Assignment 3

Date. 14/5/20 No. 11

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Matric No:- 17/ENG03/002.

course :- structural design.

Capitals/dropping = 1.2m

25 - H10 N/mm² concrete s

Slab thickness = 250mm

finishes = 1.2 KN/m²

partition = 1.0 KN/m²

slab = 0.25 × 25 = 6KN/m²

Total = 8.2 KN/m²

Designing = 5.0

Area = 4.5 × 4 = 18m²

D.L per area = 1.4 GK + 1.6 QK

= (1.4 × 9.2 × 1.8) + (1.6 × 5 × 18)

= 206.64 + 135

= 341.64

short span → Middle strip → span

span = $L_x - \frac{2}{3}h$ = $4 - \frac{2}{3} \times 1.2$ = 3200mm

Date. No.

Moment = 45% × 0.071 W_2 = $^{45}/_{100}$ × 0.071 × 341.6 × 4

= 43.6 kN/m

Width = b = $\frac{l_x}{2}$ = $\frac{4}{2}$ = 2 = 2000mm

d = h - (cover - ½ ϕ = 250 - 25 - 6

= 219mm

K = $\frac{M}{bd^2 f_{cu}}$ = $\frac{43.66 \times 10^6}{2000 \times 219^2 \times 25}$ = 0.018

$l_a = 0.5 + \sqrt{0.25 - K/0.9} = 0.5 + \sqrt{0.25 - \frac{0.018}{0.9}}$

= 0.97 × 0.95

z = l_a · d = 0.95 × 219 = 208.05

$A_s = \frac{M}{0.95 f_y z} = \frac{43.66 \times 10^6}{0.95 \times 410 \times 208.05}$ = 538.5

provide y12 @ 200c/c (A_s = 566mm²).

M_2 = 25% × 0.071 W_2 = $^{25}/_{100}$ × 0.071 × 341.64 × 4

= 24.25

W_1 = 2000m = b

Date. No.

$K = \frac{24.25 \times 10^6}{2000 \times 219^2 \times 25} = 0.01$

$z_a = 0.5 + \sqrt{0.25 - \frac{0.01}{0.9}} = 0.989 \times 0.95 = 0.95$

$z = z_a \cdot d = 0.95 \times 219 = 208.05$

$A_s = \frac{24.25 \times 10^6}{0.95 \times 208.05 \times 410} = 299.25$

provide Y12 @ 300 c/c ($A_s = 377 mm^2$)

Column strip (short)

span = 3200 mm

b = 2000 mm

$M = 55\% \; 0.07 f_{cu} = \frac{55}{100} \times 0.071 \times 34.64 \times 4 = 53.36 kN/m^2$

$K = \frac{M}{bd^2 f_{cu}} = \frac{53.36 \times 10^6}{2000 \times 219^2 \times 25} = 0.022$

$z_a = 0.5 + \sqrt{0.25 - \frac{0.02^2}{0.9}} = 0.97 \times 0.95 = 0.95$

$z = z_a \cdot d = 0.95 \times 219 = 208.05$

$A_s = \frac{53.36 \times 10^6}{0.95 \times 410 \times 208.05} = 658.47$

provide Y12 @ 150 c/c $(A_s = 754 mm^2)$

Date. No.

$M = \frac{75}{100} \times 0.071 \times 341.64 \times 4 = 72.77$

$K = \frac{72.77 \times 10^6}{1000 \times 219^2 \times 25} = 0.030$

$Z_a = 0.5 + \sqrt{0.25 - \frac{0.032}{0.9}} = 0.96 > 0.95 = 0.95$

$Z = 208.05$

$A_s = \frac{72.77 \times 10^6}{208.05 \times 410 \times 0.95} = 898$

provide Y12 @ 125 c/c $\angle A_s = 905 mm^2$

Long span → middle strip → $\angle$ span →

$L_y - \frac{2}{3}h = 4.5 - \frac{2}{3} \times 1.2 = 3700 mm$

Moment $= 0.45 \times 0.071 \times 304.64 \times 4.5 = 49.12$

Width $= b = L_y - L_x/2 = 4.5 - 2 = 2.5 = 2500$

$K = \frac{49.12 \times 10^6}{2500 \times 219^2 \times 25} = 0.01$

$Z_a = 0.5 + \sqrt{0.25 - \frac{0.01}{0.9}} = 0.98 > 0.95 = 0.95$

$Z = 208.05$

$A_y = \frac{49.12 \times 10^6}{0.95 \times 208.05 \times 410} = 606.15$

provide Y12 @ 175 c/c $\angle A_s = 646 mm^2$

Date. No.

$M = 0.25 \times 0.071 \times 34.64 \times 4.5 = 28.21$

$b = 2500$

$d = 219$

$K = \frac{28.89 \times 10^6}{2500 \times 219^2 \times 25} = 9.10 \times 10^{-3}$

$Za = 0.5 + \sqrt{0.25 - \frac{9.10 \times 10^{-3}}{0.9}} = 0.989 \times 0.95 = 0.95$

$Z = Za \cdot d = 208.05$

$A_s = \frac{28.89 \times 10^6}{0.95 \times 208.05 \times 410} = 336.86$

provide Y12 @ 300 c/c $A_s = 1131 mm^2$

column slab

span = 3200 mm

width = $6c/2 = 2000 mm$

moment = $0.55 \times 0.071 \times 341.67 \times 4.5 = 60.04$

$K = \frac{60.04 \times 10^6}{2000 \times 219^2 \times 25} = 0.025$

$Za = 0.5 + \sqrt{0.25 - \frac{0.02}{0.9}}$ $0.97 \times 0.95 = 0.95$

$Z = 208.05$

$A_s =$ 6

0.95

prod

Moment

$K =$ 9

200

$Za =$ 0

$Z =$ 2

$A_s =$

0

2a.

$A_s = \frac{60.04 \times 10^6}{0.95 \times 410 \times 208.05} = 744.69$ Date. No.

provide Y12 @ 150 c/c $\angle A_s$ 754 mm² ✓

Moment = $0.75 \times 0.071 \times 341.67 \times 4.5 = 81.87$

$k = \frac{81.87 \times 10^6}{20000 \times 219^2 \times 25} = 0.034$

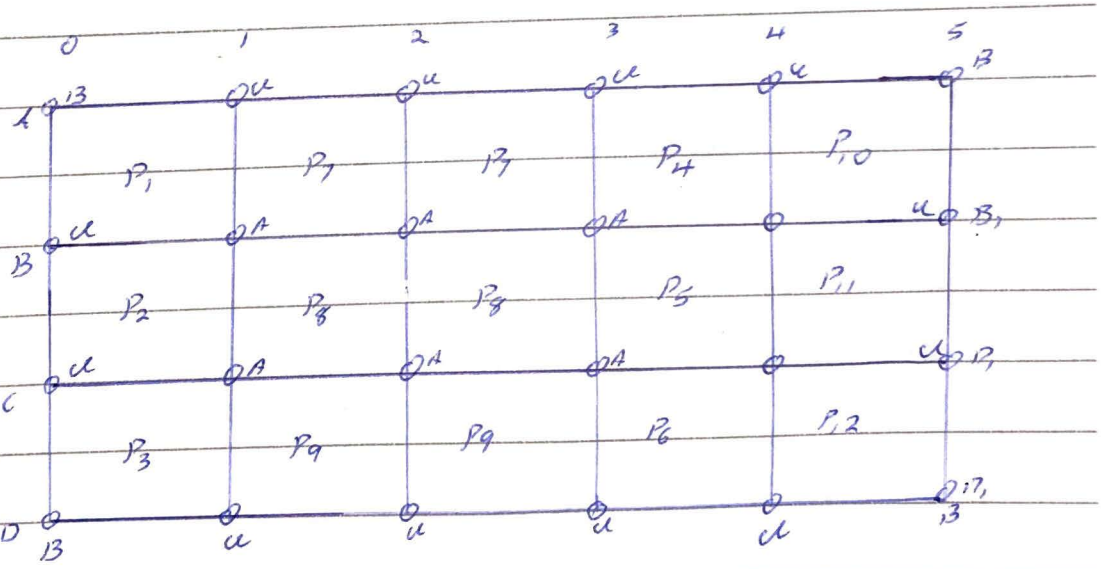
$z_a = 0.5 + \sqrt{0.25 - \frac{0.034}{0.9}} = 0.96 \times 0.95$

$z = 208.05$

$A_s = \frac{81.87 \times 10^6}{0.95 \times 410 \times 208.05} = 1010.298$

provide Y12 @ 100 c/c $\angle A_s = 1130$ ✓

2a.



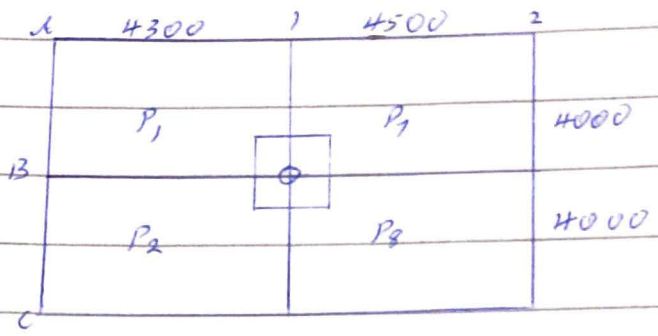
Key : A = Axial

B = Biaxially

U = Uniaxially.

Date. No.

designing for column B2



$A = 4 \times 4.4 = 17.6 m^2$

Slab load.

Weight of slab $= 0.15 \times 24 = 3.6 KN/m^2$

finishes $= 1.2 KN/m^2$

partition $= \underline{1.0 KN/m^2}$

$5.9 KN/m^2$

Design load $= 1.4QK + 1.6QK$

$= 1.4 \times 5.8 + 1.6 \times 2.5$

$= 12.12 KN/m^2$

Beam load

beam self $= 0.225 \times 0.6 \times 24 = 3.24 KN/m^2$

wall load $= 3.47 \times 3 = 10.41 KN/m^2$

$= 13.65 KN/m^2$

DL $= 1.4 \times 13.65 = 19.11 KN/m^2$

Design

Date. No.

Roof - 3rd Floor

Roof load = Area × 1.5 × 1.5

= 17.6 × 1.5² = 39.6KN

Roof beam = 0.225 × 0.45 × 24 = 2.43KN/m²

Finishes = 1.0 KN/m²

= 3.43KN/m²

Roof beam = 3.43(

column load = 10KN

Total load = 89.94 KN

3rd Floor → 2nd Floor

Load = 89.94KN

column load = 10KN

slab load = 17.6 × 12.12 = 213.312 KN

Beam load = 19.11 × (8.4) = 160.52KN

Total = 463.776KN

2nd Floor to 1st Floor

Load from above = 463.78KN

column load = 10KN

Slab = 213.312 KN

Wall & beam = 160.52KN

Total = 856.61KN.

Date. No.

1st Floor to ground floor

Load from above = 865.61KN

column load = 10KN

slab = 213.312 KN

wall & beam = 160.524

= 1249.45 ≈ 1300KN

$A_s = \frac{M - 0.35 f_{ck} bh}{0.7 f_y - 0.35 f_{ck}}$

M = 1300KN

f_{ck} = 25

f_y = 410

b = 125

$A_s = \frac{1300 \times 10^6 - 0.35 (25 \times 225^2)}{0.7 \times 410 - 0.35 \times 25} = 3080.07 mm^2$

provide $\angle A_s = 3920 mm^2$ ✓

$A_{s min} = 0.4\% bh = 0.004 \times 225^2 = 202.5 mm^2$