

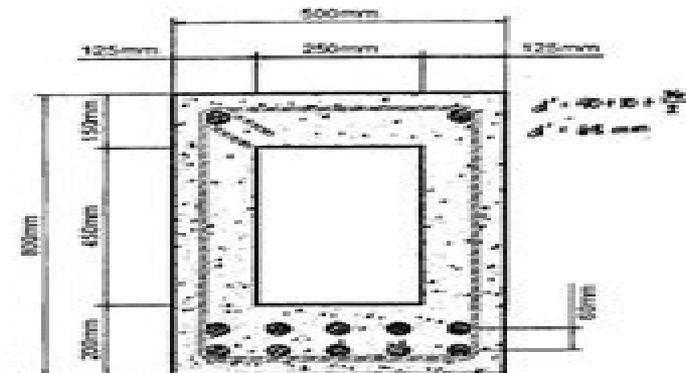


MIDTERM EXAM: ANALYSIS OF IRREGULAR REINFORCED CONCRETE BEAM

PROBLEM 1:

A hollow rectangular concrete beam shown in the figure is reinforced by 36mmØ main bars and 10mmØ stirrups. Concrete strength $f_c' = 34.2$ MPa, Steel Yield Strength $f_y = 415$ MPa. Minimum concrete cover was applied on the section.

- Determine the total compressive force of concrete.
- Determine the total tensile force of the steel.
- Compute the ultimate strength design of the section.



$$b = 0.85 = \frac{0.85}{1} (34.2 - 25)$$

$$b = 0.8087$$

$$f_b = \frac{0.85(34.2)(0.8087)}{415} \left(\frac{400}{800 + 725} \right)$$

$$f_b = 0.03336$$

$$f_{max} = 0.75 f_b = 0.75(0.03336)$$

$$f_{max} = 0.02502$$

$$d = 800 - 10 - 10 - \frac{36}{2} - \frac{36}{2}$$

$$d = 702 \text{ mm}$$

$$\rho = \frac{\frac{4}{3} (36)^2 (10)}{(800)(702) - (250)(450)}$$

$$\rho = 0.04284$$

$$\rho > f_{max} \therefore \text{Doubly Reinforced Beam}$$

Depth of Compressive Block (a):

$$\text{Let } a: 0 \leq a \leq 150$$

$$e f_c = 0; (f_c' + f_y)$$

$$C = T$$

$$0.85(34.2)(a)(800) + 415 \left(\frac{4}{3} (36)^2 (10) \right) = 415 \left(\frac{4}{3} (36)^2 (10) \right)$$

$$a = 232.4873 \text{ mm}$$

$$\text{Let } a: 150 \leq a \leq 800$$

$$e f_c = 0; (f_c' + f_y)$$

$$C = T$$

$$0.85(34.2)(a)(800) - 0.85(34.2)(a - 250)(250) + 415 \left(\frac{4}{3} (36)^2 (10) \right) = 415 \left(\frac{4}{3} (36)^2 (10) \right)$$

$$a = 319.9946 \text{ mm}$$

$$f_c' = 800 \left(\frac{a - d'}{a} \right)$$

$$f_c' = 435.69 \text{ MPa} \therefore \text{Yield}$$

$$a) \quad C_c = 0.85(34.2)(319.9946)(800) - 0.85(34.2)(319.9946)(250)$$

$$C_c = 3,373,246.960 \text{ N}$$

$$C_c = 3,373.25 \text{ kN}$$

Concrete Engineering Questions

Rosina Ehmman



Concrete Engineering Questions:

Reviewing **Concrete Engineering Questions**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Concrete Engineering Questions**," an enthralling opus penned by a very acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve into the book's central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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