154} \text{ cm} \quad 154 \text{ cm.}$$

$$24 \phi 1-1/8$$

$$E_{sf. Cort.}: V_i = 90700 - 46000 \times 0.55 = 65400 \text{ Kg.} \quad v = 0.03 f_6$$

$$V_d = 115900 - 46000 \times 0.55 = 86900 \text{ " } \quad v = 0.41 f_6$$

Estribos:- (6 ϕ 1/2) Derecha:- 1 a 12 ; 2 a 24 cm.

ACERO POSITIVO:

$$A_s = 972000 / 1400 \times 0.866 \times 55 = 12.6 \text{ cm}^2$$

$$A_{s_{min}} = 0.005 \times 220 \times 55 = 60.6 \text{ cm}^2$$

$$E_o = 29900 / 15.8 \times 0.866 \times 55 = 29.7 \text{ cm.}$$

$$16 \phi 7/8$$

ACERO TRANSVERSAL:

$$w' = 109100 / 2.20 = 49700 \text{ Kg/m.l.}$$

$$M' = 49700 \times 0.90 \times 0.45 = 20100 \text{ Kgm.}$$

$$A_s = 2010000 / 1400 \times 0.866 \times 55 = 30.2$$

$$E_o = 49700 \times 0.90 / 15.8 \times 0.866 \times 55 = 66 \text{ cm.}$$

$$11 \phi 3/4$$

$$w'' = 148180 / 2.20 = 67500 \text{ Kg/m.l.}$$

$$M'' = 67500 \times 0.85 \times 0.43 = 24400 \text{ Kgm.}$$

$$A_s = 2440000 / 1400 \times 0.866 \times 55 = 36.6$$

$$E_o = 67500 \times 0.85 / 15.8 \times 0.866 \times 55 = \overset{\text{XX}}{96} \text{ cm.} \quad 76 \text{ cm.}$$

$$\text{XB} \quad 16 \phi 3/4$$

B1 - B2

$$P' = 161880$$

$$P'' = 164480$$

$$b' = 60 \text{ cm}$$

$$b'' = 60 \text{ cm}$$

$$t' = 50 \text{ cm}$$

$$t'' = 50 \text{ "}$$

$$L = 4.50 \text{ m.}$$

$$L' = 4.00 \text{ "}$$

Carga total: $W = 161880 + 164480 + 0.10(326360) = 35896$

Area: $A = 358996/2.5 = 143500 \text{ cm}^2$

Dist. Result. $X = 164480 \times 4.50 / 326360 = 2.27 \text{ m.}$

Dimensiones: $\bar{A} = 2(2.27 + 0.25) = 5.10 \text{ m.}$

$$\bar{B} = 143500 / 510 = 2.80 \text{ m.}$$

presion neta: $w = 325660 / 5.10 = 63800 \text{ Kg/m.l.}$

Esfuerzos cortantes:

$$V_{.5} = -161880 + 63800 \times 0.5 = -129980 \text{ Kg.}$$

$$V_{4.5} = -161880 + 63800 \times 4.5 = +125120 \text{ Kg}$$

$$V_5 = -(63800 \times 0.1) = -6380 \text{ Kg.}$$

Momento maximo: $(x = 161880 / 63800 = 2.54 \text{ m.})$

$$M_{2.54} = -161880 \times 2.29 + 63800 \times 254 \times 1.27 = 165000 \text{ Kgm.}$$

$$M_5 = -(-63800 \times 0.1 \times 0.05) = 320 \text{ Kgm.}$$

Altura útil:

$$d = 60 \text{ cm.}$$

ACERO NEGATIVO:

$$A_s = 16500000 / 1400 \times 0.866 \times 60 = 227 \text{ cm}^2$$

$$E_o = 129980 / 15.8 \times 0.866 \times 60 = 158$$

$$23 \phi 1-1/4$$

Esf. Cort.: $V_l = 129980 - 63800 \times 0.6 = 91780 \quad v = 0.03 f_6$

$$V_d = 125120 - 63800 \times 0.6 = 86920 \quad v = 0.028 f_6$$

ACERO POSITIVO:

$$A_s = 32000 / 1400 \times 0.866 \times 60 = 0.5 \text{ cm}^2$$

$$A_{s_{min}} = 0.05 \times 280 \times 60 = 84 \text{ cm}^2$$

$$22 \phi 7/8$$

ACERO TRANSVERSAL:

$$w' = 161880 / 2.80 = 57800 \text{ Kg/m.l.}$$

$$M' = 57800 \times 1.10 \times 0.55 = 34900 \text{ Kgm.}$$

$$A_s = 3490000 / 1400 \times 0.866 \times 60 = 48 \text{ cm}^2$$

$$E_o = 57800 \times 1.10 / 15.8 \times 0.866 \times 60 = 78 \text{ cm.}$$

$$17 \phi 3/4$$

$$w'' = 164480 / 2.8 = 58800 \text{ Kg/m.l.}$$

$$M'' = 58800 \times 1.1 \times 0.55 = 35600 \text{ Kgm.}$$

$$A_s = 3560000 / 1400 \times 0.866 \times 60 = 49 \text{ cm}^2$$

$$E_o = 58800 \times 1.10 / 15.8 \times 0.866 \times 60 = 79 \text{ cm.}$$

17 ϕ 3/4

D1 - D2

$$P' = 81780 \text{ Kg}$$

$$P'' = 113350 \text{ Kg.}$$

$$b' = 40 \text{ cm.}$$

$$b'' = 50 \text{ cm.}$$

$$t' = 40 \text{ "}$$

$$t'' = 40 \text{ "}$$

$$L = 4.50 \text{ m.}$$

$$L' = 4.10 \text{ "}$$

Carga total: $W = 81780 + 113350 + 0.1(195130) = 21463 \text{ Kg.}$

Area: $A = 214643 / 2.5 = 85600 \text{ cm}^2$

Dist. Result. $X = 113350 / 195130 = 2.61$

Dimensiones: $\bar{A} = 2(2.61 + 0.20) = 5.60 \text{ m.}$

$$\bar{B} = 85600 / 5.6 = 1.60 \text{ m.}$$

presion neta: $w = 195130 / 5.6 = 35000 \text{ Kg/m.l.}$

Esfuerzos cortantes:

$$V_{.4} = -81780 + 35000 \times 0.4 = -67780 \text{ Kg.}$$

$$V_{4.5} = -81780 + 35000 \times 4.5 = 75720 \text{ Kg.}$$

$$V_{4.9} = -(35000 \times 0.7) = -24500 \text{ Kg.}$$

Momento máximo: $(x) = 81780 / 35000 = 2.34 \text{ m.}$

$$M_{2.34} = -81780 \times 2.14 + 35000 \times 2.34 \times 1.17 = -79200 \text{ Kg.}$$

$$M_{4.9} = -(-35000 \times 0.7 \times 0.35) = 8580 \text{ Kgm.}$$

Altura útil:

$$d = 55 \text{ cm.}$$

ACERO NEGATIVO:

$$A_s = 7920000 / 1400 \times 0.866 \times 55 = 119 \text{ cm}^2$$

$$E_o = 75720 / 15.8 \times 0.866 \times 55 = 100 \text{ cm.}$$

24 ϕ 1"

Esf. Cort.: $V_l = 67780 - 35000 \times 0.55 = 48580 \quad v = 0.03f\delta$

$$V_d = 75720 - 35000 \times 0.55 = 56520 \quad v = 0.035f\delta$$

Estribos: - ($6\phi 1/2$) Derecha: - 1 a 13 ; 1 a 26 cm.

ACERO POSITIVO:

$$A_s = 858000/1400 \times 0.866 \times 55 = 12.2 \text{ cm}^2$$

$$A_{s_{min}} = 0.005 \times 160 \times 55 = 44 \text{ cm}^2$$

$$E_o = 24500/15.8 \times 0.866 \times 55 = 32.8$$

16 ϕ 3/4

ACERO TRANSVERSAL:

$$w' = 81780/1.60 = 51000 \text{ Kg/m.l.}$$

$$M' = 51000 \times 0.6 \times 0.3 = 9180 \text{ Kgm.}$$

$$A_s = 918000/1400 \times 0.866 \times 55 = 13.7 \text{ cm}^2$$

$$E_o = 51000 \times 0.6/15.8 \times 0.866 \times 55 = 40.7 \text{ cm}$$

7 ϕ 3/4

$$w'' = 11335/1.60 = 71000 \text{ Kg/m.l.}$$

$$M'' = 71000 \times 0.55 \times 0.28 = 19600 \text{ Kgm.}$$

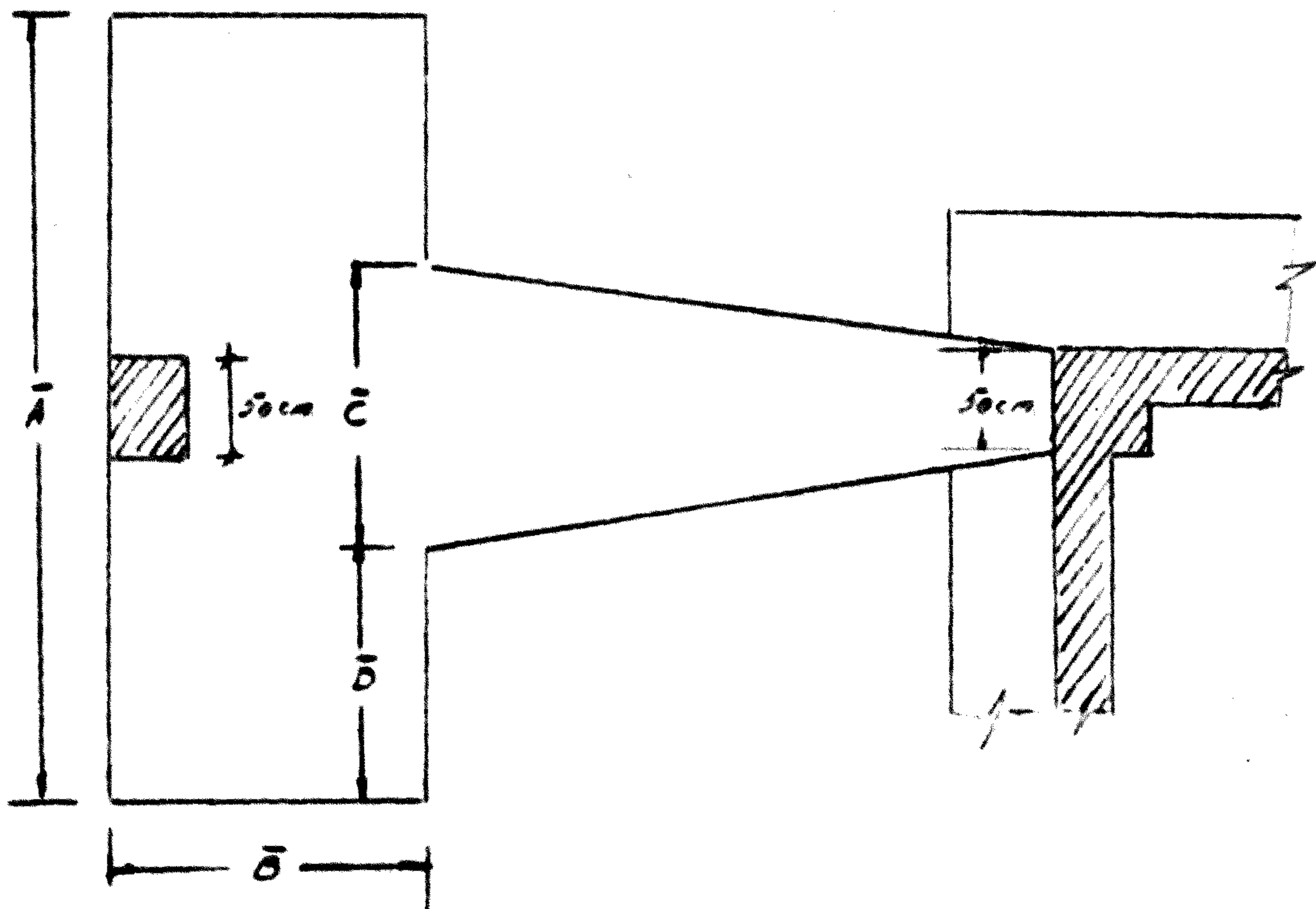
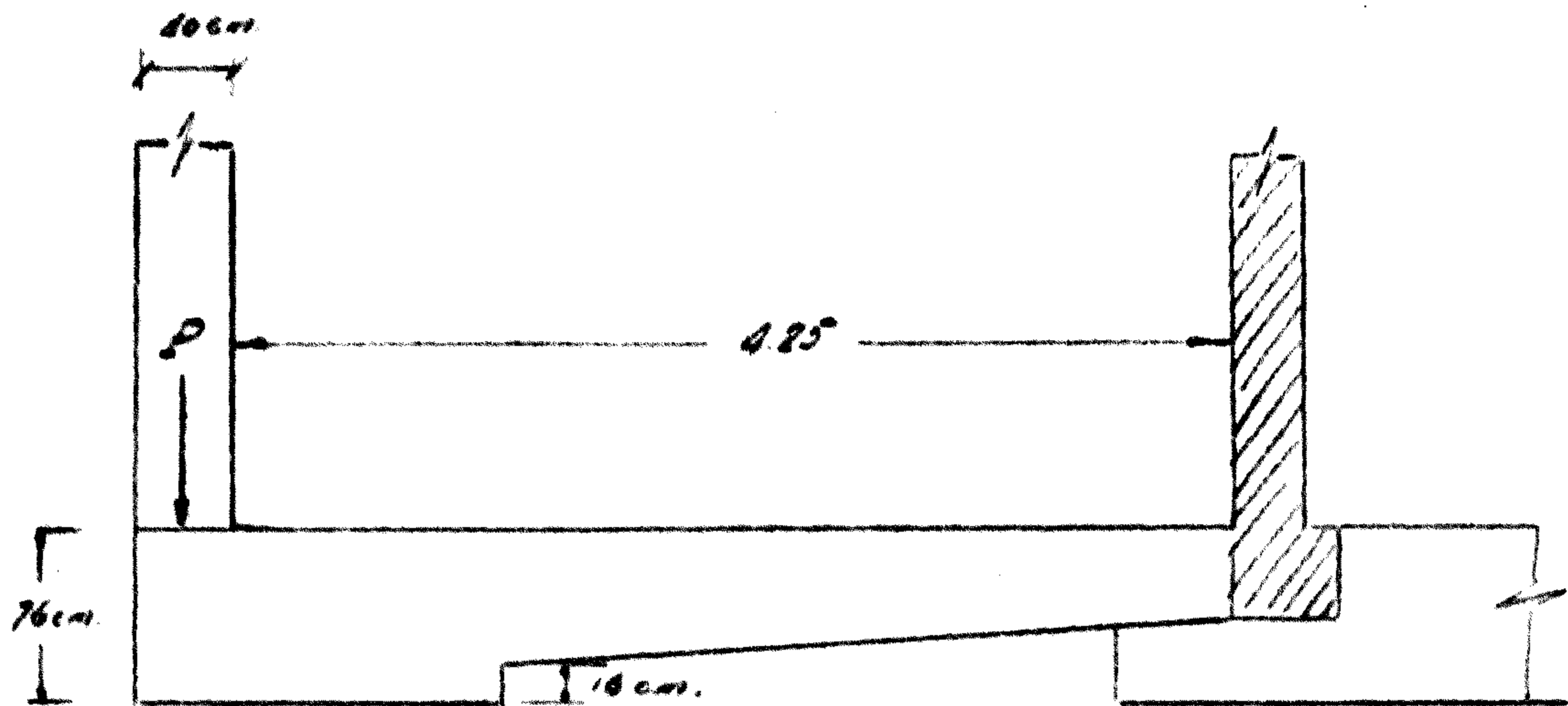
$$A_s = 1960000/1400 \times 0.866 \times 55 = 29.4 \text{ cm}^2$$

$$E_o = 71000 \times 0.55/15.8 \times 0.866 \times 55 = 51.7$$

11 ϕ 3/4

ZAPATA CONECTADA

($f_b = 210 \text{ Kg/cm}^2$)



C1

$P = 119720 \text{ Kg.}$

$b \times t = 40 \times 50 \text{ cm.}$

Carga total:

$W = 1.15 P = w_n \cdot \bar{A} \cdot \bar{B}$

$w_n = 2.5 - 0.2 = 2.3 \text{ Kg/cm}^2$

$\bar{A} = 2.5 \bar{B}$

$1.15P = w_n \bar{B}^2 \times 2.5$

Dimensiones:

$\bar{B} = \frac{1.15 \times 119720}{2.5 \times 2.3} \quad \bar{B} = 1.60 \text{ m.}$

$\bar{A} = 2.5 \times 1.60 = 4.00 \text{ m.}$

$\bar{C} = 0.83 \bar{B} = 0.83 \times 1.60 = 1.40 \text{ m.}$

$$D = \frac{4.00 - 1.40}{2} = 1.30 \text{ m.}$$

Momento máximo: $M = 160 \times 130 \times 65 \times 2.3 = 3110000 \text{ Kg-cm.}$

Esf. Cort. Max.: $V = 160 \times 130 \times 2.3 = 47800 \text{ Kg.}$

Altura útil: $d = V/vjb = 47800/5.3 \times 0.866 \times 160 = 66 \text{ cm.}$

ACERO: $A_s = 3110000/1400 \times 0.866 \times 66 = 42.8 \text{ cm}^2$

$$E_o = 47800/11.8 \times 0.866 \times 66 = 71 \text{ cm.}$$

15 ϕ 3/4

VIGA DE CONEXION:

$$M = P.e \quad e = 0.80 - 0.20 = 0.60 \text{ m.}$$

$$M = 119720 \times 0.6 = 71800 \text{ Kgm.}$$

El momento mas desfavorable se encuentra en la seccion de la cara interior de la zapata, este momento es:

$$M' = 71800(4.65 - 1.60)/(4.65 - 0.8) = 57700 \text{ Kgm.}$$

Altura útil: $d' = 50 \text{ cm.}$

Acero: $A_s = 5770000/1400 \times 0.866 \times 50 = 95 \text{ cm}^2$

$$V = 71800/3.85 = 18700 \text{ Kg.}$$

$$E_o = 18700/11.8 \times 0.866 \times 50 = 36.5 \text{ cm.}$$

12 ϕ 1-1/8

$$v = 18700/140 \times 0.866 \times 50 = 3.1 \text{ Kg/cm}^2$$

Para el extremo de la viga vamos a tomar un ancho $b = 50 \text{ cm.}$ y una altura útil $d = 40 \text{ cm.}$

Esfuerzo cortante: $V_c = 6.3 \times 0.866 \times 50 \times 40 = 10900$

$$V_s = 18700 - 10900 = 7800$$

Estridos: (2 ϕ 1/2) 1 a 8 ; 9 a 16 cm.

VIGAS TECHO SOTANO

($f_b = 210 \text{ Kg/cm}^2$)

FORMULAS EMPLEADAS Y ALGUNOS VALORES DE CONSTANTES.-

VIGAS 30 x 70

$d = 65 \text{ cm.}$ $V_o = 10600 \text{ Kg.}$
 $A_{smin} = 9.75 \text{ cm}^2$ $v = 0.000593V$
 $M_{Asmin} = 7690 \text{ Kgm.}$ $E_o = 0.00113V$
 $M_o = 20863 \text{ Kgm.}$

VIGAS 30 x 60

$d = 55 \text{ cm.}$ $V_o = 9000 \text{ Kg.}$
 $A_{smin} = 8.28 \text{ cm}^2$ $v = 0.0007V$
 $M_{Asmin} = 5500 \text{ Kgm.}$ $E_o = 0.00134V$
 $M_o = 14973 \text{ Kgm.}$

Areas de acero:

$$A_s = \frac{M}{f_s j d} = \frac{M}{d} \times 0.0825$$

Estridos:

$$s = \frac{a_s f_s j d}{V_{sm}} \quad a = \frac{V_{sm}}{w}$$

Cuadro para cálculo de estridos a diferentes espaciamientos:

| | s | V_{sm} | $V_{sm} + V_o$ |
|----------|----|----------|----------------|
| (d = 65) | 10 | 11200 | 20800 |
| | 15 | 7470 | 18070 |
| | 20 | 5600 | 16200 |
| | 25 | 4480 | 15080 |
| | 30 | 3730 | 14330 |
| (d = 55) | 10 | 9470 | 18470 |
| | 15 | 6320 | 15320 |
| | 20 | 4740 | 13740 |
| | 25 | 3780 | 12780 |

$$a = \frac{V_{max} - (V_{sm} + V_o)}{w}$$

SVIAB 30 x 70 cm. L = 6.75 mts. d = 65 cm.

Pp 530
M 2000 2530 x 6.75 = 1700

| | u | M | A _B | Ø | E _o |
|-----------|-------|-------|----------------|---------------|----------------|
| Izquierda | 9600 | 6219 | 9.75 | 2Ø7/8 + 1Ø5/8 | 19 |
| Centro | 14400 | 6011 | 9.75 | 2Ø7/8 + 1Ø5/8 | 19 |
| Derecha | 9600 | 10559 | 13.4 | 2Ø7/8 + 2Ø3/4 | 26 |

$$V_t = 8550 - 640 = 8910 \quad E_o = 10.1 \quad v = 0.025 f'_c$$

$$V_d = 8550 + 640 = 9190 \quad 10.4 \quad 0.026$$

SVIBC 30 x 60 4.10 55

Pp 450
M 2000
L 1350
a/e 900 4700 x 4.1 = 19300

| | | | | | |
|-----------|------|------|-------|-----------------------|----|
| Izquierda | 6600 | 7234 | 10.85 | 2Ø7/8 + 2Ø3/4 | 26 |
| Centro | 9900 | 2905 | 8.26 | 3Ø3/4 | 18 |
| Derecha | 6600 | 6757 | 10.15 | 2Ø3/4 + 1Ø5/8 + 1Ø7/8 | 24 |

$$V_t = 9650 + 12 = 96662 \quad E_o = 12.9 \quad v = 0.032 f'_c$$

$$V_d = 9650 - 12 = 9638 \quad 12.8 \quad 0.032$$

Estribos: (2Ø3/8) Izq. 1 a 14 cm
Der. 1 a 14 "

SVICD 30 x 60 4.05 55

Pp 450
M 2000
T 620
L 1440
a/e 960 5470 x 4.05 = 22200

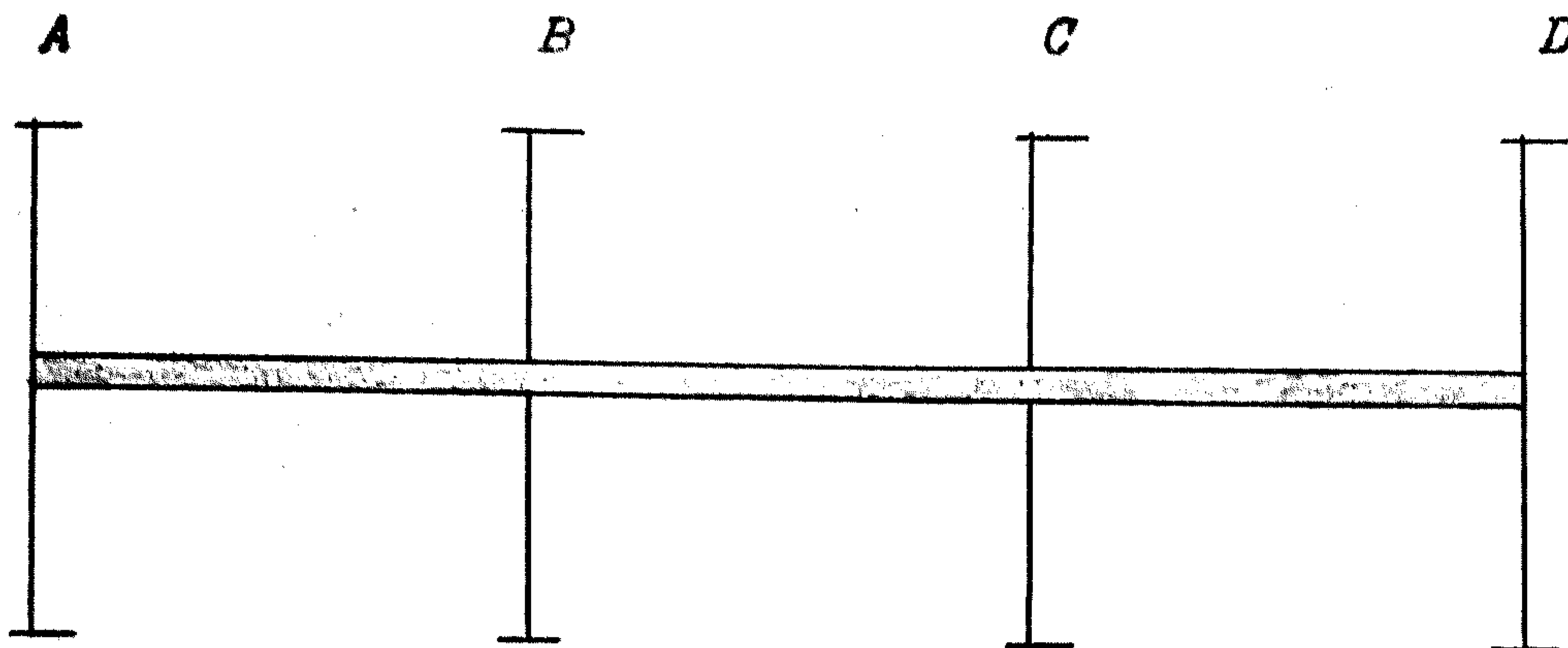
$$\angle a 2.20 = 1170$$

| | | | | | |
|-----------|----------------------------|------|-------|-----------------------|----|
| Izquierda | 7480 <u>480</u> 7960 | 7749 | 11.65 | 2Ø3/4 + 1Ø5/8 + 1Ø7/8 | 24 |
| Centro | 11200 <u>1180</u> 12380 | 6508 | 9.80 | 2Ø7/8 + 1Ø5/8 | 19 |
| Derecha | 7480 <u>640</u> 8120 | 4008 | 8.26 | 1Ø3/4 + 3Ø5/8 | 21 |

$$V_t = 11100 + 530 + 930 = 12560 \quad E_o = 16.6 \quad v = 0.043 f'_c$$

$$V_d = 11100 + 640 - 930 = 10710 \quad 14.6 \quad 0.037$$

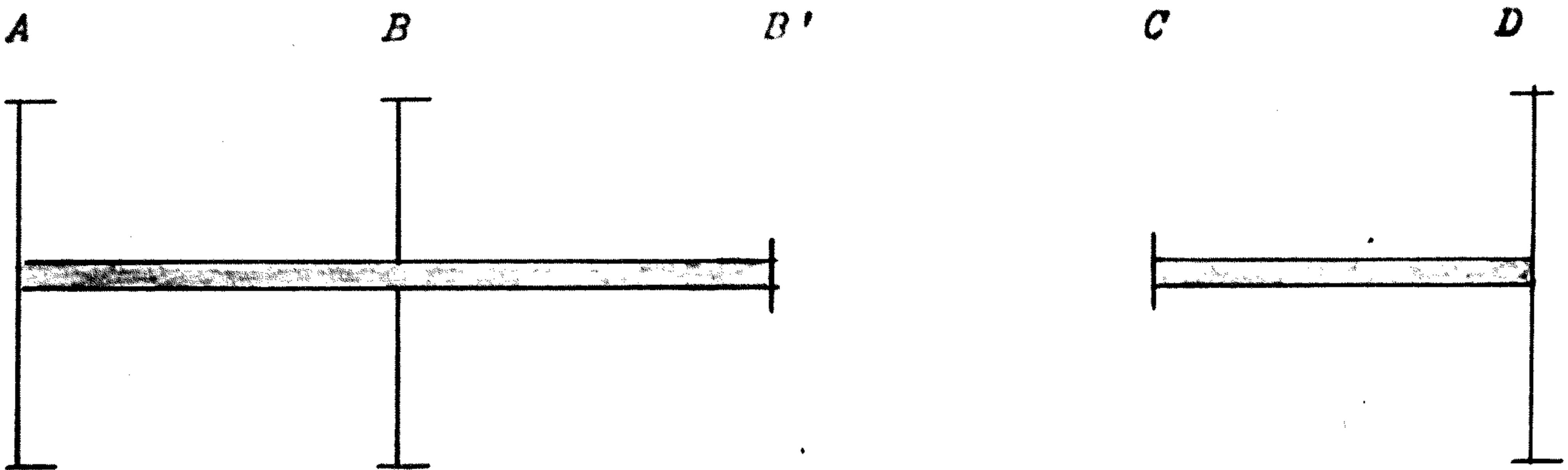
- SJE 1 -



| .382 | .179 | .175 | .271 | .282 | .524 |
|--------------|---------------|--------------|--------------|--------------|--------------|
| +9600 | -9600 | +6600 | -6600 | +7960 | -8120 |
| -3660 | + 537 | + 537 | - 369 | - 383 | +4250 |
| + 268 | -1830 | - 184 | + 268 | + 364 | - 192 |
| - 100 | + 360 | + 353 | - 171 | - 178 | + 100 |
| + 180 | - 50 | - 86 | + 176 | + 50 | - 89 |
| - 69 | + 24 | + 24 | - 61 | - 64 | + 47 |
| <u>+6219</u> | <u>-10559</u> | <u>+7234</u> | <u>-6757</u> | <u>+7749</u> | <u>-4004</u> |

- 0 - - 0 -

- SJE 2 -



| .235 | .168 | .284 | 0 |
|---------------|---------------|--------------|--------------|
| +16500 | -16500 | +2000 | -2000 |
| - 3880 | + 2440 | +4120 | 0 |
| + 1220 | - 1940 | 0 | +2060 |
| - 287 | + 326 | + 551 | 0 |
| + 163 | - 143 | 0 | + 257 |
| - 38 | + 24 | + 39 | 0 |
| <u>+13678</u> | <u>-15793</u> | <u>+6710</u> | <u>+ 335</u> |

| 0 | .387 |
|---------------|---------------|
| +10400 | -10400 |
| 0 | + 4020 |
| +2010 | 0 |
| 0 | 0 |
| <u>+12410</u> | <u>- 6380</u> |

- 0 - 0 - 0 -

Estribos:
(2ø3/8)

Izquierda: 1 a 0.12 ; 2 a 0.25 mts.

Derecha: 1 a 0.12 ; 1 a 0.25 "

- 39 -

SV2AB

30 x 70

6.40

65

Pp 530

M 2000

L 1380

a/c 920 4830 x 6.4 = 31000

Izquierda 16500 13678 17.3 2ø1" + 2ø7/8 30

Centro 24700 9965 12.65 1ø1" + 2ø7/8 22

Derecha 16500 15793 20.0 4ø1" 32

$V_i = 15500 - 330 = 15170$ $E_o = 17.1$ $v = 0.043 f'_o$

$V_d = 15500 + 330 = 15830$ 17.8 0.045 "

Estribos:
(2ø3/8)

Izq. 1 a 12 ; 1 a 25 ; 2 a 30 cm.

Der. 1 a 11 ; 1 a 22 ; 2 a 30 "

SV2BB'

30 x 60

2.20

55

Pp 450

L 2700

a/c 1800 4950 x 2.2 = 10900

Izquierda 2000 6710 10.1 4ø1" 32

Centro 3000 (-187) 8.26 4ø1" 32

Derecha 2000 335 8.26 3ø3/4 18

$V_i = 5450 + 3200 = 8650$ $E_o = 11.5$ $v = 0.029 f'_o$

$V_d = 5450 - 3200 = 2250$ 2.5

SV2CD

30 x 60

4.10

55

Pp 450

T 2460

L 2700

a/c 1800 7410 x 4.1 = 30400

Izquierda 10400 12410 18.6 3ø1" + 1ø7/8 31

Centro 15600 6035 9.05 1ø7/8 + 1ø5/8 19

Derecha 10400 6380 9.58 1ø7/8 + 3 ø 1" 31

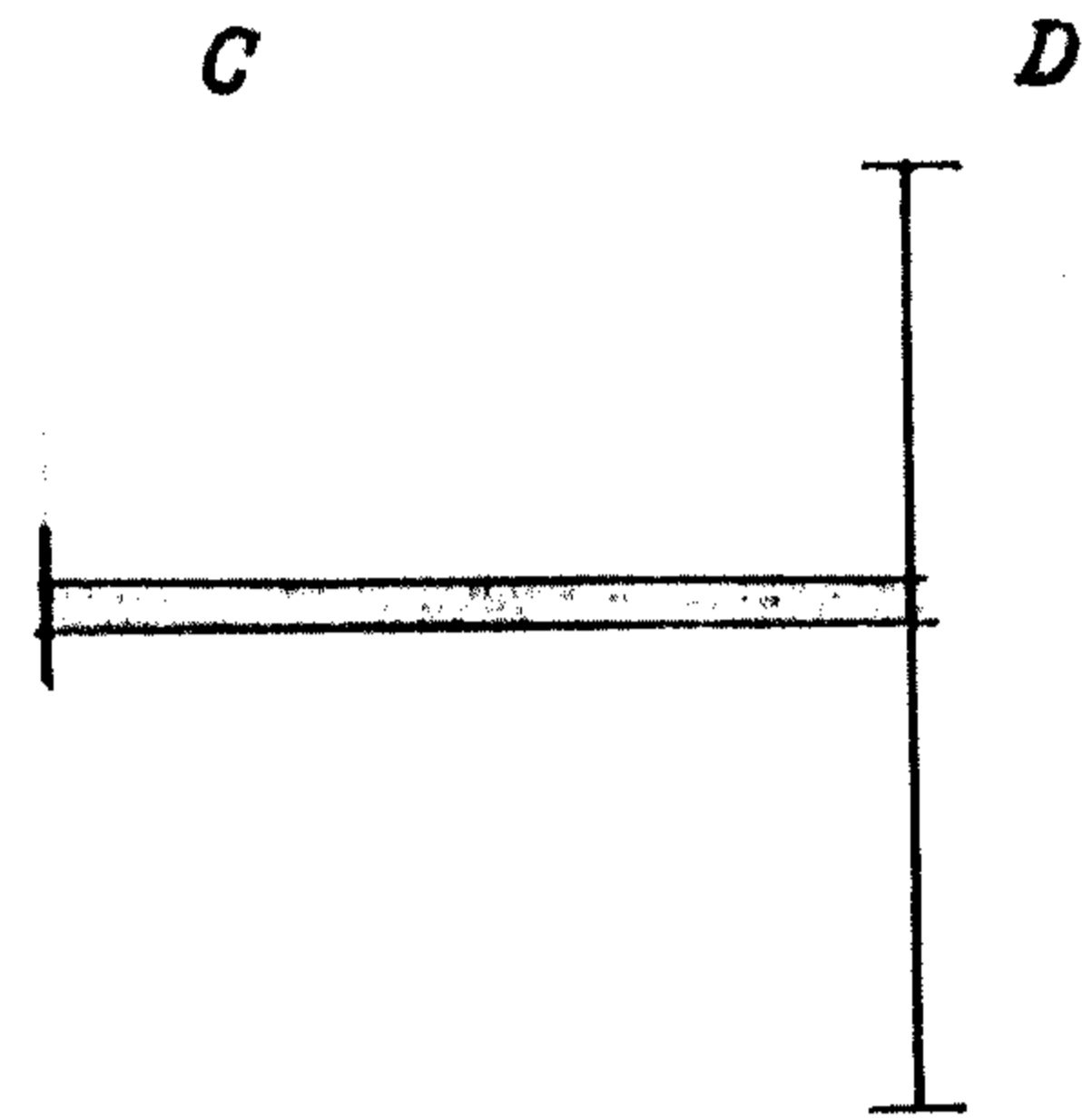
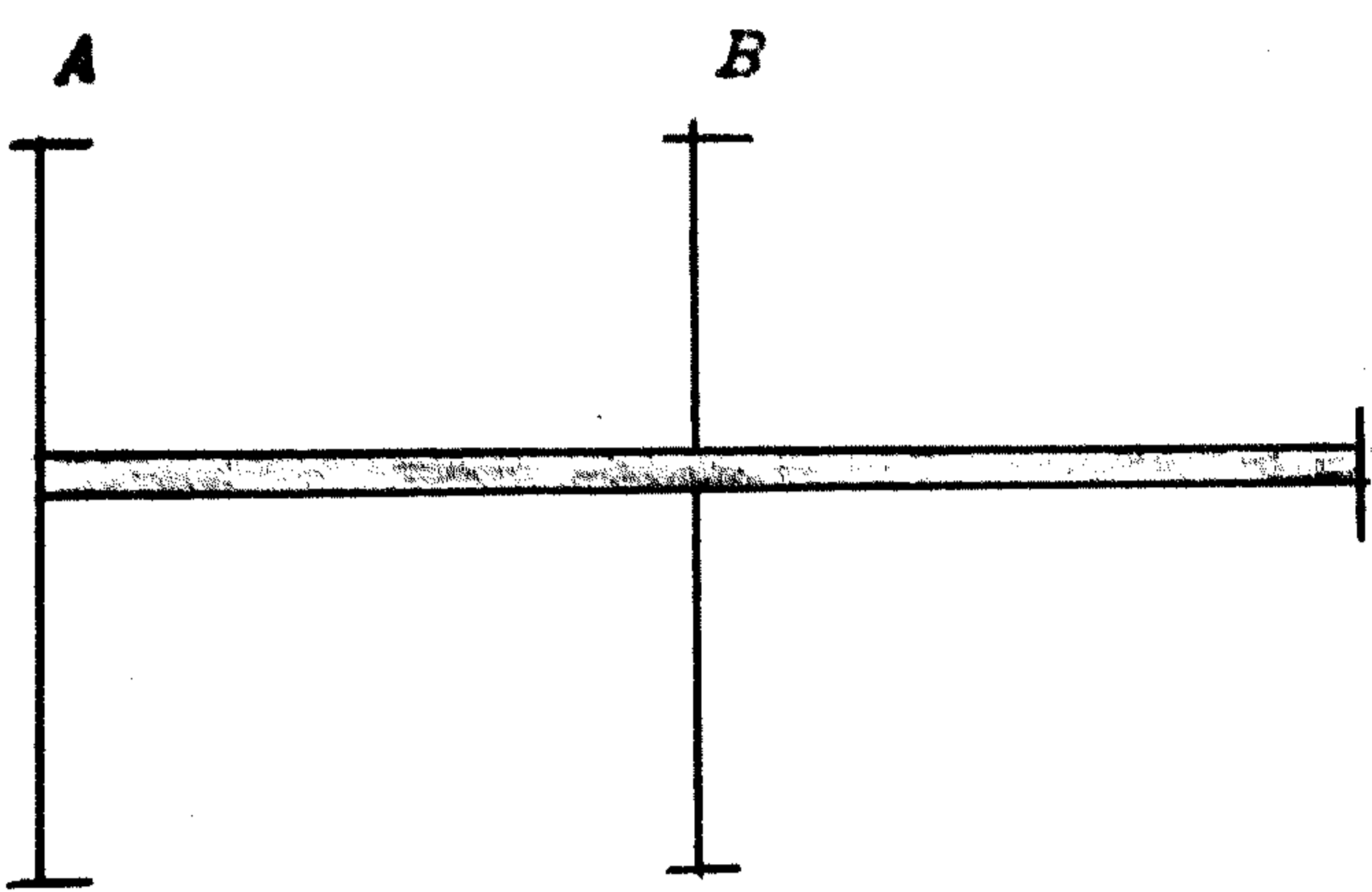
$V_i = 15200 + 137 = 15437$ 30.8 0.052

$V_d = 15200 - 137 = 15063$ 30.1 0.050

Estribos:- Izq. 1 a 7 ; 2 a 15 ; 2 a 25

(2ø3/8) Der. 1 a 8 ; 2 a 16 ; 2 a 25

- EJE 3 -



| .265 | .163 | .275 | 0 |
|---------------|---------------|--------------|--------------|
| +20300 | -20300 | +2100 | -2100 |
| - 5380 | + 2970 | +4820 | 0 |
| + 1485 | - 2690 | 0 | +2410 |
| - 394 | + 438 | + 740 | 0 |
| + 219 | - 197 | 0 | + 370 |
| - 58 | + 32 | + 54 | 0 |
| <u>+16172</u> | <u>-19747</u> | <u>+7714</u> | <u>+ 680</u> |

| 0 | .387 |
|---------------|---------------|
| +11890 | -10690 |
| 0 | +4140 |
| + 2070 | 0 |
| 0 | 0 |
| <u>+13960</u> | <u>- 6550</u> |

| | | | |
|-------------------|---------------------------------------|---------------------|------------------------------|
| <u>SV3AB</u> | 30 x 70 | 6.35 | 62.5 cm. |
| Pp | 530 | | |
| M | 1000 | | |
| L | 2700 | | |
| a/c | <u>1800</u> | 6030 x 6.35 = 38300 | |
| Izquierda | 20300 | 16172 | 21.30 2ø7/8 + 5ø3/4 44 |
| Centro | 30500 | 12541 | 16.60 1ø1 + 3ø7/8 29 |
| Derecha | 20300 | 19747 | 26.0 4ø7/8 + 4ø3/4 51 |
| V_i | = 19150 - 590 = 18560 | | 21 0.053 |
| V_d | = 19150 + 590 = 19740 | | 22 0.056 |
| Estribos: (2ø3/8) | Izq. 1 a 7 ; 2 a 14 ; 2 a 20 ; 2 a 30 | | |
| | der. 1 a 6 ; 5 a 12 ; 2 a 20 ; 2 a 30 | | |

66

| | | | |
|---------------|-----------------------|--------------------|-------------------------------|
| <u>SV3BB'</u> | 30 x 60 | 2.10 | 55 |
| Pp | 450 | | |
| T | 770 | | |
| L | 2700 | | |
| a/c | <u>1800</u> | 5720 x 2.1 = 12000 | |
| Izquierda | 2100 | 7714 | 11.60 4ø3/4 + 4 ø7/8 52 |
| Centro | 3150 | (-367) | 8.26 4ø3/4 + 4ø7/8 52 |
| Derecha | 2100B | 680 | 8.26 3 ø 3/4 18 |
| V_i | = 3700 + 4000 = 7700 | | 8.8 0.027 |
| V_d | = 3700 - 4000 = - 300 | | |

| | | | |
|-----------------|-------------|--------------------|---------------------------------------|
| <u>SV3CD</u> | 30 x 60 | 4.10 | 52.5 |
| Pp | 450 | | |
| T | 1670 | | |
| L | 2700 | | |
| a/c | <u>1800</u> | 6620 x 4.1 = 27200 | |
| \angle a 0.95 | = 3200 | | |
| \angle a 2.10 | = 1600 | | |
| Izquierda | 9300 | | |
| | 1790 | | |
| | <u>800</u> | 11890 | 13960 21.95 4ø7/8 + 2ø3/4 34 |
| XXXXXXXX | | | |
| Derecha | 14000 | | |
| | 1510 | | |
| | <u>1590</u> | 17100 | 6900 10.30 2ø7/8 + 1ø3/4 20 |
| Derecha | 9300 | | |
| | 540 | | |
| | <u>850</u> | 10690 | 6550 9.83 1ø7/8 + 2ø3/4 19 |

- EJE 4 -

| A | B | C | D | E |
|---|---|---|---|---|
| | | | | |
| | | | | |

| .271 | .173 | .163 | .234 | .234 | .181 | .181 | .496 |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|
| +15600 | -15600 | +6900 | -6900 | +6900 | -6900 | +5630 | -5270 |
| - 4220 | + 1670 | +1580 | 0 | 0 | + 230 | + 230 | +3120 |
| + 835 | - 2110 | 0 | + 790 | + 115 | 0 | +1560 | + 115 |
| - 226 | + 366 | + 344 | - 212 | - 212 | - 282 | - 282 | - 57 |
| + 183 | - 113 | - 106 | + 172 | - 141 | - 106 | - 28 | - 141 |
| - 50 | + 28 | + 26 | - 8 | - 8 | + 24 | + 24 | + 70 |
| <u>+12122</u> | <u>-15759</u> | <u>+8744</u> | <u>-6158</u> | <u>+6654</u> | <u>-7034</u> | <u>+7134</u> | <u>-3163</u> |

| .271 | .173 | .163 | .234 | .234 | .181 | .181 | .496 |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|
| +15600 | -15600 | +4500 | -4500 | +6900 | -6900 | +5630 | -5630 |
| - 4220 | + 1930 | +1810 | - 560 | - 560 | + 230 | + 230 | +2790 |
| + 965 | - 2110 | - 280 | + 905 | + 115 | - 280 | -1395 | + 115 |
| - 261 | + 414 | + 390 | - 238 | - 238 | + 303 | + 303 | - 57 |
| + 207 | - 131 | - 119 | + 195 | + 152 | - 119 | - 28 | + 152 |
| - 56 | + 43 | + 41 | - 81 | - 81 | + 27 | + 27 | - 75 |
| <u>-12235</u> | <u>-15454</u> | <u>+6342</u> | <u>-4279</u> | <u>+6288</u> | <u>-6739</u> | <u>+4767</u> | <u>-2705</u> |

| .271 | .173 | .163 | .234 | .234 | .181 | .181 | .496 |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|
| +10000 | -10000 | +6900 | -6900 | +4500 | -4500 | +5630 | -6270 |
| - 2710 | + 536 | + 505 | + 562 | + 562 | - 205 | - 205 | +3110 |
| + 268 | - 1355 | + 281 | + 253 | - 103 | + 281 | +1555 | - 103 |
| - 73 | + 203 | + 192 | - 35 | - 35 | - 332 | - 332 | + 51 |
| + 102 | - 36 | + 18 | + 96 | - 166 | - 18 | + 26 | - 166 |
| - 28 | + 3 | + 3 | + 16 | + 16 | - 1 | - 1 | + 82 |
| <u>+ 7559</u> | <u>-10649</u> | <u>+7899</u> | <u>-6008</u> | <u>+4774</u> | <u>-4775</u> | <u>+6673</u> | <u>-3296</u> |

| .271 | .173 | .163 | .234 | .234 | .181 | .181 | .496 |
|---------------|---------------|--------------|--------------|----------|----------|----------|----------|
| +15600 | -15600 | +6900 | -6900 | +4500 | -4500 | +5630 | -5630 |
| - 4220 | + 1670 | +1580 | + 562 | + 562 | - 205 | - 205 | +3110 |
| + 835 | - 2110 | + 281 | + 790 | - 103 | + 281 | +1555 | - 103 |
| - 226 | + 316 | + 298 | - 160 | - 160 | - 332 | - 332 | + 51 |
| + 158 | - 113 | - 80 | + 149 | - 166 | - 80 | + 26 | - 166 |
| - 35 | + 33 | + 31 | - 4 | - 4 | + 10 | + 10 | - 82 |
| <u>+12110</u> | <u>-15804</u> | <u>+9010</u> | <u>-5563</u> | <u> </u> | <u> </u> | <u> </u> | <u> </u> |

- RJE 4 -

| A | B | | C | | D | | E |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>.271</u> | <u>.173</u> | <u>.163</u> | <u>.234</u> | <u>.234</u> | <u>.181</u> | <u>.181</u> | <u>.496</u> |
| +10000 | -10000 | +6900 | -6900 | +6900 | -6900 | +5630 | -6270 |
| - 2710 | + 536 | + 505 | 0 | 0 | + 230 | + 230 | +2790 |
| + 268 | + 1355 | 0 | + 253 | + 115 | 0 | +1395 | + 115 |
| - 73 | - 234 | - 220 | - 86 | - 86 | - 252 | - 252 | - 57 |
| - 117 | - 36 | - 43 | - 110 | - 126 | - 43 | - 28 | - 126 |
| + 31 | + 14 | + 13 | + 55 | + 55 | + 13 | + 13 | + 62 |
| | | +7155 | -6788 | +6858 | -6952 | | |

| A | B | | C | | D | | E |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>.271</u> | <u>.173</u> | <u>.163</u> | <u>.234</u> | <u>.234</u> | <u>.181</u> | <u>.181</u> | <u>.496</u> |
| +15600 | -15600 | +4500 | -4500 | +6900 | -6900 | +5630 | -6270 |
| - 4220 | + 1930 | +1810 | - 560 | - 560 | + 230 | + 230 | +3120 |
| + 965 | - 2110 | - 280 | + 905 | + 115 | - 280 | +1560 | + 115 |
| - 261 | + 413 | + 390 | - 238 | - 238 | - 232 | - 232 | - 57 |
| + 207 | - 131 | - 119 | + 195 | - 116 | - 119 | - 29 | - 116 |
| - 56 | + 43 | + 41 | - 14 | - 14 | + 27 | + 27 | + 58 |
| | | | | +6087 | -7274 | +7186 | -3060 |

$$V_i = 13600 + 2460 + 770 + 181 = 17011 \quad 22.7 \quad 0.057$$

$$V_o = 1360 + 740 + 830 - 181 = 14989 \quad 18.7 \quad 0.05$$

Estribos: Izq. 1 a 6 ; 5 a 12 ; 3 a 25
 (2ø3/8) Der. 1 a 8 ; 2 a 16 ; 2 a 25

SV4AB 30 x 70 6.10 65

Pp 530
 L 2700
 a/c 1800 5030 x 6.1 = 30700

| | | | | | |
|-----------|-------|-------|-------|--------------|----|
| Izquierda | 15600 | 12235 | 16.15 | 1ø1" + 3ø7/8 | 29 |
| Centro | 23400 | 10556 | 14.95 | 3ø1" | 24 |
| Derecha | 15600 | 15804 | 20.05 | 4ø1" | 32 |

$$V_i = 15350 - 312 = 15038 \quad 17 \quad 0.042$$

$$V_d = 15350 + 606 = 15956 \quad 18 \quad 0.045$$

Estribos:- 1 a 12 ; 1 a 25 ; 2 a 30 (izq.)
 (2ø3/8) 1 a 10 ; 1 a 20 ; 3 a 30

SV4BC 30 x 60 4.00 55

Pp 450
 T 230
 L 2700
 a/c 1800 5180 x 4.0

| | | | | | |
|-----------|-------|------|-------|-------|----|
| Izquierda | 6900 | 9010 | 13.5 | 4ø1" | 16 |
| Centro | 10400 | 3447 | 8.26 | 3ø3/4 | 18 |
| Derecha | 6900 | 6788 | 10.20 | 4ø3/4 | 24 |

$$V_i = 10360 + 862 = 11222 \quad 15 \quad 0.037$$

$$V_d = 10360 - 117 = 10242 \quad 13.6 \quad 0.034$$

Estribos:- Izquierda 1 a 12 ; 2 a 25
 (2ø3/8) Derecha 1 a 12 ; 1 a 25

SV4CD 30 x 60 4.00 55

Pp 450
 T 230
 L 2700
 a/c 1800 5180 x 4 = 20720

| | | | | | |
|-----------|-------|------|-------|---------|----|
| Izquierda | 6900 | 6658 | 10.28 | 4 ø 3/4 | 24 |
| Centro | 10400 | 3869 | 8.26 | 3ø3/4 | 18 |
| Derecha | 6900 | 7274 | 10.90 | 4ø3/4 | 24 |

$V_i = 10360 - 241 = 10336$ 13.8 0.034
 $V_d = 10360 + 297 = 10657$ 14.3 0.036

Estribos:- *Izq.* 1 a 12 ; 1 a 25
 (2ø3/8) *Der.* 1 a 12 : 1 a 25

SV4DE 30 x 60 4.00 55

Pp 450
M 2000 2450 x 4 = 9800

\angle a 2.2 = 5530

| | | | | | | |
|------------------|-------------|-------|------|-------|-------|----|
| <i>Izquierda</i> | 3270 | | | | | |
| | <u>2360</u> | 5630 | 7186 | 10.75 | 4ø3/4 | 24 |
| <i>Centro</i> | 4900 | | | | | |
| | <u>5440</u> | 10340 | 5956 | 8.26 | 3ø3/4 | 18 |
| <i>Derecha</i> | 3270 | | | | | |
| | <u>3000</u> | 6270 | 3296 | 8.26 | 3ø3/4 | 18 |

$V_i = 4900 + 1030 = 5930$ 8 0.019
 $V_d = 4900 - 844 = 4056$ 5 0.014

SV4'DD' 40 x 20 2.10 17

Pp 220
L 450
a/c 750 1420 x 2.1 = 2310

| | | | | | |
|----------------|-----|----------------|-----|---------------|----|
| <i>Izq.</i> | 202 | MXE | 4.0 | 1ø5/8 + 2ø1/4 | 13 |
| <i>Centro</i> | 610 | -- | 4.0 | 1ø5/8 + 2ø1/4 | 13 |
| <i>Derecha</i> | 202 | -- | 4.0 | 1ø5/8 + 2ø1/4 | 13 |

$V_i = 1155$ $E_o = 5$ $v = 0.01$
 $V_d = 1155$ 5 0.01

SV5AB 30 x 70 5.90 65

Pp 530
L 2700
a/c 1800 5030 x 5.9 = 29800

| | | | | | |
|------------------|-------|-------|-------|----------------|----|
| <i>Izquierda</i> | 14700 | 11421 | 14.50 | 3ø7/8 + 1 ø3/4 | 27 |
| <i>Centro</i> | 21600 | 8636 | 10.95 | 3ø7/8 | 21 |
| <i>Derecha</i> | 14700 | 15121 | 19.20 | 3ø1" + 1ø7/8 | 31 |

$V_i = 14900 - 463 = 14437$ 16.3 0.041
 $V_d = 14900 + 663 = 15563$ 17.6 0.044

- SJE 5 -

| A | B | | C | | D | | E |
|---|---|--|---|--|---|--|---|
| | | | | | | | |
| | | | | | | | |

| .280 | .160 | .145 | .217 | .217 | .181 | .181 | .305 |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|
| +14700 | -14700 | +6600 | -6600 | +6600 | -6600 | +6110 | -7440 |
| - 4120 | + 1295 | +1170 | 0 | 0 | + 89 | + 89 | +2270 |
| + 647 | - 2060 | 0 | + 585 | + 44 | 0 | +1135 | + 44 |
| - 181 | + 330 | + 298 | - 136 | - 136 | - 206 | - 206 | - 13 |
| + 165 | - 90 | - 68 | + 149 | - 103 | - 68 | - 7 | - 103 |
| - 46 | + 25 | + 23 | - 10 | - 10 | + 14 | + 14 | + 32 |
| <u>+11165</u> | <u>-15200</u> | <u>+8023</u> | <u>-6012</u> | <u>+6395</u> | <u>-6771</u> | <u>+7135</u> | <u>-5210</u> |

| .280 | .160 | .145 | .217 | .217 | .181 | .181 | .305 |
|---------------|---------------|--------------|--------------|--------------|--------------|-------|-------|
| +14700 | -14700 | +2620 | -2620 | +6600 | -6600 | +4890 | -6220 |
| - 4120 | + 1940 | +1750 | - 862 | - 862 | + 310 | + 310 | +1890 |
| + 970 | - 2060 | - 431 | + 875 | + 155 | - 431 | + 945 | + 155 |
| - 272 | + 398 | + 361 | - 224 | - 224 | - 93 | - 93 | - 48 |
| + 199 | - 136 | - 112 | + 181 | - 47 | - 112 | - 24 | - 47 |
| - 56 | + 40 | + 36 | - 29 | - 29 | + 25 | + 25 | + 14 |
| <u>+11421</u> | <u>-14518</u> | <u>+4224</u> | <u>-2679</u> | <u>+5593</u> | <u>-6901</u> | | |

| .280 | .10 | .145 | .217 | .217 | .181 | .181 | .305 |
|-------|-------|--------------|--------------|-------|--------------|--------------|--------------|
| +9380 | -9380 | +6600 | -6600 | +2620 | -2620 | +6110 | -7440 |
| -2630 | + 445 | + 403 | + 864 | + 864 | - 630 | - 630 | +2270 |
| + 223 | -1315 | + 432 | + 202 | - 315 | + 432 | +1135 | - 315 |
| - 60 | + 141 | + 128 | - 25 | - 25 | - 284 | - 284 | + 96 |
| + 71 | - 30 | - 13 | + 64 | - 142 | - 19 | + 48 | - 142 |
| - 20 | + 5 | + 5 | + 17 | + 17 | - 8 | - 8 | + 43 |
| | | <u>+7555</u> | <u>-5478</u> | | <u>-3121</u> | <u>+6371</u> | <u>-5488</u> |

| .280 | .160 | .145 | .217 | .217 | .181 | .181 | .305 |
|---------------|---------------|--------------|--------------|-------|-------|-------|-------|
| +14700 | -14700 | +6600 | -6600 | +2620 | -2620 | +6110 | -7440 |
| -4120 | + 1295 | +1170 | + 860 | + 864 | - 630 | - 630 | +2270 |
| + 647 | - 2060 | + 432 | + 585 | - 315 | + 432 | +1135 | - 315 |
| - 181 | + 261 | + 236 | - 59 | - 59 | - 283 | - 283 | + 96 |
| + 131 | - 91 | - 29 | + 118 | - 142 | - 29 | + 48 | - 142 |
| - 37 | + 19 | + 17 | + 5 | + 5 | - 3 | - 3 | + 43 |
| <u>+11140</u> | <u>-15276</u> | <u>+8426</u> | <u>-5087</u> | | | | |

- EJE 5 -

| A | B | | C | | D | | E |
|--------------|--------------|-------------|--------------|--------------|-------------|--------------|--------------|
| <u>.280</u> | <u>.160</u> | <u>.145</u> | <u>.217</u> | <u>.217</u> | <u>.181</u> | <u>.181</u> | <u>.305</u> |
| +9380 | -9380 | +6600 | -6600 | +6600 | -6600 | +4890 | -6220 |
| -2630 | + 445 | + 403 | 0 | 0 | + 310 | + 310 | +1890 |
| <u>+ 223</u> | <u>-1315</u> | <u>0</u> | <u>+ 202</u> | <u>+ 155</u> | <u>0</u> | <u>+ 945</u> | <u>+ 155</u> |
| - 63 | + 211 | + 191 | - 78 | - 78 | - 170 | - 170 | - 47 |
| + 106 | - 32 | - 39 | + 96 | - 85 | - 39 | - 23 | - 85 |
| <u>- 30</u> | <u>+ 15</u> | <u>+ 15</u> | <u>- 2</u> | <u>- 2</u> | <u>+ 11</u> | <u>+ 11</u> | <u>+ 26</u> |
| | | +7170 | -6382 | +6590 | -6488 | | |

| A | B | | C | | D | | E |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <u>.280</u> | <u>.160</u> | <u>.145</u> | <u>.217</u> | <u>.217</u> | <u>.181</u> | <u>.181</u> | <u>.305</u> |
| +14700 | -14700 | +2620 | -2620 | +6600 | -6600 | +6110 | -7440 |
| - 4120 | + 1940 | +1750 | - 862 | - 862 | + 89 | + 89 | +2270 |
| + 970 | - 2060 | - 431 | + 875 | + 44 | - 431 | +1135 | + 44 |
| - 271 | + 398 | + 361 | - 200 | - 200 | - 127 | - 127 | - 19 |
| + 199 | - 136 | - 100 | + 181 | - 64 | - 100 | - 6 | - 63 |
| <u>- 56</u> | <u>+ 38</u> | <u>+ 34</u> | <u>- 25</u> | <u>- 25</u> | <u>+ 19</u> | <u>+ 19</u> | <u>+ 19</u> |
| | | | | +5493 | -7150 | +7220 | -5183 |

o - o - o - o

- 48 -

Estribos: Izquierda: 1 a 15 ; 2 a 30
 (2ø3/8) Derecha: 1 a 11 ; 1 a 22 ; 3 a 30

| | | | |
|----------------------------|-------------|----------------------|-----------------------|
| <u>SV5BE</u> | 30 x 60 | 4.00 | 55 |
| Pp | 450 | | |
| L | 2700 | | |
| s/c | <u>1800</u> | 4950 x 4 = 19800 | |
| Izquierda | 6600 | 8426 | 12.40 3ø1" + 1ø7/8 25 |
| Centro | 9900 | 3383 | 8.26 3ø3/4 18 |
| Derecha | 6600 | 6382 | 9.60 2ø3/4 + 2ø5/8 22 |
| $V_i = 9900 + 947 = 10847$ | | 12.5 14.5 | 0.036 |
| $V_d = 9900 - 472 = 9428$ | | 12.6 | 0.031 |
| Estribos:- | Izquierda | 1 a 12 ; 1 a 25 | |
| (2ø3/8) | Derecha | 1 a 12 | |

| | | | |
|----------------------------|-------------|------------------|-----------------------|
| <u>SV5CD</u> | 30 x 60 | 4.00 | 55 |
| Pp | 450 | | |
| L | 2700 | | |
| s/c | <u>1800</u> | 4950 x 4 = 19800 | |
| Izquierda | 6600 | 6590 | 9.9 2ø3/4 + 2 ø5/8 22 |
| Centro | 9900 | 3653 | 8.26 3ø3/4 18 |
| Derecha | 6600 | 7150 | 10.70 4ø3/4 24 |
| $V_i = 9900 - 17 = 9883$ | | 13.2 | 0.033 |
| $V_d = 9900 + 503 = 10403$ | | 13.9 | 0.035 |
| Estribos: | Izquierda | 1 a 13 ; 1 a 25 | |
| (2ø3/8) | Derecha | 1 a 13 ; 1 a 25 | |

| | | | |
|------------------------|------------|------------------------|------------------|
| <u>SV5DE</u> | 30 x 60 | 4.00 | 55 |
| Pp | 450 | | |
| L | 1380 | | |
| s/c | <u>920</u> | 2750 x 4 = 11000 | |
| $\angle a 2.20 = 6190$ | | | |
| Izquierda | 3660 | <u>2450</u> 6110 7220 | 11.80 4 ø 3/4 24 |
| Centro | 5500 | <u>5450</u> 10950 5021 | 8.26 3ø3/4 18 |
| Derecha | 3660 | <u>3780</u> 7440 5488 | 8.26 3ø3/4 18 |

- EJE 6 -

| A | B | | C | | D | | E |
|---|---|--|---|--|---|--|---|
| | | | | | | | |
| | | | | | | | |

| .254 | .164 | .145 | .165 | .165 | .181 | .181 | .305 |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|
| +15300 | -15300 | +7300 | -7300 | +7300 | -7300 | -7300 | -7660 |
| - 3880 | + 1310 | +1160 | 0 | 0 | - 65 | - 65 | +2320 |
| + 655 | - 1940 | 0 | + 580 | - 33 | 0 | +1210 | - 33 |
| - 166 | + 320 | + 282 | - 90 | - 90 | - 220 | - 220 | + 10 |
| + 160 | - 89 | - 45 | + 141 | - 110 | - 45 | + 5 | - 110 |
| - 41 | + 21 | + 19 | - 5 | - 5 | + 7 | + 7 | + 28 |
| <u>+12028</u> | <u>-15672</u> | <u>+8716</u> | <u>-6674</u> | <u>+7098</u> | <u>-7623</u> | <u>+8597</u> | <u>-5445</u> |

| .254 | .164 | .145 | .165 | .165 | .181 | .181 | .305 |
|---------------|---------------|--------------|--------------|--------------|--------------|-------|-------|
| +15300 | -15300 | +4600 | -4600 | +7300 | -7300 | +4840 | -4840 |
| - 3880 | + 1750 | +1550 | - 446 | - 446 | + 446 | + 446 | +1480 |
| + 875 | - 1940 | - 223 | + 775 | + 223 | - 223 | + 440 | + 223 |
| - 222 | + 355 | + 314 | - 165 | - 165 | - 94 | - 94 | - 68 |
| + 177 | - 111 | - 89 | + 157 | - 47 | - 83 | - 34 | - 47 |
| - 45 | + 32 | + 28 | - 18 | - 18 | + 21 | + 21 | + 15 |
| <u>+12205</u> | <u>-15214</u> | <u>+6186</u> | <u>-4297</u> | <u>+6847</u> | <u>-7239</u> | | |

| .254 | .164 | .145 | .165 | .165 | .181 | .181 | .305 |
|-------|-------|--------------|--------------|-------|--------------|--------------|--------------|
| +9700 | -9700 | +7300 | -7300 | +4600 | -4600 | +7660 | -7660 |
| -2460 | + 393 | + 348 | + 446 | + 446 | - 488 | - 488 | +2320 |
| + 197 | -1230 | + 223 | + 174 | - 244 | + 223 | +1160 | - 244 |
| - 50 | - 165 | - 146 | + 12 | + 12 | - 250 | - 250 | + 74 |
| - 83 | - 25 | + 6 | - 73 | - 125 | + 6 | + 37 | - 125 |
| + 21 | + 9 | + 9 | + 33 | + 33 | - 8 | - 8 | + 38 |
| | | <u>+7734</u> | <u>-6708</u> | | <u>-5117</u> | <u>+8050</u> | <u>-5597</u> |

| .254 | .164 | .145 | .165 | .165 | .181 | .181 | .305 |
|---------------|---------------|--------------|--------------|-------|-------|-------|-------|
| +15300 | -15300 | +7300 | -7300 | +4600 | -4600 | +7660 | -7660 |
| - 3880 | + 1310 | +1160 | + 446 | + 446 | - 448 | - 448 | +2320 |
| + 655 | - 1940 | + 223 | + 580 | - 224 | + 223 | +1160 | - 224 |
| - 169 | + 282 | + 250 | - 59 | - 59 | - 250 | - 250 | + 68 |
| + 141 | - 84 | - 29 | + 125 | - 125 | - 29 | + 34 | - 125 |
| - 36 | + 18 | + 16 | 0 | 0 | - 1 | - 1 | + 28 |
| <u>+12011</u> | <u>-15714</u> | <u>+8920</u> | <u>-6208</u> | | | | |

- EJE 6 -

A B C D E

| .254 | .164 | .145 | .165 | .165 | .181 | .181 | .305 |
|--------------|---------------|--------------|--------------|--------------|--------------|-------|-------|
| +9700 | -9700 | +7300 | -7300 | +7300 | -7300 | +4800 | -4840 |
| -2640 | +393 | +348 | 0 | 0 | +446 | +446 | +1480 |
| +196 | -1230 | 0 | +174 | +223 | 0 | +740 | +223 |
| -50 | +202 | +178 | -66 | -66 | -134 | -134 | -68 |
| +101 | -25 | -33 | +89 | -67 | -33 | 34 | -67 |
| -26 | +9 | +8 | -4 | -4 | +12 | +12 | +21 |
| <u>+7461</u> | <u>-10351</u> | <u>+7801</u> | <u>-7107</u> | <u>+7386</u> | <u>-7009</u> | | |

| .254 | .164 | .145 | XXXB | .165 | .165 | .181 | .181 | .305 |
|--------|--------|-------|-----------------|--------------|--------------|--------------|--------------|------|
| +15300 | -15300 | +4600 | -4600 | +7300 | -7300 | +7600 | -7600 | |
| -3880 | +1750 | +1550 | +446 | +446 | -65 | -65 | +2030 | |
| +875 | -1940 | +223 | +775 | -33 | +223 | +1015 | -33 | |
| -222 | +282 | +249 | -122 | -122 | -224 | -224 | +10 | |
| +141 | -111 | -61 | +124 | -112 | -61 | +5 | -112 | |
| -36 | +28 | +25 | -2 | -2 | +10 | +10 | +34 | |
| | | | | <u>+7447</u> | <u>-7417</u> | <u>+8341</u> | <u>-5671</u> | |

$V_i = 5450 + 2720 + 1004 = 9174$ 12.3 0.031
 $V_d = 5450 + 3470 - 748 = 8172$ 10.9 0.027

Estribos:- (2ø3/8) Izquierda 1 a 12

SV6AB 30 x 70 5.60 65

Pp 530
L 3180
a/c 2120 5830 x 5.6 = 32700

Izquierda 15300 12205 16.10 1ø1" + 3ø7/8 29
Centro 22900 9191 11.68 3ø7/8 21
Derecha 15300 15714 19.95 4ø1" 32

$V_i = 16350 - 538 = 15812$ 17.9 0.045
 $V_d = 16350 + 926 = 17276$ 19.5 0.049

Estribos:- Izq. 1 a 10 ; 1 a 20 ; 2 a 30
(2ø3/8) Der. 1 a 8 ; 3 a 17 ; 2 a 30

SV6BC 30 x 60 3.90 55

Pp 450
L 3180
a/c 2120 5750 x 3.9 = 22400

Izquierda 7300 8920 13.38 4ø1" 32
Centro 10900 3679 8.26 3ø3/4 18
Derecha 7300 7107 10.65 4ø3/4 24

$V_i = 11200 + 678 = 11878$ 15.9 0.033
 $V_d = 11200 - 174 = 11026$ 14.7 0.031

Estribos: Izquierda 1 a 12 ; 2 a 25
(2ø3/8) Derecha 1 a 12 ; 1 a 25

SV6CD 30 x 60 3.90 55

Pp 450
L 3180
a/c 2120 5750 x 3.9 = 22400

Izquierda 7300 7386 11.08 4ø3/4 24
Centro 10900 3860 8.26 3ø3/4 18
Derecha 7300 7417 11.2 3ø3/4 + 1ø7/8 25

$V_i = 11200 + 94 = 11294$ 15.1 0.032
 $V_d = 11200 - 15 = 11185$ 15.0 0.032

Estribos:- Izq. 1 a 12 ; 2 a 25
 (2ø3/8) Der. 1 a 12 ; 1 a 25

| | | | | |
|--------------|-----------------|------------|-------|------------------|
| <u>SV6DE</u> | 30 x 60 | 4.00 | 55 | |
| Pp | 450 | | | |
| L | 3180 | | | |
| a/c | <u>2120</u> | 5750 x 4 = | 23000 | |
| Izquierda | 7660 | 8341 | 12.50 | 1ø7/8 + 3ø3/4 25 |
| Centro | 11500 | 4677 | 8.26 | 3ø3/4 18 |
| Derecha | 7660 | 5597 | 8.39 | 3ø3/4 18 |
| V_i | = 11500 + 678 = | 12178 | 16.3 | 0.034 |
| V_d | = 11500 - 615 = | 10885 | 14.5 | 0.031 |

Estribos:- Izquierda 1 a 12 ; 2 a 25
 (2ø3/8) Derecha 1 a 12 ; 1 a 25

| | | | | |
|--------------|------------------|--------------|-------|-------------------------|
| <u>SV7AB</u> | 30 x 70 | 5.70 | 65 | |
| Pp | 530 | | | |
| M | 2000 | | | |
| L | 1800 | | | |
| a/c | <u>1200</u> | 5530 x 5.7 = | 31500 | |
| Izquierda | 15000 | 9366 | 11.38 | 1ø1" + 1ø7/8 + 1ø3/4 21 |
| Centro | 22500 | 10090 | 12.80 | 1ø1" + 2ø7/8 22 |
| Derecha | 15000 | 16083 | 20.20 | 4ø1" 32 |
| V_i | = 15750 - 1100 = | 14650 | 16.5 | 0.041 |
| V_d | = 15750 + 1190 = | 16940 | 19.2 | 0.048 |

Estribos:- Izq. 1 a 15 ; 1 a 30
 (2ø3/8) Der. 1 a 9 ; 2 a 18 ; 3 a 30

| | | | | |
|--------------|-----------------|-------------------------|-------|------------------|
| <u>SV7BC</u> | 30 x 60 | 4.00 | 55 | |
| Pp | 450 | | | |
| M | 2000 | | | |
| L | 1800 | | | |
| a/c | <u>1200</u> | 5450 x 4 = | 21800 | |
| Izquierda | 7270 | 8341 9426 | 14.10 | 4ø1" 32 |
| Centro | 11900 | 4427 | 8.26 | 3ø3/4 18 |
| Derecha | 7270 | 6817 | 10.28 | 2ø7/8 + 1ø3/4 20 |
| V_i | = 10900 + 870 = | 11770 | 15.7 | 0.039 |
| V_d | = 10900 - 416 = | 10484 | 14.0 | 0.035 |

- EJE 7 -

| A | B | C | D | E |
|---|---|---|---|---|
| | | | | |
| | | | | |

XXXXXX

| .429 | .216 | .181 | .279 | .279 | .279 | .279 | .496 |
|---------------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|
| +15000 | -15000 | +7270 | -7270 | +7270 | -7270 | +7270 | -7270 |
| - 6440 | + 1670 | + 1400 | 0 | 0 | 0 | 0 | +3600 |
| + 835 | - 3220 | 0 | + 700 | 0 | 0 | +1800 | 0 |
| - 359 | + 695 | + 582 | - 195 | -195 | - 503 | - 503 | 0 |
| + 347 | - 179 | - 97 | + 291 | - 252 | + 97 | 0 | - 252 |
| - 149 | + 60 | + 50 | - 10 | - 10 | - 27 | - 27 | + 125 |
| + 30 | - 74 | - 5 | + 25 | - 14 | - 5 | - 63 | - 14 |
| - 13 | + 17 | + 14 | - 3 | - 3 | + 19 | + 19 | + 7 |
| <u>+ 9251</u> | <u>- 16031</u> | <u>+9214</u> | <u>-6462</u> | <u>+6796</u> | <u>-7689</u> | <u>+8496</u> | <u>-3804</u> |

| .429 | .216 | .181 | .279 | .279 | .279 | .279 | .296 |
|---------------|---------------|--------------|--------------|--------------|--------------|-------|-------|
| +15000 | -15000 | +5670 | -5670 | +7270 | -7270 | +5670 | -5670 |
| - 6440 | + 2020 | +1690 | - 446 | - 446 | + 446 | + 446 | +2810 |
| + 1010 | - 3220 | - 223 | + 845 | + 223 | - 223 | +1405 | + 223 |
| - 434 | + 743 | + 683 | - 298 | - 298 | - 330 | - 330 | - 110 |
| + 371 | - 217 | - 149 | + 311 | - 165 | - 149 | - 55 | - 165 |
| - 163 | + 79 | + 66 | - 41 | - 41 | + 57 | + 57 | + 82 |
| + 39 | - 82 | - 21 | + 33 | + 28 | - 21 | + 41 | + 28 |
| - 17 | + 22 | + 19 | - 17 | - 17 | - 6 | - 6 | - 14 |
| <u>+ 9366</u> | <u>-15655</u> | <u>+7675</u> | <u>-5283</u> | <u>+6554</u> | <u>-7496</u> | | |

| .429 | .216 | .181 | .279 | .279 | .279 | .279 | .496 |
|--------|--------|--------------|---------------|-------|--------------|--------------|--------------|
| +11700 | -11700 | +7270 | -7270 | +5670 | -5670 | +7270 | -7270 |
| - 5030 | + 957 | + 802 | + 446 | + 446 | - 446 | - 446 | +3600 |
| + 478 | - 2515 | + 223 | + 401 | - 223 | + 223 | +1800 | - 223 |
| - 205 | + 495 | + 415 | - 50 | - 50 | - 564 | - 564 | + 110 |
| + 248 | - 103 | - 25 | + 207 | - 282 | - 25 | + 55 | - 282 |
| - 106 | + 28 | + 23 | + 20 | + 20 | - 8 | - 8 | + 140 |
| + 14 | - 53 | + 10 | + 12 | - 4 | + 10 | + 70 | - 4 |
| - 6 | - 9 | - 8 | - 2 | - 2 | - 22 | - 22 | + 2 |
| | | <u>+8710</u> | <u>- 6236</u> | | <u>-6458</u> | <u>+8155</u> | <u>-3927</u> |

- EJE 7 -

A B C D E

| .429 | .216 | .181 | .279 | .279 | .279 | .279 | .496 |
|---------------|---------------|--------------|--------------|-------|-------|-------|-------|
| +15000 | -15000 | +7270 | -7270 | +5670 | -5670 | +7270 | -7270 |
| - 6440 | + 1670 | +1400 | + 446 | + 446 | - 446 | - 446 | +3600 |
| + 835 | - 3220 | + 223 | + 700 | - 223 | + 223 | +1800 | - 223 |
| - 358 | + 647 | + 542 | - 139 | - 133 | - 564 | - 564 | + 110 |
| + 323 | - 179 | - 66 | + 271 | - 282 | - 67 | + 55 | - 282 |
| - 139 | + 53 | + 44 | + 2 | + 2 | + 6 | + 6 | + 135 |
| + 26 | - 69 | + 1 | + 22 | + 3 | + 1 | + 67 | + 3 |
| - 11 | + 15 | + 12 | - 7 | - 7 | - 19 | - 19 | - 1 |
| <u>+ 9276</u> | <u>-16083</u> | <u>+9426</u> | <u>-5955</u> | | | | |

| .429 | .216 | .181 | .279 | .279 | .279 | .279 | .496 |
|--------|--------|--------------|--------------|--------------|--------------|-------|-------|
| +11700 | -11700 | +7270 | -7270 | +7270 | -7270 | +5670 | -5670 |
| - 5030 | + 957 | + 802 | 0 | 0 | + 446 | + 446 | +2810 |
| + 478 | - 2515 | 0 | + 401 | + 223 | 0 | +1405 | + 223 |
| - 205 | + 543 | + 455 | - 174 | - 174 | - 398 | - 398 | - 111 |
| + 272 | - 103 | - 87 | + 227 | - 199 | - 87 | - 55 | - 199 |
| - 117 | + 41 | + 34 | - 8 | - 8 | + 40 | + 40 | + 99 |
| + 21 | - 58 | - 4 | + 17 | + 20 | - 4 | - 49 | + 20 |
| - 9 | + 13 | + 11 | - 10 | - 10 | + 14 | + 14 | - 10 |
| | | <u>+8481</u> | <u>-6817</u> | <u>+7122</u> | <u>-7259</u> | | |

| .429 | .216 | .181 | .279 | .279 | .279 | .279 | .496 |
|------------|-------------|-------------|------------|--------------|--------------|--------------|--------------|
| +15000 | -15000 | +5670 | -5670 | +7270 | -7270 | +7270 | -7270 |
| - 6440 | + 2020 | +1690 | - 446 | - 446 | 0 | 0 | +3600 |
| + 1010 | - 3220 | - 223 | + 845 | 0 | - 223 | +1800 | 0 |
| - 436 | + 647 | + 542 | - 236 | - 236 | - 437 | - 437 | 0 |
| + 323 | + 218 | - 118 | + 271 | - 218 | - 118 | 0 | - 218 |
| - 139 | - 21 | - 18 | - 15 | - 15 | + 33 | + 33 | + 108 |
| - 10 | - 69 | - 7 | - 9 | - 16 | - 7 | - 70 | - 16 |
| <u>+ 4</u> | <u>+ 32</u> | <u>+ 26</u> | <u>+ 7</u> | <u>+ 7</u> | <u>+ 22</u> | <u>+ 22</u> | <u>+ 8</u> |
| | | | | <u>+6346</u> | <u>-8000</u> | <u>+8618</u> | <u>-3788</u> |

Estridos:- Izq. 1 a 12 ; 2 a 25
 (2ø3/8) Der. 1 a 12 ; 1 a 25

SV7CD 30 x 60 4.00 55

Pp 450
 M 2000
 L 1800
 a/c 1200 5450 x 4 = 21800

| | | | | | |
|-----------|-------|------|-------|---------------|----|
| Izquierda | 7270 | 7122 | 10.68 | 2ø7/8 + 1ø3/4 | 20 |
| Centro | 11900 | 4875 | 8.26 | 3ø3/4 | 18 |
| Derecha | 7270 | 8000 | 12.0 | 1ø3/4 + 3ø5/8 | 21 |

$V_i = 10900 + 414 = 11374$ 15.1 0.038

$V_d = 10900 - 34 = 10866$ 14.5 0.036

Estridos:- Izq. 1 a 12 ; 2 a 25
 (2ø3/8) Der. 1 a 12 ; 1 a 25

SV7DE 30 x 60 4.00 55

Pp 450
 M 2000
 L 1800
 a/c 1200 5450 x 4 = 21800

| | | | | | |
|-----------|-------|------|-------|-----------------------|----|
| Izquierda | 7270 | 8618 | 12.92 | 1ø3/4 + 3ø5/8 | 21 |
| Centro | 11900 | 5859 | 8.80 | 1ø7/8 + 1ø3/4 + 1ø5/8 | 18 |
| Derecha | 7270 | 3927 | 8.26 | 3ø3/4 | 18 |

$V_i = 10900 + 1210 = 12110$ 16.2 0.04

$V_d = 10900 - 1052 = 9848$ 12.7 0.033

Estridos:- Izq. 1 a 12 ; 2 a 25
 (2ø3/8) Der. 1 a 12 ; 1 a 25

| | | | | | |
|---------------------------------------|-------------|--------------------|------|------|----------|
| <u>SVA12</u> | 30 x 60 | 4.10 | 55 | | |
| Pp | 450 | | | | |
| M | <u>2000</u> | 2450 x 4.1 = 10000 | | | |
| / a D.70 = 1000 | | | | | |
| / a 2.40 = 1000 | | | | | |
| Izquierda | 3440 | | | | |
| | 480 | | | | |
| | <u>410</u> | 4330 | 2465 | 8.26 | 3ø3/4 18 |
| Centro | 5160 | | | | |
| | 350 | | | | |
| | <u>840</u> | 6350 | 2797 | 8.26 | 3ø3/4 18 |
| Derecha | 3440 | | | | |
| | 98 | | | | |
| | <u>590</u> | 4128 | 4642 | 8.26 | 3ø3/4 18 |
| $V_i = 5350 + 830 + 410 - 530 = 6060$ | | | | | |
| $V_d = 5350 + 170 + 590 + 530 = 6640$ | | | | | |
| | | | | 8.1 | 0.02 |
| | | | | 8.7 | 0.022 |

| | | | | | |
|--------------------------|-------------|-------------------|------|-------------------|----|
| <u>SVA23</u> | 25 x 50 | 4.10 | 45 | | |
| Pp | 310 | | | | |
| M | <u>2000</u> | 2310 x 4.1 = 9500 | | | |
| Izquierda | 3240 | 3481 | 6.38 | 1ø3/4+1ø5/8+1ø7/8 | 18 |
| Centro | 4860 | 1548 | 5.63 | 3ø5/8 | 15 |
| Derecha | 3240 | 3144 | 5.76 | 3ø5/8 | 15 |
| $V_i = 4750 + 82 = 4832$ | | | | | |
| $V_d = 4750 - 82 = 4668$ | | | | | |
| | | | 7.9 | 0.024 | |
| | | | 7.6 | 0.023 | |

| | | | | | |
|-------------------------|-------------|-------------------|------|-------|----|
| <u>SVA34</u> | 25 x 50 | 4.10 | 45 | | |
| Pp | 310 | | | | |
| M | <u>2000</u> | 2310 x 4.1 = 9500 | | | |
| Izquierda | 3240 | 3215 | 5.90 | 3ø5/8 | 15 |
| Centro | 4860 | 1629 | 5.63 | 3ø5/8 | 15 |
| Derecha | 3240 | 3231 | 5.95 | 3ø5/8 | 15 |
| $V_i = 4750 - 8 = 4742$ | | | | | |
| $V_d = 4750 + 8 = 4758$ | | | | | |
| | | | 7.7 | 0.023 | |
| | | | 7.8 | 0.023 | |

| | | | | | |
|--------------|-------------|-------------------|----|--|--|
| <u>SVA45</u> | 25 x 50 | 4.10 | 45 | | |
| Pp | 310 | | | | |
| M | <u>2000</u> | 2310 x 4.1 = 9500 | | | |

| | | | | | |
|-----------|------|------|------|---------------|----|
| Izquierda | 3240 | 3257 | 5.95 | 3ø5/8 | 15 |
| Centro | 4860 | 1637 | 5.63 | 3ø5/8 | 15 |
| Derecha | 3240 | 3291 | 6.04 | 1ø3/4 + 2ø5/8 | 16 |

$V_i = 4750 + 16 = 4766$ 7.8 0.023

$V_d = 4750 - 16 = 4734$ 7.7 0.023

SVA56 25 x 50 4.10 45

Pp 310
M 2000 2310 x 4.1 = 9500

| | | | | | |
|-----------|------|------|------|---------------|----|
| Izquierda | 3240 | 3036 | 5.63 | 1ø3/4 + 2ø3/8 | 12 |
| Centro | 4860 | 1267 | 5.63 | 3ø5/8 | 15 |
| Derecha | 3240 | 3737 | 6.84 | 2ø5/8 + 2ø7/8 | 24 |

$V_i = 4750 - 170 = 4580$ 7.4 0.022

$V_d = 4750 + 170 = 4920$ 8.0 0.024

SVA67 25 x 50 5.50 45

Pp 310
M 2000 2310 x 5.5 = 12700

| | | | | | |
|-----------|------|------|-------|---------------|----|
| Izquierda | 5830 | 6165 | 11.35 | 2ø7/8 + 2ø5/8 | 24 |
| Centro | 8750 | 3500 | 6.42 | 1ø3/4 + 2ø5/8 | 16 |
| Derecha | 5830 | 4527 | 8.30 | 3ø3/4 | 18 |

$V_i = 6350 + 457 = 6807$ 9.6 0.029

$V_d = 6350 - 457 = 5893$ 11.1 0.033

Estribos: - (~~2ø1/4~~) Derecha: 1 a 10 ; 1 a 20
(2ø1/4)

SVE12 25 x 50 4.00 45

Pp 310
M 2000 2310 x 4 = 9240

| | | | | | |
|-----------|--|------|------|---------------|----|
| Izquierda | | 3080 | 5.63 | 1ø3/4 + 3ø5/8 | 15 |
| Centro | | 2640 | 5.63 | 3ø5/8 | 15 |
| Derecha | | 3700 | 6.78 | 1ø3/4 + 2ø5/8 | 16 |

$V_i = 10120 - 149 = 9971$ 16.1 0.048

$V_d = 10120 + 149 = 10269$ 16.3 0.050

Estribos: (2ø1/4) Izq. 1 a 5 ; 4 a 9 ; 2 a 20
Der. 1 a 4 ; 5 a 8 ; 2 a 20

| | | | | | | |
|---------------------------|------------|-----------------|------|--------------|--|----|
| <u>SVB23</u> | | 25 x 50 | | 4.00 | | 45 |
| Pp | 310 | | | | | |
| L | 780 | | | | | |
| a/c | <u>520</u> | 1610 x 4 = 6440 | | | | |
| <i>Izquierda</i> | 2150 | 2963 | 5.63 | 1ø1" + 2ø7/8 | | 22 |
| <i>Centro</i> | 3230 | 1925 | 5.63 | 3ø5/8 | | 15 |
| <i>Derecha</i> | 2150 | 1647 | 5.63 | 3ø5/8 | | 15 |
| $V_i = 3220 + 330 = 3550$ | | | 5.8 | 0.017 | | |
| $V_d = 3220 - 330 = 2890$ | | | 4.7 | 0.014 | | |

| | | | | | | |
|------------------|------------------|---------|------|-------|--|----|
| <u>SVB34</u> | | 25 x 50 | | 4.00 | | 45 |
| Pp | 310 x 4.0 = 1240 | | | | | |
| <i>Izquierda</i> | 414 | | 5.63 | 3ø5/8 | | |
| <i>Centro</i> | 620 | | 5.63 | 3ø5/8 | | |
| <i>Derecha</i> | 414 | | 5.63 | 3ø5/8 | | |
| $V_i = 620$ | | | | | | |
| $V_d = 620$ | | | | | | |

| | | | | | | |
|------------------|------------------|---------|------|-------|--|--|
| <u>SVB45</u> | | 25 x 50 | | 4.00 | | |
| Pp | 310 x 4.0 = 1240 | | | | | |
| <i>Izquierda</i> | 414 | | 5.63 | 3ø5/8 | | |
| <i>Centro</i> | 620 | | 5.63 | 3ø5/8 | | |
| <i>Derecha</i> | 414 | | 5.63 | 3ø5/8 | | |
| $V_i = 620$ | | | | | | |
| $V_d = 620$ | | | | | | |

| | | | | | | |
|------------------|------------------|---------|------|-------|--|--|
| <u>SVB56</u> | | 25 x 50 | | 4.00 | | |
| Pp | 310 x 4.0 = 1240 | | | | | |
| <i>Izquierda</i> | 414 | | 5.63 | 3ø5/8 | | |
| <i>Centro</i> | 620 | | 5.63 | 3ø5/8 | | |
| <i>Derecha</i> | 414 | | 5.63 | 3ø5/8 | | |
| $V_i = 620$ | | | | | | |
| $V_d = 620$ | | | | | | |

| | | | |
|--------------|------------------|------|-------|
| <u>SVB67</u> | 25 x 50 | 5.50 | |
| Pp | 310 x 5.5 = 1700 | | |
| Izquierda | 780 | 5.63 | 3ø5/8 |
| Centro | 1170 | 5.63 | 3ø5/8 |
| Derecha | 780 | 5.63 | 3ø5/8 |

$$V_i = V_d = 850$$

| | | | |
|-------------------------------|---------|-------------------|------|
| SVB12 <u>SVC12</u> | 25 x 50 | 4.20 | |
| Pp | 310 | | |
| T | 1500 | 1810 x 4.2 = 7600 | |
| Izquierda | 26660 | 1880 | 5.63 |
| Centro | 4000 | 1535 | 5.63 |
| Derecha | 2660 | 3050 | 5.63 |

$$V_i = 8500 - 626 = 7874 \quad 12.9 \quad 0.039$$

$$V_d = 8500 + 626 = 9126 \quad 14.9 \quad 0.045$$

Estribos(2ø1/4) : Izquierda 1 a 10 ; 4 a 20
 Der.: 1 a 6 ; 5 a 12 ; 5 a 20

| | | | |
|--------------|--------------------|------|-------|
| <u>SVC34</u> | 25 x 50 | 4.10 | 45 |
| Pp | 310 x 4.1 = 1270 | | |
| III | 1000 x 1.05 = 1050 | | |
| Izquierda | 440 | | |
| | <u>380</u> 720 | 5.63 | 3ø5/8 |
| Centro | 650 | | |
| | <u>260</u> 910 | 5.63 | 3ø5/8 |
| Derecha | 440 | | |
| | <u>80</u> 520 | 5.63 | 3ø5/8 |

$$V_i = 635 + 916 = 1551$$

$$V_d = 635 + 134 = 769$$

| | | | |
|--------------|----------------|------|-------|
| <u>SVC45</u> | 25 x 50 | 4.00 | |
| Pp | 310 x 4 = 1240 | | |
| Izquierda | 414 | 5.63 | 3ø5/8 |
| Centro | 620 | 5.63 | 3ø5/8 |
| Derecha | 414 | 5.63 | 3ø5/8 |

$$V_i = V_d = 620$$

| | | | |
|--------------|---------|------|-------|
| <u>SVC56</u> | 25 x 50 | 4.00 | |
| Pp | 310 | | |
| Izquierda | | | 3ø5/8 |
| Centro | | | 3ø5/8 |
| Derecha | | | 3ø5/8 |

| | | | |
|--------------|---------|------|-------|
| <u>SVC67</u> | 25 x 50 | 5.50 | |
| Pp | 310 | | |
| Izquierda | | | 3ø5/8 |
| Centro | | | 3ø5/8 |
| Derecha | | | 3ø5/8 |

| | | | |
|--------------|-------------------|-------------------|-------|
| <u>SVD12</u> | 25 x 50 | 4.10 | |
| Pp | 310 | | |
| M | <u>2000</u> | 2310 x 4.1 = 9500 | |
| Izquierda | 3240 | 2000 | 5.63 |
| Centro | 4860 | 1937 | 5.63 |
| Derecha | 3240 | 3259 | 5.97 |
| $V_i =$ | 4750 - 450 = 4300 | 7.1 | 0.021 |
| $V_d =$ | 4750 + 450 = 5200 | 8.5 | 0.025 |

| | | | |
|---------------|-------------|------|-------|
| <u>SVD23</u> | 25 x 50 | 4.10 | |
| Pp | 310 | | |
| M | <u>2000</u> | 2310 | |
| Izquierda | 3240 | 3254 | 5.96 |
| Centro | 4860 | 1604 | 5.63 |
| Derecha | 3240 | 3259 | 5.97 |
| $V_i = V_d =$ | 4750 | 7.8 | 0.023 |

| | | | |
|--------------|-------------|------|------|
| <u>SVD34</u> | 25 x 50 | 4.10 | |
| Pp | 330 | | |
| M | <u>2000</u> | 2310 | |
| Izquierda | 3240 | 3305 | 6.06 |
| Centro | 4860 | 1666 | 5.63 |
| Derecha | 3240 | 3084 | 5.65 |

$V_l = V_d = 4750$ 7.7 0.023

SVD45 25 x 50 4.00

Pp 310
T 1000 1310 x 4 = 5240

∠ a 3.10 = 1160

III_d 1300 x 0.65 = 845

Isquierda 1750
 150
 30 1930 2184 5.63 3ø5/8

Centro 2620
 500
 140 3260 2349 5.63 3ø5/8

Derecha 1750
 610
 220 2580 1658 5.63 3ø5/8

$V_l = 2600 + 250 + 70 + 128 = 3048$ 5.0 0.015

$V_d = 2600 + 910 + 775 - 128 = 4157$ 6.8 0.020

SVD56 25 x 50 4.00

Pp 310

Isquierda 3ø5/8

Centro 3ø5/8

Derecha 3ø5/8

SVØ67 25 x 50 5.50

Pp 310

Isquierda 3ø5/8

Centro 3ø5/8

Derecha 3ø5/8

SVD'45 25 x 50 4.20

Pp 310
T 1000
L 720
a/o 480 2510 x 4.2 = 10550

∠ a 3.30 = 1160

Isquierda 1850
 80 1930 5.63 3ø5/8

Centro 5540
 810 6350 11.65 3ø7/8

Derecha 1850
 330 2180 5.63 3ø5/8

$$V_i = 5275 + 250 = 5525 \quad 9.0 \quad 0.027$$

$$V_d = 5275 + 910 = 6185 \quad 10.7 \quad 0.030$$

SVE45 25 x 50 4.10

Pp 310
M 2000
L 1200 3510 x 4.1 = 14400

Izquierda 4920 3401 6.20 1ø3/4 + 2ø5/8 16

Centro 7380 3533 6.50 1ø3/4 + 2ø5/8 16

Derecha 4920 5293 9.7 2ø7/8 + 1ø5/8 19

$$V_i = 7100 - 923 = 6177 \quad 10.1 \quad 0.030$$

$$V_d = 7100 + 923 = 8023 \quad 13.1 \quad 0.039$$

Estribos:- (2ø1/4) Derecha 1 a 9 ; 3 a 18

SVE56 25 x 50 4.00

Pp 310
M 2000 2910 x 4 = 9240

Izquierda 3080 3267 5.98 2ø7/8 + 1ø5/8 19

Centro 4620 1243 5.63 3ø5/8

Derecha 3080 3487 6.38 3ø7/8

$$V_i = V_d = 4620 \quad 7.5 \quad 0.023$$

SVE67 25 x 50 5.50

Pp 310
M 2000 2910 x 5.5 = 12700

Izquierda 5830 6063 11.0 3ø7/8

Centro 8750 3249 5.96 3ø5/8

Derecha 5830 4442 8.15 1ø7/8 + 1ø3/4 + 1ø5/8 18

$$V_i = 6350 + 229 = 6579 \quad 10.8 \quad 0.032$$

$$V_d = 6350 - 229 = 6121 \quad 10.0 \quad 0.030$$

Estribos:- (2ø1/4) izquierda: 1 a 10 ; 1 a 20

VIGAS TECHO PRIMER PISO

$(f_b = 140 \text{ Kg/cm}^2)$

FORMULAS EMPLEADAS Y ALGUNOS VALORES CONSTANTES.-

VIGAS 30 x 70

| | |
|---------------------------------|--------------------------|
| $d = 65 \text{ cm.}$ | $V_o = 7100 \text{ Kg.}$ |
| $A_{smin} = 9.75 \text{ cm}^2$ | $v = 0.000593V$ |
| $M_{Asmin} = 7690 \text{ Kgm.}$ | $E_o = 0.00169V$ |
| $M_o = 13942 \text{ Kgm.}$ | |

VIGAS 30 x 60

| | |
|---------------------------------|--------------------------|
| $d = 55 \text{ cm.}$ | $V_o = 6000 \text{ Kg.}$ |
| $A_{smin} = 8.26 \text{ cm}^2$ | $v = 0.0007V$ |
| $M_{Asmin} = 5500 \text{ Kgm.}$ | $E_o = 0.002V$ |
| $M_o = 9982$ | |

Areas de acero:

$$A_s = \frac{M}{d} \times 0.0825$$

Estribos:

Cuadro para el calculo de estribos a diferentes espaciamentos:

| | s | $V_{sm} + V_o$ |
|----------|----|----------------|
| (d = 65) | 10 | 18300 |
| | 15 | 14570 |
| | 20 | 12700 |
| | 25 | 11580 |
| | 30 | 10830 |
| (d = 55) | 10 | 15470 |
| | 15 | 12320 |
| | 20 | 10740 |
| | 25 | 9780 |

$$a = \frac{V_{max} - (V_{sm} + V_o)}{w}$$

IVLAB 30 x 70 L = 6.95 mts. d = 65

Pp 530
M 1500 2030 x 6.95 = 14100

\angle a 5.70 = 2807
~~mm~~ i = 1460 x 5.35 = 7800

| | | | | | | | |
|-----------|-------------|-------|-------|------|---|--|----|
| Izquierda | 8160 | | | | | | |
| | 2370 | | | | | | |
| | <u>5580</u> | 16110 | 10638 | 13.5 | 2 ϕ 1" + 1 ϕ 7/8 | | 23 |
| Centro | 12250 | | | | | | |
| | 1760 | | | | | | |
| | <u>7860</u> | 21880 | 9859 | 12.5 | 1 ϕ 1" + 2 ϕ 7/8 | | 22 |
| Derecha | 8160 | | | | | | |
| | 530 | | | | | | |
| | <u>4560</u> | 13250 | 13405 | 17.0 | 2 ϕ 1" + 1 ϕ 7/8 + 1 ϕ 3/4 | | 29 |

V_i = 7050 + 2800 + 457 + 165 = 12472 21.1 0.053

V_d = 7050 + 3000 + 2350 - 165 = 12235 20.0 0.052

Estribos: Izq.: 1 a 10 ; 2 a 20 ; 4 a 30
(2 ϕ 3/8) Der.: 1 a 10 ; 5 a 20 ; 4 a 30

IVIBC 30 x 60 4.20 55

Pp 450
M 1500 1950 x 4.2 = 8180

\angle a 2.30 = 2990
~~mm~~ d = 1460 x 1.65 = 2410

| | | | | | | | |
|-----------|-------------|------|------|------|---|--|----|
| Izquierda | 2870 | | | | | | |
| | 1710 | | | | | | |
| | <u>364</u> | 4944 | 7831 | 11.8 | 1 ϕ 1" + 2 ϕ 7/8 + 1 ϕ 3/4 | | 28 |
| Centro | 4300 | | | | | | |
| | 2820 | | | | | | |
| | <u>1010</u> | 8130 | 1865 | 8.26 | 3 ϕ 3/4 | | 18 |
| Derecha | 2870 | | | | | | |
| | 1395 | | | | | | |
| | <u>1090</u> | 5355 | 4700 | 8.26 | 3 ϕ 3/4 | | 18 |

V_i = 4090 + 1350 + 1925 + 638 = 8003 16.0 0.040

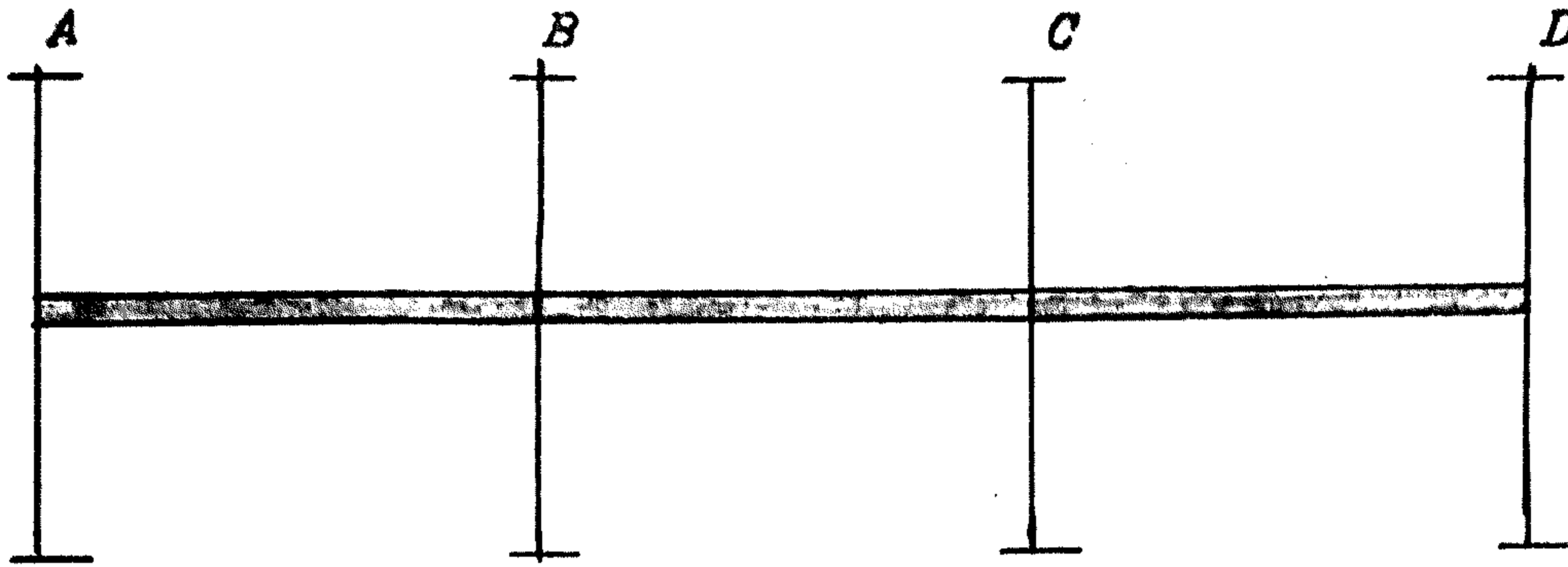
V_d = 4090 + 1640 + 485 - 638 = 5577 11.1 0.028

Estribos:- Izq.: 1 a 19 ; 4 a 25 (2 ϕ 3/8)

IVICD 30 x 60 4.10

Pp 450
M 1500
L 1460 3420 x 4.1 = 14000

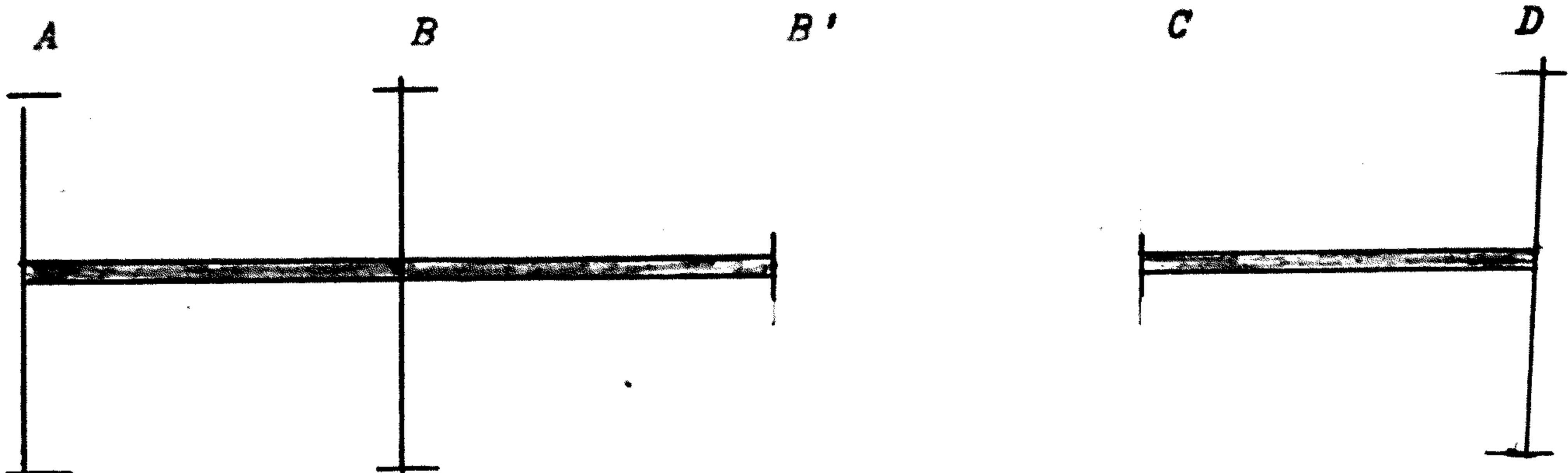
- EJE 1 -



| .415 | .277 | .271 | .343 | .358 | .670 |
|---------------|---------------|--------------|--------------|--------------|--------------|
| +16110 | -13250 | +4944 | -5355 | +4800 | -4800 |
| - 6680 | + 2300 | +2250 | + 190 | + 199 | +3210 |
| <u>+ 1150</u> | <u>-3330</u> | <u>+ 95</u> | <u>+1125</u> | <u>+1605</u> | <u>+ 99</u> |
| - 268 | + 900 | + 880 | - 936 | - 978 | - 66 |
| + 450 | - 134 | - 468 | + 440 | + 33 | - 489 |
| - 187 | + 164 | + 164 | - 162 | - 169 | + 323 |
| + 82 | - 93 | + 81 | + 82 | + 162 | - 84 |
| - 19 | + 48 | + 47 | - 84 | - 87 | + 56 |
| <u>+10638</u> | <u>-13405</u> | <u>+7831</u> | <u>-4700</u> | <u>+5565</u> | <u>-1751</u> |

- 0 - 0 -

- EJE 2 -



| .425 | .247 | .418 | 0 |
|---------------|---------------|--------------|--------------|
| +12600 | -12600 | + 770 | - 770 |
| - 5950 | + 2920 | +4950 | 0 |
| <u>+ 1460</u> | <u>- 2675</u> | <u>0</u> | <u>+2475</u> |
| - 620 | + 662 | +1120 | 0 |
| + 331 | - 310 | 0 | + 560 |
| - 141 | + 77 | + 130 | 0 |
| + 38 | - 71 | 0 | + 65 |
| - 16 | + 18 | + 30 | 0 |
| <u>+ 8302</u> | <u>-11799</u> | <u>+7000</u> | <u>+2330</u> |

| 0 | XXXX | .543 |
|--------------|--------------|------|
| +4970 | -4970 | |
| 0 | +2700 | |
| <u>+1350</u> | <u>0</u> | |
| 0 | 0 | |
| <u>+6320</u> | <u>-2270</u> | |

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| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 4800 | 5565 | 8.40 | 3ø3/4 |
| Centro | 7180 | 3442 | 8.26 | 3ø3/4 |
| Derecha | 4800 | 1751 | 8.26 | 3ø3/4 |

$$V_i = 7000 + 950 = 7950 \quad 15.9 \quad 0.040$$

$$V_d = 7000 - 950 = 6050 \quad 12.1 \quad 0.030$$

Estribos: - (2ø3/8) Izq.: 1 a 13 ; 2 a 25

1V1'BB' 1V4'DD' 40 x 18 2.20 15

Pp 180
L 450
a/c 750 1380 x 2.2 = 3030

| | | | | |
|-----------|-----|--|-----|---------------|
| Izquierda | 417 | | 2.3 | 1ø1/2 + 2ø3/8 |
| Centro | 835 | | 4.6 | 2ø5/8 + 1ø3/8 |
| Derecha | 417 | | 2.3 | 1ø1/2 + 2ø3/8 |

$$V_i = V_d = 1515$$

1V2AB 30 x 70 6.60 65

Pp 530
L 2930 3460 x 6.6 = 22900

| | | | | | |
|-----------|-------|-------|-------|---------------|----|
| Izquierda | 12600 | 8302 | 10.50 | 2ø7/8 + 1ø3/4 | 20 |
| Centro | 18900 | 8670 | 10.95 | 3ø7/8 | 21 |
| Derecha | 12600 | 11799 | 14.95 | 3ø1" | 24 |

$$V_i = 11450 - 530 = 10920 \quad 18.4 \quad 0.046$$

$$V_d = 11450 + 530 = 11980 \quad 20.3 \quad 0.050$$

Estribos: (2ø3/8) Izq.: 1 a 15 ; 2 a 30

Der.: 1 a 11 ; 1 a 23 ; 4 a 30

1V2BB' 30 x 60 2.20

Pp 450
L 1460 1910 x 2.2 = 4200

| | | | | | |
|-----------|------|---------|------|-------|----|
| Izquierda | 770 | 7700 | 18.6 | 3ø1" | 24 |
| Centro | 1160 | (-1175) | 8.26 | 3ø1" | |
| Derecha | 770 | 2330 | 8.26 | 3ø3/4 | |

$$V_i = 2100 + 4250 = 6350 \quad 12.7 \quad 0.032$$

$$V_d = 2100 - 4250 = -2150 \quad 4.3 \quad 0.010$$

Estribos:- (2ø3/8) Izq.: 1 a 13

| | | | | | | |
|---------------------------|-------------|--------------|-------|---------------|----|--|
| <u>1V2CD</u> | | 30 x 60 | | 4.20 | | |
| Pp | 450 | | | | | |
| L | <u>2930</u> | 3380 x 4.2 = | 14200 | | | |
| Izquierda | 4970 | 6320 | 9.48 | 1ø7/8 + 2ø3/4 | 19 | |
| Centro | 7460 | 3165 | 8.26 | 3ø3/4 | 18 | |
| Derecha | 4970 | 2270 | 8.26 | 3ø3/4 | 18 | |
| $V_i = 7100 + 965 = 8065$ | | | 16.1 | 0.040 | | |
| $V_d = 7100 - 965 = 6135$ | | | 12.2 | 0.031 | | |

Estribos:- (2ø3/8) Izq.: 1 a 13 ; 2 a 25
Der.: 1 a 13

| | | | | | | |
|--|-------------|--------------|-------|-------|--------------|----|
| <u>1V3AB</u> | | 30 x 70 | | 6.50 | | |
| Pp | 530 | | | | | |
| L | <u>1460</u> | 1990 x 6.5 = | 12900 | | | |
| $\equiv_i = 1460 x 4.80 = 7000$ | | | | | | |
| $\angle a 5.0 = 4970$ | | | | | | |
| Izquierda | 7000 | | | | | |
| | 4770 | | | | | |
| | <u>3720</u> | 15490 | 9752 | 12.4 | 1ø1" + 2ø7/8 | 22 |
| Centro | 10500 | | | | | |
| | 6650 | | | | | |
| | <u>3720</u> | 20870 | 9768 | 12.4 | 1ø1" + 2ø7/8 | 22 |
| Derecha | 7000 | | | | | |
| | 3680 | | | | | |
| | <u>1120</u> | 11800 | 12452 | 15.70 | 4ø7/8 | 28 |
| $V_i = 6450 + 1820 + 1057 - 420 = 8907$ | | | | 15.1 | 0.038 | |
| $V_d = 6450 + 5180 + 3820 + 420 = 15870$ | | | | 26.8 | 0.067 | |

Estribos:- Izq.: 1 a 15
(2ø3/8) Der.: 1 a 6 ; 8 a 13 ; 15 a 15

| | | | | | | |
|-----------------------|-------------|--------------|------|------|-------|----|
| <u>1V3BB'</u> | | 30 x 60 | | 2.20 | | |
| Pp | 450 | | | | | |
| L | <u>2930</u> | 3380 x 2.2 = | 7440 | | | |
| $\angle a 2.0 = 1690$ | | | | | | |
| Izquierda | 1360 | | | | | |
| | <u>28</u> | 1388 | 6357 | 9.5 | 4ø7/8 | 28 |

- EJE 3)-

| A | | B | | B' | C | | D |
|--------|--------|--------|-------|----|-------|-------|------|
| .425 | | .210 | .354 | 0 | 0 | | .543 |
| +15490 | -11800 | +1388 | -1386 | | +4850 | -4850 | |
| - 6580 | + 2190 | + 3690 | 0 | | 0 | +2630 | |
| + 1095 | - 3290 | 0 | +1845 | | +1315 | 0 | |
| - 466 | + 690 | +1170 | 0 | | 0 | 0 | |
| + 345 | - 233 | 0 | + 585 | | +6165 | -2220 | |
| - 146 | + 49 | + 83 | 0 | | | | |
| + 24 | - 73 | 0 | + 42 | | | | |
| - 10 | + 15 | + 26 | 0 | | | | |
| + 9752 | -12452 | +6357 | +1086 | | | | |

- 0 - 0 - 0 -

- EJE 4 -

| A | B | | C | | D | E | |
|--------|--------|-------|-------|-------|-------|-------|-------|
| .432 | .252 | .240 | .296 | .296 | .243 | .243 | .543 |
| +11100 | -11100 | +4520 | -4520 | +6000 | -6730 | +6110 | -4980 |
| - 4800 | + 1660 | +1580 | - 438 | - 438 | + 151 | + 151 | +2710 |
| + 830 | - 2400 | - 219 | + 790 | + 75 | - 219 | +1355 | + 76 |
| - 358 | + 660 | + 628 | - 247 | - 247 | - 277 | - 277 | - 41 |
| + 330 | - 179 | - 123 | + 314 | - 138 | - 123 | - 21 | - 138 |
| - 142 | + 76 | + 73 | - 52 | - 52 | + 35 | + 35 | + 75 |
| + 38 | - 71 | - 26 | - 36 | - 18 | - 26 | + 38 | + 18 |
| - 16 | + 24 | + 23 | + 16 | + 16 | - 3 | + 3 | - 10 |
| +6982 | -11330 | +6456 | -4173 | +5198 | -7192 | +7388 | -2290 |

- 0 - 0 - 0 -

| | | | | | |
|---------|------------------------|----------|---------|------|-------|
| Centro | 2040 | | | | |
| | <u>167</u> | 2207 | (-429) | 8.26 | 4ø7/8 |
| Derecha | 1360 | | | | |
| | <u>26</u> | 1386 | (+1086) | 8.26 | 3ø3/4 |
| V_i | $= 3720 + 150 + 3390$ | $= 7260$ | | 14.3 | 0.036 |
| V_d | $= 3720 + 1540 - 3390$ | $= 1870$ | | 3.7 | 0.01 |

Estribos:- (2ø3/8) Izq.: 1 a 13 ; 1 a 25

| | | | | | |
|--------------|-----------------|-----------------|-------|------------------|-------|
| <u>1V3CD</u> | | 30 x 60 | | 4.15 | |
| Pp | 450 | | | | |
| L | <u>2930</u> | 3380 x 4.15 = | 14000 | | |
| | | | 6165 | | |
| Izquierda | 4850 | XXXX | 9.25 | 1ø7/8 + 2ø3/4 | 19 |
| Centro | 7380 | 3188 | 8.26 | 3ø3/4 | 18 |
| Derecha | 8850 | 2220 | 8.26 | 3ø3/4 | 18 |
| V_i | $= 7000 + 950$ | $= 7950$ | 10.6 | XXXXX | 0.040 |
| V_d | $= 7000 - 950$ | $= 6050$ | 8.0 | XXXXX | 0.030 |

Estribos:- (2ø3/8) Izq.: 1 a 13 ; 2 a 25

| | | | | | |
|--------------|-----------------|---------------|-------|---------------|-------|
| <u>1V4AB</u> | | 30 x 70 | | 6.20 | 65 |
| Pp | 530 | | | | |
| L | <u>2930</u> | 3460 x 6.20 = | 21400 | | |
| Izquierda | 11100 | 6982 | 9.75 | 2ø7/8 + 1ø5/8 | 19 |
| Centro | 16600 | 7449 | 9.75 | 2ø7/8 + 1ø5/8 | 19 |
| Derecha | 11100 | 11330 | 14.38 | 3ø7/8 + 1ø3/4 | 27 |
| V_i | $= 10700 - 700$ | $= 10000$ | 16.9 | | 0.042 |
| V_d | $= 10700 + 700$ | $= 11400$ | 19.3 | | 0.047 |

Estribos:- (2ø3/8) 1 a 15 ; 3 a 30

Der.: 1 a 13 ; 1 a 25 ; 3 a 30

| | | | | | |
|--------------|-------------|------------|-------|---------------|----|
| <u>1V4BC</u> | | 30 x 60 | | 4.00 | |
| Pp | 450 | | | | |
| L | <u>2930</u> | 3380 x 4 = | 13520 | | |
| Izquierda | 4520 | 6454 | 9.67 | 3ø7/8 + 1ø3/4 | 27 |
| Centro | 6780 | 1476 | 8.26 | 3ø3/4 | 18 |

| | | | | | |
|---------------------------|------|------|------|-------|----|
| Derecha | 4520 | 4173 | 8.26 | 3ø3/4 | 18 |
| $V_i = 6760 + 570 = 7330$ | | | 14.6 | 0.037 | |
| $V_d = 6760 - 570 = 6190$ | | | 12.3 | 0.031 | |

Distribos:- (2ø3/8) Izq.ï 1 a 13 ; 1 a 25
 Der.: 1 a 13

1V4CD 30 x 60 4.00

Pp 450
 L 2930
 T 404 3784 x 4 = 15136

\angle a 1.40 = 1700

| | | | | | | |
|-----------|------|------------------|------|-------|-------|----|
| Izquierda | 5060 | <u>940</u> 6000 | 5198 | 8.26 | 3ø3/4 | 18 |
| Centro | 7600 | <u>1500</u> 9100 | 3005 | 8.26 | 3ø3/4 | |
| Derecha | 5060 | <u>1670</u> 6730 | 7192 | 10.80 | 4ø3/4 | |

| | | |
|---------------------------------|------|-------|
| $V_i = 7568 + 750 - 500 = 7818$ | 15.6 | 0.039 |
| $V_d = 7568 + 950 + 500 = 9018$ | 18.3 | 0.045 |

Distribos:- (2ø3/8) Izq.: 1 a 13 ; 2 a 25
 Der.: 1 a 12 ; 2 a 25

1V4DE 30 x 60 4.05

Pp 450
 M 1500 1950 x 4.05 = 7900

$\frac{6}{1111}d = 1460 \times 1.70 = 2480$
 \angle a 2.30 = 2933

| | | | | | | |
|-----------|------|------|------------------|------|-------|-------|
| Izquierda | 3330 | 1120 | <u>1660</u> 6110 | 7388 | 11.08 | 4ø3/4 |
| Centro | 4000 | 1060 | <u>2550</u> 8220 | 3391 | 8.26 | 3ø3/4 |
| Derecha | 3330 | 400 | <u>1250</u> 4980 | 2290 | 8.26 | 3ø3/4 |

| | | |
|-----------------------------------|------|-------|
| $V_i = 3950 + 1960 + 1270 = 7180$ | 14.3 | 0.036 |
| $V_d = 3950 + 520 - 1270 = 3200$ | 6.4 | 0.016 |

Estribos:- (2ø3/8) Izq.: 1 a 13 ; 2 a 25

1V5AB 30 x 70 6.00

Pp 530
L 1460 1990 x 6 = 11940

\square a 4.3 = 6280

\triangle a 4.5 = 4900

Isquierda 5980
4040
1380 11400 7074 8.98 1ø7/8+1ø3/4+1ø5/8 18

Centro 8980
5500
3680 18160 8029 10.20 2ø7/8 + 1ø3/4 20

Derecha 5980
3030
4120 13130 13187 16.70 2ø1" + 1ø7/8 + 1ø3/4 31

$V_i = 5970 + 4030 + 207 - 1020 = 9187$ 15 0.039

$V_d = 5970 + 2250 + 3700 + 1020 = 12940$ 21.2 0.055

Estribos:- (2ø3/8) Izq.: 1 a 15 ; 2 a 30

Der.: 1 a 10; 5 a 20; 2 a 25; 2 a 30

1V5BC 30 x 60 3.95

Pp 450
L 2930
T 540 3920 x 3.95 = 13000

Isquierda 4280 6191 9.20 2ø1" + 1ø7/8 + 1ø3/4 29

Centro 6440 1244 8.26 3ø3/4

Derecha 4280 4201 8.26 3ø3/4

$V_i = 6500 + 505 = 7005$ 14 0.035

$V_d = 6500 - 505 = 5995$ 11.9 0.030

Estribos:- (2ø3/8) Izq.: 1 a 13 ; 2 a 25

1V5CD 30 x 60 4.00

Pp 450
T 1170
L 2930 4550 x 4 = 18200

\triangle a 1.40 = 1170

- EJE 5 -

| A | B | | C | | D | | E |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | | | | | |
| <u>.443</u> | <u>.222</u> | <u>.201</u> | <u>.296</u> | <u>.296</u> | <u>.279</u> | <u>.279</u> | <u>.420</u> |
| +11400 | -13130 | +4280 | -4280 | +6764 | -6445 | +5146 | -5960 |
| - 5050 | + 1960 | +1780 | - 735 | + 385 | + 363 | + 363 | +2500 |
| + 980 | - 2525 | - 367 | + 890 | + 182 | - 367 | +1250 | + 182 |
| - 434 | + 642 | + 580 | - 317 | - 317 | - 246 | - 246 | - 76 |
| + 321 | - 217 | - 158 | + 290 | - 123 | - 158 | - 38 | - 123 |
| - 143 | + 83 | + 76 | - 49 | - 49 | + 55 | + 55 | + 52 |
| <u>+ 7074</u> | <u>-13187</u> | <u>+6191</u> | <u>-4201</u> | <u>+5722</u> | <u>-6798</u> | <u>+6530</u> | <u>-3425</u> |

- 0 - 0 -

- EJE 6 -

| A | B | | C | | D | | E |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | | | | | |
| <u>.450</u> | <u>.226</u> | <u>.200</u> | <u>.243</u> | <u>.243</u> | <u>.243</u> | <u>.243</u> | <u>.420</u> |
| +10800 | -10800 | +5798 | -5840 | +3000 | -3000 | +3700 | -3235 |
| - 4860 | + 1160 | +1020 | + 693 | + 693 | - 172 | - 172 | +1360 |
| + 580 | - 2430 | + 347 | + 510 | - 86 | + 347 | + 680 | - 86 |
| - 261 | + 470 | + 416 | - 103 | - 103 | - 249 | - 249 | + 36 |
| + 235 | - 131 | - 52 | + 208 | - 124 | - 52 | + 18 | - 124 |
| - 106 | + 41 | + 37 | - 42 | - 42 | + 8 | + 8 | + 52 |
| <u>+ 6388</u> | <u>-11740</u> | <u>+7150</u> | <u>-4574</u> | <u>+3338</u> | <u>-3118</u> | <u>+3985</u> | <u>-1997</u> |

- 0 - 0 -

| | | | | | | |
|------------------|------------|------|------|-------|--|--------------|
| <i>Izquierda</i> | 6070 | | | | | |
| | <u>694</u> | 6764 | 5722 | 8.58 | | 3ø3/4 |
| <i>Centro</i> | 9100 | | | | | |
| | <u>820</u> | 9920 | 3660 | 8.26 | | 3ø3/4 |
| <i>Derecha</i> | 6070 | | | | | |
| | <u>375</u> | 6445 | 6798 | 10.20 | | 1ø1" + 2ø3/4 |

$V_i = 9000 + 760 - 270 = 9490 \quad 18.5 \quad 0.048$

$V_d = 9000 + 410 + 270 = 9680 \quad 19.3 \quad 0.048$

Estribos:- (2ø3/8) *Izq.:* 1 a 12 ; 2 a 25

Der.: 1 a 12 ; 2 a 25

IV5DB 30 x 60 4.00

Pp 450
T 1220
L 1460 2330 x 4 = 9320

$\frac{KK}{\text{Estr}}_d = 1460 \times 1.60 = 2340$

$\angle a 2.10 = 3508$

| | | | | | | |
|------------------|-------------|-------|------|------|--|-----------------------|
| <i>Izquierda</i> | 3110 | | | | | |
| | 346 | | | | | |
| | <u>1690</u> | 5146 | 6530 | 9.80 | | 1ø1" + 2ø3/4 20 |
| <i>Centro</i> | 4660 | | | | | |
| | 3000 | | | | | |
| | <u>3370</u> | 11030 | 6053 | 9.07 | | 1ø7/8 + 2ø3/4 19 |
| <i>Derecha</i> | 3110 | | | | | |
| | 1020 | | | | | |
| | <u>1830</u> | 5960 | 3425 | 8.26 | | 3ø3/4 |

$V_i = 4660 + 1070 + 16668 + 760 = 8158 \quad 16.3 \quad 0.041$

$V_d = 4660 + 1270 + 1840 - 260 = 7010 \quad 14 \quad 0.035$

Estribos:- (2ø3/8) *Izq.:* 1 a 13 ; 3 a 25

Der.: 1 a 13 ; 3 a 25

IV6AB 30 x 70 5.70

Pp 530
L 3450 3980 x 5.7 = 22700

| | | | | | | |
|------------------|-------|--|-------|-------|--|------------------------------|
| <i>Izquierda</i> | 10800 | | 6388 | 9.75 | | 2ø7/8 + 1ø5/8 19 |
| <i>Centro</i> | 16200 | | 7136 | 9.75 | | 2ø7/8 + 1ø5/8 19 |
| <i>Derecha</i> | 10800 | | 11740 | 14.85 | | 1ø1" + 1ø7/8 + 2ø3/4 27 |

$$V_i = 11350 - 940 = 10410 \quad 17.6 \quad 0.044$$

$$V_d = 11350 + 940 = 12290 \quad 20.4 \quad 0.052$$

Estribos:- (2Ø3/8) Izq.: 1 a 15 ; 2 a 30
 Der.: 1 a 10 ; 1 a 20 ; 4 a 30

BB

1V6BC 30 x 60 2.90

Pp 450
 L 3450
 T 390 4290 x 3.9 = 16800

/ a 1.5 = 580

/ a 3.5 = 580

Izquierda 5450
 328
 20 5798 7150 10.70 1Ø1" + 1Ø7/8 + 2Ø3/4 27

Centro 8180
 440
 113 8733 2871 8.26 3Ø3/4 18

Derecha 5450
 210
 184 5840 4574 8.26 3Ø3/4

$$V_i = 8400 + 357 + 60 + 660 = 9477 \quad 18.9 \quad 0.047$$

$$V_d = 8400 + 223 + 520 - 660 = 8483 \quad 16.9 \quad 0.043$$

Estribos:- (2Ø3/8) Izq.: 1 a 13 ; 3 a 25
 Der.: 1 a 13 ; 2 a ~~BB~~ 25

1V6CD 30 x 60 4.00

Pp 450
 L 3450
 T 350 4250 x 4 = 9000

Izquierda 3000 3338 8.26 3Ø3/4 18

Centro 4500 1272 8.26 3Ø3/4

Derecha 3000 3118 8.26 3Ø3/4

$$V_i = 4500 + 55 = 4555 \quad 9.1 \quad 0.022$$

$$V_d = 4500 - 55 = 4445 \quad 8.8 \quad 0.022$$

1V6DE 30 x 60 4.00

Pp 450
 L 3450
 T 350 4250 x 4 = 9000

/ a 1.0 = 1250

| | | | | |
|---------------------------------|--------------------------------|------|------|-------|
| <i>Isquierda</i> | <u>3000</u> <u>700</u> 3700 | 3985 | 8.26 | 3ø3/4 |
| <i>Centro</i> | <u>4500</u> <u>626</u> 5126 | 2135 | 8.26 | 3ø3/4 |
| <i>Derecha</i> | <u>3000</u> <u>235</u> 3235 | 1997 | 8.26 | 3ø3/4 |
| | | | | |
| $V_i = 938 + 4500 + 498 = 5981$ | | | 11.9 | 0.030 |
| $V_d = 312 + 4500 - 498 = 4314$ | | | 8.6 | 0.021 |

1V7AB *30 x 70* 5.50

Pp 450
M 1500
L 1950 3900 x 5.5 = 16500

| | | | | | |
|---------------------------|-----------------|----------------------|-------|-----------------------|----|
| <i>Isquierda</i> | 7570 | 8250 3450 | 9.75 | 2ø7/8 + 1ø5/8 | 19 |
| <i>Centro</i> | 11300 7570 | 5349 | 9.75 | 2ø7/8 + 1ø5/8 | 19 |
| <i>Derecha</i> | 8250 | 8465 | 10.72 | 1ø7/8 + 1ø3/4 + 2ø5/8 | 23 |
| | | | | | |
| $V_i = 8250 - 910 = 7340$ | | | 12.4 | 0.037 | |
| $V_d = 8250 + 910 = 9060$ | | | 15.3 | 0.045 | |
| | | | | | |
| <i>Estribos:- (2ø3/8)</i> | <i>Izq.:</i> | 1 a 15 | | | |
| | <i>Der.:</i> | 1 a 15 ; 2 a 30 | | | |

1V7BC *30 x 60* 4.00

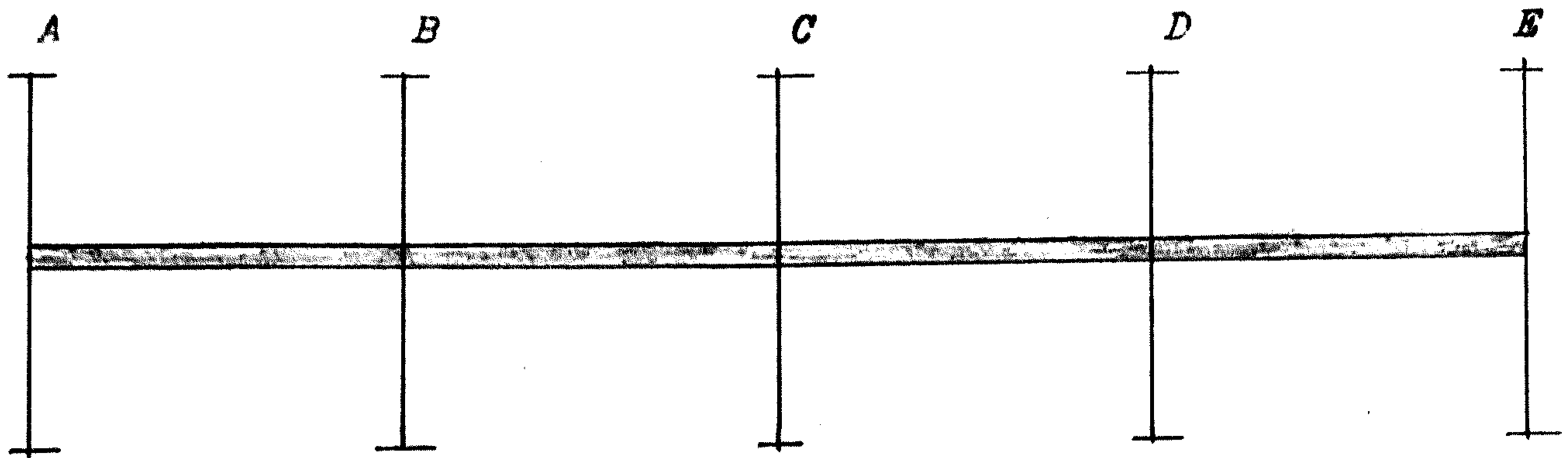
Pp 450
M 1500
L 1950 3900 x 4 = 15600

| | | | | | |
|---------------------------|--------------|-----------------|------|-----------------------|----|
| <i>Isquierda</i> | 5200 | 6531 | 9.8 | 1ø7/8 + 1ø3/4 + 2ø5/8 | 23 |
| <i>Centro</i> | 7800 | 2308 | 8.26 | 3ø3/4 | |
| <i>Derecha</i> | 5200 | 4652 | 8.26 | 3ø3/4 | |
| | | | | | |
| $V_i = 7800 + 470 = 8270$ | | | 16.3 | 0.041 | |
| $V_d = 7800 - 470 = 7330$ | | | 14.6 | 0.037 | |
| | | | | | |
| <i>Estribos:- (2ø3/8)</i> | <i>Izq.:</i> | 1 a 13 ; 2 a 25 | | | |
| | <i>Der.:</i> | 1 a 13 ; 1 a 25 | | | |

1V7CD *30x60* 4.00

Pp 450

- EJE 7 -



| A | | B | | C | | D | | E |
|--------------|--------------|--------------|------|--------------|--------------|--------------|--------------|--------------|
| .587 | | .315 | .287 | .336 | .336 | .336 | .336 | .626 |
| +7570 | -7570 | +5200 | | -5200 | +5200 | -5200 | +5200 | -5200 |
| -4430 | +747 | +681 | | 0 | 0 | 0 | 0 | +3250 |
| +373 | -2215 | 0 | | +341 | 0 | 0 | +1625 | 0 |
| -219 | +698 | +639 | | -114 | -114 | -547 | -547 | 0 |
| +349 | -109 | -57 | | +318 | -273 | -57 | 0 | -273 |
| -203 | +51 | +47 | | -15 | -15 | +19 | +19 | +17 |
| +26 | -102 | -8 | | +23 | -9 | -8 | +8 | +9 |
| -16 | +35 | +32 | | -5 | -5 | 0 | 0 | -6 |
| <u>+3450</u> | <u>-8465</u> | <u>+6531</u> | | <u>-6452</u> | <u>+4784</u> | <u>-5793</u> | <u>+6305</u> | <u>-2203</u> |

M 1500
 L 1950 3900 x 4 = 15600

| | | | | |
|-----------|------|------|------|---------------|
| Izquierda | 5200 | 4784 | 8.26 | 3ø3/4 |
| Centro | 7800 | 2512 | 8.26 | 3ø3/4 |
| Derecha | 5200 | 5793 | 8.68 | 2ø3/4 + 1ø7/8 |

Vi = 7800 - 250 = 7550 15.1 0.038

Vd = 7800 + 250 = 8050 16.1 0.040

Estribos: (2ø3/8) Izq.: 1 a 13 ; 1 a 25

Der.: 1 a 13 ; 2 a 25

LV7DE 30 x 60 4.00

Pp 450
 M 1500
 L 1950 3900 x 4 = 15600

| | | | | | |
|-----------|------|------|------|---------------|----|
| Izquierda | 5200 | 6305 | 9.45 | 1ø7/8 + 2ø3/4 | 19 |
| Centro | 7800 | 3546 | 8.26 | 3ø3/4 | |
| Derecha | 5200 | 2203 | 8.26 | 3ø3/4 | |

Vi = 7800 + 1000 = 8800 17.6 0.044

Vd = 7800 - 1000 = 6800 13.6 0.034

Estribos: (2ø3/8) Izq.: 1 a 13 ; 3 a 25

Der.: 1 a 13 ; 1 a 25

XXXX

1-2-3-4-5VA12 25 x 50 4.10

Pp 310
M 1500 1810 x 4.1 = 7420

| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 2470 | 1503 | 5.63 | 3ø5/8 |
| Centro | 3700 | 1522 | 5.63 | 3ø5/8 |
| Derecha | 2470 | 2853 | 5.63 | 3ø5/8 |

Vi = 3710

Vd = 3710

1-2-3-4-5VA23 25 x 50 4.10

Pp 310
M 1500 1810 x 4.1 = 7420

| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 2470 | 2587 | 5.63 | 3ø5/8 |
| Centro | 3700 | 1194 | 5.63 | 3ø5/8 |
| Derecha | 2470 | 2426 | 5.63 | 3ø5/8 |

Vi = Vd = 3710

1-2-3-4-5VA34 25 x 50 4.10

Pp 310
M 1500 1810 x 4.1 = 7420

| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 2470 | 2456 | 5.63 | 3ø5/8 |
| Centro | 3700 | 1233 | 5.63 | 3ø5/8 |
| Derecha | 2470 | 2478 | 5.63 | 3ø5/8 |

Vi = Vd = 3710

1-2-3-4-5VA45 25 x 50 4.10

Pp 310
M 1500 1810 x 4.1 = 7420

| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 2470 | 2494 | 5.63 | 3ø5/8 |
| Centro | 3700 | 1174 | 5.63 | 3ø5/8 |
| Derecha | 2470 | 2559 | 5.63 | 3ø5/8 |

Vi = Vd = 3710

1-2-3-4-5VA56 25 x 50 4.10

Pp 310
M 1500 1810 x 4.1 = 7420

| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 2470 | 2182 | 5.63 | 3ø5/8 |
| Centro | 3700 | 1103 | 5.63 | 3ø5/8 |

Derecha 2470 3212 5.88 1ø7/8 + 2ø3/4
 Vi = Vd = 3700

1-2-3-4-5VA67 25 x 50 5.60

Pp 310
 M 1500 1810 x 5.6 = 10100

Izquierda 4740 5024 9.2 1ø7/8 + 2ø3/4 19

Centro 7120 3021 5.63 3ø5/8

Derecha 4740 3175 5.8 3ø5/8

Vi = 5050 + 330 = 5380 13.1 0.046

Vd = 5050 - 330 = 4720 11.5 0.041

Estribos: (2ø1/4) Izq.: 1 a 6 ; 4 a 12

Der.: 1 a 7 ; 3 a 14

1-2-3-4-5VA'12 40 x 20 4.10

Pp 200
 L 455 655 x 4.1 = 2690

Izquierda 460 ~~XXX~~ 3.6 1ø5/8 + 2ø3/8

Centro 1380 -- 6.34 1ø3/4 + 2ø5/8

Derecha 460 -- 3.6 1ø5/8 + 2ø3/8

~~XXXXXXXX~~ Vi = Vd = 1345

1-2-3-4-5VB12 25 x 50 4.10

Pp 310
 T 750 1060 x 4.1 = 4340

La 0.70 = 730

La 3.10 = 1515

Izquierda 1490
 350
274 2114 -- 5.63 3ø5/8

Centro 2230
 255
747 3232 -- 5.63 3ø5/8

Derecha ~~XXXX~~
 1490
 72
860 2422 -- 5.63 3ø5/8

Vi = 2170 + 611 + 365 = 3146

Vd = 2170 + 119 + 1150 = 3439

1-2-3-4-5VB23 25 x 50 4.10

Pp 310
T 750 1060 x 4.1 = 4340

Izquierda 3ø5/8
Centro 3ø5/8
Derecha 3ø5/8

1-2-3-4-5VB34 25 x 50 4.10

Pp 310
T 750 1060

Izquierda 3ø5/8
Centro 3ø5/8
Derecha 3ø5/8

1-2-3-4-5VB45 25 x 50 4.10

Pp 310
T 750 1060

Izquierda 3ø5/8
Centro 3ø5/8
Derecha 3ø5/8

1-2-3-4-5VB56 25 x 50 4.10

Pp 310
T 750 1060

Izquierda 3ø5/8
Centro 3ø5/8
Derecha 3ø5/8

1-2-3-4-5VB67 25 x 50 5.60

Pp 310

Izquierda 3ø5/8
Centro 3ø5/8
Derecha 3ø5/8

1-2-3-4VB'12 25 x 50 4.10

Pp 310
T 750 1060 x 4.1 = 4350

$\angle a 3.30 = 1515$

| | | | |
|-----------|-------------------------|------|-------|
| Izquierda | 4350 | 5.63 | 3ø5/8 |
| Centro | 2230 <u>620</u> 2850 | -- | 5.63 |
| Derecha | 4350 | 5.63 | 3ø5/8 |

1-2-3-4VB'56 40 x 20 4.10

Pp 200 x 4.1 = 820

$\square d = 750 \times 2.40 = 1800$

| | | | |
|-----------|------|------|---------------|
| Izquierda | 725 | 3.6 | 1ø5/8 + 2ø3/8 |
| Centro | 1450 | 6.65 | 1ø3/4 + 2ø5/8 |
| Derecha | 725 | 3.6 | 1ø5/8 + 2ø3/8 |

1-2-3-4-5VC12 25 x 50 4.10

Pp 310

| | | | |
|-----------|--|--|-------|
| Izquierda | | | 3ø5/8 |
| Centro | | | 3ø5/8 |
| Derecha | | | 3ø5/8 |

1-2-3-4-5VC21 34 25 x 50 4.10

Pp 310

| | | | |
|-----------|--|--|-------|
| Izquierda | | | 3ø5/8 |
| Centro | | | 3ø5/8 |
| Derecha | | | 3ø5/8 |

1-2-3-4-5VC24 45 25 x 50 4.10

Pp 310

| | | | |
|-----------|--|--|-------|
| Izquierda | | | 3ø5/8 |
| Centro | | | 3ø5/8 |
| Derecha | | | 3ø5/8 |

1-2-3-4-5VC56 25 x 50 4.10

Pp 310

| | | | |
|-----------|--|--|-------|
| Izquierda | | | 3ø5/8 |
| Centro | | | 3ø5/8 |
| Derecha | | | 3ø5/8 |

| | | | | |
|----------------------|---------|------|------|-------|
| <u>1-2-3-4-5VC67</u> | 25 x 50 | | 5.60 | |
| Pp 310 | | | | |
| Isquierda | | | | 3ø5/8 |
| Centro | | | | 3ø5/8 |
| Derecha | | | | 3ø5/8 |
| <hr/> | | | | |
| <u>1-2-3-4-5VD12</u> | 25 x 50 | | 4.10 | |
| Pp 310 | | | | |
| M <u>1500</u> 1810 | | | | |
| Isquierda 2540 | 1503 | 5.63 | | 3ø5/8 |
| Centro 3800 | 1522 | 5.63 | | 3ø5/8 |
| Derecha 2540 | 2853 | 5.63 | | 3ø5/8 |
| <hr/> | | | | |
| <u>1-2-3-4-5VD23</u> | 25 x 50 | | 4.10 | |
| Pp 310 | | | | |
| M <u>1500</u> 1810 | | | | |
| Isquierda 2540 | 2587 | 5.63 | | 3ø5/8 |
| Centro 3800 | 1194 | 5.63 | | 3ø5/8 |
| Derecha 2540 | 2426 | 5.63 | | 3ø5/8 |
| <hr/> | | | | |
| <u>1-2-3-4-5VD34</u> | 25 x 50 | | 4.10 | |
| Pp 310 | | | | |
| M <u>1500</u> 1810 | | | | |
| Isquierda 2540 | 2456 | 5.63 | | 3ø5/8 |
| Centro 3800 | 1233 | 5.63 | | 3ø5/8 |
| Derecha 2540 | 2478 | 5.63 | | 3ø5/8 |
| <hr/> | | | | |
| <u>1-2-3-4-5VD45</u> | 25 x 50 | | 4.10 | |
| Pp 310 | | | | |
| T <u>750</u> 1060 | | | | |
| Isquierda | | | | 3ø5/8 |
| Centro | | | | 3ø5/8 |
| Derecha | | | | 3ø5/8 |
| <hr/> | | | | |
| <u>1-2-3-4-5VD56</u> | 25 x 50 | | 4.10 | |
| Pp 310 | | | | |
| Isquierda | | | | 3ø5/8 |

Centro 3ø5/8
 Derecha 3ø5/8

1-2-3-4-5VD67 25 x 50 5.60

Pp 310

Isquierda 3ø5/8

Centro 3ø5/8

Derecha 3ø5/8

1-2-3-4VD'45 25 x 50 4.10

(Igual a 1-2-3-4VB'12)

1-2-3-4-5VE45 25 x 50 4.10

Pp 310
 M 1500 1810

Isquierda 3ø5/8

Centro 3ø5/8

Derecha 3ø5/8

1-2-3-4-5VE56 25 x 50 4.10

Pp 310
 M 1500 1810

Isquierda 2470 2182 5.63 3ø5/8

Centro 3700 1103 5.63 3ø5/8

Derecha 2470 3212 5.88 1ø7/8 + 2ø3/4

1-2-3-4-5VE67 25 x 50 5.60

Pp 310
 M 1500 1810 x 5.6 = 10100

Isquierda 4740 5024 9.2 1ø7/8 + 2ø3/4

Centro 7120 3021 5.63 3ø5/8

Derecha 4740 3175 5.8 3ø5/8

Vi = 5050 + 330 = 5380

Vd = 5050 - 330 = 4720

tribos: (2ø3/8) Isq.: 1 a 6 ; 4 a 12

Der.: 1 a 7 ; 3 a 14

VIGAS TECHO 2° - 3° y 4° PISO

($f_c = 140 \text{ Kg/cm}^2$)

2-3-4VIAB 30 x 70 7.00

Pp 530
~~MB~~
 M 1500 2030

~~mm~~ = 1460 x 5.35 = 7800

\angle a 5.70 = 2807

| | | | | | |
|-----------|-------|-------|-------|-----------------------------|----|
| Izquierda | 16550 | 9725 | 12.35 | 1 ϕ 1" + 2 ϕ 7/8 | 22 |
| Centro | 22500 | 11145 | 14.5 | 3 ϕ 7/8 + 1 ϕ 3/4 | 27 |
| Derecha | 13600 | 14613 | 18.60 | 3 ϕ 1" + 1 ϕ 7/8 | 31 |

Vi = 7050 + 4800 + 457 - 775 = 11530 19.6 0.049

Vd = 7050 + 3000 + 2350 + 775 = 13175 22 0.055

Estribos:- 1 a 12 ; 1 a 25 ; 3 a 30 (izq)
 (2 ϕ 3/8) 1 a 7; 8 a 15; 1 a 25; 4 a 30 (der.)

2-3-4VIBC 30 x 60 4.20

Pp 450
 M 1500 1950

\angle a 2.30 = 2990

~~mm~~ = 1460 x 1.65 = 2410

| | | | | | |
|-----------|------|------|-------|----------------------------|----|
| Izquierda | 4944 | 7936 | 11.90 | 3 ϕ 1" + 1 ϕ 7/8 | 31 |
| Centro | 8130 | 1538 | 8.26 | 3 ϕ 3/4 | |
| Derecha | 5355 | 4595 | 8.25 | 3 ϕ 3/4 | |

Vi = 4090 + 1350 + 1925 + 111 = 7476 14.9 0.037

Vd = 4090 + 1640 + 485 - 111 = 6104 12.2 0.030

Estribos:- (2 ϕ 3/8) Izq. 1 a 13 ; 3 a 25

2-3-4VICD 30 x 60 4.15

Pp 450
 M 1500
 L 1400 3410

| | | | | | |
|-----------|------|------|------|--------------|--|
| Izquierda | 4920 | 5397 | 8.26 | 3 ϕ 3/4 | |
| Centro | 7360 | 3519 | 8.26 | 3 ϕ 3/4 | |
| Derecha | 4920 | 2441 | 8.26 | 3 ϕ 3/4 | |

Vi = 7000 + 660 = 7660 15.3 0.038

- EJE 1 -

| A | | B | | C | | D | |
|---------------|---------------|--------------|--------------|--------------|--------------|------|--|
| /468 | | .239 | | .264 | | .344 | |
| .358 | | .546 | | | | | |
| +16550 | -13600 | +4944 | -5355 | +4920 | -4920 | | |
| - 7600 | + 2070 | +2200 | + 150 | + 156 | +2680 | | |
| + 1035 | - 3800 | + 75 | +1100 | +1340 | + 78 | | |
| - 558 | + 890 | + 984 | - 840 | - 883 | - 42 | | |
| + 445 | - 279 | - 420 | + 492 | - 21 | - 436 | | |
| - 209 | + 167 | + 185 | - 162 | - 168 | + 237 | | |
| + 134 | - 104 | - 81 | + 92 | + 118 | - 84 | | |
| - 72 | + 43 | + 49 | - 72 | - 75 | + 46 | | |
| <u>+ 9725</u> | <u>-14619</u> | <u>+7936</u> | <u>-4595</u> | <u>+5397</u> | <u>-2448</u> | | |

- 0 -

- EJE 2 -

| A | | B | | B' | | C | | D | |
|---------------|---------------|--------------|--------------|------|--|--------------|--------------|---|--|
| .478 | | .264 | | .448 | | 0 | | 0 | |
| .546 | | | | | | | | | |
| +13400 | -13400 | + 770 | - 770 | | | +4970 | -4970 | | |
| - 6400 | + 3340 | +5680 | 0 | | | 0 | +2700 | | |
| - 1670 | - 3200 | 0 | +2840 | | | +1350 | 0 | | |
| + 800 | + 845 | +1435 | 0 | | | 0 | 0 | | |
| + 423 | + 400 | 0 | + 718 | | | <u>+6320</u> | <u>-2270</u> | | |
| - 203 | - 103 | - 180 | 0 | | | | | | |
| - 52 | - 102 | 0 | - 90 | | | | | | |
| + 25 | + 27 | + 46 | 0 | | | | | | |
| <u>+ 6323</u> | <u>-12193</u> | <u>+7751</u> | <u>+2698</u> | | | | | | |

- 0 - 0 -

$$Vd = 7000 - 660 = 6340 \quad 12.6 \quad 0.032$$

-estribos:- (2 ϕ 3/8) Izq.: 1 a 13 ; 2 a 25

Der.; 1 a 13

2-3-4V2AB 30 x 70 6.80

Pp 530
L 2930 3460

| | | | | | |
|-----------|-------|-------|-------|-----------------------------|----|
| Izquierda | 13400 | 6323 | 9.75 | 2 ϕ 1/8 + 1 ϕ 5/8 | 19 |
| Centro | 20000 | 10742 | 13.60 | 2 ϕ 1" + 1 ϕ 7/8 | 23 |
| Derecha | 13400 | 12193 | 15.45 | 4 ϕ 7/8 | 28 |

$$Vi = 11450 - 860 = 10590 \quad 17.8 \quad 0.044$$

$$Vd \pm 11450 + 860 = 12310 \quad 20.8 \quad 0.052$$

Estribos: (2 ϕ 3/8) Izq.: 1 a 15 ; 3 a 30

der.; 1 a 10 ; 3 a 20 ; 7 a 30

2-3-4V2BB' 30x60 2.20

Pp 450
L 1460 1910

| | | | | | |
|-----------|------|---------|------|--------------|--|
| Izquierda | 770 | 7751 | 11.7 | 4 ϕ 7/8 | |
| Centro | 1160 | (-1366) | 8.26 | 4 ϕ 7/8 | |
| Derecha | 770 | (+2698) | 8.26 | 3 ϕ 3/4 | |

$$Vi = 2100 + 4750 = 6850 \quad 13.7 \quad 0.034$$

$$Vd = 2100 - 4750 = -2650 \quad 5.3 \quad 0.013$$

Estribos: (2 ϕ 3/8) izq.: 1 a 13 ; 2 a 25

2-3-4V2CD 30 x 60 4.20

Pp 450
L 2930 3380

| | | | | | |
|-----------|------|------|------|-----------------------------|----|
| Izquierda | 4970 | 6320 | 9.48 | 1 ϕ 7/8 + 2 ϕ 3/4 | 19 |
| Centro | 7460 | 3165 | 8.26 | 3 ϕ 3/4 | 18 |
| Derecha | 4970 | 2270 | 8.26 | 3 ϕ 3/4 | |

$$Vi = 7100 + 965 = 8065 \quad 16.1 \quad 0.040$$

$Vd = 7100 - 965 = 6135$ 12.2 0.030

Estribos: - ~~XXXX~~ (2ø3/8) Izq.: 1 a 13 ; 2 a 25

2-3-4V3AB 30 x 70 6.60

Pp 530
L 1460 1990

$\Rightarrow i = 1460 \times 4.80 = 7000$

$\angle a 5.0 = 4970$

| | | | | | |
|-----------|-------|------------------|------------------|----------------------|----|
| Izquierda | 15950 | 9102 | 11.55 | 1ø1" + 1ø7/8 + 1ø3/4 | 21 |
| | | 10332 | 13.10 | | |
| Centro | 21500 | 15255 | 16.80 | 2ø1" + 1ø3/4 | 22 |
| Derecha | 12150 | 13235 | 16.80 | 2ø1" + 1ø7/8 + 1ø3/4 | 30 |

$Vi = 6450 + 1820 + 1057 - 628 = 8699$ 14.7 0.037

$Vd = 6450 + 5180 + 3820 + 628 = 16076$ 27 0.068

Estribos: (2ø3/8) Izq.: 1 a 15 ; 1 a 30

Der.: 1 a 6 ; 10 a 12 ; 14 a 15

2-3-4V3BB' 30 x 60 2.20

Pp 450
L 2930 3380

$\angle a 2.00 = 1690$

| | | | | | |
|-----------|------|---------|------|----------------------|----|
| Izquierda | 1388 | 6645 | 9.81 | 2ø1" + 1ø7/8 + 1ø3/4 | 30 |
| Centro | 2207 | (-502) | 8.26 | 2ø1" + 1ø7/8 + 1ø3/4 | |
| Derecha | 1388 | (-1226) | 8.26 | 3ø3/4 | |

$Vi = 3720 + 150 + 3580 = 7450$ 14.9 0.037

$Vd = 3720 + 1540 - 3580 = 1680$ 3.3 0.01

Estribos.: (2ø3/8) Izq.: 1 a 13 ; 1 a 25

2-3-4V3CD 30 x 60 4.15

Pp 450
L 2930 3380

| | | | | | |
|-----------|------|------|------|---------------|----|
| Izquierda | 4850 | 6175 | 9.27 | 1ø7/8 + 2ø3/4 | 19 |
| Centro | 7380 | 3193 | 8.26 | 3ø3/4 | |
| Derecha | 4850 | 2200 | 8.26 | 3ø3/4 | |

- EJE 3 -

| A | | B | | B' | C | | D |
|--------|--------|-------|-------|------|-------|-------|------|
| .478 | | .208 | | .352 | 0 | | .546 |
| +15950 | -12150 | +1388 | -1388 | 0 | +4850 | -4850 | |
| - 7670 | + 2230 | +3780 | 0 | | 0 | +2650 | |
| + 1115 | - 3825 | 0 | +1890 | | +1325 | 0 | |
| - 535 | + 797 | +1350 | 0 | | 0 | 0 | |
| + 398 | - 267 | 0 | + 675 | | +6175 | -2200 | |
| - 191 | + 56 | + 94 | 0 | | | | |
| + 28 | - 96 | 0 | + 47 | | | | |
| - 13 | + 20 | + 33 | 0 | | | | |
| + 9102 | -13235 | +6645 | +1226 | | | | |

- 0 - 0 -

- EJE 4 -

| A | B | | C | | D | | E |
|--------|--------|-------|-------|-------|-------|-------|-------|
| .486 | .249 | .237 | .321 | .321 | .240 | .240 | .546 |
| +11650 | -11650 | +4640 | -4640 | +6150 | -6980 | +6110 | -4980 |
| - 5650 | + 1740 | +1660 | - 485 | - 485 | + 209 | + 209 | +2720 |
| + 870 | - 2825 | - 243 | + 830 | - 104 | - 243 | +1360 | + 104 |
| - 423 | + 765 | + 727 | - 233 | - 233 | - 267 | - 267 | - 57 |
| + 382 | - 212 | - 116 | + 363 | - 133 | - 116 | - 28 | - 133 |
| - 185 | + 107 | + 102 | - 74 | - 74 | + 35 | + 35 | + 73 |
| + 53 | - 93 | - 37 | + 51 | + 18 | - 37 | + 37 | + 18 |
| - 26 | + 30 | + 29 | - 22 | - 22 | 0 | 0 | - 10 |
| + 6671 | -12138 | +6762 | -4210 | +5117 | -7309 | +7456 | -2265 |

- 0 - 0 -

$Vi = 7000 + 957 = 7957$ 15.9 0.04
 $Vd = 7000 - 957 = 6043$ 12.0 0.03

Estribos: (2ø3/8) Izq.: 1 a 13 ; 2 a 25

2-3-4V4AB 30 x 70 6.35
 Pp 530
 L 2930 3460
 Izquierda 11650 6671 9.75 2ø7/8 + 1ø5/8 19
 Centro 17500 8096 10.28 2ø7/8 + 1ø3/4 20
 Derecha 11650 12138 15.38 4ø7/8 28

$Vi = 10700 - 860 = 9840$ 16.4 0.042
 $Vd = 10700 + 860 = 11560$ 19.5 0.049

Estribos: (2ø3/8) Izq.: 1 a 15 ; 2 a 30
 Der.: 1 a 13 ; 1 a 25 ; 3 a 30

2-3-4V4BC 30 x 60 4.05
 Pp 450
 L 2930 3380
 Izquierda 4640 6762 10.15 4ø7/8 28
 Centro 6950 1464 8.26 3ø3/4 18
 Derecha 4640 4210 8.26 3ø3/4 18

$Vi = 6760 + 630 = 7390$ 14.7 0.037
 $Vd = 6760 - 630 = 6130$ 12.2 0.031

Estribos: (2ø3/8) Izq. 1 a 13 ; 1 a 25
 Der. 1 a 13

2-3-4V4CD 30 x 60 4.05
 Pp 450
 L 2930
 T 404 3784
 $\angle a 1.40 = 1700$
 Izquierda 6150 5117 8.26 3ø3/4
 Centro 9320 3107 8.26 3ø3/4

Derecha 6890 7309 10.95 4ø3/4
 Vi = 7568 + 750 - 540 = 7778 15.5 0.039
 Vd = 756' + 950 + 540 = 9058 18.1 0.045

Estribos: (2ø3/8) Izq.: 1 a 13 ; 2 a 25
 Der.: 1 a 13; 3 a 25

2-3-4V4DE 30 x 60 4.05

Pp 450
 M 1500 1950

||||d = 1460 x 1.70 = 2480

/ a 2.30 = 2933

Izquierda 6110 7456 11.18 4ø3/4 24
 Centro 8220 2675 8.26 3ø3/4
 Derecha 4980 2265 8.26 3ø3/4

Vi = 3950 + 1960 + 280 = 6190 12.3 0.031
 Vd = 3950 + 520 - 280 = 4190 8.3 0.021

2-3-4V5AB 30 x 70 6.10

Pp 530
 L 1460 1990

==i = 1460 x 4.3 = 6280

/ a 4.50 = 4900

Izquierda 11800 6754 9.75 1ø7/8 + 3ø5/8 22
 Centro 18750 8601 10.90 3ø7/8 21
 Derecha 13600 13545 17.20 2ø1" + 2ø7/8 30

Vi = 5970 + 8030 + 207 - 1110 = 9097 15.4 0.038
 Vd = 5970 + 2250 + 3700 + 1110 = 13030 22 0.055

Estribos: Izq.: 1 a 15 ; 2 a 30
 (2ø3/8) Der.: 1 a 7; 6 a 15; 2 a 25; 4 a 30

2-3-4V5BC 30 x 60 4.00

Pp 450
 L 2930
 T 540 3920

- EJE 5 -

| A | | B | | C | | D | | E |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|
| | | | | | | | | |
| <u>.498</u> | | <u>.258</u> | <u>.234</u> | <u>.321</u> | <u>321</u> | <u>.321</u> | <u>.321</u> | <u>.470</u> |
| +11800 | -13600 | +4340 | -4340 | +6930 | -6600 | +5260 | -6100 | |
| - 5890 | + 2380 | +2160 | - 832 | - 832 | + 430 | + 430 | +2890 | |
| + 1190 | - 2945 | - 416 | +1080 | + 215 | - 416 | +1445 | + 215 | |
| - 594 | + 856 | + 785 | - 416 | - 416 | - 331 | - 331 | - 102 | |
| + 428 | - 297 | - 208 | + 392 | - 165 | - 208 | - 51 | - 165 | |
| - 213 | + 130 | + 118 | - 73 | - 73 | + 83 | + 83 | + 78 | |
| + 65 | - 106 | - 37 | + 59 | + 42 | - 36 | + 39 | + 42 | |
| - 32 | + 37 | + 33 | - 32 | - 32 | - 1 | - 1 | - 20 | |
| <u>+ 6754</u> | <u>-13545</u> | <u>+6775</u> | <u>-4152</u> | <u>+5669</u> | <u>-7079</u> | <u>+6874</u> | <u>-3162</u> | |

- 0 - 0 -

- EJE 6 -

| A | | B | | C | | D | | E |
|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|
| | | | | | | | | |
| <u>.504</u> | | <u>.264</u> | <u>.232</u> | <u>.240</u> | <u>.240</u> | <u>.240</u> | <u>.240</u> | <u>.474</u> |
| +11500 | -11500 | +6100 | -6150 | +3080 | -3080 | +3790 | -3320 | |
| - 5800 | + 1420 | +1250 | + 737 | + 737 | - 170 | - 170 | +1570 | |
| + 710 | - 2900 | + 368 | + 625 | - 85 | + 368 | + 785 | - 85 | |
| - 358 | + 615 | + 584 | - 127 | - 127 | - 277 | - 277 | + 40 | |
| + 307 | - 179 | - 63 | + 292 | - 138 | - 63 | + 20 | - 138 | |
| - 155 | + 64 | + 56 | - 38 | - 38 | + 10 | + 10 | + 65 | |
| + 32 | - 77 | - 19 | + 28 | + 5 | - 19 | + 33 | + 10 | |
| - 16 | + 25 | + 22 | - 8 | - 8 | - 3 | - 3 | - 5 | |
| <u>+ 6220</u> | <u>-12532</u> | <u>+8298</u> | <u>-4641</u> | <u>+3426</u> | <u>-3234</u> | <u>+4188</u> | <u>-1863</u> | |

- 0 - 0 -

XXXXX

| | | | | | |
|----------------|------|------|-------|--------------|----|
| Inqui | 4340 | 6775 | 10.15 | 2ø1" + 2ø7/8 | 30 |
| Centro | 7840 | 2377 | 8.26 | 3ø3/4 | |
| Derecha | 4340 | 4152 | 8.26 | 3ø3/4 | |

$Vl = 6500 + 656 = 7156$ 14.3 0.036

$Vd = 6500 - 656 = 5844$ 11.7 0.029

Estridos: (2ø3/8) Isq.: 1 a 13 ; 1 a 25

2-3-4V5CD 30 x 60 4.05

Pp 450
T 1170
L 2930 4550

$\angle a 1.40 = 1170$

| | | | | | |
|----------------|-------|------|-------|---------------|--|
| Inqui | 6930 | 5669 | 8.50 | 3ø3/4 | |
| Centro | 10150 | 3776 | 8.26 | 3ø3/4 | |
| Derecha | 6600 | 7079 | 10.60 | 3ø3/4 + 1ø5/8 | |

$Vl = 9000 + 760 - 348 = 9412$ 18.8 0.047

$Vd = 9000 + 270 + 348 = 9618$ 19.2 0.049

Estridos: (2ø3/8) Isq.: 1 a 13 ; 3 a 25

Der.: 1 a 13 ; 3 a 25

2-3-4V5DE 30 x 60 4.05

Pp 450
T 420
L 1460 2330

$\square d = 1460 \times 1.60 = 2340$

$\angle a 2.10 = 3508$

| | | | | | |
|----------------|-------|------|-------|---------------|----|
| Inqui | 5260 | 6874 | 10.25 | 3ø3/4 + 1ø5/8 | 23 |
| Centro | 11300 | 5520 | 8.26 | 3ø3/4 | |
| Derecha | 6100 | 3162 | 8.26 | 3ø3/4 | |

$Vl = 4660 + 1070 + 1668 + 208 = 7606$ 15.2 0.038

$Vd = 4660 + 1270 + 1840 - 208 = 7562$ 15.1 0.037

Estridos: (2ø3/8) Isq. 1 a 13 ; 3 a 25
Der 1 a 13 ; 2 a 25

| | | | | | |
|--|------------------|---------|-------|----------------------|-------|
| <u>2-3-4V6AB</u> | | 30 x 70 | 5.90 | | |
| Pp | 530 | | | | |
| L | <u>3450</u> | 3980 | | | |
| Izquierda | 11500 | 6280 | 9.75 | 2ø7/8 + 2ø5/8 | 24 |
| Centro | 17800 | 9424 | 11.92 | 1ø1" + 1ø7/8 + 1ø3/4 | 21 |
| Derecha | 11500 | 12532 | 15.91 | 1ø1" + 3ø7/8 | 29 |
| Vi | = 11350 - 1080 = | 10270 | | 17.2 | 0.043 |
| Vd | = 11350 + 1080 = | 12430 | | 21 | 0.053 |
| Estribos:- (2ø3/8) Izq.: 1 a 15 ; 2 a 30 | | | | | |
| Der. 1 a 10; 2 a 20; 3 a 30 | | | | | |

| | | | | | |
|--|----------------------------|---------|-------|--------------|-------|
| <u>2-3-4V6BC</u> | | 30 x 60 | 4.00 | | |
| Pp | 450 | | | | |
| L | 3450 | | | | |
| T | <u>390</u> | 4290 | | | |
| ∠ | a 1.50 = | 580 | | | |
| ∠ | a 3.50 = | 580 | | | |
| Izquierda | 6100 | 8298 | 12.45 | 1ø1" + 3ø7/8 | 29 |
| Centro | 9200 | 2731 | 8.26 | 3ø3/4 | |
| Derecha | 6150 | 4641 | 8.26 | 3ø3/4 | |
| Vi | = 8400 + 914 + 357 + 60 = | 9731 | | 19.4 | 0.049 |
| Vd | = 8400 - 914 + 223 + 520 = | 8229 | | 16.4 | 0.041 |
| Estribos.: (2ø3/8) Izq.: 1 a 13 ; 3 a 25 | | | | | |
| Der.: 1 a 13 ; 2 a 25 | | | | | |

| | | | | | |
|------------------|----------------|---------|------|-------|-------|
| <u>2-3-4V6CD</u> | | 30 x 60 | 4.05 | | |
| Pp | 450 | | | | |
| L | 3450 | | | | |
| T | <u>350</u> | 4250 | | | |
| Izquierda | 3080 | 3426 | 8.26 | 3ø3/4 | |
| Centro | 4610 | 1280 | 8.26 | 3ø3/4 | |
| Derecha | 3080 | 3234 | 8.26 | 3ø3/4 | |
| Vi | = 4500 + 474 = | 4974 | | 9.9 | 0.025 |
| Vd | = 4500 - 474 = | 4026 | | 8.0 | 0.020 |

| | | | | |
|------------------------------|-----------------|---------|------|-------|
| <u>2-3-4V6DE</u> | | 30 x 60 | 4.05 | |
| Pp | 450 | | | |
| L | 3450 | | | |
| T | <u>350</u> 4250 | | | |
| / a 1.00 = 1250 | | | | |
| Izquierda | 3790 | 4188 | 8.26 | 3ø3/4 |
| Centro | 5260 | 2235 | 8.26 | 3ø3/4 |
| Derecha | 3320 | 1863 | 8.26 | 3ø3/4 |
| Vi = 4500 + 938 + 574 = 6012 | | | 12.0 | 0.030 |
| Vd = 4500 + 312 - 574 = 4238 | | | 8.4 | 0.021 |

| | | | | |
|-------------------------------|------------------|---------|-------|------------------|
| <u>2-3-4V7AB</u> | | 30 x 70 | 5.60 | |
| Pp | 450 | | | |
| M | 1500 | | | |
| L | <u>1950</u> 3900 | | | |
| Izquierda | 7850 | 3594 | 9.75 | 2ø7/8 + 1ø5/8 19 |
| Centro | 11700 | 5603 | 9.75 | 2ø7/8 + 1ø5/8 |
| Derecha | 7850 | 8600 | 10.90 | 3ø7/8 |
| Vi = 8250 - 893 = 7357 | | | 12.4 | 0.031 |
| Vd = 8250 + 893 = 9143 | | | 15.4 | 0.039 |
| Estribos: (2ø3/8) Izq. 1 a 15 | | | | |
| Der.: 1 a 15 ; 2 a 25 | | | | |

| | | | | |
|--|------------------|---------|-------|-------|
| <u>2-3-4V7BC</u> | | 30 x 60 | 4.10 | |
| Pp | 450 | | | |
| M | 1500 | | | |
| L | <u>1950</u> 3900 | | | |
| Izquierda | 5460 | 6926 | 10.38 | 3ø7/8 |
| Centro | 8190 | 2305 | 8.26 | 3ø3/4 |
| Derecha | 5460 | 4884 | 8.26 | 3ø3/4 |
| Vi = 7800 + 507 = 8307 | | | 16.6 | 0.042 |
| Vd = 7800 - 507 = 7293 | | | 14.5 | 0.036 |
| Estribos: (2ø3/8) Izq. 1 a 13 ; 2 a 25 | | | | |
| Der. 1 a 15 ; 1 a 25 | | | | |

- EJE 7 -

| A | | B | | C | | D | | E |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---|
| <u>588</u> | <u>.361</u> | <u>.903</u> | <u>.321</u> | <u>.321</u> | <u>.321</u> | <u>.321</u> | <u>.546</u> | |
| +7850 | -7850 | +5460 | -5460 | +5460 | -5460 | +5460 | -5460 | |
| -4620 | + 863 | + 724 | 0 | 0 | 0 | 0 | +3980 | |
| <u>+ 432</u> | <u>-2310</u> | 0 | <u>+ 362</u> | 0 | 0 | <u>+1990</u> | 0 | |
| - 254 | + 833 | + 700 | - 116 | - 116 | - 640 | - 640 | 0 | |
| <u>+ 416</u> | <u>- 127</u> | - 58 | <u>+ 350</u> | - 320 | - 58 | 0 | - 320 | |
| - 244 | + 67 | + 67 | - 10 | - 10 | + 19 | + 19 | + 175 | |
| <u>+ 34</u> | <u>- 122</u> | - 5 | <u>+ 34</u> | + 9 | - 5 | - 87 | + 9 | |
| - 20 | + 46 | + 38 | - 14 | - 14 | + 30 | + 30 | - 5 | |
| <u>+3594</u> | <u>-8600</u> | <u>+6926</u> | <u>-4844</u> | <u>+5009</u> | <u>-6114</u> | <u>+6772</u> | <u>-1621</u> | |

| | | | | |
|--|-------------|-----------------------|------|---------------|
| <u>2-3-4V7CD</u> | | 30 x 60 | 4.10 | |
| Pp | 450 | | | |
| M | 1500 | | | |
| L | <u>1950</u> | 3900 | | |
| Izquierda | 5460 | 5009 | 8.26 | 3ø3/4 |
| Centro | 8190 | 2629 | 8.26 | 3ø3/4 |
| Derecha | 5460 | 6114 | 9.16 | 3ø3/4 + 1ø5/8 |
| Vi = 7800 - 270 = 7530 | | | 15.0 | 0.037 |
| Vd = 8070 7800 + 270 = 8070 | | | 16 | 0.040 |
| -stribos: (2ø3/8) | | Izq. 1 a 13 ; 1 a 25 | | |
| | | Der.: 1 a 13 ; 2 a 25 | | |

| | | | | |
|-------------------------|-------------|-----------------------|-------|------------------|
| <u>2-3-4V7DE</u> | | 30 x 60 | 4.20 | |
| Pp | 450 | | | |
| M | 1500 | | | |
| L | <u>1950</u> | 3900 | | |
| Izquierda | 5460 | 6772 | 10.15 | 3ø3/4 + 1ø5/8 23 |
| Centro | 8190 | 3994 | 8.26 | 3ø3/4 18 |
| Derecha | 5460 | 1621 | 8.26 | 3ø3/4 |
| Vi = 7800 + 1220 = 9020 | | | 18 | 0.045 |
| Vd = 7800 - 1220 = 6580 | | | 12.1 | 0.033 |
| -stribos: (2ø3/8) | | Izq.: 1 a 13 ; 3 a 25 | | |
| | | Der.: 1 a 13 | | |

VIGAS TECHO QUINTO PISO

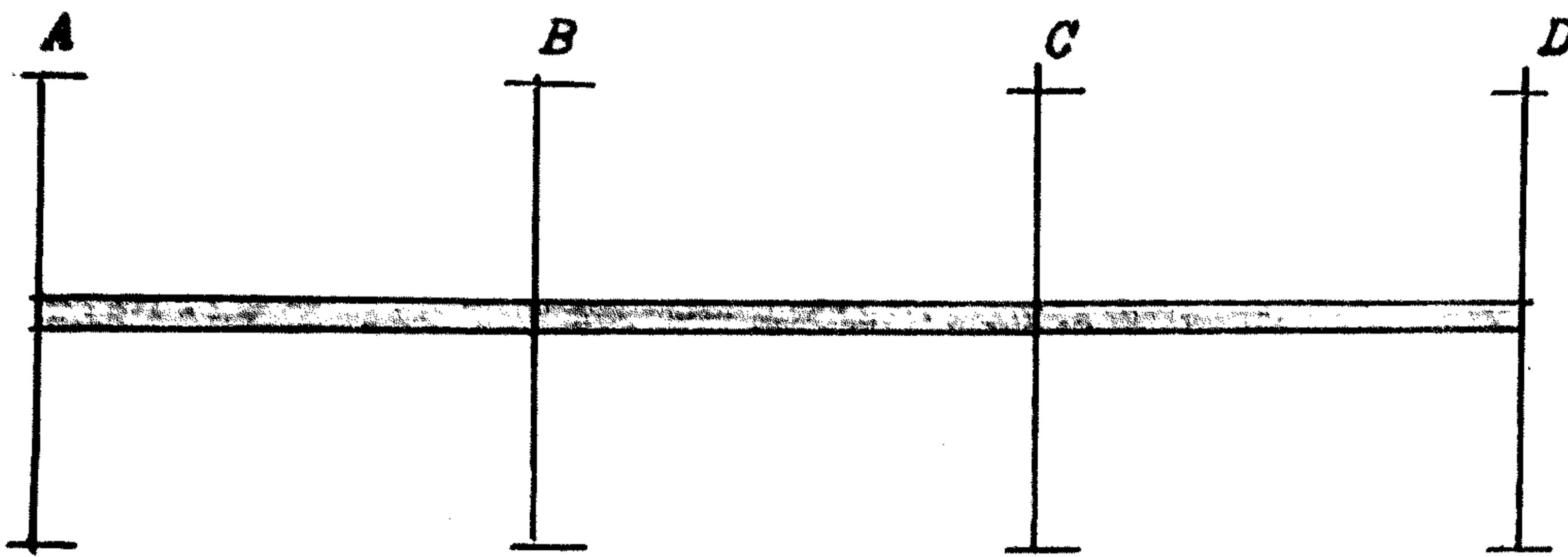
($f'c = 140 \text{ Kg/cm}^2$)

| | | | | | |
|-----------------------------------|----------------|--------------|-------|------|--------------|
| <u>5VIAB</u> | | 30 x 60 | | 6.90 | |
| Pp | 450 | | | | |
| P | 500 | | | | |
| L | <u>1040</u> | 1990 x 6.9 = | 13700 | | |
| Izquierda | 7900 | 4171 | 8.26 | | 3ø3/4 |
| Centro | 11800 | 5516 | 8.26 | | 3ø3/4 |
| Derecha | 7900 | 8398 | 12.6 | | 1ø1" + 2ø7/8 |
| Vi | = 6850 - 613 = | 6237 | | 12.4 | 0.031 |
| Vd | = 6850 + 613 = | 7463 | | 14.9 | 0.037 |
| Atribos: (2ø3/8) Izquierda 1 a 13 | | | | | |
| Derecha: 1 a 13 ; 2 a 25 | | | | | |

| | | | | | |
|--------------|------------------------------|-----------------|------|------|------------------|
| <u>5VIBC</u> | | 25 x 60 | | 4.20 | |
| Pp | 375 | | | | |
| P | <u>500</u> | 875 x 4.2 = | 3670 | | |
| | <u>290</u> | a 2.40 = | 2920 | | |
| | <u>1770</u> | = 1040 x 1.70 = | 1770 | | |
| Izquierda | 1290 | | | | |
| | 1290 | | | | |
| | <u>290</u> | 2870 | 5043 | 7.56 | 1ø1" + 2ø7/8 22 |
| Centro | 1930 | | | | |
| | 2640 | | | | |
| | <u>756</u> | 5326 | 1265 | 6.88 | 1ø3/4 + 2ø5/8 16 |
| Derecha | 1290 | | | | |
| | 1720 | | | | |
| | <u>818</u> | 3828 | 3079 | 6.88 | 1ø3/4 + 2ø5/8 16 |
| Vi | = 1835 + 1260 + 360 + 480 = | 3935 | | 7.8 | 0.024 |
| Vd | = 1835 + 1660 + 1410 - 480 = | 4425 | | 8.8 | 0.026 |

| | | | | | |
|-----------------|----------------|---------------|------|------|---------------|
| <u>5VINE CD</u> | | 25 x 60 | | 4.15 | |
| Pp | 375 | | | | |
| P | 500 | | | | |
| L | <u>1040</u> | 1915 x 4.15 = | 7950 | | |
| Izquierda | 2750 | | 3288 | 6.88 | 1ø3/4 + 2ø5/8 |
| Centro | 4120 | | 1987 | 6.88 | 1ø3/4 + 2ø5/8 |
| Derecha | 2750 | | 979 | 6.88 | 1ø3/4 + 2ø5/8 |
| Vi | = 3975 + 564 = | 4539 | | 9.0 | 0.027 |
| Vd | = 3975 - 564 = | 3411 | | 6.8 | 0.020 |

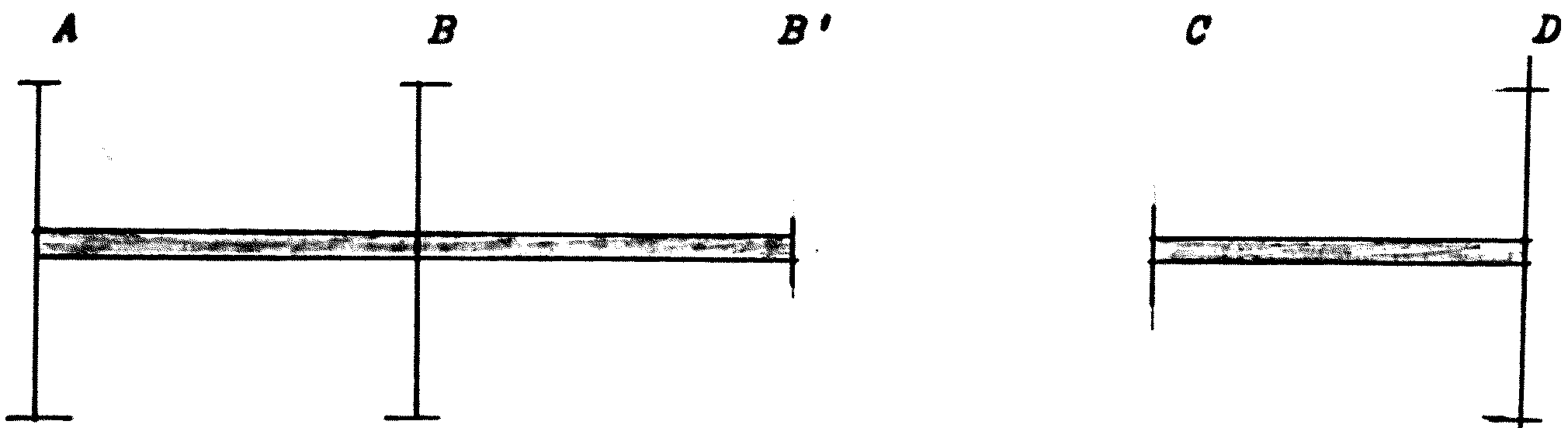
- EJE 1 -



| .526 | .247 | .320 | .391 | .407 | .667 |
|--------------|--------------|--------------|--------------|--------------|-------------|
| +7900 | -7900 | +2870 | -3828 | +2750 | -2750 |
| -4150 | +1240 | +1610 | +422 | +438 | +1830 |
| +620 | -2075 | +211 | +805 | +915 | +219 |
| -325 | +460 | +598 | -672 | -700 | -148 |
| +230 | -162 | -336 | +299 | -73 | -350 |
| -121 | +74 | +95 | -88 | -92 | +233 |
| +38 | -61 | -44 | +47 | +117 | -46 |
| -20 | +26 | +34 | -64 | -67 | +31 |
| <u>+4171</u> | <u>-8398</u> | <u>+5043</u> | <u>-3079</u> | <u>+3288</u> | <u>-979</u> |

- 0 - 0 -

- EJE 2 -



| .537 | .220 | .590 | 0 |
|--------------|--------------|--------------|--------------|
| +9540 | -9540 | +783 | -783 |
| -5120 | +1920 | +5170 | 0 |
| +960 | -2560 | 0 | +2585 |
| -517 | +564 | +1510 | 0 |
| +282 | -258 | 0 | +755 |
| -151 | +57 | +152 | 0 |
| +28 | -76 | 0 | +76 |
| -15 | +16 | +45 | 0 |
| <u>+5007</u> | <u>-9877</u> | <u>+7660</u> | <u>+2633</u> |

| 0 | .667 |
|--------------|--------------|
| +3500 | -3500 |
| 0 | +2340 |
| +1170 | 0 |
| 0 | 0 |
| <u>+4670</u> | <u>-1160</u> |

- 0 - 0 -

| | | | |
|---------------|-------------------|------|-------|
| <u>5VA'12</u> | 40 x 20 | 4.10 | |
| Pp 200 | | | |
| L <u>320</u> | 590 x 4.1 = 24200 | | |
| Izquierda | 687 | 3.78 | 2ø5/8 |
| Centro | 1030 | 5.65 | 3ø5/8 |
| Derecha | 687 | 3.78 | 2ø5/8 |

| | | | | |
|------------------------|--|------|-------|---------------|
| <u>5V2AB</u> | 30 x 60 | 6.80 | | |
| Pp 450 | | | | |
| L <u>2070</u> | 2470 x 6.8 = 16800 | | | |
| Izquierda | 9540 | 5007 | 8.26 | 3ø3/4 |
| Centro | 14300 | 6858 | 10.30 | 2ø7/8 + 1ø3/4 |
| Derecha | 9540 | 9877 | 14.8 | 3ø1" |
| Vi = 8400 - 718 = 7682 | | 15.3 | 0.039 | |
| Vd = 8400 + 718 = 9118 | | 18.3 | 0.046 | |
| Estribos: (2ø3/8) | Izq.: 1 a 12 ; 2 a 25 | | | |
| | Der.: IXXXXXX 1 a 13 ; 3 a 25 | | | |

| | | | | |
|-------------------------|-----------------------|---------|-------|---------------|
| <u>5V2BB'</u> | 30 x 60 | 2.20 | | |
| Pp 450 | | | | |
| L <u>1040</u> | 1490 x 2.2 = 4270 | | | |
| Izquierda | 783 | 7660 | 11.5 | 3ø1" |
| Centro | 1170 | (-1343) | 6.88 | 3ø1" |
| Derecha | 783 | (+2633) | 6.88 | 1ø3/4 + 2ø5/8 |
| Vi = 2135 + 5140 = 7275 | | 14.3 | 0.036 | |
| Vd = 2135 - 5140 = 3005 | | 6.0 | 0.015 | |
| Estribos:- (2ø3/8) | Izq.: 1 a 13 ; 2 a 25 | | | |

| | | | | |
|---------------|--------------------|------|------|---------------|
| <u>5V2CD</u> | 25 x 60 | 4.20 | | |
| Pp 375 | | | | |
| L <u>2040</u> | 2375 x 4.2 = 10000 | | | |
| Izquierda | 3500 | 4670 | 6.88 | 1ø3/4 + 2ø5/8 |
| Centro | 5250 | 2335 | 6.88 | 1ø3/4 + 2ø5/8 |
| Derecha | 3500 | 1160 | 6.88 | 1ø3/4 + 2ø5/8 |

$V_i = 5000 + 837 = 5837$ 11.6 0.035

$V_d = \text{XXXXX} 5000 - 837 = 4163$ 8.3 0.025

Estribos: (2ø3/8) Izq.: 1 a 13 ; 1 a 25

5V3AB 30 x 60 6.60

Pp 450
L 2070 2520 x 6.6 = 16600

Izquierda 9170 4824 8.26 3ø3/4
Centro 13200 6021 9.06 1ø7/8 + 2ø3/4
Derecha 9170 9534 14.26 2ø1" + 1ø7/8

$V_i = 8300 - 714 = 7586$ 15.1 0.037

$V_d = 8300 + 714 = 9014$ 18.0 0.045

Estribos:- (2ø3/8) Izq.: 1 a 13 ; 2 a 25

Der.: 1 a 13 ; 3 a 25

5V3BB' 30 x 60 2.20

Pp 450
L 2070 2520 x 2.2 = 5550

Izquierda 1020 7135 10.70 2ø1" + 1ø7/8
Centro 1520 (-1039) 6.88 2ø1" + 1ø7/8
Derecha 1020 (+2017) 6.88 1ø3/4 + 2ø5/8

$V_i = 2775 + 4170 = 6945$ 13.9 0.035

$V_d = 2775 - 4170 = 1395$ 2.8 0.001

Estribos: (2ø3/8) Izquierda 1 a 13 ; 3 a 25

5V3CD 25 x 60 4.20

Pp 375
L 2070 2445 x 4.20 = 10250

Izquierda 3600 4870 6.88 1ø3/4 + 2ø5/8
Centro 5400 2435 6.88 1ø3/4 + 2ø5/8
Derecha 3600 1060 6.88 1ø3/4 + 2ø5/8

$V_i = 5125 + 908 = 6033$ 12.0 0.036

- EJE 3 -

| A | | | | B | | | | B' | | | | C | | | | D | | | | | | | |
|--------------|--|--|--|--------------|--|--|--|--------------|--|--|--|--------------|--|--|--|-------|--|--|--|-------|--|--|--|
| .535 | | | | .220 | | | | .590 | | | | 0 | | | | 0 | | | | .705 | | | |
| +9170 | | | | -9170 | | | | +1020 | | | | -1020 | | | | +3600 | | | | -3600 | | | |
| -4900 | | | | +1790 | | | | +4570 | | | | 0 | | | | 0 | | | | +2540 | | | |
| + 895 | | | | -2450 | | | | 0 | | | | +2285 | | | | +1270 | | | | 0 | | | |
| - 478 | | | | + 538 | | | | +1370 | | | | 0 | | | | 0 | | | | 0 | | | |
| + 269 | | | | - 239 | | | | 0 | | | | + 685 | | | | +4870 | | | | -1060 | | | |
| - 144 | | | | + 53 | | | | + 134 | | | | 0 | | | | | | | | | | | |
| + 26 | | | | - 72 | | | | 0 | | | | + 67 | | | | | | | | | | | |
| - 14 | | | | + 16 | | | | + 41 | | | | 0 | | | | | | | | | | | |
| <u>+4824</u> | | | | <u>-9534</u> | | | | <u>+7135</u> | | | | <u>+2017</u> | | | | | | | | | | | |

- 0 - 0 -

- EJE 4 -

| A | | | B | | | C | | | D | | | E | | | | | | | | | | | |
|--------------|--|--|--------------|--|--|--------------|--|--|--------------|--|--|--------------|--|--|--------------|--|--|--------------|--|--|--------------|--|--|
| .543 | | | .256 | | | .324 | | | .376 | | | .376 | | | .303 | | | .303 | | | .667 | | |
| +8590 | | | -8590 | | | +3350 | | | -3350 | | | +3350 | | | -3350 | | | +1940 | | | -1940 | | |
| -4670 | | | +1340 | | | +1700 | | | 0 | | | 0 | | | + 427 | | | + 427 | | | +1290 | | |
| + 670 | | | -2335 | | | 0 | | | + 850 | | | + 213 | | | 0 | | | + 645 | | | + 213 | | |
| - 364 | | | + 600 | | | + 762 | | | - 400 | | | - 400 | | | - 195 | | | - 195 | | | - 142 | | |
| + 300 | | | - 182 | | | - 200 | | | + 381 | | | - 97 | | | - 200 | | | - 71 | | | - 97 | | |
| - 163 | | | + 98 | | | + 124 | | | - 107 | | | - 107 | | | + 82 | | | + 82 | | | + 65 | | |
| + 49 | | | + 81 | | | - 53 | | | + 62 | | | + 41 | | | - 53 | | | + 32 | | | + 41 | | |
| - 27 | | | - 7 | | | - 9 | | | - 39 | | | - 39 | | | + 6 | | | + 6 | | | - 27 | | |
| <u>+4385</u> | | | <u>-8995</u> | | | <u>+5674</u> | | | <u>-2603</u> | | | <u>+2961</u> | | | <u>+3283</u> | | | <u>+2866</u> | | | <u>- 597</u> | | |

- 0 - 0 -

| | | | | |
|--------------------|--------------------------------|-----------------|------|--------------|
| <u>5V5AB</u> | 30 x 60 | 6.10 | | |
| Pp | 450 | | | |
| L | <u>2070</u> 2520 x 6.1 = 15360 | | | |
| Izquierda | 7800 | 3863 | 8.26 | 3ø3/4 |
| Centro | 11700 | 5565 | 8.26 | 3ø3/4 |
| Derecha | 7800 | 8410 | 12.6 | 1ø1" + 2ø7/8 |
| | | | | 22 |
| Vi = | 7680 - 750 = 6930 | | 13.8 | 0.034 |
| Vd = | 7680 + 750 = 8430 | | 16.8 | 0.042 |
| Estribos (2ø3/8):- | | | | |
| | Izquierda | 1 a 13 ; 3 a 25 | | |
| | Derecha: | 1 a 13 ; 6 a 25 | | |

| | | | | |
|--------------|--------------------------------|------|------|---------------|
| <u>5V5BC</u> | 25 x 60 | 4.05 | | |
| pp | 375 | | | |
| L | <u>2070</u> 2445 x 4.05 = 9900 | | | |
| Izquierda | 3350 | 5422 | 8.15 | 1ø1" + 2ø7/8 |
| | | | | 22 |
| Centro | 5020 | 998 | 6.88 | 1ø3/4 + 2ø5/8 |
| | | | | 16 |
| Derecha | 3350 | 2622 | 6.88 | 1ø3/4 + 2ø5/8 |
| Vi = | 4950 + 69 = 5019 | | 10.0 | 0.030 |
| Vd = | 4950 - 69 = 4881 | | 9.7 | 0.029 |

| | | | | |
|--------------|--------------------------------|------|------|---------------|
| <u>5V5CD</u> | 25 x 60 | 4.10 | | |
| Pp | 375 | | | |
| L | <u>2070</u> 2445 x 4.1 = 10000 | | | |
| Izquierda | 3420 | 2875 | 6.88 | 1ø3/4 + 2ø5/8 |
| Centro | 5120 | 1705 | 6.88 | 1ø3/4 + 2ø5/8 |
| Derecha | 3420 | 3936 | 6.88 | 1ø3/4 + 2ø5/8 |
| V4 = | 5000 - 260 = 4740 | | 9.4 | 0.028 |
| Vd = | 5000 + 260 = 5260 | | 10.5 | 0.030 |

| | | | | |
|--------------|--------------------------------|------|------|---------------|
| <u>5V5DE</u> | 25 x 60 | 4.10 | | |
| Pp | 375 | | | |
| L | <u>2070</u> 2445 x 4.1 = 10000 | | | |
| Izquierda | 3420 | 4161 | 6.88 | 1ø3/4 + 2ø5/8 |
| Centro | 5120 | 2322 | 6.88 | 1ø3/4 + 2ø5/8 |
| Derecha | 3420 | 1496 | 6.88 | 1ø3/4 + 2ø5/8 |
| Vi = | 5000 + 1360 = 4360 | | 8.7 | 0.026 |
| Vd = | 5000 - 1360 = 3640 | | 7.2 | 0.022 |

o- EJE 5 -

| A | B | | C | | D | | E |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | | | | | |
| <u>.555</u> | <u>.265</u> | <u>.320</u> | <u>.376</u> | <u>.376</u> | <u>.376</u> | <u>.376</u> | <u>.600</u> |
| +7800 | -7800 | +3950 | -3950 | +3420 | -3420 | +3420 | -3420 |
| <u>-4930</u> | <u>+1130</u> | <u>+1420</u> | <u>- 25</u> | <u>- 25</u> | <u> 0</u> | <u> 0</u> | <u>+2050</u> |
| + 565 | -2165 | - 12 | + 710 | 0 | - 12 | +1025 | 0 |
| <u>- 313</u> | <u>+ 558</u> | <u>+ 700</u> | <u>- 267</u> | <u>- 267</u> | <u>- 381</u> | <u>- 381</u> | <u> 0</u> |
| + 279 | - 159 | - 133 | + 350 | - 191 | - 133 | 0 | - 191 |
| <u>- 154</u> | <u>+ 75</u> | <u>+ 93</u> | <u>- 60</u> | <u>- 60</u> | <u>+ 50</u> | <u>+ 50</u> | <u>+ 115</u> |
| + 38 | - 77 | - 30 | + 47 | + 25 | - 30 | + 57 | + 25 |
| <u>- 21</u> | <u>+ 28</u> | <u>+ 34</u> | <u>- 27</u> | <u>- 27</u> | <u>- 10</u> | <u>- 10</u> | <u>- 15</u> |
| <u>+3863</u> | <u>-8410</u> | <u>+5422</u> | <u>-2622</u> | <u>+2875</u> | <u>-3936</u> | <u>+4161</u> | <u>-1436</u> |

- o - o -

- EJE 6 -

| A | B | | C | | D | | E |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | | | | | |
| <u>.562</u> | <u>.272</u> | <u>.317</u> | <u>.303</u> | <u>.303</u> | <u>.303</u> | <u>.303</u> | <u>.600</u> |
| +8670 | -8670 | +3900 | -3900 | +3850 | -3850 | +3850 | -3850 |
| <u>-4860</u> | <u>+1290</u> | <u>+1510</u> | <u>+ 15</u> | <u>+ 15</u> | <u> 0</u> | <u> 0</u> | <u>+2350</u> |
| + 645 | -2430 | + 8 | + 755 | 0 | + 8 | +1150 | 0 |
| <u>- 362</u> | <u>+ 653</u> | <u>+ 762</u> | <u>- 230</u> | <u>- 230</u> | <u>- 353</u> | <u>- 353</u> | <u> 0</u> |
| +327 | - 181 | - 115 | + 381 | - 127 | - 115 | 0 | - 176 |
| <u>- 188</u> | <u>+ 81</u> | <u>+ 94</u> | <u>- 62</u> | <u>- 62</u> | <u>+ 35</u> | <u>+ 35</u> | <u>+ 105</u> |
| + 41 | - 91 | - 31 | + 47 | + 17 | - 31 | + 52 | + 17 |
| <u>- 23</u> | <u>+ 33</u> | <u>+ 39</u> | <u>- 19</u> | <u>- 19</u> | <u>- 6</u> | <u>- 6</u> | <u>- 10</u> |
| <u>+4255</u> | <u>-9323</u> | <u>+6171</u> | <u>+3017</u> | <u>+3446</u> | <u>-4078</u> | <u>+4728</u> | <u>-1628</u> |

| A | B | | C | | D | | E |
|---|---|--|---|--|---|--|---|
| | | | | | | | |

- o - o -

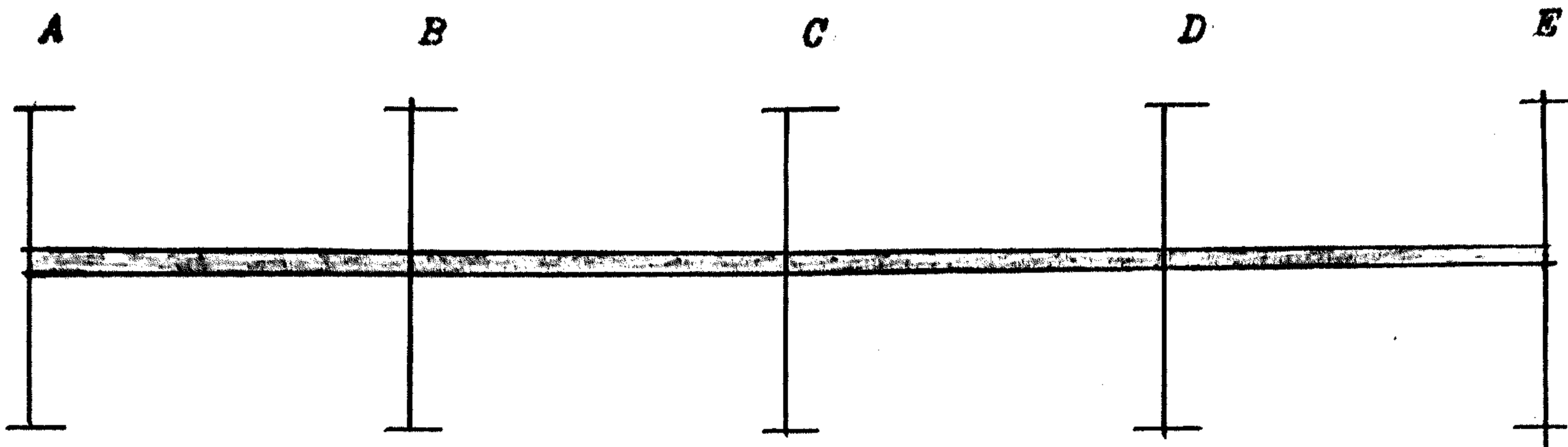
| | | | | | |
|--------------|----------------|---------------|------|---------------|-------|
| <u>5V4DE</u> | | 25 x 60 | | 4.05 | |
| Pp | 375 | | | | |
| L | <u>1040</u> | 1415 x 4.05 = | 5740 | | |
| Izquierda | 1940 | 2866 | 6.88 | 1 3/4 + 2 5/8 | |
| Centro | 2900 | 1168 | 6.88 | 1 3/4 + 2 5/8 | |
| Derecha | 1940 | 597 | 6.88 | 1 3/4 + 2 5/8 | |
| Vi | = 2870 + 550 = | 3420 | | 6.8 | 0.021 |
| Vd | = 2870 - 550 = | 2220 | | 4.4 | 0.013 |

| | | | | | |
|--------------|----------------|--------------|-----------------|---------------------------------|-------|
| <u>5V6AB</u> | | 30 x 60 | | 5.90 | |
| Pp | 450 | | | | |
| L | <u>2440</u> | 2890 x 5.9 = | 17600 | | |
| Izquierda | 8670 | 4255 | 8.26 | 3 3/4 | |
| Centro | 13000 | 7213 | 10.8 | 1 1/2 1 1/2" + 2 3/4 | |
| Derecha | 8670 | 9323 | 14.0 | 2 1/2" + 1 7/8 | |
| Vi | = 8800 - 860 = | 7940 | | 15.8 | 0.040 |
| Vd | = 8800 + 860 = | 9660 | | 19.3 | 0.048 |
| Estribos:- | (2 3/8) | Izquierda: | 1 a 13 ; 3 a 25 | | |
| | | Derecha | 1 a 13 ; 6 a 25 | | |

| | | | | | |
|--------------|----------------|------------|-----------------|----------------|-------|
| <u>5V6BC</u> | | 25 x 60 | | 4.00 | |
| Pp | 375 | | | | |
| L | <u>2440</u> | 2815 x 4 = | 11660 | | |
| Izquierda | 3900 | 6171 | 9.28 | 2 1/2" + 1 7/8 | |
| Centro | 5840 | 1246 | 6.88 | 1 3/4 + 2 5/8 | |
| Derecha | 3900 | 3017 | 6.88 | 1 3/4 + 2 5/8 | |
| Vi | = 5830 + 790 = | 6620 | | 13.2 | 0.040 |
| Vd | = 5830 - 790 = | 5040 | | 10.0 | 0.030 |
| Estribos: | (2 3/8) | Izq.: | 1 a 13 ; 2 a 25 | | |

| | | | | | |
|--------------|-------------|---------------|-------|---------------|--|
| <u>5V6CD</u> | | 25 x 60 | | 4.05 | |
| Pp | 375 | | | | |
| L | <u>2440</u> | 2815 x 4.05 = | 11400 | | |
| Izquierda | 3850 | 3446 | 6.88 | 1 3/4 + 2 5/8 | |

- EJE 7 -



| .644 | .351 | .390 | .376 | .376 | .376 | .376 | .667 |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|
| +4740 | -4740 | +2460 | -2460 | +2460 | -2460 | +2460 | -2460 |
| -3050 | +800 | +888 | 0 | 0 | 0 | 0 | +1640 |
| +400 | -1525 | 0 | +444 | 0 | 0 | +820 | 0 |
| -258 | +535 | +595 | -167 | -167 | -305 | -305 | 0 |
| +267 | -129 | -83 | +297 | -154 | -83 | 0 | -154 |
| -172 | +75 | +83 | -54 | -54 | +32 | +32 | +103 |
| +37 | -86 | -27 | +41 | +16 | -27 | +52 | +16 |
| -24 | +40 | +44 | -22 | -22 | -9 | -9 | -11 |
| <u>+1940</u> | <u>-4990</u> | <u>+3960</u> | <u>-1921</u> | <u>+2079</u> | <u>-2855</u> | <u>+3047</u> | <u>-866</u> |

| | | | | |
|---------|------|------|------|---------------|
| Centro | 5780 | 2018 | 6.88 | 1ø3/4 + 2ø5/8 |
| Derecha | 3850 | 4078 | 6.88 | 1ø3/4 + 2ø5/8 |

Vi = 5700 - 155 = 5545 11.0 0.039

Vd = 5700 + 155 = 5855 11.7 0.035

Estribos: - (2ø3/8) Izq.: 1 a 13 ; 1 a 25

Der.: 1 a 13 ; 1 a 25

5V6DE 25 x 60 4.05

Pp 375
L 2440 2815 x 4.05 = 11400

| | | | | |
|-----------|------|------|------|---------------|
| Izquierda | 3850 | 4728 | 6.88 | 1ø3/4 + 2ø5/8 |
|-----------|------|------|------|---------------|

| | | | | |
|--------|------|------|------|---------------|
| Centro | 5780 | 2602 | 6.88 | 1ø3/4 + 2ø5/8 |
|--------|------|------|------|---------------|

| | | | | |
|---------|------|------|------|---------------|
| Derecha | 3850 | 1628 | 6.88 | 1ø3/4 + 2ø5/8 |
|---------|------|------|------|---------------|

Vi = 5700 + 770 = 6470 ~~XXXXXX~~ 12.9 0.039

Vd = 5700 - 770 = 4930 9.8 0.029

Estribos: (2ø3/8) Izq.: 1 a 13 ; 1 a 25

5V7AB 30 x 60 5.60

Pp 450
L 1380 1830 x 5.6 = 10250

| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 4740 | 1940 | 8.26 | 3ø3/4 |
|-----------|------|------|------|-------|

| | | | | |
|--------|------|------|------|-------|
| Centro | 7120 | 3655 | 8.26 | 3ø3/4 |
|--------|------|------|------|-------|

| | | | | |
|---------|------|------|------|-------|
| Derecha | 4740 | 4990 | 8.26 | 3ø3/4 |
|---------|------|------|------|-------|

Vi = 5125 - 545 = 4580 9.1 0.023

Vd = 5125 + 545 = 5660 11.3 0.028

5V7BC 25 x 60 4.10

Pp 375
L 1380 1755 x 4.1 = 7200

| | | | | |
|-----------|------|------|------|-------|
| Izquierda | 2460 | 3960 | 6.88 | 3ø3/4 |
|-----------|------|------|------|-------|

| | | | | |
|--------|------|-----|------|---------------|
| Centro | 3690 | 750 | 6.88 | 1ø3/4 + 2ø5/8 |
|--------|------|-----|------|---------------|

| | | | | |
|---------|------|------|------|---------------|
| Derecha | 2460 | 1921 | 6.88 | 1ø3/4 + 2ø5/8 |
|---------|------|------|------|---------------|

Vi = 3600 + 495 = 4095 8.1 0.024
 Vd = 3600 - 495 = 3205 6.4 0.019

5V7CD 25 x 60 4.10

Pp ³⁷⁵
 L 1380 1755 x 4.1 = 7200

Izquierda 2460 2079 6.88 1 3/4 + 2 5/8
 Centro 3690 1233 6.88 1 3/4 + 2 5/8
 Derecha 2460 2855 6.88 1 3/4 + 2 5/8

Vi = 3600 - 190 = 3410 6.8 0.019
 Vd = 3600 + 190 = 3790 7.5 0.023

5V7DE 25 x 60 4.10

Pp 375
 L 1380 1755 x 4.1 = 7200

Izquierda 2460 3047 6.88 1 3/4 + 2 5/8
 Centro 3690 1734 6.88 1 3/4 + 2 5/8
 Derecha 2460 866 6.88 1 3/4 + 2 5/8

Vi = 3600 + 530 = 4130 8.2 0.025
 Vd = 3600 - 530 = 3070 6.0 0.018

PILARES SOTANO Y PRIMER PISO

($f_c = 210 \text{ Kg/cm}^2$)

PILARES DEL SOTANO

($f_c = 210 \text{ Kg/cm}^2$)

| | | | |
|---------------------------|-------------------------------|-------------------|---------------|
| <u>SPA1</u> | $M = 455000$ | $N = 109100$ | $bxt = 40x50$ |
| | $e = 4.17$ | $e/t = 0.08$ | $d'/t = 0.10$ |
| $p = 0.030$ | $(n-1)p = 0.27$ | $C = 1.1$ | $f_c = 60.0$ |
| | $D = 5.0$ | $De/t = 0.4$ | |
| | $f_a/f_c = 0.268$ | $f_p/f_c = 0.305$ | $f_p = 64.0$ |
| $A_s = 60.0 \text{ cm}^2$ | $3 \phi 1" + 4 \phi 1-1/8$ | | |
| <u>SPA2</u> | $M = 1025000$ | $N = 148180$ | $bxt = 50x60$ |
| | $e = 6.92$ | $e/t = 0.11$ | $d'/t = 0.10$ |
| $p = 0.025$ | $(n-1)p = 0.225$ | $C = 1.28$ | $f_c = 63.4$ |
| | $D = 5.16$ | $De/t = 0.6$ | |
| | $f_a/f_c = 0.256$ | $f_p/f_c = 0.305$ | $f_p = 64.0$ |
| $A_s = 75.0 \text{ cm}^2$ | $4 \phi 1-1/4 + 4 \phi 1-1/8$ | | |
| <u>SPA3</u> | $M = 1140000$ | $N = 142510$ | $bxt = 40x60$ |
| | $e = 8.0$ | $e/t = 0.13$ | $d'/t = 0.10$ |
| $p = 0.038$ | $(n-1)p = 0.342$ | $C = 1.2$ | $f_c = 71.3$ |
| | $D = 4.85$ | $De/t = 0.7$ | |
| | $f_a/f_c = 0.286$ | $f_p/f_c = 0.345$ | $f_p = 72.4$ |
| $A_s = 91.2 \text{ cm}^2$ | $10 \phi 1-1/4$ | | |
| <u>SPA4</u> | $M = 866000$ | $N = 139230$ | $bxt = 40x60$ |
| | $e = 6.50$ | $e/t = 0.11$ | $d'/t = 0.10$ |
| $p = 0.032$ | $(n-1)p = 0.288$ | $C = 1.21$ | $f_c = 67.2$ |
| | $D = 4.92$ | $De/t = 0.5$ | |
| | $f_a/f_c = 0.27$ | $f_p/f_c = 0.32$ | $f_p = 67.2$ |
| $A_s = 76.8 \text{ cm}^2$ | $8 \phi 1-1/4$ | | |
| <u>SPA5</u> | $M = 810000$ | $N = 130440$ | $bxt = 40x60$ |
| | $e = 6.23$ | $e/t = 0.10$ | $d'/t = 0.10$ |
| $p = 0.030$ | $(n-1)p = 0.27$ | $C = 1.19$ | $f_c = 64.6$ |
| | $D = 5.0$ | $De/t = 0.52$ | |

$f_a/f_b = 0.268$ $f_p/f_b = 0.315$ $f_p = 66$
 $A_s = 72.0 \text{ cm}^2$ $4 \phi 1-1/4 + 4 \phi 1-1/8$

SPA6 $M = 91700$ $N = 148870$ $bxt = 50x60$
 $e = 6.30$ $e/t = 0.10$ $d'/t = 0.10$
 $p = 0.022$ $(n-1)p = 0.198$ $C = 1.27$ $F_c = 63$
 $D = 5.20$ $De/t = 0.54$
 $f_a/f_b = 0.246$ $f_p/f_b = 0.30$ $f_p = 63$
 $A_s = 66.0$ $4 \phi 1" + 4 \phi 1-1/4$

SPA7 $M = 686000$ $N = 109390$ $bxt = 40x50$
 $e = 5.73$ $e/t = 0.12$ $d'/t = 0.10$
 $p = 0.035$ $(n-1)p = 0.315$ $c = 1.21$ $f_c = 66$
 $D = 4.90$ $De/t = 0.6$
 $f_a/f_b = 0.28$ $f_p/f_b = 0.325$ $f_p = 68.4$
 $A_s \underline{9} \text{ MAX } 70.0 \text{ cm}^2$ $4 \phi 1-1/4 + 4 \phi 1-1/8$

SPB1 $M = 237000$ $N = 161880$ $bxt = 50x60$
 $e = 1.47$ $e/t = 0.03$ $d'/t = 0.10$
 $p = 0.025$ $(n-1)p = 0.225$ $c = 0.95$ $f_c = \text{MAX } 51$
 $D = 5.16$ $De/t = 0.13$
 $f_a/f_b = 0.256$ $f_p/f_b = 0.26$ $f_p = 54.6$
 $A_s = 75.0 \text{ cm}^2$ $8 \phi 1-1/4$

SPB2 $M = 682000$ $N = 164480$ $bxt = 50x60$
 $e = 4.14$ $e/t = 0.07$ $d'/t = 0.10$
 $p = 0.028$ $(n-1)p = 0.252$ $C = 1.09$ $f_c = 59.8$
 $D = 5.05$ $De/t = 0.35$
 $f_a/f_b = 0.263$ $f_p/f_b = 0.295$ $f_p = 62.0$
 $A_s = 84.0$ $10 \phi 1-1/8$

SPB3 $M = 853000$ $N = 171660$ $bxt = 50x60$
 $e = 4.98$ $e/t = 0.08$ $d'/t = 0.10$
 $p = 0.030$ $(n-1)p = 0.27$ $C = 1.1$ $f_c = 63$

| | | | |
|---------------------------|-------------------------------|-------------------|---------------|
| | $D = 5.0$ | $D_e/t = 0.42$ | |
| | $f_a/f_b = 0.268$ | $f_p/f_b = 0.31$ | $f_p = 65$ |
| $A_s = 90.0 \text{ cm}^2$ | $10 \phi 1-1/4$ | | |
| <hr/> | | | |
| <u>SPB4</u> | $M = 677000$ | $N = 179430$ | $bxt = 60x60$ |
| | $e = 3.78$ | $e/t = 0.06$ | $d'/t = 0.10$ |
| $p = 0.020$ | $(n-1)p = 0.020$ | $C = 1.11$ | $f_c = 54.8$ |
| | $D = 5.25$ | $D_e/t = 0.33$ | |
| | $f_a/f_b = 0.243$ | $f_p/f_b = 0.27$ | $f_p = 56.7$ |
| $A_s = 72.0 \text{ cm}^2$ | $4 \phi 1-1/4 + 4 \phi 1-1/8$ | | |
| <hr/> | | | |
| <u>SPB5</u> | $M = 654000$ | $N = 194570$ | $bxt = 60x60$ |
| | $e = 3.37$ | $e/t = 0.055$ | $d'/t = 0.10$ |
| $p \pm 0.025$ | $(n-1)p = 0.225$ | $C = 1.05$ | $f_c = 56.6$ |
| | $D = 5.16$ | $D_e/t = 0.29$ | |
| | $f_a/f_b = 0.256$ | $f_p/f_b = 0.28$ | $f_p = 58.7$ |
| $A_s = 90.0$ | $10 \phi 1-1/4$ | | |
| <hr/> | | | |
| <u>SPB6</u> | $M = 566000$ | $N = 191250$ | $bxt = 60x60$ |
| | $e = 2.96$ | $e/t = 0.05$ | $d'/t = 0.10$ |
| $p = 0.022$ | $(n-1)p = 0.198$ | $C = 1.05$ | $f_c = 55.7$ |
| | $D = 5.20$ | $D_e/t = 0.25$ | |
| | $f_a/f_b = 0.246$ | $f_p/f_b = 0.275$ | $f_p = 57.7$ |
| $A_s = 97.2$ | $10 \phi 1-1/4$ | | |
| <hr/> | | | |
| <u>SPB7</u> | $M = 600000$ | $N = 149720$ | $bxt = 50x60$ |
| | $e = 4.02$ | $e/t = 0.07$ | $d'/t = 0.10$ |
| $p = 0.020$ | $(n-1)p = 0.080$ | $C = 1.16$ | $f_c = 58$ |
| | $D = 5.25$ | $D_e/t = 0.35$ | |
| | $f_a/f_b = 0.243$ | $f_p/f_b = 0.28$ | $f_p = 58.7$ |
| $A_s = 60.0 \text{ cm}^2$ | $4 \phi 1" + 4 \phi 1-1/8$ | | |
| <hr/> | | | |
| <u>SPC1</u> | $M = 72500$ | $N = 119720$ | $bxt = 40x50$ |
| | $e = 0.6$ | $e/t = 0.01$ | $d'/t = 0.10$ |
| $p = 0.022$ | $(n-1)p = 0.198$ | $C = 0.87$ | $f_c = 52$ |

$D = 5.2$ $De/t = 0.06$
 $fa/fc = 0.246$ $fp/fc = 0.25$ $fp = 52.5$
 $As = 44.0 \text{ cm}^2$ $8\phi 1"$

SPC 4 $M = 121000$ $N = 143650$ $bxt = 50x50$
 $e = 0.84$ $e/t = 0.017$ $d'/t = 0.10$
 $p = 0.022$ $(n-1)p = 0.198$ $C = 0.9$ $fc = 51.6$
 $D = 5.20$ $De/t = 0.255$
 $fa/fc = 0.246$ $fp/fc = 0.255$ $fp = 53.5$
 $As = 55.0$ $4\phi 1" + 4\phi 1-1/8$

SPC5 $M = 199000$ $N = 148880$ $bxt = 50x60$
 $e = 1.34$ $e/t = 0.022$ $d'/t = 0.10$
 $p = 0.015$ $(n-1)p = 0.135$ $C = 0.99$ $fc = 49.1$
 $D = 5.40$ $De/t = 0.12$
 $fa/fc = 0.23$ $fp/fc = 0.24$ $fp = 50.4$
 $As = 45.0 \text{ cm}^2$ $8\phi 1"$

SPC6 $M = 190000$ $N = 183440$ $bxt = 60x60$
 $e = 1.04$ $De/t = 0.017$
 $p = 0.015$ $(n-1)p = 0.135$ $C = 0.96$ $fc = 48.8$
 $D = 5.40$ $De/t = 0.09$
 $fa/fc = 0.229$ $fp/fc = 0.24$ $fp = 50.4$
 $As = 54.0 \text{ cm}^2$ $4\phi 1" + 4\phi 1-1/8$

SPC7 $M = 93000$ $N = 121760$ $bxt = 40x50$
 $e = 0.76$ $e/t = 0.015$ $d'/t = 0.10$
 $p = 0.025$ $(n-1)p = 0.225$ $C = 0.88$ $fc = 53.6$
 $D = 5.16$ $De/t = 0.08$
 $fa/fc = 0.256$ $fp/fc = 0.265$ $fp = 55.7$
 $As = 54.0 \text{ cm}^2$ $4\phi 1" + 4\phi 1-1/8$

SPD1 $M = 264000$ $N = 81780$ $bxt = \overset{XXXX}{40x50}$
 $e = 3.23$ $e/t = 0.08$ $d'/t = 0.15$

$p = 0.022$ $(n-1)p = 0.198$ $C = 1.18$ $f_c = 60.3$
 $D = 5.58$ $D_e/t = 0.45$
 $f_a/f_c = 0.246$ $f_p/f_c = 0.29$ $f_p = 60.8$
 $A_s = 35.2$ $4\phi 1" + 4\phi 7/8$

SPD2 $M = 467000$ $N = 113350$ $bxt = 40x50$
 $e = 4.12$ $e/t = 0.08$ $d'/t = 0.10$
 $p = 0.030$ $(n-1)p = 0.27$ $C = 1.1$ $f_c = 62.3$
 $D = 5.0$ $D_e/t = 0.41$
 $f_a/f_c = 0.268$ $f_p/f_c = 0.305$ $f_p = 64$
 $A_s = 60.0 \text{ cm}^2$ $4\phi 1" + 4\phi 1-1/8$

SPD3 $M = 482000$ $N = 109650$ $bxt = 40x50$
 $e = 4.4$ $e/t = 0.09$ $d'/t = 0.10$
 $p = 0.028$ $(n-1)p = 0.252$ $C = 1.15$ $f_c = 62.7$
 $D = 5.05$ $D_e/t = 0.45$
 $f_a/f_c = 0.26$ $f_p/f_c = 0.30$ $f_p = 63$
 $A_s = 56.0 \text{ cm}^2$ $4\phi 1" + 4\phi 1-1/8$

SPD4 $M = 139000$ $N = 174430$ $bxt = 50x60$
 $e = 0.8$ $e/t = 0.01$ $d'/t = 0.10$
 $p = 0.022$ $(n-1)p = 0.198$ $C = 0.88$ $f_c = 51$
 $D = 5.2$ $D_e/t = 0.07$
 $f_a/f_c = 0.246$ $f_p/f_c = 0.255$ $f_p = 53.5$
 $A_s = 66.0 \text{ cm}^2$ $4\phi 1" + 4\phi 1-1/4$

SPD5 $M = 230000$ $N = 151550$ $bxt = 50x60$
 $e = 1.5$ $e/t = 0.02$ $d'/t = 0.10$
 $p = 0.018$ $(n-1)p = 0.162$ $C = 9.6$ $f_c = 48.5$
 $D = 5.30$ $D_e/t = 0.13$
 $f_a/f_c = 0.237$ $f_p/f_c = 0.24$ $f_p = 50.4$
 $A_s = 54.0$ $4\phi 1" + 4\phi 1-1/8$

SPD6 $M = 20700$ $N = 166690$ $bxt = 50x60$
 $e = 1.24$ $e/t = 0.02$ $d'/t = 0.10$

$p = 0.022$ $(n-1)p = 0.198$ $C = 9.2$ $f_c = 51.2$
 $D = 5.20$ $De/t = 0.11$
 $f_a/f_c = 0.246$ $f_p/f_c = 0.255$ $f_p = 53.5$
 $A_s = 66.0 \text{ cm}^2$ $4 \phi 1" + 4 \phi 1-1/4$

SPD7 $M = 124000$ $N = 121190$ $b_{xt} = 40 \times 50$
 $e = 1.03$ $e/t = 0.02$ $d'/t = 0.10$
 $p = 0.025$ $(n-1)p = 0.225$ $C = 0.9$ $f_c = 54.5$
 $D = 5.16$ $De/t = 0.11$
 $f_a/f_c = 0.256$ $f_p/f_c = 0.26$ $f_p = 54.6$
 $A_s = 50.0$ $8 \phi 1"$

SPE4 $M = 192000$ $N = 96460$ $b_{xt} = 40 \times 40$
 $e = 2.0$ $e/t = 0.05$ $d'/t = 0.15$
 $p = 0.028$ $(n-1)p = 0.252$ $C = 1.0$ $f_c = 60.2$
 $D = 5.5$ $De/t = 0.25$
 $f_a/f_c = 0.263$ $f_p/f_c = 0.29$ $f_p = 60.9$
 $A_s = 44.8$ $8 \phi 1"$

SPE5 $M = 350000$ $N = 127000$ $b_{xt} = 50 \times 50$
 $e = 2.75$ $e/t = 0.055$ $d'/t = 0.10$
 $p = 0.020$ $(n-1)p = 0.18$ $C = 1.09$ $f_c = 55.4$
 $D = 5.25$ $\bar{D}e/t = 0.29$
 $f_a/f_c = 0.243$ $f_p/f_c = 0.275$ $f_p = 57.8$
 $A_s = 50.0 \text{ cm}^2$ $8 \phi 1"$

SPE6 $M = 356000$ $N = 127440$ $b_{xt} = 50 \times 50$
 $e = 2.8$ $e/t = 0.055$ $d'/t = 0.10$
 $p = 0.024$ $(n-1)p = 0.18$ $C = 1.09$ $f_c = 55.6$
 $D = 5.25$ $De/t = 0.55$
 $f_a/f_c = 0.243$ $f_p/f_c = 0.275$ $f_p = 57.8$
 $A_s = 50.0$ $8 \phi 1"$

SPE7 $M = 229000$ $N = 95250$ $bxt = 40x40$
 $e = 2.4$ $e/t = 0.06$ $d'/t = 0.15$
 $p = 0.028$ $(n-1)p = 0.252$ $C = 1.04$ $fc = 62$
 $D = 5.5$ $De/t = 0.33$
 $fa/f\theta = 0.263$ $fp/fc = 0.30$ $fp = 63$
 $As = 44.8$ $8\phi 1"$

PILARES PRIMER PISO

($f_c = 210 \text{ Kg/cm}^2$)

IPA1 $M = 635000$ $N = 84460$ $bxt = 40x50$
 $e = 7.50$ $e/t = 0.15$ $d'/t = 0.10$
 $p = 0.020$ $(n-1)p = 0.18$ $C = 1.51$ $f_c = 69.8$
 $D = 5.25$ $De/t = 0.79$
 $f_a/f_c = 0.243$ $f_p/f_c = 0.305$ $f_p = 64.1$
 $A_s = 40.0$ $8 \phi 1"$

IPA2 $M = 496000$ $N = 108570$ $bxt = 40x50$
 $e = 4.57$ $e/t = 0.091$ $d'/t = 0.10$
 $p = 0.030$ $(n-1) 0.27$ $C = 0.46$ $f_c = 62.2$
 $D = 5.0$ $De/t = 0.46$
 $f_a/f_c = 0.268$ $f_p/f_c = 0.305$ $f_p = 64.1$
 $A_s = 60.0$ $4 \phi 1" + 4 \phi 1-1/8$

IPA3 $M = 584000$ $N = 106020$ $bxt = 40x50$
 $e = 5.5$ $e/t = 0.11$ $d'/t = 0.10$
 $p = 0.032$ $(n-1)p = 0.288$ $C = 1.21$ $f_c = 64.2$
 $D = 5.68$ $De/t = 0.68$
 $f_a/f_c = 0.27$ $f_p/f_c = 0.32$ $f_p = 67.2$
 $A_s = 64.0 \text{ cm}^2$ $8 \phi 1-1/8$

IPA4 $M = 417000$ $N = 103480$ $bxt = 40x50$
 $e = 4.03$ $e/t = 0.081$ $d'/t = 0.10$
 $p = 0.025$ $(n-1)p = 0.225$ $C = 1.15$ $f_c = 59.3$
 $D = 5.16$ $De/t = 0.42$
 $f_a/f_c = 0.256$ $f_p/f_c = 0.29$ $f_p = 61$
 $A_s = 50.0$ $8 \phi 1"$

IPA5 $M = 42300$ $N = 101280$ $bxt \text{ } \underline{6} \text{ } 40x50$
 $e = 4.18$ $e/t = 0.089$ $d'/t = 0.10$
 $p = \text{XXXXXXXXXX}$ $(n-1)p = 0.225$ $C = 1.16$ $f_c = 58.7$
 0.025 $D = 5.16$ $De/t = 0.42$

| | | | |
|---------------------------|--------------------------|------------------|---------------|
| | $f_a/f_b = 0.268$ | $f_p/f_b = 0.30$ | $f_p = 63$ |
| $A_s = 60.0$ | $4\phi 1" + 4\phi 1-1/8$ | | |
| <u>1PA6</u> | $M = 382000$ | $N = 115580$ | $bxt = 40x50$ |
| | $e = 3.31$ | $e/t = 0.067$ | $d'/t = 0.10$ |
| $p = 0.030$ | $(n-1)p = 0.27$ | $C = 1.07$ | $f_c = 61.6$ |
| | $D = 5.00$ | $De/t = 0.33$ | |
| | $f_a/f_b = 0.268$ | $f_p/f_b = 0.30$ | $f_c = 63$ |
| $A_s = 60.0 \text{ cm}^2$ | $4\phi 1" + 4\phi 1-1/8$ | | |
| <u>1PA7</u> | $M = 122500$ | $N = 84600$ | $bxt = 40x40$ |
| | $e = 1.45$ | $e/t = 0.036$ | $d'/t = 0.15$ |
| $p = 0.020$ | $(n-1)p = 0.18$ | $C = 1.02$ | $f_c = 54$ |
| | $D = 5.6$ | $De/t = 0.2$ | |
| | $f_a/f_b = 0.24$ | $f_p/f_b = 0.26$ | $f_p = 54.6$ |
| $A_s = 32.0 \text{ cm}^2$ | $4\phi 7/8 + 4\phi 1"$ | | |
| <u>1PB1</u> | $M = 363000$ | $N = 126220$ | $bxt = 50x50$ |
| | $e = 2.87$ | $e/t = 0.058$ | $d'/t = 0.10$ |
| $p = 0.022$ | $(n-1)p = 0.198$ | $C = 1.09$ | $f_c = 55$ |
| | $D = 5.20$ | $De/t = 0.3$ | |
| | $f_a/f_b = 0.246$ | $f_p/f_b = 0.28$ | $f_p = 58.8$ |
| $A_s = 55.0$ | $4\phi 1" + 4\phi 1-1/8$ | | |
| <u>1PB2</u> | $M = 287000$ | $N = 121050$ | $bxt = 40x50$ |
| | $e = 2.37$ | $e/t = 0.048$ | $d'/t = 0.10$ |
| $p = 0.030$ | $(n-1)p = 0.27$ | $C = 0.99$ | $f_c = 60$ |
| | $D = 5.0$ | $De/t = 0.23$ | |
| | $f_a/f_b = 0.268$ | $f_p/f_b = 0.29$ | $f_p = 60.9$ |
| $A_s = 60.0$ | $4\phi 1" + 4\phi 1-1/8$ | | |
| <u>1PB3</u> | $M = 297000$ | $N = 134840$ | $bxt = 50x50$ |
| | $e = 2.2$ | $e/t = 0.044$ | |
| $p = 0.025$ | $(n-1)p = 0.225$ | $C = 1.01$ | $f_c = 54$ |

| | | | |
|-----------------------------|-------------------------------|--------------------|--------------------------------|
| | $D = 5.16$ | $De/t = 0.23$ | |
| | $f_a/f'_c = 0.256$ | $f_p/f'_c = 0.275$ | XXXXXX $f_p = 57.7$ |
| $A_s = 62.5 \text{ cm}^2$ | $10 \phi 1''$ | | |
| <u>1PB4</u> | $M = 238000$ | $N = 145740$ | $bxt = 50x50$ |
| | $e = 1.63$ | $e/t = 0.033$ | $d'/t = 0.10$ |
| $p = 0.028$ | $(n-1)p = 0.252$ | $C = 0.94$ | $f_c = 54.8$ |
| | $D = 5.05$ | $De/t = 0.17$ | |
| | $f_a/f'_c = 0.263$ | $f_p/f'_c = 0.285$ | $f_p = 57.7$ |
| $A_s = 70.0 \text{ cm}^2$ | $4 \phi 1-1/4 + 4 \phi 1-1/8$ | | |
| 1PB5 <u>1PB5</u> | $M = 435000$ | $N = 161480$ | $bxt = 50x60$ |
| | $e = 2.69$ | $e/t = 0.045$ | $d'/t = 0.10$ |
| $p = 0.022$ | $(n-1)p = 0.198$ | $C = 1.03$ | $F_c = 55.4$ |
| | $D = 5.20$ | $De/t = 0.24$ | |
| | $f_a/f'_c = 0.246$ | $f_p/f'_c = 0.275$ | $f_p = 57.7$ |
| $A_s = 66.0$ | $4 \phi 1'' + 4 \phi 1-1/4$ | | |
| <u>1PB6</u> | $M = 286000$ | $N = 159360$ | $bxt = 50x60$ |
| | $e = 1.81$ | $e/t = 0.031$ | $d'/t = 0.10$ |
| $p = 0.020$ | $(n-1)p = 0.18$ | $C = 0.99$ | $f_c = 50.6$ |
| | $D = 5.25$ | $De/t = 0.16$ | |
| | $f_a/f'_c = 0.243$ | $f_p/f'_c = 0.255$ | $f_p = 53.6$ |
| $A_s = 60.0 \text{ cm}^2$ | $4 \phi 1'' + 4 \phi 1-1/8$ | | |
| <u>1PB7</u> | $M = 116000$ | $N = 117460$ | $bxt = 40x50$ |
| | $e = 0.99$ | $e/t = 0.020$ | $d'/t = 0.10$ |
| $p = 0.025$ | $(n-1)p = 0.225$ | $C = 0.9$ | $f_c = 52.7$ |
| | $D = 5.16$ | $De/t = 0.1$ | |
| | $f_a/f'_c = 0.256$ | $f_p/f'_c = 0.255$ | $f_c = 53.6$ |
| $A_s = 50.0$ | $8 \phi 1''$ | | |
| <u>1PC1</u> | $M = 43200$ | $N = 89430$ | $bxt = 40x40$ |
| | $e = 0.48$ | $e/t = 0.012$ | $d'/t = 0.15$ |

$p = 0.022$ $(n-1)p = 0.198$ $C = 0.90$ $f_c = 50.2$
 $D = 5.58$ $De/t = 0.07$
 $f_a/f'_c = 0.246$ $f_p/f'_c = 0.25$ $f_p = 52.5$
 $A_s = 35.2$ $4 \phi 7/8 + 4 \phi 1"$

1PC4 $M = 614000$ $N = 116700$ $bxt = 40x50$
 $e = 0.53$ $e/t = 0.11$ $d'/t = 0.10$
 $p = 0.025$ $(n-1)p = 0.225$ $C = 0.85$ $f_c = 49.7$
 $D = 5.16$ $De/t = 0.05$
 $f_a/f'_c = 0.256$ $f_p/f'_c = 0.26$ $f_p = 54.5$
 $A_s = 50.0$ $8 \phi 1"$

1PC5 $M = 91000$ $N = 121930$ $bxt = 40x50$
 $e = 0.75$ $e/t = 0.015$ $d'/t = 0.10$
 $p = 0.028$ $(n-1)p = 0.252$ $C = 0.85$ $f_c = 51.4$
 $D = 5.05$ $De/t = 0.08$
 $f_a/f'_c = 0.256$ $f_p/f'_c = 0.26$ $f_p = 54.5$
 $A_s = 56.0 \text{ cm}^2$ $4 \phi 1" + 4 \phi 1-1/8$

1PC6 $M = 60500$ $N = 150870$ $bxt = 50x50$
 $e = 0.40$ $e/t = 0.008$ $d'/t = 0.15$
 $p = 0.020$ $(n-1)p = 0.18$ $C = 0.89$ $f_c = 53.5$
 $D = 5.25$ $De/t = 0.04$
 $f_a/f'_c = 0.243$ $f_p/f'_c = 0.255$ $f_p = 53.5$
 $A_s = 50.0$ $8 \phi 1"$

1PC7 $N = 94470$ $bxt = 40x40$

$$p = \frac{\frac{94470}{0.8 \times 1600} - 0.225 \times 210}{1400} = 0.019$$

$A_s = 30.4$ $4 \phi 1" + 4 \phi 7/8$

1PD1 $M = 112000$ $N = 60250$ $bxt = 30x40$
 $e = 1.86$ $e/t = 0.047$ $d'/t = 0.15$

$$\begin{aligned}
 p &= 0.020 & (n-1)p &= 0.18 & C &= 1.06 & f_c &= 53.4 \\
 D &= 5.60 & D_e/t &= 0.26 \\
 f_a/f_c &= 0.24 & f_p/f_c &= 0.265 & f_p &= 55.6 \\
 A_s &= 24.0 & & & & & & 4\phi 3/4 + 4\phi 7/8
 \end{aligned}$$

1PD2

$$\begin{aligned}
 M &= 119500 & N &= 82920 & bxt &= 40x40 \\
 e &= 1.38 & e/t &= 0.034 & d'/t &= 0.15 \\
 p &= 0.020 & (n-1)p &= 0.18 & C &= 1.01 & f_c &= 52.3 \\
 D &= 5.6 & D_e/t &= 0.19 \\
 f_a/f_c &= 0.243 & f_p/f_c &= 0.265 & f_p &= 55.6 \\
 A_s &= 32.0 & & & & & & 8 \phi 7/8
 \end{aligned}$$

1PD3

$$\begin{aligned}
 M &= 111000 & N &= 81630 & bxt &= 40 \times 40 \\
 e &= 1.36 & e/t &= 0.034 & d'/t &= 0.15 \\
 p &= 0.018 & (n-1)p &= 0.162 & C &= 1.02 & f_c &= 52 \\
 D &= 5.62 & D_e/t &= 0.20 \\
 f_a/f_c &= 0.237 & f_p/f_c &= 0.25 & f_p &= 52.4 \\
 A_s &= 28.8 & & & & & & ~~8\phi 7/8~~ 8 \phi 7/8
 \end{aligned}$$

1PD4

$$\begin{aligned}
 M &= 96000 & N &= 142300 & bxt &= 50x50 \\
 & & & & & & & \text{xxx} \\
 p &= \frac{\frac{142300}{0.8 \times 2500} - 0.225 \times 210}{1400} = 0.017 \\
 A_s &= 42.5 & & & & & & 8 \phi 1"
 \end{aligned}$$

1PD5

$$\begin{aligned}
 & & N &= 122700 & bxt &= 50x50 \\
 p &= \frac{\frac{122700}{0.8 \times 2500} - 0.225 \times 210}{1400} = 0.01 \\
 A_s &= 25.0 \text{ cm}^2 & & & & & & 4 \phi 3/4 + 4 \phi 7/8
 \end{aligned}$$

1PD6

$$\begin{aligned}
 & & N &= 134940 & bxt &= 50x50 \\
 p &= \frac{\frac{134940}{0.8 \times 2500} - 0.225 \times 210}{1400} = 0.015 \\
 A_s &= 37.5 \text{ cm}^2 & & & & & & 10 \phi 7/8
 \end{aligned}$$

1PD7

$N = 94040$ $bxt = 40x40$

$$p = \frac{\frac{94040}{0.8x1600} - 0.225 \times 210}{1400} = 0.019$$

$A_s = 30.4$ $8 \text{ } \phi \text{ } 7/8$

1PE4

$M = \text{XXXXX} 114500$ $N = 78070$ $bxt = 40x40$

$e = 1.47$ $e/t = 0.037$ $d'/t = 0.15$

$p = 0.018$ $(n-1)p = 0.162$ $C = 1.05$ $f_c = 51.2$

$D = 5.62$ $De/t = 0.20$

$f_a/f'_c = 0.237$ $f_p/f'_c = 0.25$ $f_p = 52.4$

$A_s = 28.8$ $8 \text{ } \phi \text{ } 7/8$

1PE5

$M = 205000$ $N = 102610$ $bxt = 40x50$

$e = 2.0$ $e/t = 0.04$ $d'/t = 0.10$

$p = 0.020$ $(n-1)p = 0.18$ $C = 1.04$ $f_c = 52$

$D = 5.25$ $De/t = 0.02$

$f_a/f'_c = 0.243$ $f_p/f'_c = 0.26$ $f_p = 54.6$

$A_s = 40.0$ $8 \text{ } \phi \text{ } 1"$

1PE6

$M = 119000$ $N = 98750$ $bxt = 40x50$

$e = 1.21$ $e/t = 0.02$ $d'/t = 0.10$

$p = 0.015$ $(n-1)p = 0.135$ $C = 0.98$ $f_c = 48.4$

$D = 5.46$ $De/t = 0.13$

$f_a/f'_c = 0.23$ $f_p/f'_c = 0.24$ $f_p = 50.4$

$A_s = 30.0$ $8 \text{ } \phi \text{ } 7/8$

1PE7

$M = 156000$ $N = 73510$ $bxt = 30x40$

$e = 2.10$ $e/t = 0.053$ $d'/t = 0.15$

$p = 0.030$ $(n-1)p = 0.27$ $C = 1.03$ $f_c = 63$

$D = 5.45$ $De/t = 0.22$

$f_a/f'_c = 0.268$ $f_p/f'_c = 0.30$ $f_p = 63$

$A_s = 36.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 1" + 4 \text{ } \phi \text{ } 7/8$

PILARES 2° - 3° - 4° y 5° PISO

($f_c = 140 \text{ Kg/cm}^2$)

PILARES DEL SEGUNDO PISO

($f'c = 140 \text{ Kg/cm}^2$)

| | | | |
|--------------------------|-----------------|------------------|---------------|
| <u>2PA1</u> | $M = 486300$ | $N = 65480$ | $bxt = 40x40$ |
| | $e = 7.4$ | $e/t = 0.18$ | $d'/t = 0.15$ |
| $p = 0.040$ | $(n-1)p = 0.56$ | $C = 1.22$ | $fc = 49.8$ |
| | $D = 5.12$ | $De/t = 0.95$ | |
| | $fa/f'c = 0.32$ | $fp/f'c = 0.37$ | $fp = 51.8$ |
| $As = 64.0$ | $8 \phi 1-1/8$ | | |
| <hr/> | | | |
| <u>2PA2</u> | $M = 316100$ | $N = 84860$ | $bxt = 40x40$ |
| | $e = 3.73$ | $e/t = 0.09$ | $d'/t = 0.15$ |
| $p = 0.04$ | $(n-1)p = 56$ | $C = 0.92$ | $fc = 48.7$ |
| | $D = 5.12$ | $De/t = 0.48$ | |
| | $fa/f'c = 0.32$ | $fp/f'c = 0.355$ | $fp = 49.7$ |
| $As = 64.0$ | $8 \phi 1-1/8$ | | |
| <hr/> | | | |
| <u>2PA3</u> | $M = 455100$ | $N = 82870$ | $bxt = 40x40$ |
| | $e = 5.5$ | $e/t = 0.14$ | $d'/t = 0.15$ |
| $p = 0.04$ | $(n-1)p = 0.56$ | $C = 1.09$ | $fc = 56.4$ |
| | $D = 5.12$ | $De/t = 0.64$ | |
| | $fa/f'c = 0.32$ | $fp/f'c = 0.37$ | $fp = 54.6$ |
| $As = 64.0 \text{ cm}^2$ | $8 \phi 1-1/8$ | | |
| <hr/> | | | |
| <u>2PA4</u> | $M = 333600$ | $N = 80890$ | $bxt = 40x40$ |
| | $e = 4.12$ | $e/t = 0.10$ | $d'/t = 0.15$ |
| $p = 0.04$ | $(n-1)p = 0.56$ | $C = 0.96$ | $fc = 48.5$ |
| | $D = 5.12$ | $De/t = 0.7$ | |
| | $fa/f'c = 0.32$ | $fp/f'c = 0.365$ | $fp = 51$ |
| $As = 64.0$ | $8 \phi 1-1/8$ | | |
| <hr/> | | | |
| <u>2PA5</u> | $M = 337700$ | $N = 79130$ | $bxt = 40x40$ |
| | $e = 4.25$ | $e/t = 0.11$ | $d'/t = 0.15$ |
| $p = 0.04$ | $(n-1)p = 0.56$ | $C = 1.0$ | $fc = 49.4$ |
| | $D = 5.12$ | $De/t = 0.55$ | |
| | $fa/f'c = 0.32$ | $fp/f'c = 0.36$ | $fp = 50.4$ |

$A_s = 64.0 \text{ cm}^2$

8 1-1/8

2PA6

$M = 311000$

$N = 90360$

$bxt = 40x40$

$e = 3.44$

$e/t = 0.086$

$d'/t = 0.15$

$p = 0.04$

$(n-1)p = 0.56$

$C = 0.9$

$fc = 50.7$

$D = 5.12$

$De/t = 0.42$

$fa/f'c = 0.32$

$fp/f'c = 0.36$

$fp = 50.4$

$A_s = 64.0 \text{ cm}^2$

8 ϕ 1-1/8

2PA7

$M = 179700$

$N = 65590$

$bxt = 40x40$

$e = 2.73$

$e/t = 0.068$

$d'/t = 0.15$

$p = 0.025$

$(n-1)p = 0.35$

$C = 1.01$

$fc = 41.4$

$D = 5.32$

$De/t = 0.36$

$fa/f'c = 0.28$

$fp/f'c = 0.312$

$fp = 43.7$

$A_s = 40.0$

8 ϕ 1"

2PB1

$M = 3339$

$N = 97960$

$bxt = 40x50$

$e = 3.45$

$e/t = 0.087$

$d'/t = 0.10$

$p = 0.035$

$(n-1)p = 0.49$

$C = 0.99$

$fc = 45.5$

$D = 5.18$

$De/t = 0.36$

$fa/f'c = 0.31$

$fp/f'c = 0.34$

$fp = 47.6$

$A_s = 70.0 \text{ cm}^2$

4 ϕ 1-1/4 + 4 ϕ 1-1/8

2PB2

$M = 222100$

$N = 95520$

$bxt = 40x40$

$e = 2.32$

$e/t = 0.058$

$d'/t = 0.15$

$p = 0.04$

$(n-1)p = 0.56$

$C = 0.82$

$fc = 49$

$D = 5.12$

$De/t = 0.3$

$fa/f'c = 0.32$

$fp/f'c = 0.35$

$fp = 49$

$A_s = 64.0$

8 ϕ 1-1/8

2PB3

$M = 329500$

$N = 105100$

$bxt = 40x50$

$e = 3.14$

$e/t = 0.063$

$d'/t = 0.15$

$p = 0.035$

$(n-1)p = 0.49$

$C = 0.86$

$fc = 45.2$

$D = 4.5$

$De/t = 0.3$

$fa/f'c = 0.31$

$fp/f'c = 0.335$

$fp = 47$

$A_s = 70.0 \text{ cm}^2$ 4 1-1/4 + 4 1-1/8

2PB4 $M = 268800$ $N = 114100$ $bxt = 40x50$
 $e = 2.36$ $e/t = 0.047$ $d'/t = 0.10$
 $P = 0.035$ $(n-1)p = 0.49$ $C = 0.8$ $f_c = 45.6$
 $D = 4.50$ $De/t = 0.22$
 $f_a/f'_c = 0.31$ $f_p/f'_c = \frac{XXXX}{0.33}$ $f_p = 46.2$
 $A_s = 70.0 \text{ cm}^2$ 4 ϕ 1-1/4 + 4 ϕ 1-1/8

2PB5 $M = 338500$ $N = 125810$ $bxt = 40x50$
 $e = 2.69$ $e/t = 0.05$ $d'/t = 0.10$
 $p = 0.04$ $(n-1)p = 0.56$ $C = 0.8$ $f_c = 48.8$
 $D = 4.50$ $De/t = 0.25$
 $f_a/f'_c = 0.321$ $f_p/f'_c = 0.345$ $f_p = 48.3$
 $A_s = 80.0 \text{ cm}^2$ 8 ϕ 1-1/4

2PB6 $M = 211700$ $N = 120570$ $bxt = 40x50$
 $e = 1.76$ $e/t = 0.035$ $d'/t = 0.10$
 $p = 0.038$ $(n-1)p = 53.2$ $c = 0.76$ $f_c = 45.8$
 $D = 4.58$ $De/t = 0.16$
 $f_a/f'_c = 0.317$ $f_p/f'_c = 0.325$ $f_p = 45.5$
 $A_s = 76$ 8 ϕ 1-1/4

2PB7 $M = 83700$ $N = 91510$ $bxt = 40x40$
 $e = 0.92$ $e/t = 0.022$ $d'/t = 0.15$
 $p = 0.04$ $(n-1)p = 0.56$ $C = 0.75$ $f_c = 43$
 $D = 5.12$ $De/t = 0.12$
 $f_a/f'_c = 0.321$ $f_p/f'_c = 0.335$ $f_p = 46.9$
 $A_s = 64.0 \text{ cm}^2$ 8 ϕ 1-1/8

2PC1 $M = 40100$ $N = 69340$ $bxt = 30x40$
 $e = 0.57$ $e/t = 0.014$ $d'/t = 0.15$
 $p = 0.030$ $(n-1)p = 0.42$ $C = 0.75$ $f_c = 43.4$
 $D = 5.28$ $De/t = 0.07$

$f_a/f_c = 0.30$ $f_p/f_c = 0.31$ $f_p = 43.4$
 $A_s = 36.0 \text{ cm}^2$ $4 \phi 7/8 + 4 \phi 1"$

2PC4 $M = 45400$ $N = 91140$ $bxt = 40x40$
 $e = 0.50$ $e/t = 0.012$ $d'/t = 0.15$
 $p = 0.035$ $(n-1)p = 0.49$ $C = 0.71$ $f_c = 40.4$
 $D = 5.18$ $De/t = 0.06$
 $f_a/f_c = 0.31$ $f_p/f_c = \cancel{XXX} 0.31$ $f_p = 43.6$
 $A_s = 56.0 \text{ cm}^2$ $4 \phi 1" + 4 \phi 1-1/8$

2PC5 $M = 75900$ $N = 95400$ $bxt = 40x40$
 $e = 0.80$ $e/t = 0.02$ $d'/t = 0.15$
 $p = 0.038$ $(n-1)p = 0.532$ $C = 0.72$ $f_c = 43$
 $D = 5.15$ $De/t = 0.1$
 $f_a/f_c = 0.317$ $f_p/f_c = 0.315$ $f_p = 44.2$
 $A_s = 60.8$ $4 \phi 1" + 4 \phi 1-1/8$

2PC6 $M = 60800$ $N = 118330$ $bxt = 40x50$
 $e = 0.52$ $e/t = 0.013$ $d'/t = 0.10$
 $p = 0.030$ $(n-1)p = 0.42$ $C = 0.75$ $f_c = \cancel{XXX} 44.3$
 $D = 4.71$ $De/t = 0.05$
 $f_a/f_c = 0.296$ $f_p/f_c = 0.31$ $f_p = 43.4$
 $A_s = 64$ $4 \phi 1" + 4 \phi 1-1/4$

2PC7 $M = 8300$ $N = 73680$ $bxt = 40 \times 40$

$$p = \frac{\frac{73680}{0.8 \times 1600} - 0.225 \times 140}{1400} = 0.019$$
 $A_s = 30.4 \text{ cm}^2$ $8 \phi 7/8$

2PD1 $M = 122100$ $N = 46370$ $bxt = 30x40$
 $e = 2.70$ $e/t = 0.07$ $\cancel{XX} d'/t = 0.15$
 $p = 0.025$ $(n-1)p = 0.35$ $C \pm 1.02$ $f_c = 39.4$
 $D = 5.32$ $De/t = 0.36$

$$f_a/f_b = 0.28 \quad f_p/f_b = 0.31 \quad f_p = 43.4$$

$$A_s = 30.0 \text{ cm}^2 \quad 8 \phi 7/8$$

2PD2

$$M = 113500 \quad N = 64390 \quad bxt = 30x40$$

$$e = 1.77 \quad e/t = 0.04 \quad d'/t = 0.15$$

$$p = 0.35 \quad (n-1)p = 0.49 \quad C = 0.82 \quad f_c = 44$$

$$D = 5.18 \quad De/t = 0.24$$

$$f_a/f_b = 0.31 \quad f_p/f_b = 0.33 \quad f_p = 46.2$$

$$A_s = 42.0 \quad 8 \phi 1"$$

2PD3

$$M = 110000 \quad N = 63390 \quad bxt = 30x40$$

$$e = 1.74 \quad e/t = 0.043 \quad d'/t = 0.15$$

$$p = 0.032 \quad (n-1)p = 0.45 \quad C = 0.85 \quad f_c = 44.8$$

$$D = 5.25 \quad De/t = 0.23$$

$$f_a/f_b = 0.301 \quad f_p/f_b = 0.32 \quad f_p = 44.8$$

$$A_s = 38.4 \quad 8 \phi 1"$$

2PD4

$$M = 7400 \quad N = 109990 \quad bxt = 40x50$$

$$p = \frac{\frac{109990}{0.8x2000} - 0.225 x 140}{1400} = 0.027$$

$$A_s = 54.0 \quad 4 \phi 1" \text{ \& } 4 \phi 1-1/8$$

2PD5

$$M = 10300 \quad N = 95640 \quad bxt = 40x40$$

$$p = \frac{\frac{95640}{0.8x1600} - 0.225 x 140}{1400} = 0.031$$

$$A_s = 49.6 \text{ cm}^2 \quad 8 \phi 1"$$

2PD6

$$M = 47700 \quad N = 105660 \quad bxt = 40x50$$

$$e = 0.45 \quad e/t = 0.01 \quad d'/t = 0.10$$

$$p = 0.030 \quad (n-1)p = 0.42 \quad C = 0.73 \quad f_c = 38.5$$

$$D = 4.71 \quad De/t = 0.04$$

$$f_a/f_b = 0.296 \quad f_p/f_b = 0.30 \quad f_p = 42$$

$$A_s = 60.0 \text{ cm}^2 \quad 4 \phi 1" \text{ \& } 4 \phi 1-1/8$$

2PD7 $M = 32900$ $N = 73330$ $bxt = 40x40$
 $e = 0.45$ $e/t = 0.01$ $d'/t = 0.15$
 $p = 0.022$ $(n-1)p = 0.308$ $C = 0.81$ $fc = 39.2$
 $D = 5.35$ $De/t = 0.06$
 $fa/fc = 0.27$ $fp/fc = 0.28$ $fp = 39.2$
 $As = 35.2$ $4\phi 7/8 + 4\phi 1"$

2PE4 $M = 113300$ $N = 59800$ $bxt = 40x40$
 $e = 1.90$ $e/t = 0.048$ $d'/t = 0.15$
 $p = 0.024$ $(n-1)p = 0.28$ $C = 0.99$ $fc = 37$
 $D = 5.41$ $De/t = 0.26$
 $fa/fc = 0.266$ $fp/fc = 0.29$ $fp = 40.6$
 $As = 32$ $8 \phi 7/8$

2PE5 $M = 158100$ $N = 79220$ $bxt = 40x40$
 $e = 2.05$ $e/t = 0.05$ $d'/t = 0.15$
 $p = 0.030$ $(n-1)p = 0.42$ $C = 0.89$ $fc = 44$
 $D = 5.28$ $De/t = 0.26$
 $fa/fc = 0.296$ $fp/fc = 0.325$ $fp = 45.6$
 $As = 48.0 \text{ cm}^2$ $8 \phi 1"$

2PE6 $M = 93200$ $N = 76890$ $bxt = 40x40$
 $e = 1.21$ $e/t = 0.03$ $d'/t = 0.15$
 $p = 0.025$ $(n-1)p = 0.35$ $C = 0.85$ $fc = 40.8$
 $D = 5.32$ $De/t = 0.16$
 $fa/fc = 0.282$ $fp/fc = 0.29$ $fp = 40.6$
 $As = 40.0$ $8 \phi 1"$

2PE7 $M = 81100$ $N = 56730$ $bxt = 30x40$
 $e = 1.43$ $e/t = 0.04$ $d'/t = 0.15$
 $p = 0.028$ $(n-1)p = 0.392$ $C = 0.87$ $fc = 41.1$
 $D = 5.30$ $De/t = 0.19$
 $fa/fc = 0.29$ $fp/fc = 0.315$ $fp = 44.2$
 $As = 33.6$ $4 \phi 7/8 + 4 \phi 1"$

PILARES DEL TERCER PISO ($f_c = 140 \text{ kg/cm}^2$)

| | | | |
|---------------------------|-------------------|-------------------|---------------|
| <u>3PA1</u> | $M = 486300$ | $N = 47660$ | $bxt = 40x40$ |
| | $e = 10.2$ | $t/e = 3.92$ | $d'/t = 0.15$ |
| $p = 0.030$ | $np = 0.45$ | $C = 6.4$ | $f_c = 48.5$ |
| | $(n-1)p = 0.42$ | $D = 5.25$ | $De/t = 1.34$ |
| | $f_a/f_c = 0.296$ | $f_p/f_c = 0.37$ | $f_p = 51.8$ |
| $A_s = 47.0 \text{ cm}^2$ | $8 \phi 1"$ | | |
| <u>3PA2</u> | $M = 316100$ | $N = 62090$ | $bxt = 40x40$ |
| | $e = 5.1$ | $e/t = 0.127$ | $d'/t = 0.15$ |
| $p = 0.028$ | $(n-1)p = 0.39$ | $C = 1.2$ | $f_c = 46.5$ |
| | $D = 5.30$ | $De/t = 0.66$ | |
| | $f_a/f_c = 0.29$ | $f_p/f_c = 0.336$ | $f_p = 47$ |
| $A_s = 44.8$ | $8 \phi 1"$ | | |
| <u>3PA3</u> | $M = 455100$ | $N = 50660$ | $bxt = 40x40$ |
| | $e = 7.5$ | $e/t = 0.188$ | $d'/t = 0.15$ |
| $p = 0.032$ | $(n-1)p = 0.448$ | $C = 1.33$ | $f_c = 50.3$ |
| | $D = 5.25$ | $De/t = 0.985$ | |
| | $f_a/f_c = 0.301$ | $f_p/f_c = 0.359$ | $f_p = 50.3$ |
| $A_s = 51.2$ | $8 \phi 1"$ | | |
| <u>3PA4</u> | $M = 333600$ | $N = 59250$ | $bxt = 40x40$ |
| | $e = 5.62$ | $e/t = 0.14$ | $d'/t = 0.15$ |
| $p = 0.028$ | $(n-1)p = 0.392$ | $C = 1.25$ | $f_c = 46.4$ |
| | $D = 5.30$ | $De/t = 0.745$ | |
| | $f_a/f_c = 0.29$ | $f_p/f_c = 0.345$ | $f_p = 48.3$ |
| $A_s = 44.8$ | $8 \phi 1"$ | | |
| <u>3PA5</u> | $M = 337700$ | $N = 57940$ | $bxt = 40x40$ |
| | $e = 5.83$ | $e/t = 0.145$ | $d'/t = 0.15$ |
| $p = 0.028$ | $(n-1)p = 0.392$ | $C = 1.28$ | $f_c = 46.4$ |
| | $D = 5.30$ | $De/t = 0.77$ | |
| | $f_a/f_c = 0.29$ | $f_p/f_c = 0.35$ | $f_p = 49$ |

| | | | |
|---------------------------|----------------------------|--------------------|---------------|
| $A_s = 44.8$ | $8 \ 1"$ | | |
| <u>3PA6</u> | $M = 311000$ | $N = 66050$ | $bxt = 40x40$ |
| | $e = 4.71$ | $e/t = 0.118$ | $d'/t = 0.15$ |
| $p = 0.035$ | $(n-1)p = 0.49$ | $C = 1.08$ | $f_c = 44.5$ |
| | $D = 5.18$ | $De/t = 0.61$ | |
| | $f_a/f'_c = 0.309$ | $f_p/f'_c = 0.35$ | $f_p = 49$ |
| $A_s = 56.0 \text{ cm}^2$ | $4 \phi 1" + 4 \phi 1-1/8$ | | |
| <u>3PA7</u> | $M = 179700$ | $N = 47680$ | $bxt = 40x40$ |
| | $e = 3.77$ | $e/t = 0.94$ | $d'/t = 0.15$ |
| $p = 0.018$ | $(n-1)p = 0.252$ | $C = 1.22$ | $f_c = 36.3$ |
| | $D = 5.62$ | $De/t = 0.53$ | |
| | $f_a/f'_c = 0.259$ | $f_p/f'_c = 0.30$ | $f_p = 42$ |
| $A_s = 28.8$ | $4 \phi 3/4 + 4 \phi 7/8$ | | |
| <u>3PB1</u> | $M = 333900$ | $N = 70670$ | $bxt = 40x50$ |
| | $e = 4.72$ | $e/t = 0.095$ | $d'/t = 0.10$ |
| $p = 0.020$ | $(n-1)p = 0.28$ | $C = 1.16$ | $f_c = 41$ |
| | $D = 4.96$ | $De/t = 0.46$ | |
| | $f_a/f'_c = 0.266$ | $f_p/f'_c = 0.30$ | $f_p = 42$ |
| $A_s = 32.0 \text{ cm}^2$ | $8 \phi 7/8$ | | |
| <u>3PB2</u> | $M = 222100$ | $N = 69790$ | $bxt = 40x50$ |
| | $e = 3.18$ | $e/t = 0.08$ | $d'/t = 0.15$ |
| $p = 0.025$ | $(n-1)p = 0.35$ | $C = 1.02$ | $f_c = 44.5$ |
| | $D = 5.32$ | $De/t = 0.42$ | |
| | $f_a/f'_c = 0.28$ | $f_p/f'_c = 0.318$ | $f_p = 44.5$ |
| $A_s = 40.0$ | $8 \phi 1"$ | | |
| <u>3PB3</u> | $M = 329500$ | $N = 76070$ | $bxt = 40x50$ |
| | $e = 4.34$ | $e/t = 0.087$ | $d'/t = 0.10$ |
| $p = 0.022$ | $(n-1)p = 0.308$ | $C = 1.1$ | $f_c = 41.8$ |
| | $D = 4.9$ | $De/t = 0.42$ | |
| | $f_a/f'_c = 0.27$ | $f_p/f'_c = 0.305$ | $f_p = 42.7$ |

$A_s = 44.0 \text{ cm}^2$ 8 ϕ 1"

3PB4 $M = 268800$ $N = 83180$ $bxt = 40x50$
 $e = 3.24$ $e/t = 0.065$ $d'/t = 0.10$
 $p = 0.025$ $(n-1)p = 0.35$ $C = 0.98$ $fc = 40.8$
 $D = 4.82$ $De/t = 0.312$
 $fa/fc = 0.282$ $fp/fc = 0.31$ $fp = 43.4$

$A_s = 50.0 \text{ cm}^2$ 8 ϕ 1"

3PB5 $M = 338500$ $N = 90850$ $bxt = 40x50$
 $e = 3.73$ $e/t = 0.075$ $d'/t = 0.10$
 $p = 0.030$ $(n-1)p = 0.42$ $C = 0.95$ $fc = 43.2$
 $D = 4.71$ $De/t = 0.35$
 $fa/fc = 0.296$ $fp/fc = 0.32$ $fp = 44.8$

$A_s = 60.0 \text{ cm}^2$ 4 ϕ 1 + 4 ϕ 1-1/8

3PB6 $M = 211700$ $N = 88390$ $bxt = 40x50$
 $e = 2.39$ $e/t = 0.048$ $d'/t = 0.10$
 $p = 0.022$ $(n-1)p = 0.308$ $C = 0.95$ $fc = 41.9$
 $D = 4.75$ $De/t = 0.23$
 $fa/fc = 0.27$ $fp/fc = 0.30$ $fp = 42$

$A_s = 44.0 \text{ cm}^2$ 8 ϕ 1"

3PB7 $M = 83700$ $N = 66490$ $bxt = 40x40$
 $e = 1.26$ $e/t = 0.03$ $d'/t = 0.15$
 $p = 0.018$ $(n-1)p = 0.252$ $C = 0.93$ $fc = 38.3$
 $D = 5.50$ $De/t = 0.17$
 $fa/fc = 0.26$ $fp/fc = 0.28$ $fp = 39.2$

$A_s = 28.0 \text{ cm}^2$ 4 ϕ 3/4 + 4 ϕ 7/8

3PC1 $M = 40100$ $N = 50320$ $bxt = 30x40$
 $e = 0.80$ $e/t = 0.02$ $d'/t = 0.15$
 $p = 0.018$ $(n-1)p = 0.252$ $C = 0.89$ $fc = 37$
 $D = 5.50$ $De/t = 0.11$

$$f_a/f_b = 0.25 \quad f_p/f_b = 0.265 \quad f_p = 37$$

$$A_s = 28.0 \text{ cm}^2 \quad 8 \text{ } \phi \text{ } 7/8$$

XXXX 3PC4 $M = 45400$ $N = 66420$ $bxt = 40x40$
 $e = 0.68$ $e/t = 0.017$ $d'/t = 0.15$
 $p = 0.015$ $(n-1)p = 0.21$ $C = 0.9$ $f_c = 37$
 $D = 5.53$ $De/t = 0.09$
 $f_a/f_b = 0.25$ $f_p/f_b = 0.265$ $f_p = 37$
 $A_s = 24.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 7/8$

3PC5 $M = 75900$ $N = 68350$ $bxt = 40x40$
 $e = 1.11$ $e/t = 0.03$ $d'/t = 0.15$
 $p = 0.020$ $(n-1)p = 0.28$ $C = 0.91$ $f_c = 38.9$
 $D = 5.41$ $De/t = 0.15$
 $f_a/f_b = 0.266$ $f_p/f_b = 0.29$ $f_p = 40.6$
 $A_s = 32.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 7/8$

3PC6 $M = 60800$ $N = 85540$ $bxt = 40x50$
 $e = 0.71$ $e/t = 0.014$ $d'/t = 0.10$
 $p = 0.018$ $(n-1)p = 0.252$ $C = 0.86$ $f_c = 36.8$
 $D = 5.06$ $De/t = 0.07$
 $f_a/f_b = 0.26$ $f_p/f_b = 0.27$ $f_p = 37.8$
 $A_s = 36.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 7/8 + 4 \text{ } \phi \text{ } 1"$

3PC7 $M = 8300$ $N = 85540$ $bxt = 40x40$
 $e = 0.15$ $e/t = 0.004$ $d'/t = 0.10$
 $p = 0.01$ $(n-1)p = 0.14$ $C = 0.9$ $f_c = 30.3$
 $D = 5.65$ $De/t = 0.01$
 $f_a/f_b = 0.229$ $f_p/f_b = 0.23$ $f_p = 32$
 $A_s = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 3/8$

3PDI $M = 122100$ $N = 33690$ $bxt = 30x40$
 $e = 3.64$ $e/t = 0.09$ $d'/t = 0.15$
 $p = 0.012$ $(n-1)p = 0.168$ $C = 1.29$ $f_c = 36.1$
 $D = 5.62$ $De/t = 0.56$

$f_a/f_b = 0.237$ $f_p/f_b = 0.275$ $f_p = 38.5$
 $A_s = 14.4$ $4 \text{ } \phi \text{ } 7/8$

3PD2 $M = 119500$ $N = 46920$ $bxt = 30x40$
 $e = 2.42$ $e/t = 0.06$ $d'/t = 0.15$
 $p = 0.022$ $(n-1)p = 0.308$ $C = 1.02$ $f_c = 39.9$
 $D = 5.35$ $De/t = 0.32$
 $f_a/f_b = 0.282$ $f_p/f_b = 0.305$ $f_p = 42.7$
 $A_s = 26.4$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 7/8$

3PD3 $M = 1100$ $N = 46220$ $bxt = 30x40$
 $e = 2.38$ $e/t = 0.06$ $d'/t = 0.15$
 $p = 0.022$ $(n-1)p = 0.308$ $C = 1.02$ $f_c = 39.3$
 $D = 5.35$ $\bar{D}e/t = 0.32$
 $f_a/f_b = 0.282$ $f_p/f_b = 0.305$ $f_p = 42.7$
 $A_s = 26.4$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 7/8$

3PD4 $M = 740000$ $N = 78630$ $bxt = 40x50$
 $e = 0.094$ $e/t = 0.002$ $d'/t = 0.10$
 $p = 0.015$ $(n-1)p = 0.21$ $C = 0.85$ $f_c = 33.5$
 $D = 5.53$ $De/t = 0.01$
 $f_a/f_b = 0.25$ $f_p/f_b = 0.26$ $f_p = 36.4$
 $A_s = 30.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 7/8$

3PD5 $M = 10300$ $N = 69420$ $bxt = 40x40$
 $e = 0.15$ $e/t = 0.004$ $d'/t = 0.15$
 $p = 0.018$ $(n-1)p = 0.252$ $C = 0.82$ $f_c = 35.6$
 $D = 5.5$ $De/t = 0.02$
 $f_a/f_b = 0.26$ $f_p/f_b = 0.28$ $f_p = 39.2$
 $A_s = 28.8$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 7/8$

3PD6 $M = 47700$ $N = 77120$ $bxt = 40x50$
 $e = 0.62$ $e/t = 0.012$ $d'/t = 0.10$
 $p = 0.015$ $(n-1)p = 0.21$ $C = 0.89$ $f_c = 34.3$
 $D = 5.53$ $De/t = 0.07$
 $f_a/f_b = 0.25$ $f_p/f_b = 0.265$ $f_p = 37.1$

$A_s = 30.0 \text{ cm}^2$ 8 ϕ 7/8

3PD7 $M = 32900$ $N = 53690$ $bxt = 40x40$
 $e = 0.61$ $e/t = 0.015$ $d'/t = 0.15$
 $p = 0.01$ $(n-1)p = 0.14$ $C = 0.95$ $f_c = 31.8$
 $D = 5.65$ $De/t = 0.09$
 $f_a/f_b = 0.23$ $f_p/f_b = 0.24$ $f_p = 33.6$

$A_s = 16 \text{ cm}^2$ ~~4XXX~~ 8 ϕ 5/8

3PE4 $M = 113900$ $N = 42720$ $bxt = 40x40$
~~XXX~~ $e = 2.65$ $e/t = 0.06$ $d'/t = 0.15$
 $p = 0.01$ $(n-1)p = 0.4$ $C = 1.18$ $f_c = 31.5$
 $D = 5.53$ $De/t = 0.37$
 $f_a/f_b = 0.23$ $f_p/f_b = 0.265$

$A_s = 16$ ~~XXXXXX~~ 8 ϕ 5/8

3PE5 $M = 158100$ $N = 56900$ $bxt = 40x40$
 $e = 2.78$ $e/t = 0.07$ $d'/t = 0.15$
 $p = 0.020$ $(n-1)p = 0.28$ $C = 1.09$ $f_c = 38.8$
 $D = 5.41$ $De/t = 0.37$
 $f_a/f_b = 26.6$ $f_p/f_b = 0.30$ $f_p = 42$

$A_s = 32.0 \text{ cm}^2$ 8 ϕ 7/8

3PE6 $M = 93200$ $N = 55050$ $bxt = 40x40$
 $e = \text{XXX } 1.70$ $e/t = 0.04$ $d'/t = 0.15$
 $p = 0.015$ $(n-1)p = 0.21$ $C = 1.01$ $f_c = 34.8$
 $D = 5.53$ $De/t = 0.24$
 $f_a/f_b = 0.25$ $f_p/f_b = 0.28$ $f_p = 39.4$

$A_s = 24.0$ 8 ϕ 3/4

3PE7 $M = 81100$ $N = 41110$ $bxt = 30x40$
 $e = 1.97$ $e/t = 0.05$ $d'/t = 0.15$
 $p = 0.015$ $(n-1)p = 0.21$ $C = 1.06$ $f_c = 36.4$
 $D = 5.53$ $De/t = 0.28$
 $f_a/f_b = 0.25$ $f_p/f_b = 0.275$ $f_p = 38.5$

$A_s = 18.0 \text{ cm}^2$ 4 ϕ 1"

PILARES CUARTO PISO ($f'c = 140 \text{ Kg/cm}^2$)

4PA1 $M = 486300$ $N = 29550$ $bxt = 40x40$
 $e = 16.5$ $t/e = 2.43$ $d'/t = 0.15$
 $p = 0.020$ $np = 0.30$ $C = 6.6$ $Fc = 50.2$
 $(n-1)p = 0.28$ $D = 5.4$ $De/t = 2.23$
 $fa/f'c = 0.266$ $fp/f'c = 0.368$ $fp = 51.5$
 $As = 32.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 7/8$

4PA2 $M = 316100$ $N = 38900$ $bxt = 40x40$
 $e = 8.13$ $t/e = 4.92$ $d'/t = 0.15$
 $p = 0.015$ $np = 0.225$ $C = 8.5$ $fc = 42$
 $(n-1)p = 0.21$ $D = 5.53$ $De/t = 1.12$
 $fa/f'c = 0.248$ $fp/f'c = 0.322$ $fp = 45$
 $As = 24.0$ $8 \text{ } \phi \text{ } 3/4$

4PA3 $M = 455100$ $N = 38040$ $bxt = 40x40$
 $e = 12$ $t/e = 3.34$ $d'/t = 0.15$
 $p = 0.020$ $np = 0.30$ $C = 7.0$ $fc = 49.7$
 $(n-1)p = 0.28$ $D = 5.41$ $De/t = 1.62$
 $fa/f'c = 0.266$ $fp/f'c = 0.355$ $fp = 49.7$
 $As = 32.0$ $8 \text{ } \phi \text{ } 7/8$

4PA4 $M = 333600$ $N = 37210$ $bxt = 40x40$
 $e = 8.96$
 $8 = \text{XXXXX}$ $t/e = 4.47$ $d'/t = 0.15$
 $p = 0.015$ $np = 0.225$ $C = 8.1$ $fc = 42.2$
 $(n-1)p = 0.21$ $D = 5.53$ $De/t = 1.24$
 $fa/f'c = \text{XX} 0.248$ $fp/f'c = 0.33$ $fp = 46.2$
 $As = 24.0$ $8 \text{ } \phi \text{ } 3/4$

4PA5 $M = 337700$ $N = 36370$ $bxt = 40x40$
 $e = 9.28$ $t/e = 4.31$ $d'/t = 0.15$
 $p = 0.018$ $np = 0.27$ $C = 7.8$ $fc = 45.9$
 $(n-1)p = 0.252$ $D = 5.50$ $De/t = 1.27$

$f_a/f'_c = 0.259$ $f_p/f'_c = 0.34$ $f_p = 47.6$
 $A_s = 28.8 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 7/8$

4PA6 $M = 311000$ $N = 41300$ $b_{xt} = 40 \times 40$
 $e = 7.34$ $t/e = 5.46$ $d'/t = 0.15$
 0.018 $n_p = 0.27$ $C = 8.5$ $f_c = 41.4$
 $(n-1)p = 0.252$ $D = 5.5$ $D_e/t = 1.01$
 $f_a/f'_c = 0.259$ $f_p/f'_c = 0.33$ $f_p = 46.2$
 $A_s = 28.8$ $4 \text{ } \phi \text{ } 3/4 + 4 \phi 7/8$

4PA7 $M = 179700$ $N = 29630$ $b_{xt} = 40 \times 40$
 $e = 6.06$ $e/t = 0.152$ $d'/t = 0.15$
 $p = 0.01$ $(n-1)p = 0.14$ $C = 1.61$ $f_c = 29.8$
 $D = 5.65$ $D_e/t = 0.85$
 $f_a/f'_c = 0.229$ $f_p/f'_c = 0.295$ $f_p = 41.3$
 $A_s = 16$ $8 \text{ } \phi \text{ } 5/8$

4PB1 $M = 333900$ $N = 42000$ $b_{xt} = 40 \times 50$

 $p = 0.01$
 $A_s = 20.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 5/8$

4PB2 $M = 222100$ $N = 43510$ $b_{xt} = 40 \times 40$

 $p = 0.01$
 $A_s = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 5/8$

4PB3 $M = 329500$ $N = 46500$ $b_{xt} = 40 \times 50$

 $p = 0.01$
 $A_s = 20.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 5/8$

4PB4 $M = 338500$ $N = 55250$ $b_{xt} = 40 \times 50$
 $e = 6.14$ $e/t = 0.122$ $d'/t = 0.10$
 $p = 0.01$ $(n-1)p = 0.122$ $C = 1.45$ $f_c = 40$
 $D = 5.39$ $D_e/t = 0.65$

$$D = 5.39 \quad De/t = 0.65$$

$$fa/fc = 0.23 \quad fp/fc = 0.288 \quad fp = 40.3$$

$$As = 20.0 \quad 4 \phi 3/4 + 4 \phi 5/8$$

$$\underline{4PB5} \quad M = 338500 \quad N = 55250 \quad bxt = 40x50$$

$$p = 0.01$$

$$As = 20.0 \text{ cm}^2 \quad 4 \phi 3/4 + 4 \phi 5/8$$

$$\underline{4PB6} \quad M = 211700 \quad N = 55470 \quad bxt = 40x50$$

$$p = 0.01$$

$$As = 20.0 \text{ cm}^2 \quad 4 \phi 3/4 + 4 \phi 5/8$$

$$\underline{4PB7} \quad M = 83700 \quad N = 41050 \quad bxt = \del{40x50} \\ 40x40$$

$$p = 0.01$$

$$As = 16.0 \quad 8 \phi 5/8$$

$$\underline{4PC1} \quad M = 40100 \quad N = 31020 \quad bxt = 30x40$$

$$p = 0.01$$

$$As = 12.0 \text{ cm}^2 \quad 4 \phi 3/4$$

$$\del{4PC2} \quad \underline{4PC4} \quad M = 45400 \quad N = 41190 \quad bxt = 40x40$$

$$p = 0.01$$

$$As = 16.0 \text{ cm}^2 \quad 8 \phi 5/8$$

$$\underline{4PC5} \quad M = 75900 \quad N = 42160 \quad bxt = 40x40$$

$$p = 0.01$$

$$As = 16.0 \text{ cm}^2 \quad 8 \phi 5/8$$

$$\underline{4PC6} \quad M = 60800 \quad N = 52150 \quad bxt = 40x50$$

$$p = 0.01$$

$$As = 20.0 \text{ cm}^2 \quad 4 \phi 3/4 + 4 \phi 5/8$$

4PC7 $M = 8300$ $N = 33750$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 5/8$

4PD1 $M = 122100$ $N = 20860$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4$

4PD2 $M = 113500$ $N = 29200$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4$

4PD3 $M = 110000$ $N = 28900$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4$

4PD4 $M = 7400$ $N = 46870$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 5/8$

4PD5 $M = 10300$ $N = 42690$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 5/8$

4PD6 $M = 47700$ $N = 47970$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0$ $4 \text{ } \phi \text{ } 3/4 + 4 \text{ } \phi \text{ } 5/8$

4PD7 $M = 32900$ $N = 33580$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 5/8$

4PE4 $M = 119300$ $N = 25480$ $bxt = 40x40$

$p = 0.01$

$As = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 5/8$

4PE5 $M = 158100$ $N = 34300$ $bxt = 40x40$

$p = 0.01$

$As = 16.0$ $8 \text{ } \phi \text{ } 5/8$

4PE6 $M = 99200$ $N = 34870$ $bxt = 40x40$

$p = 0.01$

$As = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 5/8$

4PE7 $M = 81100$ $N = 25300$ $bxt = 30x40$

$p = 0.01$

$As = 12.0$ $4 \text{ } \phi \text{ } 3/4$

PILARES DEL QUINTO PISO ($f'c = 140 \text{ Kg/cm}^2$)

| | | | |
|-------------|---------------------------|------------------|---------------|
| <u>5PA1</u> | $M = 486300$ | $N = 11200$ | $bxt = 40x40$ |
| | $e = 43.4$ | $t/e = 0.92$ | $d'/t = 0.15$ |
| $p = 0.015$ | $np = 0.225$ | $C = 7.1$ | $fc = 54$ |
| | $(n-1)p = 0.21$ | $D = 5.53$ | $De/t = 6.0$ |
| | $fa/f'c = 0.244$ | $fp/f'c = 0.40$ | $fp = 56$ |
| $As = 24.0$ | $4 \phi 3/4 + 4 \phi 7/8$ | | |
| <u>5PA2</u> | $M = 500700$ | $N = 15300$ | $bxt = 40x40$ |
| | $e = 32.7$ | $t/e = 1.22$ | $d'/t = 0.15$ |
| $p = 0.017$ | $np = 0.225$ | $C = 6.8$ | $fc = 53.2$ |
| | $(n-1)p = 0.238$ | $D = 5.51$ | $De/t = 4.5$ |
| | $fa/f'c = 0.255$ | $fp/f'c = 0.392$ | $fp = 55$ |
| $As = 27.2$ | $4 \phi 3/4 + 4 \phi 7/8$ | | |
| <u>5PA3</u> | $M = 482400$ | $N = 15010$ | $bxt = 40x40$ |
| | $e = 32.2$ | $t/e = 1.24$ | $d'/t = 0.15$ |
| $p = 0.016$ | $np = 0.24$ | $C = 6.9$ | $fc = 52$ |
| | $(n-1)p = 0.224$ | $D = 5.54$ | $De/t = 4.40$ |
| | $fa/f'c = 0.25$ | $fp/f'c = 0.391$ | $fp = 54.7$ |
| $As = 25.6$ | $4 \phi 3/4 + 4 \phi 7/8$ | | |
| <u>5PA4</u> | $M = 438500$ | $N = 14780$ | $bxt = 40x40$ |
| | $e = 29.7$ | $t/e = 1.35$ | $d'/t = 0.15$ |
| $p = 0.014$ | $np = 0.21$ | $C = 7.3$ | $fc = 50.2$ |
| | $(n-1)p = 0.196$ | $D = 5.57$ | $De/t = 4.14$ |
| | $fa/f'c = 0.245$ | $fp/f'c = 0.382$ | $fp = 53.5$ |
| $As = 22.4$ | $8 \phi 3/4$ | | |
| <u>5PA5</u> | $M = 38630$ | $N = 14420$ | $bxt = 40x40$ |
| | $e = 26.8$ | $t/e = 1.49$ | $d'/t = 0.15$ |
| $p = 0.01$ | $np = 0.15$ | $D = 8.4$ | $fc = 50.7$ |
| | $(n-1)p = 0.14$ | $D = 5.67$ | $De/t = 3.80$ |
| | $fa/f'c = 0.224$ | $fp/f'c = 0.37$ | $fp = 51.8$ |

$A_s = 16.0$ 8 \emptyset 5/8

5PA6 $M = 425500$ $N = 16110$ $bxt = 40x40$
 $e = 26.4$ $t/e = 0.151$ $d'/t = 0.15$
 $p = 0.019$ $np = 0.195$ $C = 7.5$ $f_c = 49.8$
 $(n-1)p = 0.182$ $D = 5.6$ $De/t = 3.7$
 $f_a/f'_c = 0.24$ $f_p/f'_c = 0.378$ $f_p = 52.9$

$A_s = 20.8 \text{ cm}^2$ 4 \emptyset 1"

5PA7 $M = 194000$ $N = 11230$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0$ 8 \emptyset 5/8

5PB1 $M = 335500$ $N = 14950$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0 \text{ cm}^2$ 4 \emptyset 1"

5PB2 $M = 221700$ $N = 16680$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0 \text{ cm}^2$ 8 \emptyset 5/8

5PB3 $M = 329500$ $N = 16390$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0 \text{ cm}^2$ 4 \emptyset 1"

5PB4 $M = 332100$ $N = 19370$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0$ 4 \emptyset 1"

5PB5 $M = 338500$ $N = 19020$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0 \text{ cm}^2$ 4 \emptyset 1"

5PB6 $M = 315200$ $N = 21820$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0 \text{ cm}^2$ ~~XXXXXX~~ $4 \phi 1"$

5PB7 $M = 103000$ $N = 15200$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0$ $8 \phi 5/8$

5PC1 $M = 40100$ $N = 11440$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0$ $4 \phi 3/4$

~~5PC2~~ 5PC4 $M = 45400$ $N = 15460$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0 \text{ cm}^2$ $8 \phi 5/8$

5PC5 $M = 75900$ $N = 15460$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0$ $8 \phi 5/8$

5PC6 $M = 60800$ $N = 18140$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0$ $4 \phi 1"$

5PC7 $M = 15800$ $M = 13260$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0$ $8 \phi 5/8$

5PD1 $M = 122100$ $N = 7880$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0$ $4 \phi 3/4$

5PD2 $M = 116000$ $N = 11210$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0$ $4 \text{ } \phi \text{ } 3/4$

5PD3 $M = 110000$ $N = 11110$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0$ $4 \text{ } \phi \text{ } 3/4$

5PD4 $M = 41700$ $N = 14710$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0$ $4 \text{ } \phi \text{ } 1"$

5PD5 $M = 22500$ $N = 15460$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0$ $8 \text{ } \phi \text{ } 5/8$

5PD6 $M = 65000$ $N = 18210$ $bxt = 40x50$

$p = 0.01$

$A_s = 20.0$ $4 \text{ } \phi \text{ } 1"$

5PD7 $M = 32900$ $N = 13190$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0$ $8 \text{ } \phi \text{ } 5/8$

5PE4 $M = 113300$ $N = 8190$ $bxt = 40x40$

~~PS~~ $p = 0.01$

$A_s = 16.0$ $8 \text{ } \phi \text{ } 5/8$

5PE5 $M = 1581$ $N = 11420$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0$ $8 \text{ } \phi \text{ } 5/8$

5PE6 $M = 162800$ $N = 13460$ $bxt = 40x40$

$p = 0.01$

$A_s = 16.0 \text{ cm}^2$ $8 \text{ } \phi \text{ } 5/8$

5PE7 $M = 86600$ $N = 9300$ $bxt = 30x40$

$p = 0.01$

$A_s = 12.0 \text{ cm}^2$ $4 \text{ } \phi \text{ } 3/4$

RAMPA DEL SOTANO

La rampa se compone de una losa de 16 cm. apoyada en dos vigas marginales de 30x60 cm.

LOSA ($f_c = 210 \text{ Kg/cm}^2$) $L = 4.30 \text{ m.}$ $h = 16 \text{ cm.}$

pp 400
piso 100
a/c 600 1100 Kg/m.l.

Momento positivo: $M = 1/8(wl^2) = 1100 \times 4.3^2 / 8 = 2540 \text{ Kgm.}$

Altura útil:

$$d = \frac{254000}{16.6 \times 100} = 12.4 = 13$$

$$h = 13 + 3 = 16 \text{ cm.}$$

Area de acero: $A_s = 254000 / 1400 \times 0.866 \times 13 = 16.1 \text{ cm}^2$

$$\phi 3/4 \text{ a } 17 \text{ cm.}$$

Momento negativo: $M = 1/24(wl^2) = 1100 \times 4.3^2 / 24 = 850 \text{ Kgm.}$

$$A_s = 85000 / 1400 \times 0.866 \times 13 = 5.4 \text{ cm}^2$$

$$A_{s_{min}} = 0.0025 \times 100 \times 13 = 3.3 \text{ cm}^2$$

$$\phi 3/4 \text{ a } 51 \text{ cm.} + \phi 1/4 \text{ a } 51 \text{ cm.}$$

Acero de reparticion y temperatura:

$$A_{s_{temp}} = 0.0025 \times 100 \times 13 = 3.3 \text{ cm}^2$$

$$\phi 1/2 \text{ a } 38 \text{ cm.}$$

VIGAS MARGINALES ($f_c = 210 \text{ Kg/cm}^2$) $L = 6.60 \text{ m.}$; $b \times t = 30 \times 60$

Pp 450
Losa 2360 2770 Kg/m.l.

Momento positivo: $M = 1/12(wl^2) = 2770 \times 6.6^2 / 12 = 10100 \text{ Kgm.}$

$$M_c = 16.6 \times 30 \times 55^2 = 15100 \text{ Kgm.}$$

Acero: $A_s = 10100 \phi / 1400 \times 0.866 \times 55 = 15.1 \text{ cm}^2$

$$3 \phi 1"$$

Momento negativo: $M = 1/12(wl^2) = 10100 \text{ Kgm.}$

Acero: $A_s = 15.1 \text{ cm}^2$

Esfuerzo Cort.: $V = 9150 \text{ Kg.}$ $v_0 = 0.03 f_c$

Adherencia: $E_0 = 9150 / 15.8 \times 0.866 \times 55 = 12.1 \text{ cm.}$

ESCALERAS

$$f_c = 140 \text{ Kg/cm}^2$$

$$L = 4.40 \text{ m.}$$

$$B = 1.10 \text{ m.}$$

$$h = 18 \text{ cm.}$$

$$\text{Losa} = 0.18 \times 1.10 \times 1.00 \times 2500 = 500 \text{ Kg/m.l.}$$

$$\text{peldaños:} \quad 200 \quad "$$

$$\text{a/c.:} \quad \underline{500} \quad "$$

$$w = 1200 \text{ Kg/m.l.}$$

Momento Positivo:

$$M = 1/10(wl^2) = 1200 \times 4.4^2 / 10 = 2330 \text{ Kgm.}$$

$$d = \frac{233000}{11 \times 110} = 14 \text{ cm} = 15 \text{ cm.}$$

$$A_s = 233000 / 1400 \times 0.866 \times 15 = 12.9 \text{ cm}^2$$

$$7 \text{ } \phi \text{ } 5/8$$

Momento Negativo:

$$M = 1/16(wl^2) = 1200 \times 4.4^2 / 16 = 1450 \text{ Kgm.}$$

$$A_s = 145000 / 1400 \times 0.866 \times 15 = 8 \text{ cm}^2$$

$$A_{s_{min}} = 0.0025 \times 110 \times 15 = 4.13 \text{ cm}^2$$

$$5 \text{ } \phi \text{ } 5/8$$

Acero de temperatura:

$$A_{s_{temp}} = 0.002 \times 110 \times 15 = 3.9 \text{ cm}^2$$

$$\phi \text{ } 3/8 \text{ a } 24 \text{ cm.}$$

$$L = 3.10$$

$$b = 1.10$$

$$h = 14 \text{ cm.}$$

$$\text{Losa} = 0.14 \times 1.10 \times 1.00 \times 2500 = 400 \text{ Kg/m.l.}$$

$$\text{peldaños:} \quad 200 \quad "$$

$$\text{a/c.:} \quad \underline{500} \quad "$$

$$w = 1100 \text{ Kg/m.l.}$$

Momento Positivo:

$$M = 1/10(wl^2) = 1100 \times 3.1^2 / 10 = 1050 \text{ Kgm.}$$

$$d = \frac{105000}{11 \times 110} = 9.3 = 11 \text{ cm.}$$

$$A_s = 105000/1400 \times 0.866 \times 11 = 7.9 \text{ cm}^2$$

7 ϕ 1/2

Momento Negativo:

$$M = 1/16(wl^2) = 1100 \times 3.1^2 / 16 = 660 \text{ Kgm.}$$

$$A_s = 66000/1400 \times 0.866 \times 11 = 5.0 \text{ cm}^2$$

4 ϕ 1/2

Acero de temperatura:

$$A_{s_{temp}} = 0.002 \times 100 \times 11 = 2.2 \text{ cm}^2$$

ϕ 3/8 a 32 cm.

ASCENSOR

El ascensor lo vamos a diseñar considerando cuatro pilares de 30x30 cm. en cada una de las esquinas, que soportaran las vigas que concurren en esos puntos; las paredes del ascensor seran muros de 20 cm. de espesor.

METRA DO

| | | |
|------|---------|----|
| 5° | Muro | 15 |
| | Losa | 40 |
| Tip. | Tabique | 8 |
| | Losa | 40 |
| Sot. | Tabique | 25 |
| | Losa | 40 |

CARGAS

| | | |
|------|---------|-------|
| 5° | Muro | 22.5 |
| | Losa | 24.0 |
| | s/c | 4.0 |
| | p.p. | 24.0 |
| | SUMA | 84.5 |
| 4° | Tabique | 6.0 |
| | Losa | 28.0 |
| | s/c. | 10.0 |
| | p.p. | 24.0 |
| | SUMA | 152.5 |
| 3° | Tabique | 6.0 |
| | Losa | 28.0 |
| | s/c. | 9.0 |
| | p.p. | 24.0 |
| | SUMA | 219.5 |
| 2° | Tabique | 6.0 |
| | Losa | 28.0 |
| | s/c. | 8.0 |
| | p.p. | 24.0 |
| | SUMA | 285.5 |
| 1° | Tabique | 6.0 |
| | Losa | 28.0 |
| | s/c. | 7.0 |
| | p.p. | 31.5 |
| | SUMA | 358.0 |
| Sot. | Tabique | 25.0 |
| | Losa | 32.0 |
| | s/c. | 16.0 |
| | p.p. | 22.5 |
| | SUMA | 453.5 |

ZAPATA DEL ASCENSOR

$P = 453500 \text{ Kg. } b \times t = 4.60 \times 2.15 \text{ m.}$

Carga total: $W = 453500 \times 1.07 = 485000 \text{ Kg.}$

Area: $A = 485000 / 2.5 = 194000 \text{ cm}^2 = (b + 2c)(t + c)$

$c = 60 \text{ cm.}$

Dimensiones: $\bar{A} = 5.80 \text{ m. } \bar{B} = 3.40 \text{ m.}$

Area: $A = 197000 \text{ cm}^2$

presion neta $w = 453500 / 197000 = 2.3 \text{ Kg/cm}^2$

Calculo de "d":

$(36.7 + 4 \times 2.3)d^2 + 2 \times 675(4.58 + 2.3)d - 2.3(197000 - 99000) = 0$

$45.9 d^2 + 9300d - 225000 = 0$

Altura util: $d = 22 \text{ cm} = 25 \text{ cm.}$

Momentos y areas de acero:

$M_A = 2.3 \times 580 \times 60^2 / 2 = 2400000 \text{ Kg-cm.}$

$A_s = 2400000 \times 0.85 / 1400 \times 0.866 \times 25 = 67.4$

$E_o = 2.3 \times 580 \times 60 \times 0.85 / 11.8 \times 0.866 \times 25 = 267 \text{ cm.}$

$45 \text{ } \phi \text{ } 3/4$

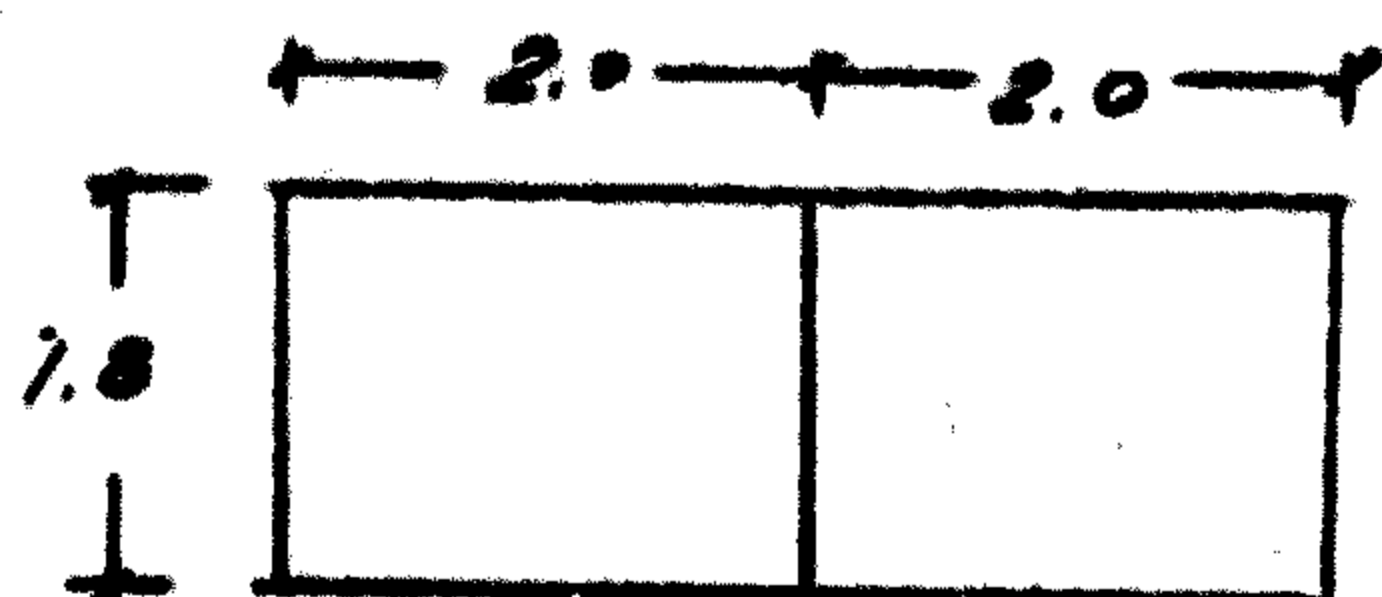
$M_B = 2.3 \times 340 \times 60^2 / 2 = 1410000 \text{ Kg-cm.}$

$A_s = 1410000 \times 0.85 / 1400 \times 0.866 \times 25 = 39.5 \text{ cm}^2$

$E_o = 2.3 \times 340 \times 60 \times 0.85 / 11.8 \times 0.866 \times 25 = 156 \text{ cm.}$

$26 \text{ } \phi \text{ } 3/4$

Ademas de los momentos en la cara exterior de las paredes, se producen momentos negativos en los espacios comprendidos entre las paredes del ascensor. Para el cálculo de momentos podemos considerar la zapata como una losa armada en dos sentidos apoyada en las paredes del ascensor.



$r = \frac{0.87 \times 2.0}{1.8} = 0.966 \quad C = 0.27$

$C_s = 0.24$

$r_1 = \frac{1.8}{0.87 \times 2.0} = 1.035$

$C'_s = 0.26$

$C'_{s1} = 0.23$

Momento negativo: $M = C(1/10)wl^2 = 0.27 \times 23000 \times 2^2 / 10$

$= 2480 \text{ Kgm.}$

$A_s = 248000 / 1400 \times 0.866 \times 25 = 8.2 \text{ cm}^2$

$\phi \text{ } 3/4 \text{ a } 35 \text{ cm.}$

Momento positivo:

$$M = C(1/16)wl^2 = 0.27 \times 23000 \times 2^2 / 16 = 1550 \text{ Kgm.}$$

$$As = 155000 / 1400 \times 0.866 \times 25 = 5.1 \text{ cm}^2$$

Ø 3/4 a 45 cm.

Momento negativo en la luz menor:

$$M' = C'(1/10)wl^2 = 0.26 \times 23000 \times 1.8^2 / 10 = 1940 \text{ Kgm.}$$

$$As = 194000 / 1400 \times 0.866 \times 25 = 6.4 \text{ cm}^2$$

Ø 3/4 a 45 cm.

- o - o -

COLUMNAS DEL ASCENSOR (f'c = 140 Kg/cm²) bxt = 30x30 cm.

La carga proporcional que recibe del primer piso es:

$$P' = \frac{0.09}{3} \times 358000 = 10750 \text{ Kg.}$$

La columna mas cargada recibe ademas las cargas de las vigas:

$$SV3CD = 17011 \text{ Kg. } y$$

$$SVC34 = 1551 \text{ "}$$

$$\text{Peso propio: } p.p. = 0.8 \times 0.3 \times 4.2 \times 2500 = 945 \text{ Kg.}$$

$$\text{Carga total: } W = 10750 + 945 + 17011 + 1551 = 30257 \text{ Kg.}$$

Cuantía:

$$Pg = \frac{\frac{30257}{0.8 \times 900} - 0.225 \times 140}{1400} = 0.0075 \approx 0.01$$

$$\text{Acero: } Ag = 0.01 \times 900 = 9 \text{ cm}^2$$

4 Ø 3/4

- o - o -

MUROS DEL ASCENSOR (f'c = 140 Kg/cm²) e = 20 cm.

$$h/e = 4/0.2 = 20.0$$

Por interpolación entre las relaciones:

$$h/e = 10 \dots\dots\dots fc = 0.25f'c$$

$$h/e = 25 \dots\dots\dots fc = 0.15f'c$$

se tiene:

$$fc = 0.183 \times 140 = 25.6 \text{ Kg/cm}^2$$

Cargas por metro lineal de muro:

$$P' = 0.2 \times 358000 / 3 = 23900 \text{ Kg.}$$

Peso propio: p.p. = 0.2x1.00x4.2x2500 = 2100 Kg.

Losa: L = 2250

Carga total: W = 23900 + 2100 + 2250 = 28250 Kg.

Comprobacion del esfuerzo en el concreto:

$$f_c = 28250/20x100 = 14.1 \text{ Kg/cm}^2$$

que vemos que es menor que el esfuerzo de trabajo admisible que hemos calculado igual a 25.6 Kg/cm²

Armadura de acero:

$$A_s = 0.0025 \times 20 \times 100 = 5 \text{ cm}^2$$

$$\varnothing 1/2 \text{ a } 25 \text{ cm.}$$

que se colocará al centro del muro, y se armará tanto vertical como horizontalmente.

Ademas de la armadura horizontal y vertical, se colocará en el perímetro de los vanos de las puertas que dan acceso al ascensor en cada piso, dos barras de 5/8" ancladas de 50 cm.

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- o -

PRESUPUESTO

CUADROS DE METRADOS

| | CONCRETO | Cemento | Arena | Piedra |
|---------------|---------------|---------------|---------------|---------------|
| SOTANO | 273 m3 | 107 m3 | 107 m3 | 214 m3 |
| 1er. Piso | 123 " | 48 " | 48 " | 96 " |
| 2º " | 110 " | 25 " | 50 " | 100 " |
| 3er. " | 110 " | 25 " | 50 " | 100 " |
| 4º " | 110 " | 25 " | 50 " | 100 " |
| 5º " | 99 " | 22 " | 44 " | 88 " |
| TOTAL: | 823 m3 | 252 m3 | 394 m3 | 698 m3 |

Cemento.- Un metro cúbico equivalen a 8.83 barriles, teniendo el barril una capacidad de 4 pies cúbicos. Luego haciendo la reduccion correspondiente, los 252 m3 de cemento son 2230 barriles.

| | FIERROS | | | | | | | | | |
|-------------------|-------------|-------------|-------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|
| | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | 1" | ϕ 1" | 1 1/8 | 1 1/4 |
| SOTANO | 390 | 580 | 2316 | 2580 | 8300 | 1620 | 480 | 2500 | 5890 | 3600 |
| 1er. Piso | 455 | 1650 | 1258 | 2250 | 970 | 1690 | 870 | 2280 | 1280 | 320 |
| 2º " | 455 | 1650 | 1258 | 2230 | 550 | 820 | 880 | 730 | 2350 | 100 |
| 3er. " | 455 | 1650 | 1258 | 2370 | 830 | 1330 | 420 | 3540 | 200 | 100 |
| 4º " | 585 | 1370 | 1258 | 2800 | 1210 | 670 | 730 | --- | --- | --- |
| 5º " | 700 | 1420 | 1422 | 2100 | 1100 | 430 | 170 | --- | --- | --- |
| PARCIALES: | 3040 | 8320 | 8770 | 14380 | 12960 | 6560 | 3550 | 9050 | 9720 | 4120 |

TOTAL: 8500 Kgs.

COSTOS

MATERIALES .-

| | | | | | | |
|-------|------------------|---------|------------|------------------|-------|---------------|
| 2230 | barriles | Cemento | a S/.50.00 | barriles | ..... | S/. 111500.00 |
| 350 | m3 | Arena | " " 16.00 | m3 | ..... | " 5600.00 |
| 670 | " | Piedra | " " 32.00 | " | ..... | " 21440.00 |
| 16000 | pie ² | Madera | " " 3.20 | pie ² | ..... | " 51200.00 |
| 8500 | Kgs. | Fierro | " " 3.50 | Kg. | ..... | " 29750.00 |

MANO DE OBRA .-

| | | | | | |
|---|-----------------------|------------|-------|------|-----------------|
| Excavacion de 1800 m3 | a S/.8.00 | m3 | ..... | " | 14400.00 |
| Eliminacion de Desmonte | a " 8.00 | " | ..... | " | 14400.00 |
| Doblado y colocacion de 8500 Kgs. de fierro | | | | | |
| | a S/.0.50 | kg. | ..... | " | 4250.00 |
| Vaciado, colocacion de encofrado y desencofrado | | | | | |
| | de 823 m3 de concreto | a S/.30.00 | m3 | .... | " 24690.00 |
| Aligerados, 2200 m2 | a S/.80.00 | m2 | ..... | " | 176000.00 |
| | | | | | |
| Direccion Tecnica y Administracion | 10% | ..... |  | " | 45323.00 |
| Imprevistos | 10% | ..... |  | " | <u>45323.00</u> |

COSTO TOTAL S/. 543876.00

SON: QUINIENTOS CUARENTITRES MIL OCHOCIENTOS SETENTISEIS
80/100 SOLES ORO.