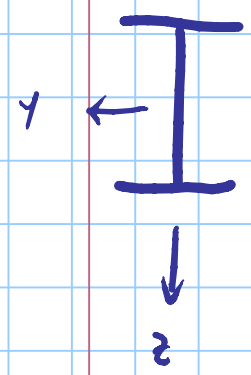
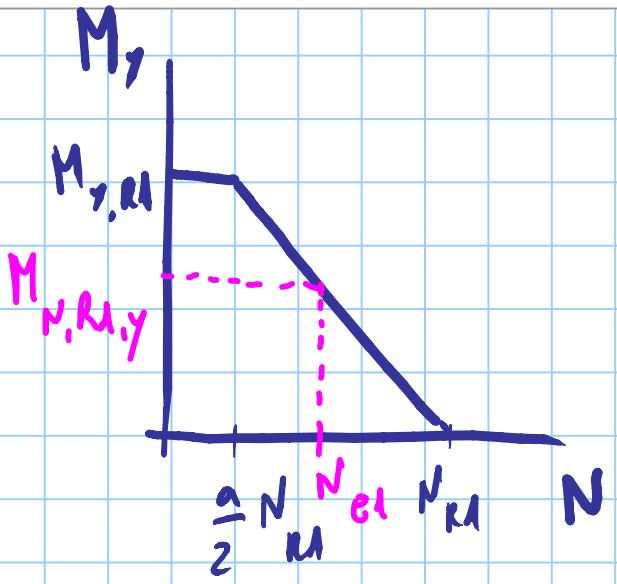
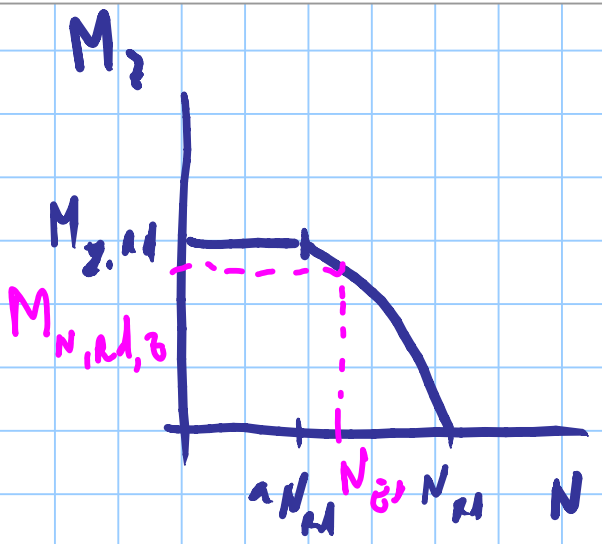
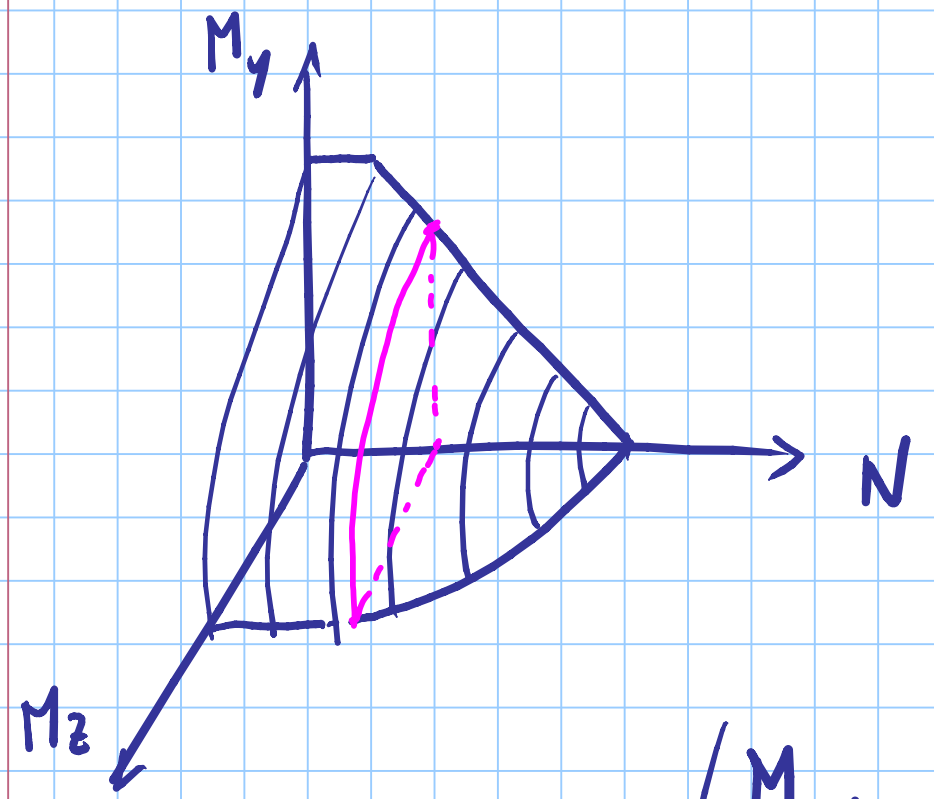
Titolo nota 18/12/2012



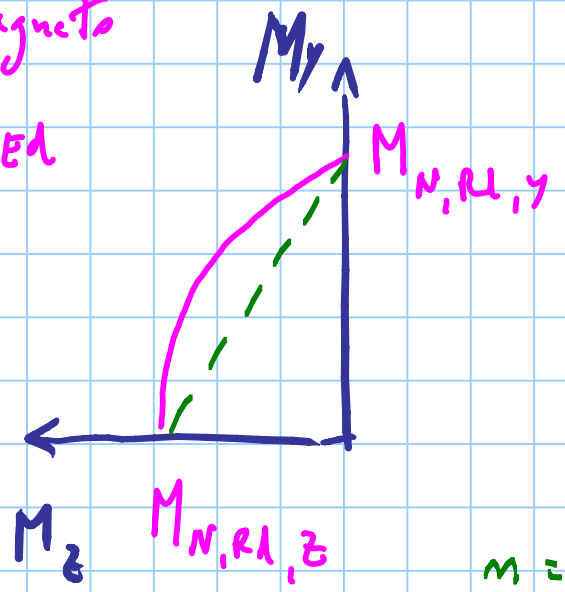






magneto

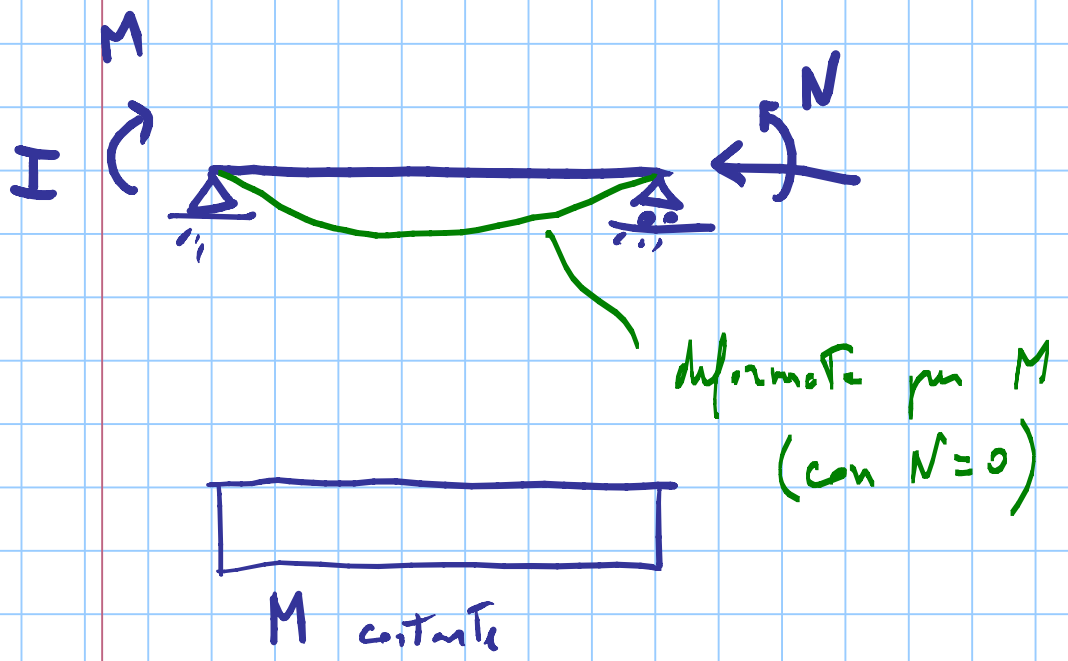
N_{Ed}



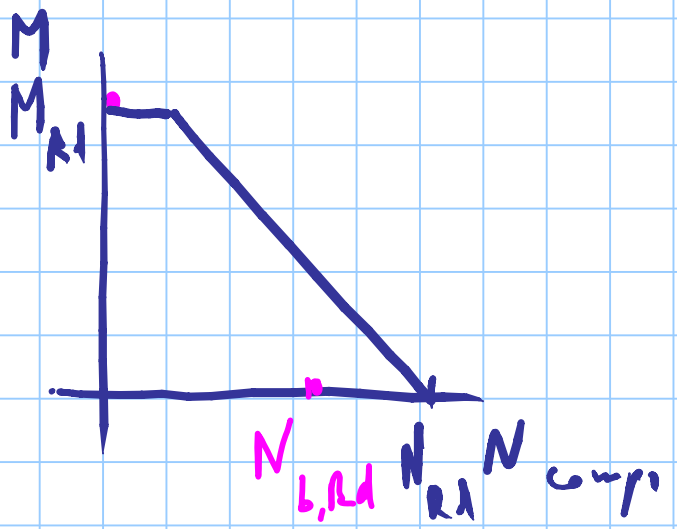
$$m = \frac{N_{Ed}}{N_{Rd}}$$

5m ≥ 1

$$\left(\frac{M_{Ed,y}}{M_{N,Rd,y}}\right)^2 + \left(\frac{M_{Ed,z}}{M_{N,Rd,z}}\right) \leq 1$$



Momento per M
(con N=0)

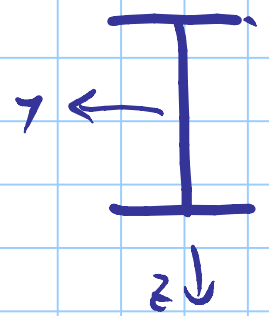


PRESSO FLESSIONE metodo A circolare

$$\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_{min}\cdot f_{yk}\cdot A}+\frac{M_{yeq,Ed}\cdot\gamma_{M1}}{f_{yk}\cdot W_y\cdot\left(1-\frac{N_{Ed}}{N_{cr,y}}\right)}+\frac{M_{zeq,Ed}\cdot\gamma_{M1}}{f_{yk}\cdot W_z\cdot\left(1-\frac{N_{Ed}}{N_{cr,z}}\right)}\leq 1$$

$$\frac{N_{Ed}}{N_{b,Rd}}+\frac{M_{y,Ed}}{M_{y,Rd}\left(1-\frac{N_{Ed}}{N_{cr,y}}\right)}+\frac{M_{z,Ed}}{M_{z,Rd}\left(1-\frac{N_{Ed}}{N_{cr,z}}\right)}\leq 1$$

HEB 240 $\quad$ S 235 $\Rightarrow \lambda_1 = 93.01$



$l_0 = 5655$ mm

$A = 106 \times 10^2$ mm^2 $\quad I_y = 11260 \times 10^4$ mm^4 $\quad I_z = 3923 \times 10^4$ mm^4

$i_y = 103.1$ mm

$i_z = 60.8$ mm $\quad \lambda_z = \dfrac{5655}{60.8} = 93.01 \Rightarrow \bar{\lambda}_z = 1$

$$N_{cr,z} = \frac{\pi^2 E I_z}{l_0^2} = \frac{3.14^2 \times 206000 \times 3923 \times 10^4}{5655^2} \times 10^{-3} = 2491 \text{ kN}$$

$$N_{Rd} = A \frac{f_y}{\gamma_{M0}} = 2372.4 \text{ kN}$$

$N_{cr,y} = 7162.8$ kN

$$N_{b,Rd} = \chi A \frac{f_y}{\gamma_{M1}} = 1280.9 \text{ kN}$$

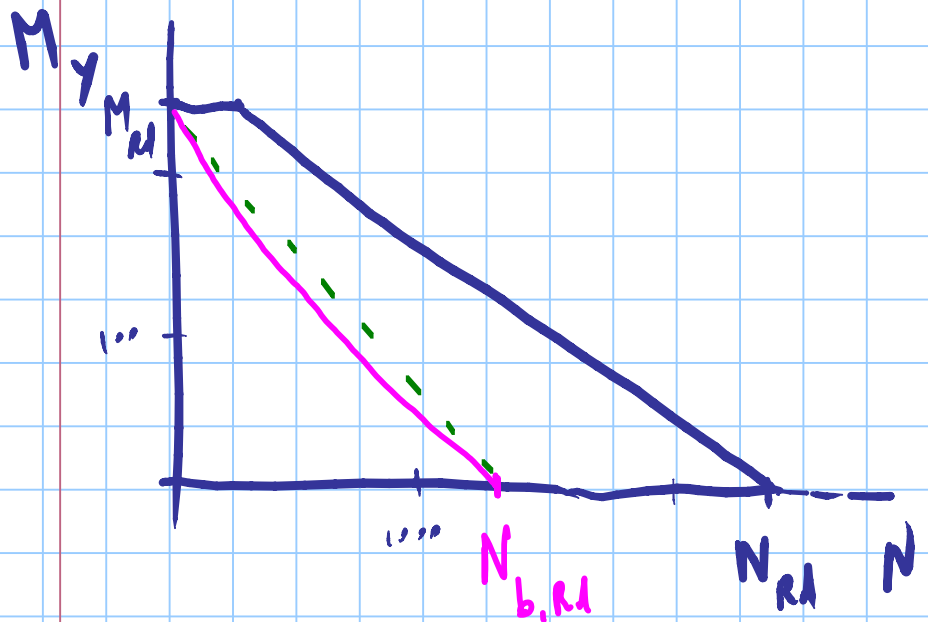
$W_{pl,y} = 1053 \times 10^3 \ mm^3$

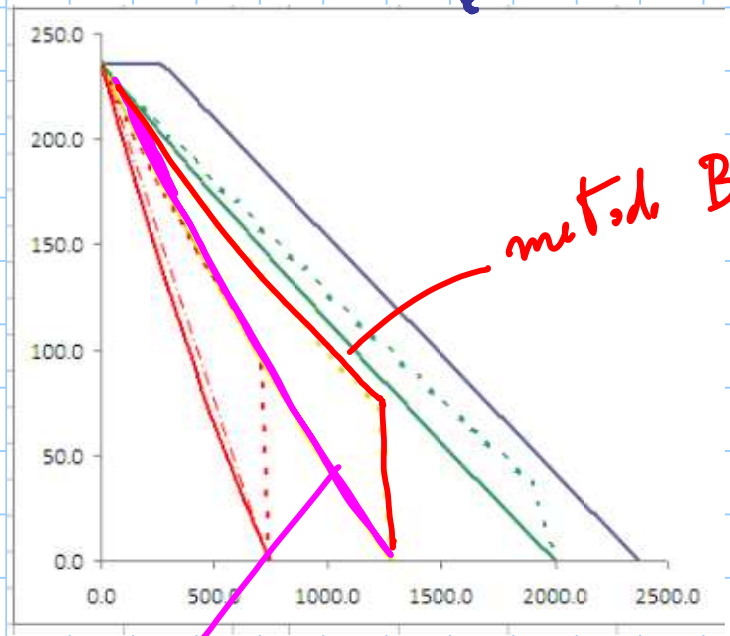
$a = 0.230$

$M_{Rd} = W_{pl,y} \dfrac{f_y}{\gamma_{M0}} = 235.7 \ kN_m$

$\dfrac{a}{2} N_{Rd} = 272.8 \ kN$

$M_z = 0$





$M_z = 0$

$$\frac{N_{Ed}}{N_{b,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}\left(1 - \frac{N_{Ed}}{N_{cr,y}}\right)} \leq 1$$

$N_{cr,y} = 7162,8$

$$M_{y,Rd,N} = \left(1 - \frac{N_{Ed}}{N_{b,Rd}}\right) M_{y,Rd}\left(1 - \frac{N_{Ed}}{N_{cr,y}}\right)$$

$N_{cr,y} = 7162,8$

$$\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}+k_{yy}\cdot\frac{M_{y,Ed}\cdot\gamma_{M1}}{\chi_{LT}\cdot W_y\cdot f_{yk}}+k_{yz}\cdot\frac{M_{z,Ed}\cdot\gamma_{M1}}{W_z\cdot f_{yk}}\le 1$$

$$\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_z\cdot A\cdot f_{yk}}+k_{zy}\cdot\frac{M_{y,Ed}\cdot\gamma_{M1}}{\chi_{LT}\cdot W_y\cdot f_{yk}}+k_{zz}\cdot\frac{M_{z,Ed}\cdot\gamma_{M1}}{W_z\cdot f_{yk}}\le 1$$

$$\frac{N_{Ed}}{N_{y,b,Rd}}+k_{yy}\frac{M_{y,Ed}}{M_{y,Rd}}+k_{yz}\frac{M_{z,Ed}}{M_{z,Rd}}\le 1$$

ni se $M_z=0$

$$\frac{N_{Ed}}{N_{z,b,Rd}}+k_{zy}\frac{M_{y,Ed}}{M_{y,Rd}}+k_{zz}\frac{M_{z,Ed}}{M_{z,Rd}}\le 1$$

$k_{zy}=0$ se $M_x=0$

k	Tipi di sezione	Sezioni di classe 3 e 4 (proprietà delle sezioni calcolate in campo elastico)	Sezioni di classe 1 e 2 (proprietà delle sezioni calcolate in campo plastico)
k_{yy}	I. H. Sezioni cave	$\alpha_{my}\cdot\left(1+0,6\cdot\bar{\lambda}_y\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)\le\alpha_{my}\cdot\left(1+0,6\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)$	$\alpha_{my}\cdot\left(1+(\bar{\lambda}_y-0,2)\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)\le\alpha_{my}\cdot\left(1+0,8\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)$
k_{yz}	I. H. Sezioni cave	k_{zz}	$0,6\cdot k_{zz}$
k_{zy}	I. H. Sezioni cave	$0,8\cdot k_{yy}$	$0,6\cdot k_{yy}$
k_{zz}	I. H	$\alpha_{mz}\cdot\left(1+0,6\cdot\bar{\lambda}_y\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)\le\alpha_{mz}\cdot\left(1+0,6\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)$	$\alpha_{mz}\cdot\left(1+(2\bar{\lambda}_y-0,6)\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)\le\alpha_{mz}\cdot\left(1+1,4\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)$
	Sezioni cave		$\alpha_{mz}\cdot\left(1+(\bar{\lambda}_y-0,2)\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)\le\alpha_{mz}\cdot\left(1+0,8\cdot\frac{N_{Ed}\cdot\gamma_{M1}}{\chi_y\cdot A\cdot f_{yk}}\right)$
Per pressoflessione retta, $M_{y,Ed}\neq 0$, $k_{zy}=0$ ($M_{z,Ed}=0$).			

* $M = \text{cost}$ $\quad \alpha = 1$ $\quad M_{z,Ed} = 0$

$$K_{yy} = 1 + (\bar{\lambda}_y - 0.2)\frac{N_{Ed}}{N_{y,b,Rd}} \le 1 + 0.8\frac{N_{Ed}}{N_{y,b,Rd}}$$

① $\dfrac{N_{Ed}}{N_{y,b,Rd}} + K_{yy} \dfrac{M_{y,Ed}}{M_{y,Rd}} \leq 1$

② $\dfrac{N_{Ed}}{N_{z,b,Rd}} \leq 1$

metodo B di circolare ad EC8

$N_{y,b,Rd}$ calcolato con

$\lambda_y = \dfrac{5655}{103.1} = 54.9$ $\quad \bar{\lambda}_y = 0.590$

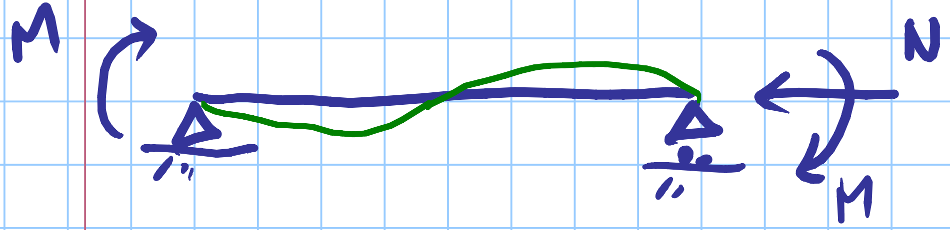
$N_{z,b,Rd}$ $\quad N_{y,b,Rd}$

$N_{y,b,Rd} = 1998$ kN

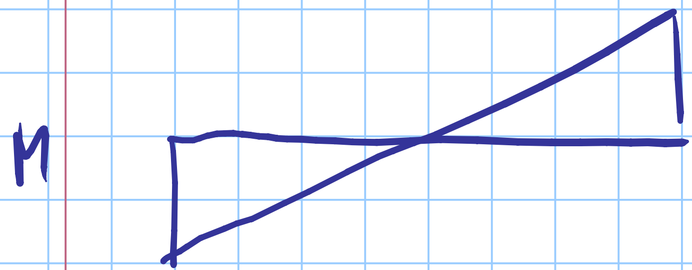
$$K_{yy} = 1 + \underbrace{(\bar{\lambda}_y - 0.2)}_{0.390} \frac{N_{Ed}}{N_{y,b,Rd}} \leq 1 + 0.8 \frac{N_{Ed}}{N_{y,b,Rd}}$$

$N_{Ed} = 500\,kN$	1.098
$N_{Ed} = 1000\,kN$	1.195

Se M non è costante

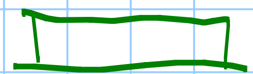


questo diagramma può addirittura aiutare (ritardare l'instabilità)

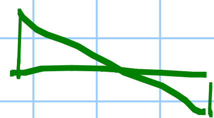


M_{Ed}

M = cost



$M_{eq} = M$



$M_{eq} = 0.4\, M_{max}$