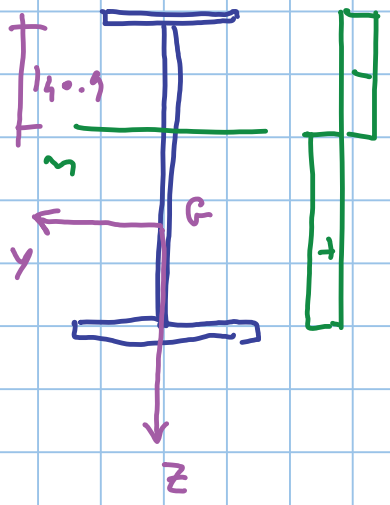
Titolo nota 04/12/2018

S 275

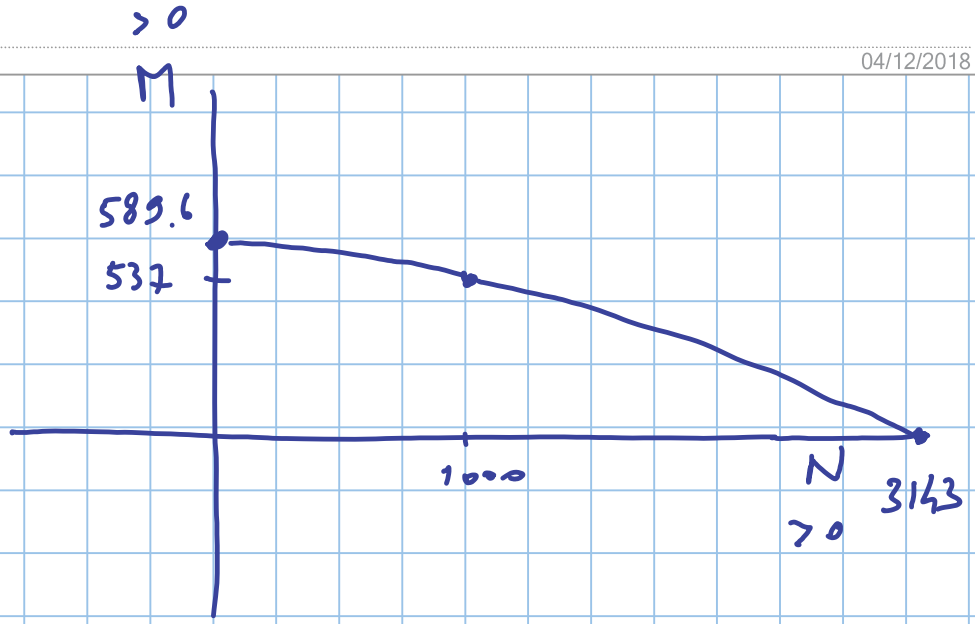
$A_{cm} = 40.91 \times 10^{-2}\ m^2$

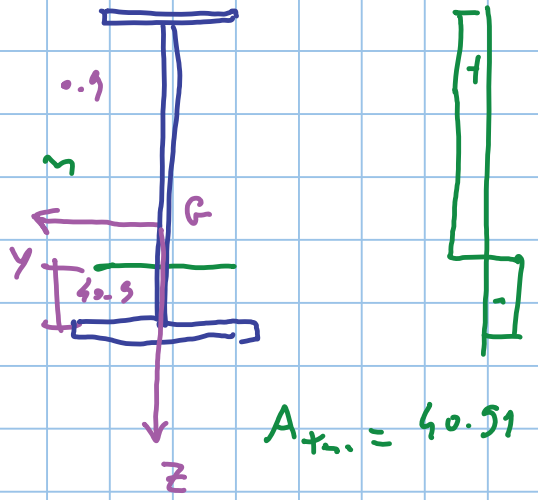


$N_{Rd} = 1000\ kN$

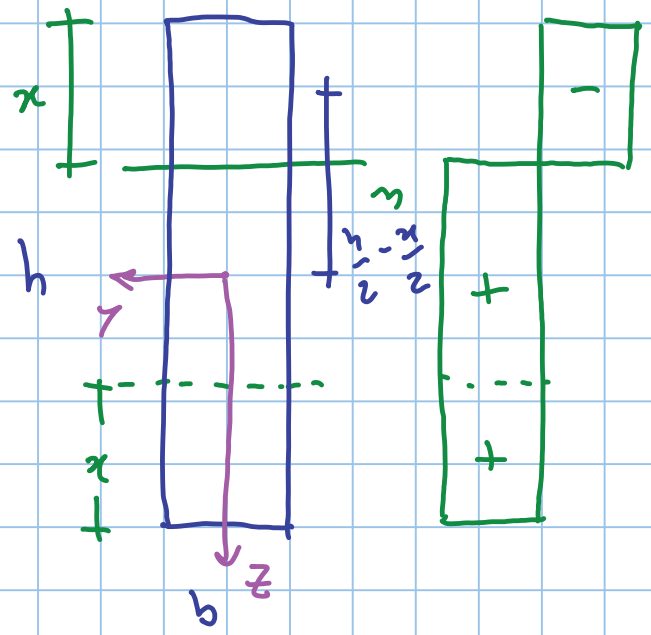
$M_{N,Rd} = 537.3\ kNm$

cambiando la posizione di n troviamo altre coppie





$A_{tm.} = 40.91 \times 10^{-2}\ m^2$



$$N = (h-2x)\,b\,\frac{f_y}{\gamma_{M0}} \qquad (1)$$

$$M = \tfrac{1}{2}\,b\,x\left(\frac{h}{2}-\frac{x}{2}\right)\frac{f_y}{\gamma_{M0}} \qquad (2)$$

$$b\,x\,(h-x)\,\frac{f_y}{\gamma_{M0}}$$

da (1)

$$N = \underbrace{h\,b\,\frac{f_y}{\gamma_{M0}}}_{N_{R1}} - 2\,x\,b\,\frac{f_y}{\gamma_{M0}} \quad \Rightarrow \quad 2\,x\,b\,\frac{f_y}{\gamma_{M0}} = N_{R1} - N$$

$$x = \frac{N_{R1}-N}{2\,b\,\frac{f_y}{\gamma_{M0}}}$$

da (7)

$$M = b \frac{N_{Rd} - N}{2b \frac{f_y}{\gamma_{M0}}} \left(h - \frac{N_{Rd} - N}{2b \frac{f_y}{\gamma_{M0}}} \right) \frac{f_y}{\gamma_{M0}}$$

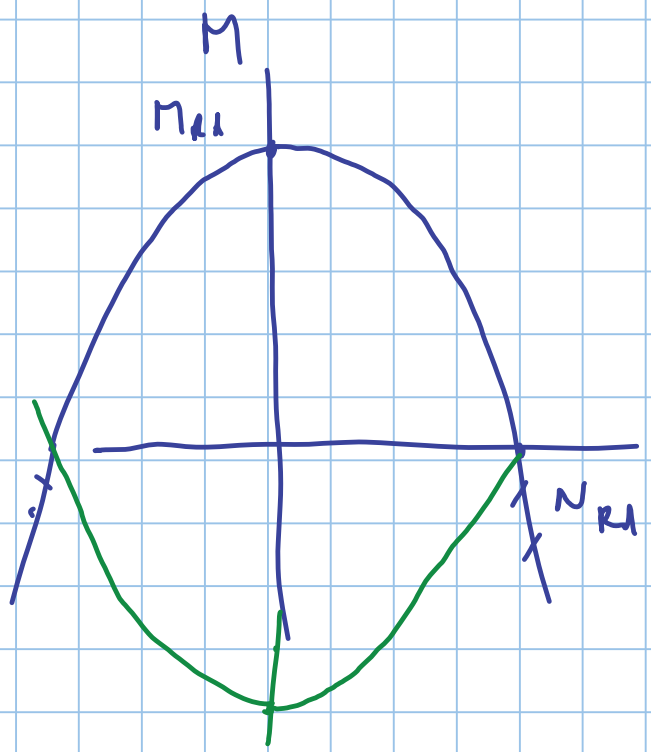
$$\Downarrow$$

$$\left(\frac{\frac{2N_{Rd}}{h \cdot 2b \frac{f_y}{\gamma_{M0}}} - N_{Rd} + N}{2b \frac{f_y}{\gamma_{M0}}} \right)$$

$$\frac{b^2 h^2 \frac{f_y^2}{\gamma_{M0}^2}}{h \, 2b \frac{f_y}{\gamma_{M0}}} = \frac{bh^2 f_y}{2 \gamma_{M0}} \quad M_{Rd}$$

$$M = \frac{N_{Rd} - N}{2} \cdot \frac{N_{Rd} + N}{2b \frac{f_y}{\gamma_{M0}}} = \left(\frac{bhf_y}{\gamma_{M0}} \right)^2 \frac{N_{Rd}^2 - N^2}{2b \frac{f_y}{\gamma_{M0}}}$$

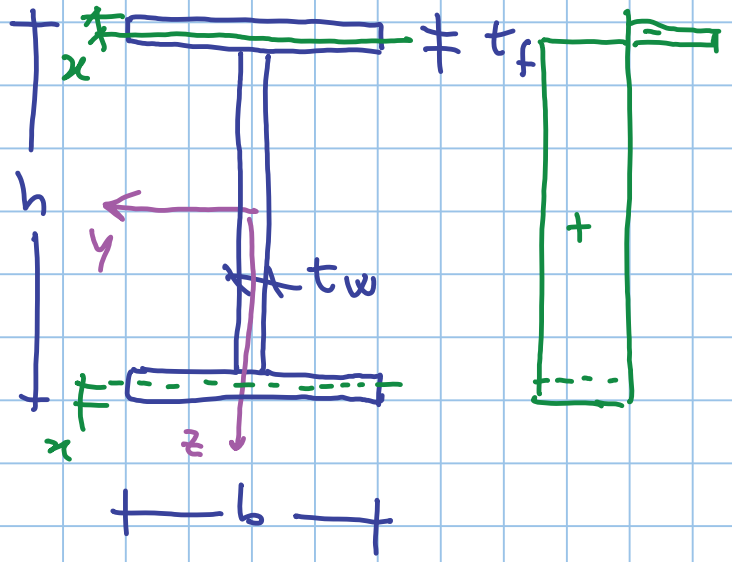
$$M = M_{Rd} \left[1 - \left(\frac{N}{N_{Rd}} \right)^2 \right] = \left(\frac{bhf_y}{\gamma_{M0}} \right)^2 \frac{N_{Rd}^2}{N_{Rd}}$$



$$M \leq M_{N,Rd} = M_{Rd}\left[1-\left(\frac{N}{N_{Rd}}\right)^2\right]$$

SEZIONE RETTANGOLARE

$$\frac{M_{Ed}}{M_{Rd}} + \left(\frac{N_{Ed}}{N_{Rd}}\right)^2 \leq 1$$



$0 \leq x \leq t_f$

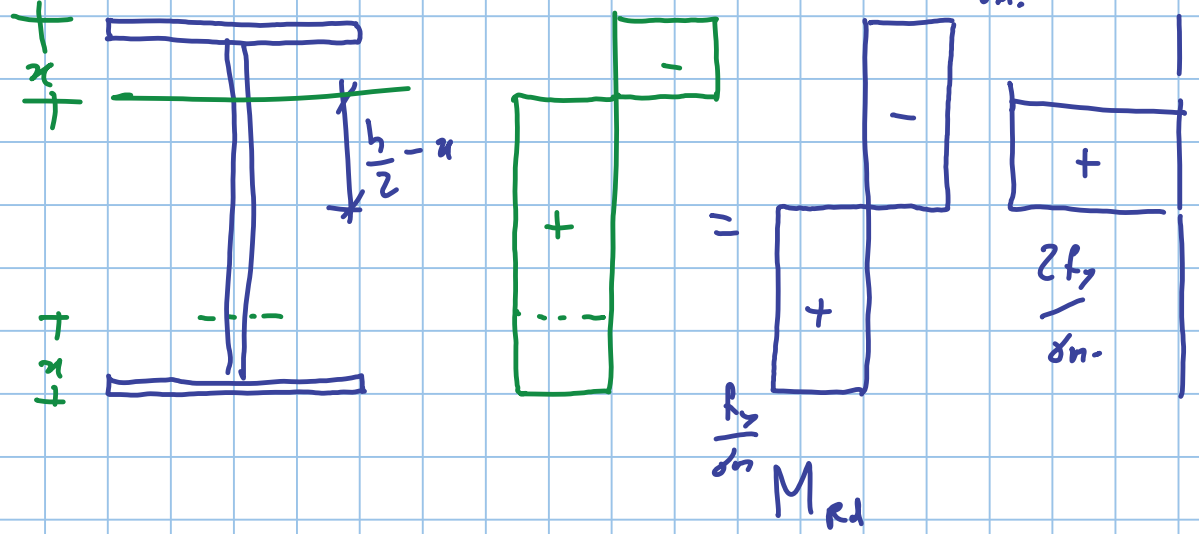
$$N = N_{Rd} - 2\,x\,b\,\frac{f_y}{\gamma_{M0}}$$

$$M = x\,b\,(h-x)\,\frac{f_y}{\gamma_{M0}}$$

N, M parabola

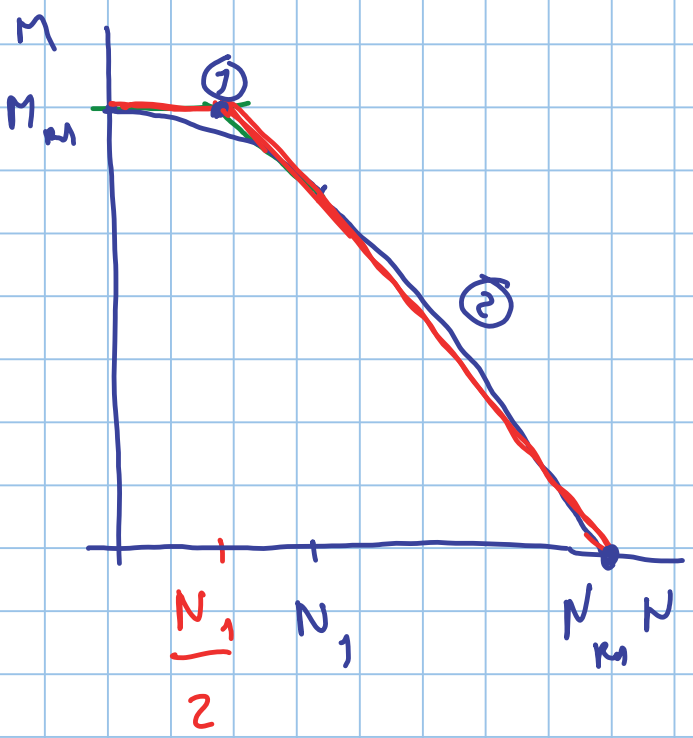
$M = f(N^2)$

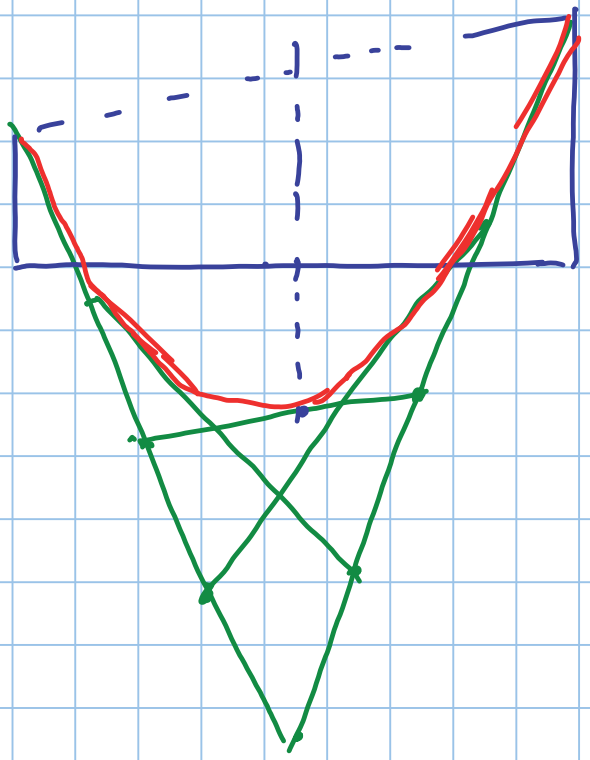
$$N_1 = N(t_f) = \left(A - 2\,b\,t_f\right)\frac{f_y}{\gamma_{M0}}$$



$$N = (h - 2x)\,t_w\,\frac{f_y}{\gamma_{M0}}$$

$$M = M_{Rd} - \left(\frac{h}{2} - x\right)^2 \frac{t_w}{2}\,\frac{2f_y}{\gamma_{M0}}$$





$$N_1 = \left(A - 2\,b\,t_f\right)\frac{f_y}{\gamma_{M0}}$$

$$N_1 = a\,N_{Rd}$$

$$\frac{N_1}{2} = \frac{a}{2}\,N_{Rd}$$

$$a = \frac{A - 2\,b\,t_f}{A}$$

$$A - 2\,b\,t_f = a\,A$$

SEZIONE A DOPPIO T con M_y

$$M_{N,Rd} = M_{Rd} \quad \text{per} \quad N \leq \frac{a}{2} N_{Rd}$$

$$M_{N,Rd} = \frac{1-n}{1-0.5\,a} M_{Rd} \quad \text{per} \quad \frac{a}{2} N_{Rd} \leq N \leq N_{Rd}$$

$$n = \frac{N_{Ed}}{N_{Rd}}$$

Esempio: IPE 300

S 275

$A = 53.8 \times 10^2 \ mm^2$ $\quad b = 150 \ mm$

$W_{pl,y} = 628.4 \times 10^3 \ mm^3$ $\quad t_f = 10.7 \ mm$

$$N_{Rd} = 53.8 \times 10^2 \times \frac{275}{1.05} \times 10^{-3} = 1409 \ kN$$

$$N_{Ed} = 1000 \ kN$$

$$M_{Rd} = 628.4 \times 10^3 \times \frac{275}{1.05} \times 10^{-6} = 164.6 \ kN_m$$

$$M_{Ed} = 70 \ kN_m$$

$$a = \frac{53.8 \times 10^2 - 2 \times 150 \times 10.7}{53.8 \times 10^2} = 0.403$$

$$\frac{a}{2} = 0.201$$

$$\frac{a}{2} N_{Rd} = 0.201 \times 1409 = 283.2 \ kN$$

$$M_{N,Rd} = \frac{1-n}{1-0.5\,a} M_{Rd} = \frac{1-0.710}{1-0.201} \times 164.6 = 59.7\ kN_m$$

$$n = \frac{N_{Ed}}{N_{Rd}} = \frac{1000}{1409} = 0.710$$

$$M_{Ed} = 70\ kN_m > M_{N,Rd} = 59.7\ kN_m$$

NON VERIFICATA

Progetto

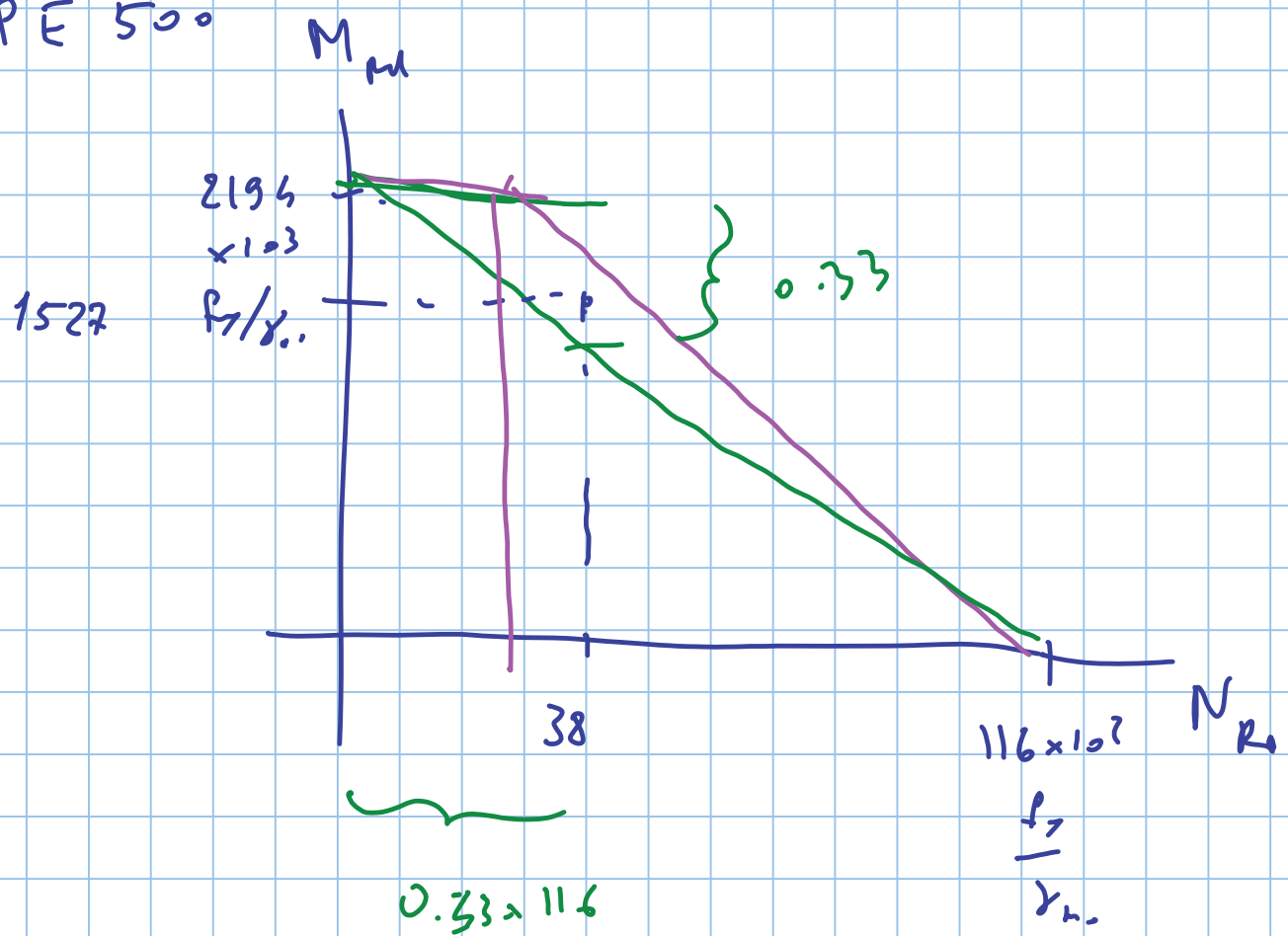
$$N_{Ed} = 1000 \text{ kN}$$

$$M_{Ed} = 400 \text{ kNm}$$

$$A = \frac{N_{Ed}\ \gamma_{M0}}{f_y} = \frac{1000 \times 10^3 \times 1.05}{275} = 38.18 \times 10^2 \text{ mm}^2$$

$$W_{pl} = \frac{M_{Ed}\ \gamma_{M0}}{f_y} = \frac{400 \times 10^6 \times 1.05}{275} = 1527.3 \times 10^3 \text{ mm}^3$$

IPE 500


M_{Rd}
2194
×10³
1527
f_y/γ_{M0}
0.33
38
N_{Rd}
116×10³
$\frac{f_y}{\gamma_{M0}}$
0.33×116