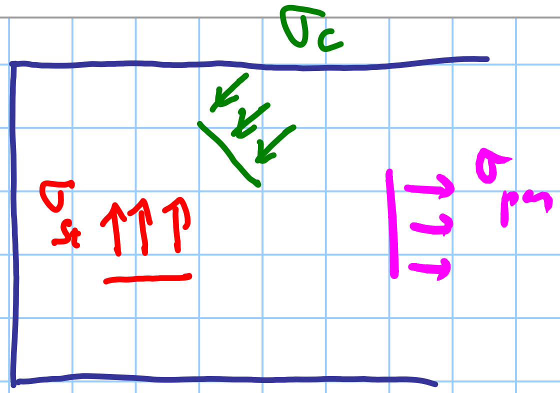
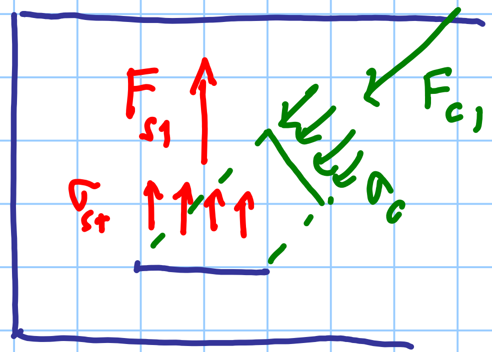
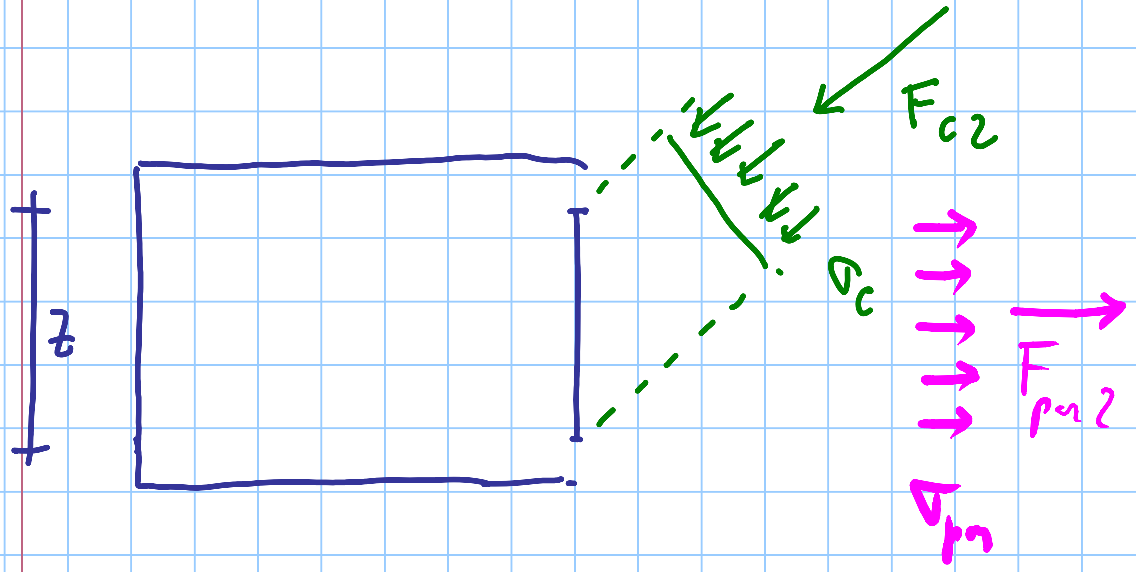
Titolo nota 12/05/2015





equil. Trasl. verticale

$$F_{c1}\,\frac{\sqrt{2}}{2} = F_{s1} \Rightarrow \text{relazione tra } \sigma_c \text{ e } \sigma_{st}$$



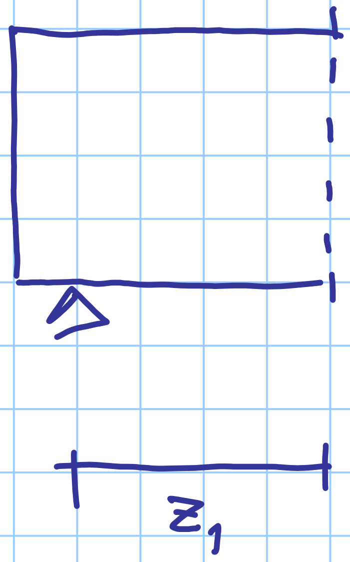
$$F_{c2} = V \frac{\sqrt{2}}{2}$$

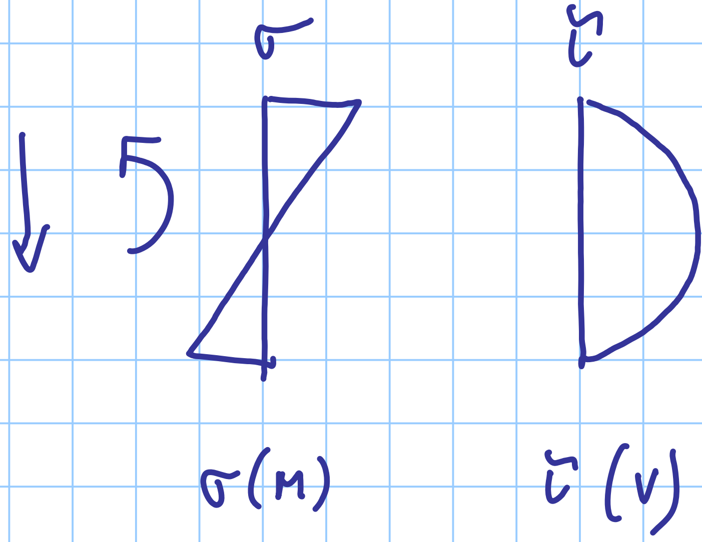
relazione tra σ_c e V

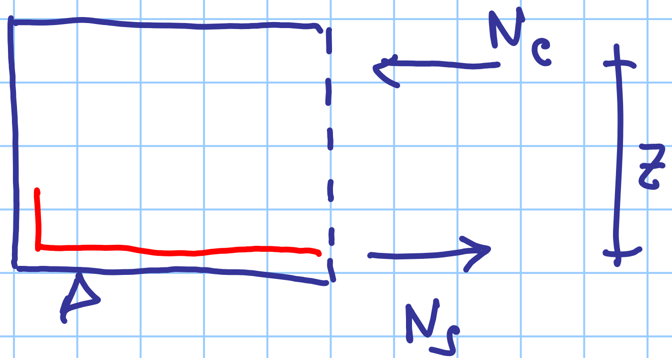
Equilibrio tra tensioni e V
alla trasla. verticale

Equilibrio alla traslazione orizzontale
NON RISPETTATO se solo staffe

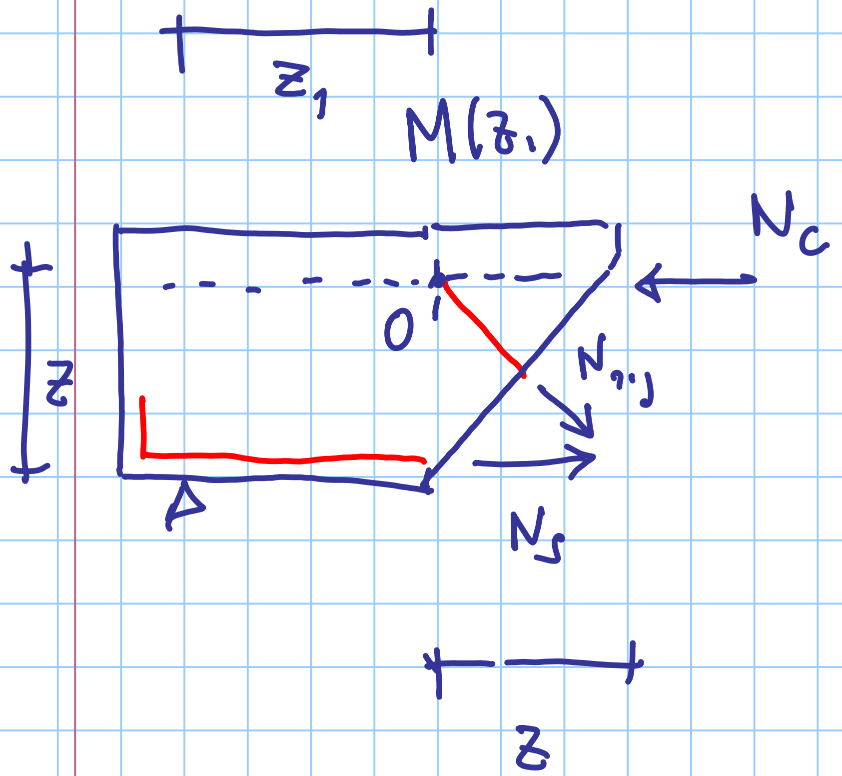
serve armatura
orizzontale

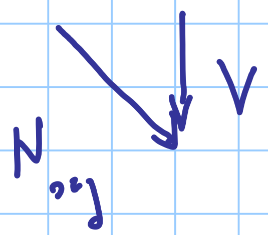






$$N_s = \frac{M(z_1)}{Z}$$

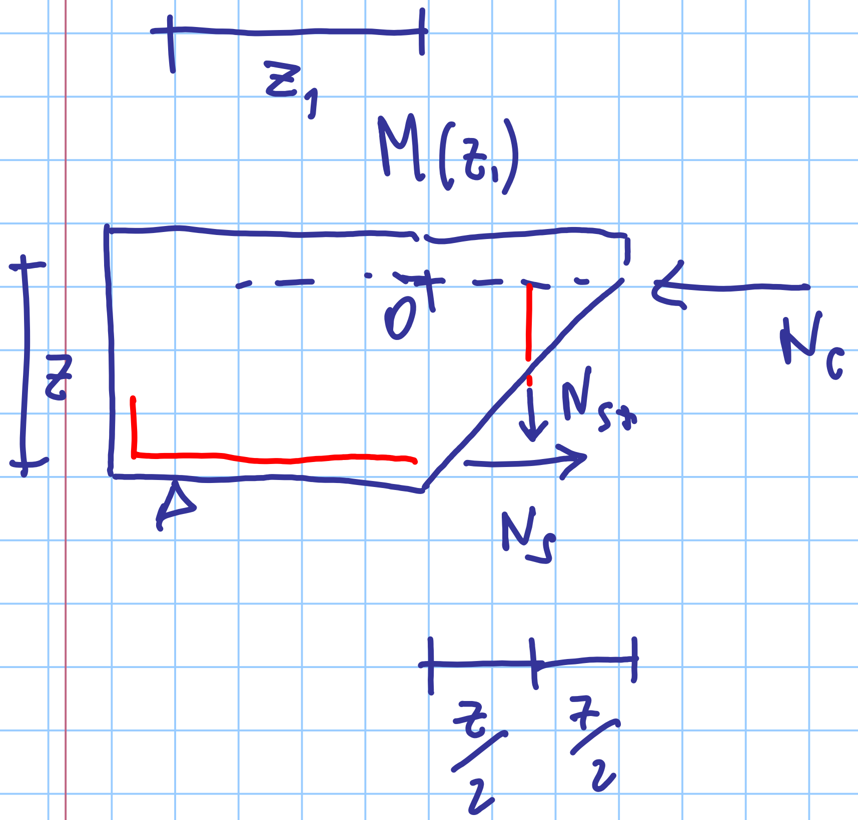




Equilibrio rotazione intorno O

$$N_s \, z = M(z_1)$$

$$N_s = \frac{M(z_1)}{z}$$



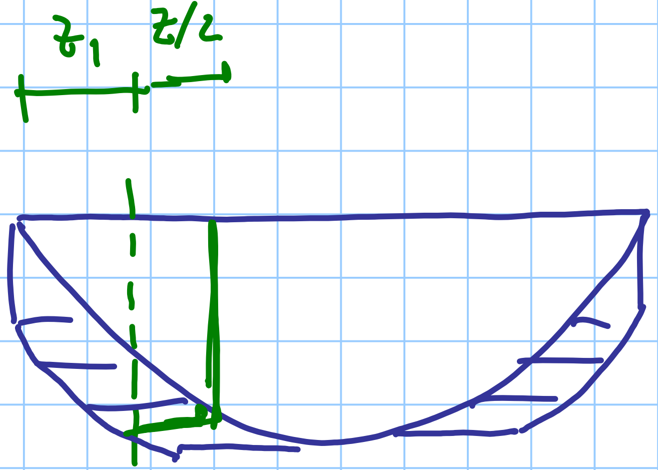
$$\downarrow N_{st} = V$$

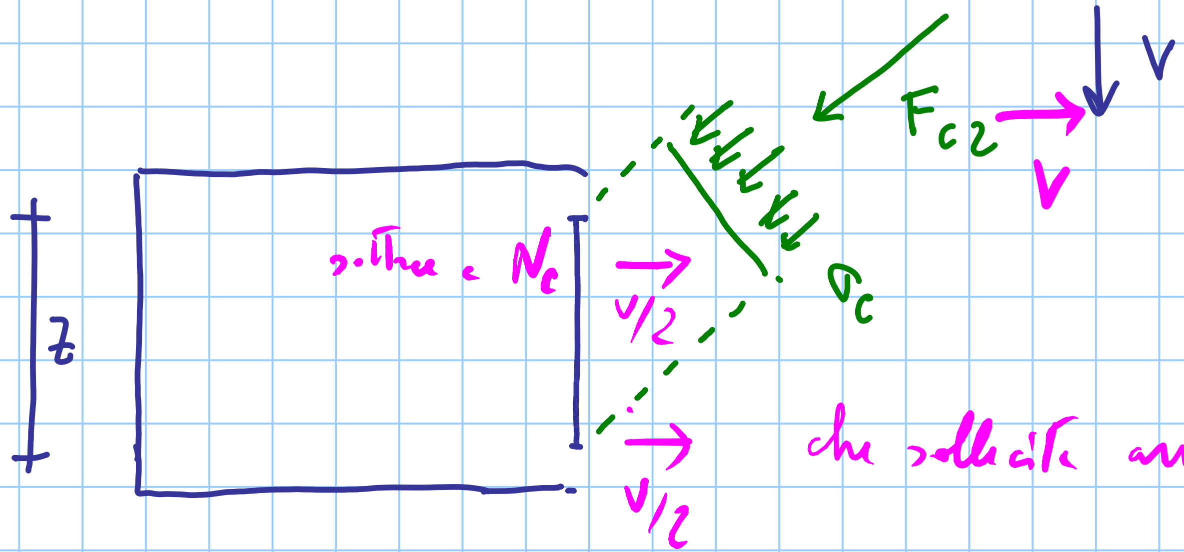
$$N_s\, z - N_{st}\,\frac{z}{2} = M(z_1)$$

$$N_s = \frac{M(z_1) + V\,z/2}{z} = \frac{M(z_1 + z/2)}{z}$$

TRASLAZIONE DEL DIAGR. DEL MOMENTO

Traslazione di M





che sollecita armat. inf

arm. inf. $\quad \frac{M}{z} + \frac{V}{2} = \frac{M + V z/2}{z}$ $\quad$ come sopra

STATO LIMITE ULTIMO

modello lineare

modello non lineare SLU

$\tau \leq \tau_{c0}$

non occorre armatura a taglio

$V_{Ed} \leq V_{Rd,c}$

$\tau_{c0} < \tau \leq \tau_{c1}$

occorre armare a taglio

$V_{Rd,c} < V_{Ed} \leq V_{Rd,max}$

$\hookrightarrow \sigma_{st} \leq \bar{\sigma}_s$

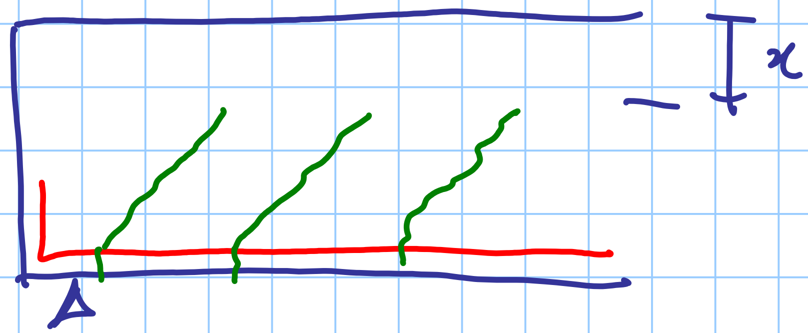
$\hookrightarrow V_{Ed} \leq V_{Rd,s}$

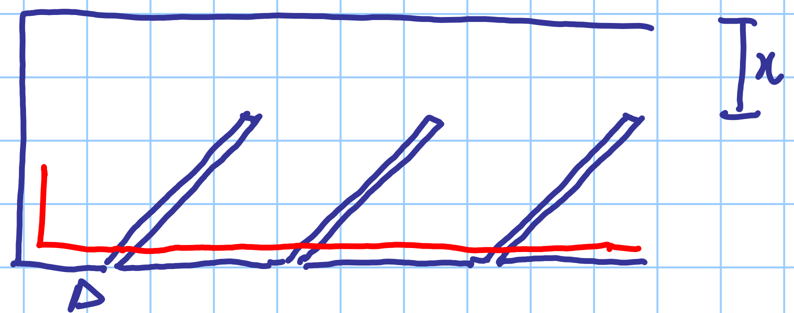
$\tau > \tau_{c1}$

la sezione di cls non va bene

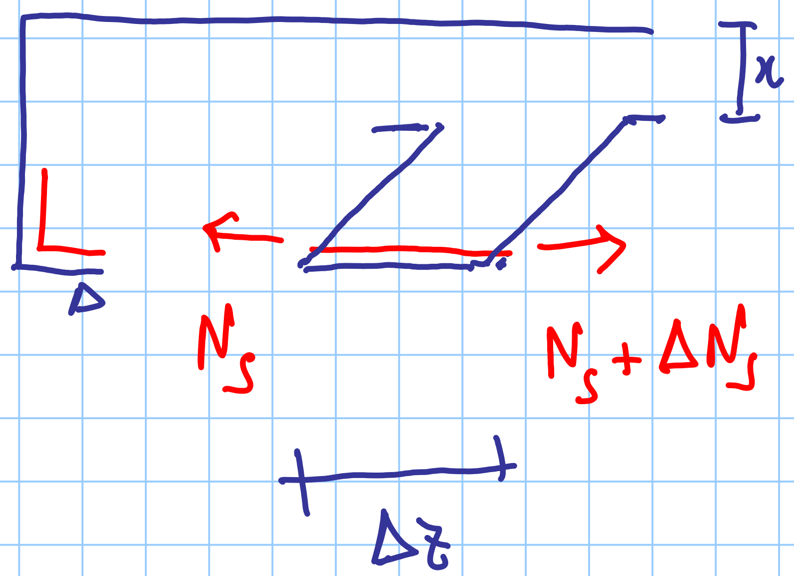
$V_{Ed} > V_{Rd,max}$

RESISTENZA A TAGLIO IN ASSENZA di armature a taglio



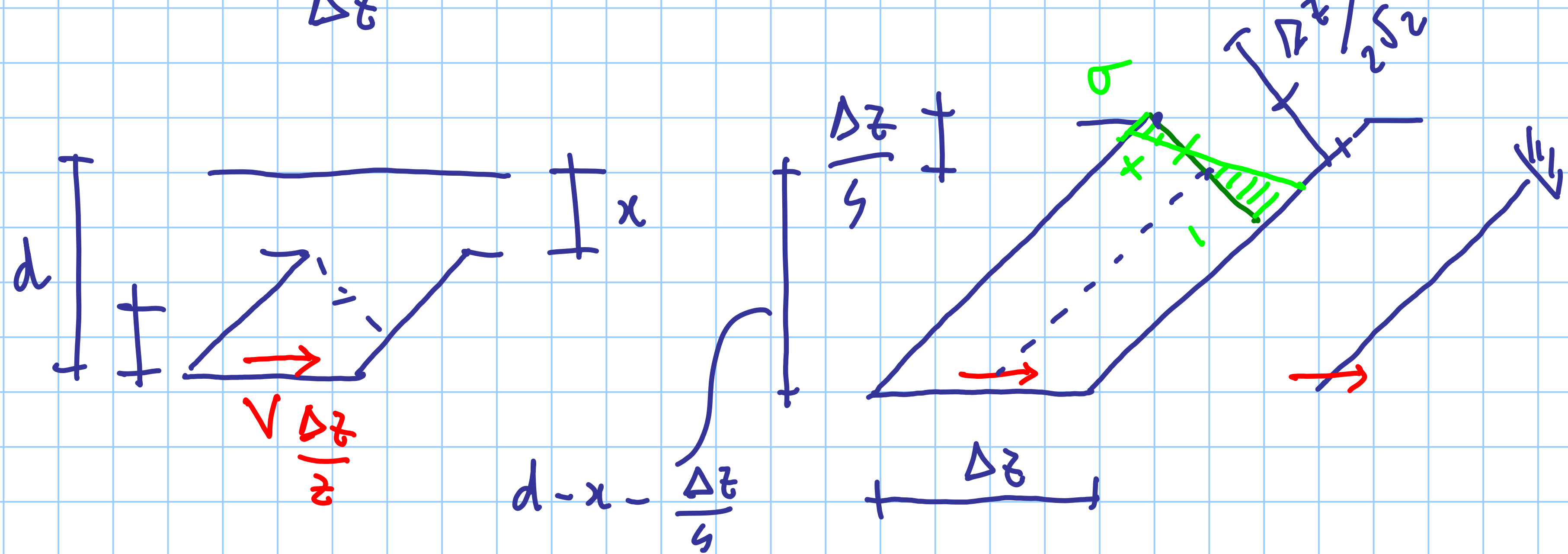


"MODELLO A PETTINE"



$$N_s = \frac{M}{z}$$

$$\Delta N_s = \frac{\Delta M}{z} = \frac{V\,\Delta z}{z}$$



$$N = -\frac{V \Delta z}{z\sqrt{2}}$$

$$M = -\frac{V \Delta z}{z}\left(d - x - \frac{\Delta z}{4}\right)$$

$$\sigma = \frac{N}{A} + \frac{M}{I} y$$

$$A = b\frac{\Delta z}{\sqrt{2}}$$

$$I = \frac{b}{12}\left(\frac{\Delta z}{\sqrt{2}}\right)^3$$

$$z = 0{,}9\ d$$

$$x = 0.2\ d$$

$$y = -\frac{\Delta z}{2\sqrt{2}}$$

$$\Delta z = d$$

$$N = -\frac{V\,\Delta z}{z\sqrt{2}} = -\frac{V}{0{,}9\sqrt{2}}$$

$$M = -\frac{V\,\Delta z}{z}\left(d - x - \frac{\Delta z}{4}\right) = -\frac{V}{0.9}\,0.55\,d$$

$$A = b\,\frac{\Delta z}{\sqrt{2}} = \frac{b\,d}{\sqrt{2}}$$

$$I = \frac{b}{12}\left(\frac{\Delta z}{\sqrt{2}}\right)^3 = \frac{b\,d^3}{24\sqrt{2}}$$

$$y = -\frac{\Delta z}{2\sqrt{2}} = -\frac{d}{2\sqrt{2}}$$

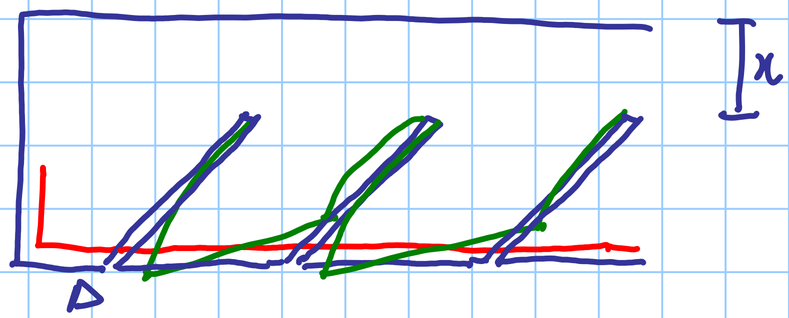
$$\sigma = \frac{N}{A} + \frac{M}{I}\,y = \frac{-\dfrac{V}{0.9\cancel{\sqrt{2}}}}{\dfrac{b\,d}{\cancel{\sqrt{2}}}} - \frac{-\dfrac{0.55\,V\,\cancel{d}}{0.9}}{\dfrac{b\,d^{\cancel{3}}}{\cancel{24}^{\,12}\,\cancel{\sqrt{2}}}}\;\frac{\cancel{d}}{\cancel{2}\,\cancel{\sqrt{2}}} =$$

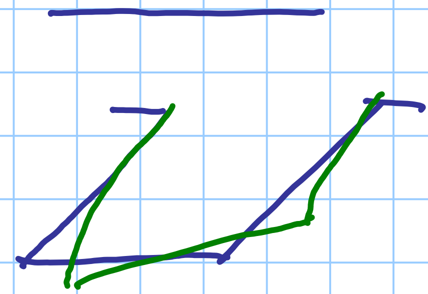
$$= -\frac{V}{0.9\,b\,d} + \frac{0.55\times 12\;V}{0.9\,b\,d} = \frac{5.6\;V}{0.9\,b\,d} = \frac{6.2\;V}{b\,d}$$

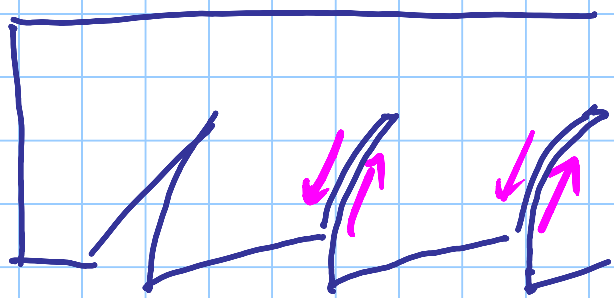
$$\sigma \le f_{cfd} = 1.6\,f_{ctd}$$

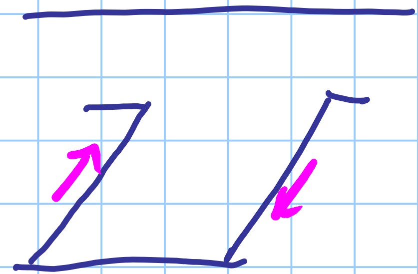
dipende da f_{cd}

$$\frac{6.2\;V}{b\,d} \le 1.6\,f_{ctd} \quad \Rightarrow \quad V \le 0.25\,b\,d\,f_{ctd}$$



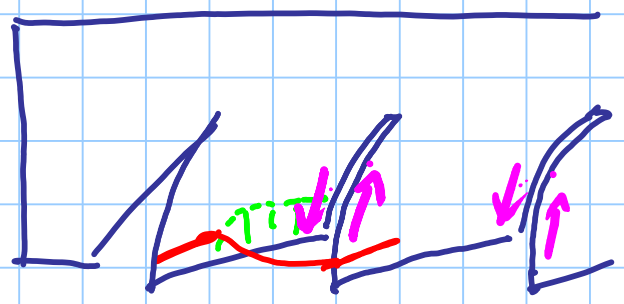






INGRANAMENTO
DEGLI INERTI (funzione di d)

M che riduce l'effett. di $\frac{V \Delta z}{z}$



espulsione di cls

EFFETTO SPINOTTO

BIETTA

(funzione di $\frac{A_s}{bd} = \rho_l$)

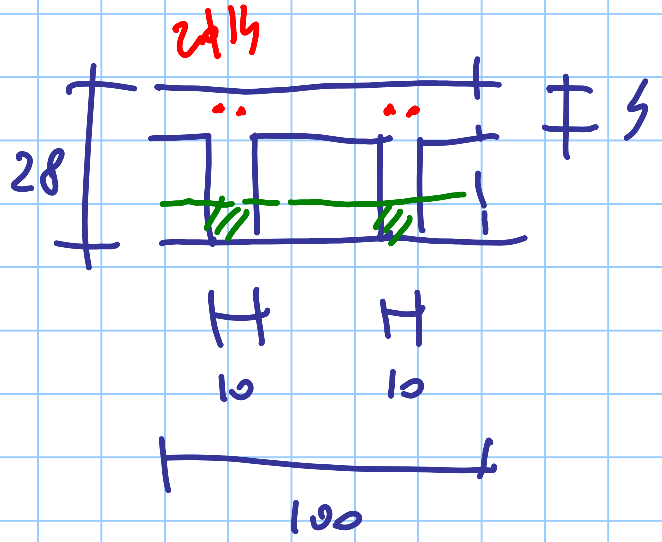
$$V_{Rd,c} = 0.18\, k \,\frac{\sqrt[3]{100\, \rho_\ell\, f_{ck}}}{\gamma_c}\, b\, d$$

$$= 0.035 \sqrt{k^3 f_{ck}}\, b\, d$$

$$\rho_\ell = \frac{A_s}{b\, d} \leq 0.02 \qquad k = 1 + \sqrt{\frac{200}{d}} \leq 2$$

$d \rightarrow \text{mm}$

Es.



all'appoggio

$C25/30 \Rightarrow f_{ck} = 25\ MPa$

$d = 24\ cm$

$$K = 1 + \sqrt{\frac{200}{240}} = 1.913$$

$A_{sl} = 4\phi14 = 6.16\ cm^2$

$b = 20\ cm$

$d = 24\ cm$

$$\rho_l = \frac{6.16}{20 \times 24} = 0.0128$$

$$0.18\,K\,\frac{\sqrt[3]{100\,\rho_l\,f_{ck}}}{\gamma_c} = 0.18 \times 1.913 \times \frac{\sqrt[3]{100 \times 0.0128 \times 25}}{1.5} =$$

$$= 0.728$$

$$0.035\sqrt{K^3 f_{ck}} = 0.035\sqrt{1.913^3 \times 25} = 0.463$$

$$V_{Rd,c} = \underset{MPa}{0.728} \times \underset{cm}{20} \times \underset{cm}{24} / 10 = 34.94 \text{ KN}$$

$$V_{Rd,c} = \left[\frac{0.18\, k \sqrt[3]{100 \rho_l f_{ck}}}{\gamma_c} + 0.15\, \sigma_c \right] b\, d$$

$$= \left[0.035 \sqrt{k^3 f_{ck}} + 0.15\, \sigma_c \right] b\, d$$

$$\sigma_c = \frac{N}{b\, d}$$ positive in compression