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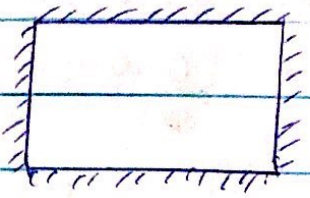
17/MHS01/083

Designing for P8



Capital / dropping = 1.8m

as - 410N/mm² Concrete grade.

slab thickness = 250mm

Finishes = 1.2 KN/m²

Partitions = 1.0 KN/m²

Slab = 0.25 * 25 = 6.25 KN/m² ≈ 6 KN/m²

Total = 8.2 KN/m²

Designing by factory = 5.0

Area = 4.5 * 4 = 18m²

D.L per area = 1.4GK + 1.6QK

= (1.4 * 8.2 * 18) + (1.6 * 5 * 18) = 350.64

Short Span = middle strip = span

Span = $L_x - \frac{2}{3}h$ = $4 - \frac{2}{3} * 1.2$ = 3200m

Moment = 45% * 0.071 Pl = $\frac{45}{100} * 0.071 * 350.64 * 4$ = ~~43.68 KN/m²~~

$= 44.81\ KN/m^2$

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

$d = h - Cover - \frac{1}{2}\phi = 250 - 25 - 6 = 219mm$

$K = \frac{M}{bd^2 f_{cu}} = \frac{44.81 \times 10^6}{2000 \times 219^2 \times 25} = 0.018$

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

$Z = Ia.d = 0.95 \times 219 = 208.05$

$As = \frac{M}{0.95 f_{y2}} = \frac{44.81 \times 10^6}{0.95 \times 410 \times 208.05} = 552.96\ mm^2$

provide y12 @ 200 c/c ($A_S = 566mm$)

Support

$M_2 = 25\% + 0.071\ P.l = \frac{25}{100} + 0.071 + 350.64 + 4 = 24.89$

$l = 2000m = b$

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

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

$Z = I_{ad} = 0.95 \times 219 = 208.05$

$AS = \frac{24.89}{0.95 \times 208.05 \times 410} = 307.14\ mm^2$

provide y12 @ 300 c/c (AS = 377 mm²)

Column strip (span)

Span = 3250 mm

b = 2000 mm

$m = 55\%\ 0.071 fl^2 = \frac{55}{100} \times 0.071 \times 350.64 \times 4 = 54.76\ kNm$

$K = \frac{m}{bd^2 f_{cu}} = \frac{54.76 \times 10^6}{2000 \times 219^2 \times 25} = 0.022$

$I_a = 0.5 + \sqrt{0.25 - K/0.9} = 0.5 + \sqrt{0.25 - \frac{0.022}{0.9}} = 0.95$

$Z = I_{ad} = 0.95 \times 219 = 208.05$

$AS = \frac{m}{0.95 f_{y2}} = \frac{54.76 \times 10^6}{0.95 \times 410 \times 208.05} = 675.75\ mm^2$

provide y12 @ 150 c/c (AS = 754 mm)

Column strip (support)

$m = \frac{95}{100} \times 0.071 \times 350.64 \times 4 = 74.68$

$$K = \frac{74.68 \times 10^6}{2000 \times 219^2 \times 25} = 0.031$$

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

$$Iad = 0.95 \times 219 = 208.05$$

$$As = \frac{M}{0.95 fy_2} = \frac{74.68 \times 10^6}{0.95 \times 208.05 \times 410} = 921.57 mm^2$$

provide y.2 @ 125 c/c.

longspan – middle strip – span.

effectivespan = $ly - \frac{2}{3}h = 4.5 - {}^2/_3 + 1.2 = 3700mm$

moment = $0.45 + 0.071 + 350.64 + 45 = 50.41$

width = $b = ly - \frac{loc}{2} = 45 - 2 = 2.5 = 2500$

$$K = \frac{50.41 \times 10^6}{2500 \times 219^2 \times 25} = 0.016$$

$$Ia = 0.5 + \sqrt{0.25 \frac{0.016}{0.9}} = 0.98 > 0.95 = 0.95$$

$Z = Iad = 0.95 \times 219 = 208.05$ = 2A

$$As = \frac{M}{0.95 fy_2} = \frac{50.41 \times 10^6}{0.95 \times 208.05 \times 410} = 622.07$$

provide y.2 @ 175 c/c ($As = 646 mm^2$)

Support

$M = 0.25 + 0.071 + 350.64 + 4.5 = 28.00$

b = 2500 & d = 219

$K = \frac{28 \times 10^6}{2500 \times 219^2 \times 25} = 9.3 \times 10^{-3}$

$Ia = 0.5 + \sqrt{0.25 - \frac{9.3 \times 10^{-3}}{0.9}} = 0.98 \text{ or } 0.95 = 0.95$

$z = Iad = 0.95 \times 219 = 208.05$

$AS = \frac{M}{0.95 f_y z} = \frac{28 \times 10^6}{0.95 \times 208.05 \times 410} = 345.52 mm^2$

provide y12 @ 300 c/c ($A_s = 377 mm^2$)

Column strip

Span = 8700mm

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

Moment = 0.55 × 0.071 × 350.64 × 4.5 = 61.61

$K = \frac{61.61 \times 10^6}{2000 \times 219^2 \times 25} = 0.025$

$Ia = 0.5 + \sqrt{0.25 - \frac{0.025}{0.9}} = 0.95$

$AS = \frac{M}{0.95 f_y z} = \frac{61.61 \times 10^6}{0.95 \times 410 \times 208.05} = 760.28 mm^2$

Provide y12 @ 150 c/c

Support

Moment = 0.75 × 0.071 × 350.64 × 4.5 = 84.02

$K = \frac{84.02 \times 10^6}{2000 \times 219^2 \times 25} = 0.035$

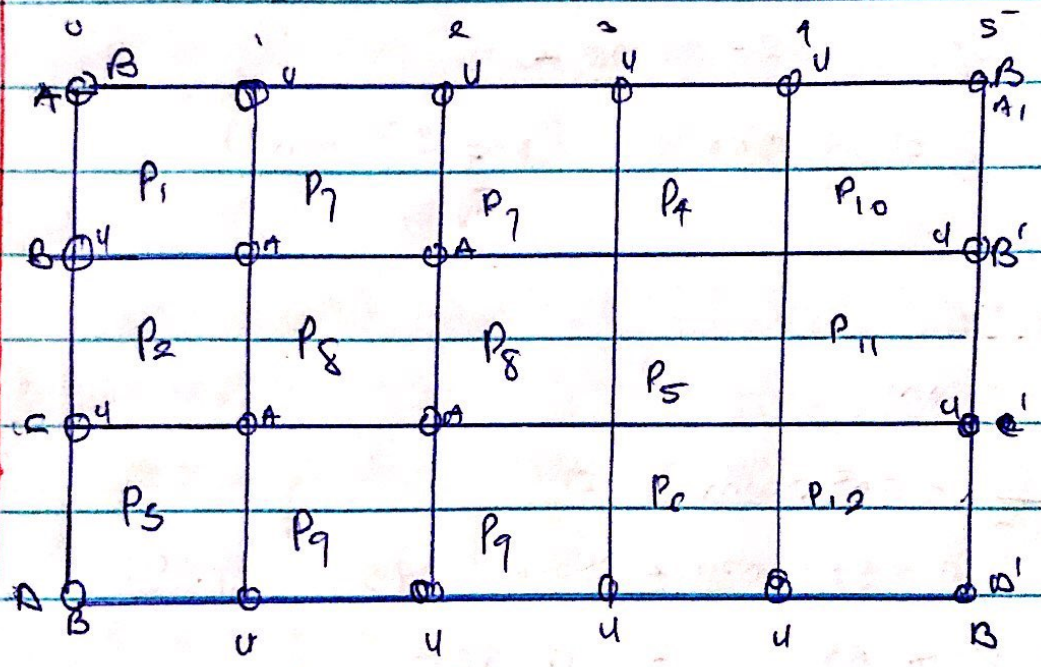
$$I_a = 0.5 + \sqrt{0.25 - \frac{0.035}{0.9}} = 0.95$$

$$Z = I_{ad} = 0.95 + 2.19 = 208.05$$

$$A_s = \frac{84.02 \times 10^6}{0.95 \times 410 + 208.05} = 1036.82 \text{ mm}^2$$

provide y.2 @ 100 c/c (As = 1130)

2A

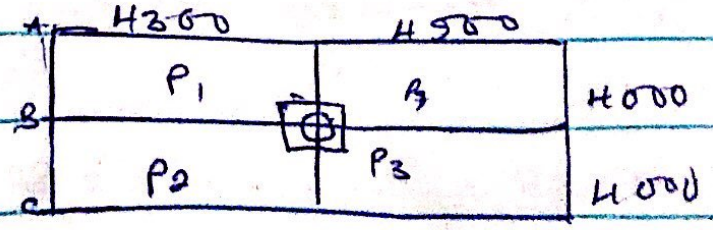


Key = A = Axial

B = Biaxially

U = Uniaxially

designing column B1



A = 4 + 4.4 = 17.6 m²

Slab load

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

finishes = 1.2 KN

Partition = 1.0 KN

5.8 KN/m²

Design load = 1.4 GK + 1.6 QK

= 1.4 × 5.8 + 1.6 × 2.5

= 12.12 KN/m²

Beam load

beam cut = 0.225 × 0.6 × 24 = 3.24 KN/m²

Wall load = 3.47 × 3 = 10.41 KN/m²

= 13.65 KN/m²

DL = 1.4 × 13.65 = 19.11 KN/m²

Design

Roof = 3rd floor

Roof load = Area × 1.5 × 1.5

= 17.6 × 1.5² = 39.6 KN

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

finishers = 1.0 KN/m²

= 3.43 KN/m²

Roof beam = 3.43 (4.4)

Column load = 10KN

Total load = 89.94KN

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 = 377 KN

2nd floor to 1st floor

load from above = 483.78 KN

column load = 10 KN

Slab = 213.312 KN

Wall and beam = 160.524

Total = 857.616

3rd floor to ground floor

Load from above = ~~860.61 KN~~ 857.616 KN

Column load = 10KN

Slab = 213.312

wall and beam = 160.524

Total = ~~1241.45~~ 1241.452

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

$N = 1300 kN$

$f_{cu} = 25$

$f_y = 410$

$b = 25$

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

provide 8y 25 ($As = 3930 mm^2$)

$As_{min} = 0.4\% h \quad = 0.004 \times 225^2 = 202.5 mm^2$