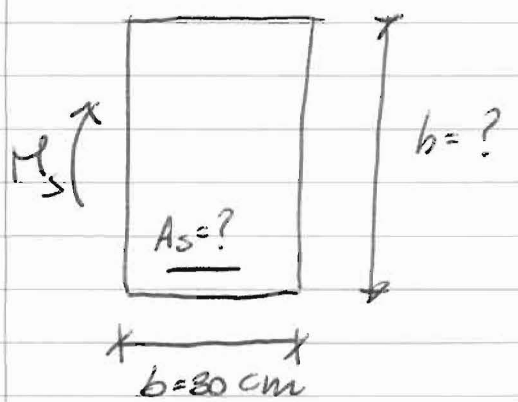
Esercitazione Flessione T.A.

Ex. 1 - Progetto semplice Armatura



$b = 30$ cm

$M_s = 150$ KN/m

$\bar{\sigma}_c = 8{,}5$ MPa

FeB 38K $\rightarrow \bar{\sigma}_s = 220$ MPa

- Progetto h (tabellare)

$$d = r\sqrt{\frac{M}{b}} \qquad r = r\left(\bar{\sigma}_s, \frac{d'}{d}, \bar{\sigma}_c, n\right) = 0{,}27$$

$$d = 0{,}27\sqrt{\frac{15000 \text{ Kgm}}{0{,}3 \text{ m}}} = 60{,}37 \text{ cm} \Rightarrow h = 65 \text{ cm}$$

- Progetto armatura

$$r = \frac{d}{\sqrt{M/b}} = \frac{62}{\sqrt{\frac{15000}{0{,}3}}} = 0{,}277 \rightarrow \zeta = 0{,}88$$

$$A_s = \frac{M_s}{\zeta\bar{\sigma}_s d} = \frac{150 \cdot 10^6 \text{ Nmm}}{220\text{MPa} \cdot 0{,}88 \cdot 620 \text{ mm}} = 1250 \text{ mm}^2$$

$\Downarrow$

$5\phi20$ ($15{,}7$ cm^2)

Ex. 2 - Progetto a Doppia Armatura

Hp. Armatura simmetrica

$$\rho = \frac{A'_s}{A_s} = 1$$

Dati

Stessi ex. 1

• Prog. h (tabellare)

$$d = r' \sqrt{\frac{M}{b}} = 0{,}187 \sqrt{\frac{15000}{0{,}3}} = 41{,}81 \text{ cm} \Rightarrow h = 45 \text{ cm}$$

$$r' = \frac{d}{\sqrt{M/b}} \simeq 0{,}187 \rightarrow \zeta' = 0{,}914$$

• Progetto Armatura

$$A_s = \frac{M}{\bar{\sigma}_s \, d \, \zeta'} = \frac{150 \cdot 10^6 \text{ Nmm}}{220 \text{ MPa} \cdot 420 \text{ mm} \cdot 0{,}914} = 1776 \text{ mm}^2$$

$\downarrow$

$6\phi 20$ ($18{,}84$ cm^2)

$$A'_s = A_s = 6\phi 20$$

• Verifica

$$y_c = \frac{n}{b}(A_s + A'_s)\left[-1 + \sqrt{1 + 2\frac{b}{n}\frac{A_s \cdot d + A'_s d'}{(A_s + A'_s)^2}}\right] =$$

$$= \frac{15}{300}(1884 + 1884)\left[-1 + \sqrt{1 + 2\frac{300}{15}\frac{1884 \cdot 620 + 1884 \cdot 30}{(1884 + 1884)^2}}\right] = 106{,}50 \text{ mm}$$

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

$$= \frac{300 \cdot 106{,}50}{3} + 15 \cdot 1884 (106{,}50 - 30)^2 + 15 \cdot 1884 \cdot (620 - 106{,}50)^2 =$$

$I_n = 7617055620 \ mm^4$

$$\sigma_c = \frac{M}{I_n} y_c = \frac{150 \cdot 10^6}{7617055620} \cdot 106,5 = 2,09 \ MPa < \bar{\sigma}_c$$

$$\sigma_s = n \frac{M}{I_n} (d - y_c) = 15 \cdot \frac{150 \cdot 10^6}{I_n} (620 - 106,5) = 151,68 \ MPa < \bar{\sigma}_s$$

$$\sigma_s' = n \frac{M}{I_n} (y_c - d') = 22,60 \ MPa < \bar{\sigma}_s$$