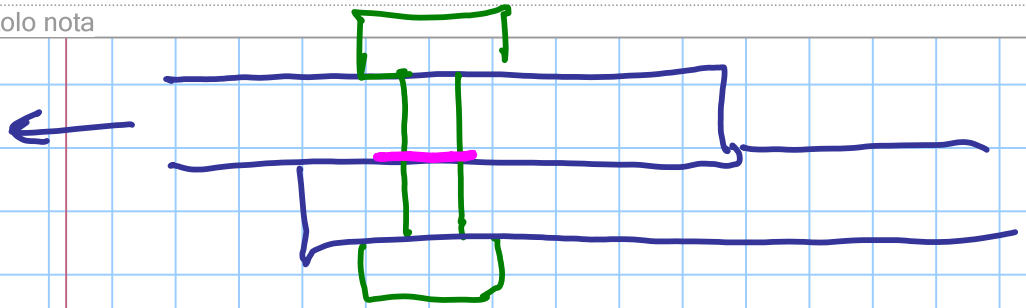
BULLONI

Titolo nota 15/01/2015



A TAGLIO

ATTRITO

scorrimento

nel raggio si crea compressione Tra i piatti

(e Trazione nel bullone)

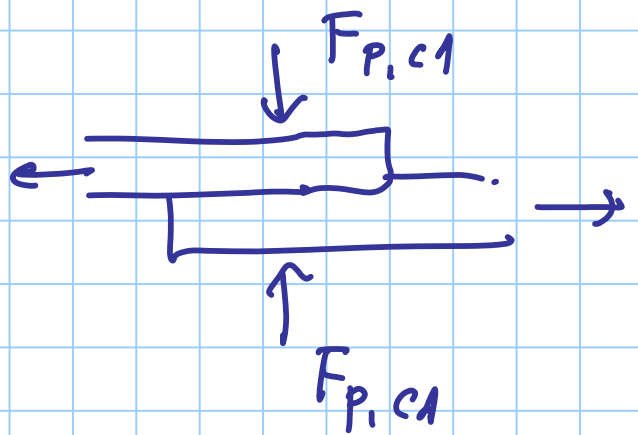
forza di precarico, esercitata nel raggio

$$F_{p.cd} = 0.7\, A_{res}\, \frac{f_{ub}}{\gamma_{M7}}$$

$\gamma_{M7} = 1.1$

COLLEGAMENTO AD ATTRITO

$$F_{S,Rd} = \mu \frac{F_{p,cd}}{\gamma_{M3}}$$



$\mu =$ 0.45 NTC 08

0.30

0.5 ÷ 0.2 EC8

$\gamma_{M3} =$ 1.25 SLU

1.1 SLE

$$F_{s,Rd} = \mu \frac{0.7\, A_{res} \frac{f_{ub}}{\gamma_{M7}}}{\gamma_{M3}} = \underbrace{\frac{0.3 \mu\, 0.7}{\gamma_{M7}}}_{\sim 0.19} A_{res} \frac{f_{ub}}{\gamma_{M3}}$$

$$F_{v,Rd} = 0.6\, A_{res} \frac{f_{ub}}{\gamma_{M2}}$$

$$F_{s,Rd} \ll F_{v,Rd}$$

BULLONI A TRAZIONE

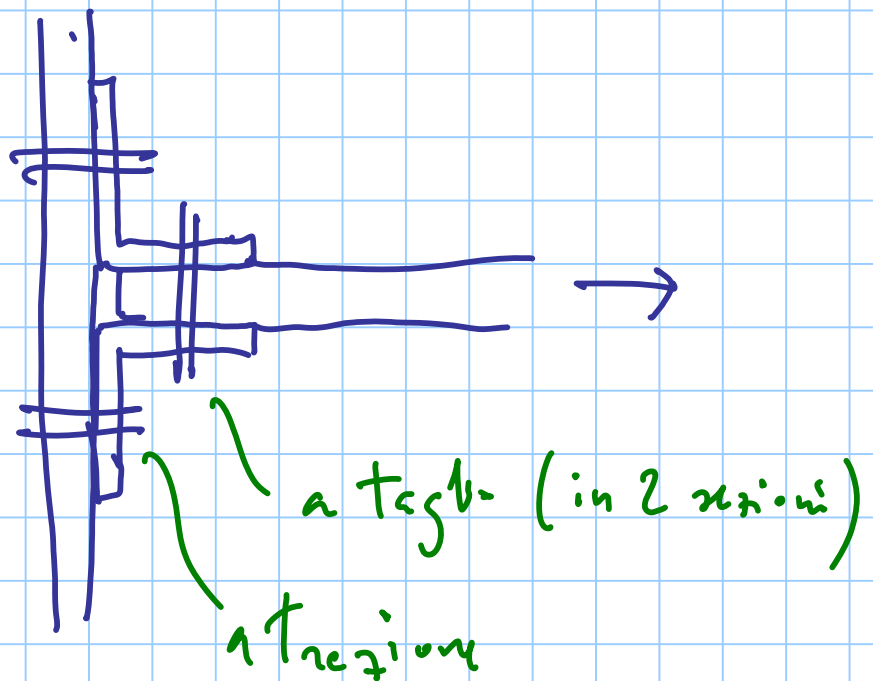
$$F_{t,Rd} = 0.9 \, A_{res} \, \frac{f_{ub}}{\gamma_{M2}}$$

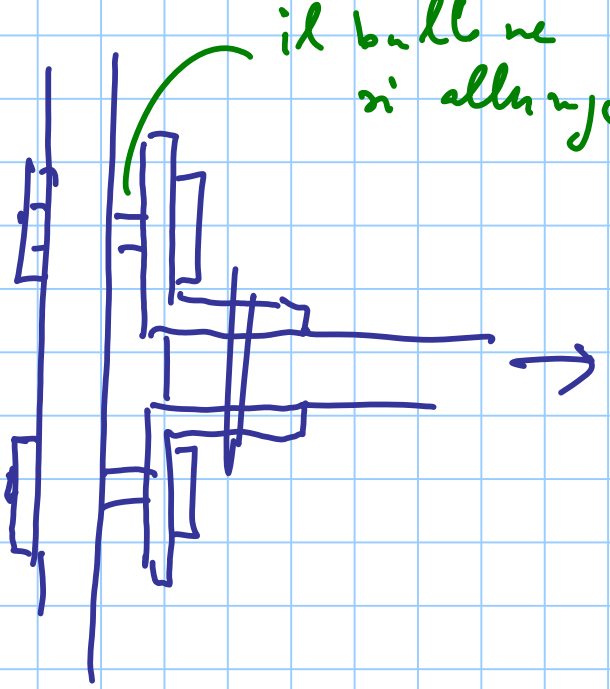
A_{res} ↓ sempre

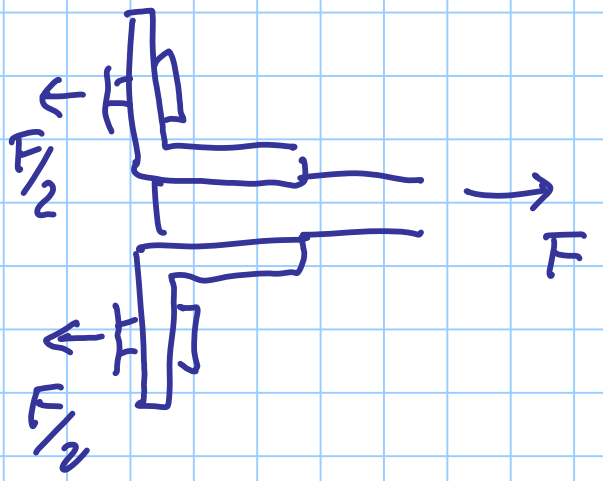
se il bullone è filettato in tutto il gambo

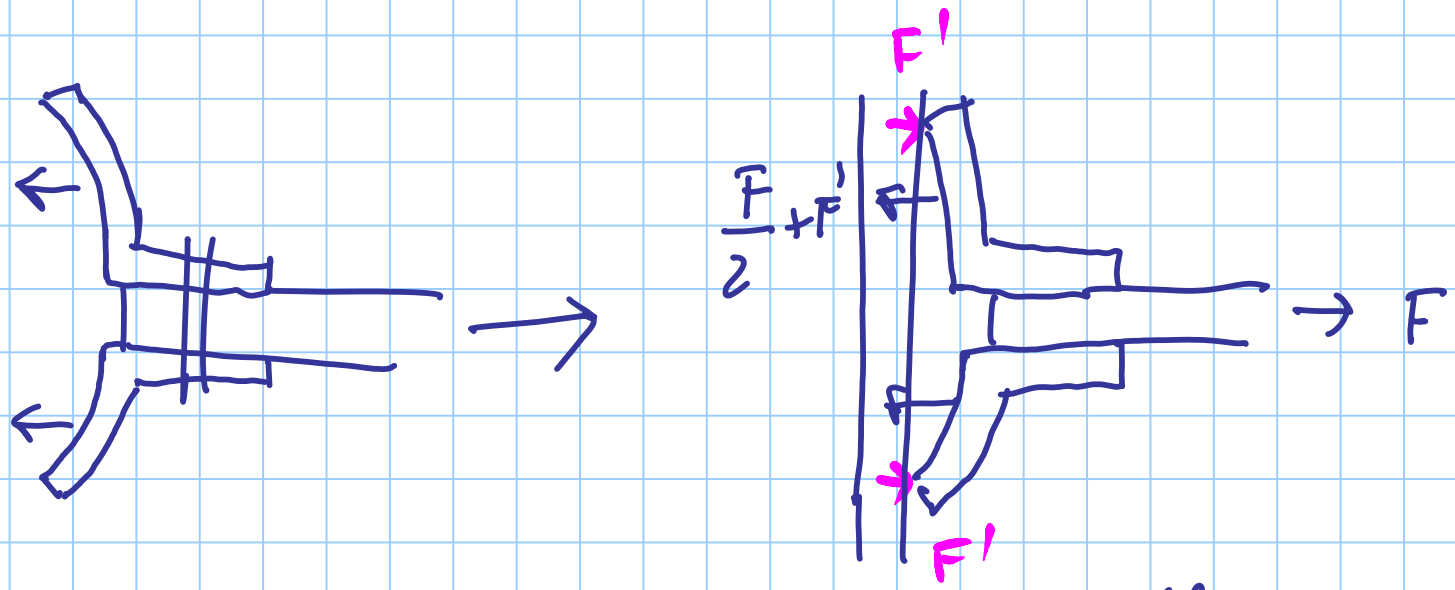
$$F_{t,Rd} = 1.5 \, F_{v,Rd}$$

se è filettato solo all'estremità $F_{t,Rd} \simeq 1.125 \, F_{v,Rd}$


a taglio (in 2 sezioni)
a trazione


il bullone si allunga


F/2
F
F/2

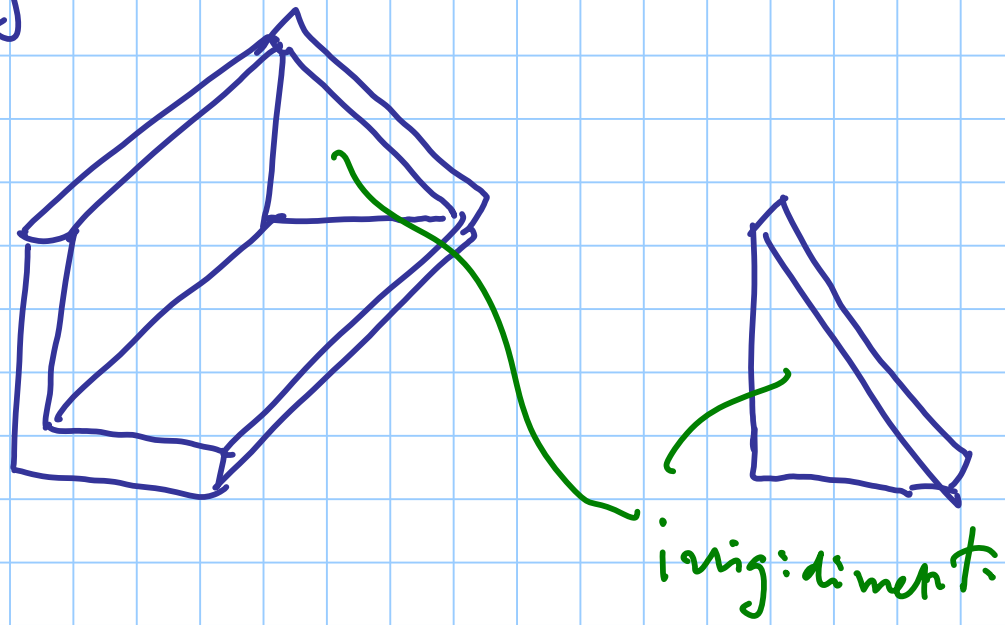


effetto LEVA

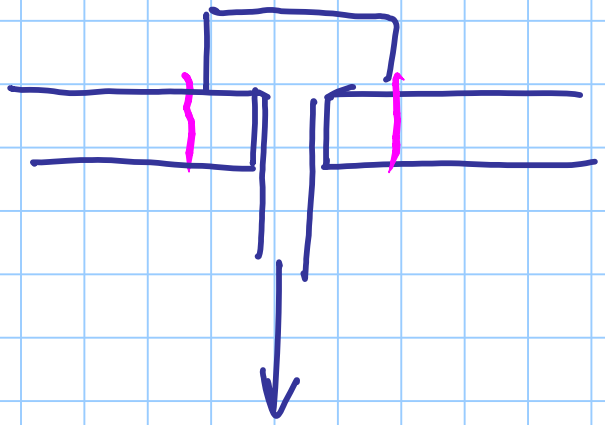
l'effetto leva aumenta la trazione nei bulloni

(ma riduce la flessione nell'angolare)

irrigidire se si vuole evitare l'effetto leva



PUNZONAMENTO

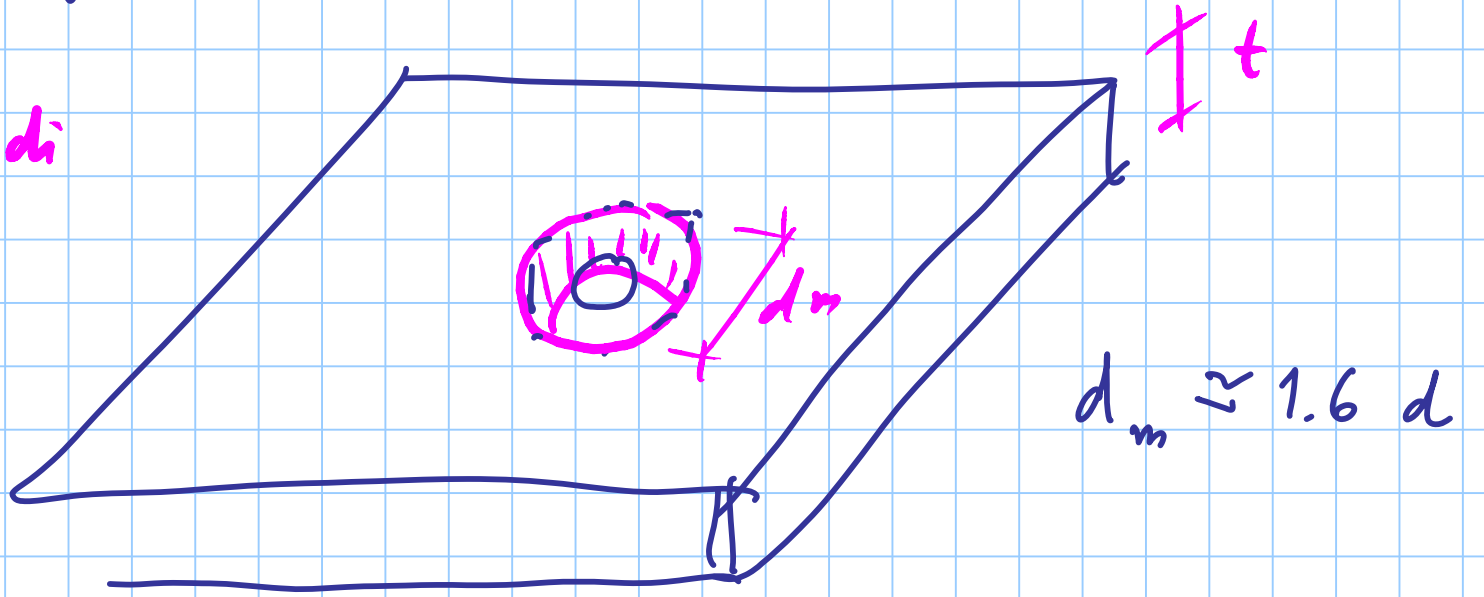


superficie di rottura

CILINDRO

$\pi d_m \cdot t$

↑ testa bullone

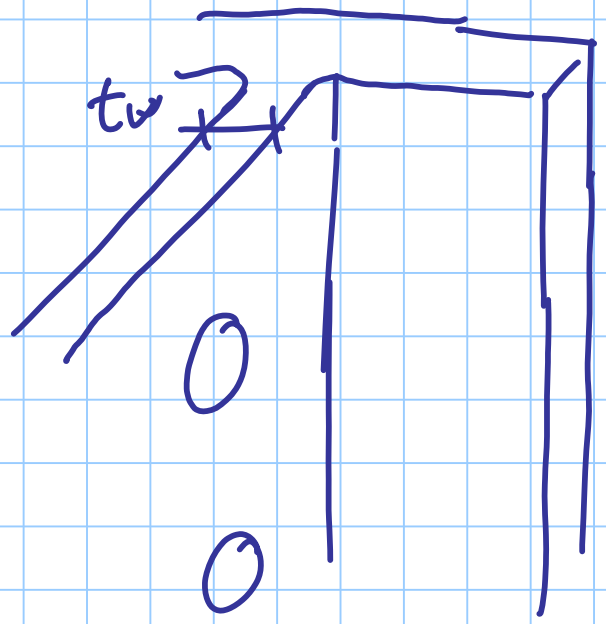


$d_m \simeq 1.6\, d$

resistenza a punzonamento

$$B_{p,Rd} = 0{,}6\,\pi\, d_m\, t\, \frac{f_u}{\gamma_{M2}}$$

perdi lesione a taglio,



HE 160 A S 275

$t_w = 6$ mm $f_u = 430$ MPa

BULLONI M14 8.8

$A_{res} = 115\ mm^2$

$d_m \simeq 1.6\, d = 22.4$ mm

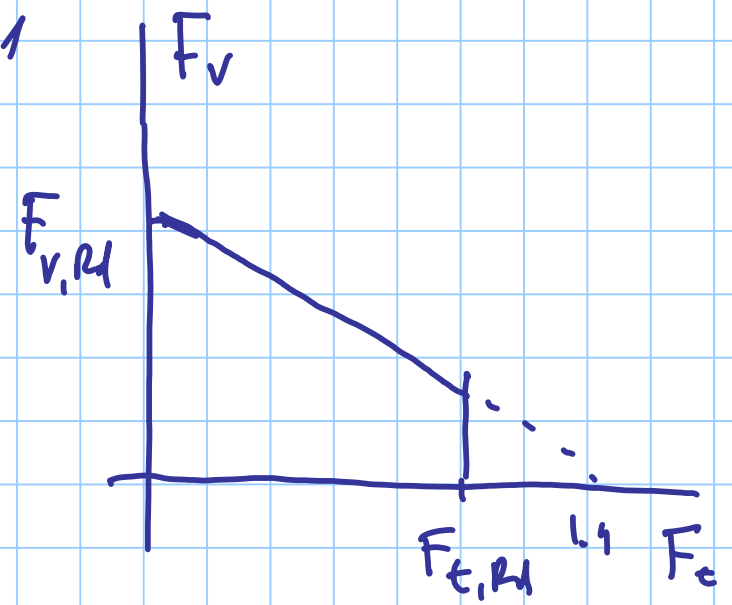
$$F_{t,Rd} = 0.9 \times 115 \times \frac{800}{1.25} \times 10^{-3} = 66.2\ kN$$

$$B_{p,Rd} = 0.6 \times 3.14 \times 22.4 \times 6 \times \frac{430}{1.25} \times 10^{-3} = 87.1\ kN$$

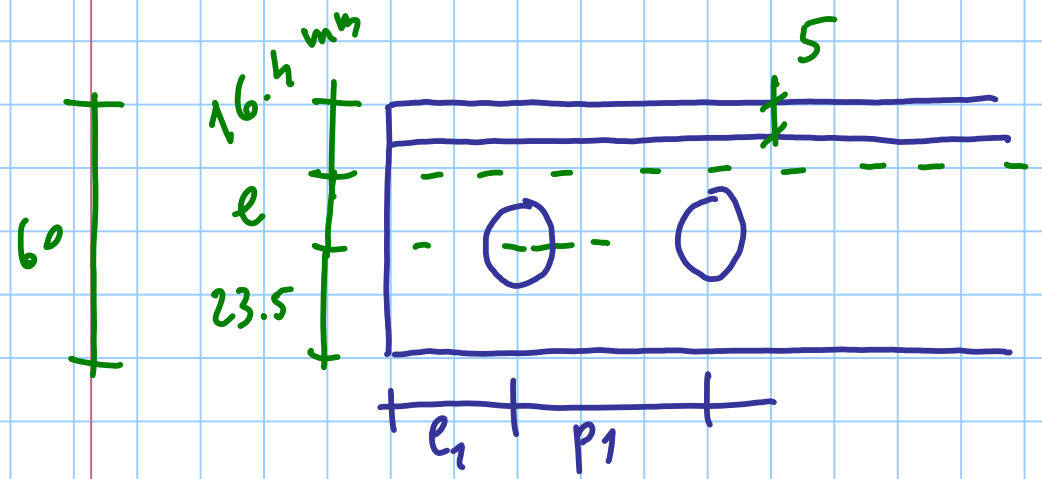
Se i bulloni lavorano contemporaneamente a Taglio $F_{V,Ed}$ e a Trazione $F_{t,Ed}$

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

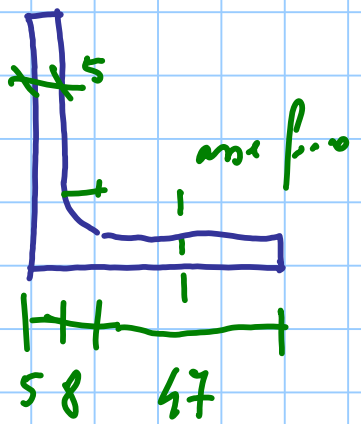
$$F_{t,Ed} \leq F_{t,Rd}$$



$r_1 = 8$ mm



$e = 20.1$ mm



$e_1 = 40$ mm

$p_1 = 50$ mm

$N_{Ed} = 100$ kN

L 60×60×5

S 275

$A = 582$ mm^2

$N_{Rd} = 152.4$ kN

2 M14 8.8 filet. en T_2

$F_{v,Rd} = 59.1$ kN

rif. elementi

$$F_{b,Rd} = K \alpha \, d \, t \, \frac{f_u}{\gamma_{M2}}$$

$d = 14$ mm

$t = 5$ mm

$f = 430$ MPa

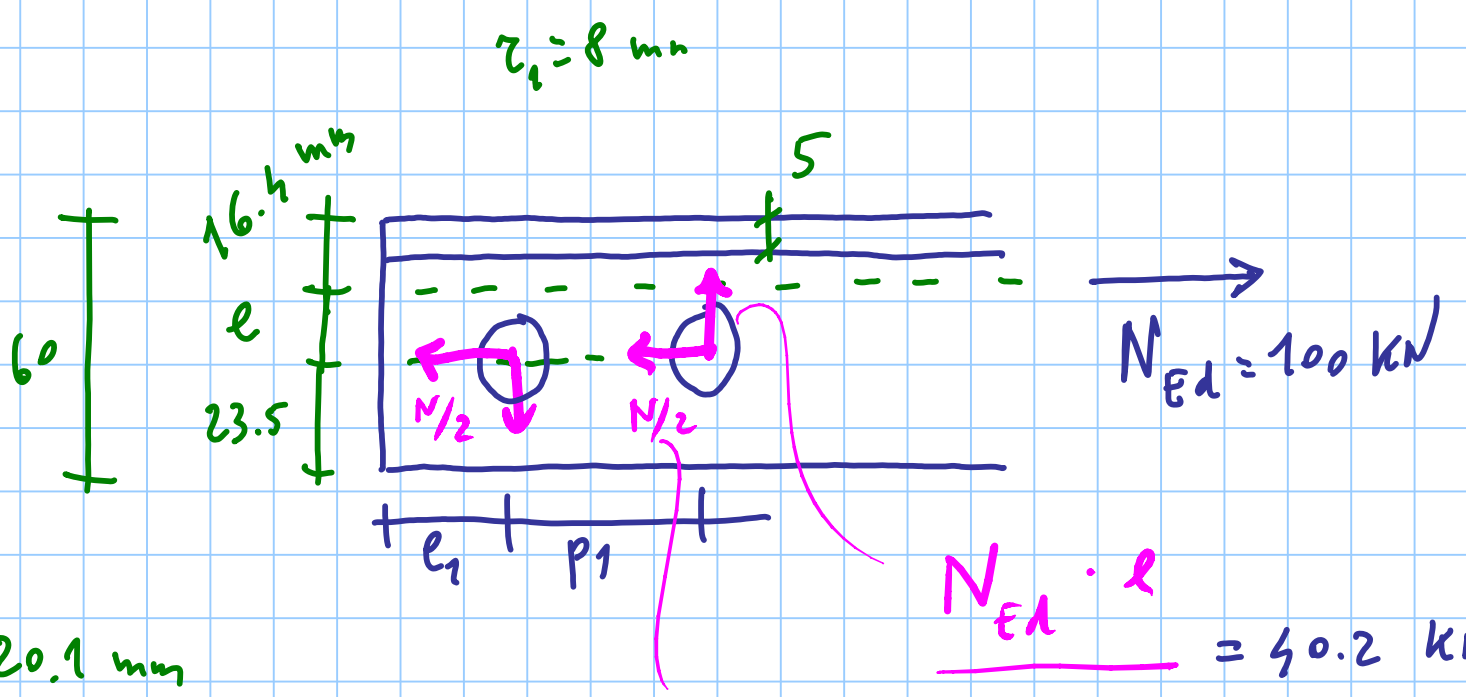
$F_{b,Rd} > 50$ kN

$K = 2.5$

$$\alpha \geq \frac{50 \times 10^3 \times 1.25}{2.5 \times 14 \times 5 \times 430} = 0.83$$

$$\frac{e_1}{3 d_0} \geq 0.83 \qquad e_1 \geq 37.3 \text{ mm} \rightarrow e_1 = 40 \text{ mm}$$

$$\frac{p_1}{3 d_0} - 0.25 \geq 0.83 \qquad p_1 \geq 48.6 \text{ mm} \qquad p_1 = 50 \text{ mm}$$



$e = 20.1$ mm

$p_1 = 50$ mm

$$\frac{N_{Ed} \cdot e}{p_1} = 40.2 \text{ kN}$$

$$F_{V,Ed} = \sqrt{50^2 + 40.2^2} = 64.2 \text{ kN}$$

aumentare p_1 ? in modo che $F_{V,Ed} \leq 59.1$

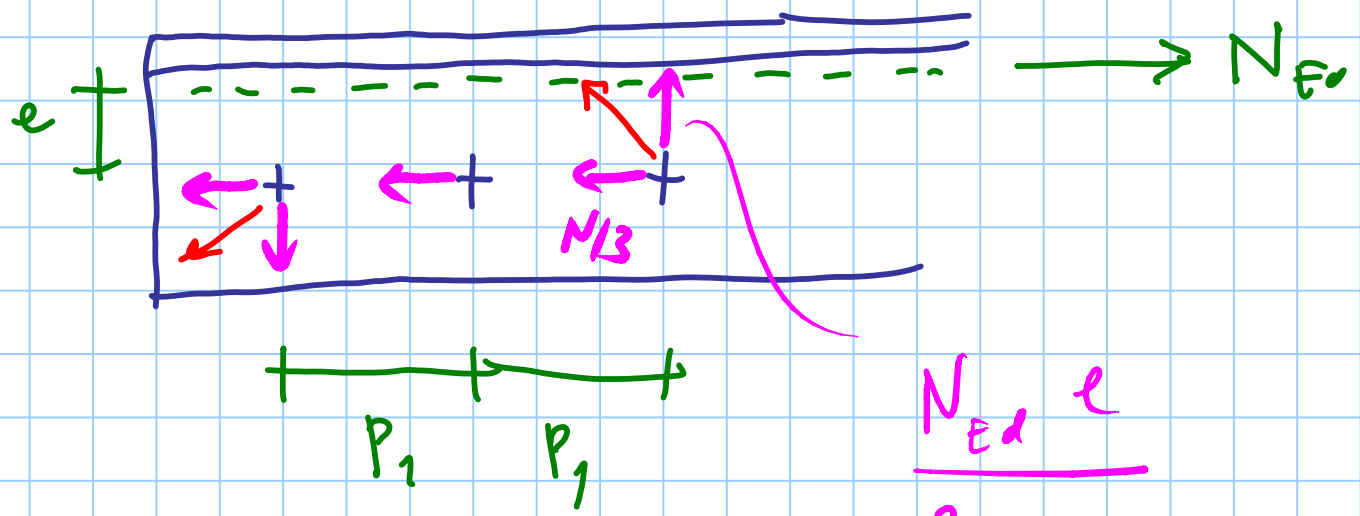
$$F_{V,Ed} = \sqrt{50^2 + \left(\frac{100\ e}{p_1}\right)^2} \leq 59.1$$

$$50^2 + \left(\frac{2010}{p_1}\right)^2 \leq 59.1^2$$

$$\left(\frac{2010}{p_1}\right)^2 \leq 992.8 \qquad \frac{2010}{p_1} \leq 31.5 \qquad p_1 \geq \frac{2010}{31.5} = 63.8 \text{ mm}$$

scelgo $p_1 = 65$ mm

3 bulloni



$$\frac{N_{Ed}\ e}{2\ P_1}$$