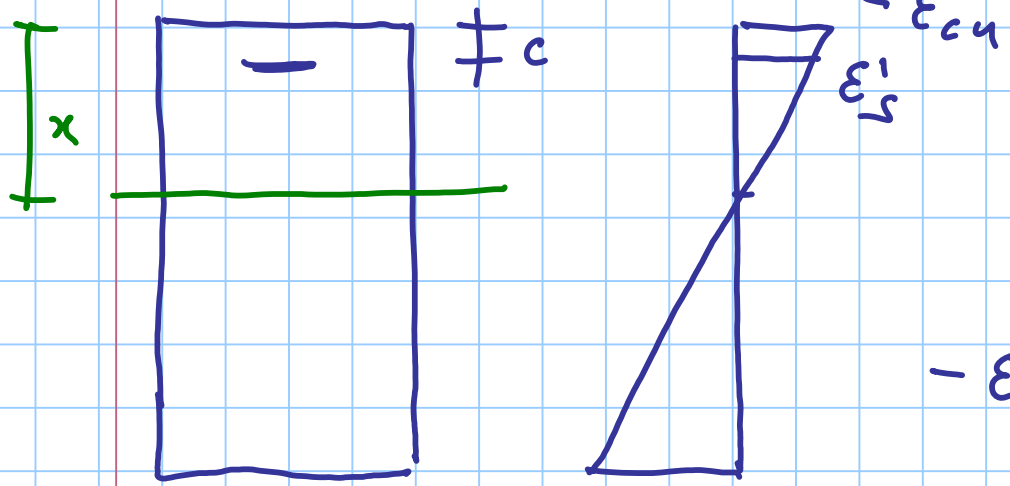
Titolo nota 15/04/2015

ε



$$\varepsilon_s' = -\frac{x-c}{x}\,\varepsilon_{cu}$$

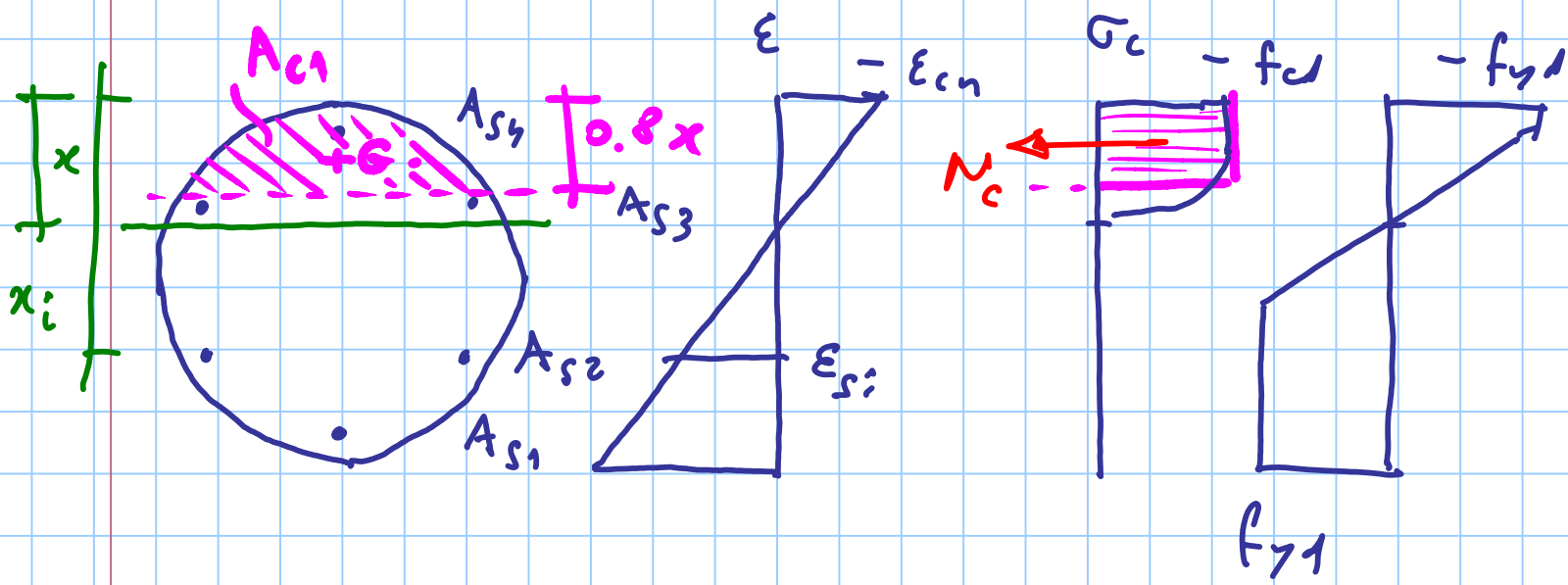
$$-\varepsilon_{y1} = -\frac{x-c}{x}\,\varepsilon_{cu}$$

$$\varepsilon_{y1}\,x = (x-c)\,\varepsilon_{cu} \qquad (\varepsilon_{y1}-\varepsilon_{cu})\,x = -c\,\varepsilon_{cu}$$

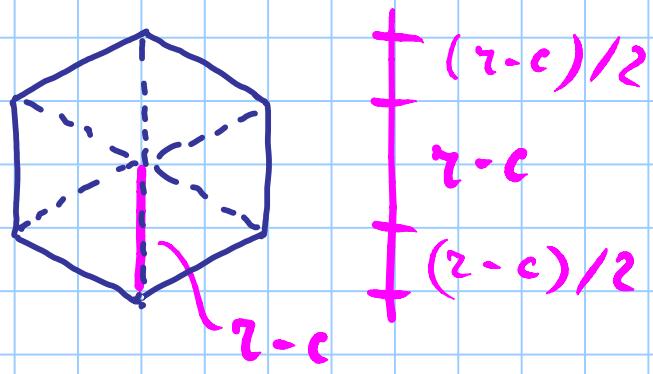
$$x = \frac{\varepsilon_{cu}}{\varepsilon_{cu}-\varepsilon_{y1}}\,c = \frac{0.0035}{0.0035-0.001956}\,c$$

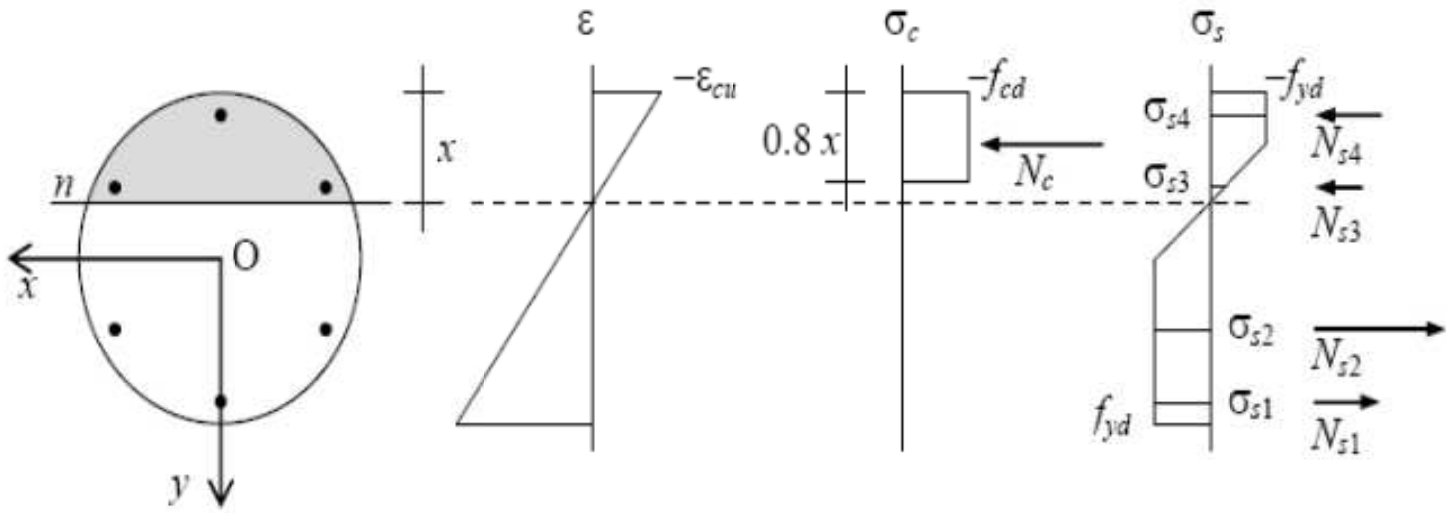
$$x = 2.27\,c \qquad \text{anche } x \quad x \geq 2.27\,c$$

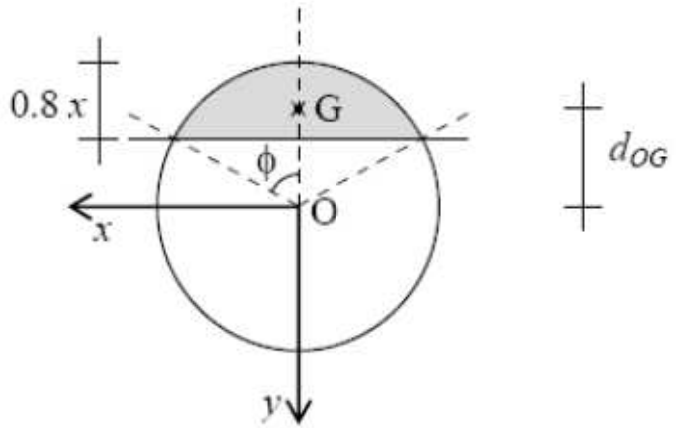
SEZIONE CIRCOLARE



$$N_c = -A_{c1} f_{cd} \qquad \varepsilon_{si} = \frac{x_i - x}{x} \varepsilon_{cu}$$





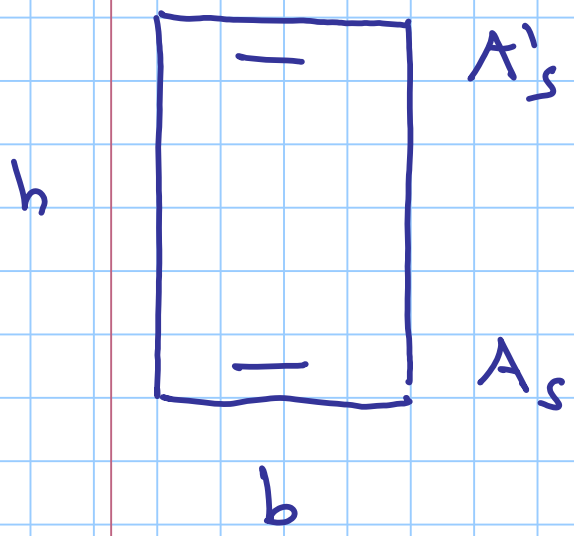


$$\phi = \arccos\frac{r - 0.8\,x}{r}$$

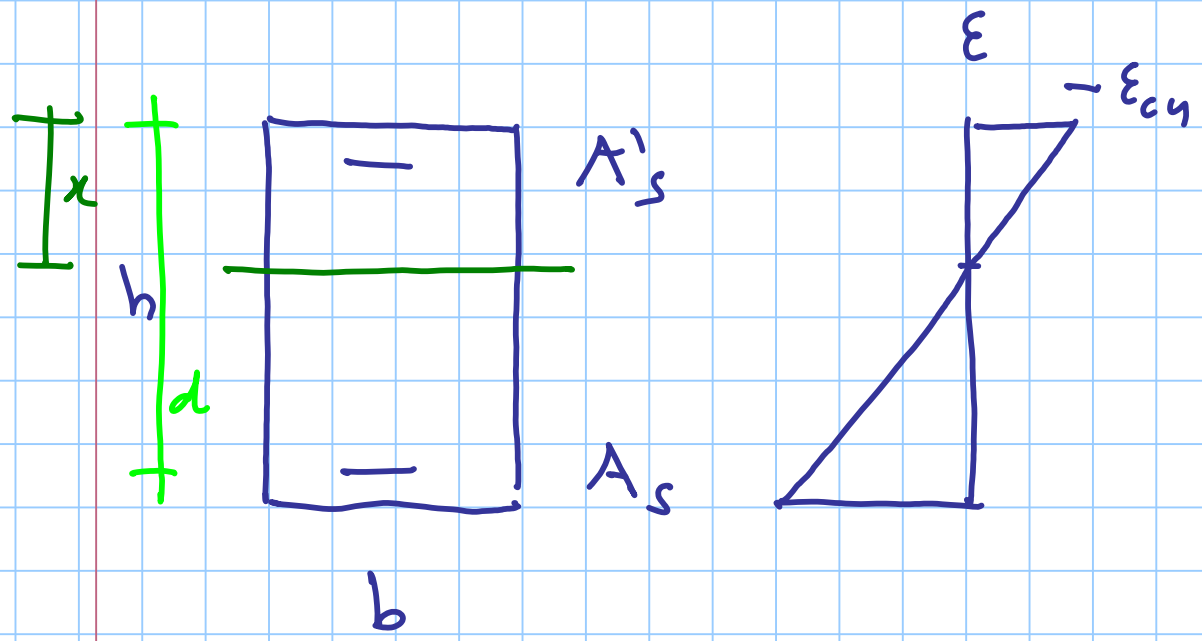
$$A = \frac{r^2}{2}(2\,\phi - \sin 2\phi)$$

$$d_{OG} = \frac{2}{3}\frac{r^3 \sin^3\phi}{A}$$

PROGETTO

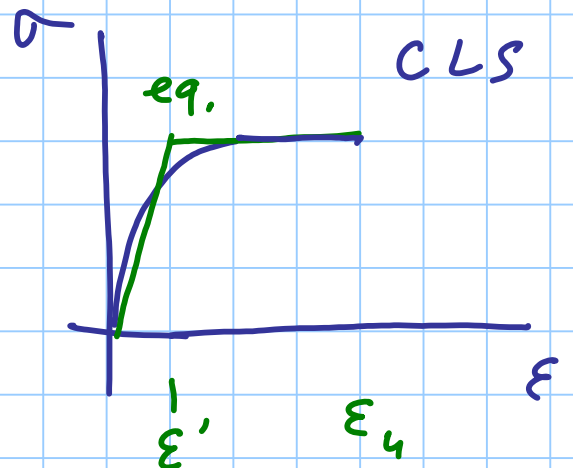


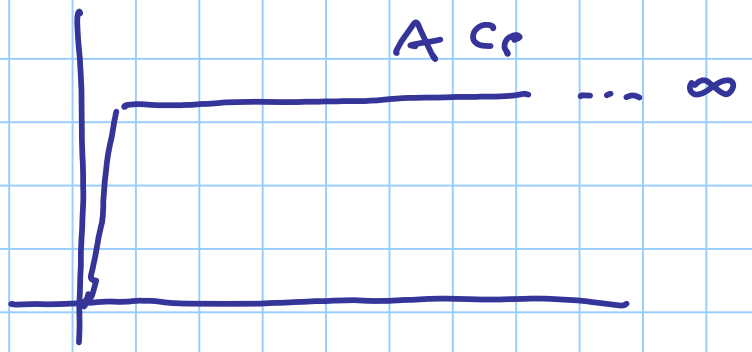
b, h, A_s, A'_s incognite



x è un dato

(meglio $\frac{x}{d}$ è un dato)

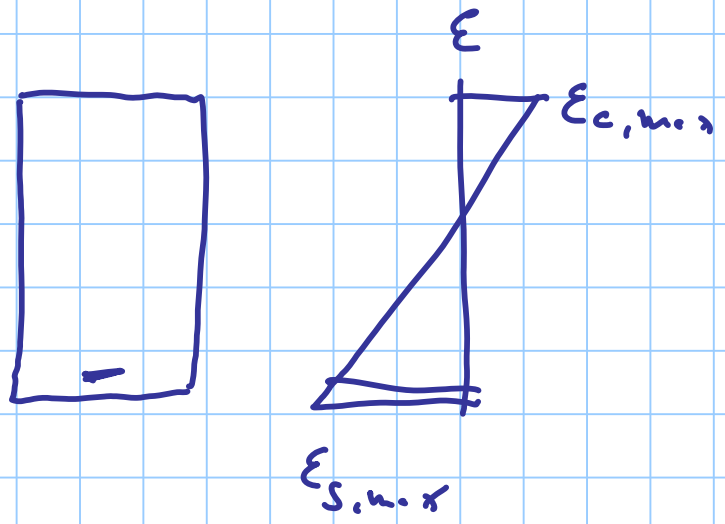


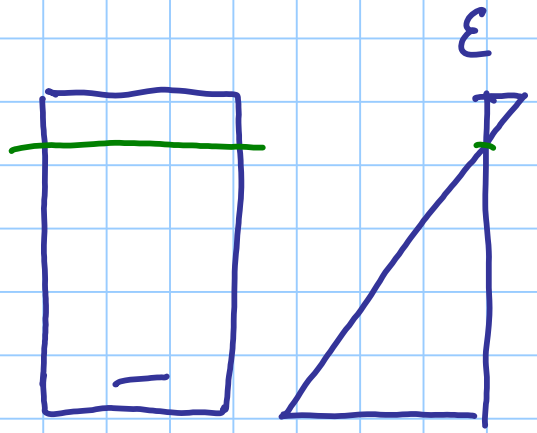


duttilità infinita

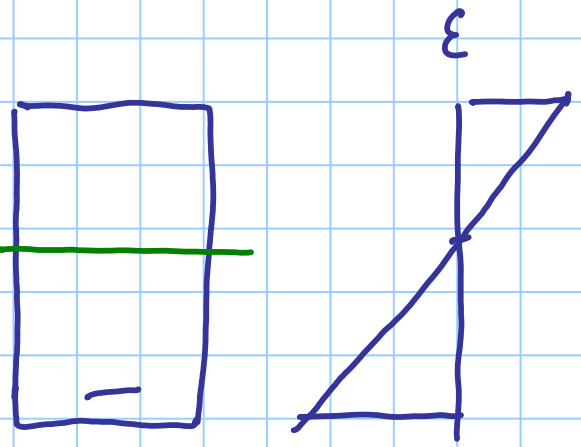
$\mu = \text{duttilità} = \frac{\varepsilon_u}{\varepsilon'}$

bassa





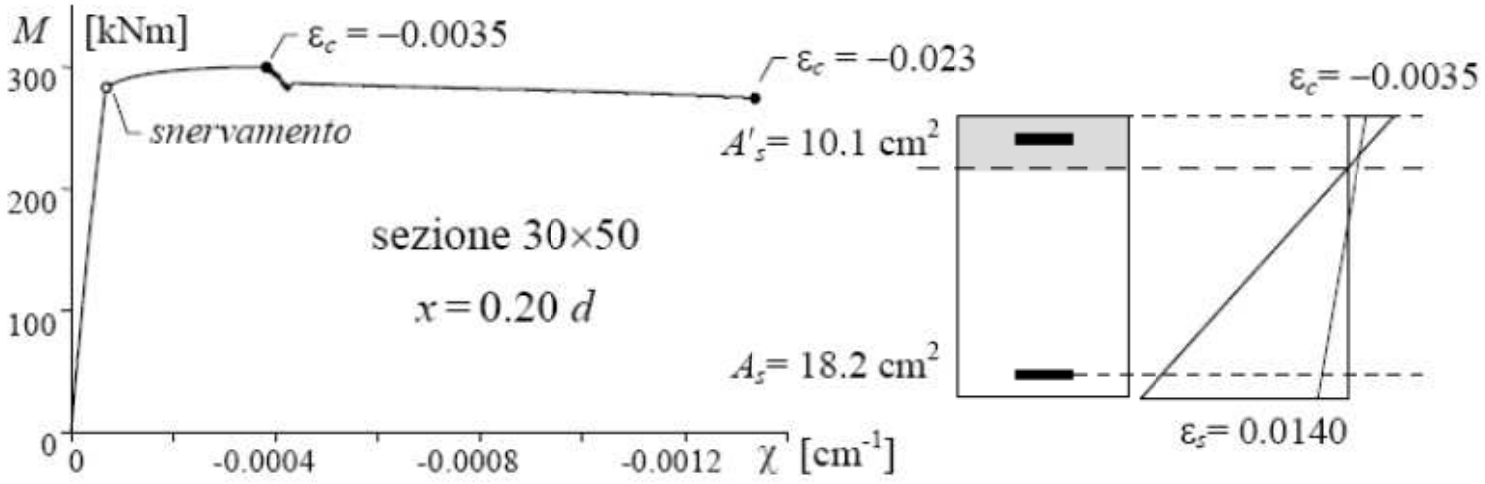
armatura debolmente

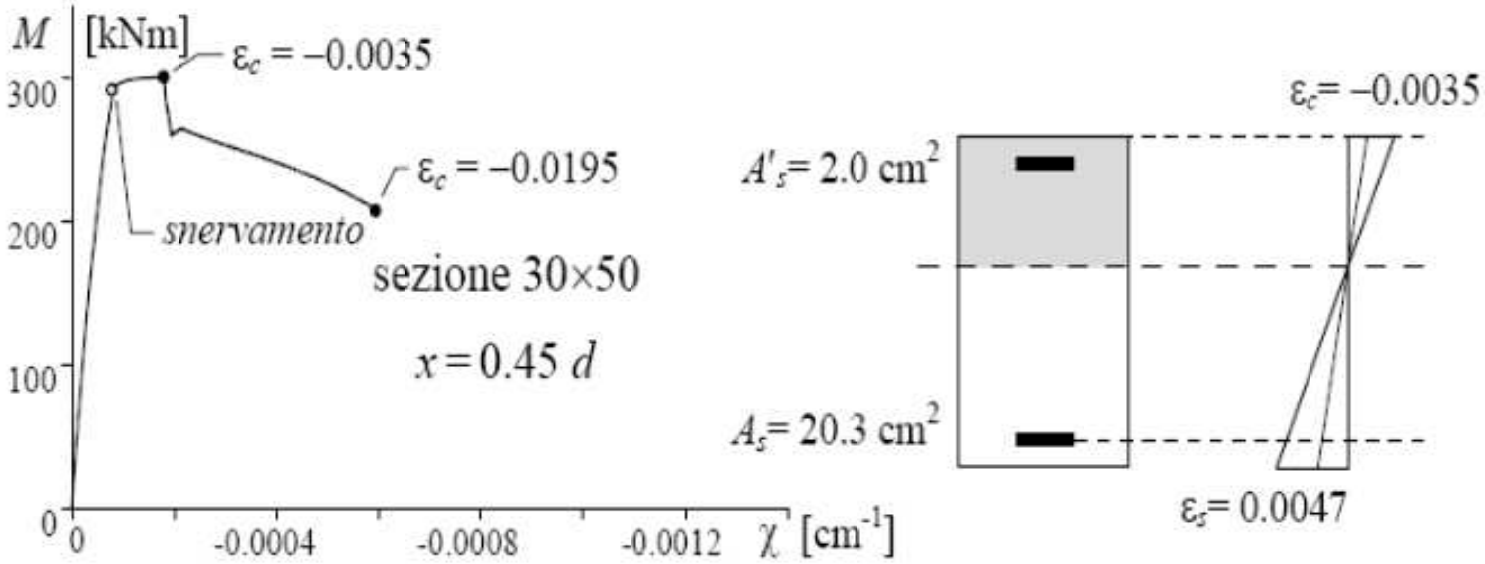


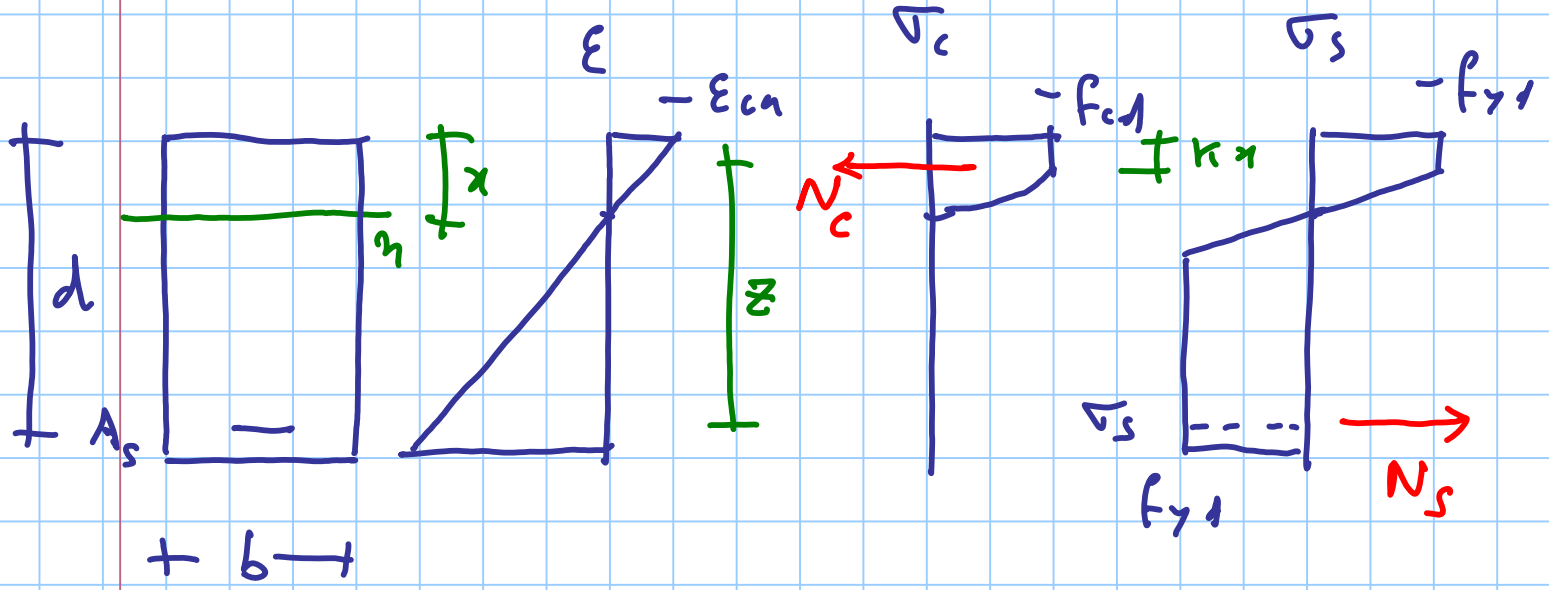
armatura forte

quando l'acciaio si snerva

il cls è lontano da ε_{cu}


M [kNm]
300
200
100
0
0
-0.0004
-0.0008
-0.0012
χ [cm-1]
εc = –0.0035
εc = –0.023
snervamento
sezione 30×50
x = 0.20 d
A's = 10.1 cm2
As = 18.2 cm2
εc = –0.0035
εs = 0.0140


M [kNm]
300
200
100
0
0
-0.0004
-0.0008
-0.0012
χ [cm-1]
εc = –0.0035
εc = –0.0195
snervamento
sezione 30×50
x = 0.45 d
A's = 2.0 cm2
As = 20.3 cm2
εc = –0.0035
εs = 0.0047



$$x = 0.25\, d$$

$$\xi = \frac{x}{d} = 0.25$$

$$N_c = -\beta\, b\, x\, f_{cd} = -\beta\, \xi\, b\, d\, f_{cd}$$

$$N_s = A_s\, f_{yd}$$

$$z = d - kx = \underbrace{(1 - k\xi)}_{I}\, d \simeq 0.9\, d$$

$$M_{Ed} = M_{Rd} = N_s \, z = A_s \, f_y \, z$$

$$z \simeq 0.9 \, d$$

$$A_s = \frac{M}{z \, f_{yd}} \simeq \frac{M}{0.9 \, d \, f_{yd}}$$

$$M \simeq 0.9 \, d \, A_s \, f_{yd}$$

$$M_{Ed} = M_{Rd} = N_c \; z =$$

$$= \beta \xi \; b \; d \; f_{cd} \cdot \zeta \; d =$$

$$= \underbrace{\beta \; \xi \; \zeta \; f_{cd}} \; b \; d^2 = \frac{b \; d^2}{z^2}$$

$$\downarrow$$

$$\frac{1}{z^2}$$

$$M = \frac{b \; d^2}{z^2}$$

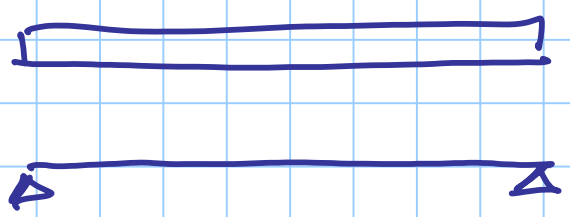
$$KN_m \qquad m$$

$$z = \frac{1}{\sqrt{\beta \; \xi \; \zeta \; f_{cd}}} = 0,0197$$

$$0.8, \quad 0.25 \quad 0,9 \quad 1420$$

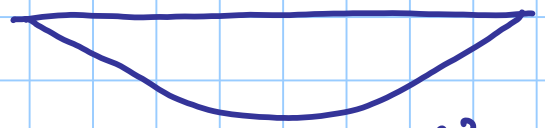
$$M = \frac{b\,d^2}{z^2} \quad \rightarrow \quad d = z\sqrt{\frac{M}{b}}$$

$$b = \frac{M\,z^2}{d^2}$$



$g_1 + q_1 = 100 \ kN/m$

$L = 30 \ m$

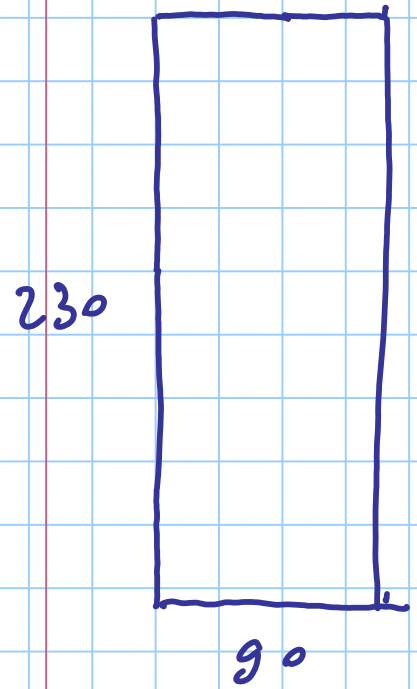


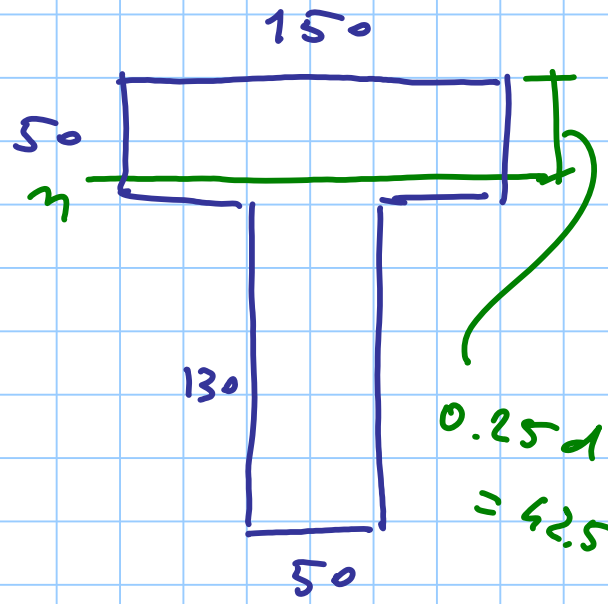
$$M_{max} = \frac{q l^2}{8} = \frac{100 \times 30^2}{8} = 1125 \ kNm$$

prov. $b = 90 \ cm$

$$d = 0.0197 \sqrt{\frac{1125}{0.90}} = 2.20 \ m$$

$h = d + c \rightarrow 2.30 \ m$





$b = 150$ cm

$d = 170$ cm

$h = 180$ cm

$0.25\,d = 42.5$ cm

$$A_s = \frac{M}{0.9\,d\,f_{yd}} = \frac{11250 \times 10}{0.9 \times 1.70 \times 391.3} =$$

$$= 187{,}9 \text{ cm}^2$$

$27\phi 30$

sezione 30×50

$A_s = 9.42 \text{ cm}^2$

$$M_{2c} = \frac{b\,d^2}{2^2} = \frac{0.30 \times 0.46^2}{0.0197} = 163.6 \text{ kN m}$$

$$M_{2s} = 0.9\, d\, A_s\, f_{yd} =$$

$$= 0.9 \times 0.46 \times 9.42 \times 391.3 / 10 = 152.6 \text{ kN m}$$

$$M_{Rd} = 152.6 \text{ kN m}$$