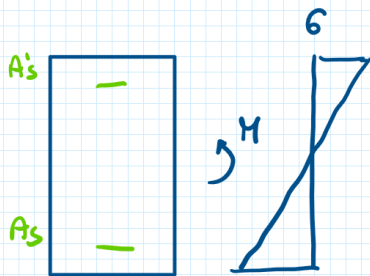


**I STADIO**

$$\sigma_{ct} \leq f_{ctk}$$

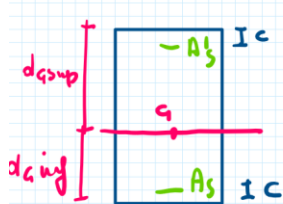
$$\sigma_{ct} = \frac{M}{I_x} y$$

PROCEDIMENTO1) DETERMINARE  $\alpha$ 

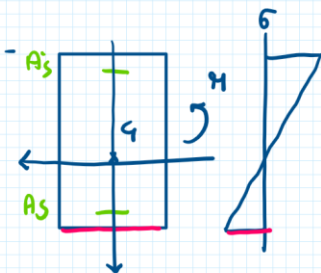
$$A_{ci} = A_c + \alpha (A'_s + A_s)$$

$$S_{sup} = b \frac{h^2}{2} + \alpha A'_s c + \alpha A_s d$$

$$d_{c\sup} = \frac{S_{sup}}{A_{ci}} \quad d_{c\inf} = h - d_{c\sup}$$

2) DETERMINARE  $I_x$ ,  $y$ 

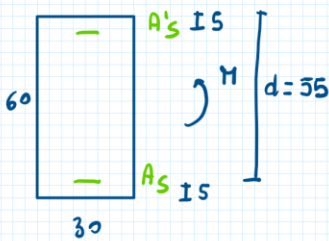
$$I_x = b \frac{d_{c\sup}^3}{3} + b \frac{d_{c\inf}^3}{3} + \alpha A'_s (d_{c\sup} - c)^2 + \alpha A_s (d_{c\inf} - c)^2$$



$$y = d_{c\inf}$$

$$3) \sigma_{ct} = \frac{M}{I_x} d_{c\inf}$$

### ESEMPIO



$$M = 70 \text{ kNm}$$

$$A'_s = 2 \phi 14$$

$$A_s = 4 \phi 20$$

$$c = 5 \text{ cm}$$

$$A_{1 \phi 14} = 1.54 \text{ cm}^2$$

$$A_{1 \phi 20} = 3.14 \text{ cm}^2$$

VER. A FESSURAZIONE

$$\sigma_{ct} \leq f_{ctk}$$

$$\sigma_{ct} = \frac{M}{I_x} y$$

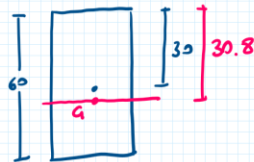
#### 1) DETERMINO $Q$

$$A_{ci} = 30 \times 60 + 6.35 (2 \times 1.54 + 4 \times 3.14) = 1899.3 \text{ cm}^2$$

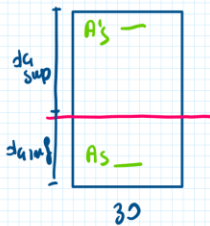
$$S_{sup} = 30 \times \frac{60^2}{2} + 6.35 \times 2 \times 1.54 \times 5 + 6.35 \times 4 \times 3.14 \times 55 = 58484.4 \text{ cm}^3$$

$$d_{g, sup} = \frac{58484.4}{1899.3} = 30.8 \text{ cm}$$

$$d_{inf} = 60 - 30.8 = 29.2 \text{ cm}$$



#### 2) DETERMINARE $I_x, y$



$$I_x = \frac{30 \times 30.8^3}{3} + \frac{30 \times 29.2^3}{3} + 6.35 \times 2 \times 1.54 (30.8 - 5)^2 + 6.35 \times 4 \times 3.14 (29.2 - 5)^2 = 600878.9 \text{ cm}^4$$

$$\frac{bh^3}{3}$$

$$\frac{I = bh^3}{12}$$

$$y = 29.2 \text{ cm}$$

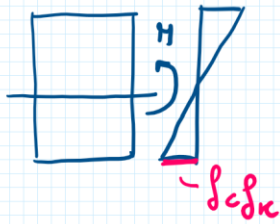
$$3) \sigma_{ct} = \frac{70}{600878.9} \cdot 29.2 \times 10^3 = 3.4 \text{ MPa}$$

$$\frac{\text{kNm}}{\text{cm}^4 \times 10^8} \times \frac{10^3}{10^3} \times 10^3$$

$$f_{ctk} = 2.15 \text{ MPa}$$

$$3.4 > 2.15 \Rightarrow \text{NON VERIFICA}$$

$M_F$  DI FESSURAZIONE ?



$$\sigma = \frac{M_F}{I_x} d_{ang} = f_{cdk}$$

$$M_F = f_{cdk} \frac{I_x}{d_{ang}} = 2.15 \cdot \frac{600878.9}{29.2} \cdot \frac{1}{10^3} = 44.3 \text{ kNm}$$

$$\frac{\text{kN}}{\text{mm}^2} \times \frac{\text{mm}^4}{\text{cm}^4} \times \frac{10^3}{10^3} \cdot \frac{1}{10^3}$$