Titolo nota 21/05/2014

TORSIONE T

$$T_{Rd,max} = 2 A_k t \nu f_{cd} \frac{\cot\vartheta}{1+\cot^2\vartheta}$$

$$T_{Rd,st} = \frac{A_{sT}}{s} 2A_k f_{yd} \cot\vartheta$$

$$T_{Rd,lon} = \frac{A_{lon}}{u_k} 2A_k f_{yd} \frac{1}{\cot\vartheta}$$

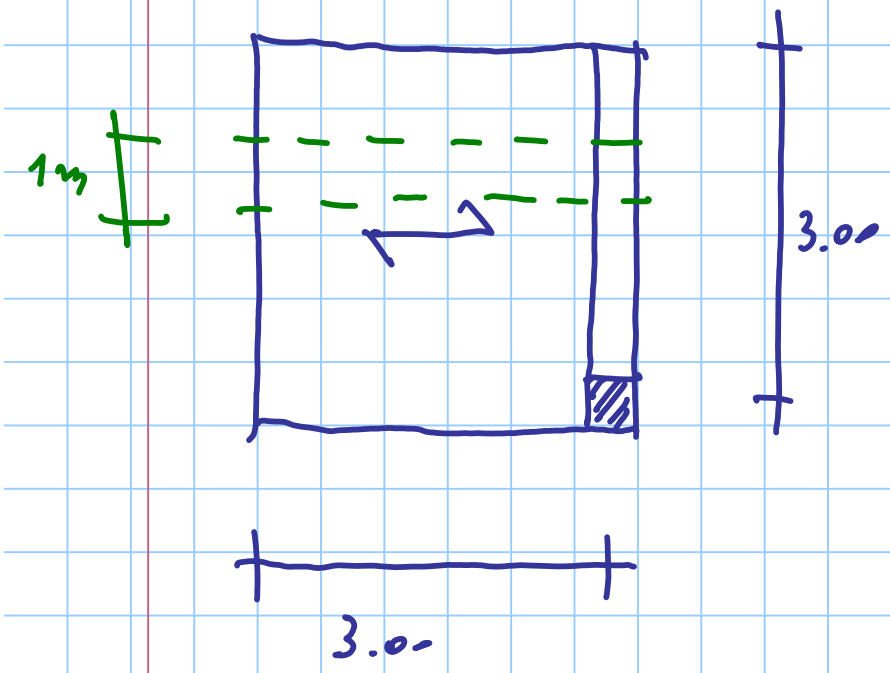
TAGLIO V

$$V_{Rd,max} = b z \nu f_{cd} \frac{\cot\vartheta}{1+\cot^2\vartheta}$$

$$V_{Rd,st} = \frac{A_{sw}}{s} z f_{yd} \cot\vartheta$$

$$V_{Rd,pm} = A_{pm} f_y \frac{1}{\cot\vartheta}$$

oppure Traslaz. diagr. mom.



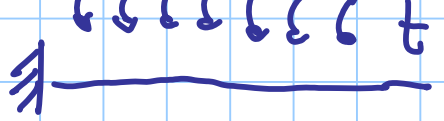
$g_k = 3.2\ KN/m^2$ — di calc.: $4.2\ KN/m^2$

$q_k = 1.0\ KN/m^2$ — $1.5\ KN/m^2$

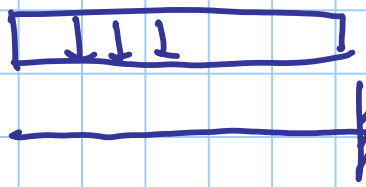
t_{trave} ? — $5\ KN/m$

(NOTA: la trave risulta un po' più pesante)

$22.1\ KN/m$



TRAVE

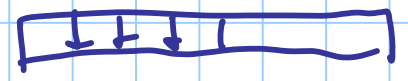


$g_1 + q_1 = 5.7\ KN/m$

SOLAIO

$\uparrow F = 17.1\ KN$

$\circlearrowleft M = 25.7\ KNm$

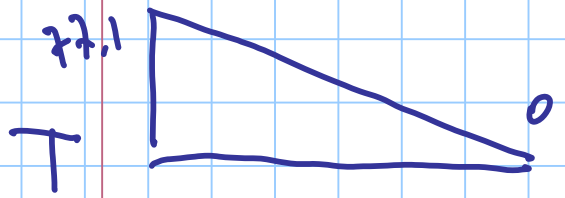


22.1 kN/m

GGGGGGG

25.7 kNm/m

$25.7 \times 3 = 77.1\ kN_m$



dimensionamento di sezione pn $T_{Ed} = 77.1$ kNm

$$T_{Rd,max} = \frac{2 A_k t \nu f_{cd}}{10^3} \frac{\cot\vartheta}{1+\cot^2\vartheta}$$

cls C25/30

$\cot\vartheta = 2$

ipotizzo $t = 10$ cm

$$A_k = \frac{T_{Ed}}{2 t \nu f_{cd} \frac{\cot\vartheta}{1+\cot^2\vartheta}} = \frac{77.1 \times 10^3}{2 \times 10 \times 0.5 \times 14.2 \times 0.6} = 1357 \text{ cm}^2$$

quale forma? ▯ □ ▭

$37 \times 37 + t$ scelgo

$35 \times 40 + t$ 40×60

$30 \times 45 + t$

$40 \times 60 \rightarrow t = \frac{40 \times 60}{2(40+60)} = 12 \text{ cm}$

$b_k = 40 - 12 = 28 \text{ cm}$

$a_k = 60 - 12 = 48 \text{ cm}$

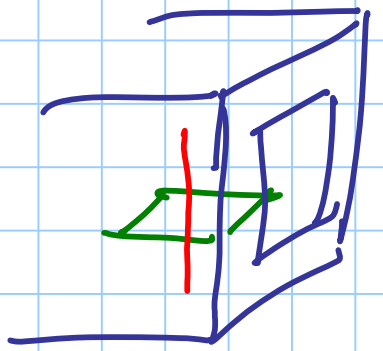
$A_k = 1344 \text{ cm}^2$

$u_k = 152 \text{ cm}$

$T_{Rd} = \frac{2 \times 1344 \times 12 \times 0.5 \times 14.2 \times 0.4}{10^3} = 91.6 \text{ kNm}$

dovremmo tener conto anche di M e V

progetto armature



un solo braccio

$$T_{Rd,st} = \frac{A_{st}}{s} 2A_k f_{yd} \cot\vartheta$$

$$\frac{A_{st}}{s} = \frac{T_{Ed} \times 10^5}{2A_k f_{yd} \cot\vartheta} = 3,67 \text{ cm}^2/\text{m} \Rightarrow \phi 8/12,5$$

$[m]$ → $1/3,44$; $\cot\vartheta = 2$

oppure $\phi 8/10$

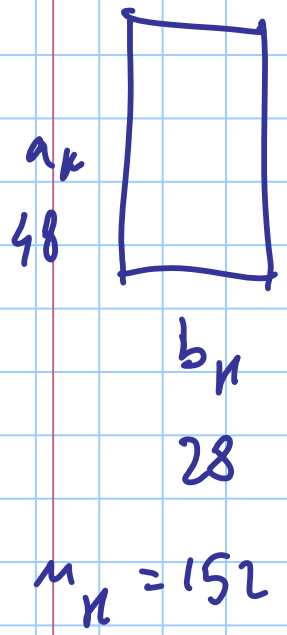
servono $7,34 \simeq 8$ staffe a metro

$$T_{Rd,lon} = \frac{A_{lon}}{u_k} 2A_k f_{yd} \frac{1}{\cot\vartheta}$$

$$A_{lon} = \frac{T_{Ed}\, u_k \cot\vartheta \times 10^3}{2A_k f_{yd}} = 22,3 \text{ cm}^2 \simeq 15\,\phi 14$$

(u_k in $[cm]$)

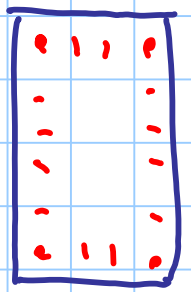
l'armatura longitudinale deve essere disposta in maniera uniforme lungo i lati



$u_x = 152$

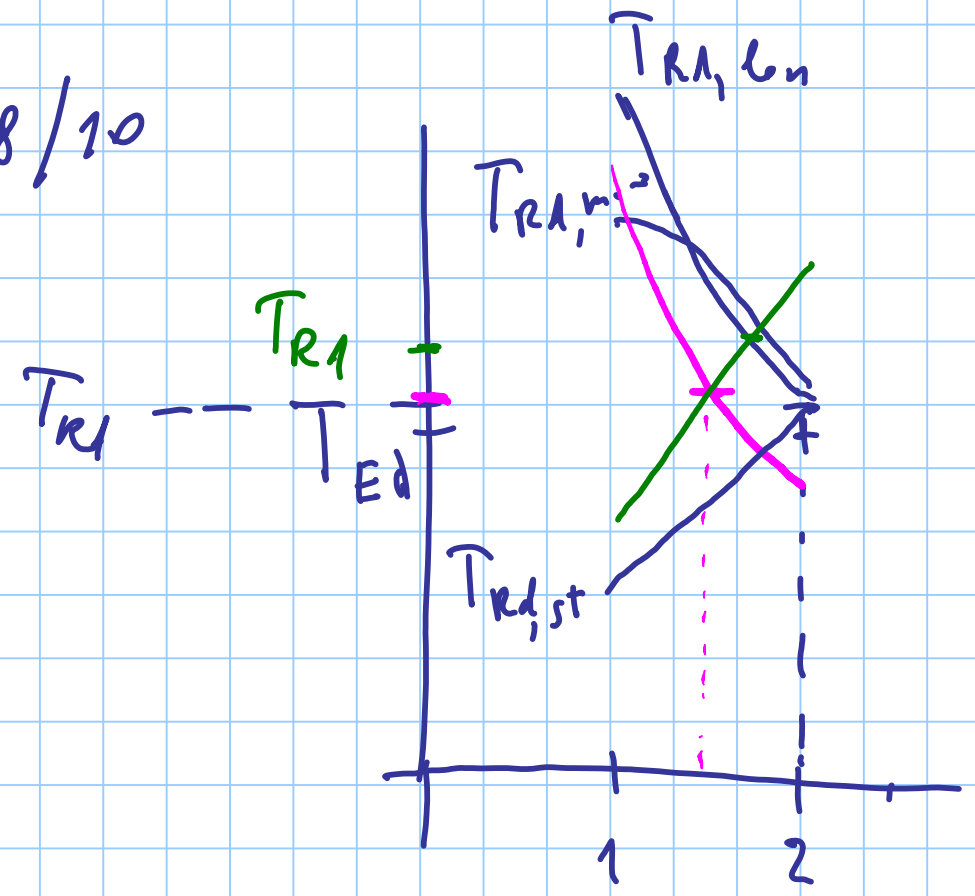
lato orizz. $\frac{28}{152}\ 22.3 = 4.1\ cm^2$

lato vert. $\frac{48}{152}\ 223 = 7.05\ cm^2$



barrette $\phi 8/12.5$

Se metto $\phi 8/10$



potrei ridurre $A_{s,min}$

aumento staffe

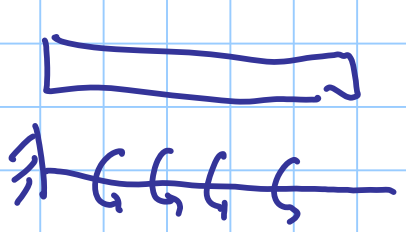
Se voglio, per es. ridurre $A_{l,m}$

$$T_{Rd,max} = \underbrace{\frac{A_{sw}}{s}}_{\text{metà}} 2 A_k f_{yd} \underbrace{\cot\vartheta}_{\text{calcolo } \cot\vartheta}$$

$$\cot\vartheta = \frac{T_{Ed} \times 10^5}{\left(\frac{A_{sw}}{s}\right)_{cm^2/m} 2 A_k f_{yd}} = 1.466 < 2 \quad \text{come previsto}$$

$$A_{l,m} = \frac{T_{Ed}\, u_k\,[cm]\, \cot\vartheta \times 10^3}{2 A_k f_{yd}} \quad (1.466) = 16.3\ cm^2 \simeq 11\ \phi 14$$

TORNIAMO AL PROGETTO

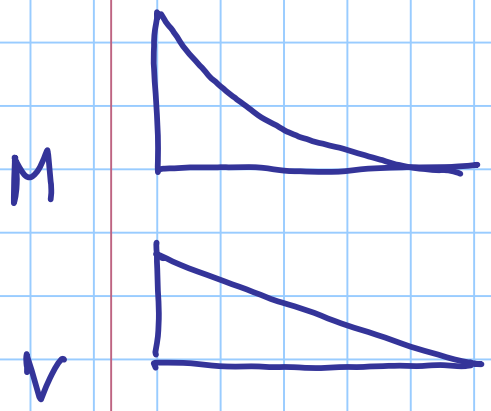


$q = 22.1$ KN/m

per tener conto del suo peso della Trave (40×60)

$q = 25$ KN/m

oltre alla Torsione c'è flessione e Taglio.



$$M_{max} = \frac{ql^2}{2} = 112.5 \text{ KNm}$$

$$V_{max} = ql = 75 \text{ kN}$$

(a 50 cm $V = 62.5$ KN)

verifica della sez.ne

M $\quad M_{Ed} \leq M_{Rd} = \dfrac{b\,d^2}{2^{12}}$

V, T $\quad \dfrac{V_{Ed}}{V_{Rd,max}} + \dfrac{T_{Ed}}{T_{Rd,max}} \leq 1$

$$V_{Rd,max} = b \; z \; \nu \; f_{cd} \; \frac{\cot\theta}{1+\cot^2\theta} \times 10^{-1} = 572\ kN$$

b = 400 | z = 0.9 · 562 = 505.8 | ν = 0.5 | f_{cd} = 14.2 | $\cot\theta$ = 0.4

$\cot\theta = 2$

oppure valore calcolato per armature

verifica $\quad \frac{62.5}{572} + \frac{77.1}{91.6} = 0.109 + 0.842 = 0.951$

OK

ARMATURE NECESSARIE

T staffe 3,67 cm²/m long. 22.3 cm² cotϑ = 2

l.or 4.1 – 7.05 l.vert

V staffe 0.79 cm²/m parete 3.2 cm² cotϑ = 2

l.or — 1.6 l.vert

M ϕ8/10 5.0 cm²/m 5.7 cm² $A_s = \frac{M}{0.5 d f_{yd}}$

⇑

Tot. staffe 4.46 cm²/m sup.

armature pr taglio

$$V_{Rd,st} = \frac{A_{,T}}{s} z f_{yd} \cot\vartheta$$

$$A_{,T} = \frac{V_{Ed}\, s \times 10}{z f_{yd} \cot\Theta} = \frac{62.5 \times 100 \times 10}{50.4 \times 391.3 \times 2} = 1.58 \text{ cm}^2/\text{m}$$

$$\frac{1.58}{4.4} = 0.79 \text{ cm}^2/\text{m}$$

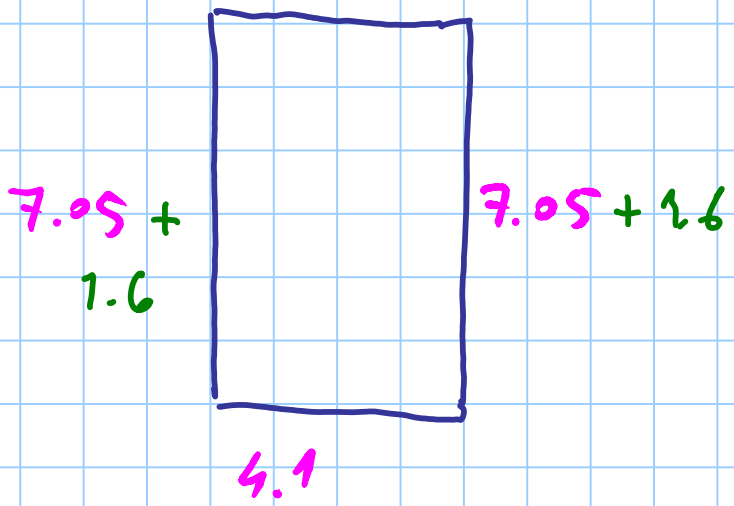
$$A_{pw} = \frac{V \cot\vartheta}{f_{yd}} = \frac{62.5 \times 2 \times 10}{391.3} = 3.2 \text{ cm}^2$$

ARMATURA LONGITUDINALE

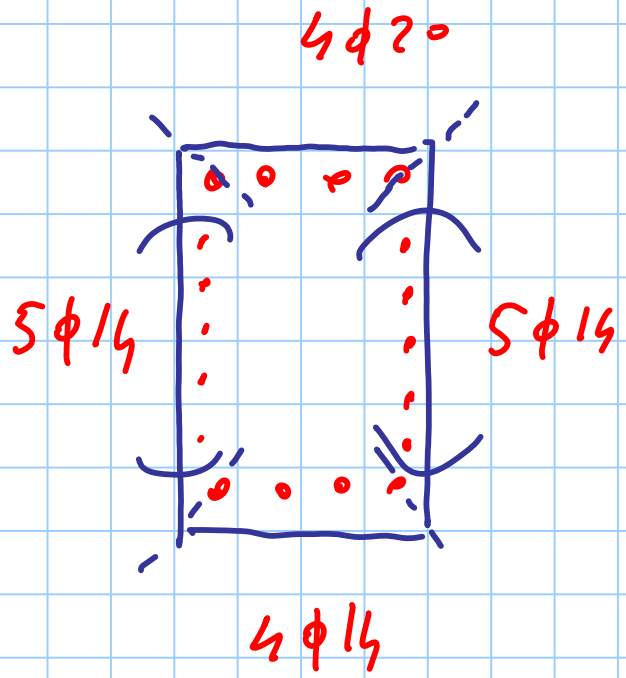
T

V

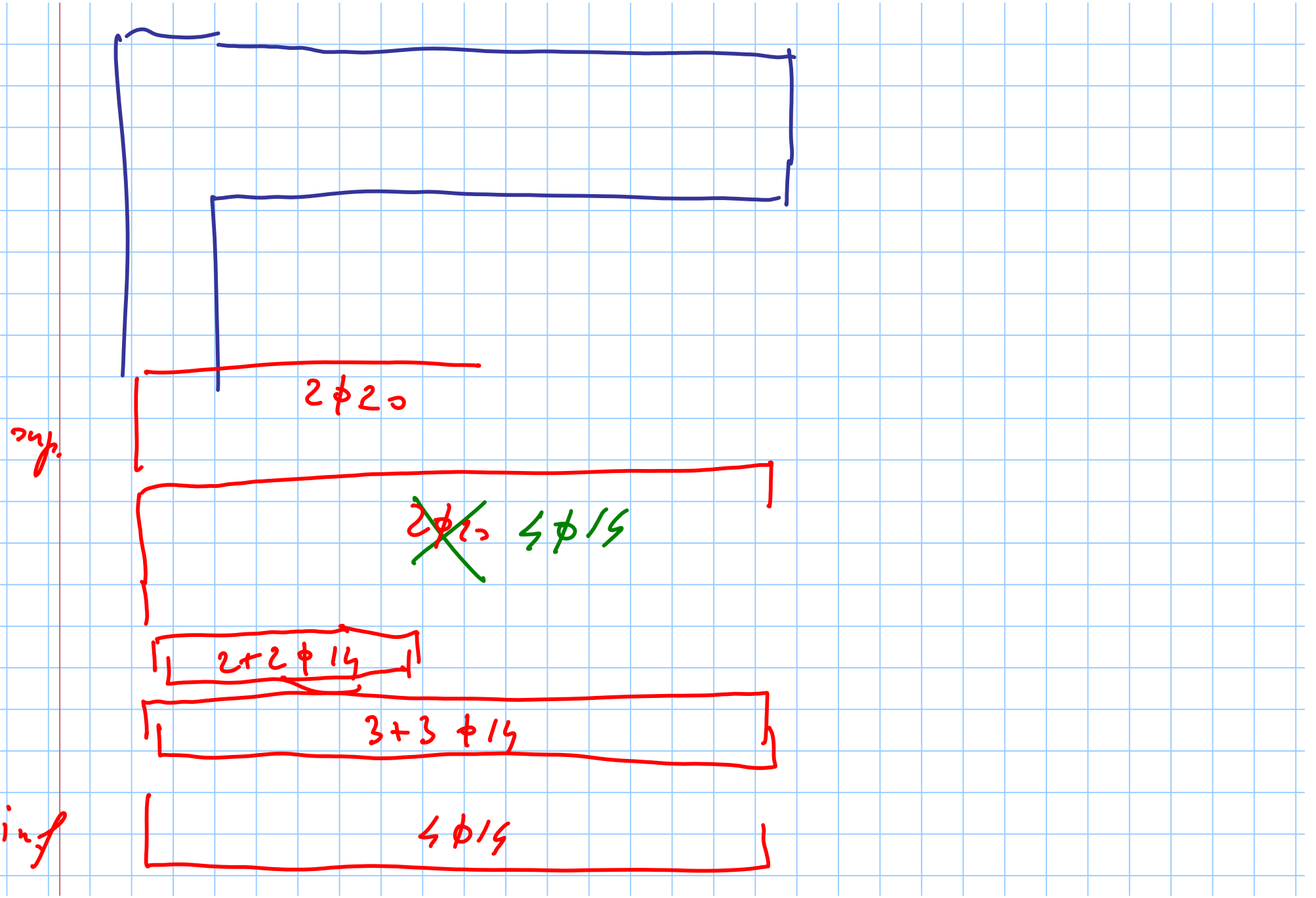
M



TOT. 31.2 cm²



TOT. 34.1 cm²


2ϕ20
sup.
2ϕ20
4ϕ14
2+2ϕ14
3+3ϕ14
inf
4ϕ14

STATO LIMITE DI ESERCIZIO

- DEFORMAZIONI
- FESSURAZIONE
- TENSIONI