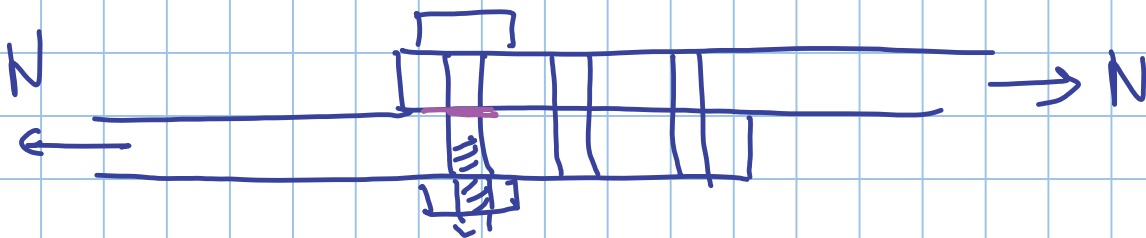
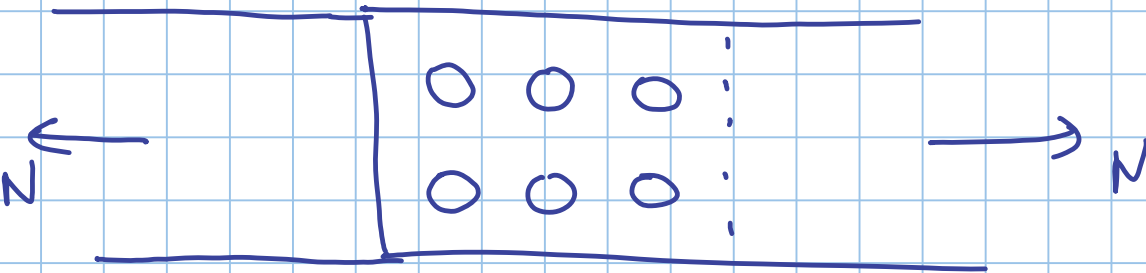


# COLLEGAMENTI

# BULLONATI

Titolo nota

13/12/2017



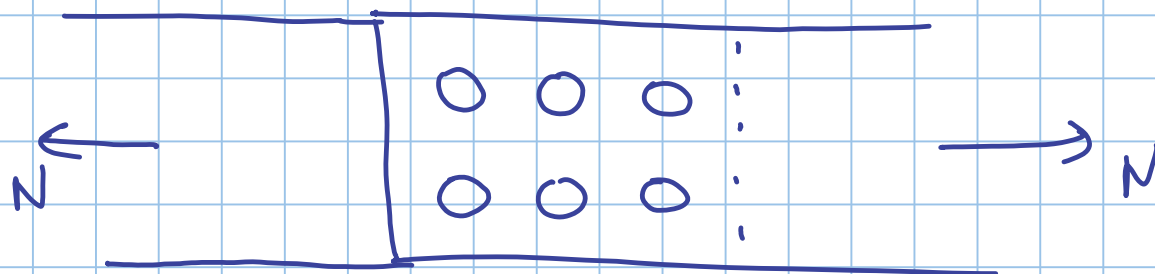
0.5 per - filatura nella sezione  
+  
danno 6.8 + 10.9

$$F_{V,EA} = \frac{N}{6} \text{ nel singolo bullone}$$

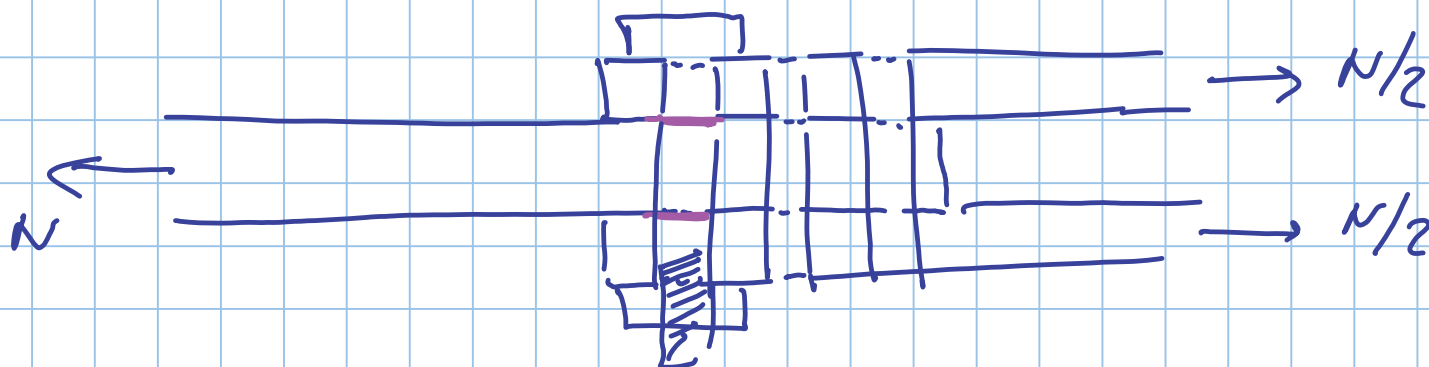
0.5

$$F_{V,RA} = A \frac{0.6 f_{ub}}{\gamma_{M2}}$$

A nominale o nella filatura.  
A<sub>us</sub> o la filatura e il

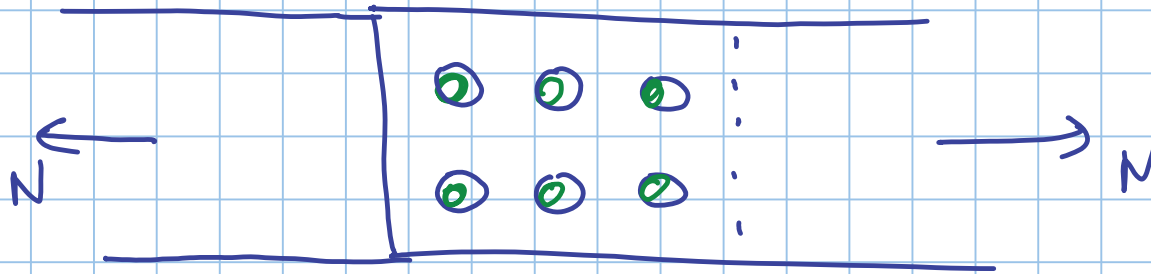


$$F_{V,EA} = \frac{N}{12}$$



$$F_{V,EA} = \frac{N}{n_L n_S} = \frac{N}{6 \times 2}$$

# RIFOLLAMENTO

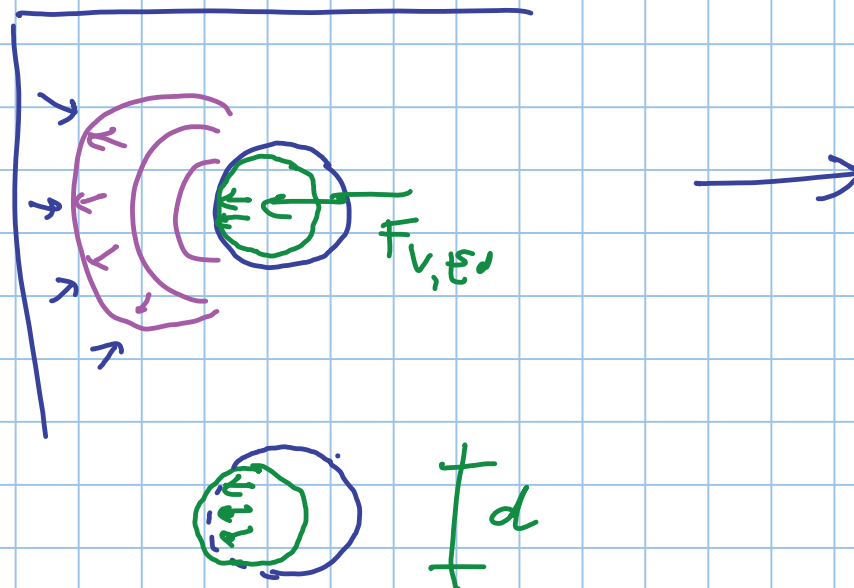


$$\sigma = \frac{F_v}{d \cdot t}$$



come calcolare  
le tensioni nel piello?

$$F_{b, Rd} = A \cdot \sigma_{max}$$



quanto posso  
valere al massimo?



fino a:  $2.5 f_u$

$$F_{b,RA} = d t \alpha K \frac{f_u}{\gamma_{m2}}$$

$\nearrow \quad \nearrow$   
 $\leq 1 \quad \leq 2.5$

$$\alpha = \text{MIN} \left( \frac{e_1}{3 d_0} ; \frac{P_1}{3 d_0} - 0.25 ; 1 ; \frac{f_{ub}}{f_u} \right)$$

$$K = \text{MIN} \left( \frac{2.8 e_2}{d_0} - 1.7 ; \frac{1.4 P_2}{d_0} - 1.7 ; 2.5 \right)$$

$$e_2 \geq 1.5 d_0$$

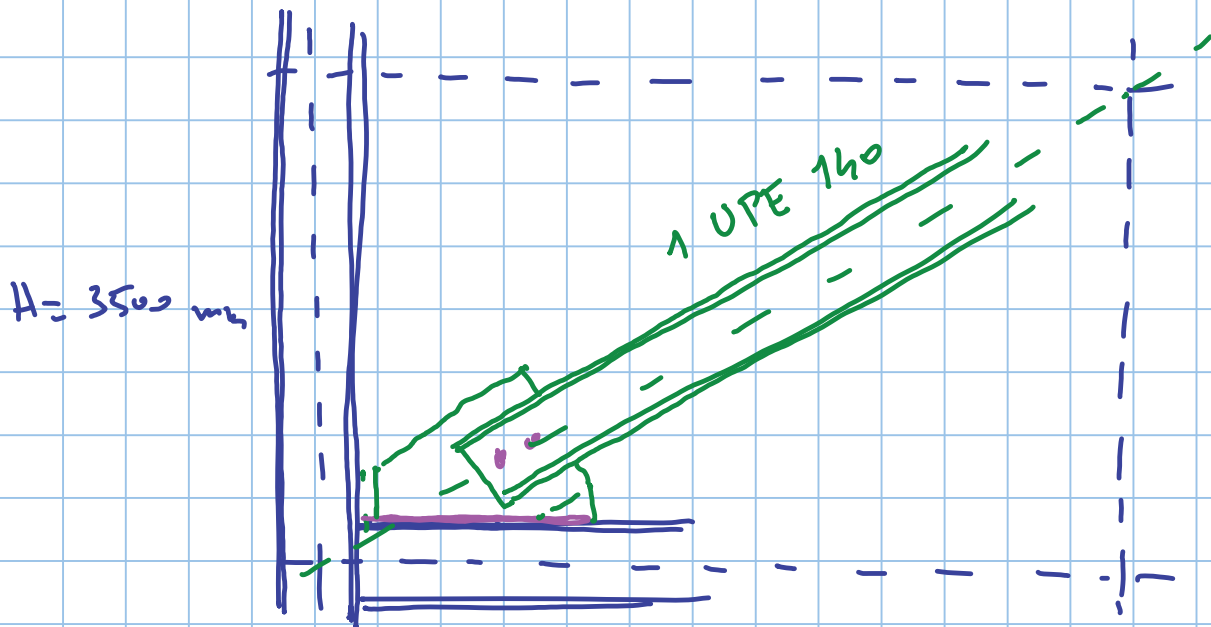
$$P_2 \geq 3 d_0$$

$$K = 2.5$$

COLLEGAMENTO

CONTROVENTO — TELAIO

S275



controvento

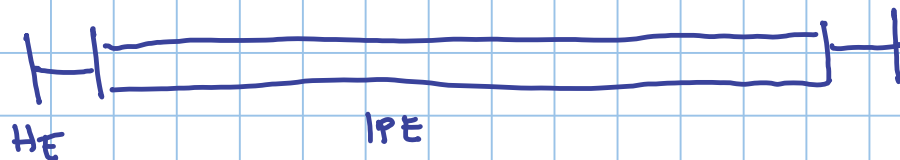
$$N_{Ed} = 400 \text{ kN}$$

$$A \geq \frac{400 \times 10^3 \times 1.05}{275} = 15.27 \times 10^2 \text{ mm}^2$$

UPE 140  $t = 5 \text{ mm}$

$h = 140 \text{ mm}$   $b = 65 \text{ mm}$

$$A = 18.4 \times 10^2 \text{ mm}^2$$



$$F_{V,Ed} = \frac{N_{Ed}}{\eta_b \times \eta_s}$$

$$F_{V,Rd} = 0.6 A \frac{f_{ub}}{\gamma_{m2}}$$

$$\frac{N_{Ed}}{\eta_b} \leq 0.6 A \frac{f_{ub}}{\gamma_{m2}}$$

$E_{2.}$

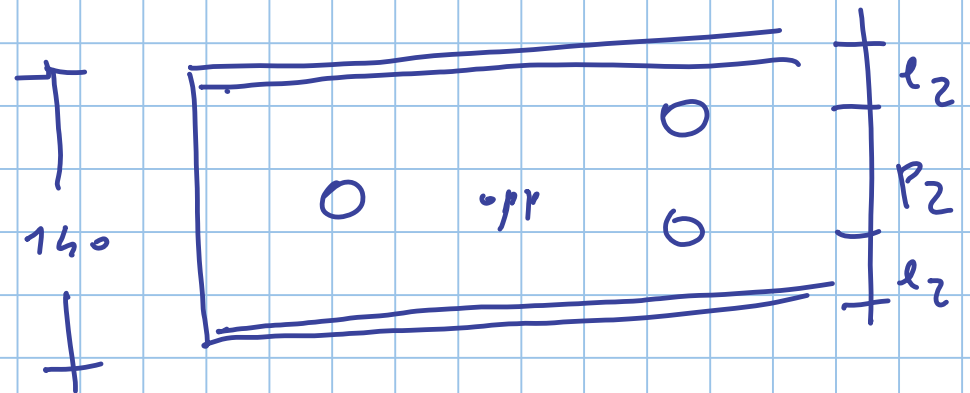
M14 diam 5.6 fillet. w.r.

$$A = 154 \text{ mm}^2$$

$$f_{ub} = 500 \text{ MPa}$$

$$F_{V,Rd} = \frac{0.6 \times 154 \times 500}{1.25} \times 10^{-3}$$

$$= 37.0 \text{ kN}$$



$$3 d_o \leq 140$$

$$6 d_o \leq 140$$

$$d_o \leq \frac{140}{6} = 23$$

6 bulloni

classe

5.6

d = ?

$$\frac{N_{Ed}}{n_b} \leq 0.6 A \frac{f_{ub}}{\gamma_{M2}}$$

$$A \geq \frac{N_{Ed}}{n_b} \cdot \frac{\gamma_{M2}}{0.6 f_{ub}} = \frac{400 \times 10^3 \times 1.25}{6 \times 0.6 \times 500} = 277.8 \text{ mm}^2$$

6 M20

verifier section nette

2 fois de 21 mm

$$A_{net} = A - 2 d t = 1840 - 2 \times 21 \times 5 = 1630 \text{ mm}^2$$

$$N_{n,Rd} = 0.9 \times 1630 \times \frac{430}{1.25} \times 10^{-3} = 504.7 \text{ kN} > 400 \text{ kN OK}$$

$$N_{p,Rd} = 1840 \times \frac{275}{1.05} \times 10^{-3} = 484 \text{ kN} > 400 \text{ kN OK}$$

$$504.7 > 484$$

comportement  
DUTTILE



erfüllt man:

$$F_{b,Rd} = \frac{d \cdot t \cdot k \cdot \alpha \cdot \frac{f_y}{\gamma_{m2}}}{20 \cdot 5 \cdot 1.25} \geq F_{v,Ed} = \frac{N}{6} = 66.7 \text{ kN}$$

$$\frac{k \cdot \alpha}{2.5} \geq \frac{F_{v,Ed} \cdot \gamma_{m2}}{d \cdot t \cdot f_y} = \frac{66.7 \times 10^3 \times 1.25}{20 \times 5 \times 430} = 1.94$$

$$\alpha \geq \frac{1.94}{2.5} = 0.776$$

$$\alpha \geq 0.776$$

$$\frac{e_1}{3d_o} \geq 0.776$$

$$d_o = 21 \text{ mm}$$

$$\Rightarrow e_1 \geq$$

$$\overbrace{0.776 \times 3}^{2.33} d_o =$$

$$= 48.9 \text{ mm}$$

$$e_1 = 50 \text{ mm}$$

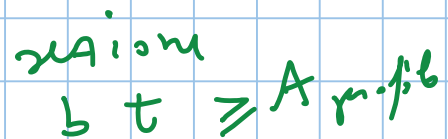
$$\frac{p_1}{3d_o} - 0.25 \geq 0.776$$

$$\Rightarrow$$

$$p_1 \geq \overbrace{3(0.776 + 0.25)}^{3.08} d_o =$$

$$= 64.6 \text{ mm}$$

$$p_1 = 70 \text{ mm}$$

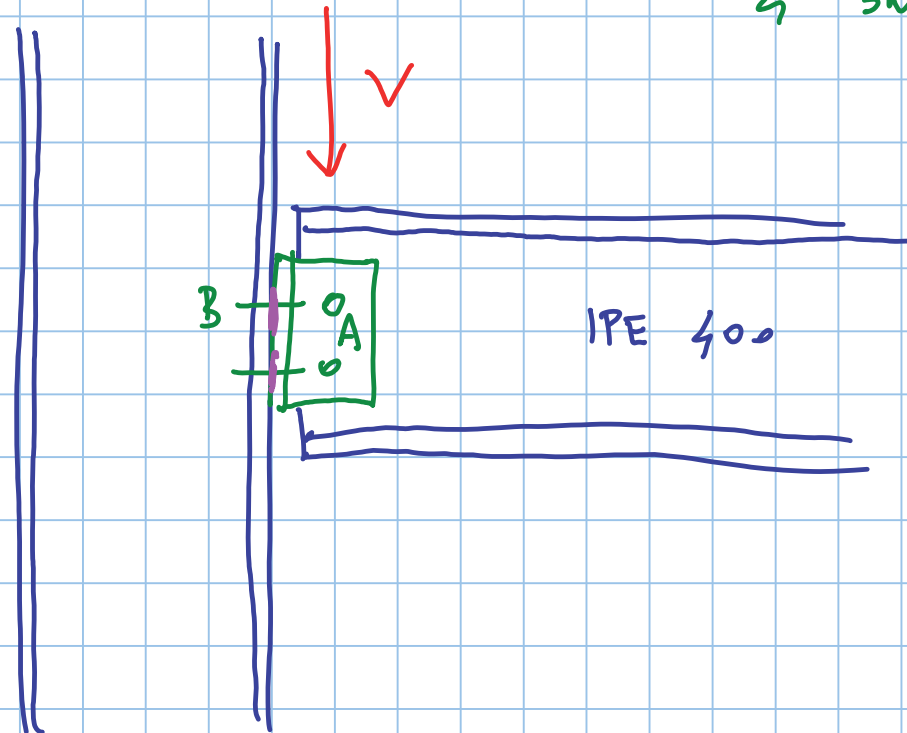

$$t = 5 \text{ mm}$$

myfi.  $t = 6$  hr

$$310 \times 6 = 1860 \text{ mm}^2$$

2 bullw A

4 bullw B

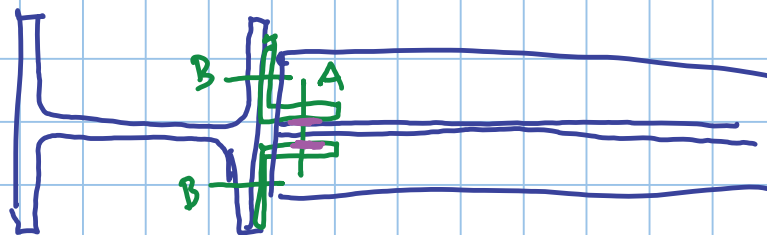


$$V_{Ed} = 150 \text{ kN}$$

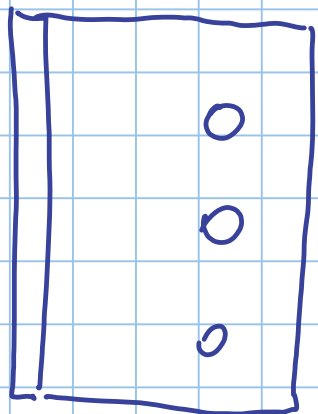
$$h = 400 \text{ mm}$$

$$b = 180 \text{ mm}$$

$$t_w = 8.6 \text{ mm}$$



S275



3 bulloni

M16

diam 5.6

$$F_{v,Rd} = 3 \times 2 \times 37.0 \text{ kN} = 222 \text{ kN}$$

$$F_{v,Rd} > V_{Ed} \quad \text{abbondante}$$

a rifollamento dell'anima ( $t_w = 8.6 \text{ mm}$ )

ogni bullone 2 usoni.

$$F_{v,Ed} = \frac{150}{3} = 50 \text{ kN}$$

$$\leq \frac{d \cdot t \cdot k_2 \cdot \frac{f_u}{\gamma_{m2}}}{15 \quad 8.6 \quad 2.5 \quad 430}$$

$$50 \text{ kN} \leq \frac{d \cdot t \cdot k \cdot \alpha \cdot \frac{f_y}{\gamma_{m2}}}{15 \cdot 8.6 \cdot 2.5 \cdot 430}$$

$$\alpha \geq \frac{50 \times 10^3 \times 1.25}{15 \times 8.6 \times 2.5 \times 430}$$

$$\frac{e_1}{3 d_0} \geq 0.45 \rightarrow e_1 \geq 0.45 \times 3 \times 15 = 20.25 \text{ mm}$$

$$p_1 \geq 2.2 d_0 = 2.2 \times 15 = 33 \text{ mm}$$

$$p_1 = 35 \text{ mm}$$

L 60x60x6

$$\sqrt{43^2 + 50^2} = 66 \text{ kN}$$

$$= 0.45$$

$$F_0 = \frac{V_e}{70}$$

