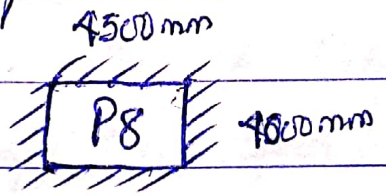
Assignment 3

Designing for P8



Capital dropping = 1.2m

25 - 410 N/mm² Concrete grade

Slab thickness = 250mm

Finishes = 1.2 KN/m²

Partitions = 1.0 KN/m²

Slab = 0.25 × 25 = 6 KN/m²

G.K = 8.2 KN/m²

Designing for a factory = 5.0

Area = 4.5×4 = 18m²

D.L per area = 1.4 G.K + 1.6 Q.K

= 1.4 (8.2×18) + 1.6 (5.0 × 18)

= 206.64 + 144

D.L = 350.64

Short span → Middle strip → Span

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

$$Moment = 45\% \times 0.071\ Rl$$

$$= \frac{45}{100} \times 0.071 \times 330.64 \times 4$$

$$= 44.81\ kN/m$$

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

$$d = h - cover - 1/2\phi = 250 - 25 - 6 = 219mm$$

$$K = \frac{M}{bd^2 f_{cu}} = \frac{44.81 \times 10^6}{2000 \times 219^2 \times 25} = 0.0186$$

$$l_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.0186}{0.9}} = 0.97 > 0.95$$

$$Z = l_a d = 0.95 \times 219 = 208.05$$

$$A_s = \frac{M}{0.95 f_y Z} = \frac{44.81 \times 10^6}{0.95 \times 410 \times 208.05} = 552.9$$

Provide Y12 @ 200 c/c (A_s = 566mm)

<u>Support</u>

$$M_2 = 25\% \times 0.071\ Rl = \frac{25}{100} \times 0.071 \times 350.64 \times 4$$

$$= 24.89$$

$$Wl = 2000m = b$$

$$K = \frac{24.89 \times 10^6}{2000 \times 219^2 \times 25} = 0.01$$

$$l_a = 0.5 + \sqrt{0.25 - \frac{0.01}{0.9}} = 0.989 > 0.95$$

$$A_s = \frac{24.89 \times 10^6}{0.95 \times 410 \times 208.05} = 307.15$$

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

Column Strip (span)

Span = 3200 mm

$b = 2000$ mm

$M = 55\%\ 0.071\ RL$

$$= \frac{55}{100} \times 0.071 \times 350.64 \times 4$$

$M = 54.76$ kN/m³

$$K = \frac{M}{bd^2 f_{cu}} = \frac{54.76 \times 10^6}{2000 \times 219^2 \times 25} = 0.023$$

$$l_a = 0.5 + \sqrt{0.25 - \frac{0.023}{0.9}} = 0.97 > 0.95$$

$Z = l_a d = 0.95 \times 219 = 208.05$

$$A_s = \frac{54.76 \times 10^6}{0.95 \times 410 \times 208.05} = 658.47$$

Provide Y12 @ 150 c/c ($A_s = 754 mm$)

(Column strip Support)

$M = \frac{75}{100} \times 0.071 \times 350.64 \times 4$

$= 74.69$

$K = \frac{74.69 \times 10^6}{2000 \times 219^2 \times 25} = 0.031$

$l_a = 0.5 + \sqrt{0.25 - \frac{0.031}{0.9}} = 0.96 > 0.95$

$Z = l_a d = 0.95 \times 219 = 208.05$

$A_s = \frac{74.49 \times 10^6}{208.05 \times 410 \times 0.95} = 921$

Provide Y12 @ 125 c/c (A_s = 905 mm)

Longspan → Middle strip → Span

Effective span = $l_y - \frac{2}{3} h$

$= 4.5 - 2/3 \times 1.2 = 3700$ mm

Moment $= 0.45 \times 0.071 \times 350.64 \times 4.5$

$= 50.41$

Width $= l_y - \frac{l_x}{2} = 4.5 - 2 = 2.5$m $= 2500$mm

$K = \frac{50.41 \times 10^6}{2500 \times 219^2 \times 25} = 0.0168$

$l_a = 0.5 + \sqrt{0.25 - \frac{0.0168}{0.9}} = 0.98 > 0.95$

$Z = 208.05$

$A_s = \frac{50.41 \times 10^6}{0.95 \times 410 \times 208.05} = 343.65$

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

<u>Column Strip</u>

Span = 3700 mm

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

Moment = $0.55 \times 0.071 \times 350.64 \times 4.5 = 61.62$

$K = \frac{61.62 \times 10^6}{2000 \times 219^2 \times 25} = 0.025$

$l_a = 0.5 + \sqrt{0.25 - \frac{0.025}{0.9}} = 0.97 > 0.95$

$Z = 208.05$

$A_s = \frac{61.62 \times 10^6}{0.95 \times 410 \times 208.05} = 760.40$

Provide Y12 @ 150 c/c ($A_s = 756 mm^2$)

<u>Support:</u>

Moment = $0.75 \times 0.071 \times 350.64 \times 4.5$

$= 84.02$

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$$K = \frac{84.02 \times 10^6}{2500 \times 219^2 \times 25} = 0.033$$

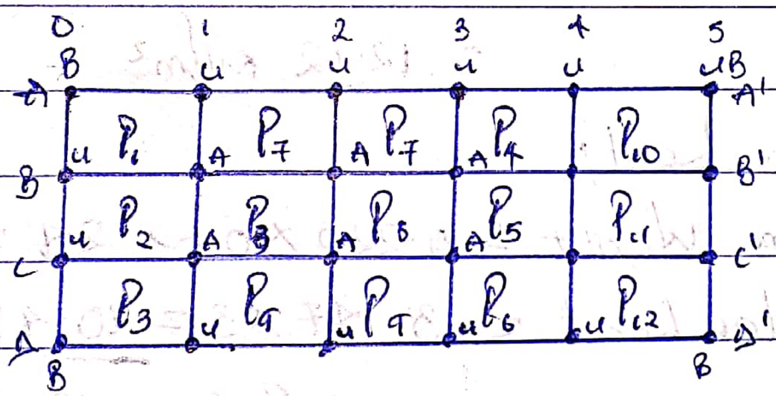
$$l_a = 0.5 + \sqrt{0.25 - \frac{0.035}{0.9}} = 0.96 > 0.95$$

$$Z = 208.05$$

$$A_s = \frac{84.02 \times 10^6}{0.95 \times 410 \times 208.05} = 1036.83$$

Provide Y12 @ 100 % c (A_s = 1130)

2a)

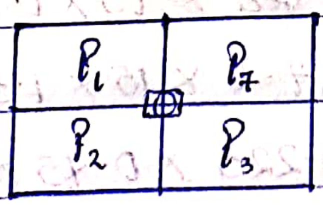


Key: A = Axial

B = Biaxial

U = Uniaxial

Designing for Column B1:



$A = 4 \times 4.4 = 17.6 m^3$

Slab Load

Weight of Slab = 0.15 × 24 = 3.6 KN/m²

Finishes = 1.2 KN/m²

Partition = 1.0 KN/m²

G.K = 5.8 KN/m²

Design Load = 1.4 G.K + 1.6 Q.K

= 1.4(5.8) + 1.6(2.5)

= 12.12 KN/m²

Beam Load;

Beam Weight = 0.225 × 0.6 × 24 = 3.24 KN/m²

Wall Load = 3.47 × 3 = 10.41 KN/m²

G.K = 13.65 KN/m²

Design Load = 1.4 × 13.65 = 19.11 KN/m²

Design;

Roof - 3rd Floor

Roof Load = Area × 15 × 1.5

= 17.6 × 15 × 1.5 = 39.6 KN

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

Finishes = 1.0 KN/m²

G.K = 3.43 KN/m²

Column Load = 10KN
Total Load = 87.94 KN

3rd floor - 2nd floor
Load from above = 87.94 KN
Column load = 10 KN
Slab Load = 17.6 × 12.12 = 213.312 KN
Beam load = 19.11 × 8.4 = 160.524 KN
Total = 463.776 KN

2nd floor - 1st floor
Load from above = 463.776 KN
Column Load = 10 KN
Slab Load = 213.312 KN
value of Beam = 160.524 KN
Total = 856.61 KN

1st floor - ground floor
Load from above = 856.61 KN
Column Load = 10KN
Slab Load = 213.312 KN
value of Beam = 160.524 KN
Total = 1249.45 => 1300 KN

$$A_s = \frac{N - 0.35 f_{cu} bh}{0.7 f_y - 0.35 f_{cu}}$$

$N = 1300$ kN

$f_{cu} = 25$

$f_y = 410$

$b = 25$

$h = 225$

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

Provide 8 Y 25 ($A_s = 3930 \, mm^2$)

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

$= 202.5 \, mm^2$

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