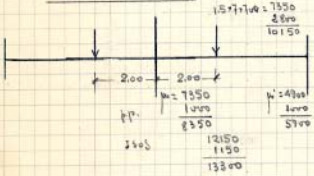
DINTELES HORIZONTALES INTERIORES

NORMAL 55×30

CENTRO	M = 8 000 mkg	a = 4.70	c = 12	M : a = 4.7 Tons / 2a = 12 ton	Ω = 8.2 + 1.7 = 13.9 cm² — 2φ20 + 2φ22 (14.3) / 2φ18 + 2φ25 (14.9)
EXTREMO	10 000	a = 2.30	1.05 × 30 × 0.55 = 17.3 cm² / 0.60 × 30 × 0.55 = 10 cm²	4φ25 (19.6) / 2φ25 (9.8)	
EXTREMO	5 500	a = 0.30	0.60 × 30 × 0.55 = 10 cm²	2φ25 (9.8)	

CON BROCHALES



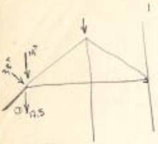
Salen momentos de empotramiento mas reducidos así como cortantes.

Aumentar estribos en zona intermedia

1393 2786

GRADERIA INFERIOR

ESFUERZOS LONGITUDINALES



En nudo inferior:

voladizo inferior: 3.00 × 7000 = 21 000

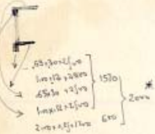
dintel superior { ural. 2.00 × 7000 = 14 000

{ hiper. $\frac{21905-7475}{5.00}$ = ↓ 2800 ↓ 35000

En nudo superior:

dintel superior { 2.00 × 7000 = 14 000 ↓

{ hiper: - 28 ↓ - 2 800



por viga inclinada: V = 67 000 kg — Ver distribución gráfica

Transmitido por viga long: 7 × 2000* = 14 000

Total a pilar: 95 000 kg.

Acimientos, semisuma medio recinto + pilar ∼ 15 000

110 000 kg

En la hipótesis de máximo momento flector en centro de dintel la reacción correspondiente es menor pues hay que disminuir en 6 Ton la reacción en nudo superior: la disminución de hasta es 6 × 2 = 12 Ton

En la hipótesis de voladizo inferior sin sobrecarga

CALCULO PILARES

← ojo - en la definitiva poco momento

SUPERIOR: N = 95 000 kg. M = 3000 kg ε = 0.03 . $\frac{\varepsilon}{c} = \frac{3}{45} = 0.07$

Sección 45×45 (2025 cm²) 4 ϕ 30 (28,3) × 1200 = 34 000 kg. $\sigma_H = \frac{61}{2.02} = 30.5$ kg/cm²

INFERIOR La flexión no llega a 1000 mkg y es insignificante:

N = 110 Ton. W = 20 cm. 4 ϕ 30 = 28,3 × 1200 = 34 Ton. $\sigma_H = \frac{76}{2.02} = 38$ kg/cm²

CIMIENTOS: $\frac{110\,000}{2}$ = 55 000 cm² ϕ 2.55. Con ϕ 2.50: $\frac{110}{4.90}$ = 2.2 kg/cm²

GRADERIA INFERIOR

BARRA HORIZONTAL IZQDA

$M = 5600$ mkg
$N = 61000$ kg

sección 50×40 $\quad \varepsilon = 0{,}092$ $\quad e = 0{,}184$

$\overline{w} = \frac{50 \times 40 \times 50}{61000} = 1{,}64$ $\quad \alpha = 0{,}10$

$\Omega = 0{,}10 \times \frac{50+40}{15} = 13{,}4\ cm^2$

2 ϕ 20 (14,1 cm²)

BARRA HORIZONTAL DCHA

EXTREMO $M = 10000$ mkg $\quad \varepsilon = 1{,}55$ $\quad \frac{\varepsilon+c}{\varepsilon+c} = \frac{1{,}35}{1{,}95} = 0{,}7$

$N = 61000$ kg

sección 50×30 $\quad$ Armadura $4\phi 20 + 1\phi 20 = 28\ cm^2$ $\quad \sigma_h = \frac{28}{1{,}5} = 22\ kg/cm^2$

CENTRO $M = 7000$ $\quad \varepsilon = 1{,}15$ $\quad \frac{\varepsilon+c}{\varepsilon+c} = \frac{1{,}05}{1{,}45} = 0{,}6$

$\begin{cases} 1{,}35 \times 16{,}5 = 22{,}3 \\ 1{,}20 \times 16{,}5 = 20\ cm^2 \end{cases}$ $\quad 3\phi 20 = 21{,}2$

$\begin{cases} 1{,}10 \times 16{,}5 = 18{,}2 \\ 0{,}7 \times 16{,}5 = 11{,}5 \end{cases}$ $\quad 2\phi 20 = 14{,}1$

RIOSTRA INCLINADA

EXTREMO
$M = 4525$
$T = 67000$ kg. $\quad 50 \times 30$ $\quad \varepsilon = 0{,}068$ $\quad e = 0{,}136$

CENTRO
$M = 0$
$T = 67000$

$\frac{67000}{1200} = 56\ cm^2$ $\quad 6\phi 35$ (57,7)

GRADERIA

CENTRO
$M = 12000$ mkg (8·5000) $\quad \varepsilon = 0{,}21$
$T = 58000$ kg (70000) $\quad e = 1{,}17$

$w = 2{,}9$ $\quad \mu = \frac{40 \times 60^2 \times 50}{12000} = 60$

$\Omega = 0{,}10$

EXTREMO
$M = 21000$
$T = 70000$ $\quad \varepsilon = 0{,}30$ $\quad e = 0{,}50$

$w = 2{,}00$ $\quad \mu = \frac{40 \times 60^2 \times 50}{21000 + 70} = 94$

$\Omega = 0{,}10 \times \frac{60+40}{15} = 16\ cm^2$

2 ϕ 20 (19,2)

911

GRADERIA SUPERIOR

PILARES

IZQUIERDO

$N = 5.5 \times 7000 = 38\,500$ kg | $\varepsilon = 0.16$ (45×45) $w = \frac{45^2 \times 50}{38\,500} = 2.6$

$M = 40\,000$ | $e = [illegible]$ $Q = 0.05$ $\Omega = 0.05\,\frac{45^2}{15} = 6.8\ cm^2$ 2φ30 (14.14)

CENTRAL

SUPERIOR

$N = 100\,000$ (45×45) } $\varepsilon = 0.10$ $w = \frac{45^2 \times 50}{100\,000} = 1.01$

$M = 15\,000$ mkg } $e = 0.22$ $Q = 0.40$ $\Omega = 0.40\,\frac{45^2}{15} = 54\ cm^2$ 5φ35

$\varepsilon = 0.15$

55×55 $e = 0.27$ } $Q = 0.23$ $\Omega = 0.23 \times \frac{55^2}{15} = 46\ cm^2$ 5φ35 (48.1)

$w = \frac{55^2 \times 50}{100\,000} = 1.5$

Piso 2° $N = 113\,000$ } $\varepsilon = 0.03$

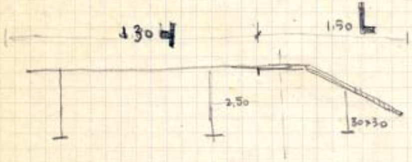
$M = 3\,000$ mkg } $e = 0.05$ $Q = 0.05$ 4φ35 50^T $\frac{70\,000}{55 \times 55}$

$w = 1.5$

Piso 1° $N = 160\,000$ 4φ35 = 38.5 × 1200 = 46^T $\frac{120\,000}{55 \times 55} = \sim 40$ kg

SOPORTE VOLADIZO φ45 $N = 60\,000$ $w = 1590\ cm^2$ 8φ20 = 25 cm^2 × 1200 = 30^T $\frac{30\,000}{1590} = \sim 20\ kg/cm^2$

ESCALERA A GRADERIA ALTA

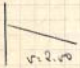


VOLADIZO 1.50

$M = \frac{1}{2}\ 750 \times 1.5^2 = 850\ mkg$ .. c=12 .. w=7.88 cm²

7φ12 (7.9)

VIGA VOLADA



$M = \frac{1}{2}\ (750 \times 1.50 + 0.40 \times 0.30 \times 2500)\ 2.0^2 = 2860\ mkg$

(1130) (300)

a=1.00 .. M:a = 2.86 Ton w=5.2 cm² 2φ20 (6.3)
c=0.12

cercos verticales cada

VIGA CONTINUA

carga en zona de grada: 0.80 × 600 = 480

130 × 0.10 × 2500 = 325

1.4 × 0.4 × 2500 = 400

~ 1200 kg/ml

carga en zona de escalera: 1400 ..

$M_{cont} = \frac{1}{12}\ 1200 \times 49 = 4900\ mkg$ $M_{7-1} = \frac{1}{12}\ 1400 \times 49 = 5700$

-200
+300
-1370
+1350 } 5780

① 5000 +5700 ② +3000

7500 | -5000 | -5700
5780 | - 680 | +2700
1720 | -100 | - 680
| -5780 | +600
| | ~2900

8500
-4340
4160

Extremo: 5700 .. M:a = 5.7 Ton .. a=1.00, c=10

w=11.0 4φ20 .. 12.6

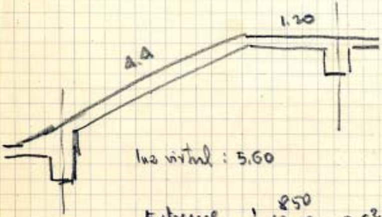
Centro: 4160 .. 0.44 × 40 × 0.5 = 8.8 cm²

3φ20 (9.4)

240
68
177
57
28 8660
85

ESCALERA ANCHA

TRIBUNA MADRID

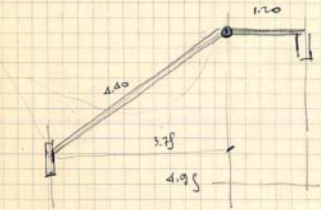


p.p. 0.16 × 2500 = 400
c.p. 0.08 × 2500 = 50
S.C. = 400
850 850

luz virtual : 5.60

Extremo $\frac{1}{10}$ ~~1300~~ 850 × 5,6² = ~~4000~~ 2660 ~~[illegible]~~ 14cm² 10φ14 (15,4)

Centro $\frac{1}{12}$ ~~1300~~ 850 × 5,6² = ~~3400~~ 2220 ~~[illegible]~~



$\frac{1}{2}$ 850 × 1.2² + 2 × 850 × 1.2 = 2650 mkg
610 2040

Inclinada

$\frac{1}{8}$ 850 × 4.4² = 2050 mkg   0.7×16 = 12cm² 8φ14
0.2×16 = 4cm² 3½

$\frac{1}{16}$ 850 × 4.4² = 1025 mkg   7cm² 5φ14 por

Horizontal

M = 2650.   0.8 × 1.8 = 14.4   9φ14 (14)
0.2 × 1.6 = 3,6   3φ14

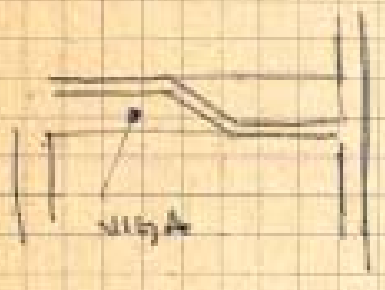
ESCALERAS

PRIMERA PLANTA d = 16 $p = 400$, $q = 400$ } 800

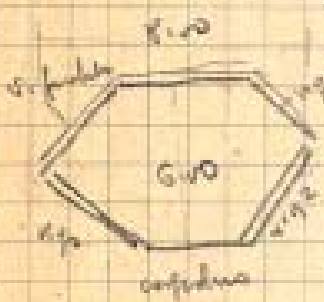
Loja de 4.00 M :

M.F extremos $\frac{1}{15} pL^2 = 850$ mkg

centro $\frac{1}{10} pL^2 = 1280$ "



LOJA EXAGONAL d = 20 500, 400 } 900



M.

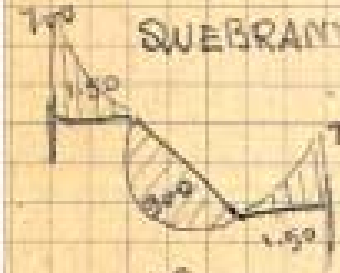
M.F Extremos $\frac{1}{20} pL^2 = 1620$

Centro $\frac{1}{12} pL^2 = 2700$ mkg

ESCALERA NORMAL

VUELO L = 1.50 d = 14 350, 350 } 700 5ϕ10

M.F Máxima : $\frac{1}{2} 700 \cdot 1.5^2 = 790$ mkg 7ϕ14

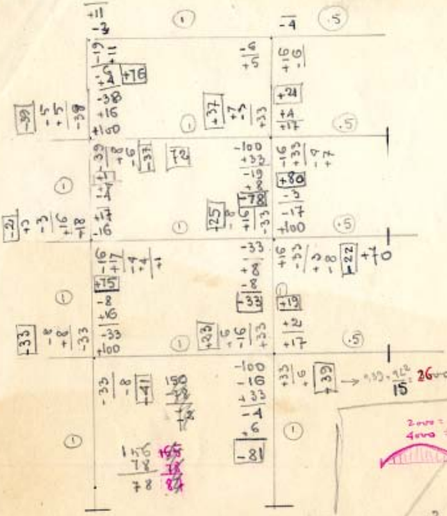


SUBRANTO

Zona intermedia : $\frac{1}{8} pL^2_{3.00} = 900$ mkg

460 VIGA CON FORMA ESCALERA

CARGA ALTERNADA



→ $0{,}33 \cdot \frac{qL^2}{15} = 2600$ mt (extradorso)

2000 = p = q
4000 = p + q

$\frac{0.75}{12} - 196$ 46 130%

$\frac{1}{15}\,4000 \cdot 7^2 = 13\,000$

Extremos: $\frac{1}{12}(p+q)L^2 = \frac{1}{12}\,3500 \cdot 7^2 = 14250$ mt

Maximos momentos flectores {

Centro: $\frac{1}{24}pL^2 + \frac{0.72}{12}qL^2 = 8750$ mt

$\frac{1}{30}pL^2 + \frac{0.90}{15}qL^2 = 0{,}09\,pL^2 = 8800$ mt

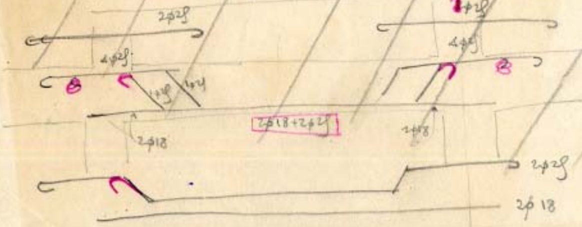
134
142

$\frac{5}{48} - \frac{1}{15}$ 0,56

Centro: $M : a = \frac{8750}{0.30} = 29$ Ton (d = 12) $w = 47.5 + 0.3 = 14{,}2$ cm² 2φ25 + 2φ18 { 50 / 1200

Extremos: a = 30 a = 65 { λ = 1,1 / λ' 0,3 ; 0,11 + 30 + 15 = 21,5 cm² ; 0,03 + 30 + 65 : 5,9 cm² 19,5 + 1,6 = 21,2 4φ25 + 2φ10 ; 5,1 cm² 2φ18

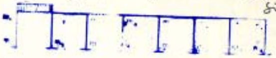
Esf. C. $\frac{1}{2}\,3500 \cdot 7 = 12\,250$ kg $T = \frac{1}{3.5}\,T = 4000$ kg $S = \frac{55 \cdot 1200 \cdot 1.0}{4000} = \sim 16$ cm 2φ10 φ de 8 $T = 1.4\,\frac{50 \cdot 1200 \cdot 4.9}{50} = \sim 8000$



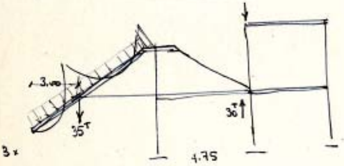
134
65
770
804
881

5,9
9,82
15,81

COMPROBACION GRADERIO BAJO



CON LOSA SUPERIOR SIN ESCALERA



Losas sup: 0.14 × 2500 × $\frac{4.75}{2}$ × 7.00 = 9000 kg

Losa inf: 2 × 9000 = 18000

18000

Con pilar hasta graderia alta: 3000

21000

Riostra inclinada 3 × 0.5 × 0,3 × 2500 ~ 1000

22000

Queda en equilibrio perfecto

SIN LOSA SUPERIOR Y SIN ESCALERA — Prolongar pilar hasta graderia alta

Piso superior { Pilar: 1750 = 1750; Vigas: 0.55×0.30×7.00, ½ 0.65×0.30×4.50 } 2500 = 4000

5750 — 5750

Piso inferior: Vigas 0.5×0.3×7.00, 0.65×0.30×4.50 } 5000 — 8000

Losa 4×7×0.12×2500 : 8400

13400 — 13400

Riostra inclinada 1000 — 1000

20100

T = 10 Ton

CON LOSA SUPERIOR SIN ESCALERA

Losa: 4200 — 4200

24300

T = 6 Ton

Tc = 4 Ton

SIN LOSA CON ESCALERA

3.00 × 2.50 × 0,15 × 2500 — 3000 — 23100

T = 7 Ton

Tc = 5 Ton

27300

CON LOSA Y ESCALERA

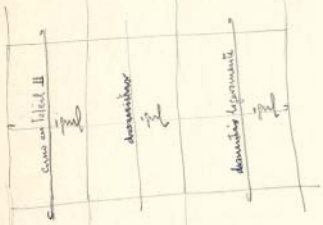
CON PILAR HASTA GRADERIA ALTA — 2500 kg — Max { Tc = 3 Ton, T = 5 T }

sin losa T = 5 Ton

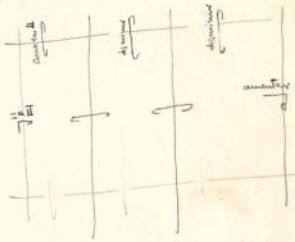
CON PILAR HASTA CIMIENTOS — 1700 kg — $\frac{3000}{0.75 \times 10^4}$ = 0,4 kg/cm²

ARMADURAS II

ARMADURAS EN EL CENTRO
COMPARACIÓN CON II

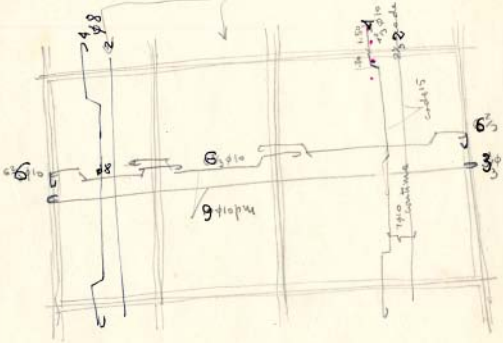


ARMADURAS EN EXTREMOS



Franja vigas longitudinales intermedias: $\frac{1.15}{12} p_t \cdot L_t^2 \cdot$

$\beta_t = \frac{L_t^4}{L_t^4 + L_t^4} = 0.17\ p.$ $\quad M = \frac{1.15}{12} \cdot 0.83 \cdot p' \cdot L_t^2 = 1300$ $\quad \begin{cases} 10.20\text{cm}^2 & 13\phi & 10.20 \\ 3.0 \text{ "} & 1\phi & 3.14 \end{cases}$



5.4

3φ10 2.4
6φ8 3.01
5.4

REPARTICION DE CARGAS

TOTAL I ALTERNADA

$① 3.4\, p_y L_y^4 = p_x L_x^4$

$p_y = \frac{3.4 L_x^4}{L_y^4 + 3.4 L_x^4}\, p$

$p_x = \frac{L_y^4}{L_y^4 + 3.4 L_x^4}\, p$

$① 1.7\, p_y L_y^4 = p_x L_x^4$

$p_y = \frac{1.7 L_x^4}{L_y^4 + 1.7 L_x^4}\, p$

$p_x = \frac{L_y^4}{L_y^4 + 1.7 L_x^4}\, p$

II

③ $p_y = \frac{1.6 L_x^4}{L_y^4 + 1.6 L_x^4}$

$p_x = \frac{L_y^4}{L_y^4 + 1.6 L_x^4}$

		L^4	3.4	1.7	L^4	1.6	L^4	1.3	$\frac{L^4}{L^4+L^4}$		$\frac{L^4}{L^4+L^4}$	
			①	②		③	④	①	①	②	③	④
L_x	5.20	729	2480	1240		1115	948		0.55	0.32	0.55	0.32
L_y	7.00	2400	2480	3640		3515	3060		0.45	0.70	0.45	0.70
L_x	4.70	488										
L_y	7.00	2400										
		2888										

780 640 0.35 0.21
3180 3640 0.65 0.79

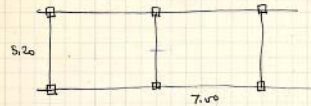
III

Vemos que el caso de dos y tres necesidad es similar

La alternada es (casi) siempre todas mas marcada

$L_x^2 = 27.04$
$L_y^2 = 42.00$ ×55

LOSA I (SUPERIOR)



	p	q	p+q
	5,20 × 7.00		
pL_x^2 =	8100	10810	18730
pL_y^2 =	14700	19600	34300

p = 300
q = 400
p+q = 700

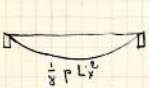
$L_y : L_x = 1.35$
$L_y^2 : L_x^2 = 1.81$
$L_y^4 : L_x^4 = 3.3$

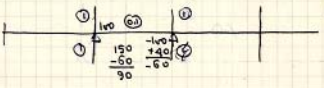
LOSA	520×12	7.00	(0.2) dos paños (0.1)
LOSA	700×12	5,20	(0.2)
PILAR	40×40	3,50	(1)

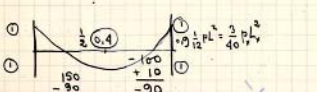
FAJA TRANSVERSAL — L_x

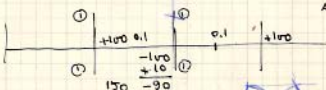
FAJA LONGITUDINAL — L_y

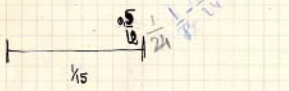
MOMENTOS PREVIOS para determinar la repartición de cargas

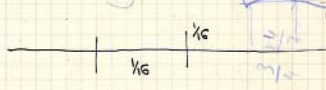












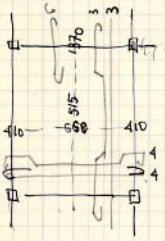
no importa la excentricidad para repartir únicamente de estudiar la repartición de cargas

REPARTICION DE CARGAS

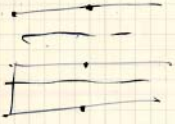
	TOTAL		ALTERNADA	
Igualdad de flechas:	$\frac{5}{32} p L_x^4 \cdot \frac{1}{E\Sigma} = \frac{1}{32} p_y L_y^4 \cdot \frac{1}{E\Sigma}$		$\left(\frac{5}{32} p L_x^4\right)_{1/2} = \frac{3}{32} p_y L_y^4$	
Cargas	$\frac{L_y^4}{L_y^4 + 3L_x^4}$	$\frac{3L_x^4}{L_y^4 + 3L_x^4}$	$\frac{L_y^4}{L_y^4 + 1.5L_x^4}$	$\frac{1.5L_x^4}{L_y^4 + 1.5L_x^4}$
	0.52 p	0,48 p	0,69 p	0,31 p
	$\frac{1}{15} \cdot 0.52\ p L_x^2 = 0.035\ pL_x^2$	$\frac{1}{24} \cdot 0.48\ pL_y^2 = 0.02\ pL_y^2$	$\frac{1}{15} 0.69\ pL_x^2 = 0.046$	$\frac{1}{16} 0.31\ pL_y^2 = 0.019$
	$\frac{2}{3} \frac{M_c^2}{pL_x^2} = 0,13$	$\frac{2}{3} \frac{M_c^2}{pL_y^2} = 0,24$	0,17	0,23
	$0,87 \cdot 0.035\ pqL_y^2 = 250$	$0,76 \cdot 0.02\ pqL_y^2 = 224$	$0,83 \cdot 0.046\ qL_y^2 = 408$	$0,77 \cdot 0.019\ qL_y^2 = 290$
	$\frac{0.5}{12} 0.52 (p+q) L_y^2 = 410$	$\frac{1}{12} 0.48 (p+q) L_y^2 = 1370$		

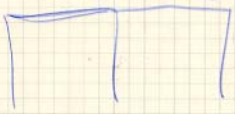
	L_y	L_y
M_c	650	515
M_E	410	1370

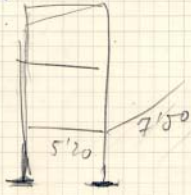
Wand I



M		w	Bewg	G	Ast
410	s	3.9	4ϕ10 4ϕ10	32	3.1 3.1
515	a	4.3	6ϕ10	34	4.71
650	a	6.00	8ϕ10	40	6.30
1370	d	0.87 10.4 0.40 4.8	12ϕ10 3ϕ10		9.4 2.4

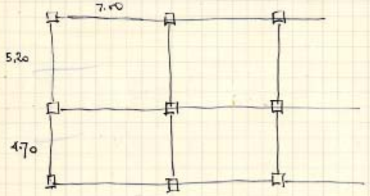






150 ≤ 1/12 l

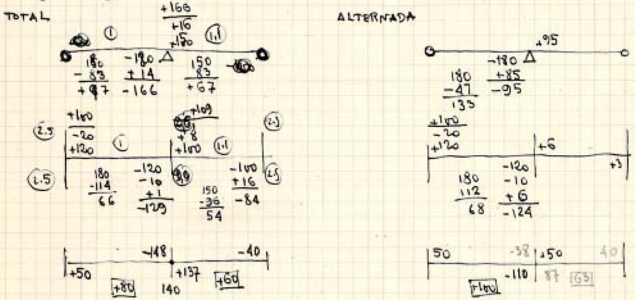
LOSA 11



LOSA	700×12	5.20
LOSA	id	4.70
PILAR	40×40	3.50
IDEM	55×55	3.50

FAJA TRANSVERSAL

TOTAL — ALTERNADA



TRAMO A

	L_x TOTAL	L_y	ALTERNADA	
Igualdad de flechas	$\left(\frac{5}{32}-0.8\frac{4}{32}\right)=\frac{68}{32}p_x L_x^4 \frac{1}{EI}$	$=\frac{1}{32}p_y L_y^4 \frac{1}{EI}$	$\left(\frac{5}{32}-0.67\times\frac{4}{32}\right)=\frac{2.3}{32}p_x L_x^4\frac{1}{EI}$	$=\frac{2}{32}p_y L_y^4\frac{1}{EI}$
Carga:	$\frac{L_y^4}{L_y^4+1.8L_x^4}=0.65$	$\frac{1.8L_x^4}{L_y^4+1.8L_x^4}=0.35$	$\frac{L_y^4}{L_y^4+1.1L_x^4}=0.75$	$\frac{1.1L_x^4}{L_y^4+1.1L_x^4}=0.25$
M_c	$\frac{0.80}{1.2}\times0.65\,\frac{pL_x^2}{12}=0.036\,p_x L_x^2$	$\times0.35\,\frac{pL_y^2}{24}=0.014$	$\frac{1.1}{1.2}\times0.75\,\frac{pL_x^2}{12}=0.042$	$\frac{1}{16}0.25\,pL_y^2=0.016$
$1-f$	$1-\frac{20}{3}\frac{M}{pL_y^2}=0.87$	$1-\frac{20}{3}\frac{M}{pL_x^2}=0.83$	$1-\frac{20}{3}\frac{M}{pL_x^2}=0.85$	$1-\frac{20}{3}\frac{M}{pL_y^2}=0.81$
M_c	$0.87\times0.036\,pL_x^2=280$ (265)	$0.83\times0.014pL_y^2=170$ (156)	$0.85\times0.042qL_x^2=385$	$0.81\times0.016qL_y^2=213$
M_E	$\frac{1.4}{12}\,0.65\frac{(p+q)}{12}^2 L_x^2=1200$	$\frac{1}{12}\,0.35(p+q)L_y^2=1000$		
M_E	$\frac{0.5}{1.2}\,0.65\frac{(p+q)}{12}^2 L_x^2=505$			

	L_x	L_y
M_c	645	425
M_E	505-1200	1000

LOSA II

TRAMO D

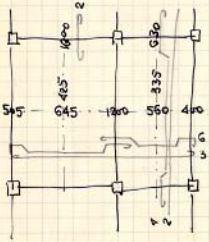
$\beta = \frac{L_y}{L_x}$ $L_x = 4.70$ $L_x^2 = 22.1$ $\frac{L_y^2}{L_x^2} = 2.2$ $\frac{L_y^4}{L_x^4} = 4.9$

$L_y = 9.80$ $L_y^2 = 49.0$

$pL_x^2 = 6630$ $qL_x^2 = 884$ $(p+q)L_x^2 =$

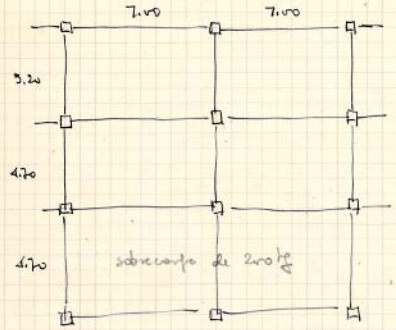
	TOTAL L_x	TOTAL L_y	ALTERNADA L_x	ALTERNADA L_y
Izquierda de luces: $\left(\frac{5}{32} - 0.9\frac{4}{32}\right) = \frac{1.4}{32} p_1 L_y^4$	$= \frac{1}{32} p_1 L_y^4$	$\left(\frac{5}{32} - 0.65\frac{4}{32}\right) = \frac{2.9}{32}$	$\frac{2}{32} p_1 L_y^4$	
Cargas $\frac{6630}{1+1.4/0.4} = 0.78$	0.22	0.82	0.18	
M_{1c}	$0.78 \times 0.6 \frac{pL_x^2}{12} = 0.039$	$0.22 \frac{pL_x^2}{24} = 0.0092$	$0.82 \times 0.63 \frac{pL_x^2}{12} = 0.043$	$0.18 \frac{1}{10} pL_y^4 = 0.016$
$1-\varphi$	$1 - \frac{20}{3}\frac{M_1}{pL_x^2} = 0.88$	$1 - \frac{20}{3}\frac{M_1}{pL_x^2} = 0.87$	$1 - \frac{20}{3}\frac{M_1}{pL_x^2}$ 0.87	0.88
M_{1c}	$0.88 \times 0.039 \, pL_x^2 = 330$	$0.87 \times 0.0092 \, pL_x^2 = 120$	$0.87 \times 0.043 qL_x^2 = 330$	215 ~~330~~
M_E	$0.4 \times 0.78 \frac{(p+q)}{12} L_y^2 = 400$	$\frac{1}{12} 0.22 (p+q) L_y^2 = 630$		

M_c	560 / 335
M_E	400 / 630

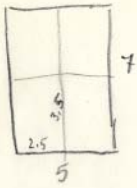


M		w	Barras	σ	Area
425	a	4.0	6φ10	30	4.71
645	a	6 t/m²	9φ10	35	7.07
1280	d	8.1	10φ10		7.8
		0	2φ10		1.6
1280	d	9.6	12φ10	50	9.4
		1.8	3φ10		2.4
560	d	4.35	6φ10		4.71
		0	3φ10		2.40
630	d	5.50	8φ10		6.3
		0	2φ10		1.6
400	a		4φ		

Losa III



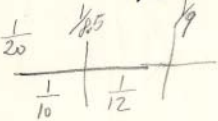
Lozas



$0.09 \times 2.500 = 225$

$q = 450$

675



$\frac{q_\varphi}{q} = \frac{3.5^2}{2.5^2+3.5^2} = \frac{12.25}{18.50} = \frac{2}{3} = 0.67$

$6.25 + 12.25$

$q_\varphi = 675 \times 0.67 = 450$

223

$12\phi 5 = 2.35\,cm^2$

$\frac{1}{9}\ 450 \times 2.5^2 = 310\ m\,Kg$ — $3.8cm^2$

$\frac{1}{12}\ 450 \times 2.5^2 = 230\ m\,Kg$ — $3cm^2$

$\frac{1}{9}\ 225 \times 3.5^2 = 310$ — $3.8cm^2$

$\frac{1}{10}\ 225 \times 3.5^2 = 275$ — $3.5cm^2$

$L = 7.00$ "

$0.60 \times 0.15 \times 2.500 = 225$

Losa $450 \times 2.5 = 1.125$

1.350

$T = 1.350 \times 3.5 = 4.700$

$\varphi = \frac{1.20 \times 50}{4.700}\ w = 13\,w$ " $w = 0.4$ $\varphi = 5.2cm$

$M_e = \frac{1}{10}\ 1.350 \times 7^2 = 8.750$ " $\frac{M_e}{a} = 58.000 - 15cm^2$

$M_c = \frac{1}{12}\ 1.350 \times 7^2 = 7.300$ " $\frac{M}{a} = 49.000 - 12cm^2$

$2\phi 5 + 4\phi 12 = 5cm^2$

$L = 5.00$

$225 \times 3.5 = 790$

1.015

$\varphi = \frac{1.2 \times 50}{2.500}\ w$

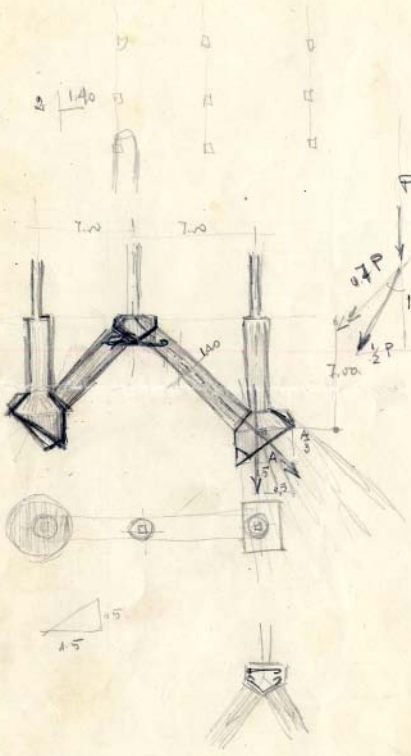
$\varphi = 10cm$

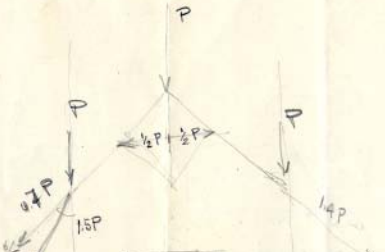
$M_e = \frac{1}{10}\ 1.015 \times 5^2 = 2.530$ " $\frac{M_e}{a} = 17.000 - 4.5cm^2$

$M_c = \frac{1}{12}\ 1.015 \times 5^2 = 2.100$ " $\frac{M}{a} = 14.000 - 3.75cm^2$ — 3.8 3.5

$L = 3.5$ " $M_e = \frac{1}{10}\ 1.350 \times 3.5^2 = 16.500$ — $4.5cm^2$

275
137





$\sqrt{1.5P^2 + 0.5P^2} = \sqrt{2.5}\,P = 1.6P$

$S = S_{\frac{1}{n\ \text{cords}}} = S_{\frac{1}{3}} = S\,\frac{1.6P}{0.5}$ $\qquad \text{max} = \frac{1.5}{1.6} = \frac{1}{3.3}$

$S = \frac{1.6}{1.5}$ $\qquad R = 1.6P$ $\qquad f = \frac{1.6P}{\frac{1.6}{1.5}} = 1.5\,h_0$ $\qquad D = \sqrt{1.5}\,D_0 = 1.2\,D_0$