

SHORT COLUMNS UNDER UNIAXIAL BENDING

RECTANGULAR

Design a reinforcements in a rectangular column of size 300mm by 500mm to support design ultimate load of 500kN together with a factored moment of 200kNm. Adopt $f_{ck} = 20 \text{ N/mm}^2$, $f_y = 415 \text{ N/mm}^2$.

Data :

$$b = 300 \text{ mm}, D = 500 \text{ mm.}$$

$$f_{ck} = 20 \text{ N/mm}^2, f_y = 415 \text{ N/mm}^2$$

$$P_u = 500 \text{ kN}, M_u = 200 \text{ kNm}, d'/D = 0.1$$

Non-Dimensional Parameters :

$$\frac{P_u}{f_{ck} b D} = \frac{500 \times 10^3}{20 \times 300 \times 500} = 0.166$$

$$\frac{M_u}{f_{ck} b D^2} = \frac{200 \times 10^6}{20 \times 300 \times 500^2} = 0.132.$$

Longitudinal Reinforcement :

In SP16, Refer chart 32, Pg.no - 117.

$$d'/b = 0.10, f_y = 415 \text{ N/mm}^2$$

$$P/f_{ck} = 0.06$$

$$P = 0.06 \times 20 = 1.2.$$

$$A_{sc} = \frac{P b D}{100}$$

$$= \frac{1.2 \times 300 \times 500}{100} = 1800 \text{ mm}^2$$

Provide 4 bars of 25 mm dia distributed,
2 nos on each face

$$A_{sc} = 4 \times \frac{\pi}{4} \times 25^2 = 1964 \text{ mm}^2.$$

Lateral Ties :

$$\text{Tie diameter } \phi_t < \begin{cases} \frac{1}{4} \times 25 = 6.25 \\ 6 \text{ mm} \end{cases} \quad \text{Provide 8mm ties}$$

$$\text{Tie spacing } S_t \leq \begin{cases} 16 \times 25 = 400 \text{ mm} \\ 48 \times 8 = 384 \text{ mm} \\ b = 300 \text{ mm} \end{cases} \quad \text{Adopt 300 mm.}$$

Provide 8mm diameter ties @ 300 mm c/c.

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CIRCULAR COLUMN

Design a short ~~cat~~ circular column of diameter 400mm to support a factored axial load of 900 kN, together with a factored moment of 100 kNm. Adopt M20 grade concrete and Fe415 grade reinforcements

Data:

$$D = b = 400 \text{ mm}, \text{ Assume } d' = 40 \text{ mm}$$

$$P_u = 900 \text{ kN} \quad d'/D = 0.10$$

$$M_u = 100 \text{ kNm} \quad f_{ck} = 20 \text{ N/mm}^2, f_y = 415 \text{ N/mm}^2$$

Non-Dimensional parameters:

In SP-16, Pg. no - 103,

$$\frac{P_u}{f_{ck} D^2} = \frac{900 \times 10^3}{20 \times 400^2} = 0.28$$

$$\frac{M_u}{f_{ck} D^3} = \frac{100 \times 10^6}{20 \times 400^3} = 0.078$$

Longitudinal Reinforcements:

In SP-16, Pg. no - 141, chart no - 56

$$\frac{P}{f_{ck}} = 0.10 \Rightarrow P = 20 \times 0.10 = 2$$

$$A_s = \frac{P \pi D^2}{400} = \frac{2 \times \pi \times 400^2}{400} = 2512 \text{ mm}^2$$

Provide 6 bars of 25mm diameter

$$A_s = 6 \times \frac{\pi}{4} \times 25^2 \\ = 2945 \text{ mm}^2$$

Lateral ties :

In IS456, Pg. no - 49, clause . 26.5.32 (c)(2)

Tie diameter $\neq \frac{25}{4} = 6.25 \text{ mm.}$

$\neq 16 \text{ mm}$ (Hence, select 8mm diameter ties)

Tie spacing $\neq 400 \text{ mm}$

$\neq (16 \times 25) = 400 \text{ mm.}$

$\neq 300 \text{ mm.}$

Provide 8mm diameter ties @ 300mm c/c

Reinforcements :

