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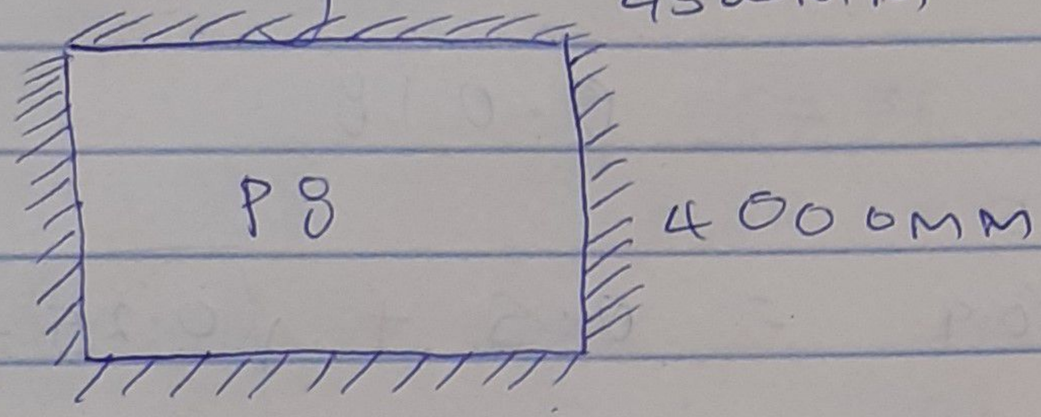
17/ENG03/061
CIVIL ENGINEERING

ASSIGNMENT 3

Designing for P8



Capital / dropping = 1.2M
25 -410 N/mm² Concrete gracle
Slab thickness = 250mm

Finishes = 1.2kN/m²
Partitions = 1.0 kN/m²
Slab = 0.25 x 25 = 6kN/m²
Total = 8.2kN/m²

Designing for factor = 5.0
Area = 4.5 x 4 = 18m²

D.L Per area = 1.4Gk + 1.6Qk
= (1.4 x 8.2 x 18) + (1.6 x 5 x 18)
= 206.64 ~~+135~~
= 341.64

Short span → middle strip → span

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

Moment = 45% $\times 0.071 \beta l$ $= \frac{45}{100} \times 0.071 \times 341.64 \times$

$d = 43.66$ KN/M

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

$d = h - \text{cover} - 1/2\,\phi = 250 - 25 - 6 = 219$ MM

$k = \frac{M}{bd^2 fu} = \frac{43.66 \times 10^6}{2000 \times 219^2 \times 25} = 0.018$

$Ia = 0.5 + \sqrt{0.25 - 1/0.9} = 0.5 + \sqrt{0.25 - \frac{0.018}{0.9}}$

$= 0.979 > 0.95$

$= 0.95$

$Z = Ia \cdot d = 0.95 \times 219 = 208.05$ mm

$As = \frac{M}{0.95 fy 2} = \frac{43.66 \times 10^6}{0.95 \times 410 \times 208.05} = 538.8\ mm^2$

Provide y12 @ 1200 c/c ($A_s = 566$ mm)

Support

$M_2 = 25\% \times 0.071 \times 341.64 \times 4$

$= 24.25$ KN/m

$kl = 2000m = b$

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

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

$= 0.95$

$Z = Ia \cdot d = 0.95 \times 219 = 208.05$ mm

$As = \frac{24.25 \times 10^6}{0.95 \times 208.05 \times 410} = 299.25\ mm^2$

provide Y12 @ 300 c/c (As = 377 mm²)

Column strip

Span

Span = 3200 mm

b = 2000 mm

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

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

$I_a = 0.5 + \sqrt{0.25 - \frac{0.02}{0.9}} = 0.97 > 0.95$

$= 0.95$

$Z = I_a \cdot d = 0.95 \times 219 = 208.05 \text{ mm}$

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

$= 658.47 \text{ mm}^2$

provide Y12 @ 150 c/c (As = 754 mm²)

Support.

$M = \frac{75}{100} \times 0.071 \times 341.64 \times 4 = 72.77 \text{ kN/m}^2$

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

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

$= 0.95$

$Z = I_a d = 0.95 \times 219 = 208.05 \text{ mm}$

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

provide Y12 @ 125 c/c (As = 905 mm)

Long span → Middle strip → (Span)

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

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

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

~~k =~~

$$k = \frac{49.12 \times 10^6}{2500 \times 219^2 \times 25} = 0.016$$

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

$$= 0.95$$

$Z = 208.05$ mm

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

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

Support

$$M_2 = \frac{25}{100} \times 0.071 \times 341.64 \times 4.5 = 27.29 \text{ kN/m}$$

$b = 2500$

$d = 219$

$$k = \frac{27.29 \times 10^6}{2500 \times 219^2 \times 25} = 9.10 \times 10^{-3}$$

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

$$= 0.95$$

$Z = I_{ad} = 208.05$ mm

$$A_s = \frac{27.29 \times 10^6}{0.95 \times 208.05 \times 410}$$

$= 336.76 mm^2$

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

Column strip

Span

Span = 3750mm

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

$$M = \frac{55}{100} \times 0.071 \times 391.67 \times 4.5 = 60.04 \text{ kN/m}$$

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

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

$$= 0.95$$

$$Z = I_{ad} = 208.05 \text{ mm}$$

$$A_s = \frac{60.04 \times 10^6}{0.95 \times 410 \times 208.05} = 740.91 \text{ mm}^2$$

provide Y12 @ 150 c/c ($A_s = 756 mm$)

Support

~~Moment~~ $M = \frac{75}{100} \times 0.071 \times 391.67 \times 4.5$

$= 81.87 \text{ kN/m}^2$

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

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

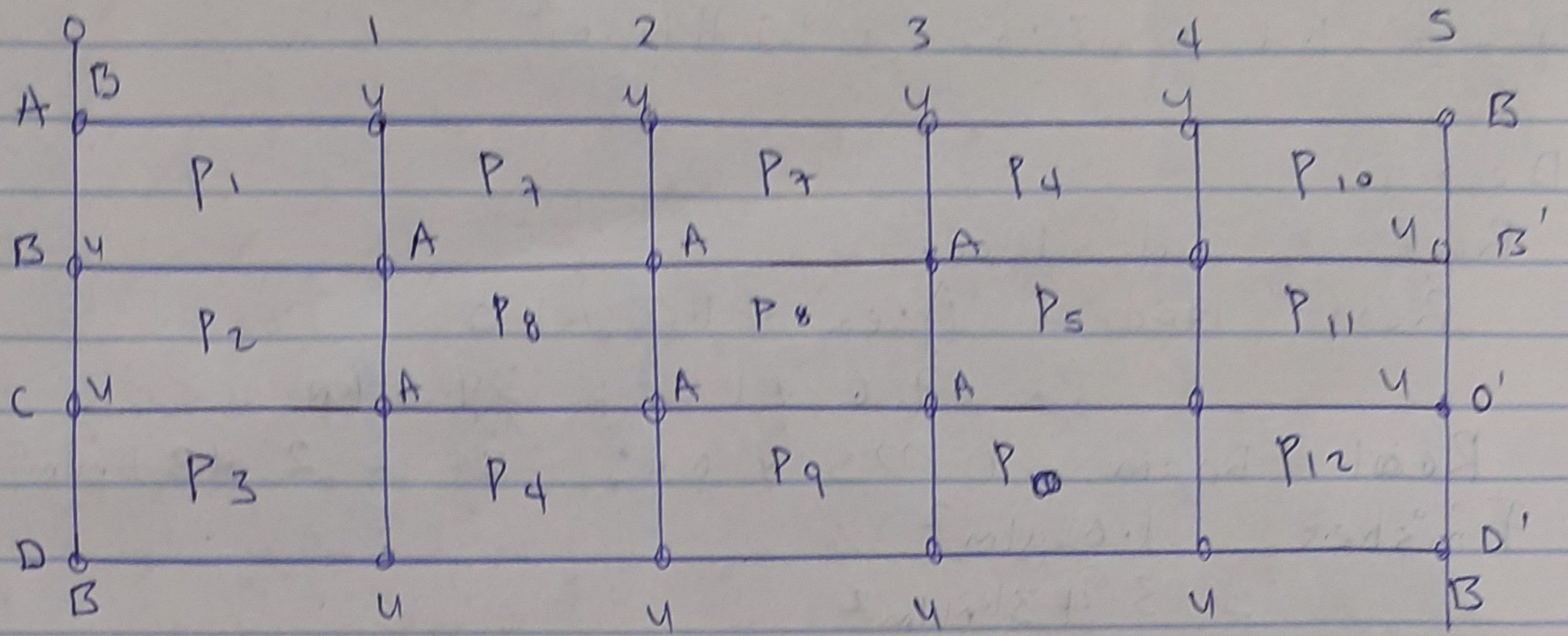
$$= 0.95$$

$$Z = I_{ad} = 208.05$$

$$A_s = \frac{60.04 \times 10^6}{0.95 \times 410 \times 208.05} = 740.91 \text{ mm}^2$$

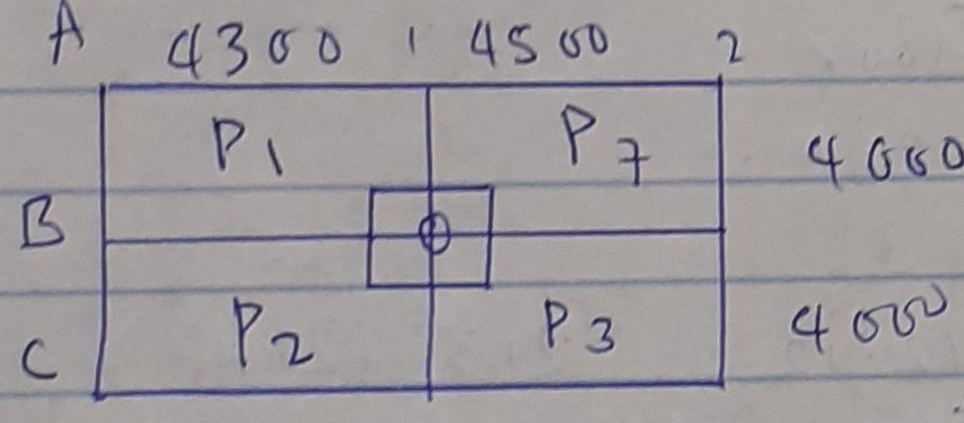
Provide Y12 @ 100 c/c ($A_s = 1130 mm^2$)

2a



Key = A : Axial
B : Biaxially
U : Uniaxally

Designing for Column B.1



$A = 4 \times 4.5 = 17.6 m^2$

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

$13.65 kN/m^2$

D.L = 1.4 x 13.65 = 19.11 KN/m²

Design

Roof - 3rd floor

Roof load = Area x 1.5 x 1.5

= 17.6 x 1.5² = 39.6 KN

Roof beam = 0.225 x 0.45 x 24 = 2.437 N/m²

Finishes = 1.0 KN/m²

= 3.43 KN/m²

Roof beam = 3.43 (4.4) x 1.4 = 1

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 x 12.12 = 213.12 KN

Beam load = 19.11 x (8.4) = 160.524 KN

Total = 463.776 KN

2nd floor → 1st floor

Load from above = 463.78 KN

Column load = 10 KN

Slab = 213.312 KN

Wall and beam = 160.524 KN

= 1249.45

≈ 1300 KN

$$A_S = \frac{N - 0.35 f_{cu} b b}{0.7 f_y - 0.35 f_y}$$

N = 1300 KN

f_{cu} = 25

$R_y = 410$

$b = 225$

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

$$= 3080.07 \text{ mm}^2$$

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

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