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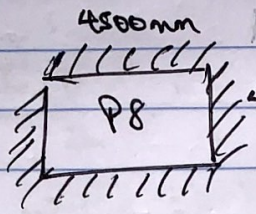
COURSE: STRUCTURAL DRAWING CVE308

MATRIC NO: 17/ENG03/1054

TOPIC: LMS ~~ASSIGNMENT~~ 3

Designing P8



Capital / dropping = 1.2m

25-410 N/mm² concrete grade

Slab thickness = 250mm

Finishes = 1.2kN/m²

Partitions = 1.0kN/m²

Slab = 0.25 × 25 = 6kN/m²

Total = 8.2kN/m²

Designing for factors = 5.0

Area = 4 × 4 = 18m²

D.L per area = 1.4Gk + 1.6Qk

= (1.4 × 8.2 × 18) + (1.6 × 5 × 18)

= 206.64 + 135

= 341.64

short span → middle strip → span

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

$$\text{Moment} = 45\% \times 0.071\,PL = \frac{45}{100} \times 0.071 \times 341.64 \times 4 = 43.60\text{kN/m}$$

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

$$d = h - \text{cover} - \tfrac{1}{2}\phi = 250 - 25 - 6 = 219\text{mm}$$

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

$$I_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.018}{0.9}} = 0.97 \geq 0.95$$

$$= 0.95$$

$z = I_{2d} = 0.95 \times 219 = 208.05$

$A_s = \frac{M}{0.95 f_y z} = \frac{43.66 \times 10^6}{0.95 \times 410 \times 208.05} = 538.8$

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

Support

$M_2 = 25\% \times 0.071 \Delta L = \frac{25}{100} \times 0.071 \times 341.64 \times 4 = 24.25$

$w = 2000 mm$

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

$I_2 = 0.5 + \sqrt{0.25 - \frac{0.01}{0.9}} = 0.989 > 0.95$

$= 0.95$

$z = I_{2d} = 0.95 \times 219 = 208.05$

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

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

Column strip (span)

Span = 3200mm

b = 2000mm

$M = 55\% \times 0.071 \Delta L = \frac{55}{100} \times 0.071 \times 341.64 \times 4 = 53.36 kN/m^2$

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

$I_2 = 0.5 + \sqrt{0.25 - \frac{0.022}{0.9}} = 0.97 > 0.95 = 0.95$

$z = I_{2d} = 0.95 \times 219 = 208.05$

$A_s = \frac{53.36 \times 10^6}{0.95 \times 410 \times 208.05} = 608.47$

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

Column strip (support)

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

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

$I_z = 0.5 + \sqrt{0.25 - \frac{0.030}{0.9}} = 0.96 > 0.95 \therefore 0.95$

$z = I_{zd} = 0.95 \times 219 = 208.05$

$A_s = \frac{72.77 \times 10^6}{208.05 \times 410 \times 0.95} = 898 mm^2$

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

Long span → middle strip → span

Effective span $= l_y - \frac{2l_x}{3} = 4.5 - \frac{2}{3} \times 1.2 = 3700 mm$

moment $= 0.45 \times 0.071 \times 341.64 \times 4.5 = 49.12$

width $= b = l_y - \frac{l_x}{2} = 4.5 - 2 = 2.5 = 2500 mm$

$K = \frac{49.12 \times 10^6}{2500 \times 219^2 \times 25} = 0.010$

$I_z = 0.5 + \sqrt{0.25 - \frac{0.010}{0.9}} = 0.98 > 0.95 \therefore 0.95$

$z = I_{zd} = 208.05$

$A_s = \frac{49.12 \times 10^6}{0.95 \times 208.05 \times 410} = 606.15 mm^2$

Provide Y12 @ 175 c/c ($A_s = 646 mm^2$)

Support

$M = 0.25 \times 0.071 \times 341.64 \times 4.5 = 28.29$

$b = 2500$

$d = 219$

$K = \frac{28.29 \times 10^6}{2500 \times 219^2 \times 25} = 9.10 \times 10^{-3}$

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

$z = I_{zd} = 208.05$

$A_s = \frac{28.29 \times 10^6}{0.95 \times 208.05 \times 410} = 336.86$

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

Column Strip (Spn)

Span = 3700mm

width = $l_x/2$ = 2000mm

Moment = 0.55 × 0.071 × 341.67 × 4.5 = 60.04

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

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

z = 208.05

$A_s = \frac{60.04 \times 10^6}{0.95 \times 410 \times 208.05} = 740.9 mm^2$

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

Support

Moment = 0.75 × 0.071 × 341.67 × 4.5 = 81.87

$K = \frac{81.87 \times 10^6}{2000 \times 219^2 \times 25} = 0.034$

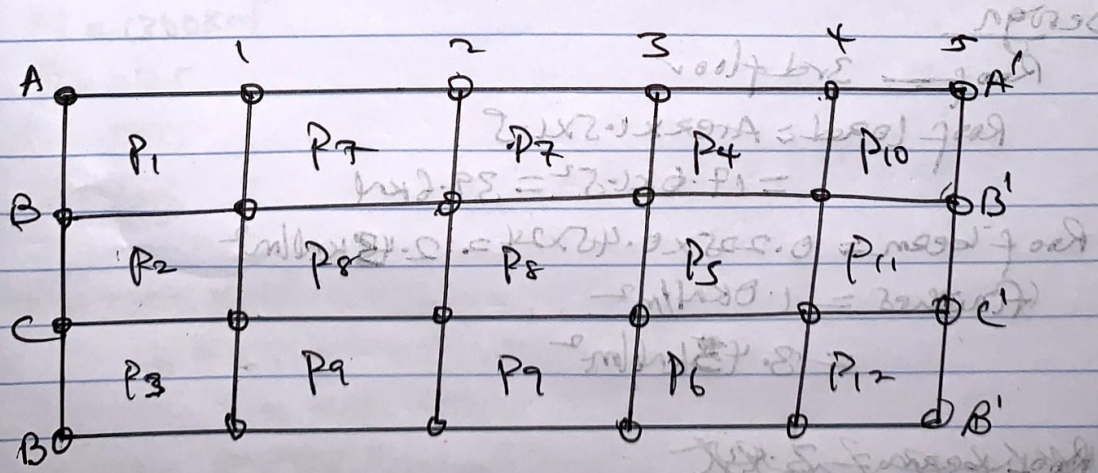
$I_x = 0.5 + \sqrt{0.25 - \frac{0.034}{0.9}} = 0.96 > 0.95 \therefore 0.95$

z = 208.05

$A_s = \frac{81.87 \times 10^6}{0.95 \times 410 \times 208.05} = 1010.248 mm^2$

Provide Y12 @ 100 c/c (A_s (1130))

2a)

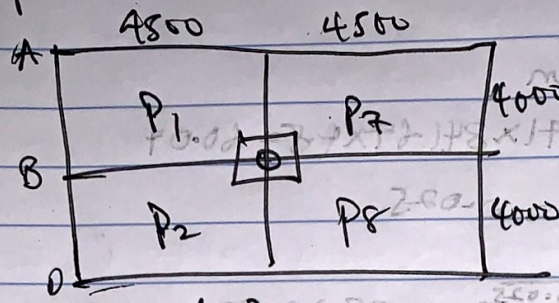


Key = A = Axial

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 = $1.0 KN/m^2$

$5.8 KN/m^2$

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

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

Roof — 3rd floor

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

$= 17.6 \times 1.5^2 = 39.6 KN$

Roof beam = $0.225 \times 0.45 \times 24 = 2.43 KN/m^2$

finishes = $1.0 KN/m^2$

$= 3.43 KN/m^2$

Column load = 10KN

Total load = $89.94 KN$

3rd floor ⇒ 2nd floor

load from above = 89.94 KN

column load = 10 KN

Slab load = 17.6 × 12.12 = 213.312 KN

Beam load = 19.11 × (8.4) = 160.524 KN

Total ⇒ 463.778 KN

2nd floor to 1st floor

load from above = 463.78 KN

Column load = 10 KN

Slab = 213.312 KN

wall & beam = 160.52 KN

Total ⇒ 865.61 KN

1st floor to ground floor

load from above = 865.61 KN

Column load = 10 KN

Slab = 213.312 KN

wall & beam = 160.524

= 249.45 × 1300 KN

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

N = 1300 KN

$f_{ck} = 25$

$f_y = 410$

b = 25

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

$= 3080.07 mm^2$

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

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