Department of Civil Engineering
Katihar Engineering College, Katihar

Subject: Design of Concrete Structure-I

Topic: Column

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lecture: 01

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COLUMNS

Working stress method :

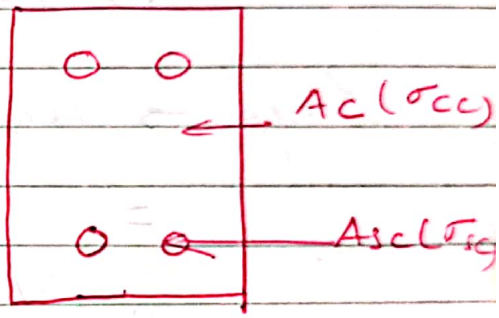
① Slenderness ratio = $\frac{\text{Effective length}}{\text{least lateral dimension}}$

$SR = \frac{L_{eff}}{LLD} \leq 12$ → short column

$\frac{L_{eff}}{LLD} > 12$ → long column.

② Load carrying capacity of a short column subjected to axial ~~loaded~~ load.

$$P = \sigma_{sc} A_{sc} + \sigma_{cc} \cdot A_c \quad \text{—①}$$

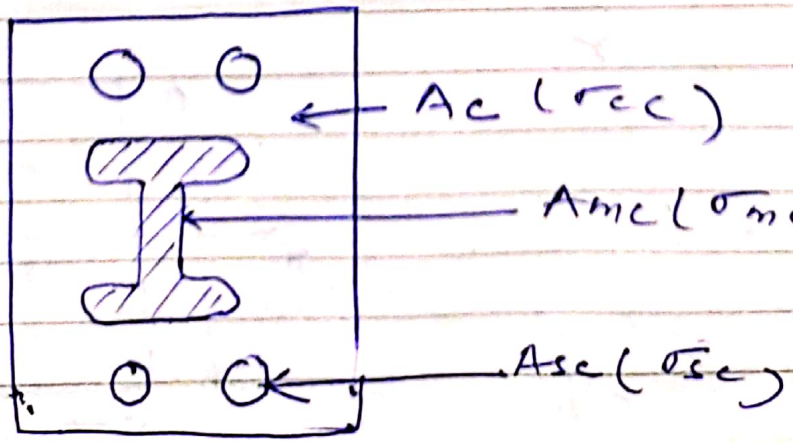


③ If any other ~~math~~ metal is also provided in the column

$$P = [\sigma_{sc} \cdot A_{sc} + \sigma_{cc} \cdot A_c + \sigma_{mc} \cdot A_{mc}]$$

If Total $A = B \times D$

$A_c = (A - A_{sc} - A_{mc})$



(4) If the column is a long column

4 red^{n} factor C_r is used

$$C_r = 1.25 - \frac{L_{eff}}{48B} \quad \text{---(1)}$$

↳ For Rectangular / square / section

$$C_r = 1.25 - \frac{L_{eff}}{160\, i_{min}} \quad \text{---(2)}$$

↳ For Irregular section

i_{min} → least radius of gyration

$$= \sqrt{\frac{I_{min}}{A}}$$

→ Load carrying capacity of a long column:

$$P = C_r(\sigma_{sc} A_{sc} + \sigma_{cc} \cdot A_c + \sigma_{mc} \cdot A_{mc})$$

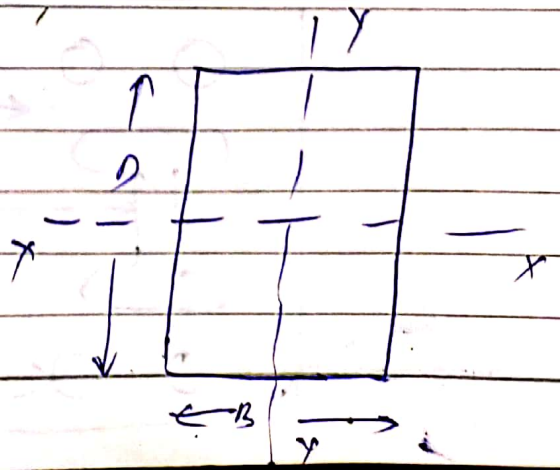
If metal core is absent

$$P = C_r(\sigma_{sc} \cdot A_{sc} + \sigma_{cc} \cdot A_c)$$

⇒ Value of C_r

Least lateral dimension = B

$\frac{L_{eff}}{B} \geq 12$ → long column



(1) $C_r = \left(1.25 - \frac{L_{eff}}{48B}\right)$

(2) from 2nd formula

$$C_r = 1.25 - \frac{L_{eff}}{160\, l_{min}}$$

I_{min} = about Y–Y

$I_y = D B^3/12$

$$l_{min} = \sqrt{\frac{I_{min}}{A}} = \sqrt{\frac{DB^3}{12 \times BD}}$$

$$= \frac{B}{\sqrt{12}}$$

$$C_r = 1.25 - \frac{L_{eff}}{160 \cdot \frac{B}{\sqrt{12}}} \Rightarrow$$

$$\boxed{C_r = 1.25 - \frac{L_{eff}}{46.2B}}$$

⇒ Some other important point :

(i) Min^m area of steel of main reinforcement for Column = 0.8%

(ii) Max^m Area of steel

⇒ 6% → When no laps are provided

⇒ 4% → if reinforcement are lapped

(iii) Min^m dia of bars = 12 mm

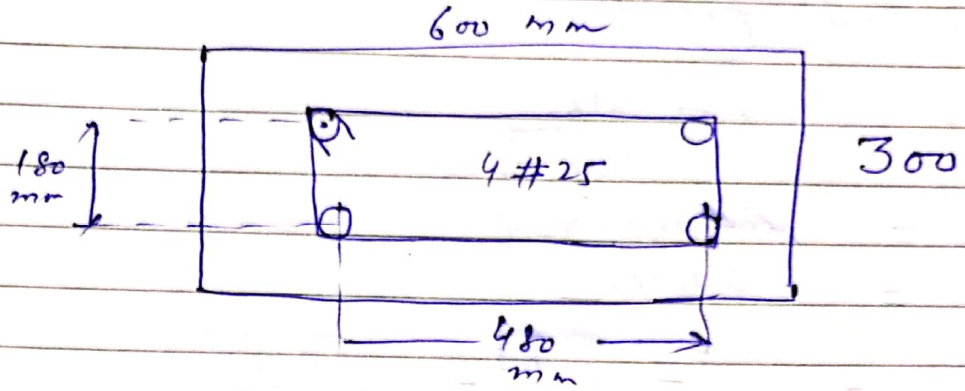
(iv) Min^m no of main reinforcement

Rectangular = 4

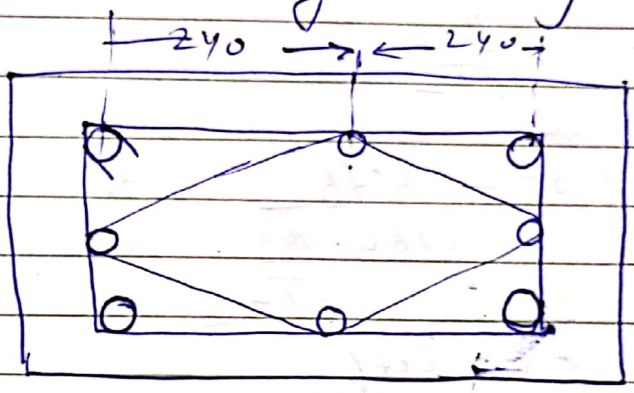
Circular = 6

(v) Max^m spacing of main reinforcement
= 300 mm

Eg



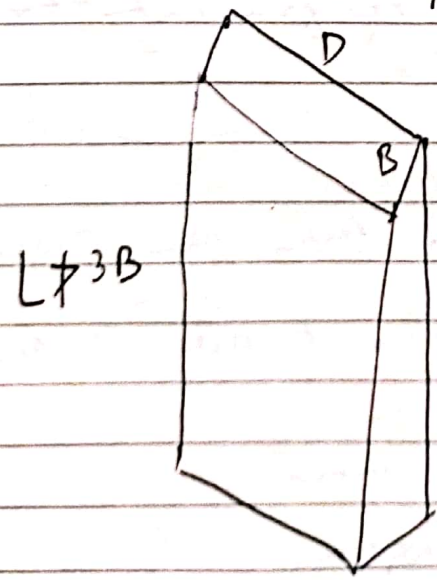
Wrong detailing



Correct detailing

(VI) Pedestal : is a short column for which

$L_{eff} \neq 3.B$



In this case

Min^m % of steel = 0.15 %

0.8 %. of Min^m steel not req^d in this case

Happy Learning