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STVDIO TECNICO DOTT. ING. L. POTÌ
REDATTO: INGG. L. POTÌ e A. MALDARI

PIANO TIPO
SCALA - PENSILINA
GIUNTI

CASE POPOLARI in BRINDISI
X° LOTTO - QVARTIERE C.E.P.
ELEMENTI A-B-C-D-E-F

RELAZIONE DI CALCOLO

L'IMPRESA
LVIGI SARDELLA

MAGGIO 1961

RELAZIONE DI CALCOLO

PER QVANTO RIGVARDA I CARICHI VNITARI ASSVNTI A BASE DEL CALCOLO CI SI RIMANDA ALLE PREMESSE RIPORTATE NELLA RELAZIONE SVILVPPATA PER LE FONDAZIONI. PER QVANTO RIGVARDA LA STRVTTVRA IN ELEVAZIONE, IL CALCOLO SARÀ ESEGVITO APPLICANDO IL METODO DEL CROSS ALLA TRAVE CONTINVA; PER TENER CONTO DELLA RIGIDEZZA DEGLI APPOGGI DI ESTREMITÀ, SARANNO ADOTTATI OPPORTVNI COEFFICIENTI DI RIPARTIZIONE NEI NODI ESTREMI; LA VALVTAZIONE DEI MOMENTI POSITIVI DI CAMPATA SARÀ ESEQVITA CALCOLANDO I MOMENTI EFFETTIVI PROVENIENTI DALLA SOLVZIONE DELLE TRAVI CONTINVE

SI FARÀ VSO DI CEMENTO 680 E FERRO OMOGENEO R.Q.42

SARANNO ASSVNTI I SEGVENTI TASSI DI LAVORO:

calcestruzzo dosato q.li 300 m.c Kg/cm² 50
ferro A.Q.42 1400 Kg/cm²

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

Solaio	1870
Muratura	1100
p.p.	375
Totale	3345 Kg/ml.

Solaio	1870
Muratura	1100
p.p.	375
Sbalzo $\frac{2\times0.50\times800}{4.10}$	195
Totale	3540

Muratura	1.100
p.p.	315
Totale	1415

Solaio 5.40x6,50 :	1770
Muratura	1100
p.p.	312
Totale	3182

PAL. A.

Tratto
2-3
5-6

Tratto
1-2
4-5

Tratto
3-4

Tratto

CARATTERISTICHE ELASTICHE e GEOMETRICHE

NODO	ASTA	SEZ.	LUNG.	J	W.	K.
2	1-2 2-3	0,30x0,50 0,30x0,50	4.40 4.40	30 30	6.818 6,818	0.5 0.5
3	3-2 3-4	0,30x0,50 0,25x0,50	4.40 2.50	30 25	6.818 10	0,405 0,595
4	4-3 4-5	0,25x0,50 0,30x0,50	2.50 4.40	25	10 6.818	0,595 0,405
5	5-4 5-6	0,30x0,50 0,30x0,50	4.40 4.40	30 30	6,818 6,818	0.5 0.5
6	6-5 6-1	0,30x0,50 0,25x0,50	4.40 2.50	30 25	6.818 7.5	0,476 0,524

Al nodo di estremità diamo un grado di incastro pari a 0,25

$M = \frac{1}{12} 4.40^2 \times 3345 = 5396$ Kgm

$M = \frac{1}{12} 2.50^2 \times 1412 = 735$ Kgm

$\overline{M} = \frac{1}{8} 2.50^2 \times 1412 = 1100$ Kgm

$\overline{M} = \frac{1}{8} \times 4.40^2 \times 3345 = 8093$ Kgm

$M = \frac{1}{12} \times 2.50^2 \times 3182 = 1657$ Kgm $\quad M = \frac{1}{8} 3182 \times 2.50^2 = 2485$ kgm

$M = \frac{1}{12} \times 4.40^2 \times 3540 = 5710$ Kgm $\quad M = \frac{1}{8} 4.40^2 \times 3540 = 8566$

-15	1	1	3	4	-1	-1	5	4	-1	-1
18	-6	4	9	-7	8	-1	-7	-4	2	-9
-81	37	37	18	13	-1	8	36	36	-9	-97
109	-40	-34	-68	-40	-14	-10	-27	-45	18	-1730
-73	818	218	109	-100	6	18	372	372	-89	-2485
147	-36	-401	-803	59	-81	-55	41	-786	186	
459	895	295	147	-1188	-50	186	782	-782	-1572	
-613	830	-820	-1639	1838	119	81	-1251	-5396	391	
4288	-1227	-1227	-613	-2409	-591	391	5710		5396	
-5710	2141	-5396	5396	-735	3077	2502				
	5710				-1204	-5710				
					735					
0.75	05	05	0405	0595	0595	0405	05	05	0476	0524
1	2		3		4		5		6	

DISTRIBUZIONE MOMENTI

1475 — 7323 , -7323 — 2559 , 2559 — 2597 , 2597 — 6601 , 6601 — 4322 , 4322

4415 — 3327 — (-) — 4317 — 3969

RICERCA dei TAGLI

$T_1 = \frac{3540\times4.40}{2} - \frac{7323-1475}{4.40} = 7782-1330 = 6458$ Kg ; $T_2'' = \frac{3345\times4.40}{2} + \frac{7323-2559}{4.40} = 8441$ Kg ; $T_3'' = \frac{1415\times2.50}{2} - \frac{2597-2559}{2.50} = 754$ Kg ; $T_4 = \frac{3540\times440}{2} - \frac{6601-2597}{4.40} = 6997$ Kg $\quad T_5'' = \frac{3345\times440}{2} + \frac{6601-4322}{440} = 8410$ Kg $\quad T_6'' =$

$T_2' = 7788 + 1330 = 9118$ Kg $\quad T_3' = 7359 - 1082 = 6277$ Kg. $\quad T_4' = 1768 + 14 = 1782$ Kg $\quad T_5' = 7788 + 910 = 8579$ Kg $\quad T_6' = 7359 - 1051 = 6308$ Kg $\quad T_1 =$

DISTRIBUZIONE TAGLI

6458 — 9118 , 8441 — 6277 , 1754 — 1782 , 6997 — 8579 , 8410 — 6308 , 5705

RICERCA DEI MOMENTI POSITIVI

$M = \frac{6458^2}{2\times3540} - 1475 = 4415$; $M = \frac{8441^2}{2\times3345} - 7323 = 3327$; $M = \frac{1754^2}{2\times1415} - 2559 = (-)$; $M = \frac{6997^2}{2\times3540} - 2597 = 4317$; $M = \frac{8410^2}{2\times3345} - 6601 = 3969$; $M = \frac{5705^2}{2\times3182}$

1

792

$\frac{3182 \times 2.50}{2} + \frac{4382}{2.50} = 5705$ Kg

$3977 - 1728 = 2249$ Kg

2249

$-4382 = 792$

ARMATURE A MOMENTO FLETTENTE

$M = 1475$; $b = 30$; $H = 50$; $h = 48$; $\sigma_c = 30,5$; $\sigma_f = 1400$; $r = 0,687$; $A_f = 2,3$

$M = 4415$; $b = 30$; $H = 50$; $h = 48$; $\sigma_c = 55$; $\sigma_f = 1400$; $r = 0,14$ $\sigma'_f = 310$

$M_0 = 4800$; $A_{1f} = 675$; $A_{2f} = \frac{4415 - 4800}{1400 \times 46} = 0,35$; $A'_f = \frac{4415 - 4800}{\times 46} = 1,5$

$M = 7323$; $b = 30$; $H = 50$; $h = 48$; $\sigma_c = 55$; $\sigma_f = 1400$; $\sigma'_f = 310$

$A_{1f} = 6,75$; $A_{2f} = 4,85$; $A'_f = 21,5$

$M = 3327$; $b = 30$; $H = 50$; $h = 48$; $\sigma_c = 48$; $\sigma_f = 1400$; $r = 0,455$; $A_f = 5,4$

$M = 2559$; $b = 25$; $H = 50$; $h = 48$; $\sigma_c = 41,5$; $\sigma_f = 1400$; $r = 0,518$; $A_f = 4,1$

$M = 2597$; $b = 25$; $H = 50$; $h = 48$; $\sigma_c = 41,8$; $\sigma_f = 1400$; $r = 0,516$; $A_f = 4,2$

$M = 4317$; $b = 30$; $H = 50$; $h = 48$; $\sigma_c = 55$; $\sigma_f = 1400$; $\sigma'_f = 310$

$A_{1f} = 6,75$ $A_{2f} = 0,2$ $A'_f = 1$

$M = 6601$; $b = 30$; $H = 50$; $h = 48$; $\sigma_c = 55$; $\sigma_f = 1400$; $\sigma'_f = 310$

$A_{1f} = 6,75$ $A_{2f} = 3,7$ $A'_f = 16,7$

$M = 3969$; $b = 30$; $H = 50$; $h = 48$; $\sigma_c = 60$; $\sigma_f = 1800$;

$A_f = 7,5$

$M = 4322$; $b = 25$; $H = 50$; $h = 48$; $\sigma_c = 55$; $\sigma_f = 1400$; $\sigma'_f = 310$

$A_{1f} = 5,65$ $A_{2f} = 1,2$ $A'_f = 15,7$

$M = 792$; $b = 25$; $H = 50$; $h = 48$; $\sigma_c < 3$ $A_f = 1,5$

ARMATURE A TAGLIO

1) $\tau = \frac{6458}{0,9 \times 48 \times 30} = 4,9 < 6$ Kg/cm²

2) $\tau = \frac{9118}{0,9 \times 48 \times 30} = 7,03$ Kg/cm² $S = \frac{7,03 \times 30 \times 4.40}{4} = 23199$ Kg $n = 11$

Staffe φ8 a due braccia a 20" $S_{st} = 2 \times 0,50 \times 1400 \times 11 = 15400$ Kg

$A_{fp} = \frac{23199 - 15400}{1,41 \times 1400} = 3,9$ cm²

3) $\tau = \frac{8441}{0,9 \times 48 \times 30} = 6,5$ Kg/cm² $S = \frac{6,5 \times 30 \times 4.40}{4} = 21450$ Kg

Staffe φ8 a due braccia a 20" $S_{st} = 15400$

$A_{fp} = \frac{21450 - 15400}{1,41 \times 1400} = 3,06$ cm²

4) $\tau = \frac{8579}{0,9 \times 48 \times 30} = 6,61$ Kg/cm² $S = \frac{6,61 \times 30 \times 440}{4} = 21813$ Kg

Staffe φ8/20" $A_{fp} = 3,2$ cm²

5) $\tau = \frac{5705}{25 \times 0,9 \times 48} = 5.2$ Kg/cm²

ARMATURE MENSOLE GIUNTO A SEDIA

$A_{fp} = \frac{2249 \times \sqrt{2}}{1000} = 3,18$ cm² $\tau = \frac{2949}{0,9 \times 25 \times 25} = 3,9$ Kg/cm²

TRAVE 7-8-9-10-11-12-7 PAL. A

TRAVE 12-11-9-8-7-12 PAL. F

TRATTO 7-8-9-; 10-11-12

SOLAIO	660 x 5,75	= 3740
P.P.		= 600
		4340 Kg/m.l.

TRATTO 9-10 ; 12-7

Solaio	$\frac{6.50 \times 5.75}{2}$ =	1870
mur		600
P.P		250
		2720

CARATTERISTICHE ELASTICHE E GEOMETRICHE

nodo	Asta	Sez	Lung.	J	w	K
8	8-7	40 x 60	4.40	40	9,09	0,5
	8-9	40 x 60	4.40	40	9,09	0,5
9	9-8	40 x 60	4.40	40	9,09	0,532
	9-10	20 x 60	2.50	20	8	0,468
10	10-9	20 x 60	2.50	20	8	0,468
	10-11	40 x 60	4.40	40	9,09	0,532
11	11-10	40 x 60	4.40	40	9,09	0,5
	11-12	40 x 60	4.40	40	9,09	0,5
12	12-11	40 x 60	4.40	40	9,09	0,603
	12-7	20 x 60	2.50	20	6	0,397

Al nodo di estremità diamo un grado di incastro pari a 0,55

$M = \frac{1}{12} 4.40^2 \times 4340 = 7000$ kgm

$M = \frac{1}{12} 2,50^2 \times 2720 = 1416$ Kgm

$M = \frac{1}{8} 2,50^2 \times 2720 = 2125$ Kgm

ARMATURE A MOMENTO FLETTENTE

$\underline{M = 3792}$ $b = 40$; $H = 60$; $h: 58$; $\sigma_c = 36$; $\sigma_f = 1400$; $A_f: 5\ cm^2$

$\underline{M = 4371}$ $b = 40$; $H = 60$; $h: 58$; $\sigma_c = 39$; $\sigma_f = 1400$; $A_f: 5{,}82\ cm^2$

$\underline{M = 8766}$ $b = 40$; $H: 60$; $h: 58$; $\sigma_c = 50$; $\sigma_f = 1400$; $\sigma_f' : 275$; $r: 0{,}44$

$M_0 : 6700$ $A_{f1} = 9{,}1$ $A_{f2} = \frac{8766-6700}{1400 \times 56} = 2{,}6$ $A_f' = \frac{8760-6700}{2.75 \times 56} = 13\ cm^2$

$\underline{M = 4784}$ $b: 40$; $H = 60$; $h: 58$; $\sigma_c = 41$; $\sigma_f = 1400$; $A_f = 6.35$; $r: 0{,}525$

$\underline{M = 3153}$ $b: 20$; $H = 60$; $h = 58$; $\sigma_c = 41$; $\sigma_f = 1400$; $A_f = 4{,}27$; $r: 0{,}454$

$\underline{M = 3172}$ $b: 20$; $H: 60$; $h = 58$; $\sigma_c = 49$; $\sigma_f = 1400$; $A_f = 4{,}3$

$\underline{M = 4747}$ $b = 40$; $H = 60$; $h = 58$; $\sigma_c = 40{,}8$; $\sigma_f = 1400$; $A_f = 6{,}2$; $r: 0{,}538$

$\underline{M = 8706}$ $b = 40$; $H = 60$; $h = 58$; $\sigma_c = 50$; $\sigma_f = 1400$; $\sigma_f' = 274$

$M_0 : 6700$ $A_{f1} = 9{,}1$ $A_f^2 = \frac{8706-6700}{14.00 \times 56} = 2{,}5$ $A_f' = \frac{8706-6700}{2.75 \times 56} = 12{,}5$

$\underline{M = 4275}$ $b = 40$; $H: 60$; $h: 58$; $\sigma_c = 39$; $\sigma_f = 1400$; $A_f = 5{,}8$

$\underline{M = 4008}$ $b: 20$; $H: 60$; $h: 58$; $\sigma_c = 52$; $\sigma_f = 1200$; $A_f = 6{,}4$

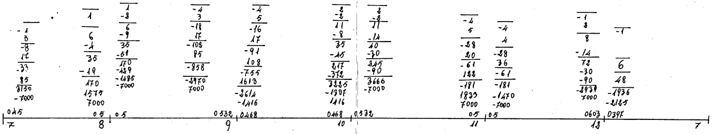
$\underline{M = 679}$ $b = 20$; $H = 60$; $h = 58$; $A_f : 1{,}2$

ARMATURE A TAGLIO

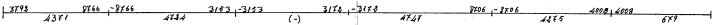
$\tau = \frac{10678}{0{,}9 \times 40 \times 58} = 5{,}1 < 6\ kg/cm^2$

$\tau = \frac{3396}{0{,}9 \times 20 \times 58} = 3{,}2\ kg/cm^2$

$\tau = \frac{5000}{0{,}9 \times 20 \times 58} = 4{,}7\ kg/cm^2$



DISTRIBUZIONE MOMENTI



RICERCA DEI TAGLI

$T_7 = \frac{4240 \times 4.40}{2} - \frac{8766-3792}{4.40} =$;
$= 8418\ kg$

$T_8'' = \frac{4340 \times 440}{2} + \frac{8766-3153}{4.40} =$
$= 10823\ Kg$

$T_9'' = \frac{2720 \times 2.50}{2} - \frac{3172-3153}{2.50} =$
$= 3796\ kg$

$T_{10}'' \frac{4340 \times 4.40}{2} - \frac{8706-3172}{4.40} =$
$= 8291\ Kg$

$T_{11}'' = \frac{4340 \times 4.40}{2} + \frac{8706-4008}{4.40} =$
$= 10615$

$T_{12}'' \frac{2720 \times 2.50}{2} + \frac{4000}{2.50} =$
$= 5000$

$T_8' = 9548 + 1130 = 10678\ Kg$

$T_9' = 9548 - 1275 = 8273\ Kg$

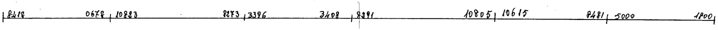
$T_{10}' = 3400 + 8 = 3408\ Kg$

$T_{11}' = 9548 + 1257 = 10805\ Kg$

$T_{12}' = 9548 - 1067 = 8481$

$T_7 = 3400 - 1600 = 1800$

DISTRIBUZIONE TAGLI



RICERCA MOMENTI POSITIVI di CAMPATA

$M = \frac{8418^2}{4340 \times 2} - 3792$
$= 4371$

$M = \frac{10823^2}{4340 \times 2} - 8766 =$
$= 4784$

$M = \frac{3396^2}{2720 \times 2} - 3153 =$
$= (-)$

$M = \frac{8291^2}{2 \times 4340} - 3172 =$
$= 4747$

$M = \frac{10615^2}{2 \times 4340} - 8706 =$
$= 4275$

$M = \frac{5000^2}{2 \times 2720} - 4008 =$
$= 679$

TRAVE 13-14-15-16-17-18 PAL. A

TRATTO 13-14; 16-17

Solaio $\frac{650 \times 575}{2} = 1870$

Mur. 1100

P.P. 375

TOTALE 3345 Kg/ml

TRATTO 14-15; 17-18

Solaio 1870

Mur. 1100

p.p. 375

Sbalzo 195

TOTALE 3540 Kg/ml

TRATTO 15-16

Solaio $\frac{5.45 \times 650}{2} = 1770$

Tamp. : 1100

p.p : 315

TOTALE 3185

CARATTERISTICHE ELASTICHE e GEOMETRICHE

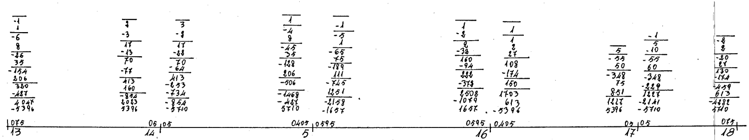
nodo	asta	Sez	lun.	J	W	K
14	14-13	30x50	4.40	30	6,818	0,5
	14-15	30x50	4.40	30	6.818	0.5
15	15-14	30x50	4.40	30	6,818	0,405
	15-16	25x50	2.50	25	10	0,595
16	16-15	25x50	2.50	25	10	0,595
	16-17	30x50	4.40	30	6,818	0,405
17	17-16	30x50	4.40	30	6,818	0,5
	17-18	30x50	4.40	30	6,818	0,5

Ai nodi di estremità diamo un grado di incastro pari a 0,25

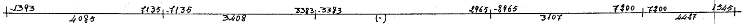
$$M = \frac{3345}{12} \times 4.40^2 = 5396 \text{ Kgm}$$

$$M = \frac{3540}{12} \times 4.40^2 = 5710 \text{ Kgm}$$

$$M = \frac{3185}{12} \times 2.50^2 = 1657 \text{ Kgm}$$



DISTRIBUZIONE MOMENTI



RICERCA DEI TAGLI

$T_{13} = \frac{3345 \times 4.40}{2} - \frac{7135-1393}{4.40} = 6054$ Kg

$T''_{14} = \frac{3540 \times 4.40}{2} + \frac{7135-3383}{4.40} = 8640$ Kg

$T''_{15} = \frac{3185 \times 2.50}{2} + \frac{3383-2965}{2.50} = 4148$ Kg

$T'_{16} = 3981 - 167 = 3814$ Kg

$T''_{16} = \frac{3345 \times 4.40}{2} - \frac{7300-2965}{4.40} = 6374$ Kg

$T''_{17} = \frac{3540 \times 4.40}{2} + \frac{7200-1545}{4.40} = 9073$ Kg

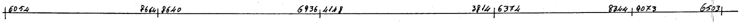
$T'_{14} = 7359 + 1305 = 8664$ Kg

$T'_{15} = 7788 - 852 = 6936$ Kg

$T'_{17} = 7359 + 985 = 8344$ Kg

$T_{18} = 7788 - 1285 = 6503$ Kg

DISTRIBUZIONE DEI TAGLI



RICERCA DEI MOMENTI POSITIVI DI CAMPATA

$M = \frac{6054^2}{2 \times 3345} - 1393 = 4085$ kg

$M = \frac{8640^2}{2 \times 3540} - 7135 = 3408$

$M = \frac{4148^2}{2 \times 3185} - 3383 = (-)$

$M = \frac{6374^2}{2 \times 3345} - 2965 = 3107$

$M = \frac{9073^2}{2 \times 3540} - 7200 = 4487$

ARMATURE A TAGLIO

$\tau = \frac{8664}{0{,}9 \times 30 \times 48} = 6{,}7$ $\quad S = \frac{6{,}7 \times 30 \times 440}{4} = 22110$ Kg

Staffe $\phi 8/20''$ $\quad n = 11$ $\quad S_{staffe} = 2 \times 0{,}50 \times 1400 \times 11 = 15400$

$A_{sp} = \frac{22110 - 15400}{1.41 \times 1400} = 3{,}3$

$\tau = \frac{8344}{0{,}9 \times 30 \times 48} = 6{,}4$ $\quad S = \frac{6{,}4 \times 30 \times 440}{4} = 21120$

Staffe $\phi 8/20''$ $\quad A_{sp} = 2{,}8$ cm²

$\tau = \frac{9073}{0{,}9 \times 30 \times 48} = 7{,}00$ $\quad S = \frac{7 \times 30 \times 440}{4} = 23100$

Staffe $\phi 8/20''$ $\quad A_{sp} = 3{,}9$ cm²

$\tau = \frac{6936}{0{,}9 \times 30 \times 48} = 5{,}3$ kg/cm² < 6

$\tau = \frac{4148}{0{,}9 \times 25 \times 48} = 3{,}8$ kg/cm² < 6

ARMATURE A MOMENTO FLETTENTE

$\underline{M = 1393}$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c < 30$; $\sigma_f = 1400$; $A_f = 2{,}18$

$\underline{M = 4085}$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c = 54$; $\sigma_f = 1400$;

$A_f = 6{,}6$

$\underline{M = 7135}$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c = 55$; $\sigma_f = 1400$; $\sigma_f' = 310$

$M_0 = 4200$ $\quad A_{1f} = 6{,}75$ $\quad A_{2f} = 4{,}5$ $\quad A_f' = 20{,}5$

$\underline{M = 3408}$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c = 49$; $\sigma_f = 1400$; $x = 0{,}45$; $A_f = 5{,}5$

$\underline{M = 3383}$ $\quad b = 25$; $H = 50$; $h = 48$; $\sigma_c = 54$; $\sigma_f = 1400$;

$A_f = 5{,}5$

$\underline{M = 2965}$ $\quad b = 25$; $H = 50$; $h = 48$; $\sigma_c = 50$; $\sigma_f = 1400$;

$A_f = 4{,}8$

$\underline{M = 3107}$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c = 46{,}2$; $\sigma_f = 1400$; $x = 0{,}423$ $\quad A_f = 5$ cm²

$\underline{M = 7200}$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c = 55$; $\sigma_f = 1400$; $\sigma_f' = 310$

$A_{1f} = 6{,}75$; $A_{2f} = 4{,}6$ cm² $\quad A_f' = 20{,}9$ cm²

$\underline{M = 4427}$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c = 52{,}5$; $\sigma_f = 1200$;

$A_f = 8{,}4$

$M = 1545$ $\quad b = 30$; $H = 50$; $h = 48$; $\sigma_c = 31{,}2$; $\sigma_f = 1400$; $x = 0{,}67$; $A_f = 2{,}42$ cm²

CALCOLO DELLA SCALA

Scalino

caratteristiche geometriche

pedata	cm. 30
alzata	cm. 16
larg. intr.	cm. 34
inclin.	$\alpha = 28°10'$

Analisi di carico per gradino

p.p.	$1{,}10\,(\underline{0{,}16 \times 0{,}30} + 0{,}04 \times 0{,}34)\,2500$	= 98 kg
pedata in marmo	$1{,}10 \times 0{,}03 \times 0{,}345 \times 2700$	= 32
alzata in marmo	$1{,}10 \times (0{,}16 - 0{,}02)\,2700$	= 9
massetto di malta	$1{,}10\,(0{,}30 + 0{,}16)\,0{,}2 \times 1400$	= 16
Intonaco intrad.	$1{,}10 \times 0{,}34 \times 0{,}01 \times 1500$	= 6
Sovraccarico	$1{,}10 \times 0{,}30 \times 400$	= 132
	Carico Totale	293 Kg

Calcolo a flessione: Alla sezione Trapezia si sostituisce sezione rettangolare di altezza $h = \frac{a}{2} + x - 2\,\text{cm} = 10\,\text{cm}$.

$$M = \frac{293 \times 1{,}10}{2} + 30 \times 1{,}10 = 162 + 33 = 195 \text{ kgm}$$

(30 Kg è il carico concentrato per ogni gradino)

$\sigma_f = 1400$ $\quad \sigma_c = 53$ $\quad A_f = 1{,}52$ cm² $= 2\,\phi 10$

reggistaffe $\phi 8$ e staffe $\phi 6$

PIANEROTTOLI

H = cm 18

p.p.		= 200
marmo	2700x0,02	: 54
malta	1400 x 0,02	: 28
Intonaco	1800x0,15	: 22
Sovraccarico		= 400
	TOTALE	= 700 kg/cm²

ALL' INCASTRO

$M = \frac{1}{12}\, 700 \times 2.55^2 = 380$ kgm

b = 1m ; h = 16cm ; σ_f = 1400 ; $\sigma_c < 30$; A_f = 1,77 cm² = 2φ12 ogni metro

IN MEZZERIE

$M = \frac{1}{10}\, 700 \times 2.55^2 = 455$ kgm

b = 1m ; h = 16cm ; σ_f = 1400 ; $\sigma_c < 30$; A_f = 2,12 cm² = 2φ12 ogni metro

TRAVE A GINOCCHIO

gradini	10 x (293+30)	= 3230
Pianerottoli	$2\left(\frac{1.10 \times 2.55 \times 700}{2}\right)$	= 1960
P.P	0,70 x 0,25 x 2500 x 5.20	= 2280
tom.	5.20 x 0.25 x 2000 x 2.55	= 6640
		14.110

ARMATURE a MOMENTO FLETTENTE

$M = \frac{1}{12}\, 14110 \times 5.20 = 6125$ Kgm

$\sigma_c = 51$ $\sigma_f = 1400$ $A_f = 7{,}05$ cm² 2+2φ14 reggistaffe e 2φ16 sagomati

ARMATURE a TAGLIO

$\tau = \frac{14110}{2 \times 0{,}9 \times 67 \times 25} = 4{,}65$ kg/cm² < 6

ARMATURE a TORSIONE

$M_t = \frac{195 \times 10}{2} + 380 \times 1.10 = 1392$ Kgm ; $\tau = \psi \frac{M_t}{ab^2}$ $\frac{a}{b} = \frac{70}{25} = 2{,}8$

$\psi = 3{,}76$ $\tau = \frac{139200}{43750} \times 3{,}76 = 11{,}95$ Kg/cm²

$f_s = \frac{139200 \times 15}{2 \times 1400 \times 1750} = \frac{M_t \times \Delta x}{2 \times \sigma_f \times \Omega} = 0{,}427$ $\Omega = 25 \times 70 = 1250$ cm²

St. φ 8|15" 2φ10 Longitudinali

12 Rampa a ginocchio

l = 2.80 m.

$M = \frac{1}{12}(290 \times 5 + 700 \times 1.20)\, 1.05 \times 280 = 2550$ Kgm $\sigma_c = 45$; $\sigma_f = 1200$

r = 0,457 H: 8 cm $A_f = 3{,}16$ = 4φ10

Trave portante 1 pianerottolo di riposo

muratura		1200
intonaco		90
Pianerottolo	1.28x700	900
p.p.	0,20x0,50x2500	250
	TOTALE	2440 Kg/ml

$M = \frac{2440}{12} \times 2.50^2 = 1270$ Kgm

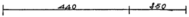
H : 50 h = 47 $\sigma_c = 36$ $\sigma_f = 1400$ $A_f = 2{,}08$

PENSILINA

Analisi dei carichi

p.p.	1.00 x 150 x 1.00	= 150
Sov.p.	1.00 x 100 x 1.00	= 100
Sov.acc.	1.00 x 100 x 1.00	= 100
Veletta	0,30x0,08x2500x100	= 60
		410 kg/ml

4.10 x 1.30 = 530 Kg/ml



All'incastro $M = 530 \times \frac{1}{12}\, 440^2 = 855$ Kgm

In mezzeria $M = 530 \times \frac{1}{24}\, 440^2 = 427$ Kgm

$M = 530 \times \frac{1}{12}\, 2.50^2 = 276$ kgm

M = 855 b = 70 H = 12 $\sigma_c = 65$ $\sigma_f = 1200$ r: 0,337 ; $A_f = 7{,}2$

M = 427 b: 70 H: 12 $\sigma_c = 50$ $\sigma_f = 1400$ $A_f = 3{,}1$ cm²

M = 276 b = 70 $\sigma_c < 30$ $\sigma_f = 1200$ $A_f = 2{,}25$ cm²

$M = \frac{1}{2}\, 350 \times 0{,}85^2 + 60 \times 0{,}85 = 177$ kgm

$\sigma_c < 30$ $A_f = 1{,}2$ Staffe φ 8/30

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

Pal. B

Tratto 1-2-4-5

Solaio	1870
muratura	1100
p.p.	375
Sbalzo	195
Totale	3540 Kg/ml

Tratto 2-3-5-6

Solaio	1870
Muratura	1100
p.p.	375
Totale	3345 Kg/ml

Tratto 3-4

muratura	1100
p.p.	315
Totale	1415

Tratto 6-1

Soldio	1770
Tomp.	1100
p.p.	315
Totale	3185 Kg/ml

CARETTERISTICHE ELASTICHE e GEOMETRICHE

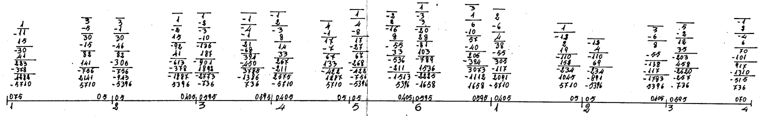
nodo	asta	lung.	sez.	J	W	K
2	2-1	4.40	30x50	30	6.818	0,5
	2-3	4.40	30x50	30	6.818	0,5
3	3-2	4.40	30x50	30	6.818	0,405
	3-4	2.50	25x50	25	10	0.595
4	4-3	2.50	25x50	25	10	0,595
	4-5	4.40	30x50	30	6.818	0,405
5	5-4	4.40	30x50	30	6.818	0,5
	5-6	4.40	30x50	30	6.818	0.5
6	6-5	4.40	30x50	30	6.818	0,405
	6-1	2.50	25x50	25	10	0,595
1	1-6	2.50	25x50	25	10	0,595
	1-2	4.40	30x50	30	6.818	0,405
2	2-1	4.40	30x50	30	6.818	0,5
	2-3	4.40	30x50	30	6.818	0,5
3	3-2	4.40	30x50	30	6.818	0,405
	3-4	2.50	25x50	25	10	0,595

$M = \frac{1}{12} 4.40^2 \times 3540 =$
$= 5710$ Kgm

$M = \frac{1}{12} 4.40^2 \times 3345 =$
$= 5396$ Kgm

$M = \frac{1}{12} 2.50^2 \times 3185 =$
$= 1658$ Kgm

$M = \frac{1}{12} 2.50^2 \times 1415 =$
$= 736$ Kgm



DISTRIBUZIONE MOMENTI

1508 | 7330 | -7330 | 2481 | -2481 | 3026, -3026 | 6788, -6788 | 3106, -3106 | 3448 | -3448 | 6578, -6570 | 3309 | -3309 | -204

4395 | 3370 | (-) | 3861 | 3253 | (-) | 3628 | 3268 | 247

RICERCA DEI TAGLIANTI

$T_1 = \frac{3540 \times 4.40}{2} - \frac{7330-1508}{4.40} =$
$= 6465$

$T_2' = 7788 + 1323 = 9111$

$T_2'' = \frac{3345 \times 4.40}{2} + \frac{7330-2481}{4.40} =$
$= 8461$

$T_3' = 7359 - 1102 = 6257$

$T_3'' = \frac{1415 \times 2.50}{2} - \frac{3026-2481}{2.50} =$
$= 1550$

$T_4' = 1768 + 218 = 1986$

$T_4'' = \frac{3540 \times 4.40}{2} - \frac{6788-3026}{4.40} =$
$= 6983$ Kg

$T_5' = 7788 + 855 =$
$= 8643$ Kg

$T_5'' = \frac{3345 \times 4.40}{2} + \frac{6788-3106}{4.40} =$
$= 8196$ Kg

$T_6' = 7359 - 837 = 6522$

$T_6'' = \frac{3185 \times 2.50}{2} - \frac{3448-3106}{2.50} =$
$= 3845$

$T_1' = 3981 + 136 = 4117$

$T_1'' = \frac{3540 \times 4.40}{2} - \frac{6578-3448}{4.40} =$
$= 7078$

$T_2' = 7788 + 710 = 8498$

$T_2'' = \frac{3345 \times 4.40}{2} + \frac{6578-3308}{4.40} =$
$= 8100$

$T_3' = 7399 - 741 = 6618$

$T_3'' \ \frac{1415 \times 2.50}{2} + \frac{3308+204}{2.50} =$
$= 3172$

$T_4 = 1768 - 1404 = 364$

6465 | 9111, 8461 | 6257, 1550 | 1986, 6983 | 8643, 8196 | 6522, 3845 | 4117, 7078 | 8498, 8100 | 6618, 3172 | 364

$M = \frac{6465^2}{2 \times 3540} - 1508 = 4395$ Kgm ; $M = \frac{8461^2}{2 \times 3345} - 7330 = 3370$; $M = \frac{1550^2}{2 \times 1415} - 2481 = (-)$

Ricerca dei momenti positivi di campata

$M = \frac{6983^2}{3540 \times 2} - 3026 = 3861$

$M = \frac{8196^2}{2 \times 3345} - 6788 = 3252$ Kgm

$M = \frac{3845^2}{2 \times 3185} - 3106 = (-)$

$M = \frac{7078^2}{2 \times 3540} - 3448 = 3628$

$M = \frac{8100^2}{2 \times 3345} - 6570 = 3268$

$M = \frac{3172^2}{2 \times 1415} - 3308 = 247$

ARMATURE A MOMENTO

$M = 1508$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 31$ $r = 0{,}675$

$A_f = 2{,}4\ cm^2$

$M = 4395$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50$ $\sigma_f' = 275$

$M_o = 3550$ $A_{f1} = 575$ $A_{f2} = \frac{4395-3550}{14.00 \times 46} = 1{,}3$ $A_f' = \frac{4395-3550}{275 \times 46} = 6{,}7$

$M = 7330$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50$ $\sigma_f' = 275$

$M_o = 3550$ $A_{f1} = 5{,}75$ $A_{f2} = 5.8$ $A_f' = 30$

$M = 3370$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 48{,}5$ $r = 0{,}453$

$A_f = 5{,}4\ cm^2$

$M = 2481$ $b = 25$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 45$ $r = 0{,}48$

$A_f = 4\ cm^2$

$M = 3026$ $b = 25$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50{,}5$ $r = 0{,}436$

$A_f = 4{,}9\ cm^2$

$M = 3308$ $b = 25$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1200$ $\sigma_c = 50$ $r = 0{,}417$

$A_f = 6{,}25\ cm^2$

$M = 3761$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50$ $\sigma_f' = 275$

$A_{f1} = 5{,}75$ $A_{f2} = 0{,}4$ $A_f' = 2{,}4$

$M = 6788$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50$ $\sigma_f' = 275$

$A_{f1} = 5{,}75$ $A_{f2} = 5$ $A_f' = 25{,}6$

$M = 3252$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 47{,}5$ $r = 0{,}46$

$A_f = 5{,}25$

$M = 3106$ $b = 25$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1200$ $\sigma_c = 48$ $r = 0{,}432$

$A_f = 5{,}75$

$M = 3448$ $b = 25$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50$

$M_o = 2960$ $A_{f1} = 4{,}78$ $A_{f2} = 0{,}7$ $A_f' = 3.8$

$M = 3628$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50$ $\sigma_f' = 275$

$A_{f1} = 5{,}75$ $A_{2f} = /$ $A_f' = /$

$M = 6972$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 50$ $\sigma_f' = 275$

$A_{f1} = 5{,}75$ $A_{2f} = 4{,}6$ $A_f' = 23{,}9$

$M = 3268$ $b = 30$ $H = 50$ $h = 48$ $m = 8$ $\sigma_f = 1400$ $\sigma_c = 47{,}5$ $r = 0{,}46$

$A_f = 5{,}3\ cm^2$

ARMATURE A TAGLIO

$T = 6465$ $\tau = \frac{6465}{0{,}9 \times 30 \times 48} = 4{,}9$ Kg/cm² St. φ8/20"

$T = 9111$ $\tau = 7$ Kg/cm² $S = \frac{7 \times 30 \times 440}{2} = 23100$ Kg $u = 11$ St. φ8/20"

$S_{st.} = 15400$

$A_{fp} = \frac{23100 - 15400}{1.41 \times 1400} = 3{,}9\ cm^2$

$T = 8461$ $\tau = 6{,}9$ $S = 21450$ St. φ8/20"

$A_{fp} = 3\ cm^2$

$T = 6257$ $\tau < 6$ Kg/cm²

$T = 6983$ $\tau < 6$ Kg/cm²

$T = 8643$ $\tau < 6{,}6$ Kg/cm² $S = 21780$ Kg St. φ8/20" $A_{fp} = 3{,}2$ Kg/cm²

$T = 8196$ $\tau = 6{,}3$ Kg/cm² $S = 20790$ Kg St. φ8/20" $A_{fp} = 2{,}7$ Kg/cm²

$T = 6522$ $\tau < 6$ St. φ8/20

$T = 3845$ $\tau < 6$ St. φ8/20

$T = 4117$ $\tau < 6$ St. φ8/20

$T = 7078$ $\tau < 6$

$T = 8498$ $\tau = 6{,}5$ $S = 21450$ Kg St. φ8/20 $A_{fp} = 3\ cm^2$

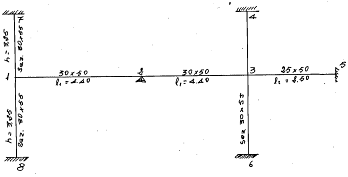
$T = 8100$ $\tau = 6{,}2$ $S = 20400$ Kg St φ8/20 $A_{fp} = 2{,}5$

$T = 6618$ $\tau < 6$ St. φ8/20

$T = 3172$ $\tau < 6$ St. φ8/20

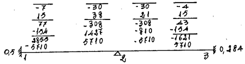
Poichè dal calcolo della travi continue, in precedenza riportato, risulta che le armature e le sollecitazioni non variano sensibilmente, risulta opportuno semplificare lo schema di calcolo ai casi sottoelencati, tenendo presente l'unificazione anche dei carichi data la piccola differenza esistente.

TRAVI DI PERIFERIA pal. B-D-F


7
h = 3.25
Sez. 30×55
4
1
30×50
$l_1 = 4.40$
2
30×50
$l_1 = 4.40$
3
25×50
$l_2 = 2.50$
5
h = 3.25
Sez. 30×55
Sez 30×55
8
6

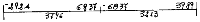
CARATTERISTICHE ELASTICHE E GEOMETRICHE

nodo	Asta	Sez.	Lung.	J	W	K
1	1-2	30×50	4.40	30	6.82	0,5
	1-7	55×30	3.25	$55 \times \frac{30^3}{50^3}$	3,6	
	1-8	55×30	3.25	$55 \times \frac{30^3}{50^3}$	3,6	
	3-2	30×50	4.40	30	6,82	0,284
	3-4	55×30	3.25	11,5	3,6	
	3-6	55×30	3.25	11,5	3,6	
	3-5	25×50	2.00	25	10	


-7
15
77
-154
2855
-5710
-30
38
-308
1427
5710
-30
21
-308
-810
-5710
-4
15
43
-154
-1621
5710
0,5
1
2
3
0,284

$$M = \frac{1}{12}\, 3540 \times 4.40^2 = 540 \text{ Kgm}$$

DISTRIBUZIONE MOMENTI

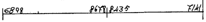

-2924
6837
-6837
3989
3796
3213

RICERCA TAGLI

$$T_1 = \frac{3540 \times 4.40}{2} - \frac{6837-2924}{4.40} = 6898 \qquad T_2'' = \frac{3540 \times 4.40}{2} + \frac{6837-3989}{4.40} = 8435$$

$$T_2' = 7788 + 890 = 8678 \qquad T_3 = 7788 - 647 = 7141$$

DISTRIBUZIONE TAGLI


6898
8678
8435
7141

RICERCA MO

M_{1-2} $\frac{6898^2}{2 \times 3540}$ – 2

ARMAT

M = 2924 b = 30

M = 3796 b = 30

M = 6837 b = 30

M_0 = 4250 A_{fs} =

M = 3213 b = 30

M = 3989 b = 30

MENTI POSITIVI DI CAMPATA

924 = 3796 Kgm ; $M_{2\cdot3} = \frac{8435^2}{2 \times 3540} - 6837 = 3213$ Kgm

VRE A MOMENTO FLETTENTE

H = 50 h = 48 σ_c = 45 σ_f = 1400 r = 0,485 A_f = 4,7 cm²

H = 50 h = 48 σ_c = 52 σ_f = 1400 r = 0,427 A_f = 6,2 cm²

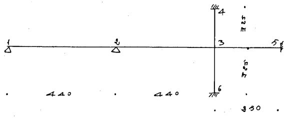
H = 50 σ_c = 55 σ_f = 1400 σ'_f = 310

$\frac{6837-4250}{46 \times 1400} = 4$ cm² $A'_f = \frac{6837-4250}{46 \times 310} = 18$ cm²

H = 50 h = 48 σ_c = 47 σ_f = 1400 r = 0,464 A_f = 5,2 cm²

H = 50 h = 48 σ_c = 50 σ_f = 1200 r = 0,42 A_f = 7,15 cm²

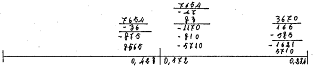
TELAIO PERIFERICO Pal. C


1
2
3
4
5
6
440
440
325
325
250

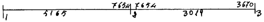
CARATTERISTICHE ELASTICHE E GEOMETRICHE

nodo	Asta	Sez.	Lung.	J	W	K
2	2-1	30x50	4.40	30	0,75x6,82	0,428
	2-3	30x50	4.40	30	6.82	0,572
3	3-2	30x50	4.40	30	6.82	0,284
	3-4	55x30	3.25	11,5	3,6	
	3-6	55x30	3.25	11,5	3,6	
	3-5	25x50	2.50	25	10	

$M = \frac{1}{12}\, 3540 \times 440^2 = 5710$ Kgm $\overline{M} = \frac{1}{8}\, 3540 \times 440^2 = 8565$ Kgm


7654
-36
-875
8565
7654
-47
83
-1170
-810
-5710
3670
166
-585
-1621
5710
0,428
0,572
0,284

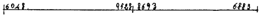
DISTRIBUZIONE MOMENTI


7654
7654
3670
5165
3019
1
2
3

$T_1 = \frac{3540 \times 440}{2} - \frac{7654}{440} = 6048$ Kg ; $T''_2 = \frac{3540 \times 440}{2} + \frac{7654-3670}{440} = 8693$ Kg

T'_2 = 7788 + 1740 = 9528 Kg ; T_3 = 7788 - 905 = 6883 kg

DISTRIBUZIONE TAGLI


6048
9528
8693
6883

$M_{1\cdot2} = \frac{6048^2}{2 \times 3540} = 5165$ $M_{2\cdot3} = \frac{8693^2}{2 \times 3540} - 7654 = 3019$

ARMATURA A MOMENTO FLETTENTE

M = 5165 b = 30 H = 50 h = 48 σ_c = 55 σ_f = 1400 σ'_f = 310
M_0 = 4250 A_{f1} = 6.8 A_{2f} = 1,4 A'_f = 6,4 cm²

M = 7654 b = 30 H = 50 h = 48 σ_c = 55 σ_f = 1400 σ'_f = 310
M_0 = 4250 A_{f1} = 6,8 A_{2f} = 5,3 A'_f = 23,8 cm²

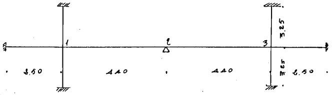
M = 3019 b = 30 H = 50 h = 48 σ_c = 45,5 σ_f = 1400 r = 0,48 A_f = 4,85 cm²

M = 3670 b = 30 H = 50 h = 48 σ_c = 51 σ_f = 140 r = 0,435 A_f = 5,8 cm²

ARMATURA GIUNTO

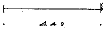
$A_{fp} = \frac{6048 \times \sqrt{2}}{1400} = 6$ cm² $\tau = \frac{6048}{24 \times 0,9 \times 30} = 9,3$ Kg/cm²

TRAVI DI PERIFERIA Pal B-D



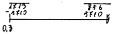
1
2
3
3.25
3.25
2.50
440
440
2.50

Lo schema di carico e lo schema geometrico sono esattamente simmetrici, tenendo però conto della rigidezza del nodo 1 già calcolata nel caso precedente –

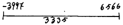


$M = \frac{1}{12}\, 3540 \times 440^2 = 5710$

DISTRIBUZIONE MOMENTI

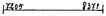


1713
-5710
0,3
856
5710



-3997
6566
3335

DISTRIBUZIONE TAGLI



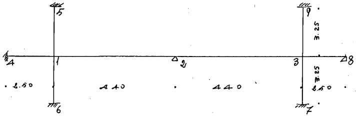
$T_1 = \frac{3540 \times 440}{2} - \frac{6566-3992}{440} = 7205$ $T_2 = 7788+583 = 8371$; $M = \frac{7205^2}{2 \times 3540} - 3997 = 3335$

$M : 3997$ $b : 30$ $H : 50$ $h : 48$ $\sigma_c = 50$ $\sigma_f : 1200$ $r : 0{,}48$ $A_f : 7{,}6\ cm^2$

$M = 3335$ $b : 30$ $H : 50$ $h : 48$ $\sigma_c = 48$ $\sigma_f : 1400$ $r : 0{,}46$ $A_f : 5{,}4\ cm^2$

$M : 6566$ $b : 30$ $H : 50$ $h : 48$ $\sigma_c : 55$ $\sigma_f : 1400$ $\sigma'_f : 310$
$M_0 : 4250$ $A'_{f_1} : 6{,}8\ cm^2$ $A_{f_2} : 3{,}6\ cm^2$ $A'_f : 16{,}8\ cm^2$

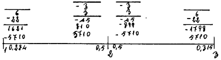
TELAIO PERIFERICO Pal. B-D-E-F



5
9
3.25
4
1
2
3
8
3.25
6
7
2.50
440
440
2.50

CARATTERISTICHE ELASTICHE E GEOMETRICHE

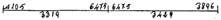
nodo	ASTA	Sez.	Lung.	J	W	K
1	1-5	55 x 30	3.25	11,5	3,6	
	1-4	25 x 50	2.50	25	10	
	1-6	55 x 30	3.25	11,5	3,6	
	1-2	30 x 50	4.40	30	6,82	0,284
3	3-2	30 x 50	4.40	30	6,82	0,315
	3-9	55 x 30	3.25	11,5	3,6	
	3-7	55 x 30	3.25	11,5	3,6	
	3-8	25 x 50	2.50	25	0,75 x 10	



6
-22
1681
-5710
1 0,284
-3
3
-45
810
5710
0,5
2
-3
3
-45
-899
-5710
0,5
6
-22
-1798
5710
0,315
3

$M = \frac{1}{12}\, 3540 \times 440^2 = 5710\ Kgm$

DISTRIBUZIONE MOMENTI



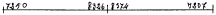
4105
3319
6475
6475
3429
3896

RICERCA SFORZI DI TAGLIO

$T_1 = \frac{3540 \times 440}{2} - \frac{6475-4105}{440} = 7250$ $T''_2 = \frac{3540 \times 440}{2}$

$T'_2 : 7788+538 = 8326$ $T_3 : 7788-586 =$

DISTRIBUZIONE TAGLI



7250
8326
8374
7207

RICERCA MOMENTI POSITIVI DI CAMP

$M_{1\text{-}2}$ $\frac{7250^2}{2 \times 3540} - 4105 = 3319\ Kgm$ $M_{2\text{-}3} : \frac{8374^2}{2 \times 3540} - 6475 =$

$+ \frac{6475-3896}{440} = 8374$

7807

ATA

3429 kgm

ARMATURE A MOMENTO FLETTENTE

$M = 4105$ $b = 30$ $H = 50$ $h = 48$ $\sigma_c = 51$ $\sigma_f = 1200$ $n = 0{,}41$ $A_f = 7{,}8\ cm^2$

$M = 3319$ $b = 30$ $H = 50$ $h = 48$ $\sigma_c = 48$ $\sigma_f = 1400$ $n = 0{,}457$ $A_f = 5{,}3\ cm^2$

$M : 6475$ $b = 30$ $H : 50$ $h : 48$ $\sigma_c = 55$ $\sigma_f = 1400$ $\sigma_f' = 310$

$M_0 = 4250$ $A_{f1} = 6{,}8\ cm^2$ $A_{f2} = 3{,}5\ cm^2$ $A_f' = 15{,}6\ cm^2$

$M = 3429$ $b = 30$ $H : 50$ $h : 48$ $\sigma_c = 48{,}5$ $\sigma_f = 1400$ $n = 0{,}455$ $A_f = 5{,}5\ cm^2$

$M : 3896$ $b = 30$ $H : 50$ $h : 48$ $\sigma_c : 49$ $\sigma_f = 1200$ $n = 0{,}425$ $A_f = 7{,}3\ cm^2$

ARMATURE A TAGLIO

Una armatura di $2\phi16$ piegati e di staffe $\phi8$ a due braccia poste a cm 20 è in grado di assorbire uno sforzo di scorrimento.

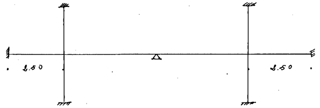
$S_{staffe} + S_{fp} = 11 \times 1.00 \times 1400 + 4 \times 1{,}41 \times 1400 = 15400 + 8000 = 23400\ Kg$

$S_{tot.} = \frac{\tau \times b \times l/2}{2}$ $\tau = \frac{4S}{b \times l}$ $\frac{T}{0{,}9\ b \times h} = \frac{4S}{b \times l}$

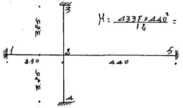
$T = \frac{4S \times 0{,}9 \times h}{l} = \frac{3{,}6 \times 23400 \times 50}{440} = 9558\ Kg.$

e quindi uno sforzo di taglio sino a 9558 Kg.

TRAVI TELAIO CENTRALE Pal. B-D



Telaio è simmetrico geometricamente e rispetto ai carichi



3
3.25
1
2
5
2.50
440
3.25
4

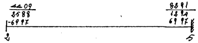
$M : \frac{4337 \times 4{,}40^2}{12} = 6997$

$K_{2\text{-}5} : \frac{W_{2\text{-}5}}{\Sigma W}$

$W_{2\text{-}5} : \frac{T_{2\text{-}5}}{l_{2\text{-}5}} : \frac{40}{440} = 9{,}1$

$W_{2\text{-}1} : \frac{T_{2\text{-}1}}{l_{2\text{-}1}} : \frac{20}{2{,}50} = 8$

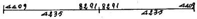
$W_{3\text{-}2} : W_{2\text{-}3} : \frac{T_{2\text{-}4}}{l_{2\text{-}4}} = \frac{40}{3.25} \cdot \frac{40^3}{603} = 3{,}7$



4409
2588
-6997
2
8891
1894
6997
5

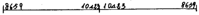
$K_{2\text{-}5} = 0{,}37$

DISTRIBUZIONE MOMENTI


4409
8291
8291
4409
4235
4235

$T = \frac{4337 \times 440}{2} - \frac{8291 - 4409}{440} = 8659$ $T' = 9541 + 882 = 10423$

DISTRIBUZIONE TAGLI


8659
10423
10423
8659

$M_{(+)} \; \frac{8659^2}{2 \times 4337} - 4409 = 4235$ Kgm

ARMATURE A MOMENTO FLETTENTE

$M = 4409$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 38,5$ $\sigma_f = 1400$ $A_f = 5,8\ cm^2$

$M = 4235$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 37,5$ $\sigma_f = 1400$ $A_f = 5,7\ cm^2$

$M = 8291$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 52$ $\sigma_f = 1200$ $x = 0,403$ $A_f = 12,9$

ARMATURE A TAGLIO

Una armatura di 2φ16 piegati e staffe φ8 ogni cm 20 è in grado di assorbire uno sforzo di scorrimento

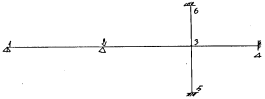
$S = 23400$

che corrisponde ad un Taglio

$T = \frac{A_s \times 0,9 \times h}{l} = \frac{3.6 \times 23400 \times 60}{440} = 11470$ Kg.

TELAIO CENTRALE

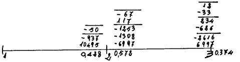
Pal. C



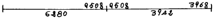
CARATTERISTICHE ELASTICHE E GEOMETRICHE

Per la rigidezza dei nodi e i coeff. di ripartizione si vedano i telai precedenti.

$M = \frac{4337 \times 440^2}{12} = 6997$ $\overline{M} = \frac{4337 \times 440^2}{8} = 10495$


-50
-937
10495
0,428
-67
117
-1253
-1308
-6997
0,572
18
-33
234
-686
-3616
6997
0,374
1
2
3

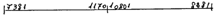
DISTRIBUZIONE MOMENTI


9508
9508
3968
6280
3942

$T_1 = \frac{4337 \times 440}{2} - \frac{9508}{440} = 7381$ $T_2'' = \frac{4337 \times 440}{2} + \frac{9508 - 3968}{440} = 10801$

$T_2' = 9541 + 2160 = 11701$ $T_3 = 9541 - 1260 = 8281$

DISTRIBUZIONE TAGLI


7381
1170
10801
8281

$M_{1-2} = \frac{7381^2}{2 \times 4337} = 6280$ Kgm $M_{2-3} = \frac{10801^2}{2 \times 4337} - 9508 = 3942$

ARMATURE A MOMENTO

$M = 6280$ $b = 40$ $H = 60$ $h = 58$

$M = 9508$ $b = 40$ $H = 60$ $h = 58$

$M_0 = 8300$ $A_{f1} = 11\ cm^2$ $A_{f2} = 1,6$ c

$M = 3942$ $b = 40$ $H = 60$ $h = 58$

$M = 3968$ $b = 40$ $H = 60$ $h = 58$

FLETTENTE

$\sigma_c = 47,5$ $\sigma_f = 1400$ $x = 0,464$ $A_f = 8,35 \text{ cm}^2$

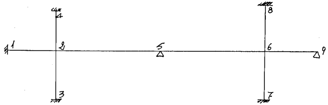
$\sigma_c' =$ $\sigma_f = 1400$ $x = 0,407$ $\sigma_f' = 310$

m² $A_f' = 7 \text{ cm}^2$

$\sigma_c = 36,5$ $\sigma_f = 1400$ $x = 0,585$ $A_f = 5,2$

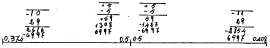
$\sigma_c = 36,5$ $\sigma_f = 1400$ $x = 0,585$ $A_f = 5,2$

TELAIO CENTRALE   Pal. B-E-F

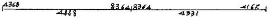


nodo	asta	Sez.	l	J	W	K
2	2-1 2-3 2-4 2-5	20x60 40x40 40x40 40x60	2.50 3.25 3.26 4.40	20 11.8 11.8 40	8 3.6 3.6 9.1 24.30	0,374
6	5-6 6-8 6-7 6-9	40x60 40x40 40x40 20x60	4.40 3.25 3.25 2.50	40 11.8 11.8 20	9.1 3.6 3.6 6 22.30	0,408

$$M = \frac{4337 \times 4.40^2}{12} = 6997 \text{ Kgm}$$


-10
29
2666
-6997
0,374
+5
-5
+59
1308
6997
+5
-5
59
-1427
-6997
0.5
05
-11
29
-2854
6997
0,408

DISTRIBUZIONE MOMENTI


4362
4228
8364
8364
4331
4167

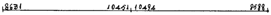
$T_2 = \frac{4337 \times 440}{2} - \frac{8364-4362}{440} = 8631$

$T_5' = 9441 + 910 = 10451$

$T_5'' = \frac{4337 \times 440}{2} + \frac{8364-4167}{440} = 10494$

$T_6 = 9541 - 953 = 8588$

DISTRIBUZIONE TAGLI


8631
10451
10494
8588

$M_{2-5} = \frac{8631^2}{2 \times 4337} - 4362 = 4228$ $M_{5-6} = \frac{10494^2}{2 \times 4337} - 8364 = 4331$

ARMATURE A MOMENTO FLETTENTE

$M = 4362$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 38,5$ $\sigma_f = 1400$ $x = 0,555$ $A_f = 5,75$

$M = 4228$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 37,5$ $\sigma_f = 1400$ $A_f = 5,7$

$M = 8364$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 55$ $\sigma_f = 1400$ $x = 0,405$ $A_f = 11 \text{ cm}^2$

$M = 4331$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 38,5$ $\sigma_f = 1400$ $x = 0,555$ $A_f = 5,75$

$M = 4167$ $b = 40$ $H = 60$ $h = 58$ $\sigma_c = 37,2$ $\sigma_f = 1400$ $x = 0,57$ $A_f = 5,45$

TRAVE DI CAPOSCALA (9-10)

Solaio	1787
Murat.	1100
p.p.	300
Tot.	3187 Kg/ml

$M = \frac{1}{12} \times 2.50^2 \times 3187 = 1165 \text{ Kgm}$

$T = 3983 \text{ Kg}$

$M = 1165$ $b = 20$ $H = 60$ $h = 58$ $\sigma_c < 30$ $\sigma_f = 1400$ $A_f = 1,53 \text{ cm}^2$

TRAVE 12-7 (in corrispondenza del giunto)

Solaio	1787
Murat.	600
p.p.	300
Tot.	2687

$M = \frac{1}{8}\ 2.50^2 \times 2687 = 2100 \text{ Kgm}$

$T = 3358 \text{ Kg}$

$M = 2100$ $b = 20$ $H = 60$ $h = 58$ $\sigma_c = 37,5$ $\sigma_f = 1400$ $A_f = 2,8 \text{ cm}^2$

ARMATVRA GIVNTO

$A_{sp} = \frac{3358 \times \sqrt{2}}{1400} = 3{,}4 \text{ cm}^2$

TRAVE 12-7 (senza giunto)

Solaio	3575
Murat.	1100
P.P.	600
TOT.	5275

$M = \frac{1}{12}\ 2{,}50^2 \times 5275 = 2747$ Kgm

$T = 6593$ Kg

$M = 2747 \quad b = 30 \quad H = 60 \quad h = 58 \quad \sigma_f = 1400 \quad \sigma_c = 45 \quad x = 0{,}485 \quad A_f = 3{,}65$

TRAVE PORTAMVRO SCALA (3-4)

Muratura	1100
P.P.	315
Tot.	1415

$M = \frac{1}{12}\ 2.50^2 \times 1415 = 736$ Kgm

$T = 1768$ Kg

$M = 736 \quad b = 25 \quad H = 50 \quad h = 48 \quad \sigma_f = 1400 \quad \sigma_c < 30 \quad A_f = 1.13 \text{ cm}^2$

TRAVE 6-1; 18-13 (In corrispondenze del giunto)

Solaio	1770
Murat.	1100
P.P.	310
Tot.	3180

$M = \frac{1}{8}\ 2.50^2 \times 3180 = 2484$ Kgm

$T = 3975$ Kg.

$M = 2484 \quad b = 25 \quad H = 50 \quad h = 48 \quad \sigma_f = 1400 \quad \sigma_c = 45{,}5 \quad A_f = 4 \text{ cm}^2$

ARMATVRA GIVNTO

$A_{sp} = \frac{T\sqrt{2}}{\sigma_f} = \frac{3975 \times \sqrt{2}}{1400} = 3{,}9 \text{ cm}^2$

TRAVE 6-1; 18-13 (senza giunto)

Solaio	1770
Murat.	1100
P.P.	310
TOT.	3180

$M = \frac{1}{12}\ 3180 \times 2.50^2 = 1656$

$T = 3975$

$M = 1656 \quad b = 25 \quad H = 50 \quad h = 48 \quad \sigma_f = 1400 \quad \sigma_c = 36 \quad A_f = 2{,}6 \quad x = 0{,}59$

TRAVE DI COLLEGAMENTO 1-7-13; 6-12-18

Muratura	1100
P.P.	310
TOT	1410

$M = \frac{1}{12}\ 1410 \times 5.58^2 = 3620$

$T = 3912$ Kg

$M = 3620 \quad b = 25 \quad H = 50 \quad h = 48 \quad \sigma_f = 1200 \quad \sigma_c = 53 \quad A_f = 6{,}9$