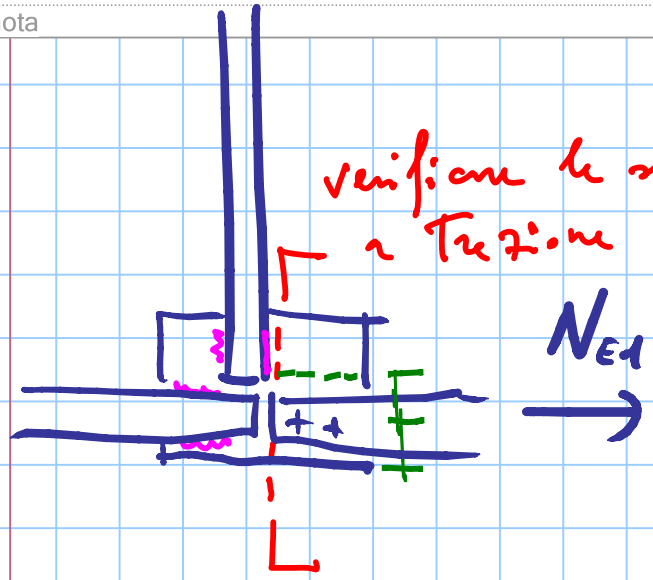
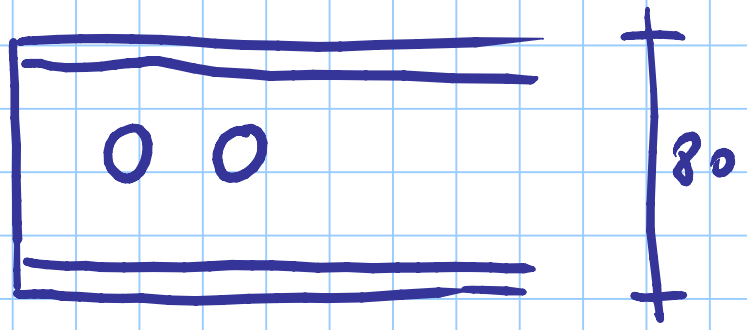
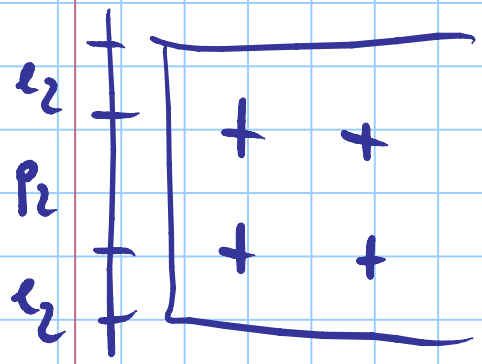
Titolo nota 10/01/2013

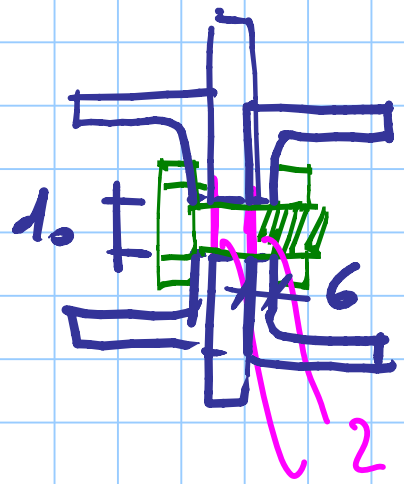
$N_{Ed} = 240$ KN

UPN 80









n_b bulloni

n_s sezioni resistenti

bulloni filettati nel piatto all'estremità

$$F_{v,Rd} = 0.6\, A\, \frac{f_{ub}}{\gamma_{M2}} \qquad F_{v,Ed} = \frac{N_{Ed}}{n_b\, n_s}$$

$n_s = 2$ piano $n_b = 2$ $\qquad F_{v,Ed} = \frac{240}{2 \times 2} = 60\ kN$

classe 5.6 $\qquad f_{ub} = 500\ MPa$

$$A \geq \frac{F_{v,Ed}\ \gamma_{M2}}{0.6\ f_{ub}} = \frac{60 \times 10^3 \times 1.25}{0.6 \times 500} = 250\ mm^2$$

M18 $A = 254\ mm^2$

classe 8.8 $\quad f_{ub} = 800\ MPa$

$$A \geq \frac{60 \times 10^3 \times 1.25}{0.6 \times 800} = 156.3\ mm^2$$

M14 $\quad A = 154\ mm^2$

M16 $\quad A = 201\ mm^2$

per avere comportamento duttile

$$\frac{A_{net}}{A} \geq \frac{f_y/\gamma_{M0}}{0.9\, f_u/\gamma_{M2}} = \frac{275/1.05}{0.9 \times 430/1.25} = 0.846$$

S275

$$\text{area } f_{ow} \leq (1 - 0.846)\, A = 0.154 \times 1102\ mm^2 = 170\ mm^2$$

$t_w = 6\ mm \rightarrow d_0 \leq \frac{170}{6} = 28\ mm$

CONSIGLI

1) VALUTARE la sovraresistenza delle sezioni delle diverse aste
(e individuarne il minimo)

⇓

GARANTIRE ai collegamenti una sovraresistenza non minore di quella

IN QUESTO MODO si plasticizzano le aste senza che i collegamenti si rompano

o, in alternativa

2) per OGNI COLLEGAMENTO fare in modo che la resistenza del collegamento sia maggiore di quella dell'arco

COLLEGAMENTO A COMPLETO RIPRISTINO DI RESISTENZA

Es. 2 UPN 80 $A = 2 \times 1102 = 2204\ mm^2$

$$N_{Rd} = 2204 \times \frac{275}{1.05} \times 10^{-3} = 577\ kN$$

progettare il collegamento per 577 kN, non 240 kN

Nel mio esempio ipotizzo di aver trovato una sovraresistenza 1.24 tra tutte le sezioni/aste

quindi (vedi pag. 1) progetterò il collegamento

per $240 \times 1.24 = 298\ kN$ $F_{v,Ed} = 74.5\ kN$

2 bulloni classe 8.8

$$A \geq \frac{74.5 \times 10^3 \times 1.25}{0.6 \times 800} = 194\ mm^2 \Rightarrow M16$$

RIFOLLAMENTO

$d = 16$ mm $t = 6$ mm (per minimi profili)

$F_{b,Ed} = 74.5$ kN

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

$k = 2.5$

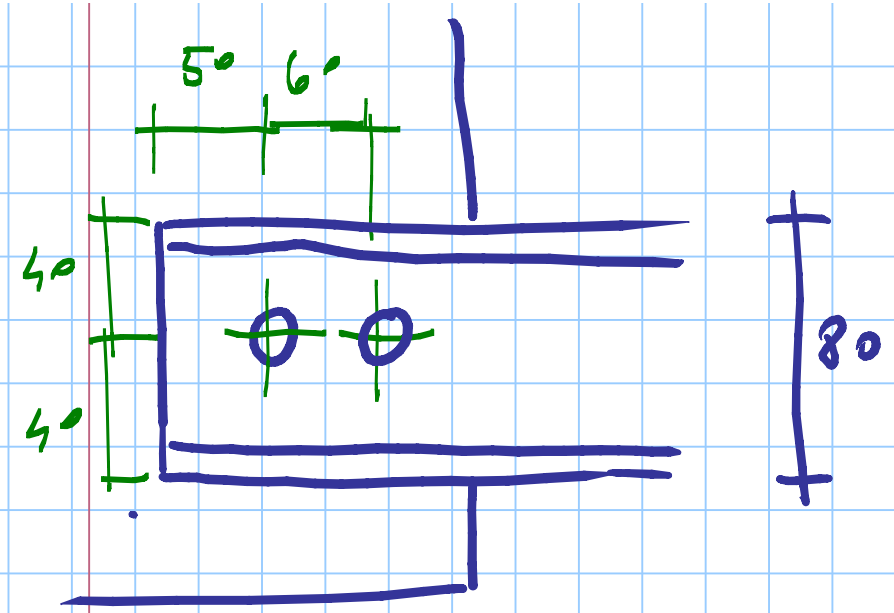
perché $e_2 > 1.5\, d_0$

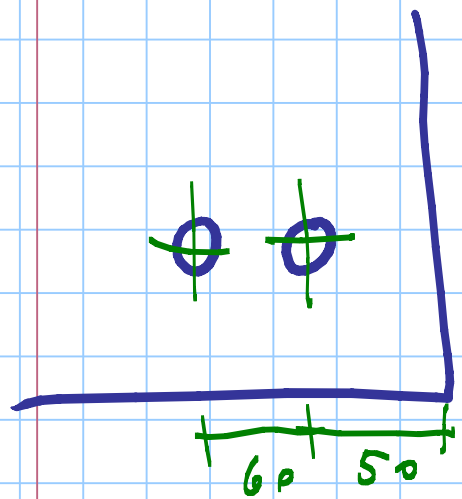
$$\alpha \geq \frac{F_{b,Ed}}{k\, d\, t\, f_u / \gamma_{M2}}$$

$$= \frac{74.5 \times 10^3}{2.5 \times 16 \times 6 \times 430 / 1.25} = 0.90$$

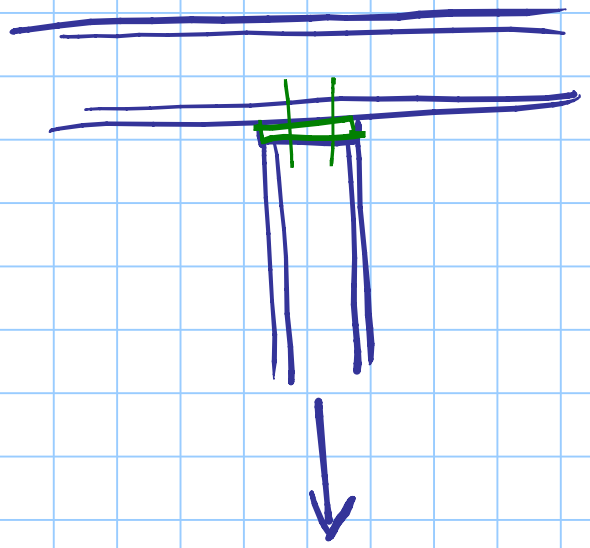
$$\frac{e_1}{3 d_0} \geq 0.90 \qquad e_1 \geq 3 \times 0.90\, d_0 = 2.7\, d_0 = 45.9 \text{ mm} \rightarrow 50$$

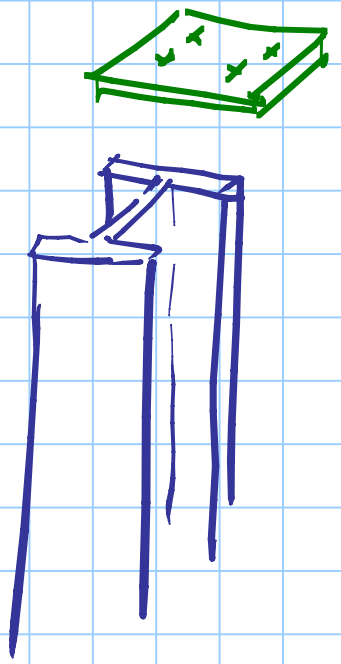
$$\frac{p_1}{3 d_0} - 0.25 \geq 0.90 \qquad p_1 \geq 3 \times 1.15\, d_0 = 3.45\, d_0 = 58.65 \text{ mm} \rightarrow 60$$


50
60
40
40
80


60
50

BULLONI CHE LAVORANO A TRAZIONE



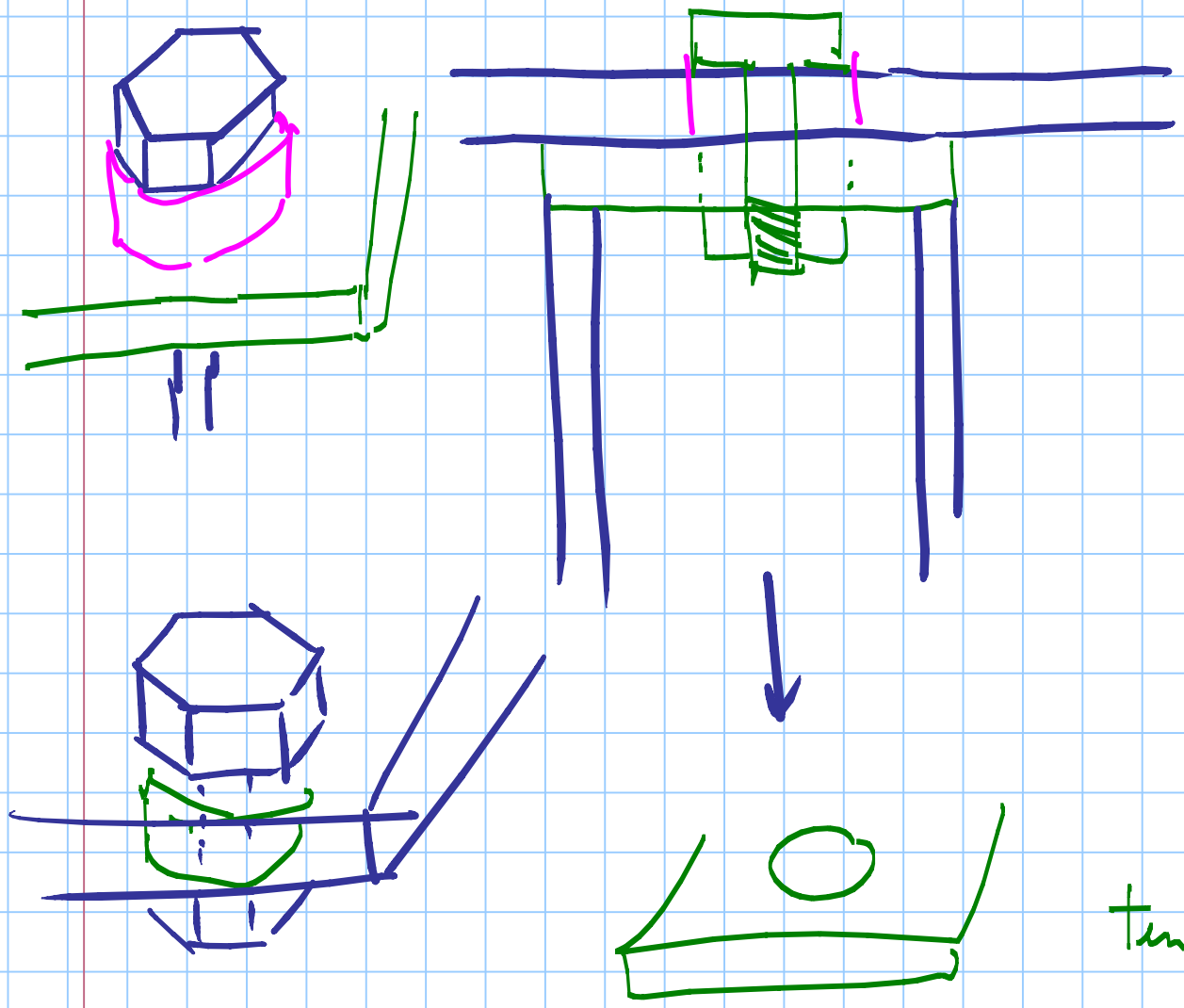


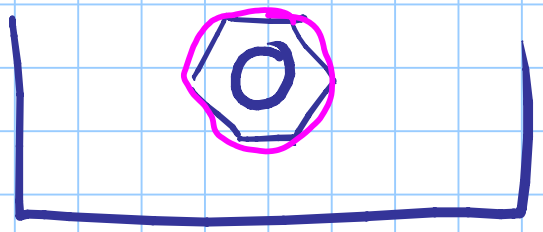
RESISTENZA A TRAZIONE

$F_{t,Rd}$

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

PUNZONAMENTO





$$\text{sup.} \simeq \sqrt{n_c}\ \pi\ d_m\ t$$

$$d_m \simeq 1.6\ d$$

$$\tau_{rd,m} \quad 0.6\ \frac{f_u}{\gamma_{M2}}$$

resistenza a punzonamento

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