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COMMITTENTE: I.A.C.P. - BRINDISI	AGG.
LAVORI: PROGRAMMA D'INTERVENTO n.010/33/1	AGG.
ESECUTORE: impresa PATI - BRINDISI	AGG.
	DIS.
RELAZIONE CALCOLI STRUTTURE	CONT.
	RAPP.

Impresa VITO PATI

BRINDISI

Relazione di calcolo strutture per
la realizzazione del programma
di intervento n. 010/33/1 IACP
Mesagne

Analisi elementare

- <u>muratura perimetrali d'tamponamento</u>
  - tavolato esterno semipieno : $0,12 \times 1100 = 132 \, k/m$
  - " interno : 100 "
  - intonaco 3 strati : 75

  peso a ml = $307 \times 3,06 = 939 \, k/ml \simeq 1 \, t/ml$ $307 \, k/m$

- <u>Solaio t/20+4 sul perio piano abitabili</u>
  - peso proprio $860 \, k/m$
  - pav + intonaco
  + malta allett + incid. tram. 140
  - sovracc. accid. $\underline{250}$
  $\overline{650 \, k/m}$

  <div style="float:right">Il meccanismo caveo
si assume sulla
copertura piana -</div>

- <u>Solaio alle parte balconi</u>
  - peso proprio : $300 \, k/m$
  - sov. : 400 "
  - pav + int + imp : $\underline{100}$ "
  $\overline{800 \, k/m}$

- <u>gradino scala</u>
  - soletta : $0,34 \times 150 = 51 \, k$
  - gradino $\dfrac{0,30+0,16}{2} \times 2500 \cdot 60$ "
  - ped. 27
  - frontino 8
  - malta 11
  - intonaco 10
  - sov. acci $\underline{120}$
  $\overline{\simeq 290 \, k/ml}$ ogni gradino

  carico a ml : $\dfrac{290}{0,30} \simeq 1000 \, k/m$.

  Il meccanismo caveo si adotta per i pianerottoli -

Copertura scala

Trave 25-13
26-20

- Soletta : 0,30×0,15×2500 = 112 4
- trave : 0,15×0,8×2500 = 300 u
- falda piana = 200
- sovraccarico 0,55×400 = 820
- Solaio: $\frac{2,40×650}{2}$ = 780
  —————
  1612

750: $(113+300)×\frac{300}{2}$ 750 4

$\overline{4.40}$ 0,50

0,50
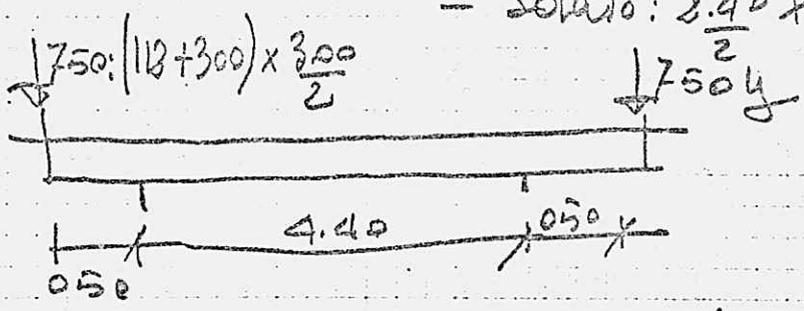
$R_{25} = R_{13} = 1612(2,20+0,50)+750 = 5108$ 4

Analisi di carico al piano di copertura (5° impalcato)

Trave 1-2-3-4-5-6-7-8

a) nel tratto 1-2-3 ; 6-7-8

- muro di attico : $1.40 \times 0.12 \times 2500 = 420$ Kg/mc
- trave : $0.80 \times 0.24 \times 2500 =$ 480 "
- Soletta. $400 \times 0.80 =$ 320 "
- Solaio : $\dfrac{3.30}{2} \times 650 =$ $\dfrac{1072}{2292 \text{ Kg/mc}} \simeq 2.3 \text{ t/mc}$ "

b) nel tratto 3-4-5-6

$$c.s. + 1.50 \times 800 = 3.5 \, t/mc$$

$R_1 = (0.50 + 1.70) \times 2.3 = 5.06 \, t.$

$R_2 = \dfrac{(3.40 + 2.80)}{2} \times 2.3 = 7.13 \, t$

$R_3 = 1.40 \times 2.3 + \dfrac{2.70}{2} \times 3.5 = 7.95 \, t.$

$R_4 = \dfrac{(2.70 + 4)}{2} \times 3.5 = 11.73 \, t$

$R_5 = 4 \times 3.5 = 14 \, t.$

$R_6 = \dfrac{4}{2} \times 3.5 + \dfrac{2.80}{2} \times 2.3 = 10.22 \, t.$

$R_7 = \left(\dfrac{2.80}{2} + 0.50\right) \times 2.3 = 4.37 \, t.$

TRAVE 8-9-10-11-12-13-14-15

A) pp + sole : 800 Kg/mc

tot.

$\dfrac{3.30 + 1.80}{2} \times 650 = 2832$ "

$\overline{3.5 \, t/mc}$

$- R_8 = (1.70 + 0.50) \times 3.5 = 7.70 \, t.$

$- R_9 = \dfrac{(3.40 + 2.80)}{2} \times 3.5 = 10.85 \, t$

$- R_{13} = R_{10} = \dfrac{(2.80 + 4)}{2} \times 3.5 = 11.90 \, t.$

$- R_{12} = R_{11} = \dfrac{(4 + 2.70)}{2} \times 3.5 = 11.73$

$- R_{14} = 3.5 \times 1.4 + 1.7 \times 3 = 10 \, t.$

$- R_{15} = 3 \times (1.70 + 0.50) = 6.6 \, t$

B) nel tratto 14-15

pp + sole. 1000

muro attico 420

Solaio : $\dfrac{4.80}{2} \times 650 = \dfrac{1560}{3 \, t/mc}$

TRAVE 16-17-18-19 ; 20-21-22-23

pp+sole :   1000 Y/mue

muro attico   420

solaio   1560
                    ———
                     3 t/mue

— sul tratto 17-18-19 :

CB + 1,20×800   ≃ 4 t/mue

$R_{16} = R_{23} = (0,50 + 1,70) \times 4 = 8.8$ t/ml

$R_{17} = R_{22} = 1,70 \times 3 + \dfrac{4,00}{2} \times 4 = 13.1$ t/ml

$R_{18} = R_{21} = \left(\dfrac{4 + 2,80}{2}\right) \times 4000 = 13.6$ t

$R_{19} = R_{20} = \dfrac{2,80}{2} \times 4000 = 5.60$ t

TRAVE 1-8-16-15-23 ; 7-14

muro attico.   420

trave + sole : 600
              ———
              1020 Y/mue   ≃ 1 t/mue

$R_1 = 0,50 + 2,10 = 2,60$ t

$R_8 = \dfrac{5,40}{2} + 2,10 = 4,8$ t

$R_{16} = \dfrac{5,40}{2} + 0,90 = 3,5$ t

$R_7 = (0,50 + 2,10) \times 1,4 = 3,64$ t

$R_{14} = 3,64$ t

$R_{15} = R_{23} = 3,5$ t

TRAVE 11-24-19 ; 18-25-20

1500
1300 q/ml

{1500 + 600 = 2100 q . (trave 30×24 + massetto + muretto
(Perimetrale attico)

$\not\times$ 1.40 $\not\times$ 4.55 $\not\times$ 1.70 $\not+$ muratura 1000
⑪   ㉔   ⑲   pp trave 300
                                            1300

– R_{11} = 1300 × 0.70 = 910 ≃ 1t + 0.70 × 1500 = 2t

TRAVE 25-26   – R_{25} = 2.96 ≃ 3t   – R_{19} = 7.27 t
                              + 0.70 × 1500 = 4t

sol. reale : $\dfrac{1.40}{2}$ × 1000 = 2200

trave : 0.60 × 0.20 × 2500 = 300 R_{25} = R_{26} = 1.50 × 3.8 = 5.7 t.

muratura   = 1000

sovr. trave 500 × 0.60 = 300
                                        ————
                                        3.8 t/ml

TRAVE 19-20 (a quota piano 2/piano)

muratura : 1000 q/ml
sol. reale a sbalzo : 0.70 × 1000 = 700
pp trave : 0.20 × 0.30 × 2500 = 450 R_{19} = R_{20} = 3.8 × 1.50 = 5.7 t
sovr.   500 × 0.90 = 450
solette reale   2200
                                        ————
                                        3.8 t/ml

Analisi di carico del solaio piano tipo (4°·3°·2° imp.)

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

Solaio: $\dfrac{3.25}{2} \times 650 = 1056 \ \text{Kg/mc}$

Murat. $= 1000$

Mp + sol. $= \underline{800}$

$\simeq 3t/\text{mc}$

- tratto 3-4-5-6:

$c_s + 1.50 \times 800 = 4.2 \ t/\text{mc}$

+ muro attico : $100 \ \text{Kg/mc} \simeq 4.3 t/\text{mc}$

$R_1 = (0.20 + 1.70) \times 3 = 5.7 t$

$R_2 = (1.70 + 1.40) \times 3 = 9.3 t$

$R_3 = 1.6 + (1.40 \times 3) + 1.35 \times 4.3 = 11.61 t$

$R_4 = (2 + 1.35) \times 4.3 = 14.40 t$

$R_5 = 4 \times 4.3 = 17.2 t$

$R_6 = (2 + 1.90) \times 3 + 1.3 \times 2 + 1.6 = 14.4 t$

$R_7 = (1.40 + 0.20) \times 3 = 4.8 t$

TRAVE 8-9-10-11-12-13-14-15

come al solaio di copertura.

TRAVE 16-17-18-19 ; 20-21-22-23

Solaio $\dfrac{5.00}{2} \times 650 = 1625 \ \text{Kg/mc}$

Murat. $= 1000$

Mp trave + sol. $= \underline{800}$

$3425 \simeq 3.5 t/\text{mc}$

tratto 17-18-19 : $c_s + 800 \times 1.20 + 100 \simeq 4.5 t/\text{mc}$

$R_{16} = (1.70 \cdot 0.20) \times 3.5 = 5.95 t$

$R_{17} = 1.6 + 3.5 \times 1.7 + \dfrac{3.70}{2} \times 4.5 = 15.88 t$

$R_{18} : 1.6 + 4.5 \left(\dfrac{3.70}{2} + 1.40 \right) = 16.83 t$

$R_{19} : 4.5 \times 1.40 = 6.30 t.$

TRAVE 1-8-16

$pp + solr = 600$
$uur. = \dfrac{1000}{1.6 \, t/ml}$

$R_1 = (0.20 + 2.10) \times 1.6 = 3.68 t.$

$R_8 = \dfrac{(4.20 + 5.40)}{2} \times 1.6 = 7.68 t.$

$R_{16} = \left(\dfrac{0.50 + 5.40}{2} \right) \times 1.6 = 5.12 t$

TRAVE 15-23

$q = 1.6 \, t/ml$

$R_{15} = 1.6 \times \left(\dfrac{0.50 + 5.40}{2} \right) \times 1.6 = R_{23}$

TRAVE 7-14 $R_7 = R_{14} = 1.6 \times 2.10 = 3.36 t$

TRAVE 11-25-19
come copertura.

$R_{11} = 8 t$; $R_{19} = 7.27 t$; $R_{25} = R_{26} = 4 t.$

TRAVE 25-26
come copertura.

$R_{25} = R_{26} = 5.7 t$

TRAVE 19-20   come copertura

$R_{19} = R_{20} = 5.7 t.$

VARIANTI AL I° IMPALCATO (ad integratione Carichi precedenti)

TRAVE 7-24 $q = 3 t/ml$

$R_{24} = R_7 = 5.7 t$

TRAVE 14-15

vetrio : 1056

$R_{14} = R_{15} = 1.70 \times 1056 = 1.8 t$

TRAVE 24-15

$pp + solr = 400$
attico $\underline{600}$ ml

$R_{24} = R_{15} = 2.10 t.$

Analisi di Carico sui pilastri

Pilastro 1

5° : 5.06 + 3.60 + 1750 $\longrightarrow$ 8.41 t : 30×30 ; 4φ12

4 : 5.70 + 3.68 + 1750 $\longrightarrow$ 18.54 t : 30×30 ; 4φ16

3 : " " " $\longrightarrow$ 28.67 t : 30×30 ; 4φ16

2 : " " " $\longrightarrow$ 38.80 t : 30×30 ; 4φ16

1 : " " 1500 $\longrightarrow$ 49.68 t : 30×40 ; 4φ16

0 : 1500 (3.90 1 3) = 5.18 $\longrightarrow$ 54.86 t : 30×40 ; 4φ16

PILASTRO 2

5° : 7.13 + 0.75 $\longrightarrow$ 7.88 t : 30×30 - 4φ12

4° : 9.3 + 0.75 $\longrightarrow$ 17.93 t : 30×30 - 4φ12

3° : " " $\longrightarrow$ 27.98 t : 30×30 - 4φ16

2° : " 0.90 $\longrightarrow$ 38.18 t : 30×30 - 4φ16

1° : " 1.5 $\longrightarrow$ 48.98 t : 30×40 - 4φ16

0° : (1.50 + 1.40) × 1.5 → 4.35 $\longrightarrow$ 53.33 t : 30×40 - 4φ16

PILASTRO 3

5° : 7.95 + 0.75 $\longrightarrow$ 8.7 t : 30×30 - 4φ12

4° : 11.61 + " $\longrightarrow$ 21.06 t : 30×30 - 4φ16

3° : 11.61 + " $\longrightarrow$ 33.42 t : 30×30 - 4φ16

2° : 11.61 + 0.9 $\longrightarrow$ 45.93 t : 30×40 - 4φ16

1° : 11.61 + 1.5 $\longrightarrow$ 59.09 t : 30×40 - 4φ16

0° : 2.8 × 1.5 = 4.2 $\longrightarrow$ 63.84 t : 30×40 - 4φ16

PILASTRO 4

5°: 1.73 + 1 + 0.75 → 13.48 t : 30x30 - 4ϕ12

4°: 14.40 + 1 + 0.75 → 89.63 t : 30x30 - 4ϕ16

3°: u u u → 45.78 t : 30x30 - 4ϕ16

2°: u u 0.9 → 62.08 t : 30x40 - 4ϕ16

1°: u u 2.00 → 79.48 t : 40x40 - 6ϕ16

0°: 3x1.5 = 4.5 → 83.98 t : 40x40 - 6ϕ16

PILASTRO 5

5°: 14 + 0.75 → 14.75 t : 30x30 - 4ϕ12

4°: 17.2 + 1 + 0.75 → 34.45 t : 30x30 - 4ϕ16

3°: u u u → 54.15 t : 30x40 - 4ϕ16

2°: u u + 0.9 → 74.00 t : 30x40 - 4ϕ16

1°: u u + 2.00 → 94.95 t : 40x40 - 6ϕ16

0°: 3.6 x 1.5 = 5.4 → 100.35 t : 40x40 - 6ϕ16

PILASTRO 6

5°: 10.22 + 0.75 → 10.97 t : 30x30 - 4ϕ12

4°: 14.4 + u → 26.12 t : 30x30 - 4ϕ16

3°: u u → 41.27 t : 30x30 - 4ϕ16

2°: u + 0.9 → 56.57 t : 30x40 - 4ϕ16

1°: u + 2.00 → 72.97 t : 40x40 - 6ϕ16

0°: 2.8 x 1.5 = 4.2 t → 77.17 t : 40x40 - 6ϕ16

PILASTRO Z

5° : 4.37 + 3.64 + 0.75 ⟶ 8.76 t : 30×30 - 4φ12
4° : 4.8 + 3.96 + 0.75 ⟶ 18.27 t : 30×30 - 4φ16
3° : " " " ⟶ 27.78 t : 30×30 - 4φ16
2° : " " + 0.9 ⟶ 37.94 t : 30×30 - 4φ16
1° : 4.8 + 3.36 + 5.7 + 1.5 ⟶ 58.80 t : 30×40 - 4φ16
0° : 2.4×1.5 = 3.6 t ⟶ 56.40 t : 30×40 - 4φ16

PILASTRO 8 - 15

5° : 7.70 + 4.8 + 0.75 ⟶ 13.25 t : 30×30 - 4φ12
4° : 7.70 + 7.68 + " ⟶ 29.38 t : 30×30 - 4φ16
3° : " " " ⟶ 45.51 t : 30×30 - 4φ16
2° : " " 0.9 ⟶ 61.79 t : 30×40 - 4φ16
1° : " " 2.00 ⟶ 79.17 t : 40×40 (30×40 pil.15) - 6φ16
                                                    4φ16
0° : (3.90 + 5.00)/2 ×1.5 = 6.7 t ⟶ 85.87 t : 40×40 (30×40 pil.15) - 6φ16
                                                    4φ16

PILASTRO 9 - 14

5° : 10.85 + 0.75 ⟶ 11.60 t : 30×30 - 4φ12
4° : " " ⟶ 23.20 t : 30×30 - 4φ16
3° : " " ⟶ 34.80 t : 30×30 - 4φ16
2° : " + 0.9 t ⟶ 46.55 t : 30×40 - 4φ16
1° : " + 2.00 t ⟶ 58.40 t : 40×40 (30×40 pil.15) 6φ16 (4φ16)
0° : (1.50 + 1.20)×1.5 = 4.05 t ⟶ 63.45 t : 40×40 ; (") 6φ16 (4φ16)

PILASTRO 10-13

$5°$: 11.90 + 0.75 —— 12.65 : 30×30 - 4φ12

$4°$: " " —— 25.30 : 30×30 - 4φ16

$3°$: " " —— 37.95 : 30×30 - 4φ16

$2°$: " + 0.9 —— 50.75 : 30×40 - 4φ16

$1°$: " + 2.00 —— 64.65 : 40×40 - 6φ16

$0°$: $\frac{(3.6+2.9)}{2}$ ×1.5 = 4.5 t —— 69.15 t : 40×40 - 6φ16

PILASTRO 11-12

$5°$: 11.73 + 0.75 —— 12.48 t : 30×30 - 4φ12

$4°$: " " +1.00 —— 25.96 t : 30×30 - 4φ16

$3°$: " " " —— 39.44 t : 30×30 - 4φ16

$2°$: " + 0.9 + 1 —— 53.07 t : 30×40 - 4φ16

$1°$: " + 2.00 +1.00 —— 67.80 t : 40×40 - 6φ16

$0°$: 4.5 —— 72.30 t : 40×40 - 6φ16

PILASTRO 25-26

$6°$: 5.10 + 0.75 —— 5.85 t : 30×30 - 4φ12

$5°$: 3.00 + 5.7 + 1 + 0.75 —— 16.30 t : 20×40 - 4φ12

$4°$: " " " " —— 26.75 t : 20×50 - 4φ12

$3°$: " " " " —— 37.20 t : 20×50 - 4φ12

$2°$: " " " 0.9 —— 47.80 t : 20×60 - 6φ12

$1°$: " " " 2.00 —— 59.50 t : 25×60 - 6φ16

$0°$: (0.25)×1.5 = 6.00 t. —— 65.50 t : 25×60 - 6φ16

PILASTRO 16-23

5°: 8.8 + 3.5 + 0.75 ———→ 13.05 t : 30x30 - 4φ12
4°: 5.95 + 5.12 + " ———→ 24.87 t : 30x30 - 4φ16
3°: " " " ———→ 36.69 t : 30x30 - 4φ16
2°: " " + 0.9 ———→ 48.66 : 30x40 - 4φ16
1°: " " . 1.5 ———→ 61.83 t : 30x40 - 4φ16
0°: (2.5+1.5)x1.5 = 6t ———→ 67.23 t : 30x40 - 4φ16

PILASTRO 17-22

5°: 13.1 + 0.75 ———→ 13.85 t : 30x30 - 4φ12
4°: 15.88 + " ———→ 30.48 t : 30x30 - 4φ16
3°: " " ———→ 47.11 t : 30x30 - 4φ16
2°: " + 0.9 ———→ 63.89 t : 30x40 - 4φ16
1°: " + 2.00 ———→ 81.77 t : 40x40 - 6φ16
0°: 3.5x1.5 = 5.25 t ———→ 87.02 t : 40x40 - 6φ16

PILASTRO 18-21

5°: 13.6 + 0.75 ———→ 14.35 t : 30x30 - 4φ12
4°: 16.83 + 0.75 ———→ 31.33 t : 30x30 - 4φ16
3°: " " ———→ 48.31 t : 30x30 - 4φ16
2°: " + 0.9 ———→ 65.44 t : 30x40 - 4φ16
1°: " + 2.00 ———→ 83.67 t : 40x40 - 6φ16
0°: (2.00+1.5+1.5)x1.5 = 7.5 t ———→ 91.17 t : 40x40 - 6φ16

PILASTRO 13-22

6° : 5.10   + 0.75 ——— 5.85 t : 20×30 - 4φ16

5° : 5.60 + 7.27 + 5.7 + 0.75 ———→ 25.17 t : 20×90 - 6φ18

4° : 6.30 + 7.27 + 5.7 + 0.75 ——— 45.19 t : 20×90 - 6φ18

3ª : "   "   "   + 0.9 ——→ 65.36 t : 20×90 - 8φ18

2° : "   "   " + 1.2 —— 85.83 t : 20×90 - 8φ18

1° :   + 2.00 —— 107.10 t : 25×90 - 8φ16 + 4φ12

0° : (8.5 + 1.5 + 3) × 1.5   = 10.5 t —— 117.60 t : 25×90 - 8φ16

Calcolo delle fondazioni

TRAVE 1-2-3-4-5-6-7-8-9

$$q_{2} = \frac{53.33 \times 10^{3}}{\frac{2.80 + 2.40}{2}} = 17.20 \ t/ml \qquad q_{3} = \frac{63.24 \times 10^{3}}{2.80} = 22.58 \ t/ml$$

$$q_{4} = \frac{84.00 \times 10^{3}}{\frac{2.70 + 4.00}{2}} = 25.07 \ t/ml \qquad q_{5} = \frac{100.23 \times 10^{3}}{4.00} = 25.07 \ t/ml$$

$$q_{6} = \frac{77.15 \times 10^{3}}{\frac{2.80 + 4.00}{2}} = 22.7 \ t/ml \qquad q_{7} = \frac{56.40 \times 10^{3}}{\frac{2.80 + 3.40}{2}} = 18.19 \ t/ml$$

Si assume un carico di 25,10 t/ml.

peso proprio : $0.50 \times 1.50 \times 2500 = 1875 \ t/ml$
$ 0.50 \times 0.90 \times 2500 = 1125 \ ''$
$ \overline{3 \ t/ml}$

$q_{tot} = 28 \ t/ml$. $\qquad \sigma_{F} = \frac{28.000}{150 \times 100} = 1.87 \ k/cm$

$\phantom{q_{tot} = 28 t/ml .} max$

considerando il maggiore $\sigma_{F} = \frac{28.000}{180 \times 100} \simeq 1.55 \ k/cm$

— $l = 3.40 \ lut.$

$$M_{max} = \frac{3.40^{2}}{12} \times 25.000 = 24.083 \ k/m$$
$$50 \times 140$$
$$\sigma_{F} = 1800$$
$$\tau_{c} = 30 \qquad A_{f} = 11 \ cm$$

$T_{max} = 1.70 \times 25.000 = 42.500 \ k \qquad \tau_{max} = \frac{42500}{0.9 \times 50 \times 135} = 6.99 \ k/cm$

Tot $\phi \ 8/15''$ a tre bracers.

$$\tau_{st} = 3 \times 0.5 \times 1800 \times 0.9 \times \frac{1.35}{0.15} = 21.870 \ k$$

$$App = \left(\frac{42.500 - 21.870}{2 \times 25.000} \right)^{2} \times \frac{1}{0.9 \times 1.35} \times \frac{1}{\sqrt{2} \times 1800} = 2.76 \ cm$$

— $l = 4.00 \ lut.$

$$M_{max} = 33.330 \ k/m \qquad \tau_{c} = 37 \ k/cm$$
$$50 \times 140 \qquad \sigma_{F} = 1800 \ k/cm \qquad A_{f} = 15 \ cm$$

$T = 50 \ t.$
$\tau_{max} = 8.23 \ k/q$

$$App = \left(\frac{50.000 - 21.870}{50.000} \right)^{2} \times \frac{1}{3083} = 5.13 \ cm$$

TRAVE 8-9-10-11-12-13-14-15

$$q_{t9} = \frac{63.45 \times 10^3}{\frac{3.40 + 2.80}{2}} = 20.46 \, t/ul \qquad q_{T10} = \frac{69.15 \times 10^3}{\frac{4.00 + 2.80}{2}} = 20.34 \, t/ul.$$

$$q_{t13} = q_{t10} \qquad q_{t14} = q/9$$

$$q_{t11} = \frac{72.30}{\frac{4.00 + 2.40}{2}} = 21.90 \, t/ul \simeq 22 \, t/ul.$$

si adottano per le luci ricorrenti
le medesime armature delle travi precedenti.

TRAVE 16-17-18-19-20-21-22-23

$$q_T = \frac{87.02 \times 10^3}{\frac{3.80 + 3.40}{2}} = 24 \, t/ul.$$

si adottano le medesime armature delle
travi 1-2-3 ecc.

TRAVE 1-8-16

$$q_{t1} = \frac{54.86}{1.50 + 1.85} \times 10^3 = 16.38 \, t/ul$$

si adotta $q = 16.38 \, t/ul$

$$q_{t8} = \frac{2/3 \times 85.8 \times 10^3}{\frac{3.90}{2} + \frac{3.00}{2}} = 13.8 \, t/ul$$

peso proprio: $0.50 \times 0.90 \times 2500 = 1125$

$$\sigma_T = \frac{18.000}{120 \times 100} = 1.58 \, t/q. \qquad 0.50 \times 1.20 \times 2500 = 1500$$

$$q_{tot} = 16380 + 2625 = 19 \, t/ul \qquad \frac{2.625 \, t/ul}{}$$

- $l = 4.20$

$$M_{max} = \frac{4.20^2}{12} \times 16380 = 27.93 \, tm$$

50×120 $\tau_c = 31$ $\sigma_f = 1800$ $A_f = 18 \, cq.$

- $l = 3.40$

$$M_{max} = \frac{5.40^2}{12} \times 16.820 = 39.8 \, tm$$

50×140 $\tau_c = 39$ $\sigma_f = 1800$ $A_f = 18 \, cq$

$$T = 2.70 \times 16.380 = 44226 \, q$$

$$A_{ff} = \frac{(44226 - 21.870)^2}{8 \times 16380} \times \frac{1}{3083} = 4.95 \, cq.$$

TRAVE 11-15-18

$P_{1/3} = 36.15 t$

$P_{15} = 65.50 t$

$P_{18} \times \frac{2}{3} = 78.40 t$

$\overline{180 t}$ $l = 1.40 + 4.70 + 0.90 = 7.00$ $q_t = \frac{180.000}{7.00} = 25.72 t/m$

$l = 4.70$ $M_{max} = \frac{4.70^2}{12} \times 25.72 = 47.34 tm$

     40×140 $\tau_c = 30$ $\sigma_f = 1800$ $A_f = 22 cm$

     $T_{max} = 2.35 \times 25.72 = 60.44 t$

                                    $\tau_{sx} = \frac{60440}{40 \times 03 \times 1.35} = 12.44 t/q$

$St \phi 8/15$ a tre braccia

     $T_{ st} = 21870$ $A_p = \frac{(60440 - 21.870)^2}{2 \times 35.720} \times \frac{1}{308} = 1.38 cq$

Armatura suole travi:

$M_{max} = \frac{030^2}{2} \times 18700 = 2337 t/m$

se allarghiamo il nastro di 15 cm per parte
per tenere una sollecitazione più ridotta sul
terreno

     $\sigma_{max} = \frac{28.000}{180 \times 100} = 1.55 t/cq$

$M_{max} = 15500 \times \frac{065^2}{2} = 3273 t/m$

     $A_f = \frac{3273.00}{0.9 \times 45 \times 1800} = 4.49 cmq/m$

Armatura solettone

     $l = 2.20$ $q = 15000 t/m$

$M_{max} = 6049 t/m / p = lut.$ $A_f = \frac{604900}{0.9 \times 45 \times 1800} = 8.3 cq / p = lut.$

Armatura cordoli di fondazione

Si consideri una muratura di tufo di altezza mt. 2.40 :

     peso proprio : 500 q/ml

     muro : 0,35 x 3.40 x 1600 : 960 "

     Intonaco 35 x 2 x 3.40 : 120 "

                  ‾‾‾‾‾‾‾‾
                   1580 q/ml

Si considera una condizione di vincolo appoggio:

- luce max : mt. 4.80

$$M_{max} = \frac{4.80^2}{8} \times 1580 = 4550 \ q/m$$

                                 sez. 30 x 30

$\overline{\sigma_c} = 51$

$\overline{\sigma_f} = 1800$ $A_f = 6 \ cq.$ - armatura simmetrica

Struttura Scala

① Soletta Scala:

luce ut. 3.90 $l_t = 4.10$

Carico: 1120 $\frac{kg}{me}$ (s. Analisi)

$$M_{max} = \frac{4.10^2}{12} \times 1120 = 1563 \frac{kg}{m}$$

$\sigma_c = 38$ $\sigma_f = 1800$ $A_f = 5.4 \, cq.$

si adottano $6 \phi 12$.

Sullo sbalzo in corrispondenza pianerottolo 2.piano

$$M_{max}: \frac{0.80^2}{2} \times 1000 + 1000 \times 0.80 = 320 + 800 = 1120 \frac{kg}{m}$$

— si adotta la medesima armatura a momento negativo della soletta —

② trave 60×20 in corrispondenza pianerottolo 2.piano:

- peso proprio trave : 300 $\frac{kg}{me}$
- muratura   1000
- soletta a sbalzo :   800
- soletta a pinocchio: 2000
- sovraccarico   4100 $\frac{kg}{me}$
  600×0.60 360   .
- totale azst.: 4500 $\frac{kg}{me}$

$l_u = 8.40 ; \quad l_t = 2.50$

- in mezzeria: $\frac{8.50^2}{10} \times 4500 = 2812 \frac{kg}{m}$

$\sigma_c = 77$ $\sigma_f = 1800$ $A_f = 9.5 \, cq.$

- all'incastro: $A_f = \frac{9.5}{1.2} = 8 \, cq.$

③ trave 60×24 in corrispondenza pianesottolo attivo:

peso proprio: 360   (+)
sol: $600 \times 0.60 = 360$ $M_{max} = \frac{1}{10} \times 8.50^2 \times 3200 = 2312 \frac{kg}{m}$
murat.   1000
soletta scala 2000 $\sigma_c = 56$ $\sigma_f = 1800$ $A_f = 6.5 cq$
              $\overline{3200 \frac{kg}{me}}$ — all'incastro $A_f = \frac{6.5}{1.2} = 5.4 \, cq.$

③ Copertura scala:

- trade 19-20 ; 25-26.

solaio $\frac{q.70 \times 600}{}$ = 1410 kg/ml.

veletta: 015×080×2500 = 300

sol.a sbalzo: 1.00×600 = 600

peso proprio   300   vincolo: appoggio

sovracc. 400×0.60 = $\dfrac{240}{2850}$ kg/ml

$M_{max}^+ = \dfrac{2,50^2}{8} \times 2850 = 2236$ kg/m   60×20

$\sigma_c = 70$ $\sigma_f = 1800$

$A_f = 8$ cm.

TRAVI AL 1° IMPALCATO (copertura)

Trave 1-2-3-4-5-6-7-24

$q_s = 2.3$ t/ml   s. An.

$q_s = 3.5$ t/ml

- $l = 3.40$; $q = 2.3$ t/ml ; 80×24

$M = 2224$ kg/m $\sigma_c = 50$; $\sigma_f = 2200$; $A_f = 5$ cm

- $l = 2.80$; $q = 2.3$ t/ml ; 80×24

$M = 1501$ kg/m $\sigma_c = 40$; $\sigma_f = 2200$ $A_f = 3.4$ cm.

- $l = 2.80$; $q = 3.5$ t/ml ; 80×24

$M = 2285$ kg/m $\sigma_c = 50$ $\sigma_f = 2200$ $A_f = 5.1$ cm.

- $l = 4.00$; $q = 3.5$ t/ml ; 80×24

$M = 9665$ kg/m $\sigma_c = 78$ $\sigma_f = 2200$ $A_f = 10.7$ cm.

- $l = 4.00$; $q = 3.5$ t/ml $P = 2.10$ t.

    80×24

$M = 9665 + \dfrac{1}{6} \times 4 \times 2100 = 1400 + 9665 = 6065$ kg/m

       $\sigma_c = 88$ $\sigma_f = 2000$ $A_f = 16$ cm.

soletta a sbalzo: (Al piano tipo)

$M_{max} = \dfrac{1.60^2}{2} \times 800 + 200 \times 1.60 = 1344$ kg/m/b=1mt.

     $\sigma_c = 41$ $\sigma_f = 2200$ $A_f = 37$ cm/b=1mt.

soletta in copertura   1.85 cm/b=50 cm   2∅12 oppure

$M_{max} = \dfrac{1.60^2 \times 800 + 500 \times 1.60}{2} = 1824$ kg/m/b=1mt.   1∅12+1∅10

     100×21 $\sigma_c = 38$ $\sigma_f = 2200$ $A_f = 4.10$ cm/m

- TRAVE 8-9-10-11-12-13-14-15

$$q = 3.5 \ t/ml.$$

$l = 3.40$ $M_{max}^{(+-)} = 3.31 \ t/ml$ $- 80 \times 24$ $\sigma_c = 64$ $\sigma_f = 2200 \ kg/cm$ $A_f = 7.8 \ cmq$

$l = 2.80$ $M_{max}^{(+-)} = 2.29 \ tm$ $- 80 \times 24$ $\sigma_c = 51$ $\sigma_f = 2200$ $A_f = 5.3 \ cmq$

$l = 4.00$ $M_{max}^{(+-)} = 4.67 \ tm$ $- 80 \times 24$ $\sigma_c = 73$ $\sigma_f = 2200 \ kg/cm$ $A_f = 11 \ cm.$

TRAVE 16-17-18-19 ; 20-21-22-23

$$q_1 = 300 \ t/ml$$
$$q_2 = 4 \ t/ml$$

$- l = 3.40 \ ; \ q = 3 \ t/ml$ $M_{max}^{(+-)} = 2.89 \ tm$ $\sigma_c = 52$ $A_f = 6.6 \ cq.$

                              97×24 $\sigma_f = 2200$

$- l = 4.00 \ ; \ q = 4 \ t/ml$ $M_{max}^{(+)} = 5.31 \ tm$ $\sigma_c = 75$ $A_f = 12.5 \ cq$

                              97×24 $\sigma_f = 2200$

$- l = 2.80 \ ; \ q = 4 \ t/ml$ $M_{max} = 2.62 \ tm$ $\sigma_c = 49$ $A_f = 6 \ cq.$

                                                 $\sigma_f = 2200$

TRAVE 20-19

     peso trave: $0.50 \times 0.24 \times 2.500 = 300 \ kg/ml$

     sovraccarico $= 200$ "

     muratura : $= 1000$ "

     muretto attico $= 500$ "

                                  $\overline{2000 \ kg/ml}$

$$M_{max}^{(+)} = \frac{2.60^2}{8} \times 2000 = 1.69 \ tm$$

                             $h. \ 50 \times 24$ $\sigma_c = 56$ $A_f = 3.9 \ cq$

                                         $\sigma_f = 2200$

$$T = 2.4 \ t$$

TRAVE 1-8-16; 15-23; 7-14

$$q = 1020 \, kg/ml.$$ Sez. 67×24

$l = 4.20$; $M_{max} = 1,5 \, tm$ $\tau_c = 40$ $\sigma_f = 1800$ $A_f = 4.15 \, cq.$

$l = 5.40$; $M_{max} = 2,5 \, tm$ $\tau_c = 55$ $\sigma_f = 1800$ $A_f = 7 \, cq$

TRAVE 11-85-19 - mensole

$$M_{max} = \frac{4.35^2}{12} \times 1300 = 2848 \, kgm \quad \text{sez. } 80 \times 50$$

$\tau_c = 48.5$ $\sigma_f = 1800$ $A_f = 3 \, cq$

sulla mensola: $M_{max} = \frac{1.60^2}{2} \times 1300 + 2400 \times 1.60 = \cancel{5548} \, kgm \; 5304$

sez. 20×50 $\tau_c = 75$ $\sigma_f = 1800$

$A_f = 7.5 \, cq$

TRAVI ALL'IMPALCATO TIPO (4°-3°-2°)

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

$$q_1 = 3 \, t/ml$$
$$q_2 = 4.3 \, t/ml.$$

- $l = 3.40$ $q = 3 \, t/ml$ $M_{max} = 2.88 \, tm$

  80×24 $\tau_c = 58$ $\sigma_f = 2200$ $A_f = 6.5 \, cq$

- $l = 2.80$ $q = 3 \, t/ml.$ $M_{max} = 1.96 \, tm.$

  80×24 $\tau_c = 46$ $\sigma_f = 2200$ $A_f = 4.4 \, cq$

- $l = 2.80$ $q = 4.3$ $M_{max} = 2.81 \, tm$

  80×24 $\tau_c = 57$ $\sigma_f = 2200$ $A_f = 6.4 \, cq$

- $l = 4.00$ $q = 4.3$ $M_{max} = 5.74 \, tm.$

  $\tau_c = 84$ $\sigma_f = 1800$ $A_f = 17 \, cq$

- $l = 4.00$ $q = 4.3$; $P = 2.10 \, t.$ $M_{max} = 7.13 \, tm$

  $\tau_c = 87$ $\sigma_f = 1800$ $A_f = 21 \, cq$!

TRAVE 8-9-10-11-12-13-14-15

l. Impalcato di copertura.

TRAVE 16-17-18-19

$$q_1 = 3 t/ml$$
$$q_2 = 4.10 t/ml$$

$l = 3.40$; $q = 3 t/ml$ $M_{max} = 2.83 tm$
    $32: 80 \times 24$ $\tau_c = 38$ $\sigma_f = 2800$ $A_f = 6.7 cq$

$l = 4.00$; $q = 4.10 t/ml$ $M_{max} = 5.47 tm$
    $32: 80 \times 24$ $\tau_c = 81$ $\sigma_f = 1800$ $A_f = 16 cq$

$l = 2.80$; $q = 4.10 t/ml$ $M_{max} = 2.68 tm$
    $32: 80 \times 24$ $\tau_c = 56$ $\sigma_f = 2800$ $A_f = 6.1 cq$.

TRAVE 11-25-13

Sradotta la sezione costante 20×50:

peso proprio .... 850 t/ml
muratura .... $\dfrac{1000}{1250}$ t/ml
carico concentrato
sulle mensole: $(1.40 + 1.20) \times 1000 = 2600 t$.

$$M_{max}^{(-)} = \frac{1.00^2}{2} \times 1250 + 2600 \times 1.00 = 3225 t/m$$
    20×50 $\tau_c = 32$ $\sigma_f = 2800$ $A_f = 3.5 cq$

$$M_{max}^{(+)} \text{ in campata}: \frac{4.50^2}{12} \times 1300 = 2193 t/m.$$
    $\tau_c = 46$ $\sigma_f = 2800$ $A_f = 2.3 cq$.

TRAVE 1-8-16 ; 7-11 ; 15-23

$q = 1.6 t/ml$ (l. analisi)

$- l = 4.20$ $M_{max} = 2.36 tm$ 60×24 $\tau_c = 61$ $A_f = 5.4 cq$
$\sigma_f = 2800$

$- l = 5.40$ $M_{max} = 3.89 tm$ 60×24
    $\tau_c = 78$
    $\sigma_f = 1800$ $A_f = 11.4 cq$.

Soletta tra le tradi 4-5-6

$$M_{max} = \frac{800 \times 1.60^2}{2} + 200 \times 1.60 = 1344 \text{ kg/m} / b = 1 \text{ mt}.$$

sez. 100×20 $\sigma c = 41$ $\sigma_f = 8200$ $A_f = 3.70 \text{ cmq} / b = 1 \text{ mt}.$

: Soletta tra le tradi 18-19 ; 20-21

$$M_{max} = \frac{650 \times 1.50^2}{2} + 1000 \times 1.35 = 2081 \text{ kg/m} / b = 1 \text{ mt}.$$

sez. 100×24 . $\sigma c = 42$; $\sigma_f = 2200 \text{ k/q}$ $A_f = 4.65 \text{ cmq}.$

VARIANTI AL I° IMPALCATO

TRAVE 11-12

$$q = 3600 + \text{musat} = 4500 \text{ kg/m}$$

$l = 3.40$ $M_{max}^{(+-)} = 4.31 \text{ tm}$

80×24 $\sigma c = 74$

$\sigma_f = 2200$ $A_f = 10 \text{ cmq}$

TRAVE 7-14

peso proprio: 300 kg/m   30×24

musatura 1000

Tot. 1300 kg/m

$M_{max} = 1.93 \text{ tm}$ $l = 4.20$

$\sigma c = 61$

$\sigma_f = 2200$ $A_f = 4.4 \text{ cmq}.$

TRAVE 7-22

sez. 80×20 - $l = 3.40$

peso proprio: 400   kg/m

solacce. :   320

solaio :   1.60 × 650 = 1040

1760 kg/m

$M_{max} = 1.7 \text{ tm}$ $\sigma c = 50$; $\sigma_f = 1800$ $A_f = 5.8 \text{ cmq}.$

TRAVE 24-15

peso proprio: 200 kg/m

si arma con armatura simmetrica 3+3∅12

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