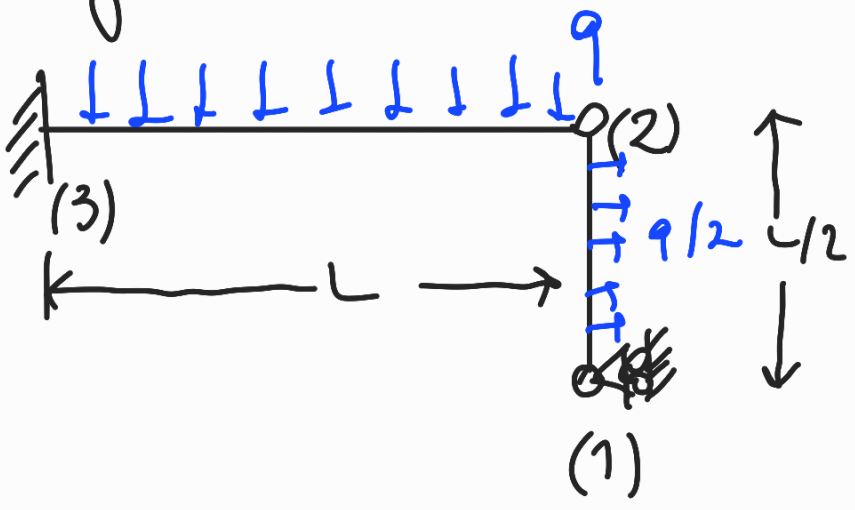
1) • Verifica che la struttura è isostatica

$n_{aste} = 2$ $\qquad$ $\nu = 3+2+1 = 6$

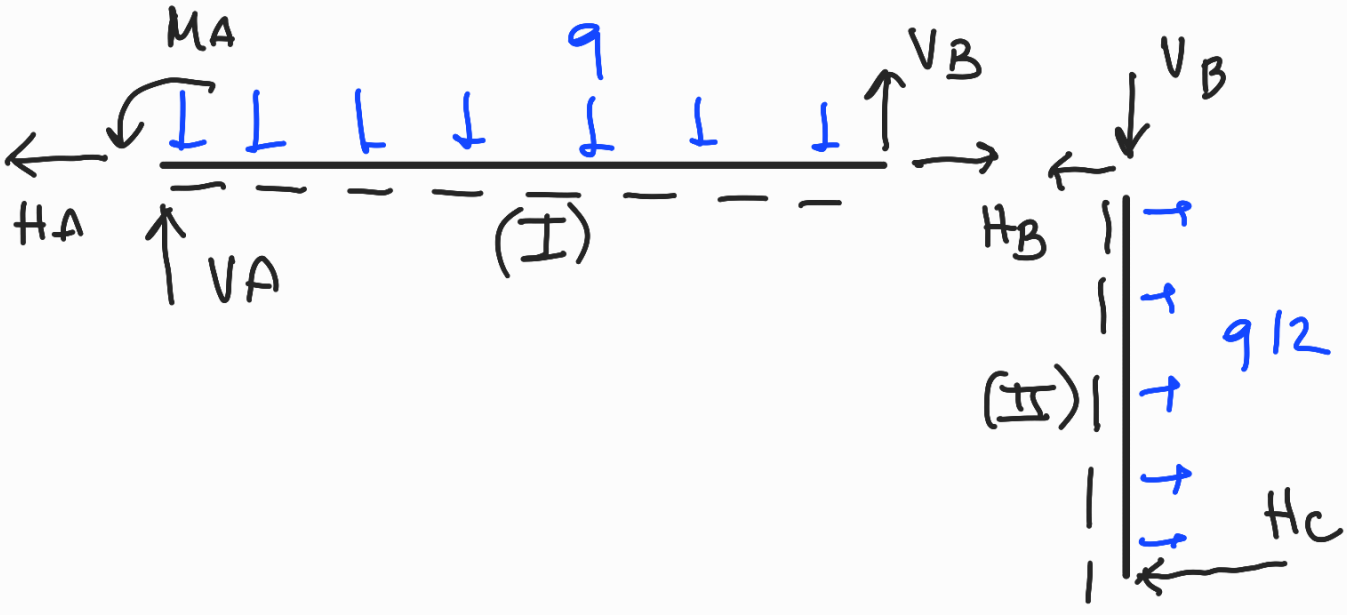
$g = 2 \cdot 3 = 6$ $\qquad$ → isostatica



$L = 6\ m$

$q = 12000\ N/m$

• Calcolo delle reazioni vincolari



Equilibri delle aste:

$$\text{I}\begin{cases} \xrightarrow{+} \; -H_A + H_B = 0 \\ \uparrow \; V_A + \cancel{V_B} - qL = 0 \\ \curvearrowleft_A : -M_A + q\frac{L^2}{2} - \cancel{V_B \cdot L} = 0 \end{cases}$$

$$H_A = H_B = 9000\ N$$

$$V_A = qL = 72000\ N$$

$$M_A = \frac{qL^2}{2} = 216000\ Nm$$

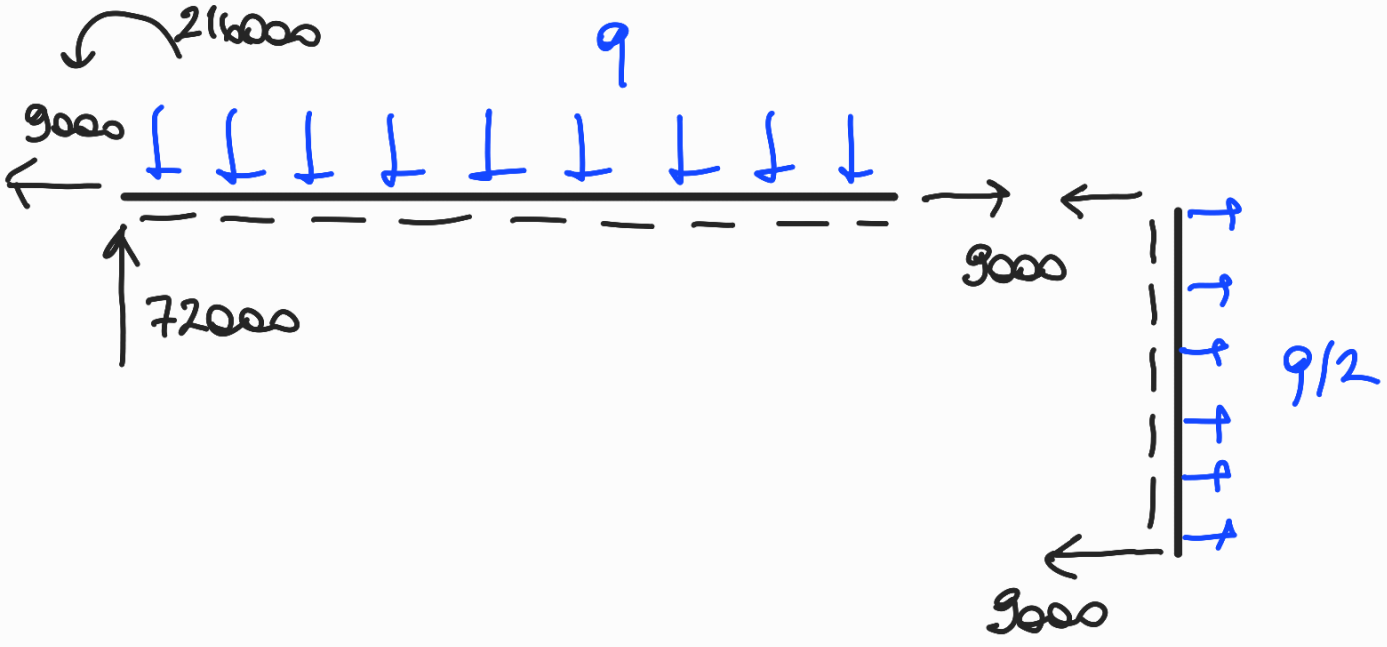
$$\text{II}\begin{cases} \rightarrow^{+} \; -H_B + \frac{q}{2}\cdot\frac{L}{2} - H_C = 0 \\ \uparrow \; -V_B = 0 \\ \curvearrowright_B \; -\frac{q}{2}\frac{L}{2}\frac{L}{4} + H_C \cdot \frac{L}{2} = 0 \end{cases}$$

$$H_B = \frac{qL}{4} - H_C = 9000$$

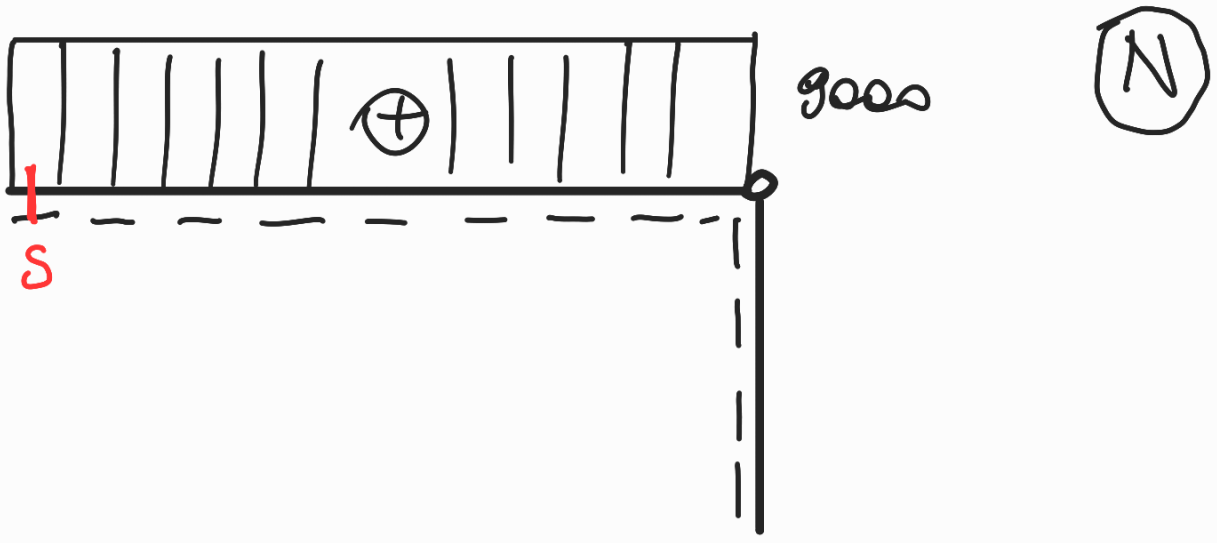
$$V_B = 0\ N$$

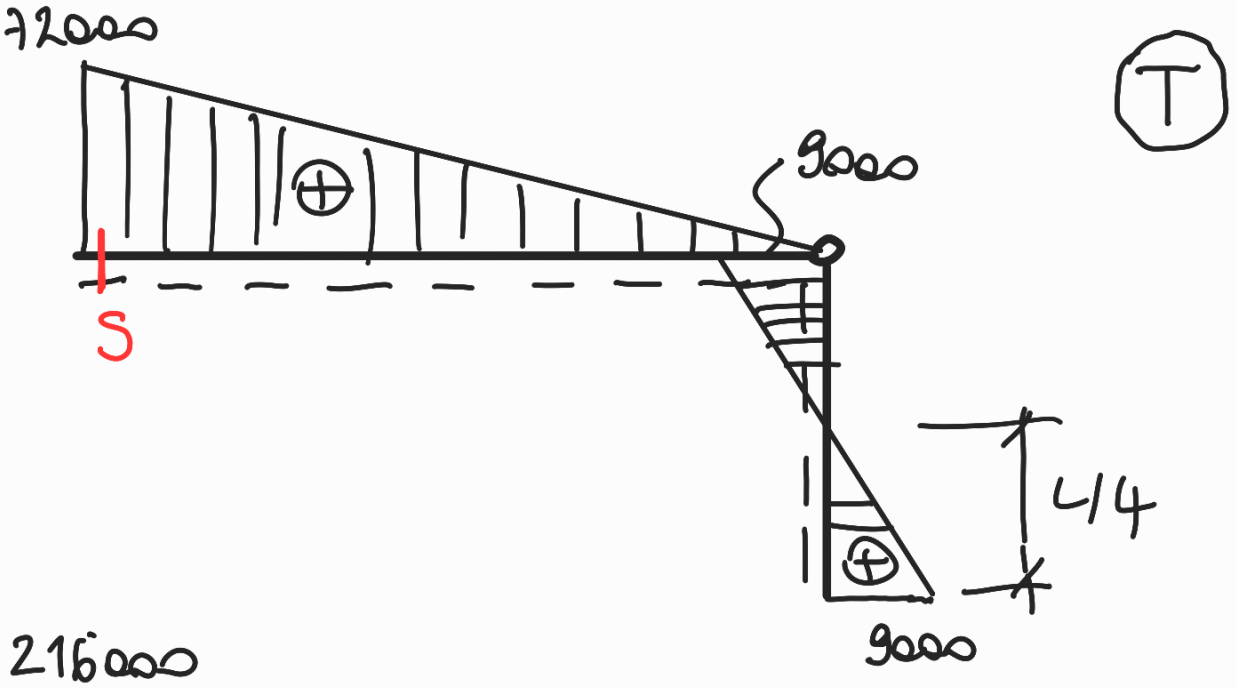
$$H_C = \frac{qL}{8} = 9000\ N$$

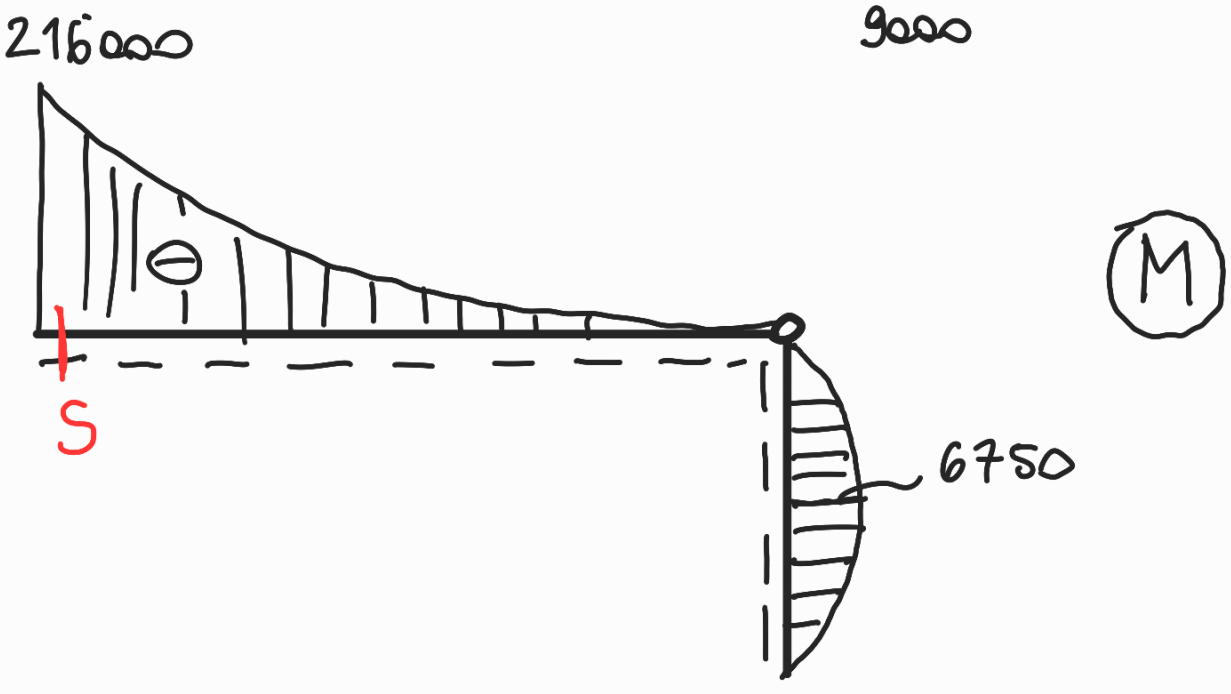
Schema finale delle forze attive e reattive



• Diagrammi delle azioni interne

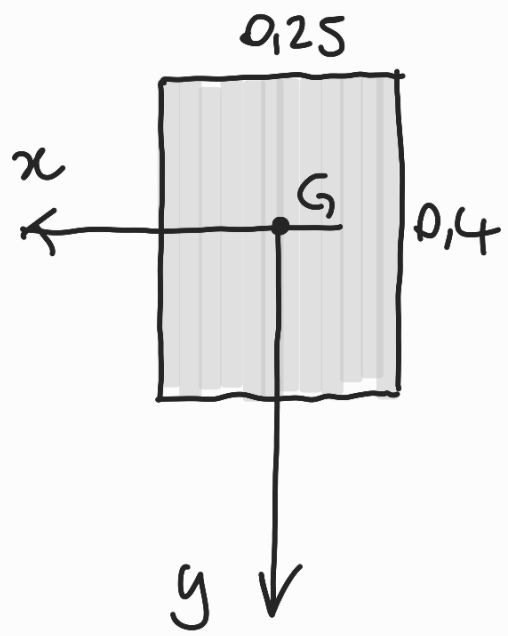






2)

- Caratteristiche geometriche della sezione

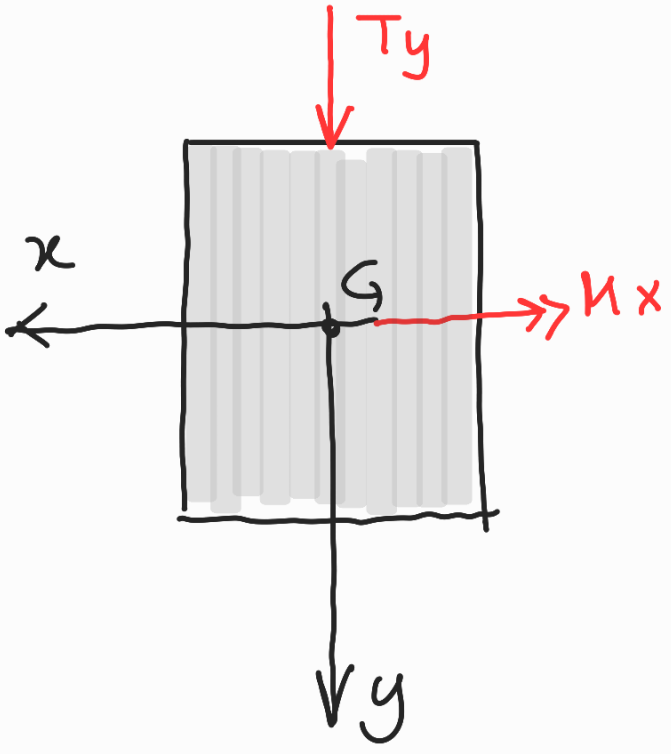


$$A = 0{,}25 \cdot 0{,}4 = 0{,}1\ m^2$$

$$I_x = \frac{0{,}25 \cdot 0{,}4^3}{12} = 1{,}33 \cdot 10^{-3}\ m^4$$

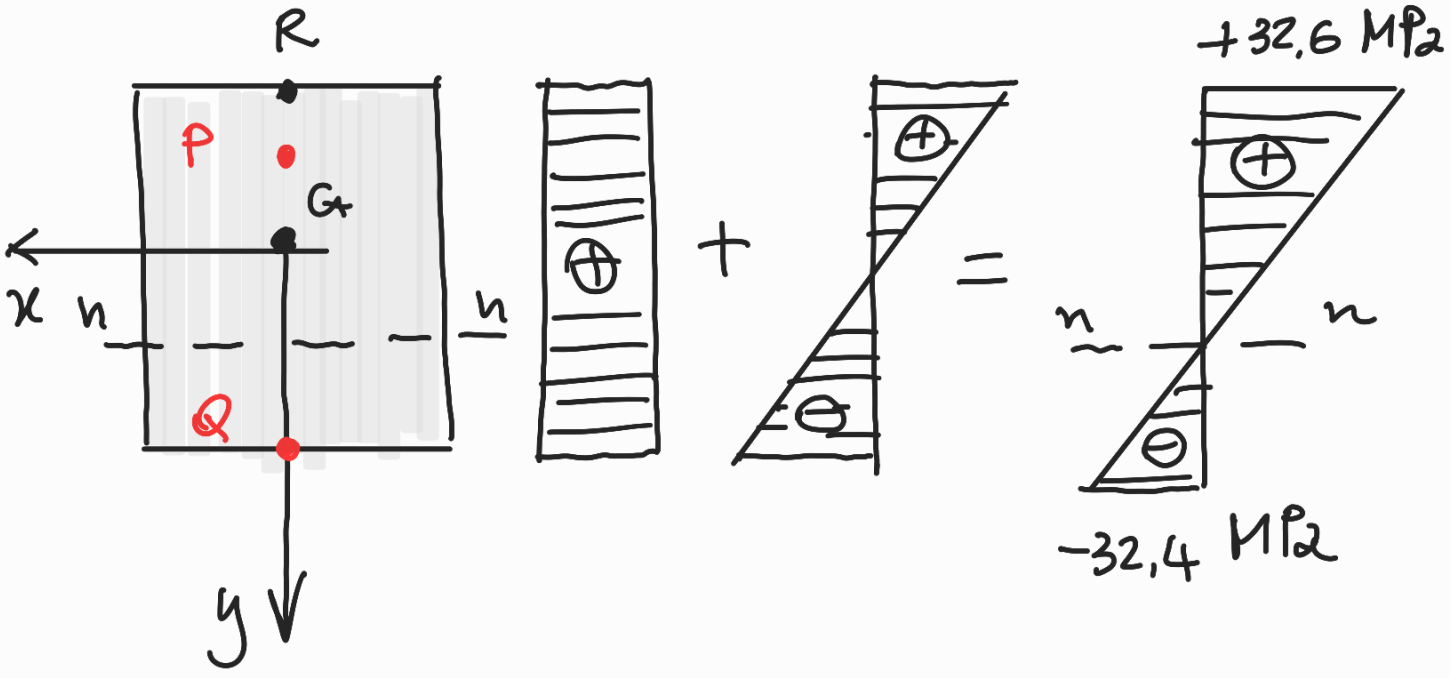
Il momento di inerzia I_y non è necessario.

- Calcolo delle Tensioni nella sez. S



$$\begin{cases} N = 9000\ N \\ T = 72000\ N \\ M_x = 216000\ N\,m \end{cases}$$

- Sforzo normale eccentrico



$$\sigma_z(y) = \frac{N}{A} + \frac{M_x}{I_x} \cdot y$$

$$\sigma_z(R) = \frac{9000}{0,1} + \frac{-216000}{1,3 \cdot 10^{-3}} \cdot (-0,2) = 90000 + 3,25 \cdot 10^7$$

$$= 3,26 \cdot 10^7$$

$$= 32.6 \text{ MPa}$$

$$\sigma_z(P) = \frac{9000}{0,1} - \frac{216000}{1,3 \cdot 10^{-3}} \cdot (-0,1) = 9000 + 1,625 \cdot 10^7$$

$$= 1,634 \cdot 10^7 \text{ Pa}$$

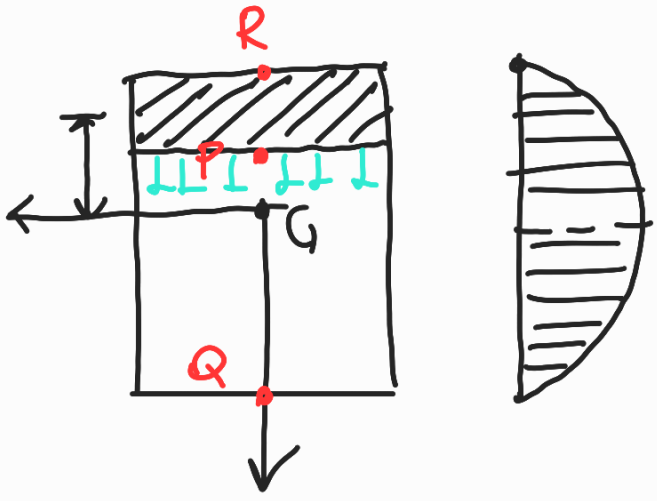
$$= 16,34 \text{ MPa}$$

$$\sigma_z(Q) = \frac{9000}{0,1} - \frac{216000}{1,3 \cdot 10^{-3}} \cdot (0,2) = 90000 - 3,25 \cdot 10^7$$

$$= -3,24 \cdot 10^7 \text{ Pa}$$

$$= -32,4 \text{ MPa}$$

- Taglio (f. di Jourawski) $\tau_{zs} = -\dfrac{T_y S_x^*}{I_x \cdot b}$



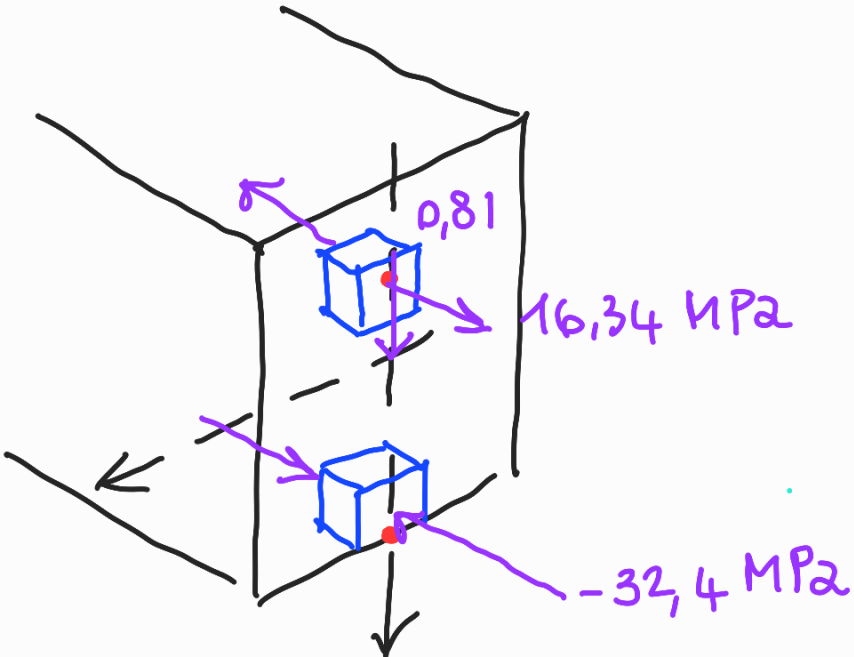
$$\tau_{zy} = \frac{-72000 \cdot S_x^*}{1{,}33 \cdot 10^{-3} \cdot 0{,}25}$$

$$\tau_{zy}(P) = \frac{-72000 \cdot (-0{,}25 \cdot 0{,}1) \cdot 0{,}15}{1{,}33 \cdot 10^{-3} \cdot 0{,}25} = 0{,}812 \text{ MPa}$$

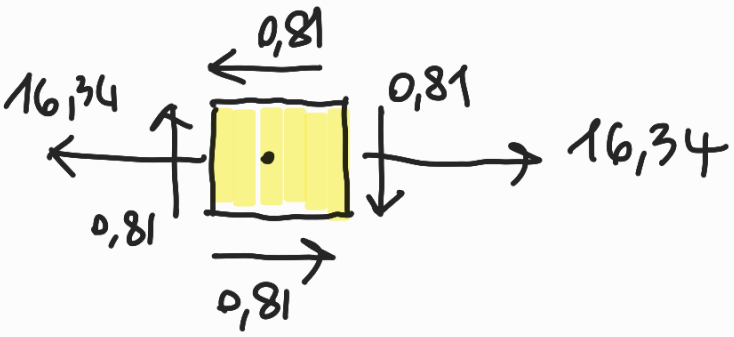
$$\tau_{zy}(G) = \frac{-72000(-0{,}25 \cdot 0{,}2 \cdot 0{,}1)}{1{,}33 \cdot 10^{-3} \cdot 0{,}25} = 1{,}08 \text{ MPa}$$

$$\tau_{zy}(Q) = 0$$

- Verifica di resistenza nel punto Q della sez S e cerchio di Mohr

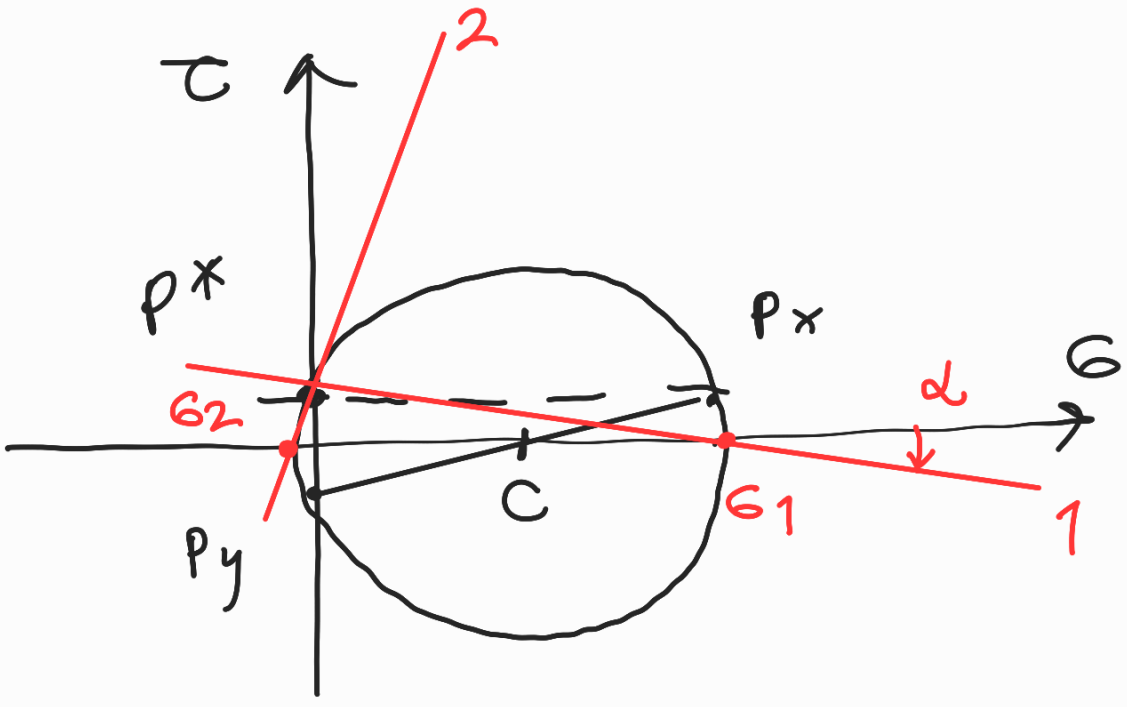


Punto P



$P_x(16,34;\ 0,81)$

$P_y(0\ ;-0,81)$

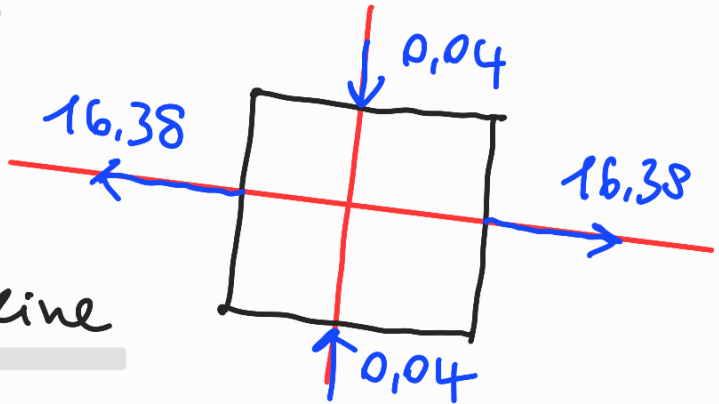


$x_c = 8,17\ MPa \qquad r = 8,21\ MPa$

$\sigma_1 = x_c + r = 16,38\ MPa$

$\sigma_2 = x_c - r = -0,04\ MPa$

$$\alpha = \frac{1}{2}\,\text{arctg}\,\frac{\tau_{xy}}{\frac{\sigma_x - \sigma_y}{2}} = -2°,83 \text{ orario}$$



Verifica con crit. di Rankine

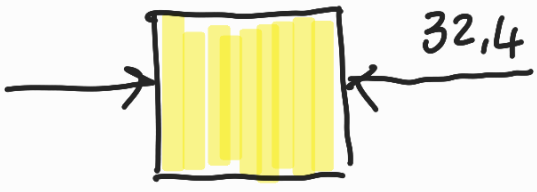
$\sigma_{c,2mm} = 20\ MPa$

$\sigma_{t,2mm} = 8\ MPa$

$\sigma_1 = 16,38 < 20$ verificato

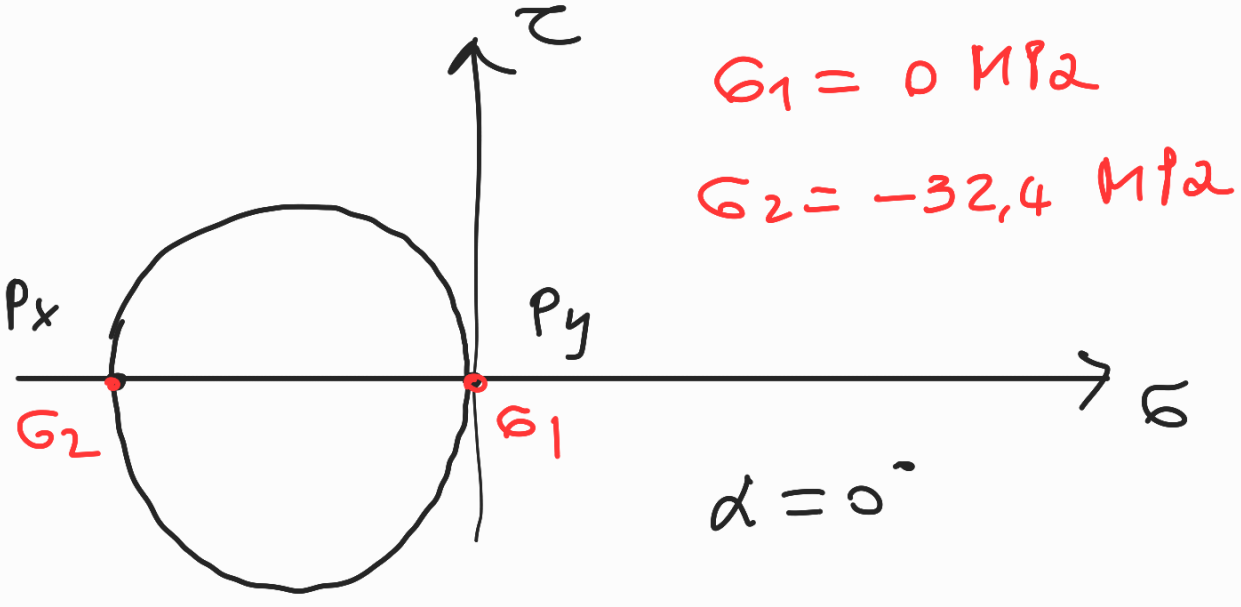
$\sigma_2 = |-0,04| < 8$ "

Punto Q



$P_x\ (-32,4\ ;\ 0)$

$P_y\ (0\ ;\ 0)$



$\sigma_1 = 0\ MPa$

$\sigma_2 = -32,4\ MPa$

$\alpha = 0°$

Verifica

$\sigma_1 = 0 < 8$ verificato

$\sigma_2 = |-32,4| > 20$ non verificato