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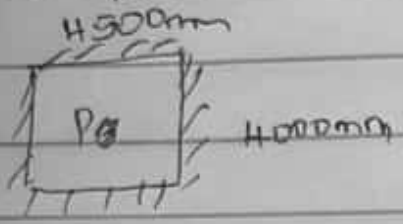
Assignment 3.

Designing b P8



Capital / dropping = 1.2m

2.5 = 40N/mm² Concrete grade

Designing for factory = 5.0

Area = 4.5 × 4 = 18m²

D.L per area = 1.4 G_k 11.6 Q_k

= (1.4 × 8.2 × 18) + (1.6 × 5 × 18)

= 206.64 + 135

= 341.64

Short span → middle strip → span

Span = $l_x - \frac{2}{3}h = 4 - \frac{2}{3} \times 1.2 = 3200mm$

moment = 45% × 0.071 pl

= $\frac{45}{100}$ × 0.071 × 341.64 × 4

$= 43.66$ kNm

width $= b = \frac{l_x}{2} = \frac{H}{2} = 2 = 2000$ mm

$d = h - \text{cover} - \frac{1}{2}\phi = 290 - 25 - 6 = 219$ mm

$K = \frac{m}{bd^2 f_w} = \frac{43.66 \times 10^6}{2000 \times 219^2 \times 25}$

$= 0.018$

$P_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}}$

$= 0.5 + \sqrt{025 - \frac{0.018}{0.9}}$

$Z = t_a \times d = 0.95 \times 219 = 0.95$

$= 208.05$

$A_s = \frac{m}{0.85 f_y Z} = \frac{43.66 \times 10^6}{0.95 \times 410 \times 208.05}$

$= 528.8$

Provide y12 @ 200 c/c $C_{A_s} = 566$ mm

Support

$M_2 = 25\% \times 0.071\,M1 = \frac{25}{100} \times 0.071 \times 341.6$

$w = 2000m = b$

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

$R_a = 0.5 + \sqrt{0.25 - \frac{0.01}{0.9}} = 0.9397 \approx 0.95$

$Z = R_a \cdot d = 0.95 \times 219 = 208.05$

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

$= 299.25$

provide 4 T12 @ 300 c/c ($A_s = 377mm^2$)

Column strip (span)

span = 3200mm

b = 2000mm

$m = 55\%\ 0.071\,M1 = \frac{55}{100} \times 0.071$

$\times 341.6H \times 4 = 53.36 \text{ kN/m}^2$

$k = \frac{m}{bd^2 f_{cu}} = \frac{53.36 \times 10^6}{2000 \times 219^2 \times 25} = 0.0222$

$z = 0.5 + \sqrt{0.25 - \frac{0.0222}{0.9}} = 0.97 > 0.95$

$= 0.95$

$z = P_d \cdot d = 0.95 \times 219$

$= 208.05$

$A_s = \frac{53.36 \times 10^6}{0.95 \times 410 \times 208.05} = 633.47$

Provide H12 @ 150 c/c (Cos = 754mm)

Column strip (support)

$m = \frac{75}{100} \times 0.071 \times 341.6H \times 4$

$= 72.77$

$\frac{72.77 \times 10^6}{2000 \times 219^2 \times 25} = 0.030$

$R_a = 0.5 + \sqrt{0.25 - \frac{0.033}{0.9}} = 0.96 \geq 0.95$

$= 0.95$

$Z = 208.05$

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

$= 898$

provide $\frac{1}{2}$ 12 @ 125 c/c ($A_s = 905mm$)

long span → middle strip → (span)

$$\text{span} = l_y - \frac{2}{3} l = 4.5 - \frac{2}{3} \times 1.2$$

$= 3700mm$

moment $= 0.45 \times 0.071 \times 3741.64 \times 4.5$

$= 449.12$

width $b = \frac{l_y}{2} - b$ $4.5 - 3$

$= 2.5$

$= 2500$

$R_a = 0.5 + \sqrt{0.25 - \frac{0.071}{0.9}} = 0.498 > 0.95$

$= 0.95$

$Z = 208.05$

$A_s = \frac{89.18 \times 10^6}{0.95 \times 208.05 \times 415} = 606.15$

Provide $\frac{1}{2}$ Ø 175 c/c [$A_s = 646 mm^2$]

Support

$M = 0.25 \times 0.071 \times 341.64 \times 4.5$

$= 28.89$

$b = 250$

$d = 219$

$R = \frac{28.89 \times 10^6}{250 \times 2192 \times 25}$

$= 9.10 \times 10^{-3}$

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

$Z = 0.95$

$R_a = 0.5 + \sqrt{0.25 - \frac{0.071}{0.9}}$ $= 0.98 > 0.95$

$= 0.95$

$Z = 208.05$

$A_s = \frac{89.18 \times 10^6}{0.95 \times 208.05 \times 415}$ $= 606.15$

Provide $4 \phi_{12}$ @ 175 c/c $[A_s = 644 mm^2]$

Support

$M = 0.25 \times 0.071 \times 314.64 \times 4.5$

$= 28.89$

$b = 2500$

$d = 219$

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

$= 9.10 \times 10^{-3}$

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

> 0.95

$z = l_a d = 208.05$

$A_s = \frac{28.89 \times 10^6}{0.95 \times 208.05 \times 410} = 336.88$

Provide 4 T12 @ 300 c/c $A_s = 339 mm^2$

Column strip

Span = 3700mm

width = $\frac{l_x}{2}$ = 2000mm

moment = $0.55 \times 0.07 \times 341.87 \times 4.5$

= 60.04

$k = \frac{60.04 \times 10^6}{2000 \times 292 \times 23} = 0.025$

$R_a = 0.5 \times \sqrt{0.25 - \frac{0.025}{0.9}} = 0.497 > 0.95$

$z = 208.05$

$A_s = \frac{60.04 \times 10^6}{0.95 \times 410 \times 208.05} = 740 mm^2$

provide 1/2 @ 150 c/c (As = 756)

Support moment = 0.75 × 0.071 × 341.67 × 4.5
= 81.87

$K = \frac{81.87 \times 10^6}{2000 \times 2192 \times 25} = 0.034$

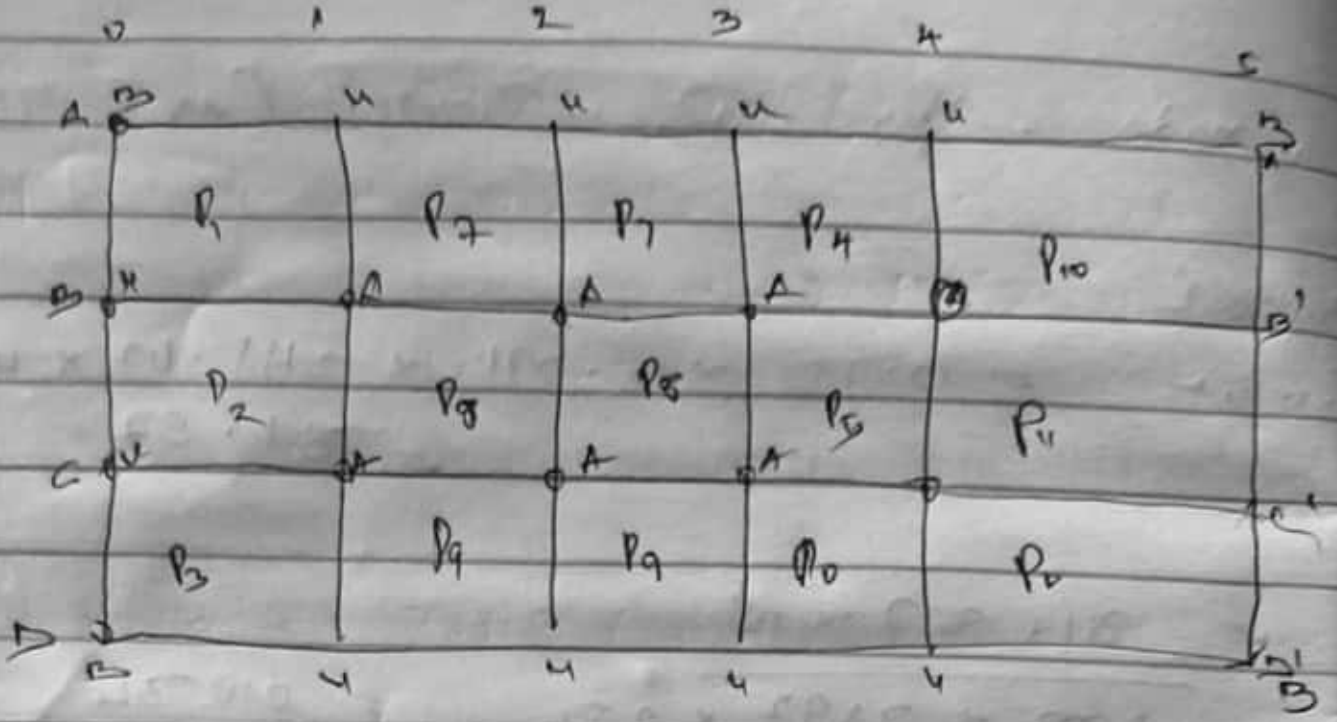
$Z_a = 0.5 + \sqrt{0.25 - \frac{0.034}{0.9}} = 0.96 > 0.9$

$Z = 208.05$

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

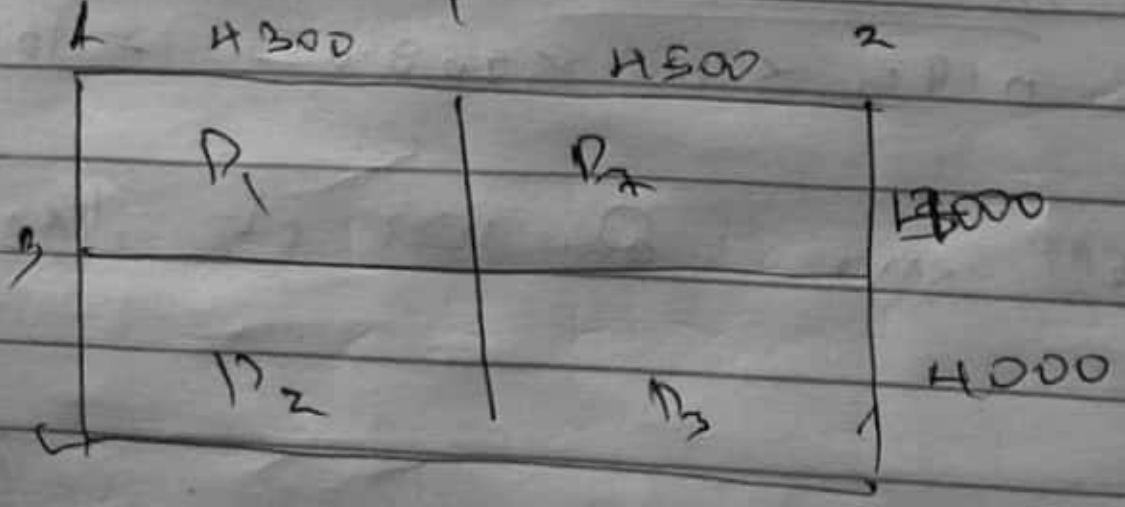
provide 1/2 @ 100 c/c (As = 1130)

2a.



Key
- A = Axial
- B = Biaxially
- U = Uniaxially

Designing for Column B1



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

Slab load

weight of slab $= 0.15 \times 24 = 3.6 kN/m^2$

finishes $= 1.2 kN/m^2$

Partition $= 1.0 kN/m^3$

$5.8 kN/m^2$

Design load $= 1.4 G_k + 1.6 Q_k$

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

$= 12.12 kN/m^2$

Beam load

beam self $= 0.225 \times 0.6 \times 24.32 kN/m^2$

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

$= 13.65 kN/m^2$

$DL = 1.4 \times 13.65$

$= 19.111 kN/m^2$

Design

Roof $=$ 3.4 Floor

Roof load $=$ Area $\times 1.5 \times 1.5$

M.b $\times 1.5^2$ = 39.6 kN

Roof beam = $0.225 \times 0.45 \times 24$

= 2.743 kN/m^2

finishes = 1.0 kN/m^2

= 3.743 kN/m^2

Roof beam = 3.43 (4.4)

Column load = 10 kN.

total load = 89.94 kN.

3rd floor = 2nd floor

load from above = 89.94 kN

Column load = 10 kN

slab load = $17.6 \times 12.12 = 213.312$ kN.

Beam load = $19.11 \times (8.4) = 160.524$ kN

total = 463.776 kN.

2nd floor to 1st floor

load from above = 463.78 kN

Column load = 101kN

slab = 213.312 kN

wall & beam = 160.52 kN

total = 565.81 kN.

1st floor to ground floor

load from above = 565.81 kN

Column load = 101 kN

slab = 213.312 kN.

wall & beam = 160.524

= 1249.45 = 1300 kN

$$A_s = \frac{N - 0.35 f_{ck} b_c}{0.7 f_y - 0.35 f_{ck}}$$

N = 1300 kN

f_{ck} = 25

f_y = 410

b = 25

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

$= 3080.07 mm^2$

Provide 8 y 25 ($A_s = 3930 mm^2$)

$A_{s,min} = 0.4\% bh = 0.004 \times 225^2 = 202$