COMUNE DI BRINDISI

CALCOLI STATICI DI MASSIMA RELATIVI AL FABBRICATO SOCIALE COOPERATIVA EDILIZIA "CASA E GIARDINO" a r.l. DI PROPRIETA' DEI SOCI DELLA STESSA - SITO IN BRINDISI AL VIALE CAPPUCCINI ANGOLO VIA DI NUOVA APERTURA- LEGGE I4/2/I963 n. 60 -

MARCA DA BOLLO LIRE 400

IL CALCOLATORE
(Dott.Ing. Giuseppe Marasco)

N. 10679 / 2.1.68/a
Visto 19 GIU 1968
IL DIRETTORE DI SEZIONE f.f.
(Dott. Cataldo Leone)

I calcoli sono stati redatti in ottemperanza alle norme previste dal R.D. I6/II/I939 n° 2229.- Sono stati adottati i seguenti carichi di sicurezza impiegando cemento tipo "680" tanto per le spese in fondazione che in elevato.-

Per pressioni semplici. . . . . $\sigma_c \leq$ 60 Kg/cmq.
per sezioni inflesse o pressoinflesse. . . . . $\sigma_c \leq$ 70 "
per l'acciaio dolce. . . . . σ_f = I400 Kg/cmq.
per l'acciaio speciale (TOR). . . . . σ_f = 2000 "

P E S I   S P E C I F I C I   E   S O V R A C C A R I C H I   A C C I D E N T A L I

- **calcestruzzo armato**	= 2500 Kg/mc.
- **tufo**	= I400 "
- **doppia fodera esterna in tufo:** 0,20×3,00×I400	= 840 Kg/ml.
- **idem + rivestimento in LITHO KLINHER**	= 940 "
- **travi di perimetro (attico):** 0,30×0,60×2500	= 450 "
- **travi di piano a spessore:** 0,25×0,60×2500	= 375 "

SOLAIO H = 20 + 5 cm.

peso proprio	I80 Kg/mq.
caldana	I00 "
pavim. + intonaco	I00 "
sovracc. acc.	320 "
	q= 700 Kg/mq.

- P A R T E   P R I M A

Piano	**Pilastri N° 3I**	**PARZ.**	**PROGRESS.**	**Sezione**	**Armatura**
6	**travi:** 3,00 × 450 **muretto:** 3,00 × 0,30 × I400 **solaio:** 3,75 × 3,00 × 700 **pilastro:** 30 × 60 × 3,00 ×/2500	I350 I260 7875 I350		25 × 60	4Ø12 Ø6/I2^5
		II835	II835		
5	**travi:** 3,00 × 3,75 **muratura:** 4,70 × 8,40 × 0,7 **solaio:** 3,00 × 3,50 × 700 **pilastro**	II25 2765 7350 I350		25 × 60	4ØI2 Ø6/I2^5
		I2590	24425		
4	I D E M			25 × 60	4ØI4 Ø6/I2^5
		I2590	370I5		
3	I DE M				2ØI4 2ØI6
		I2590	49605	25 × 60	Ø6/I2^5

2	I D E M	I2590	62I95	25 × 60	4øI6 ø6/I2^{5}
I	travi muratura solaie: 3,00 × 5,30 × 700 pilastre	II25 2765 III30 I350 I6370	78.565	25 × 60	4øI8 ø6/I2^{5}
P.T.	idem + solaie 3,00 × 5,30 × I50	I6370 2385 I8755	97.320	25 × 60	4øI8 2øI4 ø6/25

Piano	Pilastro N° 5	PARZ.	PROGRESS.	SEZIONE	ARMATURA
6	travi: 3,00 × 450 muretto: 3,00 × 0,30 × I400 solaio: 3,75 × 3,00 × 700 pilastro: 30 × 60 × 3,00 × 2500	I350 I260 7875 I350 II835	II.835	25 × 60	4øI2 ø6/I2^{5}
5	travi: 3,00 × 3,75 muratura: 4,70 × 8,40 × 0,7 solaio: 3,00 × 3,50 × 700 pilastre	II25 2765 7350 I350 I2590	24.425	25 × 60	4øI2 ø6/I2^{5}
4	I D E M	I2590	37.0I5	25 × 60	4øI4 ø6/I2^{5}
3	I D E M	I2590	49.605	25 × 60	2øI4 2øI6 ø6/I2^{5}
2	I D E M	I2590	62.I95	25 × 60	4øI6 ø6/I2^{5}
T.IT.	I D E M	I2590	74.785	25 × 60	4øI8 ø6/I2^{5}
P.T.	I D E M	I2590	87.375	25 × 60	4øI8 2øI2 ø6/I2^{5}

Piano	Pilastro 2I=20=22=23=I0=II=I2=I3	PARZ.	PROGRESS.	SEZIONE	ARMATURA
6	travi: 3,75 × 375 muratura: 30 × I400 solaie: 3,75 × 5,65 × 700 pilastro	I4I0 420 I4830 I350 I80I0	I8.0I0	25 × 60	4øI2 ø6/I2^{5}

5					4øI4
	IDEM				
		I80I0	36.020	25 × 60	ø6/I2^{5}
4					2øI4
					2øI6
	IDEM	I80I0	54.030	25 × 60	ø6/I2^{5}
3					2øI6
					2øI8
	IDEM	I80I0	72.040	25 × 60	ø6/I2^{5}
2					4øI8
					2øI0
	IDEM	I80I0	90.050	25 × 60	ø6/I2^{5}
P.I.T.					4øI8
					2øI6
		I80I0	I08.060	30 × 60	ø6/I5
P.T.	travi	I4I0			4ø20
	muratura	420			2øI6
	solaio: 3,75 × 5,65 × 850	I8000			ø6/I5
	pilastre	I350			
		2II80	I29.240	35 × 60	

Piano	Pilastri I7 = I5 = I8 = 38	PARZ.	PROGRESS.	SEZIONE	ARMATURA
6	travi: 4,50 × 450	2025			4øI2
	muratura: 4,50 × 0,30 × I400	I890			
	solaio: 2,00 × 2,50 × 700	3500			staffe
	pilastro	I350		25 × 30	ø6/I2^{5}
		8765	8.760		
5	idem + muratura: 4,00 × 840	6875			4øI2
		3365			
		I0240	I9,000	25 × 30	ø6/I2^{5}
4					4øI2
	IDEM				
		I0240	29.240	25 × 30	ø6/I2^{5}
3					4øI4
		I0240	39.480	25 × 30	ø6/I2^{5}
2					2øI4
		I0240	49.720	25 × 35	2øI6
P.I.T.					4øI6
		I0240	59.960	25 × 40	ø6/I2^{5}
P.T.	travi	2025			2øI6
	muratura	3365			2øI8
	solaio: 2,00 × 250 × 850	4250			
	pilastro	I350			ø6/I2^{5}
		I0990	70.950	25 × 50	

Piano	Pilastro N° (25 bis)=(26 bis)=36b.	PARZ.	PROGRESS.	SEZIONE	ARMATURA
6	piastra ascensore $\frac{I2.000}{4}$	3000			
	copertura V.ascensore $\frac{3,5}{2}\times\frac{I,3}{2}\times 700$	800			
	travi $(\frac{3,50}{2}+\frac{I,30}{2})$ 375	900			
	pilastro 0,30×0,25×3,00×2500	560			
	solaio copertura $\frac{2,00}{2}\times\frac{9,00}{2}\times 700$	3I50			
	travi $(\frac{3,50}{2}+\frac{I,30}{2})375+\frac{2,00}{2}\times$ × 375	I275			
	muratura $(\frac{3,50}{2}+\frac{I,30}{2})\times 0,20\times 3\times$ × I400	20I5			4ØI2
		II700	II.700	25 × 30	Ø6/I2^5
5	solaio	3I50			
	travi	I275			
	muratura	20I5			
	pilastro	560			4ØI2
		7000	I8.700	25 × 30	Ø6/I2^5
4	idem	7000	25.700	25 × 30	4ØI2 Ø6/I2^5
3	idem	7000	32.700	30 × 30	4ØI4 Ø6/I5
2	idem	7000	39.700	30 × 30	4ØI4 Ø6/I5
P.I°.	idem	7000	46.700	30 × 30	4ØI6 st.Ø6/I5
P.T.	idem	7000	53.700	30 × 30	4ØI6 Ø6/I5

PLINTO TIPO (I)

carico max pilastro = 97.000 Kg.

p.p. plinto e sottop. = 3.000 "

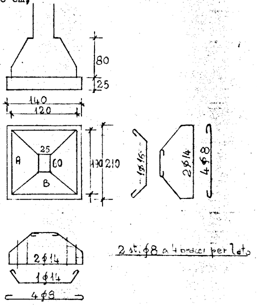
I00.000 Kg.

con un sottoplinto di m. I,40 × 2,I0 ed un plinto di m. I,20 × I,90 avremo:

$$\sigma_t = \frac{I00.000}{I40\times 2I0} = 3,40 \text{ Kg/cmq.} \qquad p = \frac{97.000}{I20\times I90} = 4,25 \text{ Kg/cmq.}$$

$$A = \frac{I90+60}{2}\times 47,5 = 5940 \text{ cmq;} \qquad y_A = \frac{47,5}{3}\times\frac{2\times I90+60}{I90+60} = 28 \text{ cm;}$$

$$B = \frac{I20+25}{2}\times 65 = 47I0 \text{ cmq;} \qquad y_B = \frac{65}{3}\times\frac{2\times I20+25}{I20+25} = 40 \text{ cm;}$$



$$M_A = 5940\times 4,25\times 0,28 = 7070 \text{ Kgm;}$$

$$M_B = 47I0\times 4,25\times 0,40 = 8007 \text{ Kgm;}$$

con H = 80 / h = 75 / b (60 (25 .

$$r_A = \frac{75}{\sqrt{\frac{707000}{60}}} = \frac{75}{I09} = 0,688 \qquad \text{per } \sigma_f = 2000 \;/\; \sigma_c = 32$$

$$A_f = 0,000744\times I09\times 60 = 4,86 \text{ cmq;} \quad < 3ØI4 + 4Ø8$$

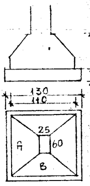
$$r_B = \frac{75}{\sqrt{\frac{800700}{25}}} = \frac{75}{I79} = 0,4I8 \qquad \text{per } \sigma_f = 2000 \;/\; \sigma_c = 56$$

$$A_f = 0,00I285\times I79\times 25 = 5,75 \text{ cmq;} \quad < 2ØI4 + IØI6 + 4Ø8$$

$$\tau = \frac{97.000}{2(25+60)80\times 0,9} = 7,92 \text{ Kg/cmq;}$$

PLINTO TIPO (2)

carico max pilastro = 87.000 Kg.
p.p. plinto e sottop. = 3.000 "
90.000 Kg.



con un sottoplinto di m. I,30 × 2,00 ed un plinto di m. I,I0 × I,80 avremo:

$$\sigma_t = \frac{90.000}{I30 \times 200} = 3{,}46 \text{ Kg/cmq;} \qquad p = \frac{87.000}{I10 \times I80} = 4{,}39 \text{ Kg/cmq;}$$

$$A = \frac{I80 + 60}{2} \times 42{,}5 \text{ cmq;} \qquad y_A = \frac{42{,}5}{3} \times \frac{2 \times I80 + 60}{I80 + 60} = 25 \text{ cm.}$$

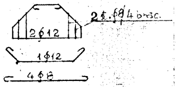
$$B = \frac{II0 + 25}{2} \times 60 = 4050 \text{ cmq;} \qquad y_B = \frac{60}{3} \times \frac{2 \times II0 + 25}{II0 + 60} = 29 \text{ cm.}$$

$M_A = 5I00 \times 4{,}39 \times 0{,}25 = 5600$ Kgm.

$M_B = 4050 \times 4{,}39 \times 0{,}29 = 5I50$ Kgm.

$H = 80 \ / \ h = 75 \ / \ b = \left(\begin{matrix} 60 \\ 25 \end{matrix} \right.$

$$r_A = \frac{75}{\sqrt{\frac{560000}{60}}} = \frac{75}{96{,}5} = 0{,}777 \qquad \text{per } \sigma_f = 2000 \ / \ \sigma_c = 28$$



$A_f = 0{,}000669 \times 96{,}5 \times 60 = 3{,}87$ cmq; $<3\varnothing I2 + 4\varnothing 8$

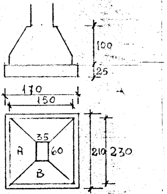
$$r_B = \frac{75}{\sqrt{\frac{5I5000}{25}}} = \frac{75}{I43} = 0{,}524 \qquad \text{per } \sigma_f = 2000 \ / \ \sigma_c = 43$$

$A_f = 0{,}00I005 \times I43 \times 25 = 3{,}59$ cmq; $<3\varnothing I2 + 4\varnothing 8$

$$\tau = \frac{87.000}{2(25 + 60)80 \times 0{,}9} = 7{,}I0 \text{ Kg/cmq;}$$

PLINTO TIPO (3)

carico pilastro = I30000 Kg.
p.p. plinto e sott. = 5000 "
I35000 Kg.



con un sottoplinto di m. I,70 × 2,30 ed un plinto di m. I,50 × 2,I0 avremo:

$$\sigma_t = \frac{I35.000}{I70 \times 230} = 3{,}45 \text{ Kg/cmq;} \qquad p = \frac{I30.000}{I50 \times 2I0} = 4{,}I2 \text{ Kg/cmq;}$$

$$A = \frac{2I0 + 60}{2} \times 57{,}5 = 7760 \text{ cmq;} \qquad y_A = \frac{57{,}5}{3} \times \frac{2 \times 2I0 + 60}{2I0 + 60} = 34 \text{ cm.}$$

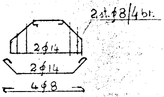
$$B = \frac{I50 + 35}{2} \times 75 = 5060 \text{ cmq;} \qquad y_B = \frac{75}{3} \times \frac{2 \times I50 + 35}{I50 + 35} = 45 \text{ cm;}$$

$M_A = 7760 \times 4{,}I2 \times 0{,}34 = I0870$ Kgm.

$M_B = 5060 \times 4{,}I2 \times 0{,}45 = 9380$ Kgm.

Essendo $H = I00 \ / \ h = 95 \ / \ b = \left(\begin{matrix} 60 \\ 35 \end{matrix} \right.$

$$r_A = \frac{95}{\sqrt{\frac{I087000}{60}}} = \frac{95}{I34{,}5} = 0{,}706 \qquad \text{per } \sigma_f = 2000 \ / \ \sigma_c = 3I$$



$A_f = 0{,}000738 \times I34{,}5 \times 60 = 5{,}95$ cmq; $<4\varnothing I4 + 4\varnothing 8$

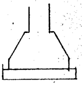
$$r_B = \frac{95}{\sqrt{\frac{938000}{35}}} = \frac{95}{I64} = 0{,}579 \qquad \text{per } \sigma_f = 2000 \ / \ \sigma_c = 39$$

$A_f = 0{,}0009I7 \times I64 \times 35 = 5{,}26$ cmq; $<4\varnothing I4 + 4\varnothing 8$

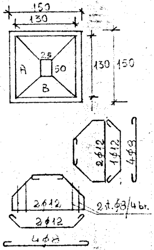
$$\tau = \frac{I30.000}{2(35 + 60) \times I00 \times 0{,}9} = 7{,}60 \text{ Kg/cmq;}$$

PLINTO TIPO (4)

carico pilastro = 7I.000 Kg.
p.p. plinto e sottop. = 3.000 "
74.000 Kg.



con un sottoplinto di m. I,50 × I,50 ed un plinto di m. I,30 × I,30 avremo:



$\sigma_t = \frac{74000}{I50 \times I50} = 3{,}30$ Kg/cmq; $p = \frac{7I.000}{I30 \times I30} = 4{,}20$ Kg/cmq;

$A = \frac{I30 + 50}{2} \times 52{,}5 = 4725$ cmq; $y_A = \frac{52{,}5}{3} \times \frac{2 \times I30 + 50}{I30 + 50} = 30$ cm.

$B = \frac{I30 + 25}{2} \times 40 = 3I00$ cmq; $y_B = \frac{40}{3} \times \frac{2 \times I30 + 25}{I30 + 25} = 25$ cm.

$M_A = 4725 \times 4{,}20 \times 0{,}30 = 5950$ Kgm.

$M_B = 3I00 \times 4{,}20 \times 0{,}25 = 3250$ Kgm.

$H = 70 \,/\, h = 65 \,/\, b = \begin{cases} 50 \\ 25 \end{cases}$

$r_A = \frac{65}{\sqrt{\frac{595000}{50}}} = \frac{65}{I09} = 0{,}596$ per $\sigma_f = 2000 \,/\, \sigma_c = 38$

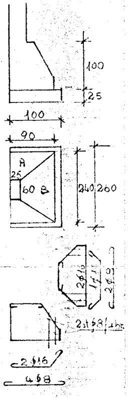
$A_f = 0{,}000895 \times I09 \times 50 = 4{,}88$ cmq; $< 4\phi I2 + 4\phi 8$

$r_B = \frac{65}{\sqrt{\frac{325000}{25}}} = \frac{65}{II4} = 0{,}57$ per $\sigma_f = 2000 \,/\, \sigma_c = 40$

$A_f = 0{,}000939 \times II4 \times 25 = 2{,}67$ cmq; $< 3\phi I2 + 4\phi 8$

$\tau = \frac{7I.000}{2(25 + 50) \times 70 \times 0{,}9} = 7{,}50$ Kg/cmq;

PLINTO TIPO (5)



carico pilastro = 87.000 Kg.
p.p. plinto e sottop. = 3.000 "
90.000 Kg.

con un sottoplinto di m. I,00 × 2,60 ed un plinto di m. 0,90 × 2,40 avremo:

$\sigma_t = \frac{90.000}{I00 \times 260} = 3{,}47$ Kg/cmq; $p = \frac{87.000}{90 \times 240} = 4{,}05$ Kg/cmq;

$A = \frac{90 + 25}{2} \times 90 = 5I75$ cmq; $y_A = \frac{90}{3} \times \frac{2 \times 90 + 25}{90 + 25} = 53$ cm.

$B = \frac{240 + 60}{2} \times 65 = 9750$ cmq; $y_B = \frac{65}{3} \times \frac{2 \times 240 + 60}{240 + 60} = 39$ cm.

$M_A = 5I75 \times 4{,}05 \times 0{,}53 = IIII0$ Kgm.

$M_B = 9750 \times 4{,}05 \times 0{,}39 = I5400$ Kgm.

$H = I00 \,/\, h = 95 \,/\, b = \begin{cases} 25 \\ 60 \end{cases}$

$r_A = \frac{95}{\sqrt{\frac{IIII000}{25}}} = \frac{95}{2II} = 0{,}45$ per $\sigma_f = 2000$ Kg/cmq; $/ \sigma_c = 52$

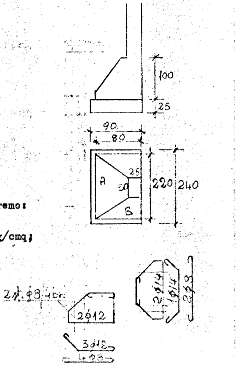
$A_f = 0{,}00I2 \times 2II \times 25 = 6{,}33$ cmq; $< 3\phi I6 + 2\phi 8$

$r_B = \frac{95}{\sqrt{\frac{I540000}{60}}} = \frac{95}{I60} = 0{,}594$ per $\sigma_f = 2000 \,/\, \sigma_c = 38$

$A_f = 0{,}000895 \times I60 \times 60 = 8{,}59$ cmq; $< 4\phi I6 + 4\phi 8$

$\tau = \frac{87.000}{\cancel{II0} \times I00 \times 0{,}9} = 8{,}78$ Kg/cmq.

PLINTO TIPO (6) (I6 e 27)



carico pilastro = 7I.000 Kg.
p.p. pilastro e sottop. = 4.000 "
75.000 Kg.

con un sottoplinto di m. 0,90 × 2,40 ed un plinto di mm 0,80 × 2,20 avremo:

$\sigma_t = \frac{75.000}{90 \times 240} = 3{,}47$ Kg/cmq; $p = \frac{7I.000}{80 \times 220} = 4{,}03$ Kg/cmq;

$A = \frac{220 + 50}{2} \times 55 = 7425$ cmq; $y_A = \frac{55}{3} \times \frac{2 \times 220 + 50}{220 + 50} = 33$ cm.

$B = \frac{80 + 25}{2} \times 85 = 4460$ cmq; $y_B = \frac{85}{3} \times \frac{2 \times 80 + 25}{80 + 25} = 50$ cm.

$M_A = 7425 \times 0{,}33 \times 4{,}03 = 9875$ Kgm.

$M_B = 4460 \times 0{,}50 \times 4{,}03 = 8985$ Kgm.

$H = I00 \;/\; h = 95 \;/\; b = \left(\begin{array}{l} 50 \\ 25 \end{array} \right.$

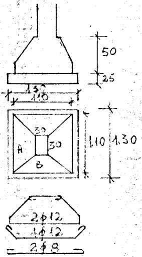
$r_A = \dfrac{95}{\sqrt{\dfrac{987500}{50}}} = \dfrac{95}{I40} = 0{,}678$ per $\sigma_f = 2000 \;/\; \sigma_c = 33$

$A_f = 0{,}000783 \times I40 \times 50 = 5{,}48$ cmq; $<5\varnothing I2 + 4\varnothing 8$

$r_B = \dfrac{95}{\sqrt{\dfrac{898500}{25}}} = \dfrac{95}{I89} = 0{,}503$ per $\sigma_f = 2000 \;/\; \sigma_c = 46$

$A_f = 0{,}00I07I \times I89 \times 25 = 5{,}06$ cmq; $<3\varnothing I4 + 2\varnothing 8$

$\tau = \dfrac{7I.000}{(2\times25+50)\times I00\times 0{,}9} = 7{,}88$ Kg/cmq;



PLINTO N° 25 bis e 26 bis

carico pilastro = 54.000 Kg.
p.p. plinto e sottop. = 3,000 "
57.000 Kg.

con un sottoplinto di m. I,30 × I,30 ed un plinto di m. I,I0 × I,I0 avremo:

$\sigma_t = \dfrac{57.000}{I30 \times I30} = 3{,}37$ Kg/cmq; $p = \dfrac{54.000}{II0 \times II0} = 4{,}46$ Kg/cmq;

$A = \dfrac{II0 + 30}{2} \times 40 = 2800$ cmq; $y = \dfrac{40}{3} \times \dfrac{2 \times II0 + 30}{II0 + 30} = 24$ cm.

$M = 2800 \times 4{,}46 \times 0{,}24 = 3000$ Kgm.

$H = 50 \;/\; h = 47 \neq b = 30$

$r = \dfrac{47}{\sqrt{\dfrac{300000}{30}}} = 0{,}47$ per $\sigma_f = 2000 \;/\; \sigma_c = 49$

$A_f = 0{,}00II35 \times I00 \times 30 = 3{,}40$ cmq; $<3\varnothing I2 + 2\varnothing 8$

PIASTRA TRA I PILASTRI (36 - 36 bis - 37)

Analisi dei carichi:

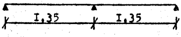
carico pilastro (36) $\dfrac{I}{2} \times 7I000$ = 35.500 Kg.
" " (36 bis) $\dfrac{I}{2} \times 54000$ = 27.000 "
" " (37) $\dfrac{I}{2} * 7I000$ = 35.500 "
p.p. piastra e trave = 7.000 "
I05.000 Kg.

Essendo la lunghezza di m. 2,75 e prevedendo una larghezza di m. I,30:

$\sigma_t = \dfrac{I05000}{275 \times I30} = 2{,}94$ Kg/cmq.

Il carico a ml. di trave sarà $\dfrac{98.000}{2{,}75} = 35.600$ Kg/ml.

$M = \dfrac{35600 \times I{,}35^2}{I0} = 6500$ Kgm.



Con $H = 80 \;/\; h = 75 \;/\; b = 50$

$r = \dfrac{75}{\sqrt{\dfrac{650000}{50}}} = \dfrac{75}{II4} = 0{,}657$ per $\sigma_f = 2000 \;/\; \sigma_c = 34$

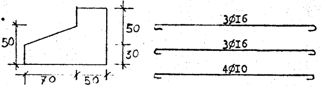
$A_f = 0{,}000805 \times II4 \times 50 = 4{,}58$ cmq. $<3\varnothing I6$

Per la mensola trasversale:

$p = 2{,}94 \times 70 \times I00 = 20580$ Kg.

$M = 20580 \times 0{,}35 = 7200$ Kgm.

$H = 50 \;/\; h = 47 \;/\; b = I00$



$r = \dfrac{47}{\sqrt{7200}} = \dfrac{47}{85} = 0{,}553$ per $\sigma_f = 2000 \;/\; \sigma_c = 4I$

A_f = 0,00096I × 85 × I00 = 8,I6 cmq. ∼ 4ØI6 cioè IØI6/25 cm.

PIASTRA FONDAZIONE TRA I PILASTRI (35-36-38-39)

Analisi dei carichi:

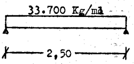
carico pilastro n. 35 = 7I.000 Kg.
" " " 36 = 7I.000 "
" " " 37 = 7I.000 "
" " " 38 = 7I.000 "
p.p. piastra 0,30×I2×2500= 9.000 "
" travi di fond. I0×0,50×0,80×2500= I0.000 Kg.
339.000 Kg.

prevedendo una piastra di m. 3,00 × 4,00 avremo: $\sigma_t = \frac{339.000}{300 \times 400}$ = 2,82 Kg/cmq.

Avendo le travi uno sviluppo complessivo di m. 9,50 avremo:

$$p = \frac{4 \times 7I.000}{9,50} = 33.700 \text{ Kg/ml.}$$

Per le travi (35-38) e (36-39) avremo:

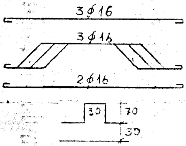


Assumiamo: in mezzeria: $M = \frac{33.700 \times \overline{2,50}^2}{I0}$ = 2I.000 Kgm.

H = I00 / h = 95 / b = I00

$r = \frac{95}{\sqrt{\frac{2I00000}{I00}}} = \frac{95}{I45} = 0,655$ per σ_f = 2000 / σ_c = 34

A_f = 0,000805 × I45 × I00 = II,67 cmq. <6ØI6

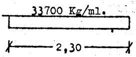


Sui pilastri: $M = \frac{33.700 \times \overline{2,50}^2}{I2}$ = I7.500 Kgm. H = I00 / h = 95 / b = 50

$r = \frac{95}{\sqrt{\frac{I750000}{50}}} = \frac{95}{I87} = 0,508$ per σ_f = 2000 / σ_c = 45

A_f = 0,00I049 × I87 × 50 = 9,80 cmq. = <5ØI6

Per le travi (35-36) = (38 - 39)



In mezzeria: $M = \frac{33700 \times \overline{2,30}^2}{I0}$ = I7.830 Kgm.

H = 80 / h = 75 / b = I00

$r = \frac{75}{\sqrt{\frac{I783000}{I00}}} = \frac{75}{I34} = 0,559$ per σ_f = 2000 / σ_c = 4I

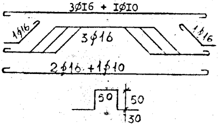
A_f = 0,00096I × I34 × I00 = I2,87 cmq. <6ØI6 + IØI0

Sui pilastri: $M = \frac{33.700 \times \overline{2,3}^2}{I2}$ = I4860 Kgm.

H = 80 / h = 75 / b = 50

$r = \frac{75}{\sqrt{\frac{I486000}{I00}}} = \frac{75}{I72} = 0,436$ per σ_f = 2000 / σ_c = 54

A_f = 0,00I242 × I72 × 50 = I0,68 cmq. <5ØI6 + IØI0



Per la piastra:

Essendo la ∼ l_y

p = 2,82 × I00 × I00 = 28200 Kg/ml.

In mezzeria: $M = \frac{p}{2} \times \frac{l^2}{I0} = \frac{I4I00 \times \overline{2,50}^2}{I2}$ = 7343 Kgm.

H = 30 cm. / h = 27,5 / b = I00 cm.

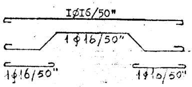
$r = \frac{27,5}{\sqrt{\frac{734300}{I00}}} = \frac{27,5}{85,8} = 0,320$ per σ_f = I400 / σ_c = 67

A_f = 0,00249 × 85,8 × I00 = 2I,35 cmq. ∼ I0ØI6

poichè l'armatura è eccessiva conviene aumentare l'altezza della piastra a 40 cm., avremo così:

$r = \frac{37,5}{\sqrt{\frac{734300}{I00}}} = \frac{37,5}{85,8} = 0,437$ per σ_f = 2000 / σ_c = 54

A_f = 0,00I242 × 85,8 × I00 = I0,65 cmq. ∼ 5ØI6 cioè IØI6/25 cm.



CALCOLO TRAVI PIANO TIPO

I) **TRAVE (I - 2 - 3 - 4 - 5 - 6 - 7 - 8)** a spessore solaio

= (28 - 29 - 30 - 3I - 3 - 33 - 3)

Analisi dei carichi:

solaio $\left(\frac{4,00}{2} + I,00\right) \times 700$ = 2I00 Kg/ml.

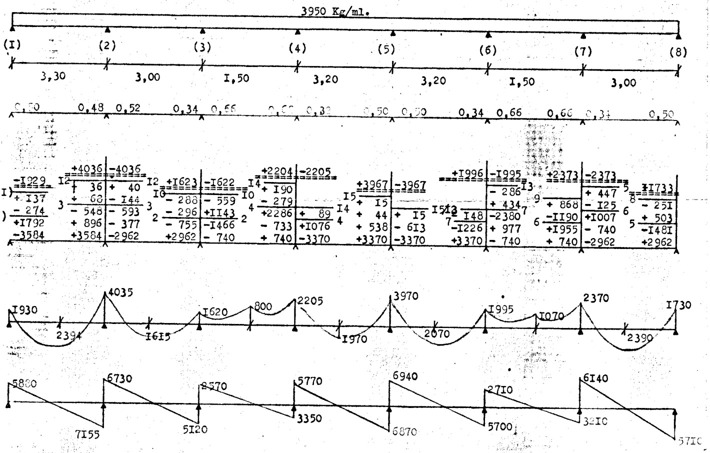
carico sulla trave 0,60 × 400 = 240 "

muratura con rivestim. = 940 "

carico momento sbalzo $\frac{I200}{4}$ = 300 "

p.p. trave 0,25×0,60×2500 = 375 "

3955 Kg/ml.



Verifiche:

Nelle mezzerie delle (I-2) = (7-8) : M = 2500 Kgm. H = 25 / h = 22,5 / b = 60

$r = \frac{22,5}{\sqrt{\frac{250000}{60}}} = \frac{22,5}{64,5} = 0,349$ per $\sigma_f = 2000 / \sigma_c = 70$

$A_f = 0,00I575 \times 64,5 \times 60 = 6,09$ cmq. <6ØI2

Nelle mezzerie della (2-3) = (4-5) + (5-6): M = 2I00 Kgm. H = 25 / h = 22,5 / b = 60

$r = \frac{22,5}{\sqrt{\frac{2I0000}{60}}} = \frac{22,5}{59,2} = 0,38$ per $\sigma_f = 2000 / \sigma_c = 63$

$A_f = 0,00I432 \times 59,2 \times 60 = 5,08$ cmq. <5ØI2

Nelle mezzerie delle (3-4) e (6-7): M = - II00 Kgm.

$r = \frac{22,5}{\sqrt{\frac{II0000}{60}}} = \frac{22,5}{42,7} = 0,563$ per $\sigma_f = 2000 / \sigma_c = 40$

$A_f = 0,000939 \times 42,7 \times 60 = 2,40$ cmq. ≃ 3ØI0

Sul pilastro (2) e (5): M = 4000 Kgm. T = 6700 Kg. M_{sp} = 3500 Kgm.

$r = \frac{22,5}{\sqrt{\frac{350000}{60}}} = \frac{22,5}{76,4} = 0,294$ per $\sigma_f = I800 / A'_f = 0,75 A_f / \sigma_c = 70$

$A_f = 0,002085 \times 76,4 \times 60 = 9,56$ cmq. <7ØI2 + 3ØI0

$A'_f = 0,75\ A_f = 7,17$ cmq.   <3∅12 + 2∅16

Sul pilastro (3) e (6): $M = 1995$ Kgm. $T = 2570$ Kg. $M_{sp} = 1740$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{1740000}{60}}} = \frac{22,5}{53,8} = 0,418 \qquad \text{per } \sigma_f = 2000\ /\ \sigma_c = 56$$

$A_f = 0,001285 \times 53,8 \times 60 = 4,15$ cmq.   <2∅12 + 3∅10

Sul pilastro (4): $M = 2200$ Kgm. $T = 3350$ Kg. $M_{sp} = 1900$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{190000}{60}}} = \frac{22,5}{56,2} = 0,400 \qquad \text{per } \sigma_f = 2000\ /\ \sigma_c = 59$$

$A_f = 0,001348 \times 56,2 \times 60 = 4,54$ cmq.   ≃ 2∅12 + 3∅10

Sul pilastro (7): $M = 2370$ Kgm. $T = 3200$ Kg. $M_{sp} = 2200$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{220000}{60}}} = \frac{22,5}{60,5} = 0,372 \qquad \text{per } \sigma_f = 2000\ /\ \sigma_c = 65$$

$A_f = 0,001473 \times 60,5 \times 60 = 5,34$ cmq.   <3∅12 + 3∅10

Al taglio:

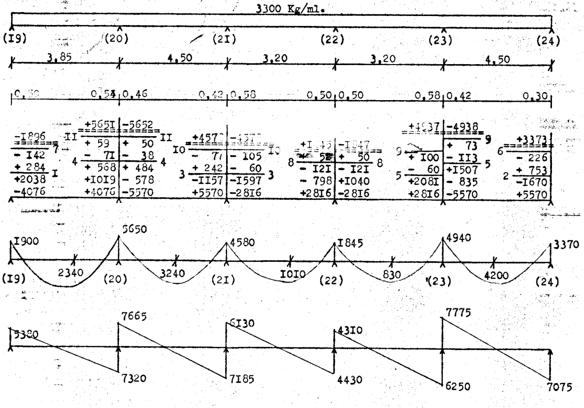
Sul pilastro (2) a sinistra: $T_{max} = \simeq 7000$ Kg. $\tau = \frac{7000}{0,9 \times 60 \times 22,5} = 5,70$ Kg/cmq.

Si adottano staffe ∅6/25 cm. per la doppia armatura.

2) TRAVE (19 - 20 - 21 - 22 - 23 - 24) = (9 - 10 - 11 - 12 - 13 - 14).

Analisi dei carichi:

carico solaio $\frac{4,00 + 2,40}{2} \times 700$	=	2240 Kg/ml.
sovrac. sulla trave $0,60 \times 400$	=	240 "
tramezzo sulla trave $0,10 \times 3,25 \times 1400$	=	450 "
p.p. trave $0,25 \times 0,60 \times 2500$	=	375 "
totale		3305 Kg/ml.



Verifiche:

In mezzeria della (I9 - 20): $M = \simeq 2500$ Kgm. $H = 25 \;/\; h = 22,5 \;/\; b = 60$

$$r = \frac{22,5}{\sqrt{\frac{250000}{60}}} = \frac{22,5}{64,5} = 0,349 \qquad \text{per } \sigma_f = 2000 \;/\; \sigma_c = 70$$

$A_f = 0,001575 \times 64,5 \times 60 = 6,09$ cmq. <6ØI2

In mezzeria della (20 - 2I): $M = 3300$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{330000}{60}}} = \frac{22,5}{74,2} = 0,303 \qquad \text{per } \sigma_f = I600 \;/\; A'_f = 0,25\, A_f \;/\; \sigma_c = 70$$

$A_f = 0,00225 \times 74,2 \times 60 = I0,00$ cmq. <7ØI4

$A'_f = 0,25\, A_f = 2,5$ cmq.

In mezzeria della (2I - 22) e (22 - 23) : $M = I800$ Kgm $\left(\frac{I}{I8}\right)$

$$r = \frac{22,5}{\sqrt{\frac{I80000}{60}}} = \frac{22,5}{55} = 0,409 \qquad \text{per } \sigma_f = 2000 \;/\; \sigma_c = 58$$

$A_f = 0,001327 \times 55 \times 60 = 4,38$ cmq. < 6ØI0

In mezzeria della (23 - 24): $M = 4300$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{430000}{60}}} = \frac{22,5}{84,5} = 0,266 \qquad \text{per } \sigma_f = I400 \;/\; A'_f = 0,6\, A_f \;/\; \sigma_c = 70$$

$A_f = 0,002965 \times 84,5 \times 60 = I5,03$ cmq. <5ØI6 + 2ØI4 (omogeneo)

$A'_f = 0,6\, A_f = 9,00$ cmq. ≃ 3ØI0 + 3ØI6 (omogeneo)

Sul pilastro (20) : $M = 5650$ Kgm. $T = 7300$ Kg. $M_{sp} = 5070$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{507000}{60}}} = \frac{22,5}{92} = 0,244 \qquad \text{per } \sigma_f = I400 \;/\; A'_f = 0,8\, A_f \;/\; \sigma_c = 70$$

$A_f = 0,003I42 \times 92 \times 60 = I7,35$ cmq. <3ØI0 + 3ØI2 + 4ØI4 + 3ØI6 (moncone)

$A'_f = 0,8\, A_f = I3,8$ cmq. <3ØI2 + 3ØI4 + 3ØI6 (moncone)

Sul pilastro (2I) e (23): $M = 4900$ Kgm. $T = 6250$ Kg. $M_{sp} = 4400$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{440000}{60}}} = \frac{22,5}{86} = 0,26I \qquad \text{per } \sigma_f = I400 \;/\; A'_f = 0,6\, A_f \;/\; \sigma_c = 70$$

$A_f = 0,002965 \times 86 \times 60 = I5,30$ cmq. <
(2I) 6ØI0 + 4ØI4 + 3ØI6 (moncone)
(23) 6ØI0 + 4ØI6 + 2ØI4 (moncone)

$A'_f = 0,6\, A_f = 9,20$ cmq. <
(2I) 3ØI0 + 3ØI4 + 2ØI2 (moncone)
(23) 3ØI0 + 2ØI4 + IØI6 + IØI6 (moncone)

Sul pilastro (22): $M = I850$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{I85000}{60}}} = \frac{22,5}{55,5} = 0,405 \qquad \text{per } \sigma_f = 2000 \;/\; \sigma_c = 58$$

$A_f = 0,001327 \times 55,5 \times 60 = 4,4I$ cmq. <6ØI0

Sul pilastro (24): $M = 3370$ Kgm. $T = 7000$ Kg. $M_{sp} = 2800$ Kgm.

$$r = \frac{22,5}{\sqrt{\frac{280000}{60}}} = \frac{22,5}{68,2} = 0,329 \qquad \text{per } \sigma_f = I800 \;/\; A'_f = 0,20\, A_f \;/\; \sigma_c = 70$$

$A_f = 0,001885 \times 68,2 \times 60 = 7,7I$ cmq. <3ØI0 + 4ØI6

$A'_f = 0,20\ A_f = I,54$ cmq. $< 2\varnothing I4 + I\varnothing I6$

Verifica al taglio:

Sul pilastro (20) a sinistra : $T = 7320$ Kg. $\tau = \dfrac{7320}{0,9 \times 60 \times 22,5} = 5,69$ Kg/mhq.

" " " a destra : $T = 7665$ Kg. $\tau = \dfrac{7665}{0,9 \times 60 \times 22,5} = 5,96$ Kg/mhq.

" " (23) a destra : $T = 7775$ Kg. $\tau = \dfrac{7775}{0,9 \times 60 \times 22,5} = 6,00$ Kg/cmq.

Si adottano staffe $\varnothing 6/$ 20+25 cm.

3) TRAVE (I7 - I8)

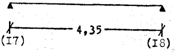
Analisi dei carichi:

solaio $\dfrac{4,70}{2} \times 700 = I645$ Kg/ml.

muratura $= 940$ "

p.p. $0,30 \times 0,60 \times 2500 = 450$ "

3035 Kg/ml.



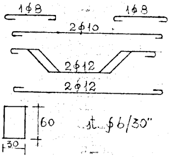
$M = \dfrac{3035 \times \overline{4,35}^2}{I2} = 4785$ Kgm. $T = \dfrac{3035 \times 4,35}{2} = 6585$ Kg.

$H = 60 \ / \ h = 57 \ / \ b = 30$

$r = \dfrac{57}{\sqrt{\dfrac{478500}{30}}} = \dfrac{57}{I26} = 0,452$ per $\sigma_f = 2000 \ / \ \sigma_c = 5I$

$A_f = 0,00II78 \times I26 \times 30 = 4,45$ cmq. $< 4\varnothing I2$

$\tau = \dfrac{6585}{0,9 \times 30 \times 57} = 4,27$ Kg/cmq.



4) TRAVE (I5 - I6)

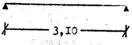
Analisi dei carichi:

solaio $\dfrac{3,30}{2} \times 700 = II55$ Kg/ml.

muratura $= 940$ "

p.p. $0,30 \times 0,40 \times 2500 = 300$ "

2395 Kg/ml.

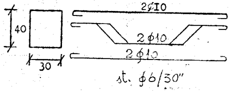


$M = \dfrac{2395 \times \overline{3,I0}^2}{I2} = I920$ Kgm. $T = \dfrac{2395 \times 3,I0}{2} = 37I2$ Kg.

$H = 40 \ / \ h = 37 \ / \ b = 30$

$r = \dfrac{37}{\sqrt{\dfrac{I92000}{30}}} = \dfrac{37}{80} = 0,462$ per $\sigma_f = 2000 \ / \ \sigma_c = 50$

$A_f = 0,00II57 \times 80 \times 30 = 2,77$ cmq. $< 4\varnothing I0$



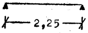
5) TRAVE (24 - 25) = (25 - 25 bis) = (25 bis - 26)

Analisi dei carichi:

solaio $\dfrac{4,70}{2} \times 700 = I650$ Kg/ml.

p.p. $= 450$ "

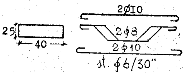
$2I00$ Kg/ml.



$M = \dfrac{2I00 \times \overline{2,25}^2}{I2} = 885$ Kgm. $H = 25 \ / \ h = 22,5 \ / \ b = 40$

$r = \dfrac{22,5}{\sqrt{\dfrac{88500}{40}}} = \dfrac{22,5}{47} = 0,478$ per $\sigma_f = 2000 \ / \ \sigma_c = 49$

$A_f = 0,00II35 \times 47 \times 40 = 2,I3$ cmq. $< 2\varnothing I0 + 2\varnothing 8$

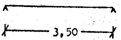


6) TRAVE (25 bis - 36) = (26 bis - 36 bis)

Analisi dei carichi:

solaio $\dfrac{2,20}{2} \times 700 = 770$ Kg/ml.

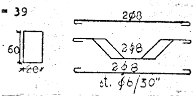
muratura 0,20 × 3 × I400 = 840 "
p.p. 0,20 × 0,60 × 2500 = 300 "
I9I0 Kg/ml.



$M = \frac{I9I0 \times 3,50^2}{I2} = I950$ Kgm.

$r = \frac{57}{\sqrt{\frac{I9I000}{20}}} = \frac{57}{98} = 0,58$ per $\sigma_f = 2000$ / $\sigma_c = 39$

$A_f = 0,000917 \times 98 \times 20 = I,80$ cmq. <4Ø8

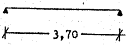


7) TRAVE (8 - I7) = (I3 - I5) = I6 - 26 = (26 - 37) =(34 - 35) = (38 - 39)

Analisi dei carichi:

muratura = 940 Kg/ml.
p.p. 0,30 × 0,40 × 2500 = 300 "
I240 Kg/ml.

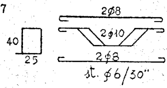
Luce max.



$M = \frac{I240 \times 3,70^2}{I2} = I4I4$ Kgm. H = 40 / h = 37 / b = 25

$r = \frac{37}{\sqrt{\frac{I4I400}{25}}} = \frac{37}{75,4} = 0,490$ per $\sigma_f = 2000$ / $\sigma_c = 47$

$A_f = 0,00I092 \times 75,4 \times 25 = 2,06$ cmq. <2Ø8 + 2ØI0

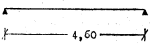


8) TRAVE (I - 9) = (I9 - 27)

Analisi dei carichi:

muratura = 940 Kg/ml.
p.p. 0,25 × 0,50 × 2500 = 3I0 "
I250 Kg/ml.

Luce max.



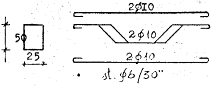
$M = \frac{I250 \times 4,60^2}{I2} = 2204$ Kgm. $T = \frac{I250 \times 4,60}{2} = 2875$ Kg.

H = 50 / h = 47 / b = 25

$r = \frac{47}{\sqrt{\frac{220400}{25}}} = \frac{47}{94} = 0,5$ per $\sigma_f = 2000$ / $\sigma_c = 46$

$A_f = 0,00I07I \times 94 \times 25 = 2,52$ cmq. <4ØI0

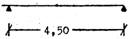
$\tau = \frac{2875}{0,9 \times 25 \times 47} = 2,74$ Kg/cmq.



9) TRAVE (27 - 28)

Analisi dei carichi:

solaio $\frac{4,50}{2} \times 700$ = I570 Kg/ml.
muratura = 940 "
p.p. 0,30 × 0,60 × 2500 = 450 "
2960 Kg/ml.



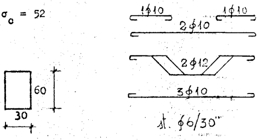
$M = \frac{2960 \times 4,50^2}{I2} = \simeq 5000$ Kgm. $T = \frac{2960 \times 4,50}{2} = 6650$ Kg.

H = 60 / h = 57 / b = 30

$r = \frac{57}{\sqrt{\frac{500000}{30}}} = \frac{57}{I29} = 0,448$ per $\sigma_f = 2000$ / $\sigma_c = 52$

$A_f = 0,00I2 \times I29 \times 30 = 4,64$ cmq. <3ØI0 + 2ØI2

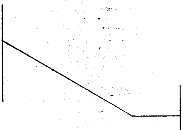
$\tau = \frac{6650}{0,9 \times 30 \times 57} = 4,32$ Kg/cmq.



TRAVE A GINOCCHIO (24 - 34) = (25 - 35)

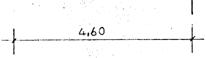
Analisi dei carichi:

rampa scala = I000 Kg/ml.
muratura 0,25 × 3 × I400 = I050 "
p.p. 0,25 × 0,70 × 2500 = 450 "
2500 Kg/ml.



A flessione:

$M = \frac{2500 \times \overline{4,6}^2}{12} = 4400$ Kgm. $\quad T = \frac{2500 \times 4,60}{2} = 5750$ Kg.



$H = 70 \ / \ h = 67 \ / \ b = 25$

$$r = \frac{67}{\sqrt{\frac{440000}{25}}} = \frac{67}{123} = 0,544 \qquad \text{per } \sigma_f = 2000 \ / \ \sigma_c = 42$$

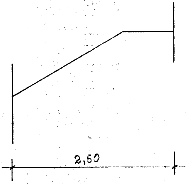
$A_f = 0,000983 \times 123 \times 25 = 3,02$ cmq. $\quad < 2\varnothing 12 + 2\varnothing 10$

A torsione: $\quad M_t = \frac{200 \times 10}{2} = 1000$ Kgm.

$$A_1 = \frac{100000\ (20+65)}{20 \times 65 \times 1400} = 4,67 \text{ cmq.} \quad < 10\varnothing 8$$

$$A_s = \frac{100000 \times 100}{2 \times 20 \times 65 \times 1400} = 2,75 \text{ cmq.} \quad \simeq 6\varnothing 8 \text{ cioè staffe } \varnothing 8/16 \text{ cm.}$$

TRAVE A GINOCCHIO (35 - 38) = (36 - 39)



Analisi dei carichi:

come per la precedente $p = 2500$ Kg/ml.

$M = \frac{2500 \times \overline{2,50}^2}{12} = 1300$ Kgm.

$H = 40 \ / \ h = 37 \ / \ b = 25$

$$r = \frac{37}{\sqrt{\frac{130000}{25}}} = \frac{37}{72} = 0,514 \qquad \text{per } \sigma_f = 2000 \ / \ \sigma_c = 44$$

$A_f = 0,001027 \times 72 \times 25 = 1,85$ cmq. $\quad < 4\varnothing 10$

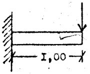
A torsione: $\quad M_t = \frac{200 \times 6}{2} = 600$ Kgm.

$$A_1 = \frac{60000(20+35)}{20 \times 35 \times 1400} = 3,36 \text{ cmq.} \quad \simeq 6\varnothing 8$$

$$A_s = \frac{60000 \times 100}{2 \times 20 \times 35 \times 1400} = 3,06 \text{ cmq.} \quad < 6\varnothing 8 \text{ cioè staffe } \varnothing 8/16"$$

MENSOLA SUL PILASTRO (9)

Analisi dei carichi:



p.p. $0,25 \times 0,50 \times 2500 = 310$ Kg/ml.

muratura $= 940$ "

1250 Kg/ml.

$P = 1200 \times 1,5 = 1800$ Kg.

$M = \frac{1250 \times \overline{1,00}^2}{2} + 1800 \times 1,00 = 2425$ Kgm.

$H = 50 \ / \ h = 47 \ / \ b = 25$

$$r = \frac{47}{\sqrt{\frac{242500}{25}}} = \frac{47}{98,5} = 0,477 \qquad \text{per } \sigma_f = 2000 \ / \ \sigma_c = 49$$

$A_f = 0,001135 \times 98,5 \times 25 = 2,79$ cmq. $\quad < 4\varnothing 10$

TRAVI IN VARIANTE PER LA COPERTURA DEL PIANO TERRA

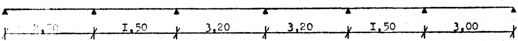
2ª TRAVE (28 - 29 - 30 - 31 - 32 - 33 - 34) a quota inferiore

Analisi dei carichi:

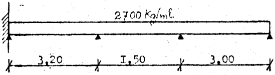
solaio $\longrightarrow \times 700 = 2275$ Kg/ml.

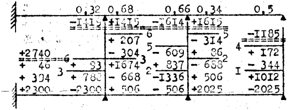
p.p. $0,25 \times 0,60 \times 2500 = 375$ "

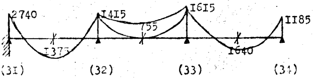
2650 Kg/ml.



Essendo le travi quasi simmetriche possiamo ridurci al seguente schema:







Verifiche:

Nelle mezzerie della (3I - 32) e (33 - 34) : M = I700 Kgm. H = 25 / h = 22,5 / b = 60

$r = \frac{22,5}{\sqrt{\frac{I70000}{60}}} = \frac{22,5}{53,2} = 0,423$ per $\sigma_f = 2000 / \sigma_c = 55$

$A_f = 0,00I264 \times 53,2 \times 60 = 4,03$ cmq. <6∅I0

Sul pilastro (32) e (33) : M = I620 Kgm. H = 25 / h = 22,5 / b = 60

$r = \frac{22,5}{\sqrt{\frac{I62000}{60}}} = \frac{22,5}{52} = 0,432$ per $\sigma_f = 2000 / \sigma_c = 54$

$A_f = 0,00I242 \times 52 \times 60 = 3,87$ cmq. <6∅I0

In mezzeria della (32 - 33): M = - 800 Kgm.

$r = \frac{22,5}{\sqrt{\frac{80000}{60}}} = \frac{22,5}{36,4} = 0,6I8$ per $\sigma_f = 2000 / \sigma_c = 35$

$A_f = 0,00085 \times 36,4 \times 60 = I,85$ cmq. <3∅I0

Sul pilastro (3I) : M = 2740 Kgm.

$r = \frac{22,5}{\sqrt{\frac{274000}{60}}} = \frac{22,5}{67,5} = 0,333$ per $\sigma_f = I800 / \sigma_c = 70$

$A_f = 0,00I826 \times 67,5 \times 60 = 7,39$ cmq. ≃ 9∅I0

Al taglio: Sul pilastro (3I) T = 4600 Kg. $\tau = \frac{4600}{0,9 \times 60 \times 22,5} = 3,78$ Kg/cmq.

Si adottano staffe ∅6/25".

TRAVI IN VARIANTE PER LA COPERTURA DELLO SCANTINATO

Trave (28 - 29 - 30 - 3I - 32 - 33 - 34)

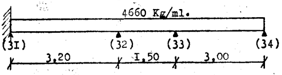
Analisi dei carichi:

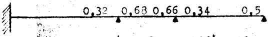
selaio $\frac{6,50 * 4,50}{2} \times 780$ = 4290 Kg/ml.

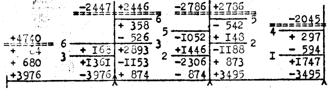
p.p. 0,25 × 0,60 × 2500 = 375 "

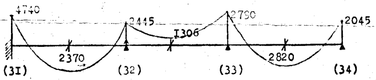
4665 Kg/ml.

Essendo la trave quasi simmetrica possiamo ridurci al seguente schema:









Verifiche:

Nella mezzeria della (3I - 32) e (33 - 34)   M = 2850 Kgm.   H = 25 / h = 22,5 / b = 60

$r = \frac{22,5}{\sqrt{\frac{285000}{60}}} = \frac{22,5}{69} = 0,326$ per σ_f = I400 / σ_c = 66

A_f = 0,002457 × 69 × 60 = I0,I7 cmq.   <3ØI4 * 3ØI6

Sul pilastro (32) e (33):   M = 2800 Kgm. σ_f = I400 / σ_c = 66

A_f = I0,I7 cmq.   <3ØI6 + 3ØI0 + IØI6 (moncone)

In mezzeria della (32 - 33):   M = I500 Kgm.   H = 25 / h = 22,5 / b = 60

$r = \frac{22,5}{\sqrt{\frac{I50000}{60}}} = \frac{22,5}{50} = 0,45$ per σ_f = 2000 / σ_c = II

A_f = 0,00II78 × 50 × 60 = 3,54 cmq.   <IØI6 + 3ØI0

Sul pilastro (3I) : M_{sp} = 4500 Kgm.

$r = \frac{22,5}{\sqrt{\frac{450000}{60}}} = \frac{22,5}{86,7} = 0,259$ per σ_f = I400 / $A'_f = 0,75\, A_f$ / σ_c = 70

A_f = 0,003I × 86,7 × 60 = I6,I2 cmq.   <6ØI6 + 3ØI0 + IØI6 (moncone)

$A'_f = 0,75\, A_f$ = I2,09 cmq.   <6ØI4 + 2ØI4 moncone

Al taglio:

Sul pilastro (3I):   T = 7920 Kg. $\tau = \frac{7920}{0,9 \times 60 \times 22,5} = 6,52$ Kg/cmq.

$S = \frac{6,52 \times 60 \times I70}{2} = 33250$ Kg.

Disponendo di 4ØI6 sagomati $S_p = 8,04 \sqrt{2} \times I400 = I5900$ Kg.

Adottando staffe Ø8 a 4 b. ogni 25 cm. $S_s = 6 \times 2 \times I400 = I6800$ Kg.

Sul pilastro (33):   T = 7220 Kg. $\tau = \frac{7220}{0,9 \times 60 \times 22,5} = 5,94$ Kg/cmq.

Si adottano staffe Ø6/25 cm.

CALCOLO SOLAI COPERTURA SCANTINATO   H = 20 + 5

Analisi dei carichi:

p.p. solaio   = 250 Kg/mq.
pavim. ecc.   = I00   "

sovracc. utile $\underline{= 600 \text{ "}}$
950 Kg/mq. $p = 950 \times 0{,}4 = 380$ Kg/ml.

Per luci fino a m. 3,00

$M = \dfrac{380 \times 3^2}{12} = 285$ Kgm. $H = 25 \;/\; h = 23 \;/\; b = 40$

$r = \dfrac{23}{\sqrt{\dfrac{28500}{40}}} = \dfrac{23}{26{,}8} = 0{,}861$ per $\sigma_f = 2000 \;/\; \sigma_c = 25$

$A_f = 0{,}000601 \times 26{,}8 \times 40 = 0{,}644$ cmq.   <2Ø8

Per luci sino a m. 4,50

$M = \dfrac{380 \times 4{,}50^2}{12} = 641$ Kgm.

$r = \dfrac{23}{\sqrt{\dfrac{64100}{40}}} = \dfrac{23}{40} = 0{,}575$ per $\sigma_f = 2000 \;/\; \sigma_c = 39$

$A_f = 0{,}000917 \times 40 \times 40 = 1{,}47$ cmq.   <2Ø10

Per luci sino a m. 5,00

$M = \dfrac{380 \times 5{,}00^2}{12} = 790$ Kgm.

$r = \dfrac{23}{\sqrt{\dfrac{79000}{40}}} = \dfrac{23}{44{,}5} = 0{,}516$ per $\sigma_f = 2000 \;/\; \sigma_c = 44$

$A_f = 0{,}001027 \times 44{,}5 \times 40 = 1{,}82$ cmq.   <1Ø10 + 1Ø12

Per luci sino a~~x~~ m. 5,50

$M = \dfrac{380 \times 5{,}50^2}{12} = 958$ Kgm.

$r = \dfrac{23}{\sqrt{\dfrac{95300}{40}}} = \dfrac{23}{49} = 0{,}469$ per $\sigma_f = 2000 \;/\; \sigma_c = 50$

$A_f = 0{,}001157 \times 49 \times 40 = 2{,}26$ cmq.   = 2Ø12

Per luci sino a m. 6,40

$M = \dfrac{380 \times 6{,}4^2}{12} = 1297$ Kgm. $T = 380 \times 3{,}2 = 1216$ Kg.

$r = \dfrac{23}{\sqrt{\dfrac{129700}{40}}} = \dfrac{23}{57} = 0{,}403$ per $\sigma_f = 2000 \;/\; \sigma_c = 59$

$A_f = 0{,}001348 \times 57 \times 40 = 3{,}07$ cmq.   <2Ø14

$\tau = \dfrac{1216}{0{,}9 \times 8 \times 23} = 7{,}36$ Kg/cmq. $S = \dfrac{7{,}36 \times 8 \times 320}{2} = 9420$ Kg.

Disponendo di 2Ø14 sagomati $S_p = \cancel{3{,}14}\ \sqrt{2} \times 1400 = 6200$ Kg.

Adottando 3 staffe Ø8 per lato $S_s = 3 \times 1{,}01 \times 1400 = 4240$ Kg.

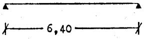
[illegible] T R A V I S C A N T I N A T O

TRAVI GARAGE (CENTRALE CON ELIMIN. PILASTRO)

Analisi dei carichi:

selaio $\left(\dfrac{4{,}20 + 2{,}40}{2} + 0{,}50\right) \times 800 = 3040$ Kg/ml.

p.p. trave $0{,}30 \times 0{,}80 \times 2500$ $\underline{= 600 \text{ "}}$
3640 Kg/ml.



$M = \dfrac{3640 \times 6{,}40^2}{10} = 14900$ Kgm. $T = \dfrac{3640 \times 6{,}40}{2} = 11650$ Kg.

$H = 80 \;/\; h = 77 \;/\; b = \begin{cases} 80 \\ 30 \end{cases}$

In mezzeria: $r = \dfrac{77}{\sqrt{\dfrac{1490000}{80}}} = \dfrac{77}{136{,}5} = 0{,}564$ per $\sigma_f = 2000 \;/\; \sigma_c = 40$

$A_f = 0{,}000939 \times 80 \times 136{,}5 = 10{,}25$ cmq.   ≃ 5Ø16

All' incastro: $M = \dfrac{3640 \times 6{,}40^2}{14} = 10640$ Kgm.

$r = \dfrac{77}{\sqrt{\dfrac{1064000}{30}}} = \dfrac{77}{188} = 0{,}409$ per $\sigma_f = 2000 \;/\; \sigma_c = 58$

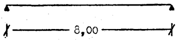
$A_f = 0,00I327 \times I88 \times 30 = 7,48$ cmq. $< 4\varnothing I6 + 2\varnothing I0$

$$\tau = \frac{II650}{0,9 \times 30 \times 77} = 5,60 \text{ Kg/cmq.}$$

TRAVI SERVIZI

Analisi dei carichi:

solaio $6,00 \times 8,00$ = 4800 Kg/ml.
p.p. trave$(0,30 \times 80 + 0,50 \times 0,25)2500$ = 900 "
5700 Kg/ml.



In mezzeria: $M = \dfrac{5700 \times \overline{8,00}^2}{I0} = 36480$ Kgm. $T = 5700 \times 4 = 22800$ Kg.

$H = 80 \; / \; h = 77 \; / \; b = I00$

$$r = \frac{77}{\sqrt{36480}} = \frac{77}{I9I} = 0,403 \qquad \text{per } \sigma_f = 2000 \; / \; \sigma_f = 59$$

$A_f = 0,00I348 \times I9I \times I00 = 25,74$ cmq. $\simeq I0\varnothing I8$

All'incastro: $M = \dfrac{5700 \times \overline{8,00}^2}{I4} = 26000$ Kg. $H = 80 \; / \; h = 77 \; / \; b = 30$

$$r = \frac{77}{\sqrt{\dfrac{2600000}{30}}} = \frac{77}{294} = 0,262 \qquad \text{per } \sigma_f = I400 \; / \; A'_f = 0,5\,A_f \; / \; \sigma_c = 70$$

$A_f = 0,00295 \times 294 \times 30 = 26$ cmq. $\simeq I0\varnothing I8$

$A'_f = \simeq I3$ cm. $< 5\varnothing I8$

$$\tau = \frac{22800}{0,9 \times 30 \times 77} = I0,95 \text{ Kg/cmq.} \qquad S = \frac{I0,95 \times 30 \times 400}{2} = 65700 \text{ Kg.}$$

Disponendo di $7\varnothing I8$ sagomati $S_p = I7,8I\sqrt{2} \times I400 = 35I50$ Kg.

Adottando staffe $\varnothing 8/20$ cm. $S_s = 20 \times I,0I \times I400 = 28300$ Kg.