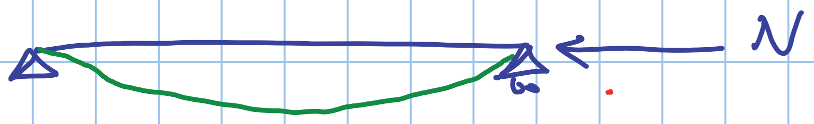
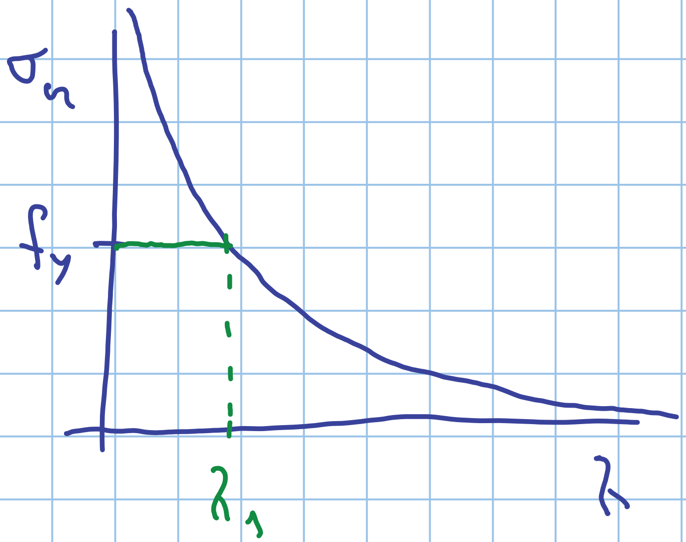
Titolo nota 07/11/2017



$$N_{cr} = \frac{\pi^2 E I}{\ell_0^2}$$

$$i = \sqrt{\frac{I}{A}} \qquad \lambda = \frac{\ell_0}{i}$$

$$\sigma_{cr} = \frac{\pi^2 E}{\lambda^2}$$

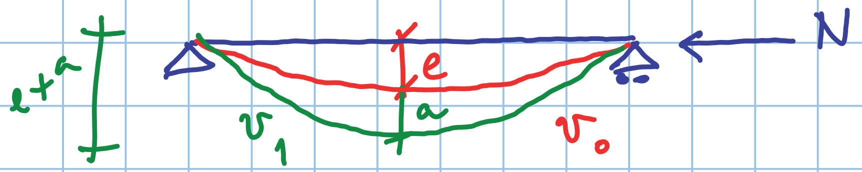


$$\lambda_1 = \pi \sqrt{\frac{E}{f_y}}$$

$$\bar{\lambda} = \frac{\lambda}{\lambda_1} = \sqrt{\frac{A f_y}{N_{cr}}}$$

$$\Downarrow$$

$$N_{cr} = \frac{A f_y}{\bar{\lambda}^2}$$



$$v_0 = e \sin \frac{\pi x}{L}$$

per $N = 0$
nessuna sollecitazione
o tensione

$$M = N v_0 \qquad \text{I ordine}$$

incremento di v

$$v_1 = a \sin \frac{\pi x}{L} \qquad v_1'' = -a \frac{\pi^2}{L^2} \sin \frac{\pi x}{L}$$

$$M = N (v_0 + v_1) \qquad \text{II ordine}$$

$$M = -EI v_1''$$

$$-EI v_1'' = N (v_0 + v_1)$$

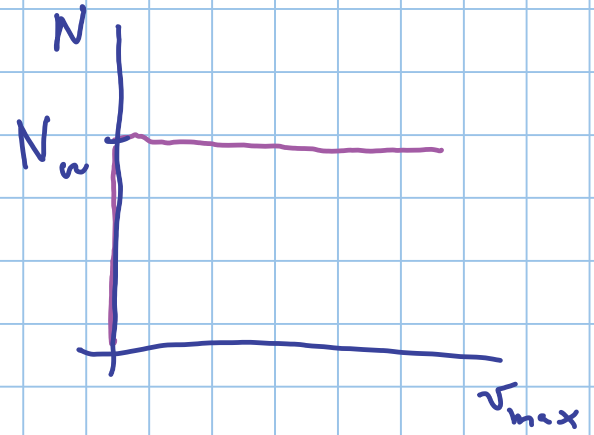
$$EI a \frac{\pi^2}{L^2} \cancel{\sin \frac{\pi x}{L}} = N (e + a) \cancel{\sin \frac{\pi x}{L}}$$

$$a N_{cr} = N(e+a) \qquad a(N_{cr} - N) = N e$$

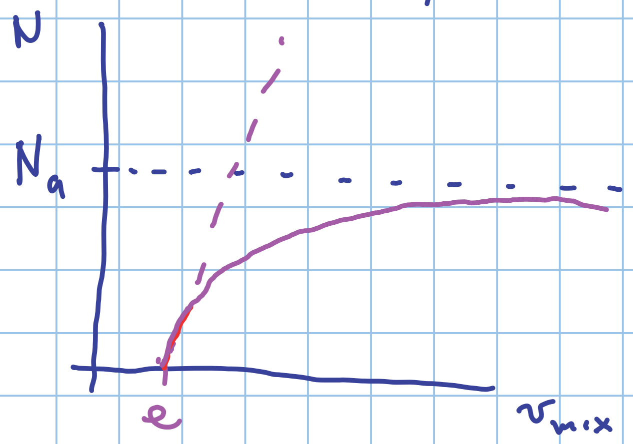
$$a = \frac{N}{N_{cr} - N}\, e$$

$$e + a = e + \frac{N}{N_{cr} - N}\, e = \frac{N_{cr} - \cancel{N} + \cancel{N}}{N_{cr} - N}\, e = \frac{1}{1 - N/N_{cr}}\, e$$

asta ideale



asta reale, materiale elastico lineare (ideale)



$$\sigma_{max} = \frac{N}{A} + \frac{M}{W} \qquad M = N(e+a) = N \frac{1}{1 - N/N_{cr}} e$$

$$\sigma_{max} = \frac{N}{A} + \frac{N}{W} \frac{1}{1 - N/N_{cr}} e =$$

$$= \frac{N}{A} \left[1 + \underbrace{\frac{A}{W} e}_{\eta} \frac{1}{1 - N/N_{cr}} \right] =$$

$$= \frac{N}{A} \frac{1 - N/N_{cr} + \eta}{1 - N/N_{cr}}$$

N massimo che può portare la sezione è quello per cui

$\sigma_{max} = f_y$ $\qquad N_b$

$$f_y = \frac{N_b}{A} \frac{1 + \eta - N_b/N_{cr}}{1 - N_b/N_{cr}}$$

$$1 - \frac{N_b}{N_{cr}} = \frac{N_b}{A f_y} \left[1 + \eta - \frac{N_b}{N_{cr}} \right] \qquad N_{cr} = \frac{A f_y}{\bar{\lambda}^2}$$

$$1 - \frac{N_b}{A f_y} \bar{\lambda}^2 = \frac{N_b}{A f_y} \left[1 + \eta - \frac{N_b}{A f_y} \bar{\lambda}^2 \right] \qquad \frac{N_b}{A f_y} = \chi$$

$$1 - \bar{\lambda}^2 x = x \left[1 + \eta - \bar{\lambda}^2 x \right]$$

$$1 - \bar{\lambda}^2 x = x(1+\eta) - \bar{\lambda}^2 x^2$$

$$\bar{\lambda}^2 x^2 - \left(1 + \eta + \bar{\lambda}^2\right) x + 1 = 0 \qquad \phi = \frac{1}{2}\left(1 + \eta + \bar{\lambda}^2\right)$$

$$\bar{\lambda}^2 x^2 - 2\phi x + 1 = 0$$

$$x = \frac{\phi \pm \sqrt{\phi^2 - \bar{\lambda}^2}}{\bar{\lambda}^2} \cdot \frac{\phi + \sqrt{\phi^2 - \bar{\lambda}^2}}{\phi + \sqrt{\phi^2 - \bar{\lambda}^2}} = \frac{\cancel{\phi^2} - \cancel{\phi^2} + \bar{\lambda}^2}{\bar{\lambda}^2 \left[\phi + \sqrt{\phi^2 - \bar{\lambda}^2}\right]}$$

$$x = \frac{1}{\phi + \sqrt{\phi^2 - \bar{\lambda}^2}}$$

$$N_b = \chi A f_y$$

$$N_{b,R1} = \chi A \frac{f_y}{\gamma_{M1}}$$

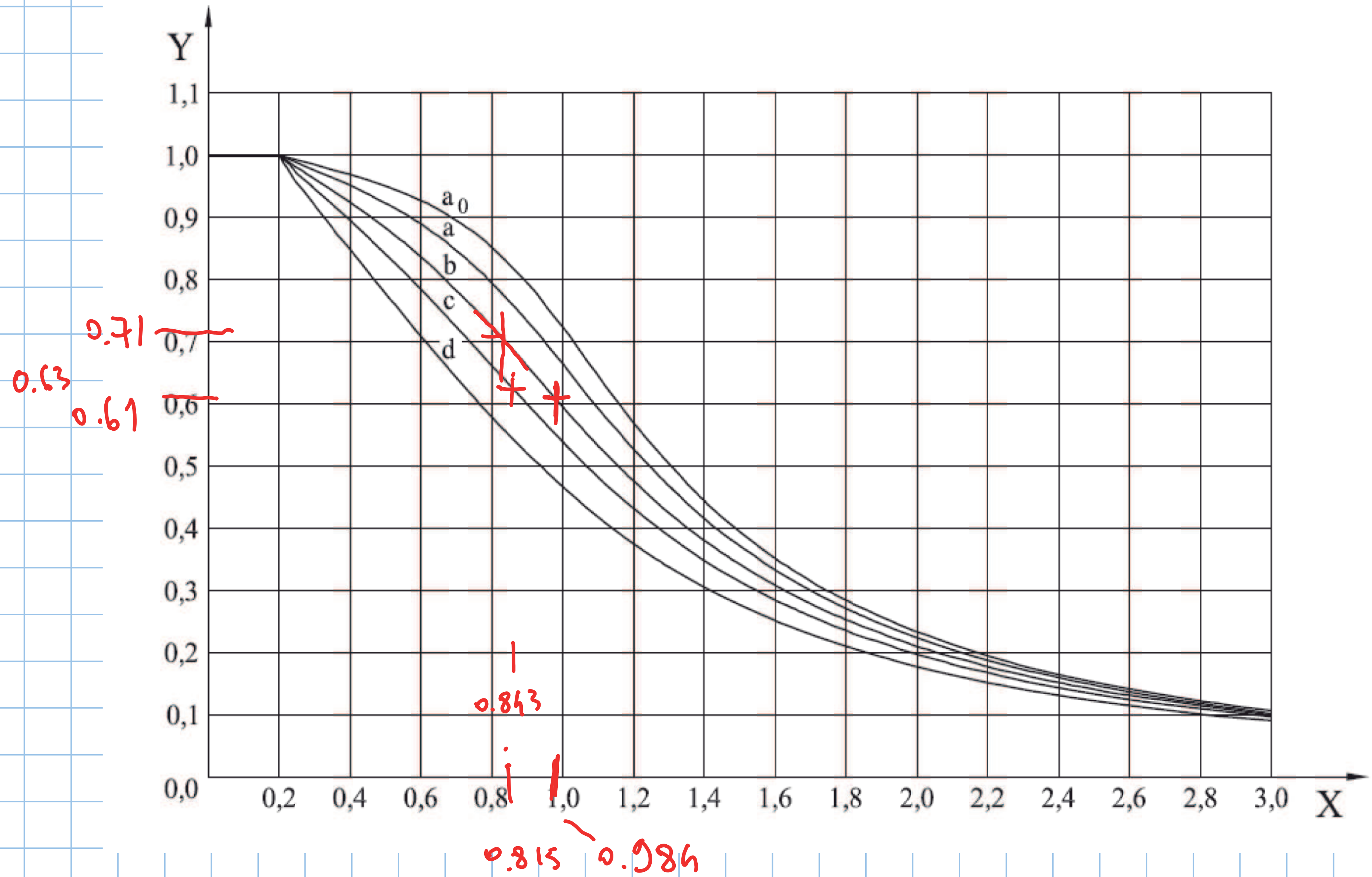
$$\chi = \frac{1}{\phi + \sqrt{\phi^2 - \bar{\lambda}^2}}$$

$$A \geq \frac{N_{Ed}\,\gamma_{M1}}{\chi f_y}$$

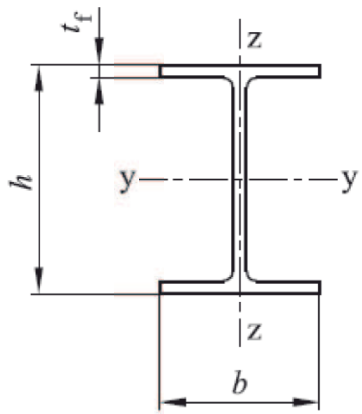
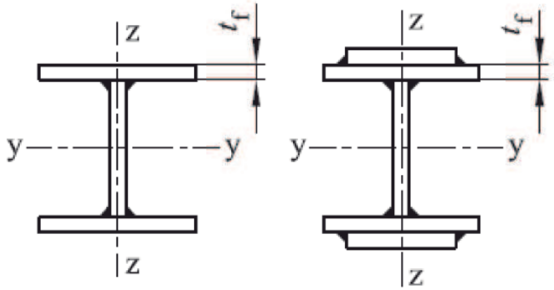
$$\phi = \frac{1}{2}\left[1 + \eta + \bar{\lambda}^2\right]$$

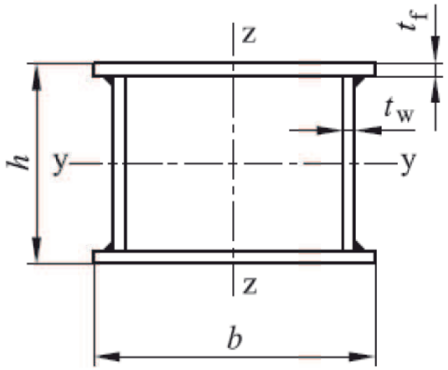
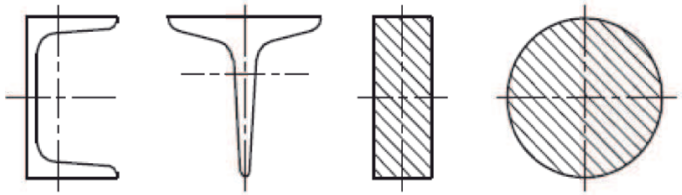
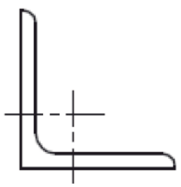
$$\eta = \alpha(\bar{\lambda} - 0.2)$$

$$\phi = \frac{1}{2}\left[1 + \alpha(\bar{\lambda} - 0{,}2) + \bar{\lambda}^2\right]$$

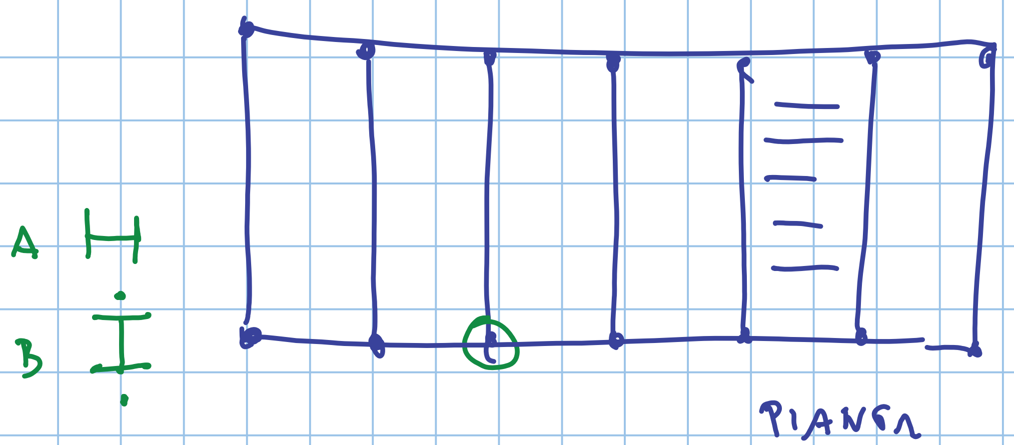

Y
1,1
1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0,0
0,2
0,4
0,6
0,8
1,0
1,2
1,4
1,6
1,8
2,0
2,2
2,4
2,6
2,8
3,0
X
a0
a
b
c
d
0.71
0.63
0.61
0.843
0.815
0.984

prospetto 6.2 **Selezione della curva di instabilità per una sezione trasversale**

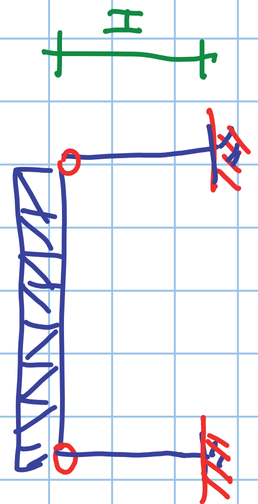
Sezione trasversale		Limiti		Instabilità intorno all'asse	Curva di instabilità	
					S 235 S 275 S 355 S 420	S 460
Sezioni laminate		$h/b > 1,2$	$t_f \leq 40$ mm	y - y z - z	*a* *b*	a_0 a_0
			40 mm < $t_f \leq 100$ mm	y - y z - z	*b* *c*	*a* *a*
		$h/b \leq 1,2$	$t_f \leq 100$ mm	y - y z - z	*b* *c*	*a* *a*
			$t_f > 100$ mm	y - y z - z	*d* *d*	*c* *c*
Sezioni saldate		$t_f \leq 40$ mm		y - y z - z	*b* *c*	*b* *c*
		$t_f > 40$ mm		y - y z - z	*c* *d*	*c* *d*

Sezioni tubolari		Laminate a caldo	qualunque	*a*	a_0
		Formate a freddo	qualunque	*c*	*c*
Sezioni a cassone saldate		In generale (ad eccezione di quanto riportato sotto)	qualunque	*b*	*b*
		Saldature spesse: $a > 0,5\ t_f$ $b/t_f < 30$ $h/t_w < 30$	qualunque	*c*	*c*
Sezioni a U, T e sezioni piene			qualunque	*c*	*c*
Sezioni a L			qualunque	*b*	*b*

CAPANNONE



$$N_{b,Rd} = 0.61 \times 149.1 \times 10^2 \times \frac{235}{1.05} \times 10^{-3} = 2035.6 \text{ kN}$$

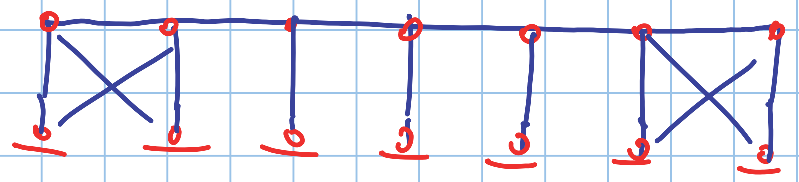


$\alpha_0 = 2$

$$\lambda = \frac{12 \times 10^3}{12.99 \times 10} = 92.38$$

$\bar{\lambda} = 0.984$

curva b



$l_0 = H$

$$\lambda = \frac{6 \times 10^3}{7.58 \times 10} = 79.16$$

$\bar{\lambda} = 0.843$

curva c

$H = 6.00$ m

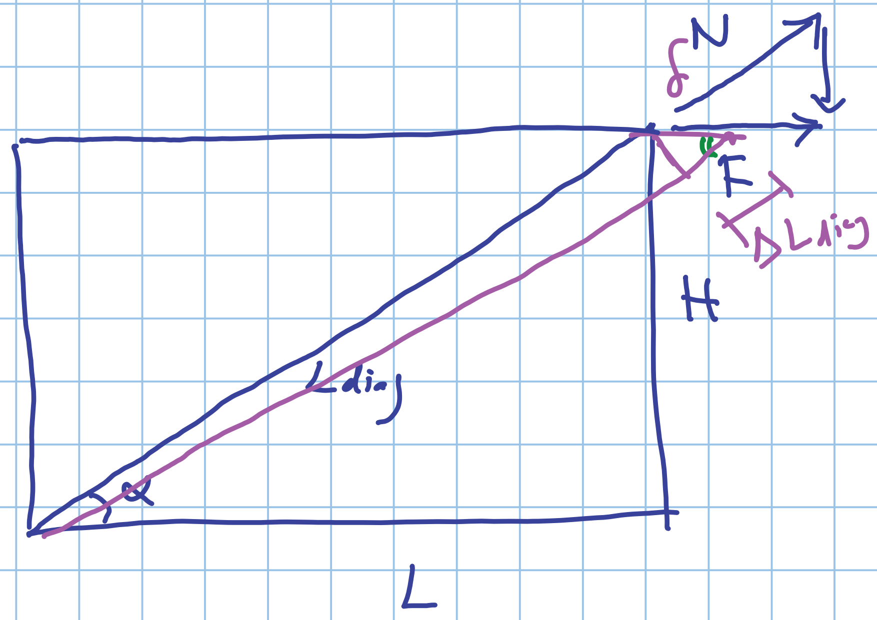
HEB 300

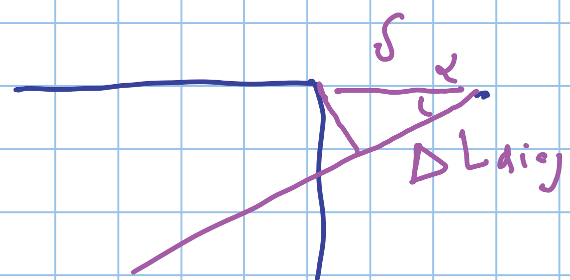
$A = 149.1 \times 10^2$ mm^2

$i_y = 12.99 \times 10$ mm

$i_z = 7.58 \times 10$ mm

S235 $\lambda_1 = 93.9$





$$tg\,\alpha = \frac{H}{L}$$

$$N = \frac{F_k}{\cos\alpha}$$

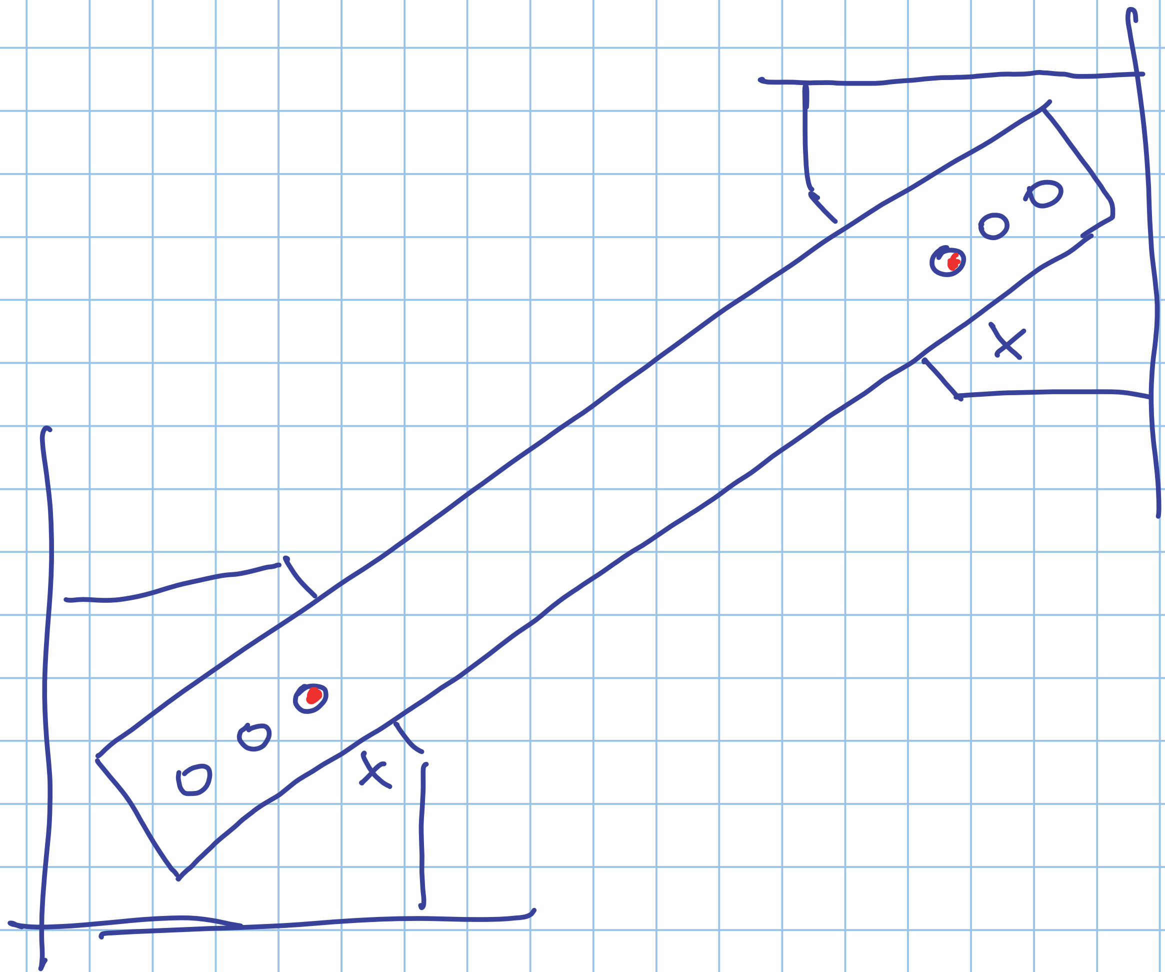
$$\Delta L_d = \frac{N\,L_{diag}}{EA}$$

$$\delta = \frac{\Delta L_{diag}(+2\,mm)}{\cos\alpha}$$

Nota: F_k

è in realtà $\sum F_k$

taglio di piano


x
x