

Il Presidente *Bosimus Elet*



COOPERATIVA EDILIZIA "Villa Italia," (Brindisi)		FINANZIAMENTO GesCaL (legge 18.2.1963 n° 60)	STAZIONE APPALTANTE: Cooperativa "VILLA ITALIA,,		
EDIFICIO CON n° 12 ALLOGGI ECONOMICI A FRANCAVILLA FONTANA (BRINDISI)			data:	agg.:	G
RELAZIONE DI CALCOLO STRUTTURE			agg.:	agg.:	
Dott. Arch. FORTUNATO PIGNATELLI Via Imp. Costantino 42 - BRINDISI - (23588)		PROGETTO <i>F. Pignatelli</i>	approvazioni:		
Dott. Ing. ALDO MALDARI Via Saponara - BRINDISI - (26836)		CALCOLO STRUTTURE IN C.C.A. ● <i>Aldo</i>	C.E.C. - 3 nov. 1965		
Dott. Ing. NERINA VIVARELLI SCARASCIA Via S. Lorenzo - BRINDISI -		IMPIANTI <i>N. Vivarelli</i>			
Dott. Ing. G. PANZUTI Latiano (BRINDISI)		DIREZIONE LAVORI <i>G. Panzuti</i>	controllo disegni:	visto:	

# Trancavilla - Cooperativa Sialva.

## Premesse di calcolo.

### a) Analisi del terreno di fondazione:

Da saggi eseguiti in loco, risulta che il terreno ha la seguente stratigrafia: dal piano di campagna sino a m. 1.20 di profondità terreno vegetale; da m. 1.20 sino a 2.00, terreno sabbioso con sabbia molto fine ma compatta e asciutta; da m. 2.00 sino a m. 4.00 argilla gialla sabbiosa con presenza di formazioni di arenaria di vario spessore e compattezza; da m. 4.00 a m. 6.00 argille compatte con minore presenza di sabbia mista a traverzi e formazioni calcaree. La falda freatica Trovasi mediamente alle profondità di m. 6.00 dal piano di campagna.

Si assume come piano di posa la quota di m. 2.50 con una  $\sigma_t$  max ammissibile pari a 1.8 kg./mq. -

### b) Carichi permanenti e pp.

- 1) Sovraccarichi accidentali: locali di abitazione 250 kg./mq.  
scale 400 kg./mq.  
balcone solare 150 kg./mq.  
terrazzine 300 kg./mq.

#### 2) Sovraccarichi permanenti:

solai locali di abitazione: intonaco, massetto, pavimento, ecc. 120 kg./mq.  
incidenza sui solai delle tramezzature leggere in laterizio da cm 8, considerate come carichi distribuiti 80 kg./mq.  
Totale 200 kg./mq.

balconi : intonaco, impermeabilizzazione, massetto, pavim. 150 kg./mq.

balcone solare : intonaco + pavimento + imperm. 100 kg./mq.  
massetto a pendio 200 kg./mq.  
Totale 300 kg./mq.

3) Peso proprio solai in opera del tipo Palersap. H 20  
oppure tipo Ume H 18 + 4 200 kg./mq.

4) Carichi complessivi dei solai  
locali di abit.:

sovr. acc.	250 kg./mq.
sovr. perm.	200 kg./mq.
pp.	200 kg./mq.
totale	<hr/> 650 kg./mq.

terrazzine:

sovr. acc.	350 kg./mq.
sovr. perm.	100 kg./mq.
pp.	200 kg./mq.
totale	<hr/> 650 kg./mq.

latines solari:

sovr. acc.	150 kg./mq.
pp.	200 kg./mq.
sovr. perm.	300 kg./mq.
totale	<hr/> 650 kg./mq.

5) Carico murature.

compagni ai piani:

intonaco	$0.03 \times 1200 \times 1.00 \times 1.00 =$	42 kg./mq.
riest.	$0.02 \times 2500 \times 1.00 \times 1.00 =$	50 kg./mq.
tavolaio in laterizio em. 10	=	80 kg./mq.
tavolaio di Tufo da em 10	=	140 kg./mq.
totale	<hr/>	312 kg./mq.

peso per ml. di lunghezza:

p.	$1.25 \times 0.15 \times 2500 =$	468 kg./mq.
arzi.		170 kg./mq.

3

ANALISI DEI CARICHI DEI PILASTRI

PILASTRO 1

- 7 ordine:

$$\text{solaio } \left( 1.30 \times \frac{3.30}{2} \right) \left( 1.20 + \frac{5.40}{2} \right) \times 650 = 5.25 \text{ t.}$$

$$\text{attico } 4.80 \times \left( 1.30 \times \frac{3.30}{2} + 1.20 + \frac{5.40}{2} \right) = 3.02 \text{ t.}$$

$$\text{pp. trav. } 0.20 \times 0.30 \times 2500 \times \left( \frac{3.30}{2} + 1.30 \right) = 0.75 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.30 \times 2500 \times 3.10 = 0.70 \text{ t.}$$

$$\text{Totale} = 9.72 \text{ t.}$$

- 6-5-4-3-2-1

ordine :

$$\text{solaio } \frac{5.20}{2} \left( \frac{3.30}{2} + 0.80 \right) \times 650 = 4.15 \text{ t.}$$

$$\text{pp. Trav. (1-2)} \quad 225 \times \left( 0.80 + \frac{3.30}{2} \right) = 0.55 \text{ t.}$$

$$\text{maggiorazione Trav. a spessore 1-6} \\ 0.8 \times 350 \times \frac{5.20}{2} = 0.75 \text{ t.}$$

$$\text{murature } \left( \frac{5.30 + 3.30}{2} + 0.80 \right) \times 1.000 = 5.10 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.50 \times 2500 \times 3.10 = 1.17 \text{ t.}$$

$$\text{Totale} = 11.72 \text{ t.}$$

$$P_{\text{tot.}} = 9.74 + 6 \times 11.72 = 70.32 \text{ t.}$$

$$\underline{9.74 \text{ t.}}$$

$$80.08 \text{ t.}$$

maggiorazione per pilastro piano Tema

$$(0.30 \times 0.60 + 0.30 \times 0.30) \times 3.50 \times 2500 - 1.17 = 1.20 \text{ t.}$$

$$P_{\text{tot.}} = 80.6 + 1.20 = 81.8 \text{ t.}$$

verifiche sollecitazioni:

- 1 ordine:

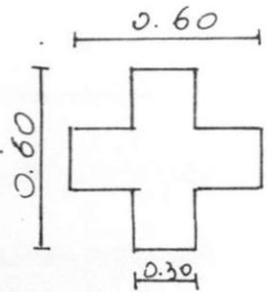
$$P = 81.8 \text{ t.} \quad \text{armatura } 6\phi 16 + 8\phi 12 - \text{St } \phi 6/12''$$

$$A_e = 2700 \text{ cm}^2.$$

$$A_p = 9.04 + 12 = 21.04 \text{ cm}^2.$$

$$A_{ec} = 8 \times 21.04 + 2700 = 2860 \text{ cm}^2.$$

$$\sigma_c = \frac{81.800}{2860} = 28.5 \text{ Kg./cm}^2.$$



2-3 ordine (30x50):

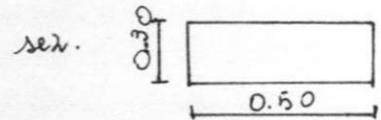
$$P = 68.88 \text{ t.} \quad \text{armatura } 6\phi 16 \quad - \text{St } \phi 6/15''$$

$$A_e = 1500 \text{ cm}^2.$$

$$A_p = 12 \text{ cm}^2.$$

$$A_{ec} = 1500 + 12 \times 8 = 1596 \text{ cm}^2.$$

$$\sigma_c = \frac{68.880}{1596} = 43 \text{ Kg./cm}^2.$$



4-5 ordine (30x40):

$$P = 68.88 - 2 \times 11.72 = 68.88 - \text{t.} \quad \text{armatura } 6\phi 16 - \text{St. } \phi 6/15''$$

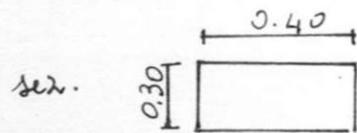
$$\begin{array}{r} 23.44 \text{ t.} \\ \hline 45.44 \text{ t.} \end{array}$$

$$A_e = 1200 \text{ cm}^2.$$

$$A_p = (6\phi 16) = 12 \text{ cm}^2.$$

$$A_{ec} = 1296 \text{ cm}^2.$$

$$\sigma_c = \frac{45440}{1296} = 35 \text{ Kg./cm}^2.$$



6-7 ordine (30x30):

$$P = 45.440 - 2 \times 11.72 = 45.44 \text{ t.} - \quad \text{armatura } 4\phi 16 - \text{St. } \phi 6/15''$$

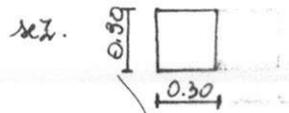
$$\begin{array}{r} 23.44 \text{ t.} \\ \hline 22.00 \text{ t.} \end{array}$$

$$A_e = 900 \text{ cm}^2.$$

$$A_p = 8 \text{ cm}^2.$$

$$A_{ec} = 972 \text{ cm}^2.$$

$$\sigma_c = \frac{22.000}{964} < 30 \text{ kg./cm}^2.$$



Il pilastro 1 risale al primo ordine mantenendo fisso l'asse x-x.  
Per gli ordini successivi risale mantenendo fisso l'asse y-y.

## PILASTRO 2

- 7 ordine :

$$\text{solai} \left( \frac{3.30 + 3.05}{2} \right) \left( 1.20 + \frac{5.10}{2} \right) \times 650 = 7.95 \text{ t.}$$

$$\text{attico } 4.80 \left( \frac{3.30 + 3.05}{2} \right) = 1.53 \text{ t.}$$

$$\text{p.p. trave } 0.50 \times 0.20 \times 2500 \times \left( \frac{3.30 + 3.05}{2} \right) = 0.72 \text{ t.}$$

$$\text{p.p. pil. } 0.30 \times 0.30 \times 2500 \times 3.10 = 0.70 \text{ t.}$$

$$\text{Totale} = 10.90 \text{ t.}$$

- 6-5-4-3-2-1  
ordine :

$$\text{solai} \left( \frac{3.30 + 3.05}{2} \right) \frac{5.10}{2} \times 650 = 5.25 \text{ t.}$$

$$\text{sol. a sp. } \frac{3.05}{2} \times 1.20 \times 650 = 1.19 \text{ t.}$$

$$\text{p.p. trave } 0.20 \times 2500 \times 0.50 \times \left( \frac{3.05 + 3.30}{2} \right) = 0.72 \text{ t.}$$

$$\text{mur. } 1000 \left( \frac{3.30 + 3.05}{2} \right) = 3.17 \text{ t.}$$

$$\text{p.p. pil. } 0.30 \times 0.50 \times 250 \times 3.10 = 1.17 \text{ t.}$$

$$\text{Totale} = 11.50 \text{ t.}$$

$$\begin{array}{r} P_1 = 10.90 \text{ t;} \\ P_2 = 10.90 \text{ t.} \\ \quad 11.50 \text{ t.} \\ \hline 22.40 \text{ t.} \end{array} \quad \begin{array}{r} P_3 = 22.40 \text{ t.} \\ \quad 11.50 \text{ t.} \\ \hline 33.90 \text{ t.} \end{array} \quad \begin{array}{r} P_4 = 33.90 \text{ t.} \\ \quad 11.50 \text{ t.} \\ \hline 45.40 \text{ t.} \end{array}$$

$$\begin{array}{r} P_5 = 45.40 \text{ t.} \\ \quad 11.50 \text{ t.} \\ \hline 56.90 \text{ t.} \end{array} \quad \begin{array}{r} P_6 = 56.90 \text{ t.} \\ \quad 11.50 \text{ t.} \\ \hline 68.40 \text{ t.} \end{array} \quad \begin{array}{r} P_7 = 68.40 \text{ t.} \\ \quad 11.50 \text{ t.} \\ \hline 79.90 \text{ t.} \end{array} \quad \text{=} 80 \text{ t.}$$

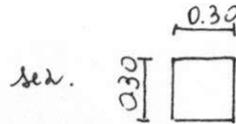
Il pilastro 2 risale sempre in asse.

6-7 ordine:

armatura 4  $\phi$ 16 - St.  $\phi$ 6/15

$$A_{ce} = 964 \text{ cm}^2.$$

$$r_c = \frac{22.400}{964} = 23,0 \text{ Kg./cm}^2.$$

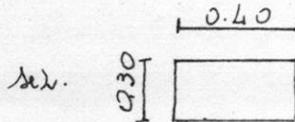


5-4 ordine:

armatura 6  $\phi$ 16 - St.  $\phi$ 6/15

$$A_{ce} = 1200 + 8 \times 12 = 1296 \text{ cm}^2.$$

$$r_c = \frac{45400}{1296} = 35 \text{ Kg./cm}^2.$$

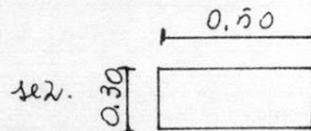


3-2 ordine:

armatura 6  $\phi$ 16 - St.  $\phi$ 6/15

$$A_{ce} = 1500 + 8 \times 12 = 1596 \text{ cm}^2.$$

$$r_c = \frac{68.400}{1596} = 42,7 \text{ Kg./cm}^2.$$

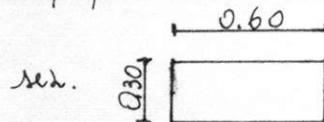


1 ordine:

armatura 6  $\phi$ 16 + 2  $\phi$ 16 - St.  $\phi$ 6/15

$$A_{ce} = 1800 + 16 \times 8 = 1928$$

$$r_c = \frac{80.000}{1928} = 41,5 \text{ Kg./cm}^2.$$



### PILASTRO 3

- 7 ordine:

$$\text{solaino } 3,08 \times \left(1,20 + \frac{5,10}{2}\right) \times 650 = 755 \text{ t.}$$

$$\text{attico } 3,08 \times 480 = 1,48 \text{ t.}$$

$$\text{p.p. Trave } 0,50 \times 0,20 \times 2500 \times 3,08 = 0,77 \text{ t.}$$

$$\text{p.p. pil. } 0,30 \times 0,30 \times 2500 \times 3,10 = 0,70 \text{ t.}$$

$$\text{Totale} = 10,70 \text{ t.}$$

- 6.5.4.3.2 ordine :

$$\text{solcio } 3.08 \times \left( \frac{5.10}{2} + 1.20 \right) \times 650 = 7.55 \text{ t.}$$

$$\text{p. trave es.} = 0.77 \text{ t.}$$

$$\text{mur. } 1000 \times 3.08 = 3.08 \text{ t.}$$

$$\text{p.p. pil. } 0.30 \times 0.50 \times 2500 \times 3.10 = 1.17 \text{ t.}$$

$$\text{Totale} = 12.57 \text{ t.}$$

- 7 ordine :

$$P = 10.70 \text{ t} \quad \text{armatura } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 964 \text{ cm}^2.$$

$$\sigma_c < 30 \text{ Kg/cm}^2.$$

- 6 ordine :

$$P = 23.27 \text{ t} \quad \text{armatura } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 964 \text{ cm}^2.$$

$$\sigma_c < 30 \text{ Kg/cm}^2.$$

- 5 ordine :

$$P = 35.84 \text{ t.} \quad \text{armatura } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 1296 \text{ cm}^2.$$

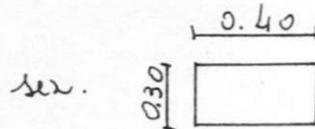
$$\sigma_c < 30 \text{ Kg/cm}^2.$$

- 4 ordine :

$$P = 48.41 \quad \text{armatura } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 1296 \text{ cm}^2.$$

$$\sigma_c = \frac{48410}{1296} = 37.5 \text{ Kg/cm}^2.$$

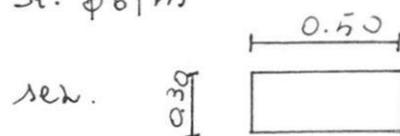


- 3 ordine :

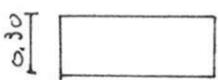
$$P = 60.98 \quad \text{armatura } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 1596 \text{ cm}^2.$$

$$\sigma_c = \frac{60980}{1596} = 38 \text{ Kg/cm}^2.$$



- 2 ordine:

$$P = 73.55 \text{ t.} \quad \text{armatura } 6 \phi 16 - \text{ST. } \phi 6/15$$
$$A_{cc} = 1596 \text{ cm}^2.$$
$$\rho_c = \frac{73550}{1596} = 46 \text{ Kg./cm}^2.$$


- 1 ordine:

$$P = 86.12 \text{ t.} \quad \text{armatura } 6 \phi 16 + 2 \phi 16 - \text{ST. } \phi 6/15$$
$$A_{cc} = 1928 \text{ cm}^2.$$
$$\rho_c = \frac{86.120}{1928} = 44.5 \text{ Kg./cm}^2.$$

### PILASTRO 4

- 7 ordine:

$$\text{solaio } (1.20 + \frac{5.10}{2}) \times 650 \left( \frac{3.10 + 2.25}{2} \right) = 655 \text{ t.}$$

$$\text{attico } \left( \frac{2.25 + 3.10}{2} \right) \times 480 = 129 \text{ t.}$$

$$\text{pp. trave } 0.20 \times 0.50 \times 2500 \times \left( \frac{3.10 + 2.25}{2} \right) = 0.67 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.30 \times 2500 \times 3.10 = 0.70 \text{ t.}$$

$$\text{Totale} = 9.21 \text{ t.}$$

- 6.5.4.3.2 ordine:

$$\text{solaio } (1.20 + \frac{5.10}{2}) \times 650 \times \left( \frac{3.10 + 2.25}{2} \right) = 6.55 \text{ t.}$$

$$\text{muratura } 1000 \left( \frac{2.25 + 3.10}{2} \right) = 2.68 \text{ t.}$$

$$\frac{2.25}{2} \times 1000 = 1.13 \text{ t.}$$

$$\text{pp. Trave } es = 0.67 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.50 \times 2500 \times 3.10 = 1.17 \text{ t.}$$

$$\text{Totale} = 12.20 \text{ t.}$$

- 7 ordine:

$$P = 9.21 \text{ t} \quad \text{armatura } 4 \phi 16 - \text{ST. } \phi 6/15$$

$$A_{cc} = 964 \text{ cm}^2.$$

$$\rho_c \leq 30 \text{ Kg./cm}^2.$$

$$\text{sez. } 30 \times 30$$

- 6 ordline :

$P_6 = 21.41 \text{ t}$  arm.  $4 \phi 16$  ST.  $\phi 6/15$   
 $A_{ee} = 964 \text{ emq.}$  sek.  $30 \times 30$   
 $\alpha = 30 \text{ Kg./emq.}$

- 5 ordline :

$P_5 = 33.61 \text{ t}$  arm.  $6 \phi 16$  ST.  $\phi 6/15$   
 $A_{ee} = 1296 \text{ emq.}$  sek.  $30 \times 40$   
 $\alpha = 30 \text{ Kg./emq.}$

- 4 ordline :

$P_4 = 45.81 \text{ t}$  arm.  $6 \phi 16$  ST.  $\phi 6/15$   
 $A_{ee} = 1296 \text{ emq.}$  sek.  $30 \times 40$   
 $\alpha = 35 \text{ Kg./emq.}$

- 3 ordline :

$P_3 = 58.01 \text{ t}$  arm.  $6 \phi 16$  ST.  $\phi 6/15$   
 $A_{ee} = 1596 \text{ emq.}$  sek.  $30 \times 50$   
 $\alpha = 36.5 \text{ Kg./emq.}$

- 2 ordline :

$P_2 = 70.21 \text{ t}$  arm.  $6 \phi 16$  ST.  $\phi 6/15$   
 $A_{ee} = 1596 \text{ emq.}$  sek.  $30 \times 50$   
 $\alpha = 44 \text{ Kg./emq.}$

- 1 ordline :

$P_1 = 82.41 \text{ t}$  arm.  $8 \phi 16$  ST.  $\phi 6/15$   
 $A_{ee} = 1928 \text{ emq.}$  sek.  $30 \times 60$   
 $\alpha = 43 \text{ Kg./emq.}$

PILASTRO 5

- 8 ordine: Cop. scala

$$\text{solai} \frac{3.00}{2} \times \frac{5.80}{2} \times 5.00 = 2.17 \text{ t.}$$

$$\text{pp. Trave } 0.30 \times 0.40 \times 2500 \times \frac{3.00}{2} = 0.45 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.30 \times 2500 \times 1.30 = 0.30 \text{ t.}$$


---

Totale = 2.92 t.

- 7 ordine:

$$\text{solita scala } 900 \times \frac{2.50 \times 5.40}{4} = 3.10 \text{ t.}$$

$$\text{sbalzo } 650 \times \left( \frac{2.25 + 2.70}{2} \right) \times 1.20 = 1.95 \text{ t.}$$

$$\text{solai } \frac{5.10}{2} \times \frac{2.25}{2} \times 6.50 = 1.90 \text{ t.}$$

$$\text{attico } \left( \frac{2.25 + 2.70}{2} \right) \times 4.80 = 1.40 \text{ t.}$$

$$\text{mur. scala } \frac{5.40}{2} \times 1000 = 2.70 \text{ t.}$$

$$\text{trave (5-51) } 0.20 \times 0.50 \times 2500 \times \frac{2.50}{2} = 0.32 \text{ t.}$$

$$\text{mur. (5-51) } 100 \times \frac{2.50}{2} \times 0.20 \times 1400 = 0.35 \text{ t.}$$

$$\text{trave (5-10) a gin. } 0.20 \times 0.70 \times 2500 \times \frac{5.40}{2} = 0.90 \text{ t.}$$

$$\text{porta mur. } 0.20 \times 0.40 \times 2500 \times \frac{5.40}{2} = 0.54 \text{ t.}$$

$$\text{trave (5-51) interna } 0.30 \times 0.40 \times 2500 \times \frac{2.50}{2} = 0.38 \text{ t.}$$

$$\text{pp. pil. } 0.20 \times 0.80 \times 2500 \times 3.10 = 1.22 \text{ t.}$$


---

Totale = 14.76 t.

- 6.5.4.3.2 ordine:

$$\text{pp. pil. es.} = 1.22 \text{ t.}$$

$$\text{solita scala es.} = 3.10 \text{ t.}$$

$$\text{sbalzo es.} = 1.95 \text{ t.}$$

$$\text{solai es.} = 1.90 \text{ t.}$$

$$\text{mur. scala } \left( \frac{5.40 + 2.50}{2} \right) \times 1000 = 3.95 \text{ t.}$$

$$\begin{aligned} \text{mur. esp. } \frac{2.25}{2} \times 1000 &= 1.12 \text{ t.} \\ \frac{2.50}{2} \times 1000 &= 1.25 \text{ t.} \\ \text{pp. Trave (5-5)} \quad 0.20 \times 0.50 \times 2500 \times \frac{2.50}{2} &= 0.32 \text{ t.} \\ &0.30 \times 0.40 \times 2500 \times \frac{2.50}{2} = 0.38 \text{ t.} \\ \text{Trave (5-10)} \quad 0.20 \times 0.70 \times \frac{5.40}{2} \times 2500 &= 0.90 \text{ t.} \\ &0.20 \times 0.40 \times 2500 \times \frac{5.40}{2} = 0.54 \text{ t.} \\ \text{Totale} &= 16.63 \text{ t.} \end{aligned}$$

- 8 ordline :

$$\begin{aligned} P_8 &= 2.92 \text{ t.} \quad \text{arm. } 4 \phi 12 \quad \text{St. } \phi 6/10 \\ &\text{sev. } 20 \times 20 \\ \sigma_c &< 30 \text{ Kg./cm}^2. \end{aligned}$$

- 7 ordline :

$$\begin{aligned} P_7 &= 17.68 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15 \\ &\text{sev. } 30 \times 30 \\ \sigma_c &< 30 \text{ Kg./cm}^2. \end{aligned}$$

- 6 ordline :

$$\begin{aligned} P_6 &= 34.31 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15 \\ A_{ee} &= 964 \text{ cm}^2. \\ \sigma_c &= \frac{34.310}{964} = 35.5 \text{ Kg./cm}^2. \\ &\text{sev. } 30 \times 30 \end{aligned}$$

- 5 ordline :

$$\begin{aligned} P_5 &= 50.94 \text{ t.} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15 \\ A_{ee} &= 1296 \text{ cm}^2. \\ \sigma_c &= \frac{50.940}{1296} = 40 \text{ Kg./cm}^2. \\ &\text{sev. } 30 \times 40 \end{aligned}$$

- 4 ordline :

$$\begin{aligned} P_4 &= 67.57 \text{ t.} \quad \text{arm. } 6 \phi 16 \\ A_{ee} &= 1596 \text{ cm}^2. \\ \sigma_c &= \frac{67.570}{1596} = 42 \text{ Kg./cm}^2. \\ &\text{sev. } 30 \times 50 \end{aligned}$$

- 3 ordina:

$$P_3 = 84.14 \text{ t.} \quad \text{arm. } 8 \phi 16$$

$$A_{ec} = 1800 + 128 = 1928 \text{ cm}^2$$

$$\sigma = \frac{84140}{1928} = 43 \text{ kg/cm}^2$$

sev. 30x60

- 2 ordina:

$$P_2 = 100.71 \text{ t.} \quad \text{arm. } 10 \phi 16$$

st.  $\phi 6/15$   $A_f = 16 \text{ cm}^2$

$A_{ic} = 2260 \text{ cm}^2$

$$\sigma = \frac{100710}{2260} = 44 \frac{1}{2} \text{ kg/cm}^2$$

sev. 30x70

- 1 ordina:

$$P_1 = 117.28 \text{ t.} \quad \text{arm. } 10 \phi 16$$

st.  $\phi 6/15$

$$A_{ec} = 2560 \text{ cm}^2$$

sev. 30x80

$$\sigma = \frac{117280}{2560} = 46 \text{ kg/cm}^2$$

## PILASTRO 6

- 7 ordina:

$$\text{soluía a sp. } 135 \times 0.22 \times \left( \frac{5.90 + 4.95}{2} \right) \times 25.00 = 4.05 \text{ t.}$$

$$\text{souz. } 4.50 \times 1.35 \times \left( \frac{5.90 + 4.95}{2} \right) = 3.32 \text{ t.}$$

$$\text{soluía } \left( \frac{5.20 + 3.95}{2} \right) \times \frac{3.40}{2} \times 650 = 5.05 \text{ t.}$$

$$\text{antes } 480 \left( \frac{5.90 + 4.95}{2} \right) = 2.62 \text{ t.}$$

$$\text{trave (6-7) } 0.22 \times 100 \times \frac{3.40}{2} \times 2.500 = 0.94 \text{ t.}$$

$$\text{souz. trave } 450 \times 100 \times \frac{3.40}{2} = 0.77 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.30 \times 2500 \times 3.10 = 0.70 \text{ t.}$$

---


$$\text{Totale} = 17.45 \text{ t.}$$

- 6.5.4.3.2.1 ordine :

solaino a sb.  $105 \times 0.22 \times 2500 \times \left( \frac{5.90 + 4.95}{2} \right) = 3.15 \text{ t.}$

sovr.  $450 \times 1.05 \left( \frac{5.90 + 4.95}{2} \right) = 2.57 \text{ t.}$

solaino es  $= 5.05 \text{ t.}$

muratura  $\left( \frac{5.90 + 4.95}{2} \right) \times 1000 = 5.45 \text{ t.}$

trave (6-7) es.  $= 0.94 \text{ t.}$

sovr. trave es.  $= 0.77 \text{ t.}$

pp. pil.  $0.30 \times 0.50 \times 2500 \times 3.10 = 1.17 \text{ t}$

Totale  $= 19.10 \text{ t.}$

- 7 ordine :

$P_7 = 17.45 \text{ t.}$  arm.  $4 \phi 16$  ST.  $\phi 6 / 15$

sev.  $30 \times 30$

$\sigma_c < 30 \text{ Kg./cmq.}$

- 6 ordine :

$P_6 = 36.55 \text{ t}$  arm.  $4 \phi 16$  ST.  $\phi 6 / 15$

sev.  $30 \times 30$

$A_{ce} = 964 \text{ cmq.}$

$\sigma_c = 37 \text{ Kg./cmq.}$

- 5 ordine :

$P_5 = 55.65 \text{ t}$  arm.  $6 \phi 16$  ST.  $\phi 6 / 15$

sev.  $30 \times 40$

$A_{ce} = 1296 \text{ cmq.}$

$\sigma_c = 43 \text{ Kg./cmq.}$

- 4 ordine :

$P_4 = 74.75 \text{ t}$  arm.  $6 \phi 16$  ST.  $\phi 6 / 15$

sev.  $30 \times 50$

$A_{ce} = 1596 \text{ cmq.}$

$\sigma_c = 46.5 \text{ Kg./cmq.}$

- 3 ordine :

$P_3 = 93.85 \text{ t.}$  arm.  $8 \phi 16$  ST.  $\phi 6 / 15$

sev.  $30 \times 60$

$A_{ce} = 1928 \text{ cmq.}$

$\sigma_c = 48 \text{ Kg./cmq.}$

- 2<sup>o</sup> ordine:

$$P_2 = 113.70 \text{ t.} \quad \text{arm. } 8 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 1928 \text{ cm}^2$$

$$s_e = \frac{113.700}{1928} = 59 \text{ Kg./cm}^2$$

sew. 30 x 60

- 1<sup>o</sup> ordine:

$$P_1 = 133.55 + 1.20 = 134.75 \text{ t.} \quad \text{arm. } 6 \phi 16 + 8 \phi 12 \quad \text{St. } \phi 6/12$$

(T. 1.20 per magg. peso pilastro)

$$A_{ee} = 2700 + 160 = 2860 \text{ cm}^2$$

$$s_e = 46.5 \text{ Kg./cm}^2$$

### PILASTRO 7-8

- 7-6-5-4-3-2-1 ordine

$$\text{colonna } \left( \frac{3.40 + 2.90}{2} \right) \times \left( \frac{5.20 + 3.95}{2} \right) \times 6.50 = 840 \text{ t.}$$

$$\text{trave } (6 \cdot 7 \cdot 8) \left( \frac{3.40 + 2.90}{2} \right) \times 2500 \times 0.22 \times 1.00 = 1.73 \text{ t.}$$

$$\text{sovr. Trave } 4.50 \times 1.00 \times \left( \frac{3.40 + 2.90}{2} \right) = 1.42 \text{ t.}$$

$$\text{p.p. pil. } 0.30 \times 0.50 \times 2500 \times 3.10 = \frac{1.17}{\text{t.}}$$

Totale = 12.72 t.

- 7<sup>o</sup> ordine:

$$P_7 = 12.72 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 964 \text{ cm}^2$$

$$s_e < 30 \text{ Kg./cm}^2$$

sew. 30 x 30

- 6<sup>o</sup> ordine:

$$P_6 = 25.44 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 964 \text{ cm}^2$$

$$s_e < 30 \text{ Kg./cm}^2$$

sew. 30 x 30

- 5<sup>o</sup> ordine:

$$P_5 = 38.16 \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ee} = 1296 \text{ cm}^2$$

$$s_e < 30 \text{ Kg./cm}^2$$

sew. 30 x 40

- 4 ordine:

$$P_4 = 50.88 \text{ t} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1296 \text{ cm}^2 \quad \text{sew. } 30 \times 40$$

$$c_e = 40 \text{ Kg./cm}^2$$

- 3 ordine:

$$P_3 = 63.60 \text{ t} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1596 \text{ cm}^2 \quad \text{sew. } 30 \times 50$$

$$c_e = 40 \text{ Kg./cm}^2$$

- 2 ordine:

$$P_2 = 76.32 \text{ t} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1596 \text{ cm}^2 \quad \text{sew. } 30 \times 50$$

$$c_e = 48 \text{ Kg./cm}^2$$

- 1 ordine:

$$P_1 = 89.04 \text{ t} \quad \text{arm. } 8 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1928 \text{ cm}^2 \quad \text{sew. } 30 \times 60$$

$$c_e = 46 \text{ Kg./cm}^2$$

### PILASTRO 9

- 7.6.5.4.3.2.1 ordine:

$$\text{solais } \left( \frac{3.40 + 2.00}{2} \right) \times \left( \frac{5.20 + 3.95}{2} \right) \times 650 = 8.03 \text{ t.}$$

$$\text{pp trave } 0.22 \times 1.00 \times 2500 \times \left( \frac{3.40 + 2.00}{2} \right) = 1.50 \text{ t.}$$

$$\text{source trave } 450 \times 1.00 \left( \frac{3.40 + 2.00}{2} \right) = 1.22 \text{ t.}$$

$$\text{pp pil. } 0.30 \times 0.50 \times 2500 \times 3.10 = 1.17 \text{ t.}$$


---


$$\text{Totale} = 11.92 \text{ t.}$$

- 7 ordine:

$$P_7 = 11.92 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 964 \text{ cm}^2 \quad \text{sew. } 30 \times 30$$

$$c_e = 30 \text{ Kg./cm}^2$$

- 6 ordline :

$$P_6 = 23.84 \text{ T.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 964 \text{ cm}^2. \quad \text{serv. } 30 \times 30$$

$$c_e = 30 \text{ Kg./cm}^2.$$

- 5 ordline :

$$P_5 = 35.76 \text{ T.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 964 \text{ cm}^2. \quad \text{serv. } 30 \times 30$$

$$c_e = 37.5 \text{ Kg./cm}^2.$$

- 4 ordline :

$$P_4 = 47.68 \text{ T.} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1296 \text{ cm}^2. \quad \text{serv. } 30 \times 40$$

$$c_e = 37 \text{ Kg./cm}^2.$$

- 3 ordline :

$$P_3 = 59.600 \text{ T.} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1596 \text{ cm}^2. \quad \text{serv. } 30 \times 50$$

$$c_e = 37.5 \text{ Kg./cm}^2.$$

- 2 ordline :

$$P_2 = 71.62 \text{ T.} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1596 \text{ cm}^2. \quad \text{serv. } 30 \times 50$$

$$c_e = 45 \text{ Kg./cm}^2.$$

- 1 ordline :

$$P_1 = 83.44 \text{ T.} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ce} = 1928 \text{ cm}^2. \quad \text{serv. } 30 \times 60$$

$$c_e = 43 \text{ Kg./cm}^2.$$

### PILASTRO 10

- 8 ordline :

$$\begin{aligned} \text{pp. trave (10-10')} & 0.20 \times 0.50 \times 2500 \times \frac{2.50}{2} & = & 0.31 \text{ T.} \\ \text{solaino } & \frac{5.80 \times 2.90}{4} \times 500 & = & 2.11 \text{ T.} \\ & \frac{2.90 \times 3.00}{4} \times 500 & = & 1.09 \text{ T.} \end{aligned}$$

$$\text{pp. pil. } 0.30 \times 0.30 \times 3.00 \times 2500 = 0.70 \text{ t.}$$

$$\text{Totale} = 4.21 \text{ t.}$$

- 7 ordine:

$$\text{solina scala } \frac{5.40}{2} \times \frac{2.50}{2} \times 900 = 3.05 \text{ t.}$$

$$\text{solaino } \left( 0.50 + \frac{2.00}{2} \right) \left( \frac{3.95}{2} \times 6.50 \right) = 1.93 \text{ t.}$$

$$\text{pp. Trave } 0.20 \times 1.10 \times 2500 \times \frac{2.50}{2} = 0.69 \text{ t.}$$

$$0.20 \times 0.70 \times 2500 \times \frac{6.40}{2} = 0.95 \text{ t.}$$

$$0.20 \times 0.40 \times 2500 \times \frac{5.40}{2} = 0.54 \text{ t.}$$

$$\text{solina ascensore } \frac{1.50 \times 1.50 \times 7000}{4} = 3.95 \text{ t.}$$

$$\text{solaino } \frac{2.00}{2} \times \frac{5.20}{2} \times 650 = 1.70 \text{ t.}$$

$$\text{muratura } \left( \frac{5.40 + 2.50 + 1.50}{2} \right) \times 1000 = 4.70 \text{ t.}$$

$$\text{pp. Trave } \frac{2.00}{2} \times 0.22 \times 2500 \times 1.00 = 0.55 \text{ t.}$$

$$\text{sovrac. } \frac{2.00}{2} \times 1.00 \times 4.50 = 0.45 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.40 \times 2500 \times 3.10 = 0.93 \text{ t.}$$

$$\text{Totale} = 19.44 \text{ t.}$$

- 6.5.4.3.2.1 ordine:

$$\text{solina scala es.} = 3.05 \text{ t.}$$

$$\text{solaino es.} = 1.93 \text{ t.}$$

$$\text{solaino es.} = 1.70 \text{ t.}$$

$$\text{pp. Trave. es.} = 0.95 \text{ t.}$$

$$\text{es.} = 0.54 \text{ t.}$$

$$0.20 \times 0.50 \times 2500 \times \frac{2.50}{2} = 0.32 \text{ t.}$$

$$\text{es.} = 0.55 \text{ t.}$$

$$\text{sovrac. Trave es.} = 0.45 \text{ t.}$$

$$\text{muratura es.} = 4.70 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.60 \times 2500 \times 3.10 = 1.40 \text{ t.}$$

$$\text{Totale} = 15.59 \text{ t.}$$

- 8 ordine :

$$P. = 4.21 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/10$$

$$A_{ie} = 664 \text{ emq.} \quad \text{sev. } 30 \times 20$$

$$\sigma_e \approx 30 \text{ Kg./emq.}$$

- 7 ordine :

$$P. = 23.65 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ie} = 264 \text{ emq.} \quad \text{sev. } 30 \times 30$$

$$\sigma_e \approx 30 \text{ Kg./emq.}$$

- 6 ordine :

$$P. = 39.24 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ie} = 964 \text{ emq.} \quad \text{sev. } 30 \times 30$$

$$\sigma_e = 40.5 \text{ Kg./emq.}$$

- 5 ordine :

$$P. = 54.83 \text{ t.} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ie} = 1296 \text{ emq.} \quad \text{sev. } 30 \times 40$$

$$\sigma_e = 42.2 \text{ Kg./emq.}$$

- 4 ordine :

$$P. = 70.42 \text{ t.} \quad \text{arm. } 6 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ie} = 1696 \text{ emq.} \quad \text{sev. } 30 \times 50$$

$$\sigma_e = 44 \text{ Kg./emq.}$$

- 3 ordine :

$$P. = 86.01 \text{ t.} \quad \text{arm. } 8 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ie} = 1928 \text{ emq.} \quad \text{sev. } 30 \times 60$$

$$\sigma_e = 44.5 \text{ Kg./emq.}$$

- 2 ordine :

$$P. = 101.60 \text{ t.} \quad \text{arm. } 8 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ie} = 2228 \text{ emq.} \quad \text{sev. } 30 \times 70$$

$$\sigma_e = 45.2 \text{ Kg./emq.}$$

- 1 ordine :

$$P. = 117.19 \text{ t.} \quad \text{arm. } 6 \phi 20 + 2 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ie} = 2583 \text{ emq.} \quad \text{sev. } 30 \times 80$$

$$e = 45.2 \text{ Kg./cm}^2$$

### PILASTRO 11

- 7 ordine:

$$\text{solaio } \frac{3.95}{2} \times \frac{3.25}{2} \times 650 = 2.10 \text{ t.}$$

$$\text{trave (6-11)} 105 \times 0.22 \times 2500 \times \frac{4.95}{2} = 1.44 \text{ t.}$$

$$\text{sovracc. } 105 \times 450 \times \frac{4.95}{2} = 1.17 \text{ t.}$$

$$\text{trave (11-12)} \left( \frac{3.25}{2} + 0.90 \right) \times 1.00 \times 0.22 \times 25000 = 1.39 \text{ t.}$$

$$\text{sovracc. } \left( \frac{3.25}{2} + 0.90 \right) \times 1.00 \times 4.50 = 1.14 \text{ t.}$$

$$\text{solaio a sb. } 1.65 \left( \frac{3.25}{2} + 0.90 \right) + 6.50 = 2.72 \text{ t.}$$

$$\text{muro attico } 4.80 \left( \frac{3.25}{2} + 0.90 + \frac{4.95}{2} + 2.00 \right) = 3.36 \text{ t.}$$

$$\text{p.p. pil. } \phi 40: 0.1250 \times 2500 \times 3.10 = 0.97 \text{ t.}$$

---


$$\text{Totale} = 14.29 \text{ t.}$$

- 6.5.4.3.2.1 ordine:

$$\text{solaio es} = 2.10 \text{ t.}$$

$$\text{trave (6-11) es} = 1.44 \text{ t.}$$

$$\text{sovracc. es.} = 1.17 \text{ t.}$$

$$\text{trave (11-12) es} = 1.39 \text{ t.}$$

$$\text{sovracc. es.} = 1.14 \text{ t.}$$

$$\text{solaio a sb. es.} = 2.72 \text{ t.}$$

$$\text{p.p. pil. es.} = 0.97 \text{ t.}$$

$$\text{mur. } \left( \frac{4.95 + 3.25}{2} \right) \times 1000 = 4.10 \text{ t.}$$

---


$$\text{Totale} = 15.03 \text{ t.}$$

- 7 ordine:

$$P = 14.29 \text{ t} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_c = 1260 \text{ cm}^2 \quad \text{sev. } \phi 40$$

$$A_f = 8 \text{ cm}^2$$

$$A_{ic} = 1340 \text{ cm}^2 \quad \rho_e < 30 \text{ g/cm}^3$$

- 6 ordine:

$$P = 29.32 \text{ t.} \quad \text{arm. } 4 \phi 16 \quad \text{St. } \phi 6/15$$

$$A_{ic} = 1340 \text{ cm}^2$$

$$r_e < 30 \frac{\text{kg}}{\text{cm}^2}$$

sev.  $\phi 40$

- 5 ordine:

$$P. = 44.35 \text{ t.} \quad \text{arm. } 6 \phi 16 \quad \text{st. } \phi 6/15$$

$$A_{ic} = 1340 \text{ cm}^2$$

$$r_e = 33 \frac{\text{kg}}{\text{cm}^2}$$

sev.  $\phi 40$

- 4 ordine:

$$P. = 59.38 \text{ t.} \quad \text{arm. } 6 \phi 16 \quad \text{st. } \phi 6/15$$

$$A_{ic} = 1340 \text{ cm}^2$$

$$r_e = 44.5 \frac{\text{kg}}{\text{cm}^2}$$

sev.  $\phi 40$

- 3 ordine:

$$P. = 74.41 \text{ t.} \quad \text{arm. } 6 \phi 16 \quad \text{st. } \phi 6/15$$

$$A_c = \phi 35 \text{ mt} = 970 \text{ cm}^2$$

$$A'_t = \frac{q_f \times \pi \times D}{4} = \frac{0.8 \times 3.14 \times 35^2}{4} = 8.8 \text{ cm}^2$$

sev.  $\phi 40$

Spirale  $\phi 10$

$$A_t = 12 \text{ cm}^2$$

$$A_{ic} = (15 A_t + 45 A'_t + A_c) = 180 + 450 + 970 = 1550 \text{ cm}^2$$

paramo 10 cm

- 2 ordine:

$$r_e = \frac{4410}{1550} = 48 \frac{\text{kg}}{\text{cm}^2}$$

$$P. = 89.44 \text{ t.} \quad \text{arm. } 8 \phi 16 \quad \text{st. } \phi 6/15$$

$$A'_t = \frac{0.8 \times 3.14 \times 35^2}{4} = 14 \text{ cm}^2$$

sev.  $\phi 40$  - Spirale  $\phi 10$

$$A_t = 16 \text{ cm}^2$$

paramo 6 cm.

$$A_{ic} = 240 + 630 + 970 = 1840 \text{ cm}^2$$

$$r_e = 48 \frac{\text{kg}}{\text{cm}^2}$$

- 1 ordine:

$$P. = 105.67 \text{ t.} \quad \text{arm. } 6 \phi 16 + 8 \phi 12 \quad \text{st. } \phi 6/15 \quad (\text{J. pil. 1.})$$

$$A_{ic} = 2860 \text{ cm}^2$$

$$r_e = 37 \frac{\text{kg}}{\text{cm}^2}$$

### PILASTRO 12-13-14.

- 7 ordine:

$$\text{solaio } 3.25 \times \frac{3.95}{2} \times 650 = 4.20 \text{ t.}$$

$$\text{sol. a sb. } 3.25 \times 1.65 \times 650 = 3.50 \text{ t.}$$

$$\text{pp. trave } 0.22 \times 1.00 \times 25000 \times 3.25 = 1.80 \text{ t.}$$

$$\text{sonae. trave } 450 \times 1.00 \times 3.25 = 1.47 \text{ t.}$$

$$\text{attico } 4.80 \times 3.25 = 1.56 \text{ t.}$$

$$\text{pp. pil. } \phi 40: 0.125 \times 3.10 \times 2500 = 0.97 \text{ t.}$$

$$\text{Totale} = 13.50 \text{ t.}$$

- 6.5.4.3.2.1 ordine:

solaino	es.	=	4.20	t.
shalio	es.	=	3.50	t.
pp. Trave	es.	=	1.80	t.
sovracc. Trave	es.	=	1.47	t.
pp. pil.	es.	=	0.97	t.
mur.	$3.25 \times 1000$	=	3.25	t.

$$\text{Totale} = 15.19 \text{ t.}$$

- 7 ordine:

$$P. = 13.50 \text{ t.}$$

$$\text{sev. } \phi 40 \text{ (P.12)} - 6 \phi 12 - 51 \phi 6 / 15 \\ r_c < 30 \text{ h/ey}$$

$$\text{sev. } 30 \times 30 \text{ (P.13-14)} - 4 \phi 16 - 51 \phi 6 / 15 \\ r_c < 30 \text{ h/ey}$$

- 6 ordine:

$$P. = 28.69 \text{ t.}$$

$$\text{sev. } \phi 40 \text{ (P.12)} - 6 \phi 12 - 51 \phi 6 / 15 \\ r_c < 30 \text{ h/ey}$$

$$\text{sev. } 30 \times 30 \text{ (P.13-14)} - 4 \phi 16 - 51 \phi 6 / 15 \\ r_c < 30$$

- 5 ordine:

$$P. = 43.88 \text{ t.}$$

$$\text{sev. } \phi 40 \text{ (P.12)} - 6 \phi 16 - 51 \phi 6 / 15 \\ A_{ic} = 1260 + 64 = 1324 \text{ ey} \quad r_c = \frac{43880}{1324} = 33 \text{ h/ey}$$

$$\text{sev. } 30 \times 40 \text{ (P.13-14)} - 6 \phi 16 - 51 \phi 6 / 15 \\ A_{ic} = 1200 + 64 = 1264 \text{ ey} \quad r_c = \frac{43880}{1264} = 34.5 \text{ h/ey}$$

- 4 ordine:

$$P. = 59.07 \text{ t}$$

$$A_{ic} = 1324 \text{ cm}^2$$

$$\sigma_c = \frac{59.070}{1324} = 44 \text{ cm}^2$$

sev.  $\phi 40$  (P. 12)  $6 \phi 16$

sev  $30 \times 40$  (P. 13-14)  $6 \phi 16$ .

- 3 ordine:

$$P. = 74.26 \text{ t}$$

$$\sigma_c = 48 \frac{\text{kg}}{\text{cm}^2} \quad (\text{v. p. l. 11})$$

sev.  $\phi 40$  (P. 12) spirale  $\phi 10$   
passo 10 cm  
 $6 \phi 16$  long.

sev.  $30 \times 50$  (P. 13-14) -  $6 \phi 16$

$$A_{ic} = 1500 + 96 = 1596 \text{ cm}^2$$

$$\sigma_c = \frac{74260}{1596} = 46 \frac{\text{kg}}{\text{cm}^2}$$

- 2 ordine:

$$P. = 89.45 \text{ t}$$

$$\sigma_c = 48 \frac{\text{kg}}{\text{cm}^2} \quad (\text{v. p. l. 11})$$

sev.  $\phi 40$  (P. 12) Spirale  $\phi 10$   
passo 6 cm  
 $8 \phi 16$  long.

sev  $30 \times 60$  (P. 13-14) -  $8 \phi 16$

$$A_{ic} = 1800 + 124 = 1924 \text{ cm}^2$$

$$\sigma_c = \frac{89450}{1924} = 46 \frac{\text{kg}}{\text{cm}^2}$$

- 1 ordine:

$$P. = 104.64 \text{ t}$$

arm.  $6 \phi 16 + 8 \phi 12$  sez. a croce

$$A_{ic} = 2860 \text{ cm}^2 \quad (\text{v. p. l. 1})$$

$$\sigma_c = 37 \frac{\text{kg}}{\text{cm}^2}$$

PILASTRO 15- 7 ordine:

$$\text{solaino } 3.30 \times \frac{3.95}{2} \times 6.50 = 4.25 \text{ t.}$$

$$\text{solaino a sb. } 3.30 \times 1.65 \times 6.50 = 3.56 \text{ t.}$$

$$\text{pp. trave } 0.22 \times 1.00 \times 2500 \times 3.30 = 1.83 \text{ t.}$$

$$\text{sovracc. trave } 4.50 \times 1.00 \times 3.30 = 1.47 \text{ t.}$$

$$\text{attico } 4.80 \times 3.30 = 1.58 \text{ t.}$$

$$\text{pp. pil. } 0.30 \times 0.30 \times 2500 \times 3.10 = 0.70 \text{ t.}$$

---


$$\text{Totale} = 13.37 \text{ t.}$$

- 6.5.4.3.2.1 ordine:

$$\text{solaino es.} = 4.25 \text{ t.}$$

$$\text{sol. a sb. es.} - \left( \frac{2.10 + 4.00}{2} \right) \times 1.40 \times 6.50 = 0.80 \text{ t.}$$

$$\text{mur. } 4.40 \times 1000 = 4.40 \text{ t.}$$

$$\text{pp. trave es.} = 1.83 \text{ t.}$$

$$\text{sovracc. es.} = 1.47 \text{ t.}$$

$$\text{pp. trave } 0.50 \times 0.22 \times 2500 \times \frac{3.00}{2} = 0.42 \text{ t.}$$

$$\text{mur. } \frac{3.00}{2} \times 600 = 0.90 \text{ t.}$$

$$\text{pp. pil. } 0.40 \times 0.40 \times 2500 \times 3.10 = 1.22 \text{ t.}$$

---


$$\text{Totale} = 15.29 \text{ t.}$$

- 7 ordine:

$$P. = 13.37 \text{ t.}$$

sev. 30x30 - 4φ16

Me < 30h/ey

- 6 ordine:

$$P. = 28.66 \text{ t.}$$

sev. 30x30 - 4φ16

Me < 30h/ey

- 5 ordine:

P. = 43.95 t.

A<sub>ie</sub> = 1296 cm<sup>2</sup>

$\rho_c = \frac{43950}{1296} = 34 \text{ kg/cm}^2$

serv. 30x40 - 6 φ16

- 4 ordine:

P. = 59.24 t.

A<sub>ie</sub> = 1296 cm<sup>2</sup>

$\rho_c = \frac{59240}{1296} = 46 \text{ kg/cm}^2$

serv. 30x40 - 6 φ16

- 3 ordine:

P. = 74.53 t.

A<sub>ie</sub> = 1696 cm<sup>2</sup>

$\rho_c = \frac{74530}{1696} = 43.5 \text{ kg/cm}^2$

serv. 40x40 - 6 φ16

- 2 ordine:

P. = 89.82 t.

A<sub>ie</sub> = 1696 cm<sup>2</sup>

$\rho_c = \frac{89820}{1696} = 52.5 \text{ kg/cm}^2$

serv. 40x40 - 6 φ16

- 1 ordine:

P. = 105.11 t.

A<sub>ie</sub> = 2800 + 160 = 2960 cm<sup>2</sup>

$\rho_c = \frac{105110}{2960} = 36 \text{ kg/cm}^2$

serv. φ60 - 10 φ16

PILASTRO 16

- 8 ordine:

cop.  $\frac{2.90 \times 3.00}{2} \times 500 = 2.18 \text{ t.}$

pp.  $0.20 \times 2.00 \times 3.10 \times 2500 = 3.10 \text{ t.}$

\*Totale = 5.28 t.

- 7 ordine:

solita ascensore  $\frac{1.50 \times 1.50 \times 7000}{2} = 7.20 \text{ t.}$

pp. trave  $1.10 \times 0.20 \times 25000 \times 1.50 = 0.83 \text{ t.}$

mur.  $1000 \times 300 = 3.00 \text{ t.}$

$$\begin{array}{rcl}
 \text{pp. pil. es} & & = 3.10 \text{ t.} \\
 \text{solai} \frac{2.80}{2} \times 2.00 \times 650 & & = 1.83 \text{ t.} \\
 \hline
 \text{Totale} & & = 16.66 \text{ t.}
 \end{array}$$

- 6.5.4.3.2.1 ordine:

$$\begin{array}{rcl}
 \text{pp. trave } 0.20 \times 0.22 \times 2500 \times 1.50 & = & 0.17 \text{ t.} \\
 \text{solai es.} & = & 1.83 \text{ t.} \\
 \text{pp. pil. es.} & = & 3.10 \text{ t.} \\
 \text{p.p. trave } 0.50 \times 0.22 \times 2500 \times \frac{3.00}{2} & = & 0.33 \text{ t.} \\
 \text{mur. } 600 \times \frac{3.00}{2} & = & 0.90 \text{ t.} \\
 \text{mur. } 1.00 \times 1000 & = & 1.00 \text{ t.} \\
 \hline
 \text{Totale} & = & 7.33 \text{ t.}
 \end{array}$$

- 8 ordine:

$$P = 5.28 \text{ t}$$

$$R_c < 30 \text{ kg/cm}^2$$

$$\text{serv. } 190 \times 20 - 18 \phi 8$$

- 7 ordine:

$$P = 21.94 \text{ t.}$$

$$R_c < 30 \text{ kg/cm}^2$$

$$\text{serv. } 190 \times 20 - 18 \phi 8$$

- 6 ordine:

$$P = 29.27 \text{ t}$$

$$R_c < 30 \text{ kg/cm}^2$$

$$\text{serv. } 190 \times 20 - 18 \phi 8$$

- 5 ordine:

$$P = 36.60 \text{ t.}$$

$$R_c < 30 \text{ kg/cm}^2$$

$$\text{serv. } 190 \times 20$$

- 4 ordline:

$$P. = 43.93 \text{ t.}$$

$$R_e < 30 \frac{h}{g}$$

$$\text{sev. } 190 \times 20 - 18 \phi 8$$

- 3 ordline:

$$P. = 51.26 \text{ t}$$

$$R_e < 30 \frac{h}{g}$$

$$\text{sev. } 190 \times 20 - 18 \phi 10$$

- 2 ordline:

$$P. = 58.59 \text{ t.}$$

$$R_e < 30 \frac{h}{g}$$

$$\text{sev. } 190 \times 20 - 18 \phi 10$$

- 1 ordline:

$$P. = 65.92 \text{ t}$$

$$R_e < 30 \frac{h}{g}$$

$$\text{sev. } 190 \times 20 - 18 \phi 10$$

VERIFICA SOLLECITAZIONE SUL TERRENOPILASTRO 1

$$P. = 818 \text{ t.}$$

$$\text{Area} = (1.70 + 0.50) \times 1.80 + \frac{3.72}{2} \times 1.00 = 5.81 \text{ mq.}$$

$$\text{p.p. trave 1-2-3 cee} :: (0.60 \times 1.80 \times 2500 + 1.00 \times 0.40 \times 2500) = 2700 + 1000 = 3700 \text{ Kg./ml.}$$

$\sigma_x$  ipotizzata in fondazione dal peso della stessa fondazione.

$$\sigma_x = \frac{3700}{18.000} = 0.2 \text{ Kg./cmq.}$$

$$\sigma_x = \frac{81.800}{58.100} + 0.2 = 1.40 + 0.2 = 1.6 \text{ Kg./cmq.}$$

PILASTRO 2

$$P. = 80 \text{ t.}$$

$$\text{Area} = \left( \frac{3.40}{2} + \frac{3.00}{2} \right) \times 1.80 = 5.76 \text{ mq.}$$

$$\sigma_x = \frac{20.000}{57.600} + 0.2 = 1.38 + 0.2 = 1.58 \text{ Kg./cmq.}$$

PILASTRO 3

$$P. = 86.12 \text{ t.}$$

$$\text{Area} = \left( \frac{3.00 + 3.10}{2} \right) \times 1.80 = 5.49 \text{ mq.}$$

$$\sigma_x = \frac{86.120}{54.900} + 0.2 = 1.66 \text{ Kg./cmq.}$$

PILASTRO 4

$$P. = 82.41 \text{ t.}$$

$$\text{Area} = \left( \frac{3.10 + 2.20}{2} \right) \times 1.80 = 4.77 \text{ mq.}$$

$$\sigma_x = \frac{82.410}{47.700} + 0.2 = 1.92 \text{ Kg./cmq.}$$

PILASTRO 5

$$P. = 117.28 \text{ t.}$$

$$\text{Area} = 155 \times 3.80 + 1.00 \times 1.80 = 5.89 + 1.80 = 7.69 \text{ mq.}$$

$$\sigma_x = \frac{117.28}{76.900} + 0.2 = 1.72 \text{ Kg./cmq.}$$

PILASTRO 6

$$P = 134.75 \text{ t.}$$

$$\text{Area} = 230 \times (170 + 050) + \frac{300}{2} \times 1.00 + \frac{360}{2} \times 1.00 =$$

$$= 5.06 + 1.50 + 1.80 = 8.36 \text{ m}^2.$$

$$\alpha = \frac{134.750}{836000} + 0.2 = 1.81 \text{ Kg./cm}^2.$$

PILASTRO 7-8

$$P = 89.047 \text{ t.}$$

$$\text{Area} = \left( \frac{3.30 + 2.95}{2} \right) \times 2.30 = 7.187 \text{ m}^2.$$

$$\alpha = \frac{89.047}{71870} + 0.2 = 1.45 \text{ Kg./cm}^2.$$

PILASTRO 9

$$P = 83.44 \text{ t.}$$

$$\text{Area} = \left( \frac{3.05 + 2.05}{2} \right) \times 2.30 = 5.9 \text{ m}^2.$$

$$\alpha = \frac{83440}{59000} + 0.2 = 1.62 \text{ Kg./cm}^2.$$

PILASTRO 10

$$P = 117.19 \text{ t.}$$

$$\text{Area} = 150. \times 3.50 + 0.80 \times 2.30 = 7.09$$

$$\alpha = \frac{117.190}{70.900} + 0.2 = 1.85 \text{ Kg./cm}^2.$$

PILASTRO 11

$$P = 105.47 \text{ t.}$$

$$\text{Area} = \left( \frac{3.20 + 0.50}{2} \right) \times 2.20 + 1.50 \times 1.00 = 4.60 + 1.50 = 6.10 \text{ m}^2.$$

$$\alpha = \frac{105.470}{61.000} + 0.2 = 1.94 \text{ Kg./cm}^2.$$

PILASTRO 12-13-14-15

$$P = 105 \text{ t.}$$

$$\text{Area} = 3.25 \times 2.20 = 715 \text{ m}^2.$$

$$\alpha = \frac{105000}{71.500} + 0.2 = 1.74 \text{ Kg./cm}^2.$$

PILASTRO 16

$P. = 65.92 \approx 66 \text{ t.}$   
 $Area = 3.00 \times 1.50 = 4.50 \text{ mq.}$   
 $\sigma = \frac{66}{4.50} + 0.2 = 167 \text{ Kg./emp.}$

CALCOLO FONDAZIONI

TRAVE 1-2-3-4-5-5' ecc.

TRAVE 1-2

$p = 18000 \times 1.40 = 25.2 \text{ t./ml.}$   
 $m = \frac{0.083 \times 25.2 \times 3.40^2}{40 \times 160} = 24.3 \text{ t. m.}$   
 $\sigma = 35 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 105 \text{ emp.}$   
 $T = 18.000 \times 1.70 \times 1.4 = 43 \text{ t.}$   
 $e = \frac{43.000}{0.9 \times 157 \times 40} = \frac{43.000}{5650} = 7.6 \text{ Kg./emp.}$   
 $S = \frac{7.6 \times 40 \times 1.70}{2} = 25.8 \text{ t.}$   
 $St = \phi 8/15 \quad S_{st} = 11 \times 1400 = 1545 \text{ t.}$   
 $A_{pp.} = \frac{12.900}{\sqrt{2} \times 1400} = 6.5 \text{ emp.}$

TRAVE 2-3

$p = 18.000 \times 1.46 = 26.2 \text{ t./ml.}$   
 $m = \frac{3.15^2 \times 26.2}{12 \times 40 \times 160} = 22 \text{ t. m.}$   
 $\sigma = 33 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 9.2 \text{ emp.}$   
 $T = 22 \times 1.575 = 34.6 \text{ t.}$   
 $e = \frac{34.600}{0.9 \times 157 \times 40} = 6.15 \text{ Kg./emp.}$   
 $S = \frac{6.15 \times 40 \times 157.5}{2} = 19.4 \text{ t.}$   
 $St = \phi 8/15 \quad S_{st} = 10 \times 1400 = 14.000 \text{ Kg.}$   
 $A_{pp.} = \frac{9700}{\sqrt{2} \times 14000} = 4.85 \text{ emp.}$

TRAVE 3-4

$$p = 1.72 \times 18.000 = 31 \text{ t./ml.}$$

$$l_{acc} = 3.05 \text{ m.}$$

$$m = \frac{3.05^2}{12} \times 31.000 = 24.2 \text{ t. m}$$

$$b = 40 \text{ cm.} \quad H = 160 \text{ cm.}$$

$$\sigma_c = 35 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 10.2 \text{ emp.}$$

$$T = 31.000 \times 1.525 = 48 \text{ t.}$$

$$e = \frac{48.000}{0.9 \times 157 \times 40} = 8.5 \text{ Kg./emp.}$$

$$S = \frac{8.5 \times 40 \times 152.5}{2} = 26 \text{ t.}$$

$$S_A = \phi 8 / 15 \quad S_{II} = 11 \times 1400 = 15.40 \text{ t.}$$

$$App. = \frac{13.000}{\sqrt{2} \times 1400} = 6.5 \text{ emp.}$$

TRAVE 4-5 : 5-5'

$$l_{acc} = 2.50 \text{ m ; } 2.30 \text{ m.}$$

$$p = 1.52 \times 18.000 = 27.4 \text{ t./ml.}$$

$$m = \frac{2.50^2}{12} \times 27.4 = 14.4 \text{ t. m.}$$

sezione 40x160

$$\sigma_c < 30 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 6.05 \text{ emp.}$$

$$T = 1.25 \times 27.4 = 34.2 \text{ t.}$$

$$e = \frac{34.2 \text{ t}}{0.9 \times 157 \times 40} = 6.05 \text{ Kg./emp.}$$

$$S = \frac{6.05 \times 40 \times 125}{2} = 15.000 \text{ t.}$$

$$S_A = \phi 8 / 15 \quad S_{II} = 8 \times 1400 = 11.200 \text{ t.}$$

$$App. = \frac{7500}{\sqrt{2} \times 1400} = 3.75 \text{ emp.}$$

TRAVATA 1.6-11TRAVE 1-6

$$p = 16.1 \text{ t./ml.}$$

$$l = 5.75 \text{ m.}$$

$$m = \frac{5.75^2}{12} \times 16.1 = 44 \text{ t. m.}$$

$$b = 40 \text{ cm.} \quad H = 60 \text{ cm.}$$

$$\sigma_c = 49 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 187 \text{ emp.}$$

$$T = 16.1 \times \frac{5.75}{2} = 46.3 \text{ t.}$$

$$ee = \frac{46.3 \text{ t.} \times 1000}{0.9 \times 40 \times 157} = \frac{46.300}{5650} = 8.2 \text{ kg./emp.}$$

$$S = 8.2 \times \frac{5.75}{4} \times 40 = 47.2 \text{ t.}$$

$$St = \phi 8/15 \quad Sst = 19 \times 1400 = 26.5 \text{ t.}$$

$$App. = \frac{23.600}{\sqrt{2} \times 1400} = 11.8 \text{ emp.}$$

### TRAVE 6-11

$$p = 17.4 \text{ t/ml.}$$

$$m = \frac{4.95^2}{12} \times 17.4 = 35.5 \text{ t.m.}$$

$$b = 40 \text{ cm.} \quad H = 160 \text{ cm}$$

$$ce = 43 \text{ kg./emp.} \quad \overline{c} = 1600 \text{ kg./emp.} \quad Af = 15.2 \text{ emp.}$$

$$T = \frac{17.4 \times 4.95}{2} = 43.000 \text{ t.}$$

$$ee = \frac{43.000}{0.9 \times 157 \times 40} = 7.6 \text{ kg./emp.}$$

$$S = 7.6 \times 40 \times \frac{4.95}{4} = 37.6 \text{ t.}$$

$$St = \phi 8/15 \quad Sst = 16 \times 1400 = 22.4 \text{ t.}$$

$$App. = \frac{18.8 \text{ t}}{\sqrt{2} \times 14} = 9.4 \text{ emp.}$$

### TAVATA 6.7.8.9.10 ecc.

### TRAVE 6-7

$$luer = 3.40 \text{ m.}$$

$$p = 1.67 \times 23.000 = 37 \text{ t/ml.}$$

$$m = \frac{3.40^2}{12} \times 37 = 35.6 \text{ t.m.}$$

$$b = 40 \text{ cm} \quad H = 160 \text{ cm.}$$

$$ce = 43 \text{ kg./emp.} \quad \overline{c} = 1600 \text{ kg./emp.} \quad Af = 15 \text{ emp.}$$

$$T = 37 \times 1.70 = 63 \text{ t.}$$

$$ee = \frac{63.000}{0.9 \times 40 \times 157} = 11.3 \text{ kg./emp.}$$

$$S = \frac{11.30 \times 40 \times 170}{2} = 38.5 \text{ t}$$

$$St = \phi 8/15$$

TRAVE 7-8

$$l_{uee} = 3.05 \text{ m.}$$

$$p = 1.25 \times 23000 = 28.8 \text{ t/ml.}$$

$$m = \frac{3.05^2}{12} \times 28.8 = 22.8 = 22.5 \text{ t.m.}$$

$$\text{sh. } 40 \times 160$$

$$\sigma_e = 34 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad Af = 9.5 \text{ emp.}$$

$$T = \frac{28.8 \times 3.05}{2} = 44 \text{ t.}$$

$$e = \frac{44.000}{0.9 \times 40 \times 157} = 7.8 \text{ Kg./emp.}$$

$$S = \frac{7.8 \times 40 \times 3.05}{4} = 23.8 \text{ t.}$$

$$St = \phi 8 / 15 \quad S_{st} = 14.000 \text{ Kg.}$$

$$App = \frac{11.900}{\sqrt{2} \times 1400} = 6 \text{ emp.}$$

TRAVE 8-9

$$l_{uee} = 3.25 \text{ m.}$$

$$p = 1.42 \times 23.000 = 32.7 \text{ t/ml.}$$

$$m = \frac{3.25^2}{12} \times 32.7 = 29 \text{ t.m.}$$

$$b = 40 \text{ cm} \quad H = 160 \text{ cm.}$$

$$\sigma_e = 39 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad Af = 12.3 \text{ emp.}$$

$$T = \frac{32.7 \times 3.25}{2} = 53.2 \text{ t.}$$

$$e = \frac{53.200}{0.9 \times 40 \times 157} = 9.4 \text{ Kg./emp.}$$

$$S = \frac{9.4 \times 40 \times 3.25}{4} = 30.5 \text{ t.}$$

$$St = \phi 8 / 15 \quad S_{st} = 11 \times 1400 = 15400 \text{ Kg.}$$

$$App = \frac{15.250}{\sqrt{2} \times 1400} = 7.6 \text{ emp.}$$

TRAVE 9-10

$$p = 23.000 \times 1.65 = 38 \text{ t/ml.}$$

$$l_{uee} = 2.00 \text{ m.}$$

$$m = \frac{2.00^2}{12} \times 38 = 12.8 \text{ t.m.}$$

$$\text{sh. } 40 \times 160$$

$$\sigma_e = 30 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad Af = 5.4 \text{ emp.}$$

$$e = \frac{38.000}{0.9 \times 40 \times 157} = 6.75 \text{ Kg./emp.}$$

$$S = \frac{6.75 \times 2.00 \times 40}{4} = 13.000 \text{ t.}$$

$$S_T = \phi 8/15 \quad S_{\bar{u}} = 7 \times 1.400 = 9.8 \text{ t}$$

$$App = \frac{6500}{\sqrt{2} \times 1400} = 3.25 \text{ emp.}$$

### TRAVE 5-10

$$p = 1.65 \times 14.500 = 24 \text{ t/ml.}$$

$$l_{uee} = 675 \text{ m}$$

$$m = \frac{5.75^2}{12} \times 24 = 66 \text{ t.m.}$$

$$b = 30 \text{ cm} \quad H = 250 \text{ cm.}$$

$$e = 43 \text{ Kg./emp.} \quad f = 1600 \text{ Kg./emp.} \quad Af = 18 \text{ emp.}$$

$$T = \frac{2400 \times 5.75}{2} = 69 \text{ t.}$$

$$e = \frac{69.000}{0.9 \times 30 \times 247} = 103 \text{ Kg./emp.}$$

$$S_T = \phi 8/15 \quad S_{\bar{u}} = 19 \times 1400 = 26.6 \text{ t.}$$

$$S = \frac{10.3 \times 30 \times 575}{4} = 44.3 \text{ t.}$$

$$App = \frac{22150}{\sqrt{2} \times 1400} = 11.08 \text{ emp.}$$

### TRAVE 10-10'

$$p = 1.65 \times 10.500 = 17.300 \text{ Kg./ml.}$$

$$m = 2.80^2 \times 17.300 = 11.4 \text{ t.m.}$$

$$e \leq 30 \text{ Kg./emp.} \quad f = 1600 \text{ Kg./emp.} \quad Af = 4.3 \text{ emp.}$$

$$e \leq 6 \text{ Kg./emp.}$$

TRAVE 11-12; 12-13; 13-14; 14-15

$$p = 1.5 \times 220.00 = 33 \text{ t/ml.}$$

$$m = \frac{3.30^2}{12} \times 33 = 30 \text{ t.m.}$$

$$b = 40 \text{ cm.} \quad H = 160 \text{ cm.}$$

$$\sigma_c = 49 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 122 \text{ emp.}$$

$$T = \frac{33 \times 3.30}{2} = 54 \text{ t.}$$

$$\sigma_e = \frac{54000}{0.9 \times 40 \times 157} = 9.6 \text{ Kg./emp.}$$

$$S = \frac{9.6 \times 40 \times 330}{4} = 31.6 \text{ t.}$$

$$ST = \phi 8 / 15$$

$$S_{\bar{u}} = 11 \times 1400 = 15.4 \text{ t.}$$

$$A_{pb} = \frac{16.200}{\sqrt{2} \times 1600} = 8.1 \text{ emp.}$$

CALCOLO SUOLA DI FONDAZIONE

TRAVE 1.2.3 ecc.

$$p = 17200 \text{ Kg./ml.}$$

$$m = \left( \frac{1.80 - 40}{2} \right)^2 / 2 \times 17200 = 4300 \text{ Kg.m./ml.}$$

$$b = 1 \text{ m} \quad H = 50 \text{ cm.}$$

$$\sigma_c = 30 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 5.9 \text{ emp.}$$

$$ST = \phi 8 / 30 \quad 1 \phi 14 / 30 \text{ destra.}$$

SUOLA DELLA TRAVE 6.7.8.9

$$p = 16500 \text{ Kg./ml.}$$

$$m = \left( \frac{2.30 - 40}{2} \right)^2 / 2 \times 16500 = 7450 \text{ Kg.m./ml.}$$

$$b = 1 \text{ m} \quad H = 50 \text{ cm.}$$

$$\sigma_c = 41 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 10.3 \text{ emp.}$$

$$ST = 1 \phi 12 / 30 \quad 1 \phi 16 / 30 \text{ alt. a 15.}$$

SUOLA DELLA TRAVE 11.12.13 ecc.

$$p = 17400 \text{ Kg./ml.}$$

$$m = \left( \frac{2.20 - 0.40}{2} \right)^2 \times 17400 = 7000 \text{ Kg.m./ml.}$$

$$b = 1 \text{ m} \quad H = 50 \text{ cm.}$$

$$\sigma_c = 39.6 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 9.7 \text{ emp.}$$

ST = 1φ12/30 1φ13/30 alt. a 15

SOLETTA SOTTO LA SCALA

$p = 16.500 \text{ Kg./ml.}$

$m = \frac{270^2 \times 16.500}{12} = 10.000 \text{ Kg/m/ml.}$

$b = 1 \text{ m} \quad H = 50 \text{ cm.}$

$\sigma_e = 48 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 14.$

$\sigma_c < 6 \text{ Kg./emp.}$

SOLETTA SOTTO L'ASCENSORE

$p = 16.500 \text{ kg./ml.}$

$m = \frac{180^2}{12} \times 16.500 = 4.500 \text{ Kg/m/ml.}$

$b = 1 \text{ m} \quad H = 50 \text{ cm.}$

$\sigma_e = 31 \text{ Kg./emp.} \quad \sigma_f = 1600 \text{ Kg./emp.} \quad A_f = 6-10 \text{ emp.}$

CALCOLO DELLE STRUTTURE SCALA

GRADINO - ANALISI DI CARICO

$p_p = \frac{0.17 \times 0.30 \times 1.20}{2} \times 2500 = 77 \text{ Kg.}$

$0.04 \times 0.345 \times 2500 \times 1.20 = 42 \text{ Kg.}$

sovracc. see.  $400 \times 0.30 \times 1.20 = 144 \text{ Kg.}$

pedate  $0.340 \times 0.03 \times 1.20 \times 3.000 = 37 \text{ Kg.}$

alw.  $0.17 \times 0.02 \times 1.20 \times 3.000 = 13 \text{ Kg.}$

man.  $(0.30 + 0.17) \times 0.015 \times 1.20 \times 1500 = 13 \text{ Kg.}$

int. immedono.  $0.345 \times 0.015 \times 1.20 \times 1500 = 10 \text{ Kg.}$

Totale = 336 Kg.

$m = 336 \times 0.60 = 202 \text{ Kg/m.}$

$b = 10 \text{ cm} \quad H = 20 \text{ cm.}$

$\sigma_e = 55 \text{ Kg./emp.} \quad \sigma_f = 1400 \text{ Kg./emp.} \quad A_f = 0.85 \text{ emp.}$

arm. 1φ10 + 1φ8 con 1φ6

ripetitoni longitudinali.

CALCOLO PIANEROTTOLO DI RIPOSO E DI ARRIVO

$$p.p. = 300 \text{ Kg./mq.}$$

$$\text{tonnee.} = 400 \text{ Kg./mq.}$$

$$\text{pav. + ind. + tot.} = 150 \text{ Kg./mq.}$$

$$\text{Totale} = 850 \text{ Kg./mq.}$$

$$\text{lucce} = m \cdot 2.50 \quad \text{lucce Teoria m. 2.70}$$

condizione di vincolo: semineario

$$m = \frac{1}{12} \cdot 2.70^2 \times 850 = 520 \text{ Kg. / per m di larg.}$$

$$b = 40 \text{ cm} \quad H = 16 + 4 \text{ cm}$$

$$\sigma \leq 30 \text{ Kg./emp.} \quad \tau_f = 1400 \text{ Kg./emp.} \quad A_f = 0.87 \text{ emp. ogni } 40 \text{ cm.}$$

CALCOLO TRAVI A GINOCCHIO

$$p = \frac{0.336}{0.30} = 1120 \text{ Kg./ml.}$$

$$p.p. \cdot 0.20 \times 0.70 \times 2500 = 350 \text{ Kg./ml.}$$

$$\text{Totale} = 1470 \text{ Kg./ml.}$$

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

$$m = \frac{4.50^2}{12} \times 1470 = 2470 \text{ Kg./ml.}$$

$$b = 20 \text{ cm.} \quad H = 70 \text{ cm}$$

$$\sigma_a = 35 \text{ Kg./emp.} \quad \tau_f = 1400 \text{ Kg./emp.} \quad A_f = 2.76 \text{ emp.}$$

Verifica a Taglio:

$$T = 2.25 \times 1.470 = 3.300 \text{ Kg.}$$

$$\sigma = \frac{3.300}{0.9 \times 20 \times 78} \leq 6 \text{ Kg./emp.}$$

TRAVE PORTAMURATURA A QUOTA SOLAIO

Carico distrib.

$$p.p. = 0.20 \times 0.70 \times 2500 = 350 \text{ Kg./ml.}$$

$$\text{mur. Tufo} = (3.31 - 0.70) \times 0.20 \times 1400 = 730 \text{ Kg./ml.}$$

$$\text{intonaco} = 300 \times 0.03 \times 1500 = 135 \text{ Kg./ml.}$$

$$\text{Totale} = 1215 \text{ Kg./ml.}$$

$$\text{Carico com. } 3.300 \text{ Kg.}$$

$$m = \frac{5.65^2}{12} \times 12.5 + \frac{1}{8} 5.65 \times 3.300 = 3250 + 2330 = 5580 \text{ Kg.}$$

$$b = 20 \text{ cm}$$

$$H = 70 \text{ cm.}$$

$$\alpha = 55 \text{ Kg./emp.}$$

$$\alpha_f = 1400 \text{ Kg./emp.}$$

$$A_f = 6.4 \text{ emp.}$$

$$\alpha = \frac{\frac{3.300}{2} + 12.15 \times \frac{5.65}{2}}{0.9 \times 80 \times 68} = \frac{6080}{1224} < 6 \text{ Kg./emp.}$$

### TRAVE 1-2-3-4-5-5' - PIANO TIPO

#### ANALISI DI CARICO

#### TRAVE 1-2

$$\text{solaino} = \frac{5.50}{2} \times 650 = 1800 \text{ Kg./ml.}$$

$$\text{pp.} = 250 \text{ Kg./ml.}$$

$$\text{muratura} = 1000 \text{ Kg./ml.}$$

$$\text{Totale} = 3050 \text{ Kg./ml.}$$

#### TRAVE 2-3; 3-4; 4-5;

$$\text{est} = 3050 \text{ Kg./ml.}$$

$$700 \times 1.20 = 840 \text{ Kg./ml.}$$

$$\text{totale} = 3900 \text{ Kg./ml.}$$

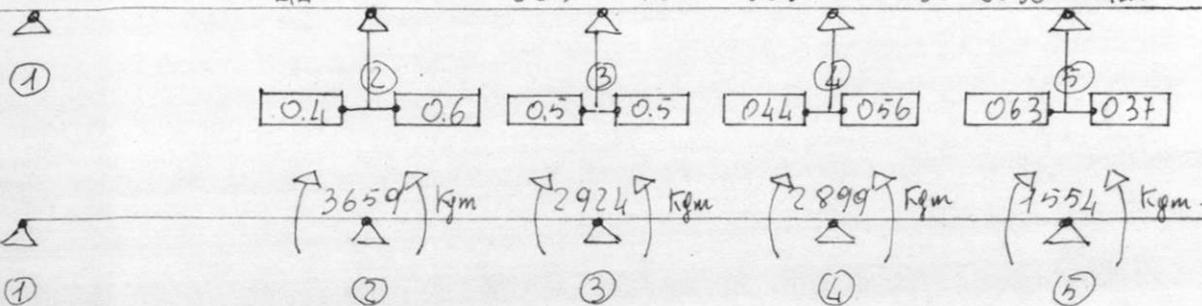
### CARATTERISTICHE ELASTICHE E GEOMETRICHE

trave	l	W	momenti prima della rotazione
1-2	3.40	$0.75 \times \frac{1}{3.40} = 0.22$	$M_{2-1} = 4400 \text{ Kg.m.}$
2-3	3.05	$\frac{1}{3.05} = 0.326$	$M = 2850 \text{ Kg.m.}$
3-4	3.15	$\frac{1}{3.15} = 0.317$	$M = 3250 \text{ Kg.m.}$
4-5	2.50	$\frac{1}{2.50} = 0.40$	$M = 2030 \text{ Kg.m.}$
5-5'	2.10	$0.5 \times \frac{1}{2.10} = 0.238$	$M = 1440 \text{ Kg.m.}$

La struttura è simmetrica e simmetricamente caricata.

CROSS

	<u>-54</u>	<u>20</u>	<u>20</u>				
	90	-27	-12	-24		10	
	<u>-36</u>	<u>-128</u>	<u>180</u>	<u>180</u>	<u>90</u>	<u>-31</u>	<u>5</u>
	-85	213	-64	-315	-630	-35	
	<u>-620</u>	<u>-913</u>	<u>427</u>	<u>427</u>	<u>213</u>	<u>-803</u>	<u>-70</u>
			<u>-465</u>				<u>-101</u>
	4400	-2850	2850	-3250	3250	-2030	2030
							<u>-1440</u>

TRAVERSE 1-2

$$T_1 = 3050 \times \frac{3.40}{2} - \frac{3659}{3.40} = \frac{5200}{1080} = 4100 \text{ Kg.}$$

$$T_2 = 6280 \text{ Kg.}$$

$$M_{1-2} = \frac{T_1^2}{29} = \frac{4100^2}{2 \times 3050} = 2750 \text{ kgm.}$$

ARMATURA A MOMENTO FLETTENTE

$$- m_2 = 3659 \text{ kgm.}$$

$$b = 20 \text{ cm} \quad H = 50 \text{ cm.}$$

$$\sigma_c = 57 \text{ Kg./emp.} \quad \sigma_f = 1000 \text{ Kg./emp.} \quad A_f = 8.6 \text{ emp.}$$

$$- m_{1-2} = 2750 \text{ kgm}$$

$$b = 20 \text{ cm} \quad H = 50 \text{ cm}$$

$$\sigma_c = 51 \text{ Kg./emp.} \quad \sigma_f = 1200 \text{ Kg./emp.} \quad A_f = 5.25 \text{ emp.}$$

$$- m_{2-3} = \frac{1}{14} 3.05^2 \times 3900 = 2570 \text{ kgm.}$$

$$b = 20 \text{ cm} \quad H = 50 \text{ cm.}$$

$$\sigma_c = 49 \text{ Kg./emp.} \quad \sigma_f = 1200 \text{ Kg./emp.} \quad A_f = 4.9 \text{ emp.}$$

$$- m_3 \approx m_4 = -2900 \text{ kgm.}$$

$$b = 20 \text{ cm} \quad H = 50 \text{ cm.}$$

$$\sigma_c = 53 \text{ Kg./emp.} \quad \sigma_f = 1200 \text{ Kg./emp.} \quad A_f = 5.45 \text{ emp.}$$

$$- m_{3-4} = \frac{1}{14} 3.15^2 \times 3900 = 2750 \text{ kgm.}$$

(vedi m 1-2)

$$- m_{4-5} = \frac{1}{14} 2.50^2 \times 3900 = 1740 \text{ kgm.}$$

$$b = 20 \text{ cm} \quad H = 50 \text{ cm}$$

$$\sigma_c = 39 \text{ Kg./emp.} \quad \sigma_f = 1200 \text{ Kg./emp.} \quad A_f = 3.26 \text{ emp.}$$

$$- m_{5-5'} = 1552 \text{ Kg.m.}$$

$$\sigma = 39 \text{ Kg./emp.} \quad \sigma_f = 1400 \text{ Kg./emp.} \quad A_f = 2.5 \text{ emp.}$$

### VERIFICA ED ARMATURA A TAGLIO

#### TRAVE 1-2

$$q_{\max} = \frac{6280}{0.9 \times 20 \times 48} = \frac{6280}{865} = 7.25 \text{ Kg./emp.}$$

$$S = \frac{7.25 \times 20 \times 1.70}{2} = 12.3 \text{ t.}$$

$$S_T = \phi 8 / 20 \quad S_{\bar{u}} = 8 \times 1400 = 11.2 \text{ t.}$$

$$A_{pp} = \frac{12.300/2}{\sqrt{2} \times 1400} = 3.1 \text{ emp.}$$

#### TRAVE 2-3 ; 3-4

$$q_{\max} = 6150 \text{ Kg.} = 3900 \times \frac{3.15}{2}$$

$$q_{\max} = \frac{6150}{0.9 \times 20 \times 48} = \frac{6150}{865} = 7.10 \text{ Kg./emp.}$$

$$S = \frac{7.10 \times 3.15 \times 20}{4} = 11.2 \text{ t.}$$

$$S_T = \phi 8 / 20$$

$$A_{pp} = \frac{11.200/2}{\sqrt{2} \times 1400} = 2.8 \text{ emp.}$$

#### TRAVE 4-5

$$T = 3900 \times 125 = 4875 \text{ Kg.}$$

$$q_{\max} \approx 6 \text{ Kg./emp.}$$

#### TRAVE 6-7-8-9-10

##### CARATTERISTICHE ELASTICHE E GEOMETRICHE

$$l_{6-7} = 3.40$$

un. 100x22

$$\text{nodo 7: } K_{7-6} = \frac{0.75}{\frac{3.40}{3.40} + \frac{1}{2.95}} = 0.4$$

$$l_{7-8} = 2.95$$

un. 100x22

$$K_{7-8} = 1 - K_{7-6} = 0.6$$

$$l_{8-9} = 3.25$$

un. 100x22

$$\text{nodo 8: } K_{8-7} = \frac{1}{\frac{2.95}{2.95} + \frac{1}{3.25}} = 0.52$$

$$l_{9-10} = 2.15$$

un. 100x22

$$K_{8-9} = 1 - K_{8-7} = 0.48$$

nodo 9

$$K_{9-10} = \frac{1}{\frac{2.15}{1} + \frac{1}{3.25}} = 06$$

$$K_{9-8} = 1 - K_{9-10} = 04.$$

ANALISI DI CARICO

$$\text{solaio} = \left( \frac{3.95 + 5.10}{2} \right) \times 650 = 2960 \text{ Kg./ml.}$$

$$p_b = 100 \times 0.22 \times 1.00 \times 2500 = 550 \text{ Kg./ml.}$$

$$\text{sovr.} = 450 \times 1.00 = 450 \text{ Kg./ml.}$$

$$\text{Totale} = 4000 \text{ Kg./ml.}$$

$$M_7 = \frac{1}{8} \cdot 3.40^2 \times 4000 = 5760 \text{ Kg.m.}$$

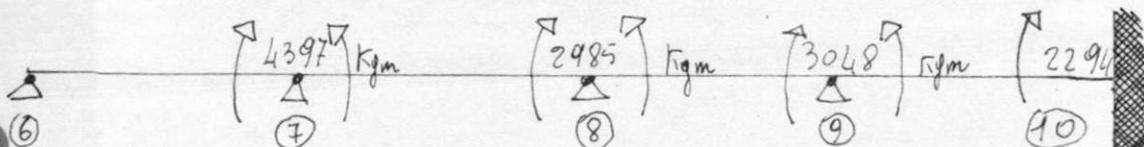
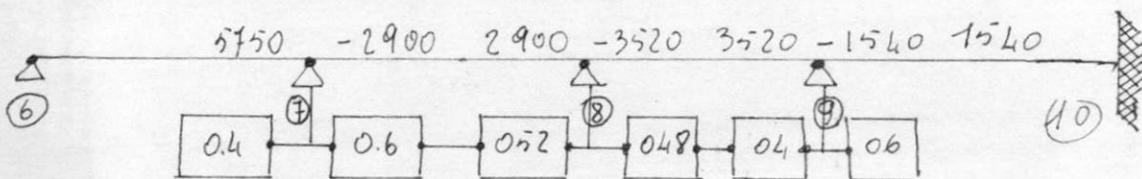
$$M_7' = M_8' = \frac{1}{12} \cdot 2.95^2 \times 4000 = 2900 \text{ Kg.m.}$$

$$M_8'' = M_9'' = \frac{1}{12} \cdot 3.25^2 \times 4000 = 3520 \text{ Kg.m.}$$

$$M_9''' = M_{10}''' = \frac{1}{12} \cdot 2.15^2 \times 4000 = 1540 \text{ Kg.m.}$$

CROSS

	<u>-4</u>	<u>-2</u>	<u>1</u>	<u>-3</u>		
	<u>7</u>	15	14	<u>7</u>		
	<u>3</u>	<u>-36</u>	<u>-18</u>	<u>-11</u>	<u>-23</u>	<u>-4</u>
	<u>-24</u>	<u>60</u>	<u>120</u>	<u>115</u>	<u>57</u>	<u>-94</u>
	<u>-190</u>	<u>-290</u>	<u>-145</u>	<u>-90</u>	<u>-180</u>	<u>-270</u>
	<u>-1150</u>	<u>480</u>	<u>960</u>	<u>900</u>	<u>450</u>	<u>-135</u>
		<u>-1700</u>	<u>-850</u>	<u>390</u>	<u>-780</u>	<u>-1200</u>
						<u>-600</u>

TRAVE 6-7

$$T_6 = \frac{3.40}{2} \times 4000 - \frac{4397}{3.40} = \frac{6800}{1300} = 5500 \text{ Kg.}$$

$$T_7 = 8100 \text{ Kg.}$$

$$M_{6-7} = \frac{T_6^2}{2 \times 9} = \frac{5500^2}{2 \times 4000} = 3750 \text{ Kg.m.}$$

$$- m = 3750 \text{ Kgm.}$$

$$b = 100 \text{ cm} \quad H = 22 \text{ cm.}$$

$$\sigma_e = 70 \text{ Kp./emp.} \quad \sigma_f = 1400 \text{ Kp./emp.} \quad A_f = 11.5 \text{ emp.}$$

$$- m = 4397 \text{ Kgm.}$$

$$b = 100 \text{ cm.} \quad H = 22 \text{ cm.}$$

$$\sigma_e = 70 \text{ Kp./emp.} \quad \sigma_f = 1400 \text{ Kp./emp.} \quad A_f = 11.5 \text{ emp.} \quad M_0 = 3750 \text{ Kp.}$$

$$\Delta H = 4397 - 3750 = 647 \text{ Kgm.}$$

$$\sigma_f = 420 \text{ Kp./emp.} \quad A_f' = \frac{64700}{18 \times 1.20} = 8.5 \text{ emp.} \quad A_f'' = \frac{64700}{18 \times 1400} = 2.55$$

### TRAVE 7-8

$$l = 2.95 \text{ m.}$$

$$T_7 = \frac{2.95}{2} \times 4000 + \frac{4397 - 2985}{2.95} = 5900 + 480 = 6360 \text{ T.}$$

$$T_8 = 5420 \text{ T.}$$

$$m_{7-8} = m_7 - \frac{T_7^2}{29} = 4397 + \frac{6360^2}{8000} = 650 \text{ Kgm.}$$

$$\text{H utrumque: } m_{7-8} = \frac{1}{16} 2.95^2 \times 4000 = 2170 \text{ Kgm.}$$

$$- m = 2170 \text{ Kgm}$$

$$b = 100 \text{ cm} \quad H = 22 \text{ cm.}$$

$$\sigma_e = 50 \text{ Kp./emp.} \quad \sigma_f = 1400 \text{ Kp./emp.} \quad A_f = 8.2 \text{ emp.}$$

$$- m = 2985 \text{ Kgm.}$$

$$b = 100 \text{ cm} \quad H = 22 \text{ cm.}$$

$$b = 100 \text{ cm} \quad H = 22 \text{ cm.}$$

$$\sigma_e = 61 \text{ Kp./emp.} \quad \sigma_f = 140 \text{ Kp./emp.} \quad A_f = 11.35 \text{ emp.}$$

### TRAVE 8-9

$$T_8'' = \frac{3.25 \times 4000}{2} - \frac{3048 - 2985}{3.25} = 6500 - 18 = \approx 6482 \text{ T.}$$

$$T_9 = 6518 \text{ T.}$$

$$m_{8-9} = m_8 - \frac{T_8''^2}{29} = \frac{6482^2}{8000} - 2985 = 5250 - 2985 = 2265 \text{ Kgm.}$$

$$\text{H utrumque: } m = \frac{1}{14} \cdot 3.25^2 \times 4000 = 3030 \text{ Kgm.}$$

$$- m = 3048 \text{ Kgm.}$$

$$b = 100 \text{ cm} \quad H = 22 \text{ cm.}$$

$$\sigma_e = 61 \text{ Kp./emp.} \quad \sigma_f = 1400 \text{ Kp./emp.} \quad A_f = 11.6 \text{ emp.}$$

TRAVE 7-10

$$l_{\text{acc}} = 2.15 \text{ m.}$$

$$T_q'' = \frac{4000 \times 2.15}{2} + \frac{3048 - 2294}{2.15} = 4650 \text{ Kg.}$$

$$T_{10}' = 3950 \text{ Kg.}$$

$$M_{q-10} = \frac{T_q''^2}{2 \times 9} - 3048 = \frac{4650^2}{18000} - 3048 = -350 \text{ Kg.m. ; ne usare un momento negativo.}$$

assumiamo pieno

$$-M_{q-10} = \frac{2.15^2}{14} \times 4000 = 13.20 \text{ Kg.m.}$$

$$b = 100 \text{ cm} \quad H = 22 \text{ cm.}$$

$$\alpha = 38 \text{ Kg./emp.} \quad \varphi = 1400 \text{ Kg./emp.} \quad A_f = 5 \text{ emp.}$$

TRAVE 10-10'

Cariere pianoro 2° passo

$$\text{m.m.} \quad \frac{1.30}{2} \times 1000 = 650 \text{ Kg./ml.}$$

$$\text{p.p.} \quad = 1200 \text{ Kg./ml.}$$

$$250 \text{ Kg./ml.}$$

$$\text{Totale} = 2100 \text{ Kg./ml.}$$

$$m = \frac{2.80^2}{12} \times 2100 = 1370 \text{ Kg.m.}$$

$$s_{\text{ev}} = 20 \times 50$$

$$\alpha = 37 \text{ Kg./emp.} \quad \varphi = 1400 \text{ Kg./emp.} \quad A_f = 2.2 \text{ emp.}$$

TRAVATA 11-12-13-14-15 ecc.

$$\text{p.p.} \quad 0.22 \times 2500 \times 100 = 550 \text{ Kg./ml.}$$

$$\text{sovr. acc. + p.m.} \quad = 450 \text{ Kg./ml.}$$

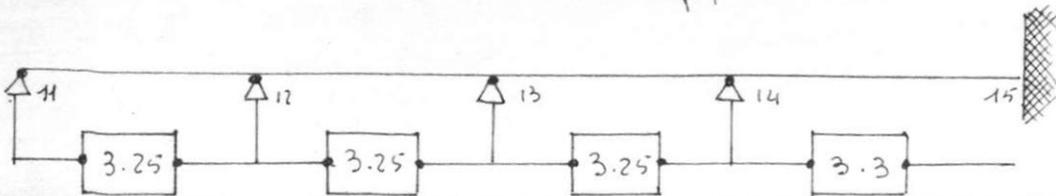
$$\text{solato} = \frac{400}{2} \times 650 = 1300 \text{ Kg./ml.}$$

$$\text{sballo} = 1.65 \times 700 = 1150 \text{ Kg./ml.}$$

$$\text{m.m.} \quad = 1000 \text{ Kg./ml.}$$

$$\text{Totale} = 4450 \text{ Kg./ml.}$$

$$\approx 4500 \text{ Kg./ml.}$$



nodo 12  $K_{12-11} = \frac{0.75}{0.75+1} = 0.43$

$K_{12-13} = 1 - K_{12-11} = 0.57$

$M_{12-11} = \frac{3.25^2}{8} \times 4500 = 6000 \text{ Kgm.}$

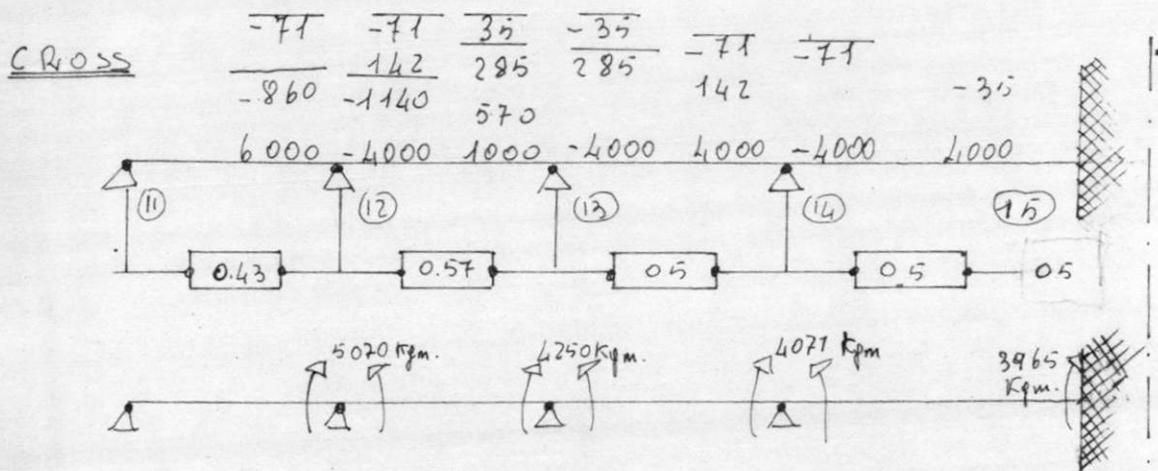
nodo 13  $K_{13-12} = 0.5$

$K_{13-14} = 0.5$

$M = \frac{3.25^2}{12} \times 4500 = 4000 \text{ Kgm.}$

nodo 14  $K_{14-13} = 0.5$

$K_{14-15} = 0.5$



TRAVE 11-12

$T_{11} = \frac{4500 \times 3.25}{2} - \frac{5070}{3.25} = 7320 - 1560 = 5760 \text{ Kgm.}$

$T'_{12} = 8880 \text{ Kgm.}$

$m_{11-12} = \frac{T_{11}^2}{2 \times 9} = \frac{5760^2}{9000} = 3700 \text{ Kgm.}$

$-m = 5070 \text{ Kgm.}$

$b = 100 \text{ cm. } H = 22 \text{ cm.}$

$M_0 = 3800 \text{ Kgm. } \sigma_c = 70 \text{ Kp./cm}^2. \sigma_f = 1400 \text{ Kp./cm}^2. A_f = 14.5 \text{ emp.}$

$Q' = 420 \text{ Kp./cm}^2. \Delta M = 1270 \text{ Kp.}$

$A/q = \frac{12.7000}{1400 \times 18} = 5.1 \text{ emp. } A_{f \text{ toti trazione}} = 19.6 \text{ emp. } A_f' = \frac{127000}{420 \times 18} = 17 \text{ emp.}$

$-m = 3700 \text{ Kgm.}$

$b = 100 \text{ cm } H = 22 \text{ cm.}$

$\sigma_c = 69 \text{ Kp./cm}^2. \sigma_f = 1400 \text{ Kp./cm}^2. A_f = 14 \text{ emp.}$

TRAVE 12-13

$T_{12}'' = 7320 + \frac{5070 - 4250}{3.25} = 7320 + 250 = 757 \text{ Kgm.}$

$$T_{13} = 7080 \text{ Kg.}$$

$$m_{12-13} = \frac{7070^2}{29} - 5070 = 1280 \text{ Kg/m.}$$

assumiamo per tutte le mensole delle travi successive un momento pari

$$- m = \frac{1}{14} 3.25^2 \times 4.500 = 3400 \text{ Kg/m.}$$

$$- m = 4250 \text{ Kg/m.}$$

$$m_0 = 3800 \text{ Kg/m.} \quad r_e = 70 \text{ Kg/emp.} \quad r_f = 1400 \text{ Kg/emp.} \quad A_{f1} = 14.5 \text{ emp.}$$

$$r_e' = 420 \text{ Kg/emp.} \quad \Delta H = 450 \text{ Kg/m.}$$

$$A_{f2} = \frac{45000}{1400 \times 18} = 1.8 \text{ emp.} \quad A_{f \text{ Tot Travi.}} = 16.3 \text{ emp.} \quad A_{f1} = \frac{45000}{420 \times 18} = 6 \text{ emp.}$$

$$- m = 3400 \text{ Kg/m} \quad r_e = 66 \text{ Kg/emp.} \quad r_f = 1400 \text{ Kg/emp.} \quad A_f = 13 \text{ emp.}$$

### TRAVATA 1.6.11

#### TRAVE 1.6

$$p.p. = 0.80 \times 0.22 \times 2500 = 440 \text{ Kg/ml.}$$

$$mur. = 1000 \text{ Kg/ml.}$$

$$\text{sovr. acc + pn } 450 \times 0.80 = 360 \text{ Kg/ml.}$$

$$\text{Totale} = 1800 \text{ Kg/ml.}$$

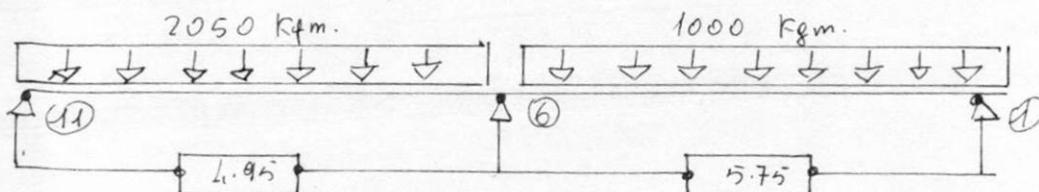
#### TRAVE 6-11

$$p.p. 550 \times 1.05 = 580 \text{ Kg/ml.}$$

$$\text{sovr. } 450 \times 1.05 = 470 \text{ Kg/ml.}$$

$$\text{mur.} = 1000 \text{ Kg/ml.}$$

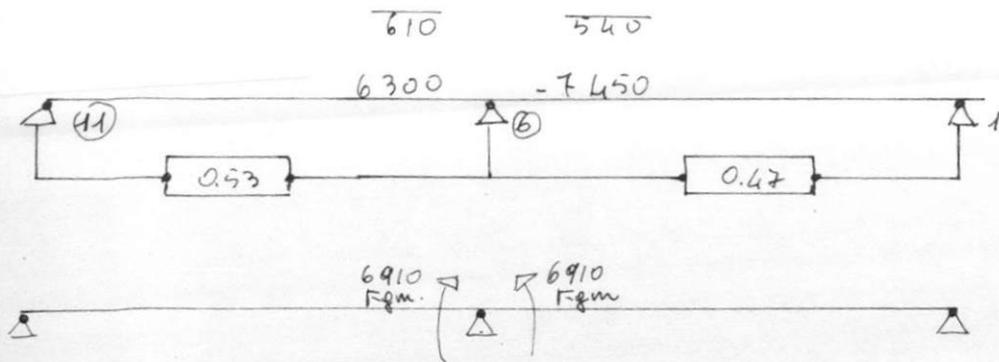
$$\text{Totale} = 2050 \text{ Kg/ml.}$$



$$\text{nodos } \left\{ \begin{array}{l} K_{6-11} = \frac{1}{\frac{4.95}{4.95} + \frac{1}{5.75}} = \frac{0.2}{0.2 + 0.175} = 0.53 \\ K_{6-1} = 0.47 \end{array} \right.$$

$$M_{11-6} = \frac{4.95^2}{8} \times 2050 = 6300 \text{ Kg/m.}$$

$$M_{6-1} = \frac{5.75^2}{8} \times 1800 = 7450 \text{ Kg/m.}$$



### TRAVE 1-6

$$T_1 = 1800 \times \frac{5.75}{2} - \frac{6910}{5.75} = 5170 - 1200 = 3970 \text{ Kg.}$$

$$T_6' = 6370 \text{ Kg.}$$

$$m_{1-6} = \frac{3970^2}{2 \times 1800} = 4370 \text{ kgm.}$$

$$-m = 4370 \text{ kgm.}$$

$$b = 80 \text{ cm} \quad H = 22 \text{ cm} \quad M_0 = 3370 \text{ kgm.}$$

$$r_e = 75 \text{ Kg./emp.} \quad r_f = 1400 \text{ Kg./emp.} \quad A_f = 13.5 \text{ emp.} \quad r_f' = 455 \text{ Kg./emp.}$$

$$A_f' = \frac{100000}{455 \times 18} = 12.4 \text{ emp.} \quad A_f'' = \frac{10000}{18 \times 1400} = 4 \text{ emp.} \quad A_f \text{ in trazione } 17.5 \text{ emp.}$$

in comp. 12.4 emp.

$$m = 6910 \text{ kgm.} \quad b = 125 \text{ cm.} \quad H = 22 \text{ cm.}$$

$$M_0 = 4700 \text{ kgm.} \quad r_f = 1400 \text{ Kg./emp.} \quad r_e = 75 \text{ Kg./emp.} \quad \Delta H = 2210 \text{ kgm.}$$

$$A_{f1} = 17.4 \text{ emp.} \quad A_{f1}' = \frac{221000}{455 \times 18} = 27 \text{ emp.} \quad r_{f1} = 455 \text{ Kg./emp.} \quad A_{f2} = \frac{2210}{1400 \times 18} = 8.8 \text{ emp.}$$

$$A_{f \text{ Tot}} \text{ in compressione} = 17.4 + 8.8 = 26.2 \text{ emp.}$$

Doppie armatura di 27 emp.

### TRAVE 6-11

$$T_{11} = \frac{2050 \times 4.95}{2} - \frac{6910}{4.95} = 5070 - 1400 = 3670 \text{ Kg.}$$

$$T_6'' = 6470 \text{ Kg.}$$

$$-m = \frac{3670^2}{2 \times 2050} = 3300 \text{ kgm.}$$

$$b = 105 \text{ cm} \quad H = 22 \text{ cm.}$$

$$r_e = 64 \text{ Kg./emp.} \quad r_f = 1400 \text{ Kg./emp.} \quad A_f = 12 \text{ emp.}$$

PIANO ATTICOTRAVE 1-2-3-4-5-5' ecc

$$\text{soffitto } 550/2 \times 650 = 1800 \text{ Kg./ml.}$$

$$\text{p.p.} = 250 \text{ Kg./ml.}$$

$$\text{muro calc. } 0.10 \times 1.50 \times 2500 = 375 \text{ Kg./ml.}$$

$$\text{mensole } 700 \times 1.20 = 840 \text{ Kg./ml.}$$

---


$$\text{Totale} = 3265 \text{ Kg./ml.}$$

TRAVE 1-2

$$l = 3.45 \text{ m.}$$

$$m = 3250 \text{ Kg/m.}$$

$$\text{sew} = 20 \times 50 \quad \alpha = 60 \text{ Kg./emp.} \quad \gamma_f = 1400 \text{ Kg./emp.} \quad A_f = 5.3 \text{ emp.}$$

TRAVE 2-3

$$l = 2.95 \text{ m}$$

$$m = 2370 \text{ Kg/m.}$$

$$\text{sew} = 20 \times 50 \quad \alpha = 50 \text{ Kg./emp.} \quad \gamma_f = 1400 \text{ Kg./emp.} \quad A_f = 3.85 \text{ emp.}$$

### TRAVE 3-4

$$l = 3.15 \text{ m}$$

$$m = 2700 \text{ Kg/m.}$$

$$sew = 20 \times 50 \quad \alpha = 54 \text{ Kg./emp.} \quad \rho = 1400 \text{ Kg./emp.} \quad A_f = 4.37 \text{ emp.}$$

### TRAVE 4-5

$$l = 2.25 \text{ m}$$

$$m = 1380 \text{ Kg/m.}$$

$$sew = 20 \times 50 \quad \alpha = 37 \text{ Kg./emp.} \quad \rho = 1400 \text{ Kg./emp.} \quad A_f = 2.2 \text{ emp.}$$

### TRAVE 5-5'

$$l = 2.60 \text{ m}$$

$$m = 1850 \text{ Kg/m.}$$

$$sew = 20 \times 50 \quad \alpha = 43 \text{ Kg./emp.} \quad \rho = 1400 \text{ Kg./emp.} \quad A_f = 2.95 \text{ emp.}$$

### TRAVE 6-7-8-9-10

Armature e carichi come piano Tipo.

### TRAVE 11-12-13-14-15 see:

$$pp \cdot 0.22 \times 2500 = 550 \text{ Kg./ml.}$$

$$\text{sovr. see. + pen.} = 450 \text{ Kg./ml.}$$

$$\text{solaino } \frac{400}{2} \times 650 = 1300 \text{ Kg./ml.}$$

$$\text{spazio } 1.65 \times 700 = 1150 \text{ Kg./ml.}$$

$$\text{muro estero} = 375 \text{ Kg./ml.}$$

---

$$\text{Totale} = 3825 \text{ Kg./ml.}$$

luce 3.25 costante

$$m = 3370 \text{ Kg/m.}$$

$$sew = 100 \times 22 \quad \alpha = 67 \text{ Kg./emp.} \quad \rho = 1400 \text{ Kg./emp.} \quad A_f = 13.4 \text{ emp.}$$

### TRAVE 1-6-11

#### TRAVE 1-6

$$pp = 0.55 \times 2500 \times 0.22 = 302 \text{ Kg./ml.}$$

$$mur = 375 \text{ Kg./ml.}$$

$$\sigma_c = 48 \text{ Kg./cmq.} \quad \tau = 1400 \text{ Kg./emp.} \quad A_f = 4 \text{ emp.}$$

$$b = 30 \text{ cm} \quad H = 20 \text{ cm.}$$

$$\sigma_c = 68 \text{ Kg./emp.} \quad \tau = 1200 \text{ Kg./emp.} \quad A_f = 2,75 \text{ emp.}$$

### SOLAI E BALCONATE

$$\text{Carico } 650 \text{ Kg./mq.}$$

$$\text{pp.} = 250 \text{ Kg./mq.}$$

$$\text{sovz. pms.} = 100 \text{ Kg./mq.}$$

$$\text{acc.} = 300 \text{ Kg./emp.}$$

$$\text{Carate} = 650 \text{ Kg./emp.}$$

- sbalzo m. 2.00.

$$m = \frac{2,00^2}{2} \times 6,50 = 1300 \text{ Kg/ml.}$$

$$b = 1 \text{ m} \quad H = 22 \text{ cm.}$$

$$\sigma_c = 43 \text{ Kg./emp.} \quad \tau = 1800 \text{ Kg./emp.} \quad A_f = 1,53 \text{ emp. per Travezzo.}$$

- sbalzo m. 1.20.

$$m = \frac{1,20^2}{2} \times 6,50 = 470 \text{ Kg/m.}$$

$$\sigma_c \times 30 \text{ Kg./emp.} \quad \tau = 1800 \text{ Kg./emp.} \quad A_f = 0,54 \text{ emp. ogni } 40 \text{ cm.}$$

- solaio luce 4,95 m.

$$m = \frac{4,95^2}{12} \times 6,50 = 1320 \text{ Kg/m.}$$

$$b = 1 \text{ m} \quad H = 22 \text{ cm}$$

$$\sigma_c = 43 \text{ Kg./emp.} \quad \tau = 1800 \text{ Kg./emp.} \quad A_f = 1,53 \text{ emp. per Travezzo.}$$

(i = 40 cm.)

- solaio luce 5,95 m.

$$m = \frac{5,95^2}{12} \times 6,50 = 1780 \text{ Kg/m.}$$

$$\sigma_c = 51 \text{ Kg/emp.} \quad \tau = 1800 \text{ Kg./emp.} \quad A_f = 2,1 \text{ emp. ogni Travezzo (i = 40 cm.)}$$

### SOLAIO A SBALZO TERRAZZA

$$\text{pp.} = 250 \text{ Kg./mq.}$$

$$\text{sovrae. acc.} = 150 \text{ Kg./mq.}$$

sovracc. pens. = 250 Kg./emp. (maximo soffitti + pavim.)

Carichi = 650 Kg./emp.

Carico cone. mur. 170 x 0.10 x 2500 = 175 Kg.

n = 650 x 2.00^2 / 2 + 1.75 x 200 = 1300 + 350 = 1650 Kg/m.

ce = 49 Kg./emp. cf = 1800 Kg./emp. Af = 1.95 emp. ogni Trave (i = 40 cm.)

COPERTURA SCALA

TRAVE 5-10; 10-5'

soffitto 500 x 2.30/2 = 575 Kg./emp.

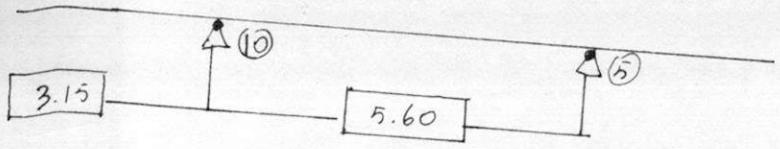
sol. 0.80 x 0.20 x 2500 = 400 Kg./emp.

torr. 2.50 x 0.80 = 200 Kg./emp.

pp. Trave 0.30 x 0.60 x 2500 = 450 Kg./emp.

Carichi = 1610 Kg./emp.

sch. 30 x 60



m10 = 3.15^2 / 2 x 1610 = 8000 Kg/m.

ce = 65 Kg./emp. cf = 1400 Kg./emp. Af' = 11 emp.

ce = 4950 / (0.9 x 30 x 58) = 4950 / 1300 < Kg./emp.

T = 3.15 x 1610 = 4950 Kg.

CALCOLO SOLETTA ASCENSORE

Dimensioni 1.70 x 1.70

Carico macchinari = 6625 Kg./emp.

pp. soletta = 625 Kg./emp.

Carichi = 7250 Kg./emp.

$$m. \text{ murino } 0.0513 \times 1.70^2 \times 7250 = 1120 \text{ Kg./emp.}$$

coeff. steccato 6

$$m. \text{ calcolo } = 2 \times 1120 = 2240 \text{ Kg./emp.}$$

$$b = 1 \text{ m.} \quad H = 25 \text{ em.}$$

$$\sigma = 45 \text{ Kg./emp.} \quad \sigma_f = 1400 \text{ Kg./emp.} \quad A_f = 7.5 \text{ emp./ml.}$$

$$e = \frac{7250 \times \frac{1.50}{2}}{100 \times 0.9 \times 23} = \frac{10850}{2050} \approx 5.3 \text{ Kg./emp.}$$



Il Presidente

*Carlo Ebe*