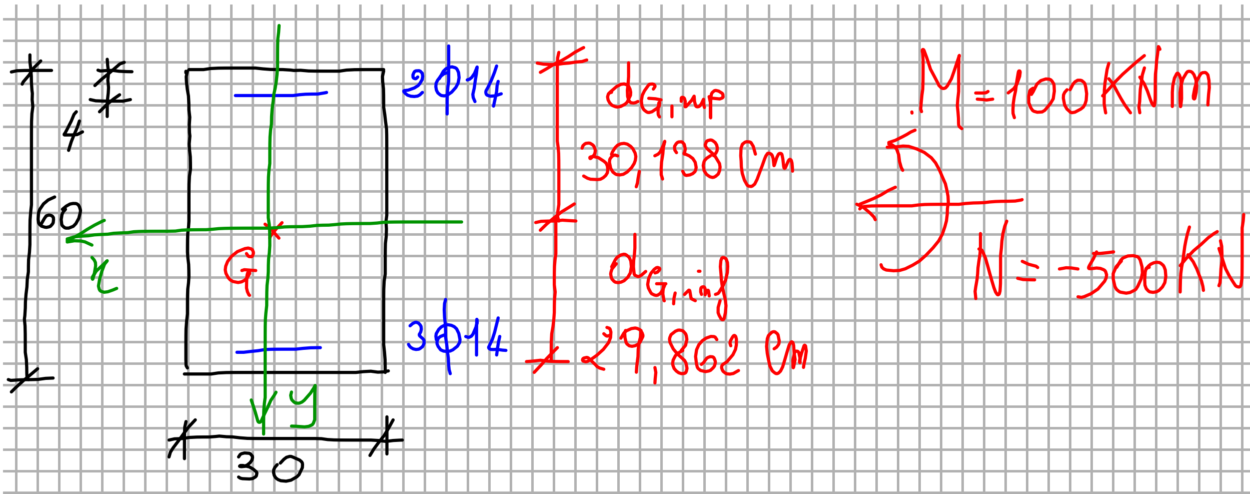
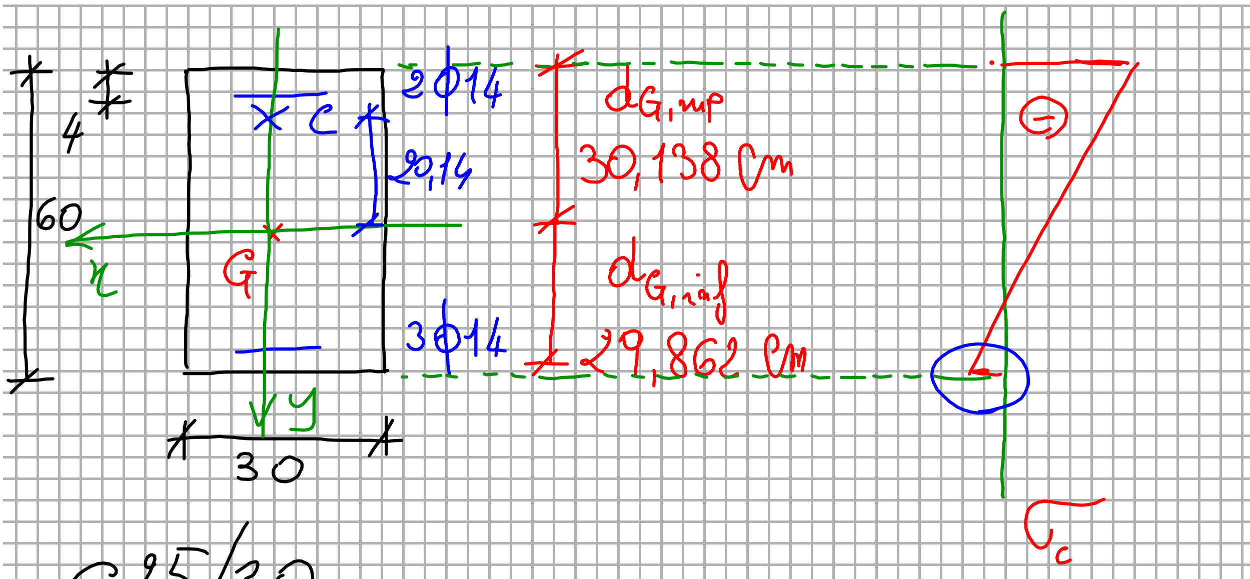


C25/30



C25/30

$n = 6{,}35$

$$\sigma = \frac{N}{A} + \frac{N e_G}{I_x} d_{G,inf}$$

Tensioni di trazione del CLS

$$e_G = \frac{M}{N} - \left(\frac{h}{2} - d_{G,inf}\right) = \frac{100}{-500} - (0{,}3 - 0{,}2986)$$

$$= -0{,}2014\ m = -20{,}14\ cm$$

$$A = 30 \times 60 + 6{,}35 \times (3{,}08 + 4{,}62) = 1848{,}9\ cm^2$$

$$\sigma_s = n \left[\frac{N}{A} + \frac{N e_G}{I_x} (d_{G,inf} - c) \right]$$

$$e_G = \frac{M}{N} - \left(\frac{h}{2} - d_{G,inf}\right) = \frac{100}{-500} - (0{,}3 - 0{,}2986)$$

$$= -0{,}2014\ m = -20{,}14\ cm$$

$$A = 30 \times 60 + 6{,}35 \times (3{,}08 + 4{,}62) = 1848{,}9\ cm^2$$

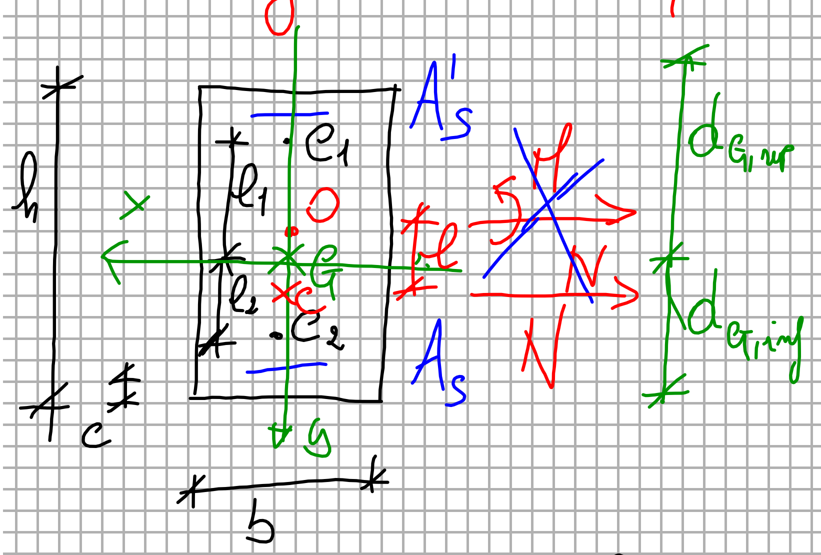
Tensione in A_s

$$I_x = \frac{30\times 30{,}14^3}{3} + \frac{30\times 29{,}86^3}{3} + 6{,}35\times 3{,}08\times 26{,}14^2 + 6{,}35\times 4{,}62\times 25{,}86^2 = 573018\ cm^4$$

$$\sigma_{ct} = -\frac{500}{1848{,}9}\times 10 + \frac{+500\times +20{,}14}{573018}\times 29{,}86\times 10 = 2{,}54\ MPa \le f_{ctk} \quad \text{NO}$$

$$C\,25/30 \qquad f_{ctk} = 2{,}16\ MPa$$

Tenso-flessione – piccola eccentricità



$$e_1 = \frac{I_x}{A\, d_{G,inf}}$$

$$e_2 = \frac{I_x}{A\, d_{G,sup}}$$

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

$$-e_1 < e_s < e_2$$

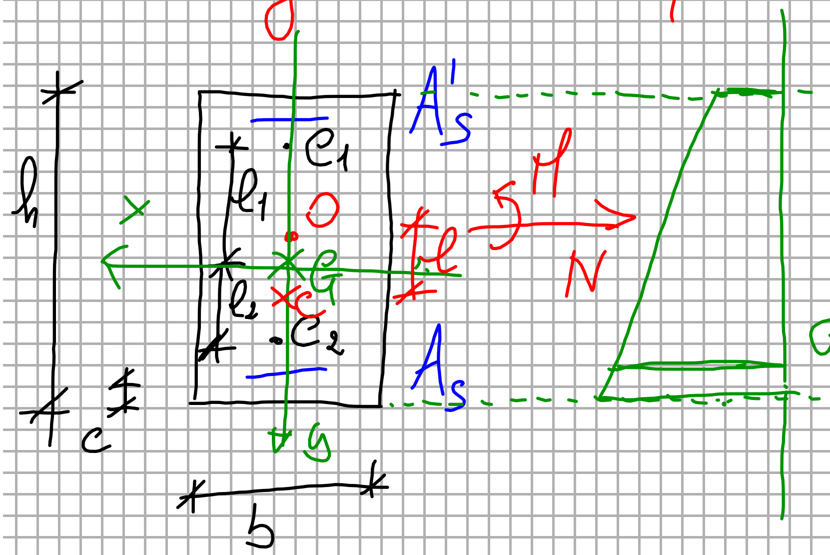
$$e_s = \frac{M}{N} - \left(\frac{h}{2} - d_{G,inf}\right)$$

$$\sigma = \frac{N}{A} + \frac{N e_s}{I_x} y$$

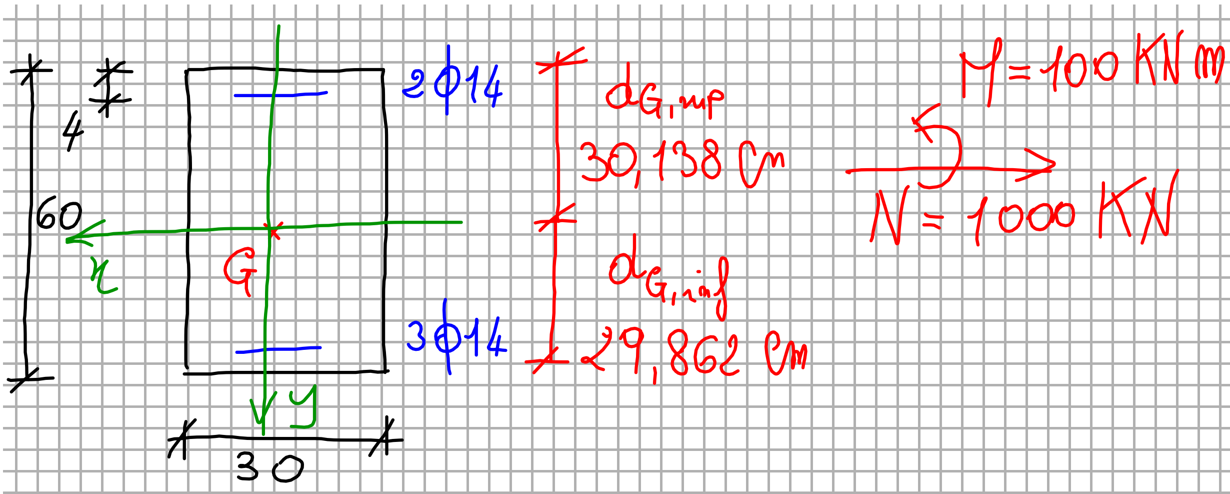
solo acciaio

$$\sigma_s = \frac{N}{A} + \frac{N e_s}{I_x} (d_{G,inf} - c)$$

Tenso-flessione – piccola eccentricità



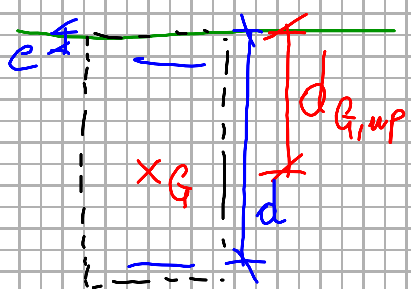
$\sigma_s \leq 0{,}8 f_{yk}$



C25/30

$$e_1 = \frac{I_x}{A\, d_{G,inf}}$$

$$d_{G,inf} = 60 - 35,2 = 24,8 \text{ cm}$$



$$d_{G,sup} = \frac{S_0}{A} = \frac{271,04}{7,7} = 35,2 \text{ cm}$$

$$A = 3,08 + 4,62 = 7,7 \text{ cm}^2$$

$$S_0 = 3,08 \times 4 + 4,62 \times 56 = 271,04 \text{ cm}^3$$

$$I_x = A_s\left(d_{G,inf} - c\right)^2 + A'_s\left(d_{G,sup} - c\right)^2$$

$$= 4{,}62 \times \left(24{,}8 - 4\right)^2 + 3{,}08 \times \left(35{,}2 - 4\right)^2$$

$$= 4997 \ cm^4$$

$$e_1 = \frac{I_x}{A\, d_{G,inf}} = 26{,}2 \ cm$$

$$e_2 = \frac{I_x}{A\, d_{G,sup}} = \frac{4997}{7{,}7 \times 35{,}2} = 18{,}4 \ cm$$

$$e_s = \frac{M}{N} - \left(\frac{h}{2} - d_{G,inf}\right) = \frac{100}{1000} - \left(0{,}3 - 0{,}248\right)$$

$$= 0{,}048 \ m = 4{,}8 \ cm$$

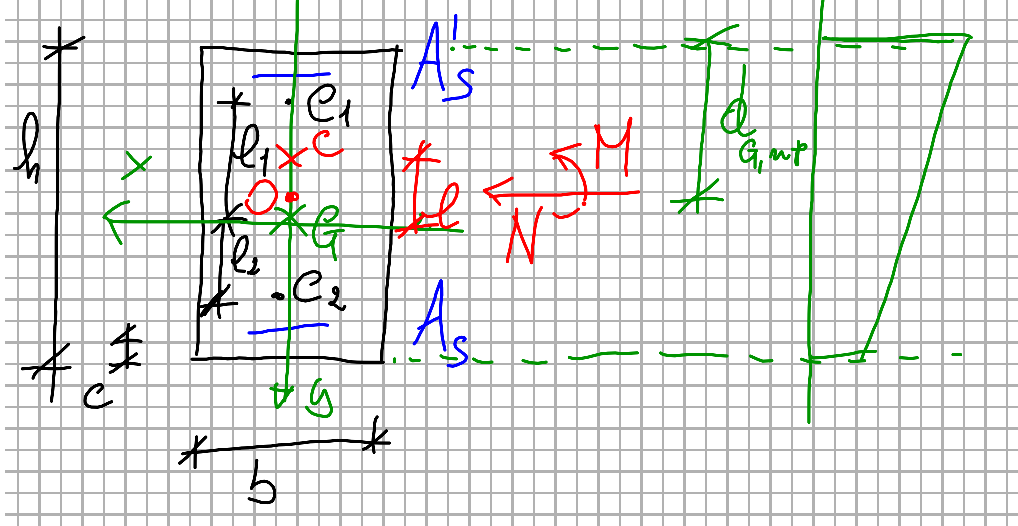
$$\sigma_s = \frac{N}{A} + \frac{N e_s}{I_x}\left(d_{G,inf} - c\right)$$

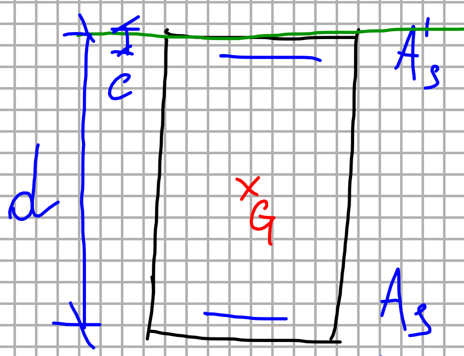
$$= \left[\frac{1000}{7{,}7} + \frac{1000 \times 4{,}8}{4997} \times (24{,}8 - 4)\right] \times 10$$

$$= 1498 \text{ MPa} \leq 0{,}8\, f_{yk} = 360 \text{ MPa}$$

B450C NO

Presso-flessione - piccola eccentricità





$$d_{G,sup} = \frac{S_0}{A}$$

$$S_0 = \frac{b h^2}{2} + m A'_s c + m A_s d$$

$$A = b h + m \left(A'_s + A_s \right)$$

$$e_1 = \frac{I_x}{A \, d_{G,inf}} \qquad e_2 = \frac{I_x}{A \, d_{G,sup}}$$

$$I_x = \frac{b d_{G,sup}^3}{3} + \frac{b \, d_{G,inf}^3}{3} + m A'_s \left(d_{G,sup} - c \right)^2 + m A_s \left(d_{G,inf} - c \right)^2$$

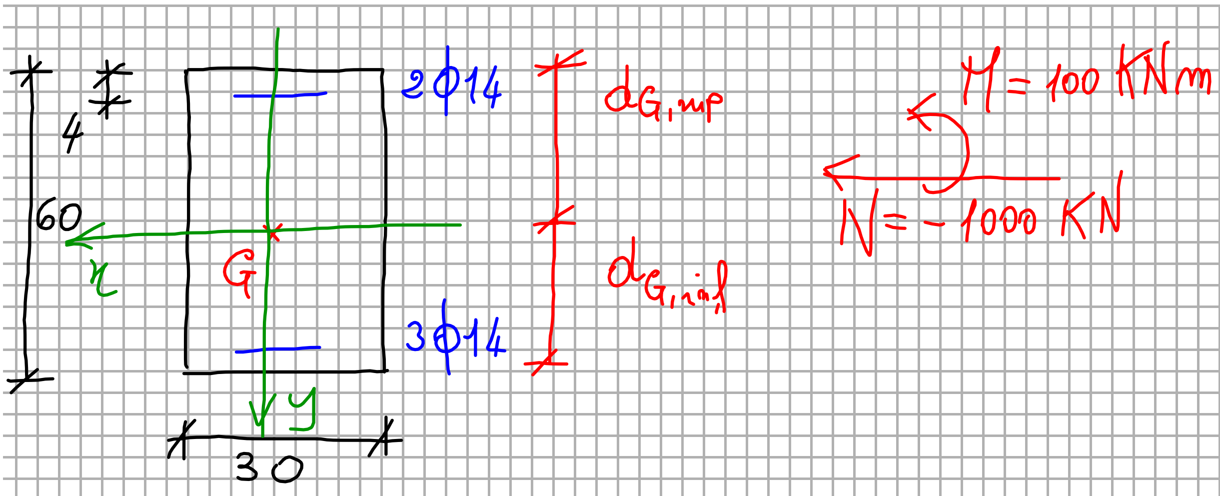
$$e_{c+s} = \frac{M}{N} - \left(\frac{h}{2} - d_{G,inf} \right)$$

$$-e_1 \leq e_{c+s} \leq e_2$$

piccola eccentricità

$$\sigma = \frac{N}{A} + \frac{N\, e_{c+s}}{I_x}\, y$$

$$\sigma_c = \frac{N}{A} - \frac{N\, e_{c+s}}{I_x}\, d_{G,sup}$$



C25/30 $\qquad m = 15$

$$S_o = \frac{30 \times 60^2}{2} + 15 \times 3{,}08 \times 4 + 15 \times 4{,}62 \times 56 = 58065{,}6 \text{ cm}^3$$

$$A = 30 \times 60 + 15 \times (3{,}08 + 4{,}62) = 1915{,}5 \text{ cm}^2$$

$$d_{G,sup} = \frac{58065{,}6}{1915{,}5} = 30{,}3 \text{ cm}$$

$$d_{G,inf} = 60 - 30{,}3 = 29{,}7 \text{ cm}$$

$$I_x = \frac{30 \times 30{,}3^3}{3} + \frac{30 \times 29{,}7^3}{3} + 15 \times 3{,}08 \times 26{,}3^2 + 15 \times 4{,}62 \times 25{,}7^2 = 617890 \text{ cm}^4$$

$$e_1 = \frac{617890}{1915{,}5 \times 29{,}7} = 10{,}86 \text{ cm}$$

$$e_2 = \frac{617890}{1915{,}5 \times 30{,}3} = 10{,}65 \text{ cm}$$

$$e_{c+s} = \frac{100}{-1000} - (0{,}3 - 0{,}297) = -10{,}31 \text{ cm}$$

$$\sigma_c = \left[-\frac{1000}{1915,5} - \frac{+1000 \times +10,31}{617890} \times 30,3\right] \times 10 = -10,3\ MPa$$

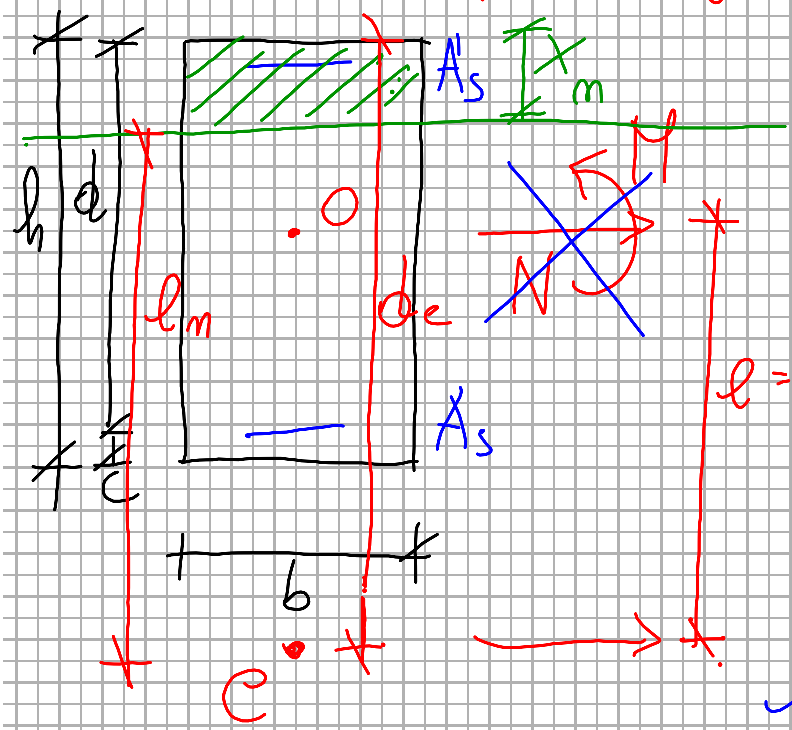
Comp. zone

$$|\sigma_c| \le 0,6 f_{ck} = 0,6 \times 25 = 15\ MPa$$

C25/30

OK!

Flessione composta - grande eccentricità



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

$$d_e = \frac{M}{N} + \frac{h}{2}$$

$$e_n = d_e - x$$

$$S_n = \frac{b x^2}{2} - n A'_s (x - c) + n A_s (d - x)$$

$$I_n = \frac{b x^3}{3} + n A'_s (x - c)^2 + n A_s (d - x)^2$$

$$\frac{b x^3}{3} + \cancel{n A'_s x^2} + n A'_s c^2 - 2 n A'_s c x + n A_s d^2 + \cancel{n A_s x^2} - 2 n A_s d x = - \frac{b x^2}{2} d_c - n A'_s d_c x + n A'_s c d_c + n A_s d d_c - n A_s d_c x + \frac{b x^3}{2} + \cancel{n A'_s x^2} - n A'_s c x - n A_s d x + \cancel{n A_s x^2}$$

$$\frac{b x^3}{6} - \frac{b d_c}{2} x^2 + n \left[A'_s (c - d_c) + A_s (d - d_c) \right] x - n \left[A'_s (c - d_c) c + A_s (d - d_c) d \right] = 0$$

$$\boxed{x^3 - 3 d_c x^2 + \frac{6n}{b} \left[A'_s (c - d_c) + A_s (d - d_c) \right] x - \frac{6n}{b} \left[A'_s (c - d_c) c + A_s (d - d_c) d \right] = 0}$$

$$\sigma = \frac{N}{S_n}\, y$$

$$\sigma_c = \frac{N}{S_n}\, x$$

$$\sigma_s = n \frac{N}{S_n} (d - x)$$