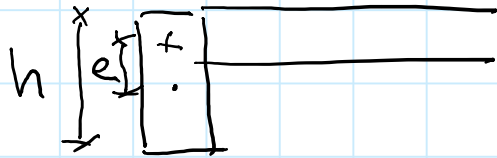


PROGETTO

$$N_{Ed} < 0$$

- PORTARE PICCOLO  $M_{Ed}$



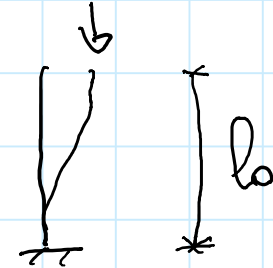
$$e \geq 20 \text{ mm}$$

$$\geq 5\%h$$

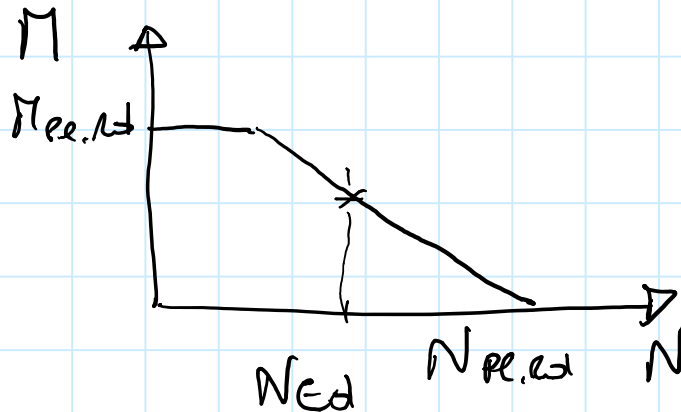
$$\geq \frac{b_0}{200}$$

NTC 08. EC2

NTC 18



ESEMPIO DOMINIO M-N  
SEZIONI IN ACCIAIO



$$N_{Rd} \geq 1.4 N_{Ed} \quad \text{CONSIGLIO}$$

$$A_c f_{cd} + A_s f_{yd} \geq 1.4 N_{Ed}$$

$$N_{re} \quad A_s f_{yd} \geq 0.10 N_{Ed}$$

0.20 CONSIGLIO

$$A_c f_{cd} \geq 1.2 N_{Ed}$$

## CONTRIBUTO ARMATURE E CLS

$$A_{s, nec} = \frac{0,20 N_{ed}}{f_{yd}}$$

$$A_{c, nec} = \frac{1,2 N_{ed}}{f_{cd}}$$

$$\rho_{nec} = \frac{A_{s, nec}}{A_{c, nec}} = \frac{0,20 N_{ed}}{f_{yd}} \cdot \frac{f_{cd}}{1,2 N_{ed}}$$

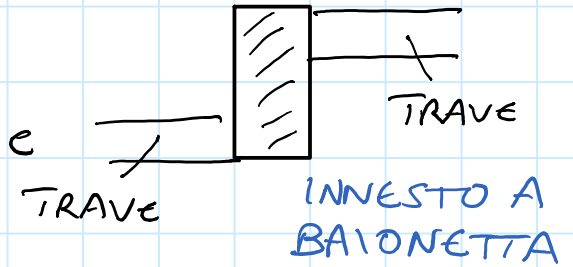
$$C 30/37 \rightarrow f_{cd} = 17 \text{ MPa}$$

$$B 450C \rightarrow f_{yd} = 391,3 \text{ MPa}$$

$$\rho_{nec} = \frac{0,20}{1,2} \cdot \frac{17}{391,3} = 0,7\%$$

# INDICAZIONI DI NORMATIVA

$$A_s \geq 0,3\% A_c \quad (\text{CONDIZIONANTE SOLO SE SI ABBONDA CON } A_c)$$
$$\leq 4\% A_c \quad (\text{ENORME})$$



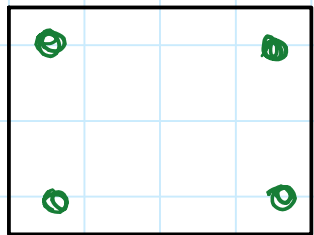
ZONA SISMICA  
CONSIGLIO

$$A_s > 1\% A_c$$

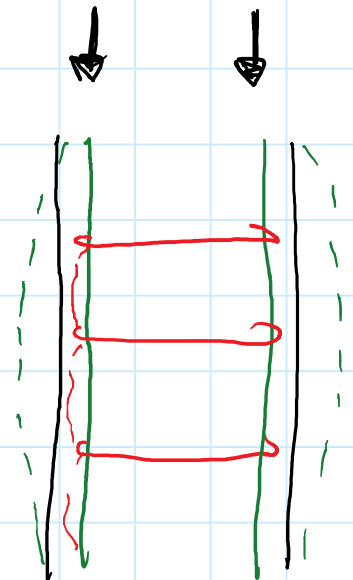
$A_s \approx 0,7\% A_c$  ANCHE IN ZONA NON SISMICA

$$\phi_{\min} = 12 \text{ mm}$$

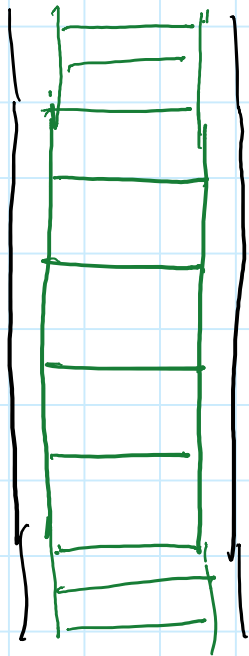
$$d_{\text{BARRE}} \leq \cancel{30} \text{ cm} \quad 25$$



ARMATURE  
VINCOLATE DA STAFFE



# STAFFE



$s^*$

$s$

$s^*$

$$\phi_{staffa} \geq \cancel{6 \text{ mm}} \quad 8 \text{ mm}$$

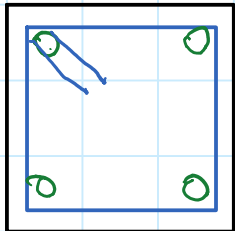
$$\geq \frac{1}{4} \phi_{max}^{LONG}$$

$$s \leq 25 \text{ cm}$$

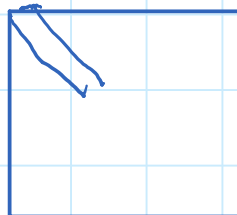
$$\leq 12 \phi_{min}^{LONG}$$

$$EC2 \quad s^* \approx 0.6 s$$

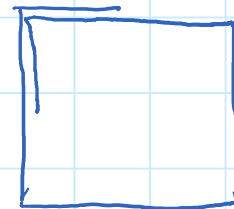
(RAFFITTE AGLI ESTREMI  
PER UN TRATTO PARI ALLA  
DIMENSIONE MAX DEL  
PIASTRO)



$s \leq 10 \text{ cm}$



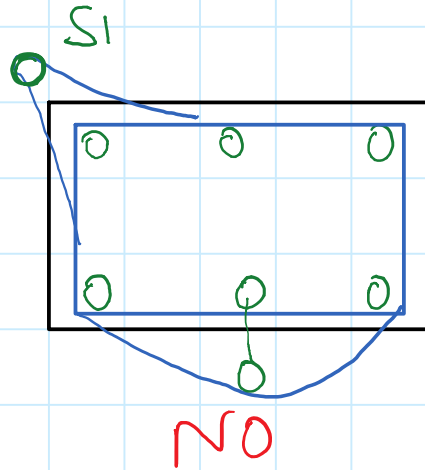
$s \leq$



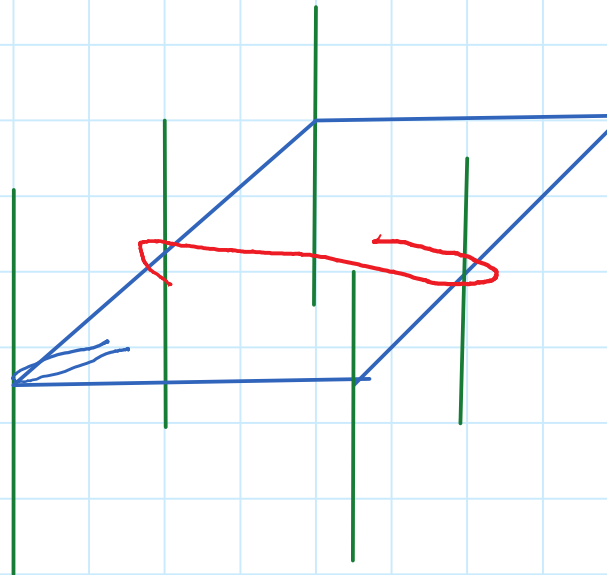
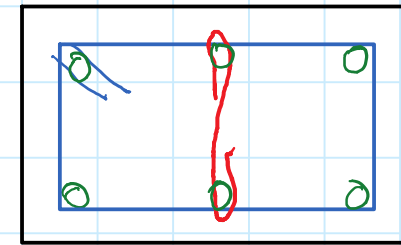
NO

# TIRANTINI

LE STAFFE DEVONO VINCOLARE LE BARRE  
LONGITUDINALI LAVORANDO A TRAZIONE



⇒ INSERISCO  
TIRANTINI



# ESEMPIO

$$F_{Ed} = 375,8 \text{ kN}$$

PIANO	$N_{Ed}$	$A_{c,nec}$	SEZIONE	$A_c$
6	375,8 kN	265,3 cm <sup>2</sup>	30x30	900 cm <sup>2</sup>
5	751,6	530,6	30x30	900 cm <sup>2</sup>
4	1127,4	795,9	30x30	900 cm <sup>2</sup>
3	1503,2	1061,2	30x40	1200 cm <sup>2</sup>
2	1879,0	1326,5	30x50	1500 cm <sup>2</sup>
1	2254,8	1591,8	30x60	1800 cm <sup>2</sup>



$$A_c = \frac{N_{Ed} \cdot 1,2}{17 \text{ N/mm}^2} \times 10$$

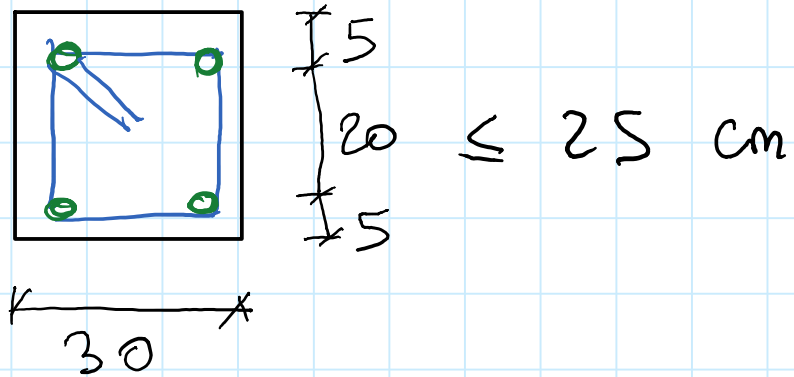
# PROGETTO ARMATURE

PIANO	$N_{ed}$	$A_{s, nec}$	$A_s = 0.7\% A_c$
6	375.8 kN	1.92 cm <sup>2</sup>	$900 \times \frac{0.7}{100} = 6.3 \text{ cm}^2$
5	751.6	3.81 cm <sup>2</sup>	6.3 cm <sup>2</sup>
4	1127.4	5.76 cm <sup>2</sup>	6.3 cm <sup>2</sup>
3	1503.2	7.68 cm <sup>2</sup>	$1200 \times \frac{0.7}{100} = 8.4$
2	1879.0	9.58 cm <sup>2</sup>	10.5 cm <sup>2</sup>
1	2254.8	12.52 cm <sup>2</sup>	12.6 cm <sup>2</sup>

$$A_{s, nec} = \frac{0.2 N_{ed}}{381.3 \text{ N/mm}^2} \times 10$$

# TABELLA SEZIONI

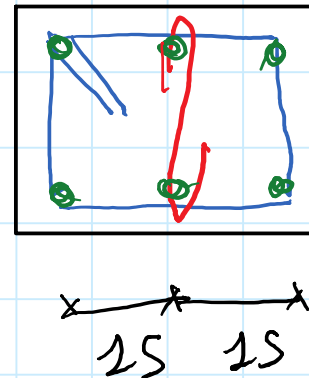
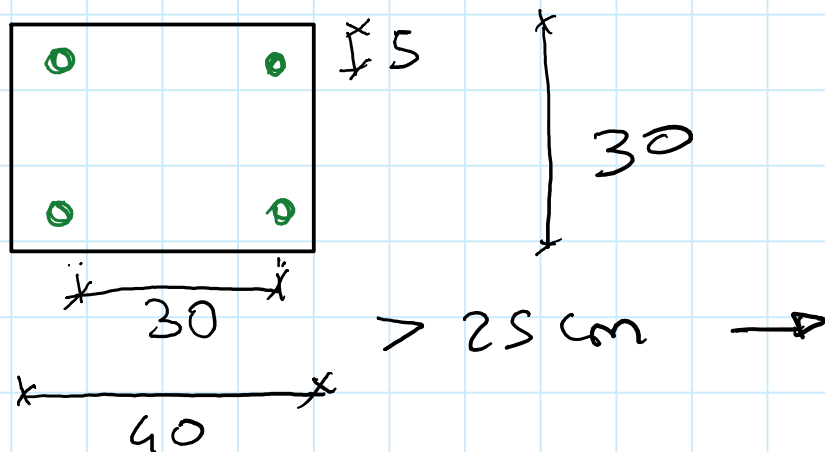
SEZ. 30x30



$$4 \phi 14 \rightarrow 4 \times 2.54 = 6.16 \text{ cm}^2$$

$$\rho = \frac{6.16 \text{ cm}^2}{900 \text{ cm}^2} = 0.68 \%$$

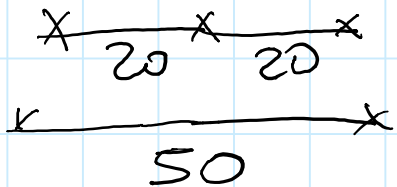
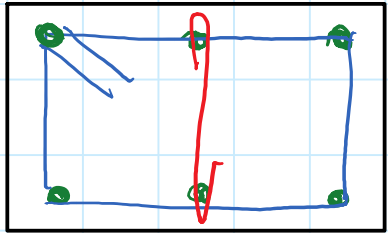
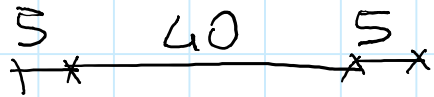
SEZ. 30x40



$$6 \phi 14 = 6 \times 2.54 = 9.24 \text{ cm}^2$$

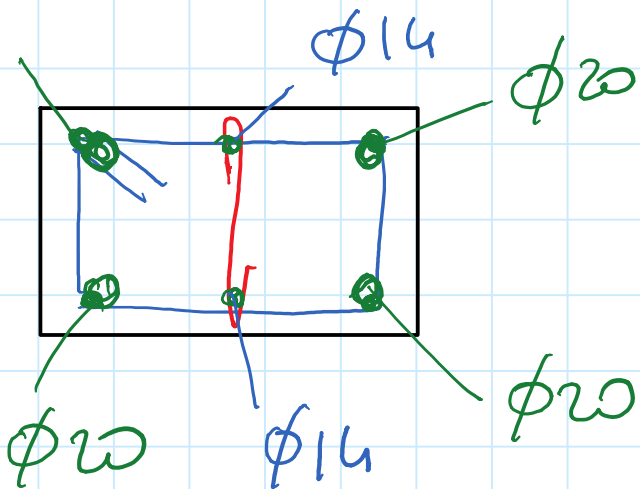


## SEZIONE 30x50



$$6 \phi 14 = 9,24 \text{ cm}^2 < A_{s, \text{ nec}}$$

## OPZIONE 1

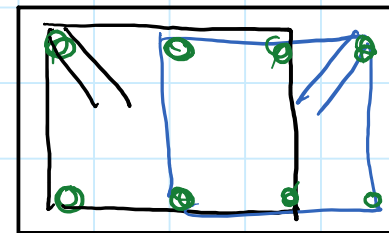


$$4 \phi 20 + 2 \phi 14$$

$$A_s = 15,64 \text{ cm}^2$$

$$\rho = \frac{15,64}{1500} = 1,04 \%$$

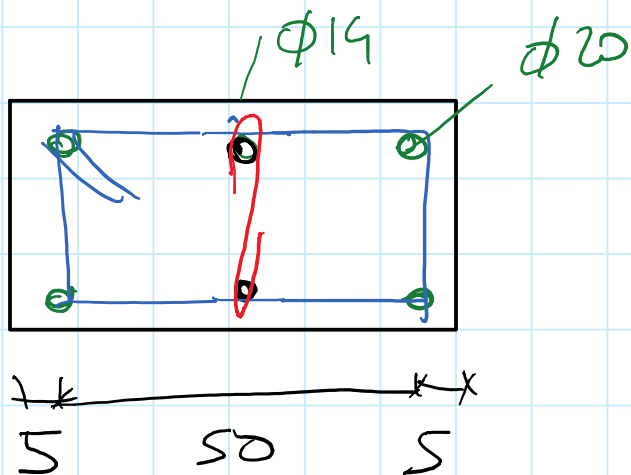
## OPZIONE 2



$$A_s = 12,32 \text{ cm}^2$$

DOPPIA STAFFA

SEZIONE 30 x 60



OPZIONE 1

$$A_s = 15,64 \text{ cm}^2 \quad (4\phi 20 + 2\phi 14)$$

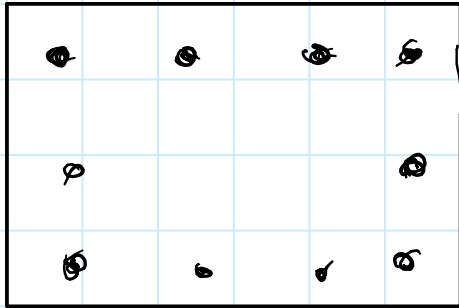
$$\rho = \frac{15,64}{1800} = 0,87\%$$

OPZIONE 2

$$A_s = 8\phi 14 = 12,32 \text{ cm}^2$$

$$\rho = \frac{12,32}{1800} = 0,68\%$$

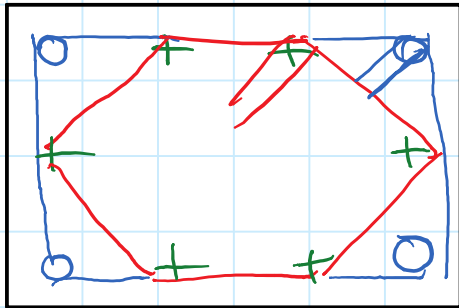
SEZ. 40 x 60



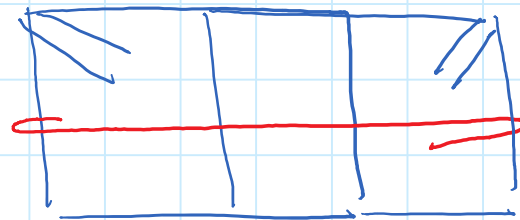
$$10\phi 14 \rightarrow A_s = 15,4 \text{ cm}^2$$

$$\rho = \frac{15,4}{2400} = 0,64 \%$$

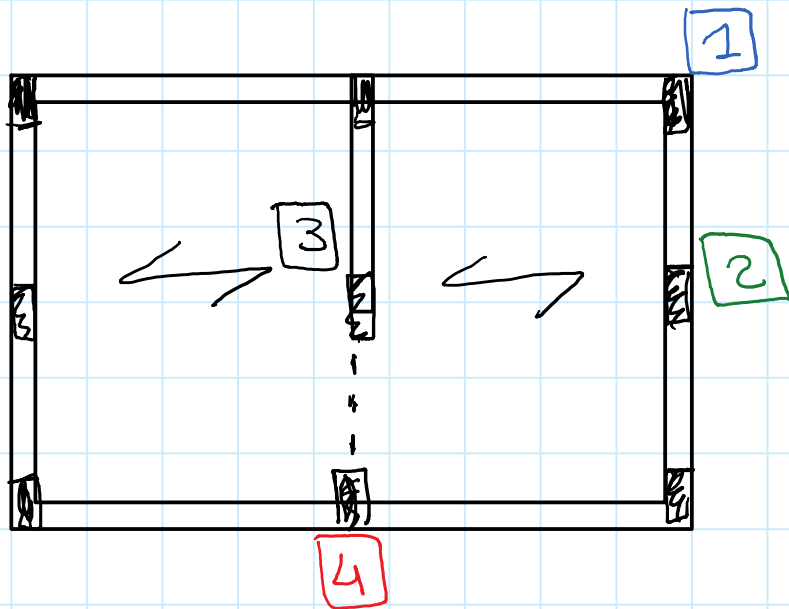
6φ14 + 4φ20



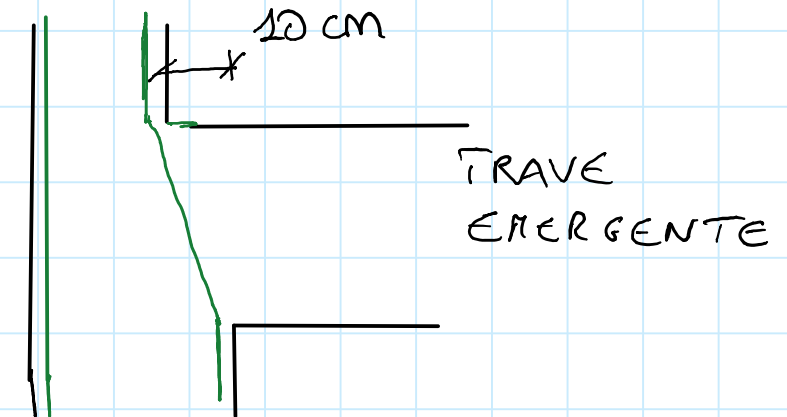
OPPURE DOPPIA STAFFA  
+ TIRANTINO



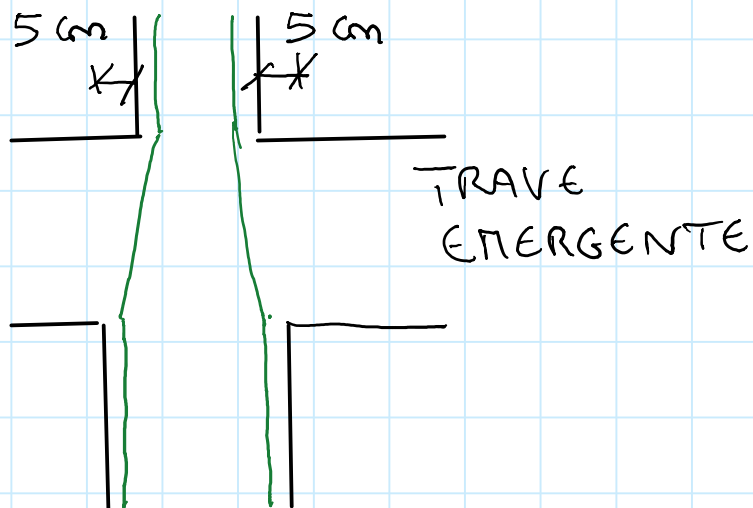
# RISEGA



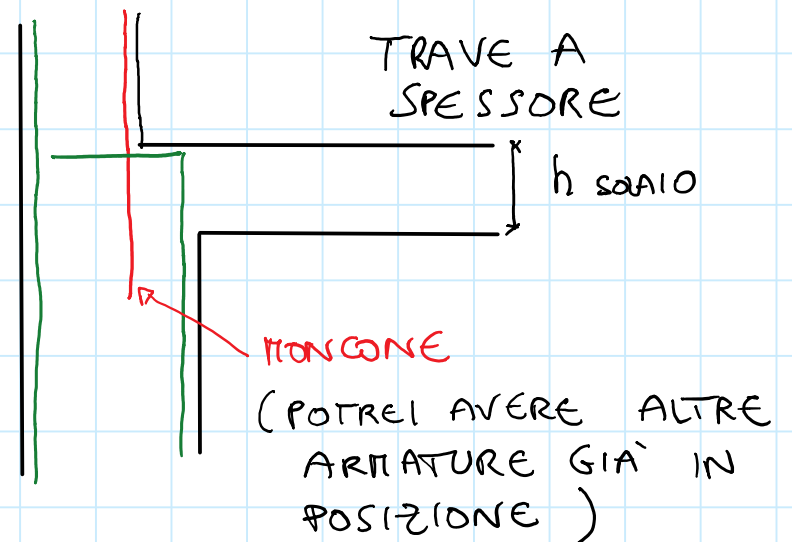
TIPO 1



TIPO 2



TIPO 4



# STAFFE NEL NODO

