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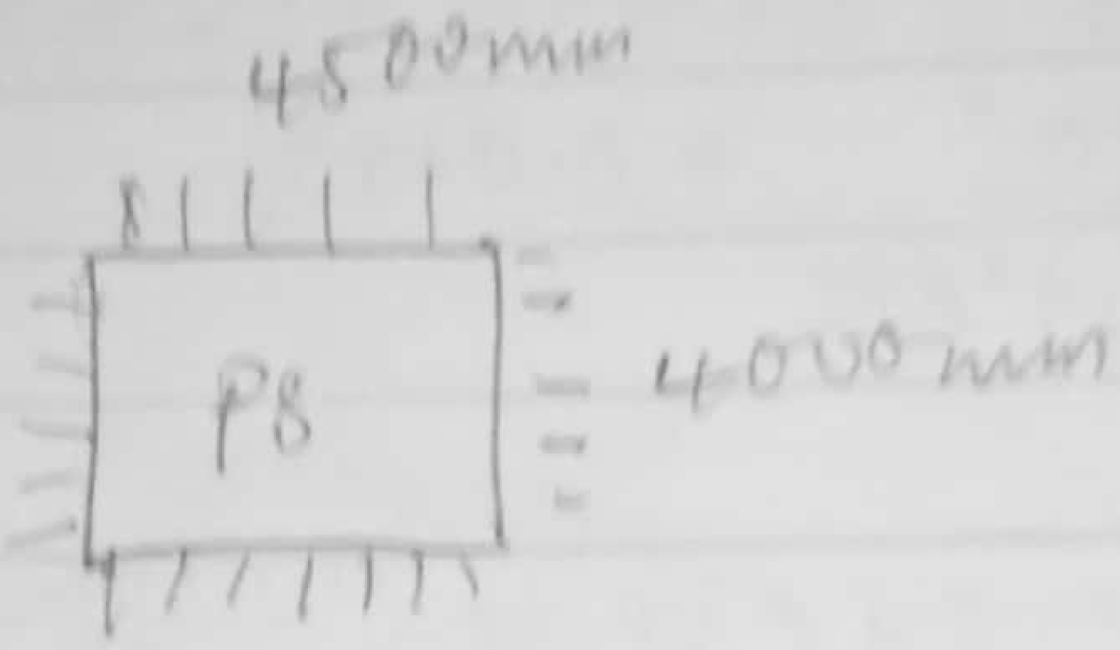
Civil engineering
16/ENG03/040
CVE 308

Assignment 3

Designing for P8



Capital / dropping = 1.2m
25 - 410 N/mm² concrete grade
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 factory = 5.0
Area = 4.5x4 = 18m²
DL per area = 1.4Gk + 1.6 Qk
= (1.4 × 8.2 × 18) + (1.6 × 5 × 18)
= 350.64

Short span → middle strip → Span
Span = lx - $\frac{2h}{3}$ = 4 - $\frac{2}{3}$ × 1.2 = 3200mm

Moment = 45% × 0.071 RL

$= \frac{45}{100} \times 0.071 \times 350.64 \times 4$

$= 44.81 kN/m$

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

d = h - cover - 1/2 ∅ = 250 - 25 - 6 = 219 mm

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

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

$= 0.95$

$z = Ia d = 0.95 \times 219 = 208.05$

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

provide Y12@ 200c/c ($As = 566mm$)

Support

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

$= 24.89$

w = 2000m = b

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

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

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

provide y12 @ 300 c/c (As = 377 mm²)

column strip (span)

span = 3200 mm

b = 2000 mm

m = 55% 0.071 Fl

$55/100 \times 0.071 \times 350.64 \times 4$

$= 54.76 \, kN/m^2$

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

$I_a = 0.5 + 0\sqrt{0.25 - \frac{0.023}{0.9}} = 0.97 > 0.95$

$= 0.95$

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

$As = \frac{53.36 \times 10^6}{0.95 \times 410 \times 208.05} = 658.49$

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

(column strip support)

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

$= 74.69$

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

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

$Z = 208.05$

$As = \frac{74.69 \times 10^6}{208.05 \times 410 \times 0.95} = 921$

provide y12 @ 125 c/c (As = 905 mm)

longspan - middle strip - span

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

$4.5 - \frac{2}{3} \times 1.2 = 3700$ mm

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

$= 50.41$

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

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

$I_a = 0.5 + \sqrt{0.25 - \frac{0.0168}{0.4}} = 0.98 > 0.95 = 0.95$

$z = 208.05$

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

provide y_{12} @ 175 c/c (As = 646 mm^2

support

$M = 0.25 \times 0.071 \times 350.64 \times 4.5 = 28.01$

b = 2500

d = 219

$k = \frac{28.01 \times 10^6}{2500 \times 219^2 \times 25} = 9.34 \times 10^{-3}$

$I_a = 0.5 + \sqrt{0.25 - \frac{9.34 \times 10^{-3}}{0.9}} \approx 0.989 > 0.95$

$z = I_a d = 208.05$

$$As = \frac{28.01 \times 10^6}{0.95 \times 208.05 \times 410} = 345.65$$

provide Y12 @ 300 c/c As (377 mm²)

Column strip

span = 3700 mm

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

moment = 0.55 × 0.071 × 350.64 × 4.5 = 61.62

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

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

z = 208.05

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

provide Y12 @ 150 c/c (As = 756)

Support

moment = 0.75 × 0.071 × 350.64 × 4.5 = 84.02

$$K = \frac{84.02 \times 10^6}{2000 \times 219^2 \times 28} = 0.035$$

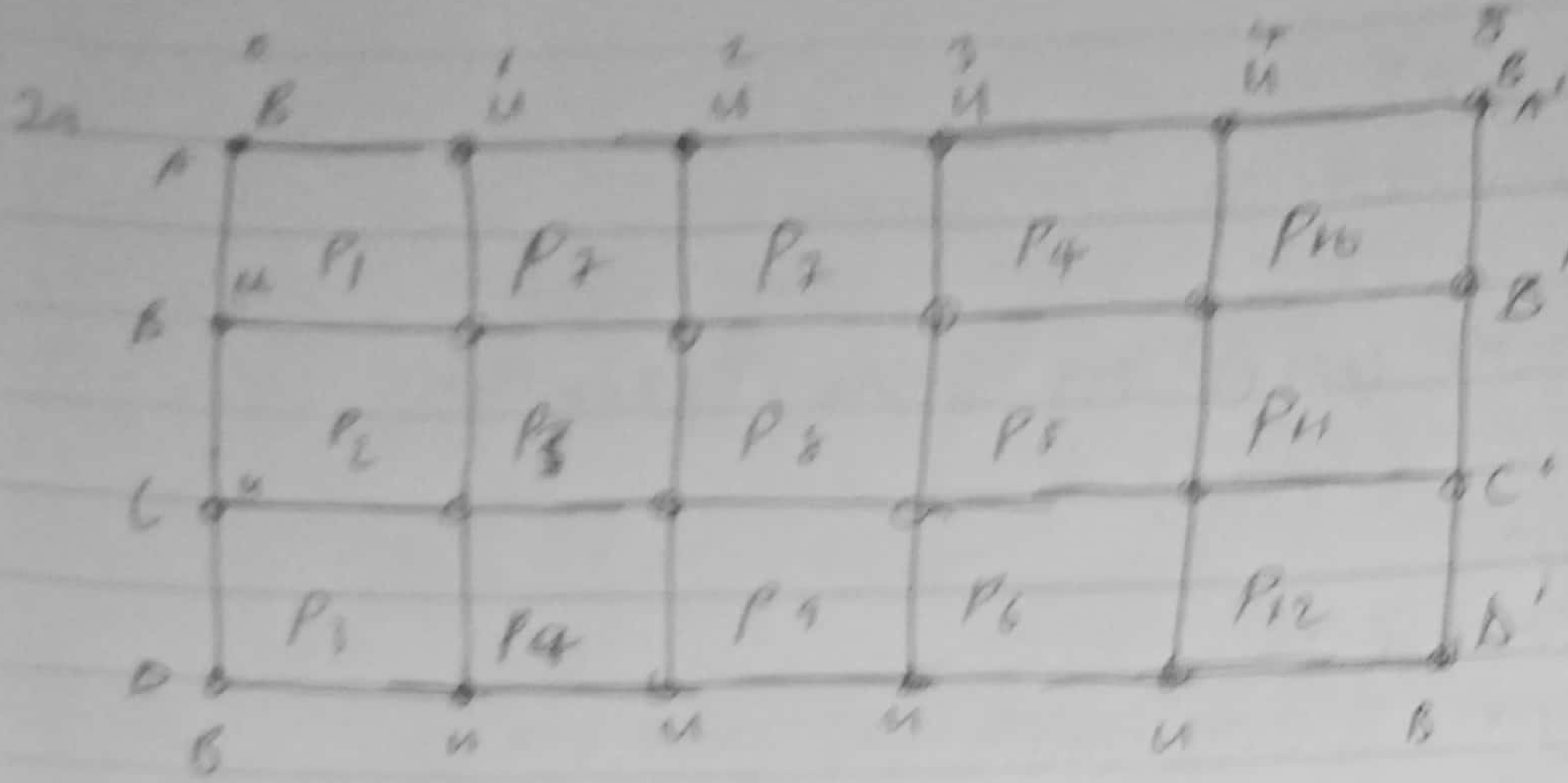
$$la = 0.5 + \sqrt{0.25 - \frac{0.035}{0.9}} = 0.96 > 0.95$$

z = 208.65

$$As = \frac{84.02 \times 10^6}{0.95 \times 410 \times 208.65} = 1036.83$$

Provide Y12 @ 100 c/c (As = 1130)

2a

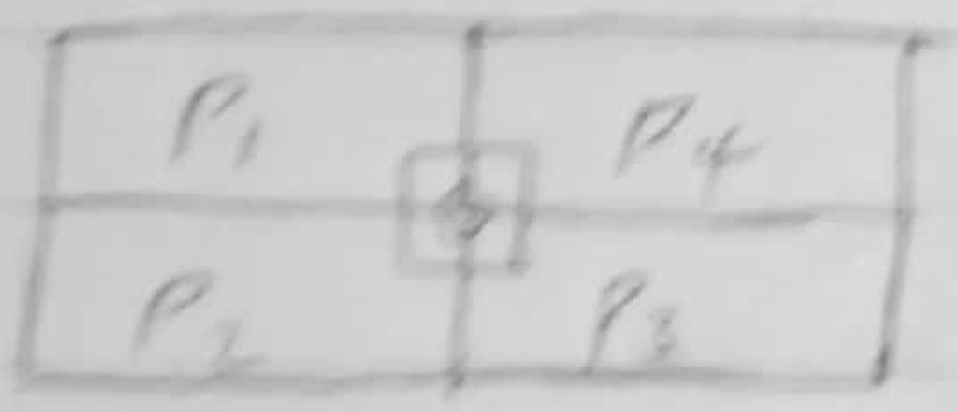


Key : A = Axial

B = Biaxially

U = Uniaxially

Designing for column B1



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

<u>Slab load</u>

weight of slab = 0.15 × 24 = 3.6 kN/m²

finishes = 1.2 kN/m²

partition = 1.0 kN/m²

6.8 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 wt = 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

finishes = 1.0 kN/m²

= 3.43 kN/m²

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 × 12.12 = 213.312 kN

Beam load = 19.11 × (8.4) = 160.524 kN

Total = 463.776 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 = 856.61 kN

1st floor to ground floor

Load from above = 865.61 kN

Column load = 10 kN

Slab = 213.312 kN

wall ~~~~ beam = 160.524

= 1249.45 => 1300kN

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

N = 1300kN

f_{cu} = 25

f_y = 410

b = 25

$$A_s = \frac{1300 \times 10^3 - 0.35 (25 \times 225^2)}{0.7 \times 410 - 0.35 \times 25}$$

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

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