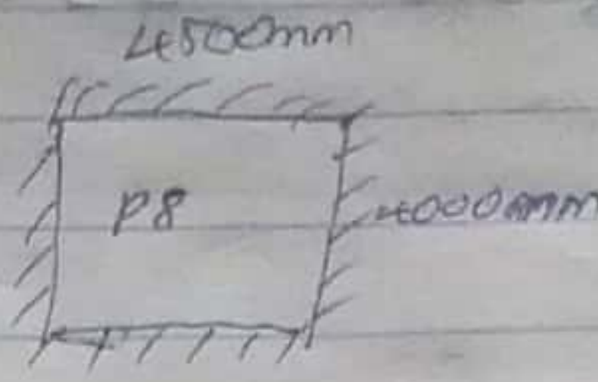
Designing for P8



Capital / dropping = 1.2m

25 - accidental concrete grade

Slab thickness = 250mm

Finishes = 1.2 kn/m²

Partitions = 1.0 kn/m²

Slab = 0.25×25 = 6kn/m²

Total = 8.2kn/m²

Designing for 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)

206.64 + 135

341.64

Short span → Middle strip → span

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

Moment = $\frac{45\%}{100} \times 0.071\ Fl = \frac{45}{100} \times 0.071 \times 341.64 \times 4 =$ 43.68kNm

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

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

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

$l_a = 0.5 + \sqrt{0.25 - \frac{k}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.018}{0.9}} = 0.979 > 0.95$

$= 0.95$

$z = l_a \cdot d = 0.95 \times 219 = 208.05$

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

Provide y12 @ 200 c/c ($A_s = 566mm$)

Span

$M_2 = 25\% \times 0.071 fL = \frac{25}{100} \times 0.071 \times 344.64 \times 4 = 24.25$

$b = 2000mm = b$

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

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

$z = l_a \cdot d = 0.95 \times 219 = 208.08$

$A_s = \frac{24.25 \times 10^6}{0.95 \times 208.05 \times 400} = 299.25$

Provide 4 Y10 @ 300 c/c ($A_s = 377 mm^2$)

Column strip (span)

span = 3200mm

b = 2000mm

$M = 55\% \ 0.071 fL = \frac{55}{100} \times 0.071 \times 344.64 \times 4 = 53.36 kNm$

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

$l_a = 0.5 + \sqrt{0.25 - \frac{0.022}{0.9}} = 0.977 > 0.95 = 0.95$

$z = l_a \cdot d = 0.95 \times 219 = 208.05$

$A_s = \frac{53.36 \times 10^6}{0.95 \times 410 \times 208.05} = 688.47$

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

Column strip (support)

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

$K = \frac{72.77 \times 10^6}{2500 \times 219^2 \times 25} = 0.030$

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

$z = 208.05$

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

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

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

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

$z = 208.05$

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

Provide Y12 @ 175 c/c (As = 646 mm²)

Sgpsbt

$M = 0.25 \times 0.071 \times 64 \times 4.5 = 28.89$

$b = 2500$

$d = 219$

$k = \dfrac{28.89\times10^6}{2500\times219^2\times25}$ 9.18×10^{-3}

$la = 0.5 + \sqrt{0.25 - \dfrac{9.18\times10^{-3}}{0.9}} = 0.989 > 0.95 = 0.95$

$z = la.d = 208.05$

$As = \dfrac{28.89\times10^6}{0.95\times208.05\times410} = 356.86$

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

Column strip

span = 3700mm

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

Moment = $0.55\times0.071\times 321.07 \times 4.5 = 60.04$

$k = \dfrac{60.04\times10^6}{2000\times219^2\times25} = 0.025$

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

$z = 208.05$

$As = \dfrac{60.04\times10^6}{0.95\times410\times208.05} = 740.91$

Provide Y12 @ 150c/c (As = 754)

Scanned by CamScanner

Support

Moment = $0·75 \times 0·071 \times 341·67 \times 4·5 = 81·87$

$k = \dfrac{81·87 \times 10^6}{1000 \times 249^2 \times 25} = 0·034$

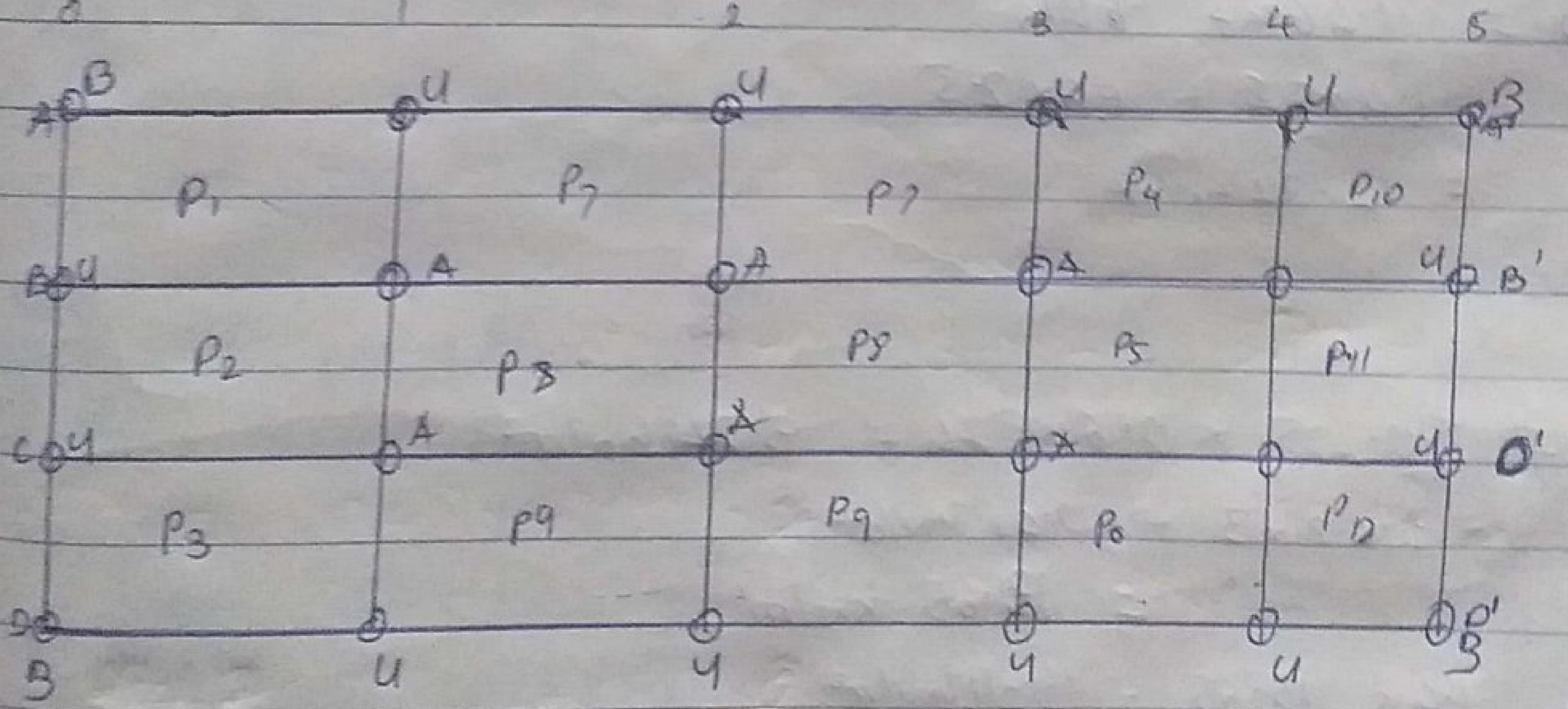
$l_a = 0·5 + \sqrt{0·25 - \dfrac{0·034}{0·9}} = 0·96 > 0·95$

$z = 208·05$

$A_s = \dfrac{81·87 \times 10^6}{0·95 \times 410 \times 208·05} = 1010·298$

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

2a

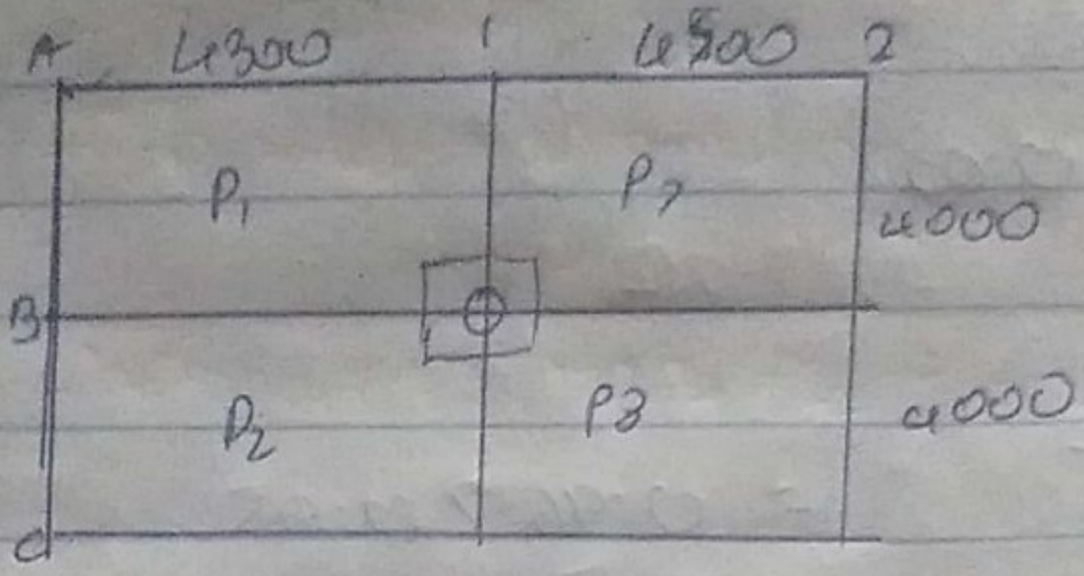


Key = A = Axial

B = Biaxially

U = Uniaxially

Designing for column B1



A = 4 x 4.4 = 17.6m²

Slab load

Weight of slab = 0.15 x 24 = 3.6kN/m²

Finished = 1.2kN/m²

Partition = 1.0kN/m²

5.8kN/m²

Design load = 1.4Gk + 1.6Qk

1.4x5.8 + 1.6x2.5

= 12.12kN/m²

Beam Load

beam wt = 0.225 x 0.6 x 24 = 3.24 kN/m²

wall load = 3.47 x 3 = 10.41 kN/m²

= 13.65 kN/m²

DL = 1.4x 13.65 = 19.11 kN/m²

Design

Roof - 3rd Floor

Roof load = Area x 1.5 x 1.5

= 17.6 x 1.5² = 39.6kN

Roof beam = 0.225 x 0.45 x 24 = 2.43kN/m²

Finished = 1.0kN/m²

= 3.43 kN/m²

Roof beam = 3.43 (4.4) x 1.4

Column load = 10kN
Total load = 89.94 kN

3rd floor -> 2nd floor
Load from above = 89.94 kN
Column load = 10kN
Slab load = 17.6 x 12.12 = 213.312 kN
Beam load = 19.11 x (8.4) = 160.524 kN
Total => 463.776 kN

2nd floor to 1st floor
Load from above = 463.78 kN
Column load = 10kN
Slab = 213.312 kN
Wall & beam = 160.524 kN
Total => 856.61 kN

1st floor to ground floor
Load from above = 865.61 kN
Column load = 10kN
slab = 213.312 kN
wall & beam = 160.524
= 1249.45 ≃ 1300 kN

$A_{sc} = \dfrac{N - 0.35 f_{cu} bh}{0.7 f_y - 0.35 f_{cu}}$

N = 1300 kN
f_{cu} = 25
f_y = 410
b = [illegible]

$$A_s = \frac{1300\times10^6 - 0.35\,(225\times225^2)}{0.7\times410 - 0.35\times25}$$

$$= 3080.07\,mm^2$$

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

$$A_{s\,min} = 0.4\%bh = 0.004\times225^2 = 202.5\,mm^2$$