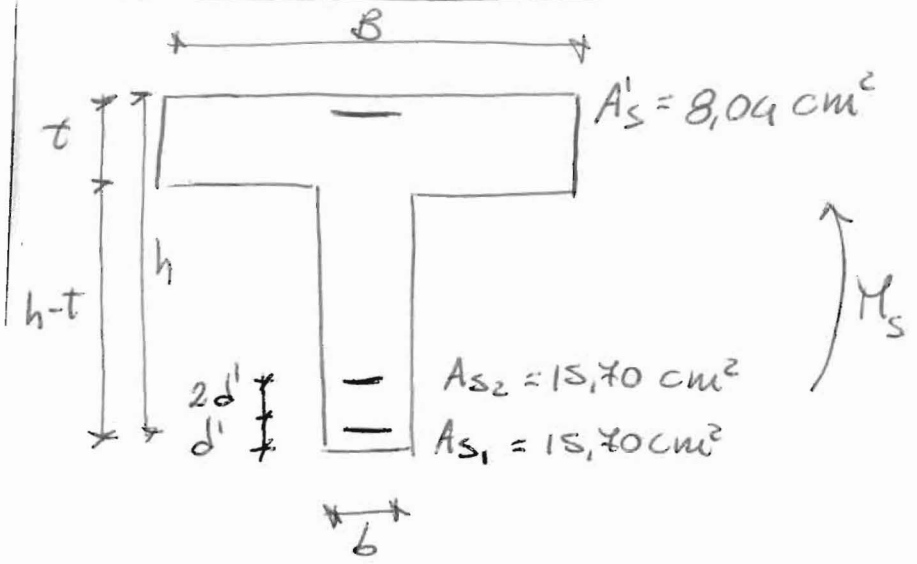
1. Verifica Sezione a T



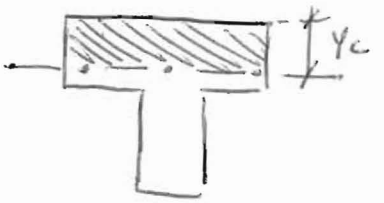
Dati

- $\bar{\sigma}_c = 8,5\ MPa$
- $\bar{\sigma}_s = 220\ MPa$
- $B = 60\ cm$
- $t = 20\ cm$
- $b = 20\ cm$
- $h = 70\ cm$
- $M_s = 300\ kNm$

- Individuazione asse neutro

$$S_n = 0$$

- Ipotesi $y_c < t$



$$\frac{B y_c^2}{2} + n A'_s (y_c - d') - n A_{s_1} (d - y_c) - n A_{s_2} (d - y_c - 2d') = 0$$

$$\frac{B}{2} y_c^2 + n (A'_s + A_{s_1} + A_{s_2}) y_c - n \left[A'_s d' + A_{s_1} d + A_{s_2} (d - 2d') \right] = 0$$

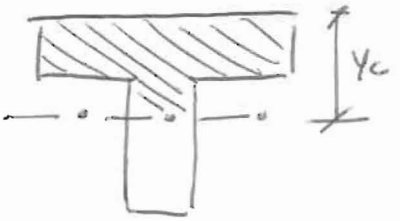
$$30\, y_c^2 + 591,6\, y_c - 30505,8 = 0$$

$$y_c = \frac{-591,6 \pm \sqrt{591,6^2 + 4 \cdot 30 \cdot 30505,8}}{2 \cdot 30} = \begin{cases} 23,52\ cm \\ -43,24\ cm \end{cases}$$

negativo non ammiss.

$y_c > 20\ cm$ (+) → ipotesi non rispettata

Calcolo asse neutro con $y_c > t$



$S_n = 0$

$$\frac{B y_c^2}{2} - \frac{(B-b)(y_c-t)^2}{2} + n A'_s (y_c - d') - n A_{s_1} (d - y_c) - n A_{s_2} (d - y_c - 2d') = 0$$

$$\frac{1}{2}\left[B-(B-b)\right] y_c^2 + \left[(B-b)t + n\left(A'_s + A_{s_1} + A_{s_2}\right)\right] y_c - \left[\frac{(B-b)t^2}{2} + \right.$$

$$\left. + n\left[A'_s d' + A_{s_1} d + A_{s_2}(d-2d')\right]\right] = 0$$

$$10\, y_c^2 + 1391{,}6\, y_c - 38505{,}8 = 0$$

$$y_c = \frac{-1391{,}6 \pm \sqrt{1391{,}6^2 + 4 \cdot 10 \cdot 38505{,}8}}{2 \cdot 10} = \begin{cases} 23{,}65 \text{ cm} \\ -162{,}81 \text{ cm} \text{ negativo} \end{cases}$$

$\underline{y_c = 23{,}65 \text{ cm}}$

- Calcolo I_n

$$I_n = \frac{B y_c^3}{3} - \frac{(B-b)(y_c-t)^3}{3} + n A'_s (y_c - d')^2 + n A_{s_1} (d - y_c)^2 + n A_{s_2} (d - y_c - 2d')^2 =$$

$$= 263911{,}18 + 51426{,}55 + 442556{,}90 + 328527{,}80 = 1087070{,}79 \text{ cm}^4$$

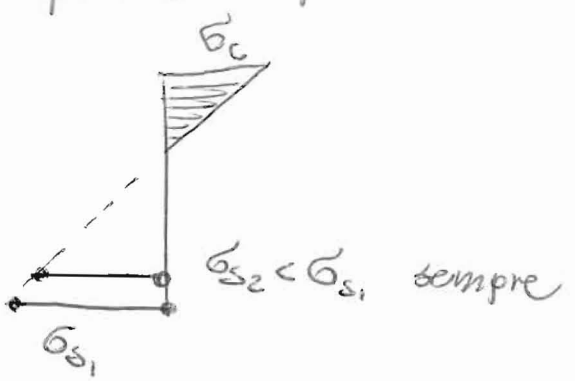
- Verifica

$$\sigma_c = \frac{M}{I_n} y_c = \frac{300 \cdot 10^6 \text{ Nmm}}{1087070{,}79 \cdot 10^4 \text{ mm}^4} \cdot 236{,}5 \text{ mm} = 6{,}53 \text{ MPa} < \bar{\sigma}_c$$

$$\sigma'_{s_1} = n \frac{M}{I_n} (y_c - d') = 85{,}48 \text{ MPa} < \bar{\sigma}_s$$

$$\sigma_{s_1} = n \frac{M}{I_m} (d - y_c) = 179{,}5\,\text{MPa} < \bar{\sigma}_s$$

σ_{s_2} è verificato perché è più vicino all'asse neutro rispetto a A_{s_1}



- Problema di Collaudo della sezione precedente

Consiste nel determinare il momento Resistente

$$M_R = \min(M_{Rc}, M'_{Rs}, M_{Rs_1})$$

$$\bar{\sigma}_c = \frac{M_{Rc}}{I_m} y_c \rightarrow M_{Rc} = \frac{I_m}{y_c} \cdot \bar{\sigma}_c = 390 \cdot 10^6\,\text{Nmm}$$
$$390\,\text{kN}$$

$$\bar{\sigma}'_s = n \frac{M'_{Rs}}{I_m} (y_c - d') \rightarrow M'_{Rs} = \frac{I_m}{n(y_c - d')} \cdot \bar{\sigma}'_s = 772 \cdot 10^6\,\text{Nmm}$$
$$772\,\text{kNm}$$

$$\bar{\sigma}_s = n \frac{M_{Rs}}{I_m} (d - y_c) \rightarrow M_{Rs} = \frac{I_m}{n(d - y_c)} \bar{\sigma}_s = 367 \cdot 10^6\,\text{Nmm}$$
$$367\,\text{kNm}$$

$$M_R = \min(390; 772; 367) = 367\,\text{kNm}$$