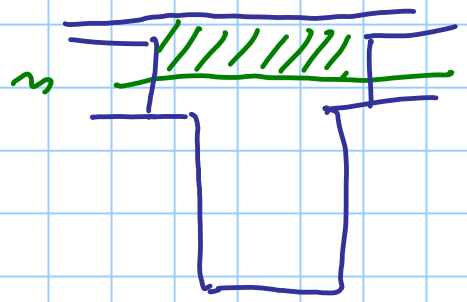
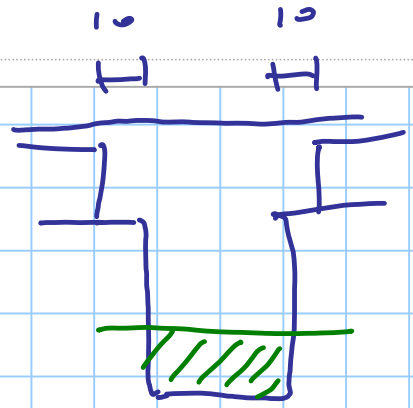
Titolo nota 17/11/2016

$M_{EA} = -350 \ kNm$



$M > 0$



$M < 0$

$$d = \alpha' \sqrt{\frac{M}{b}} =$$

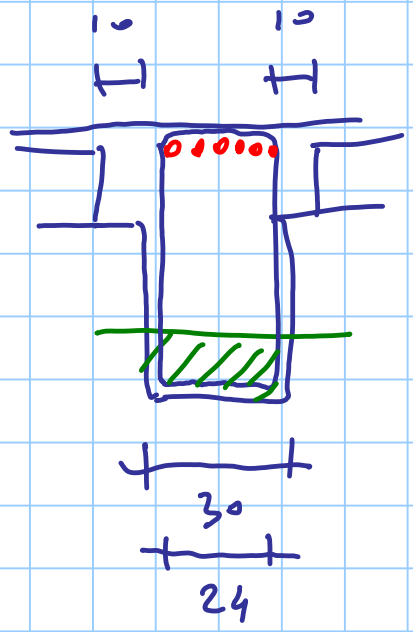
$$= 0.017 \sqrt{\frac{350}{0.30}} = 0.58 \ m = 58 \ cm$$

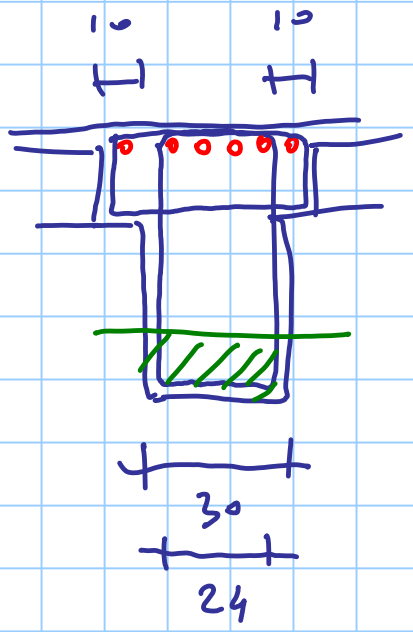
meglio 30×70

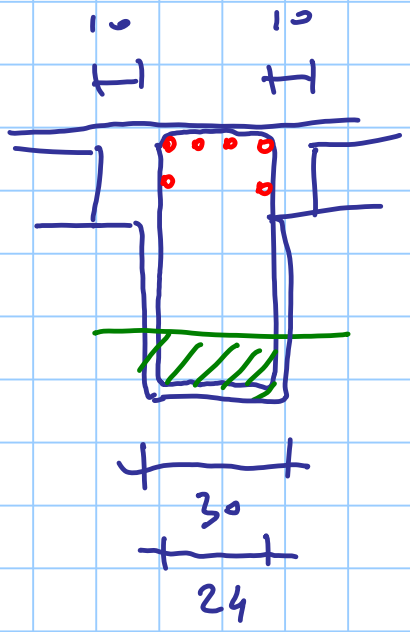
ma io provo con 30×60

$$A_s = \frac{M}{0.9 \, d \, f_{yd}} = \frac{350 \times 10}{0.9 \times 0.56 \times 391.3} = 17.7 \ cm^2$$

$6 \phi 20$



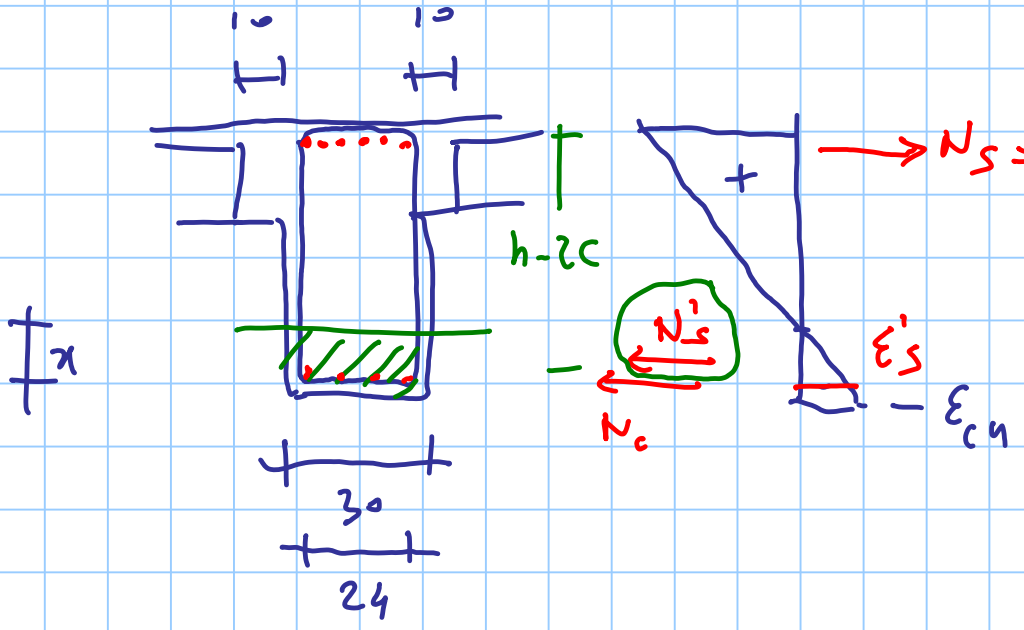




solo armatura tesa $\qquad M_{Rd} = \dfrac{b\,d^2}{z^2}$ $\qquad z = 0.0197$ per C25/30

$$M_{Rd} = \frac{0.30 \times 0.56^2}{0.0197^2} = 242.4 \ kN_m$$

serve A_s'



$x = 0.25\, d = 0.25 \times 56 = 14$ cm

$$\varepsilon'_s = -\frac{x-c}{x}\,\varepsilon_{cu} = -0.0025$$

armatura A'_s è snervata

$$\sigma'_s = f_{yd}$$

$$\Delta M = 350 - 242.4 = 107.6 \ \text{KNm}$$

$$A'_s = \frac{\Delta M}{(h-2c)\,\sigma'_s} = \frac{107.6 \times 10}{0.52 \times 391.3} = 5.3 \ \text{cm}^2$$

$4\phi 14$ $(4.11.\ 2\phi 20)$

Trave a spessore $h = 26\ cm$ $c = 4\ cm$ $d = 22\ cm$

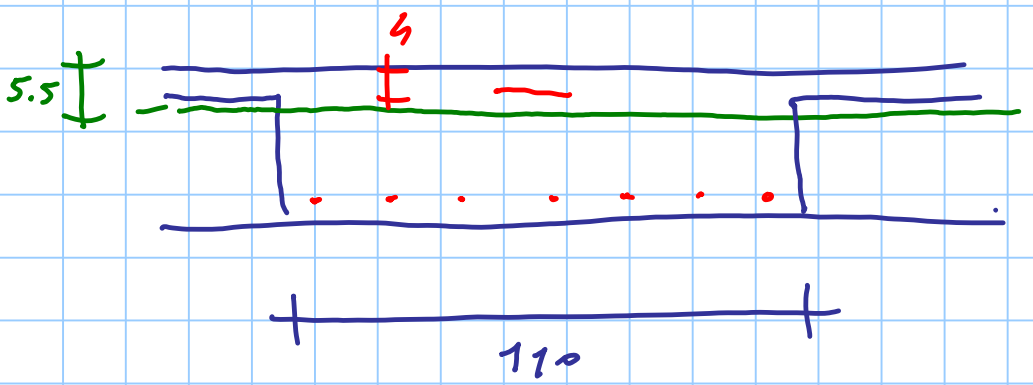
$M_{Ed} = 160\ KN_m$ > 0 positivo

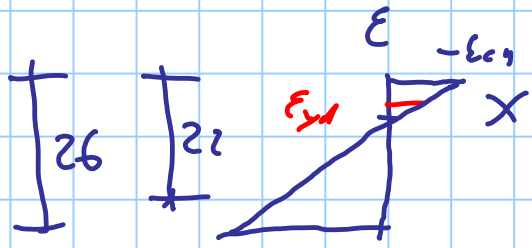
$$b = \frac{M r^2}{d^2} = \frac{160 \times 0.018^2}{0.22^2} = 1.07\ m \qquad b = 110\ cm$$

$$A_s = \frac{M}{0.9\, d\, f_{yd}} = \frac{160 \times 10}{0.9 \times 0.22 \times 391.3} = 20.7\ cm^2 \qquad 7\phi 20$$

con solo A_s $M_{Rd} = \frac{b d^2}{r^2} = \frac{1.10 \times 0.22^2}{0.0197^2} = 137.2\ KN_m$

occorre A'_s per portare $\Delta M = 160 - 137.2 = 22.8\ KN_m$





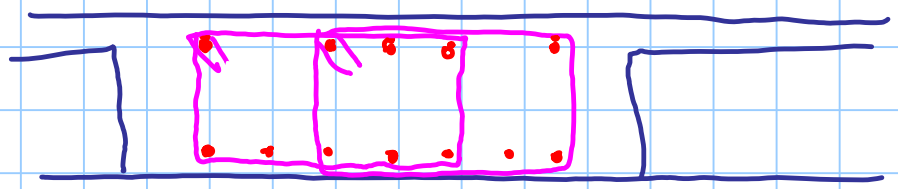
$x = 0.25\, h = 5.5$ cm

$$\varepsilon'_s = -\frac{x - c}{x}\,\varepsilon_{cu} = -0.0000968$$

$$\sigma'_s = \varepsilon'_s\, E_s = 193.6 \text{ MPa}$$

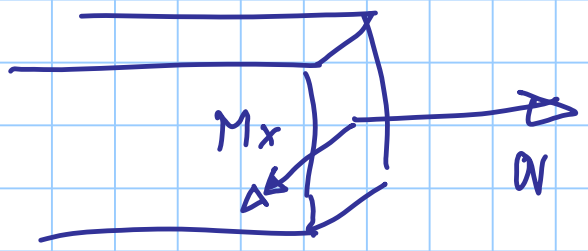
$$A'_s = \frac{\Delta M}{(h - 2c)\,\sigma'_s} = \frac{22.8 \times 10}{0.18 \times 193.6} = 6.5 \text{ cm}^2$$

$5\phi 14$



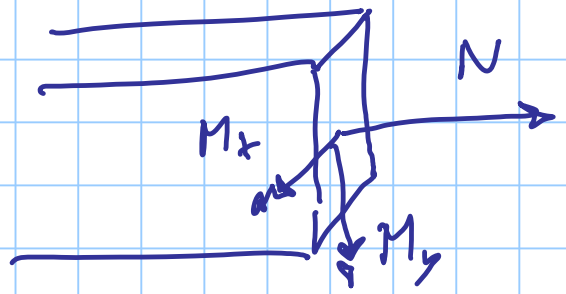
FLESSIONE COMPOSTA

RETTA



modello lineare omogeneo

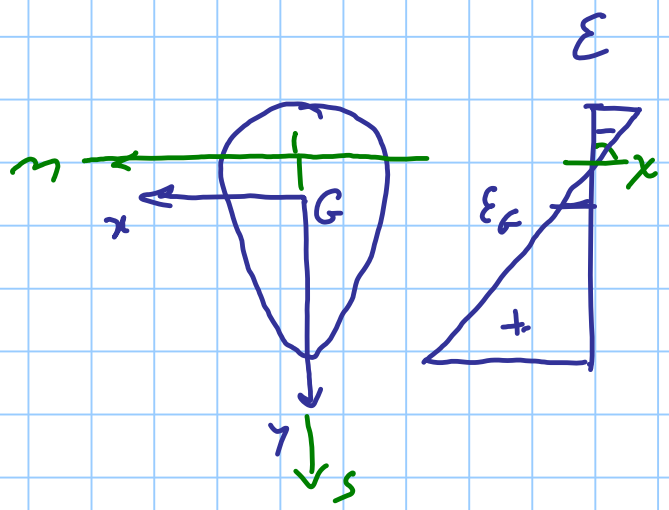
DEVIATA



$$\sigma = \frac{N}{A} + \frac{M_x}{I_x} y - \frac{M_y}{I_y} x$$

$$N = \int \sigma \, dA$$

$$M_x = \int \sigma y \, dA$$



$$N = \int E \chi s \, dA = E\chi \underbrace{\int s \, dA}_{S_n}$$

$$N = E \chi \, S_n$$

$$M_n = \int \sigma s \, dA = \int E \chi s^2 \, dA =$$

$$= E \chi \underbrace{\int s^2 \, dA}_{I_n} = E \chi \, I_n$$

$$\varepsilon = \varepsilon_G + \chi y$$

$$\sigma = E \varepsilon = E \varepsilon_G + E \chi y$$

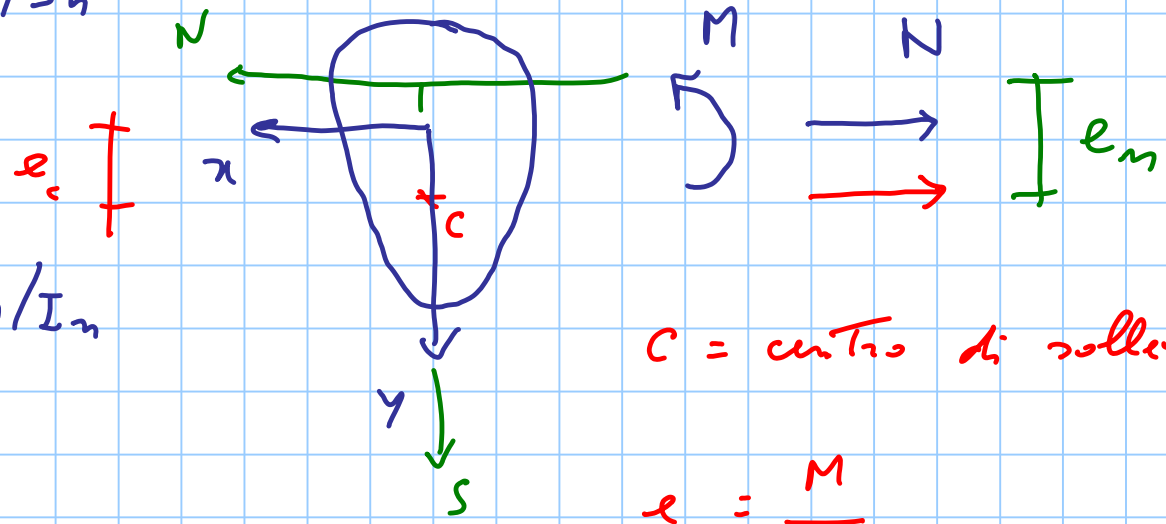
$$\varepsilon = \chi s$$

$$\sigma = E \chi s$$

$N = E\chi S_n \rightarrow E\chi = N/S_n$

$M_n = E\chi I_n \rightarrow E\chi = M_n/I_n$

$$e_n = \frac{M_n}{N} = \frac{I_n}{S_n}$$



C = centro di sollecitazione

$$e_c = \frac{M}{N}$$

$\sigma = E\chi s$

$$\sigma = \frac{M_n}{I_n} s$$

$$\sigma = \frac{N}{S_n} s$$