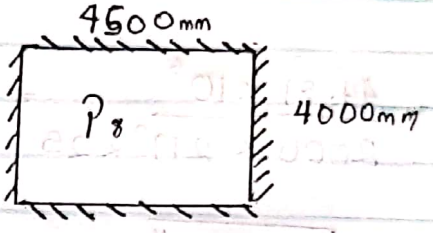
Okiemute Waterway
17/ENG03/056
Civil Engineering
Assignment 3

1) Designing for P_8



Capital/dropping = 1.2m
~~25~~ 25 – 410 N/mm² concrete grade
Slabe thickness = 250mm

Finishes = 1.2kN/m²
Partitions = 1.0kN/m²
Slab = 0.25 × 25 = 6 kN/m²

Designing for = 5.0
Area = 4.5 × 4 = 18m²

D.L = 1.4G_k + 1.6Q_k
= (1.4 × 8.2 × 18) + (1.6 × 5 × 18)
= 206.64 + 144
= 350.64

~~Short span → Middle strip~~
Span = $l_{oc} - \frac{2}{3}h$

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

Moment = $\frac{45\%}{100} \times 0.071 \times 350.64 \times 4$
= 44.81kN/m²

Scanned with CamScanner

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

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

$K = \frac{M}{bd^2 f_{cu}} = \frac{44.81 \times 10^6}{2000 \times 219^2 \times 25} = 0.019$

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

$0.5 + \sqrt{0.25 - \frac{0.019}{0.9}} = 0.978 (\geq 0.95)$

$= 0.95$

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

$A_s = \frac{M}{0.95 f_y z} = \frac{44.81 \times 10^6}{0.95 \times 410 \times 208.05} = 552.968 = 552.97$

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

Support

$M_2 = \frac{25}{100} \times 0.071 \times 350.64 \times 4 = \cancel{24.8}\ 24.9$

$W = 2000m - b$

$K = \frac{24.9 \times 10^6}{2000 \times 219^2 \times 25} = 0.01$

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

$= 0.95$

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

Scanned with CamScanner

$A_s = \frac{24.9 \times 10^6}{0.95 \times 208.05 \times 410} = 307.27$

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

Column strip (Span)

Span = 3200mm

b = 2000mm

$M = \frac{55}{100} \times 0.071 \times 350.64 \times 4 = 54.77 kNm/m^2$

$K = \frac{M}{bd^2 f_{cu}} = \frac{54.77 \times 10^6}{2000 \times 219^2 \times 25} = 0.023$

$I_a = 0.5 + \sqrt{0.25 - \frac{0.023}{0.9}}$

$= 0.97 (\geq 0.95)$

$= 0.95$

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

$A_s = \frac{54.77 \times 10^6}{0.95 \times 410 \times 208.05} = 675.88$

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

Column Strip (Support)

$M = \frac{75}{100} \times 0.071 \times 350.64 \times 4 = 74.69 kNm/m^2$

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

Scanned with CamScanner

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

$$Z = 208.05$$

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

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

Long span → middle strip → (span)

~~Eff~~ span = $l_y - \frac{2}{3}h = 4.5 - \frac{2}{3} \times 1.2$
$= 3.7m = 3700mm$

Moment = $0.45 \times 0.071 \times 350.64 \times 4.5$
$= 50.41$

width = $b = l_y - l_x/2 = 4.5 - 2 = 2500$

$$K = \frac{50.41 \times 10^6}{2500 \times 219^2 \times 25} = 0.017$$

$$I_a = 0.5 + \sqrt{0.25 - \frac{0.017}{0.9}} = 0.98 (\geq 0.95)$$
$$= 0.95$$

$Z = 208.05$

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

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

Sp.

Scanned with CamScanner

Support

$M = 0.25 * 0.071 \times 350.64 \times 4.5 = 28$

$b = 2500$

$d = 219$

$$k = \frac{28 \times 10^6}{2500 \times 219^2 \times 25} = 9.34 \times 10^{-3}$$

$$I_a = 0.5 * \sqrt{0.25 + \frac{9.34 \times 10^{-3}}{0.9}} = 0.989 (\geq 0.95)$$

$$= 0.95$$

$z = I_a d = 208.05$

$$A_s = \frac{28 \times 10^6}{0.95 \times 208.05 \times 410} = 345.53$$

Provide T12 @ 300 c/c ($A_s = 377 mm$)

Column strip

Span = 3700mm

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

Moment = $0.55 \times 0.071 \times 350.64 \times 4.5 = 61.62$

$$k = \frac{61.62 \times 10^6}{2000 \times 219^2 \times 25} = 0.026$$

$$I_a = 0.5 + \sqrt{0.25 - \frac{0.026}{0.9}} = 0.97 (\geq 0.95)$$

$$= 0.9$$

$z = 208.05$

$$A_s = \frac{61.62 \times 10^6}{0.95 \times 410 \times 208.05} = 760.41$$

Provide T12 @ 150 c/c ($A_s = 754 mm$)

Scanned with CamScanner

Support

Moment = $0.75 \times 0.071 \times 350.64 \times 4.5 - 84.02$

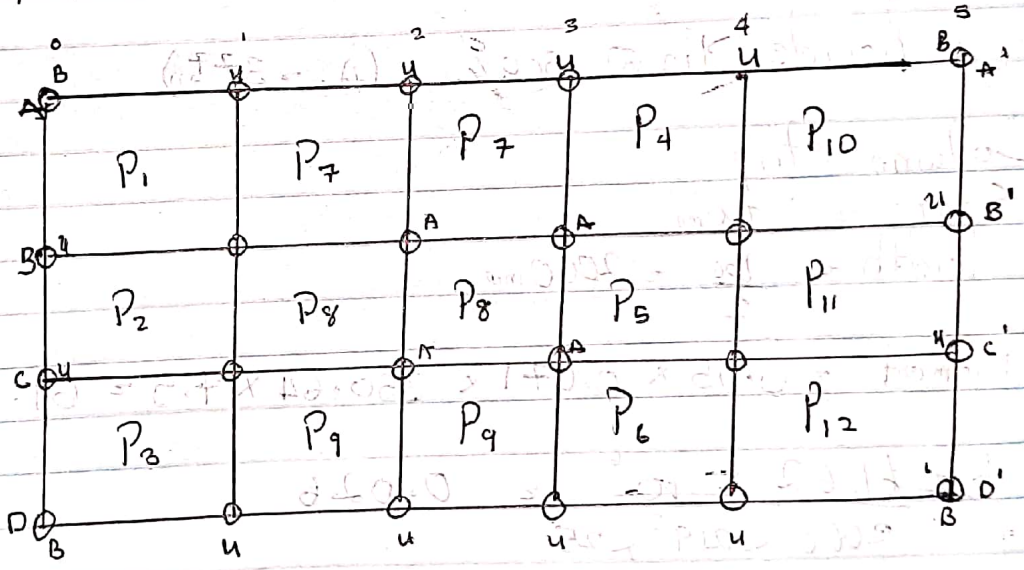
$K = \frac{84.02 \times 10^6}{2000 \times 219^2 \times 25} = 0.035$

$I_a = 0.5 + \sqrt{0.25 - \frac{0.035}{0.9}} = 0.96 \ (\geq 0.95)$

$Z = 208.05$

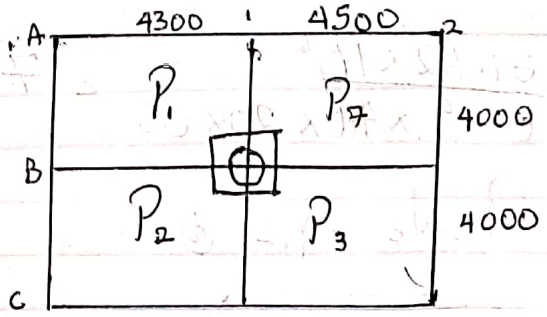
$A_s = \frac{84.02 \times 10^6}{0.95 \times 410 \times 208.05} = 1036.83$

Provide 7 12 @ 100 mm c/c ($A_s = 1130$)



A = Axial
B = Biaxially
U = Uniaxially

Designing column B1



Scanned with CamScanner

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

Slab load

wt of slab = $0.15 \times 24 = 3.6 kN/m^2$
Finishes = $1.2 kN/m^2$
Partition = $1.0 kN/m^2$
$5.8 kN/m^2$

D.L = $1.4 G_k + 1.6 Q_k$
$= (1.4 \times 5.8) + (1.6 \times 2.5)$
$= 12.12 kN/m^2$

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 = $1.0 kN/m^2$
$3.43 kN/m^2$

Roof beam = $3.43 (4.4) \times 1.4 =$

Column load = $10 kN$
Wall load = $89.94 kN$

Scanned with CamScanner

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

Total ⇒ 473.776 kN

2nd floor to 1st floor

Load from above = 473.776 kN

Column load = 10 kN

Slab = 213.312 kN

Wall & beam = 160.524

Total ⇒ = 857.61 kN

1st floor to ground floor

Load from above = 857.61 kN

Column Load = 10 kN

Slab = 213.312 kN

Wall & beam = 160.524

= ~~1249.45~~ = 1241.446 = 1242

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

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

$$= 3080.07 mm^2$$

Provide 7 T25 @ 125% A_{cs} = 3930

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

Scanned with CamScanner