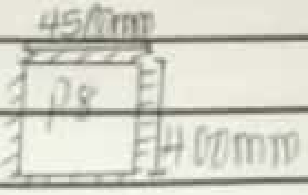
KUNDE SHARON SEPINEN
17/ENG03/032
CIVIL ENGINEERING
ASSIGNMENT III

1) Designing for panel 8



capital droppings = 1·2m in diameter
f_{cu} = 25N/mm²
f_y = 410N/mm²
slab Thickness - 250mm = 0·25m

weight of slab = 0·25 × 24 = 6KN/m²
Finishes = 1·2 KN/m²
partition = 1·0KN/m²
Total = 8·2KN/m²

Assuming Q·K = 5·0
D·L = 1·4GK + 1·6QK
= [(1·4×8·2)×(4·5×4)] + [(1·6×5·0)×(4·5×4)]
= 206·64 + 144
= 350·64KN

Short span
1) middle strip
span: Effective span = $l_x - \frac{2}{3}h$
$= 4 - \frac{2}{3} \times 1·2$
= 3·2m = 3200mm

moment$_1$ = 45% × 0.071 F l

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

= 44.81

width $= \frac{l_2}{2} = \frac{4}{2}$

= 2m = 2000mm

d = h - cover - ½ Ø

= 250 - 25 - ½ × 1.2

= 219mm

$K = \frac{m_1}{bd^2 f_{cu}} = \frac{44.81 \times 10^6}{2000 \times 219^2 \times 25}$

= 0.0186

$l_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.0186}{0.9}}$

= 0.978 (≥ 0.95)

Z = l$_a$d = 0.95 × 219

= 208.05mm

$A_s = \frac{m_1}{0.95 F_y Z} = \frac{44.81 \times 10^6}{0.95 \times 410 \times 208.05}$

= 552.9mm^2

provide Y12 @ 200 c/c (A = 566 mm^2)

(b) b/, support moment, $m_2 = 25\% \times 0.071Fl$

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

$= 24.9$

width, $b = 2000mm$

$d = 219mm$

$K = \frac{m_2}{bd^2 f_{cu}} = \frac{24.9 \times 10^6}{2000 \times 219^2 \times 26}$

$= 0.0104$

$l_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.0104}{0.9}}$

$= 0.988 \ (\geq 0.95)$

$Z = l_a d = 0.95 \times 219$

$= 208.05mm$

$A_s = \frac{m_2}{0.95 f_y Z} = \frac{24.9 \times 10^6}{0.95 \times 410 \times 208.05}$

$= 307.2mm^2$

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

Column strip

span : Effective span $= l_x - \frac{2}{3} h_c$

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

$= 3200mm$

width = $\frac{l_2}{2} = \frac{4000}{2} = 2000mm$

moment, $M_1 = 55\% \times 0.071Fl$

$= \frac{55}{100} \times 0.071 \times 350.64 \times 4$

$= 54.77$

$K = \frac{M_1}{bd^2 f_{cu}} = \frac{54.77 \times 10^6}{2000 \times 219^2 \times 25}$

$= 0.023$

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

$= 0.97 (\geq 0.95)$

$Z = l_a d = 0.95 \times 219$

$= 208.05mm$

$A_s = \frac{M_2}{0.95 f_y Z} = \frac{54.77 \times 10^6}{0.95 \times 410 \times 208.05}$

$= 675.87mm^2$

provide Y12 @ 150 c/c ($A = 754 mm^2$)

(b) support: $M_2 = 75\% \times 0.071Fl$

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

$= 74.7$

width = 2000mm

$K = \frac{M_2}{bd^2 f_{cu}} = \frac{74.7 \times 10^6}{2000 \times 219^2 \times 25}$

$= 0.0311$

$l_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.0311}{0.9}}$

$= 0.96 \ (\geq 0.95)$

$Z = l_a d = 0.95 \times 219$

$= 208.05mm$

$A_s = \frac{M_2}{0.95 f_y Z} = \frac{74.7 \times 10^6}{0.95 \times 410 \times 208.05}$

$= 921.82mm^2$

provide Y12 @ 100 c/c ($A = 1130mm^2$)

Long span

1) middle strip

a) span. Effective span $= l_y - \frac{2}{3}h$

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

$= 3.7m = 3700mm$

width $b = l_y - \frac{l_x}{2} = 4.5 - \frac{4}{2}$

$= 2.5m = 2500mm$

moment, $M_1 = 45\% \times 0.071Fl$

$= \frac{45}{100} \times 0.071 \times 350.64 \times 4.5$ ~~= 50.4~~

$= 50.41$

$d = 219mm$

$K = \frac{M_1}{bd^2 f_{cu}} = \frac{50.41 \times 10^6}{2500 \times 219^2 \times 25}$

$= 0.017$

$la = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.017}{0.9}}$

$= 0.98 (\geq 0.95)$

$Z = lad = 0.95 \times 219$

$= 208.05mm$

$A_s = \frac{M_1}{0.95 f_y z} = \frac{50.41 \times 10^6}{0.95 \times 410 \times 208.05}$

$= 622.07mm^2$

provide $Y12$ @ 175 c/c $(A = 646mm^2)$

support moment $M_2 = 25\% \times 0.071Fl$

$= \frac{25}{100} \times 0.071 \times 350.64 \times 4.5$

$= 28.01$

width, $b = 2500mm$

$d = 219mm$

$K = \frac{M_2}{bd^2 f_{cu}} = \frac{28.01 \times 10^6}{2500 \times 219^2 \times 25}$

$= 0.0093$

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$$ja = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.0093}{0.9}}$$

$$= 0.99 \ (\geq 0.95)$$

$$Z = Jad = 0.95 \times 219$$

$$= 208.05 mm$$

$$As = \frac{M_2}{0.95 F_{y} Z} = \frac{28.01 \times 10^6}{0.95 \times 410 \times 208.05}$$

$$= 345.7 mm^2$$

~~As~~ = ~~PA~~ provide Y12 @ 300 c/c ($A = 377 mm^2$)

(2) column strip

span: Effective span = 3700 mm

$$\text{width} = \frac{lx}{2} = \frac{4}{2}$$

$$2m = 2000 mm$$

$$\text{moment } M_1 = 55\% \times 0.071 Fl$$

$$= \frac{55}{100} \times 0.071 \times 350.64 \times 4.5$$

$$= 61.62$$

$$K = \frac{M_1}{bd^2 f_{cu}} = \frac{61.62 \times 10^6}{2000 \times 219^2 \times 25}$$

$$= 0.026$$

$K = \frac{M_1}{bd}$ $j_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.026}{0.9}}$

$= 0.97 \ (\geq 0.95)$

$Z = j_a d = 0.95 \times 219$

$= 208.05$

$A_s = \frac{M_2}{0.95 F_u Z} = \frac{61.62 \times 10^6}{0.95 \times 410 \times 208.85}$

$= 760.41 mm^2$

provide Y12 @ 125 c/c ($A = 905 mm^2$)

(b) support moment $M_2 = 75\% \times 0.071 F l$

$= \frac{75}{100} \times 0.071 \times 350.64 \times 4.5$

$= 84.02$

width b = 2000mm

depth = 219mm

$K = \frac{M_2}{bd^2 f_{cu}} = \frac{84.02 \times 10^6}{2000 \times 219^2 \times 25}$

$= 0.035$

$j_a = 0.5 \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.035}{0.9}}$

$= 1036.83 mm^2$

provide Y12 @ 100 c/c ($A = 1130 mm^2$)

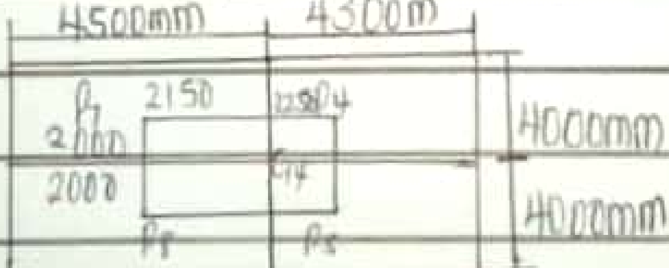
QUESTION 2

The axially loaded columns include
C6, C7, C10, C11, C14, C15, C18 and C19

The uniaxially loaded columns are
C2, C3, C5, C8, C13, C17, C9, C12, C16, C20, C22, C23

The biaxially loaded columns include
C1, C4, C21 and C24

Design for column 4



Area of floor = 4x 4.35
= 17.4m²

Slab loading

Slab weight = 0.15 × 24 = 3.6 KN/m²

Finishes = 1.2 KN/m²

Partition = 1.0 KN/m²

~~Tota~~ Total Gk = 5.8 KN/m²

AL = 1.4Gk + 1.6Qk

= (1.4 × 5.8) + (1.6 × 2.5)

= 12.12 KN/m²

Beam loading

Self weight = 0.6 × 0.225 × 24

= 3.24 KN/m²

Wall load = 3.47 × 3 = 10.41 KN/m²

Total Gk = 13.65 KN/m²

AL = 1.4Gk

= (1.4 × 13.65)

= 19.11 KN/m²

Column Design

Roof = 3rd floor

Roof load = 17.4 × 1.5 × 1.5

= 39.2 KN

Roof beam = br × 1.4 (L+b)

br = 0.45 × 0.225 × 24 = 2.43 KN/m²

Finishes = 1.0 KN/m²

3.4 KN/m²

Roof beam = 3.43 × 1.4 (L+b)

= 3.43 × 1.4 (4 + 4.4) = 40.34 KN

column load = 10KN

Total: 89.54KN

3rd floor - 2nd floor

load from above = 89.54 KN

column load = 10 KN

slab load = 17.4 × 12.12 = 211 KN

wall Beam loading = 19.11 × 8.4 = 160.52KN

Total = 411.06KN = 411 KN

2nd floor - 1st floor

load from above - 4.71 KN

column load = 10KN

slab load = 17.4 × 12.12 211KN

wall and beam load - 19.11 × 8.4 160.52KN

Total 852.52KN

1st floor - Ground floor

Load from above : 852.5kN

column load - 10KN

slab load = 211 KN

wall and beam load - 160.52KN

Total : 1234.04KN ≃ 1234KN

$$A_s = \frac{N - 0.35 f_{cu} bh}{0.9 f_y - 0.35 f_{cu}} = \frac{1234 \times 10^6 - 0.35 \times 25 \times (225 \times 225)}{0.9 \times 410 - 0.35 \times 25}$$

$= 3424.12 mm^2$

Provide 8Y25 (A_s: 3930mm²)

As min : 0.4% bh : 0.004 × 225 × 225 = 202.5mm²

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