Titolo nota 19/12/2017

COLLEGAMENTO (m. controvento - Trave)

sollecitazione $N_{Ed} = 400$ KN

resistenza dell'asta UPE140 $A = 18.4 \times 10^2$ mm^2 S275

$$N_{Rd} = 18.4 \times 10^2 \times \frac{275}{1.05} \times 10^{-3} = 481.9 \text{ KN}$$

Per avere snervamento asta prima della rottura del collegamento:

PROGETTARE COLLEGAMENTO per 481.9 KN

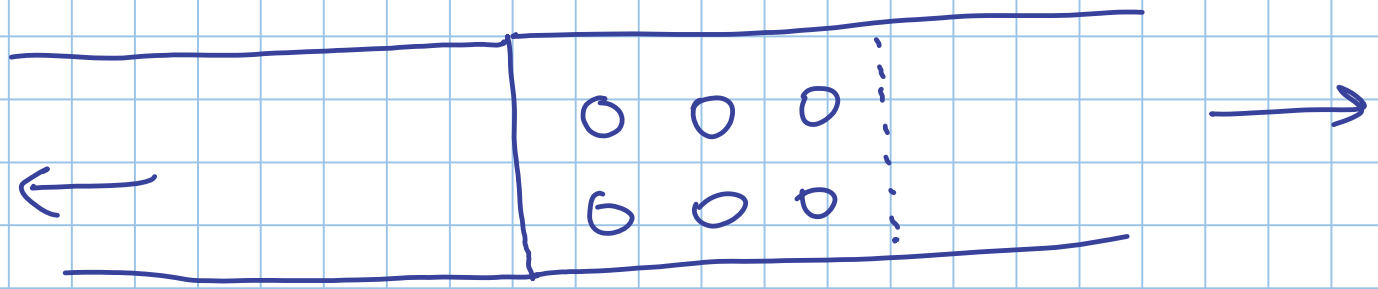
COLLEGAMENTO

a completo ripristino di resistenza

se più resistente dei pezzi che unisce

ovvero

progettato in base alla resistenza dei pezzi



I bulloni lavorano a taglio

dopo aver superato la resistenza per attrito

Alternativa

Verificare che non si abbia scorrimento

Progettare il collegamento in modo che la resistenza per ATTRITO

sia maggiore dell'azione sollecitante

Bulloni ben serrati

Forza di precarico $F_p = 0.7 \, A_{res} \, \frac{f_{ub}}{\gamma_{M7}}$ ($\gamma_{M7} = 1$ se serraggio controllato)

Resistenza per attrito

$$F_{s,Rd} = \frac{\mu \, F_p}{\gamma_{M3}}$$

$\mu = 0.2$

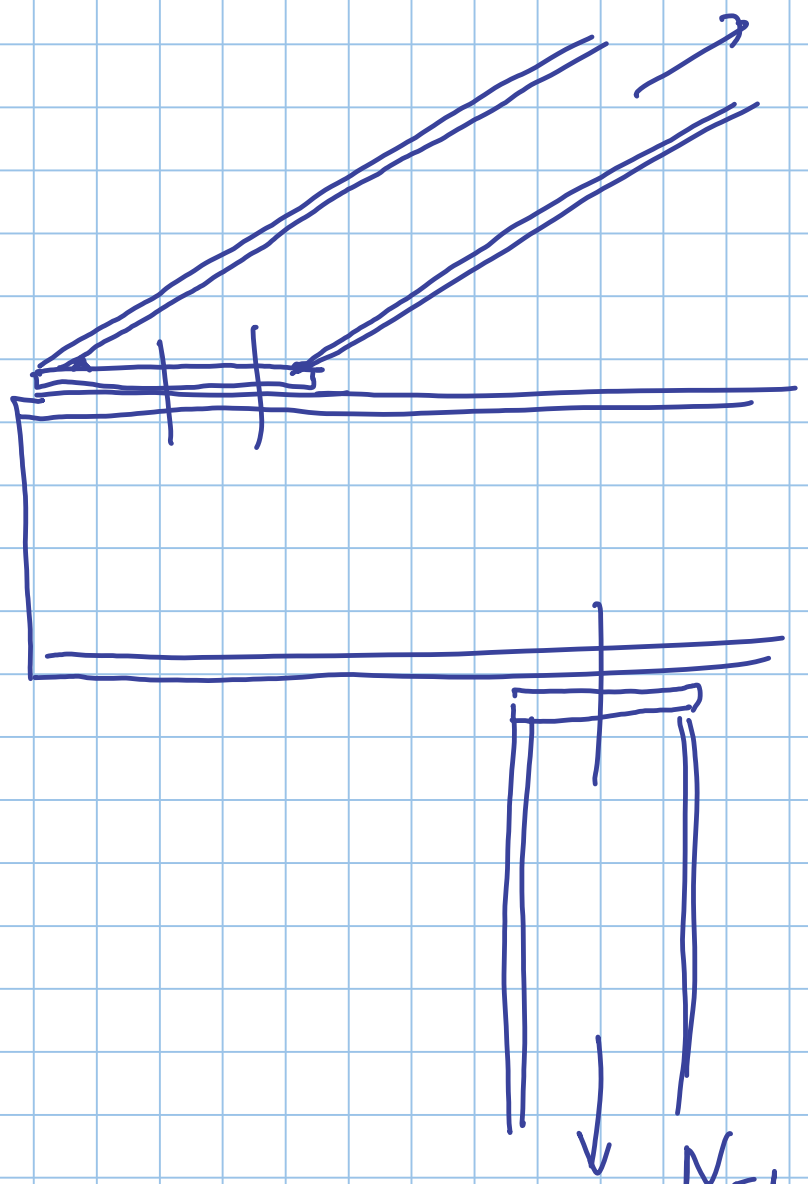
0.3

0.4

0.5

da progettare per SLU

oppure per SLE



bulloni che lavorano
a taglio e a trazione

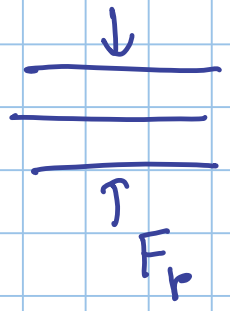
bulloni che lavorano
a trazione

$N_{Ed} = 400\ kN$

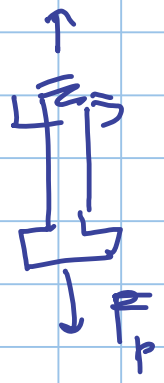
Resistenza di un bullone teso

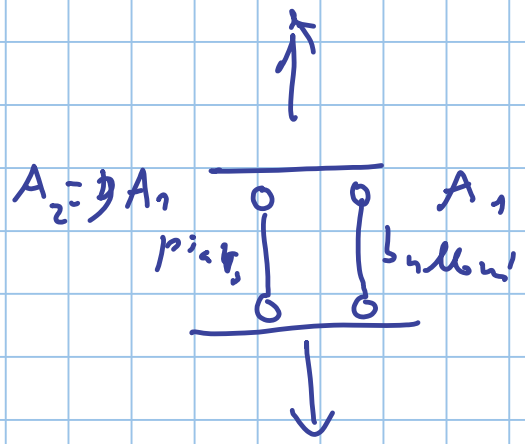
$$F_{t,Rd} = 0.9 \, A_{res} \frac{f_{ub}}{\gamma_{M2}}$$

piatti compressi

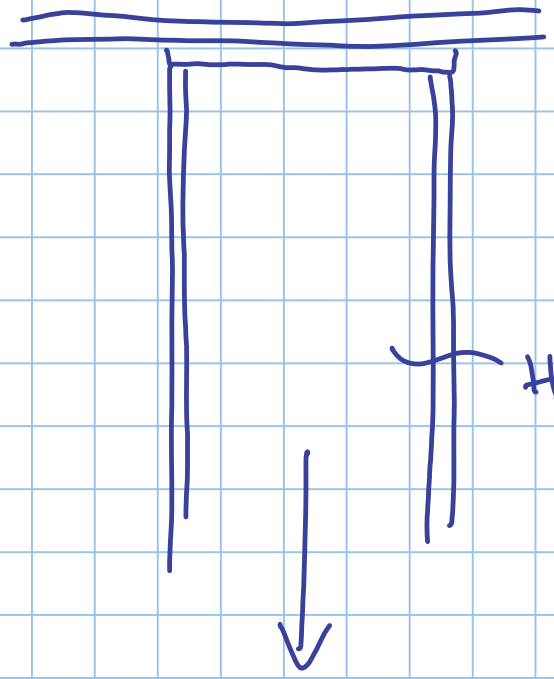


bullone

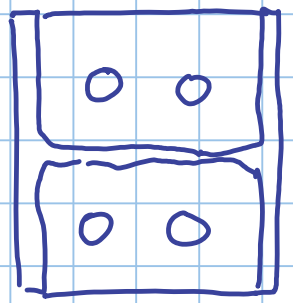




la resistenza a Trazione del bullone non dipende dalla forza di serraggio



$N_{Ed} = 600\ kN$



4 bulloni

$$N_{Rd} = 4 \times 0.9\, A_{ms}\, \frac{f_{ub}}{\gamma_{M2}}$$

bulloni 4.6

$f_{ub} = 400\ MPa$

$$N_{Rd} = 4 \times 0.9 \, A_{res} \frac{f_{ub}}{\gamma_{M2}} \geq N_{Ed} = 600 \text{ kN}$$

($f_{ub} \leftarrow 400$ MPa)

$$A_{res} \geq \frac{600 \times 10^3 \times 1.25}{4 \times 0.9 \times 400} = 520 \text{ mm}^2$$

$$4 \times 0.9 \times A_{res} \frac{f_{ub}}{\gamma_{M2}} \geq 600$$

($f_{ub} \rightarrow$ da definire)

A_{res} ↓

M20

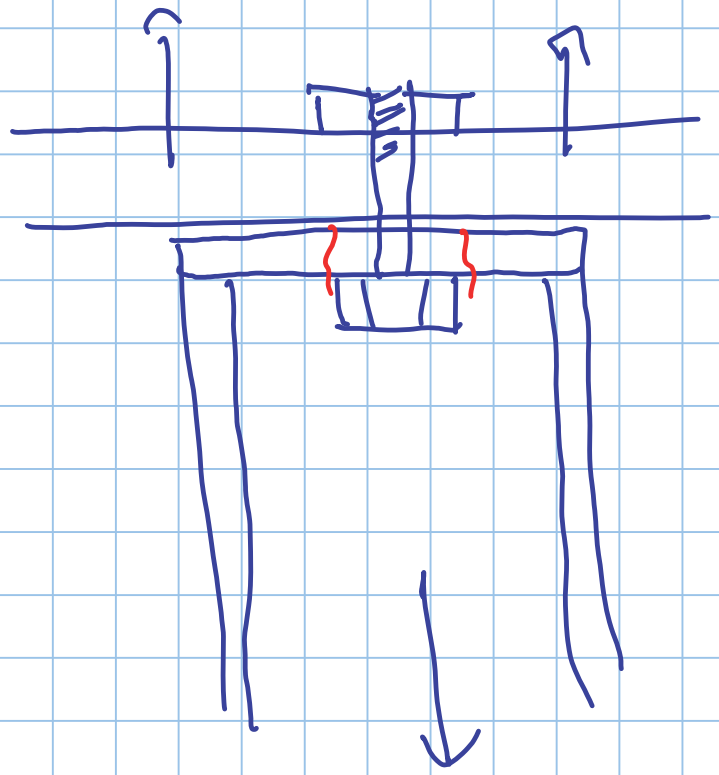
245 mm²

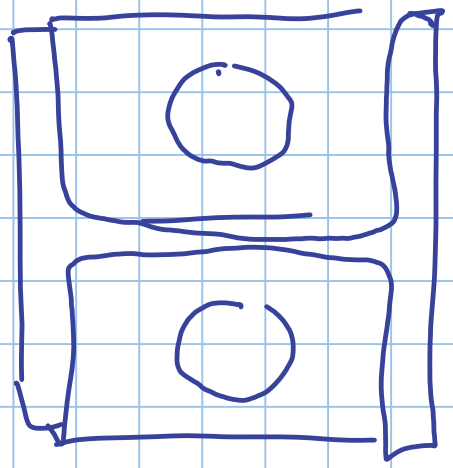
$$f_{ub} \geq \frac{600 \times 10^3 \times 1.25}{4 \times 0.9 \times 245} = 850 \text{ MPa}$$

M10.9

In presenza di bulloni tesi

possibile rottura del piatto per PUNZONAMENTO



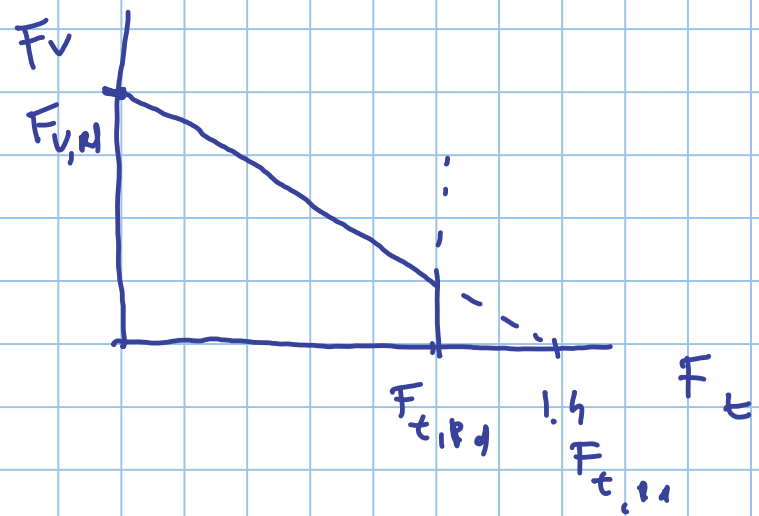


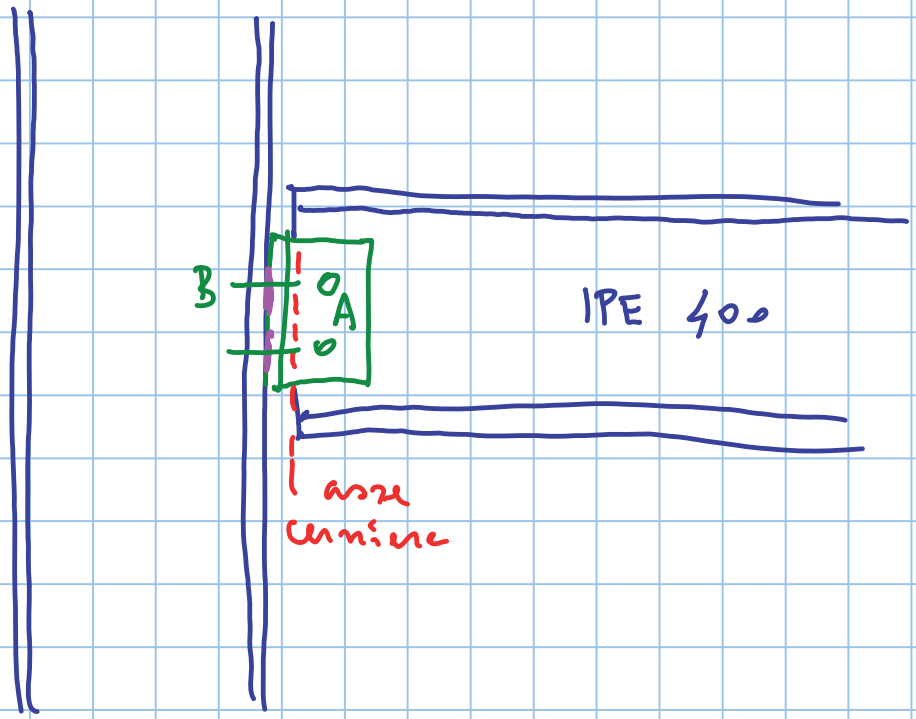
$$B_{p,Rd} = \pi d_m t \cdot 0.6 \frac{f_u}{\gamma_{M2}}$$

In presenza di taglio ($F_{v,Ed}$) e trazione ($F_{t,Rd}$) contemporaneamente:

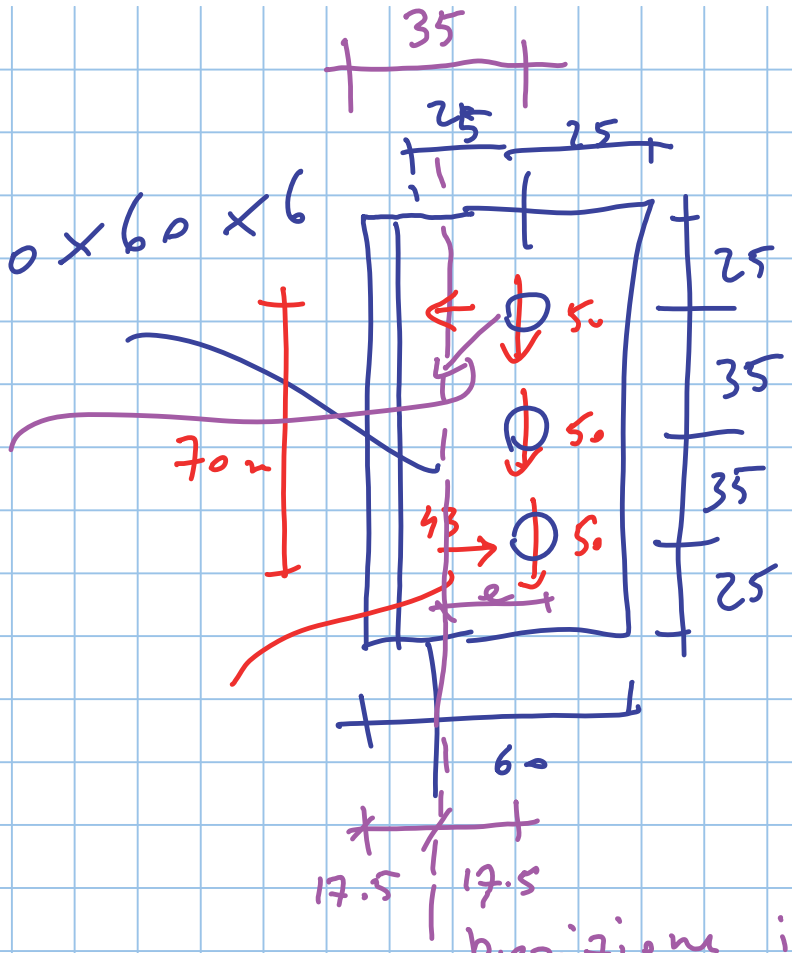
$$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4\ F_{t,Rd}} \leq 1$$

$$F_{t,Ed} \leq F_{t,Rd}$$




B
A
IPE 400
asse
cerniera

L 60×60×6



posizione ideale della cerniera

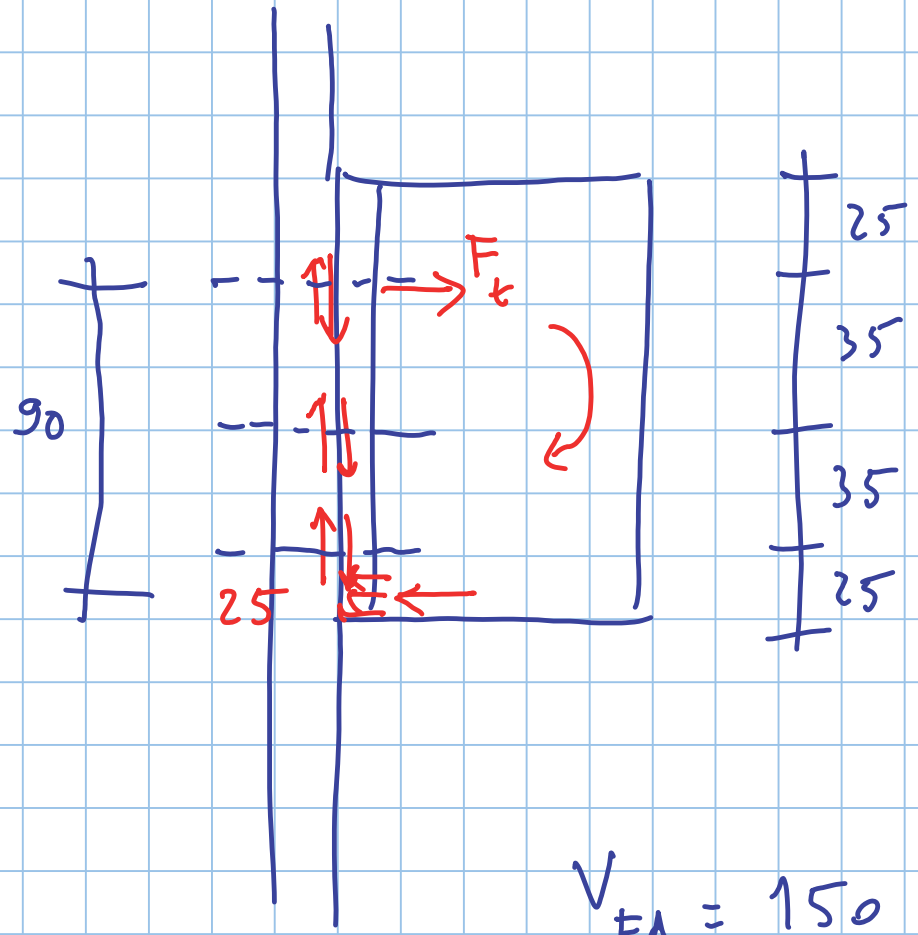
$V_{Ed} = 150$ kN

$M_{Ed} = 150 \times 0.0175 =$

$= 2.625$ kNm

bulloni M14

classe 5.6



$$F_t = \frac{2.62}{0.090} \cdot \frac{1}{2} = 14.6 \text{ KN}$$

$F_{V,Rd} = 37.0$ KN per unione

$$F_{t,Rd} = 0.9 \times 115 \times \frac{500}{1.25} =$$

$$= 41.4 \text{ KN}$$

$V_{Ed} = 150$ KN

3 × 2 bulloni $M_{Ed} = 2.62$ KNm

$$\frac{25}{37.0} + \frac{14.6}{1.4 \times 41.4} = 0.928 < 1$$

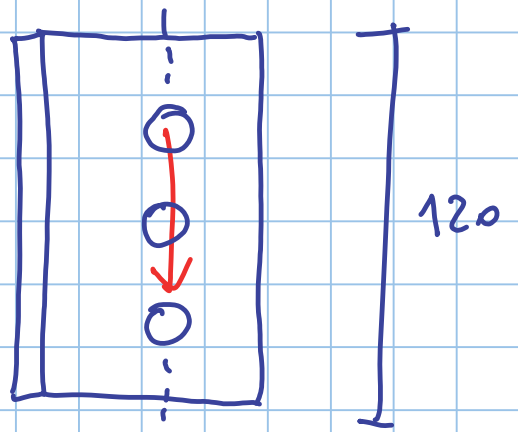
OK

2 L 60 × 60 × 6

Verifica dell'angolare a taglio

$A = 120 \times 6 = 720\ mm^2$

S 275



sezione intera

$$V_{R1} = A \frac{f_y/\sqrt{3}}{\gamma_{M0}} = \frac{720 \times 275/\sqrt{3}}{1.05} \times 10^{-3} =$$

$$= 108.9\ kN$$

$\times 2$ angolari $\quad V_{Rd} = 2 \times 108.9 = 217.8\ kN$

$> V_{Ed}$

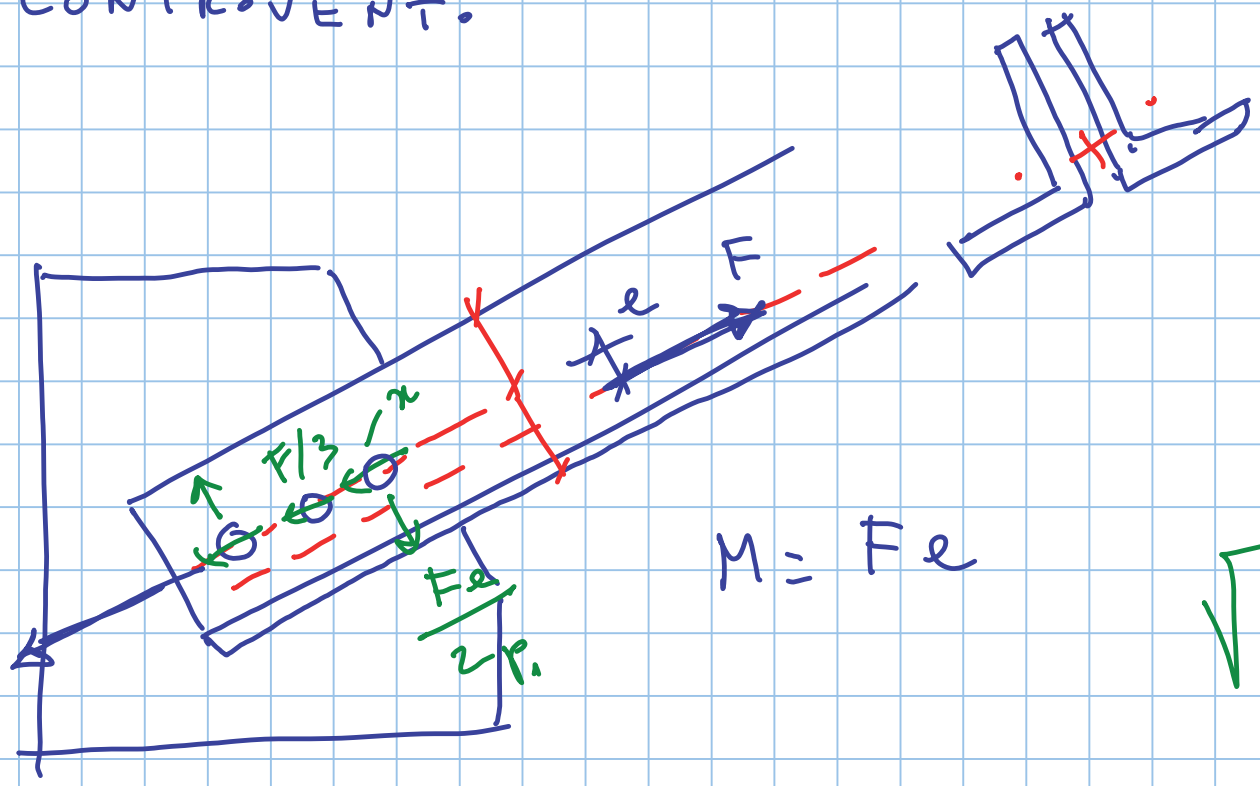
sezione forata

$A = 75 \times 6 = 450\ mm^2$

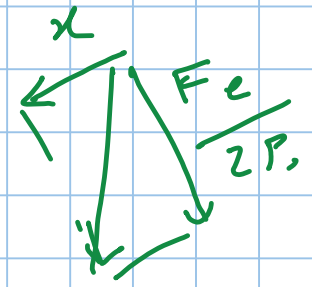
$$V_{u,Rd} = 0.9\, A_{net} \frac{f_u/\sqrt{3}}{\gamma_{M2}} = 0.9 \times 450 \times \frac{430/\sqrt{3}}{1.25} \times 10^{-3} = 80.4\ kN$$ (OK

$\times 2 = 160.8\ kN$

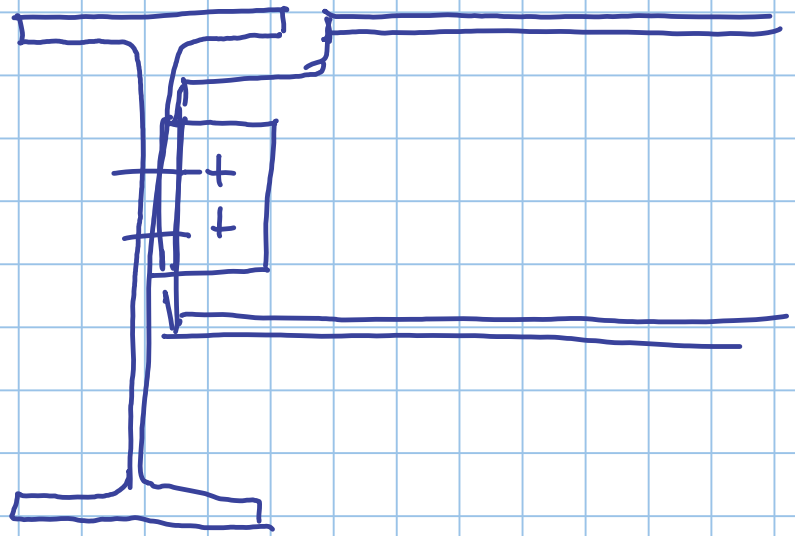
CONTRE-VENT.

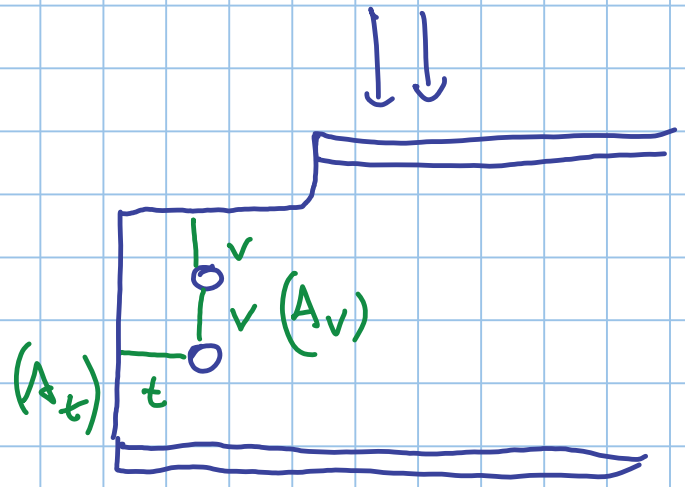


$M = Fe$



$$\sqrt{x^2 + \left(\frac{Fe}{2p_1}\right)^2} = F - 2x$$





BLOCK TEARING

$$F_{Rd} = \frac{A_t f_u}{\gamma_{m2}} + A_V \frac{f_y/\sqrt{3}}{\gamma_{m0}}$$