STRUCTURAL DESIGN.

ASSIGNMENT THREE.

Question One.

Capital/ dropping = 1.2 m diameter

F_{cu} = 25 N/mm²

F_y = 460 N/mm²

$$A_s = \frac{M_{u2}}{0.95 f_y Z} = \frac{74.7 \times 10^6}{0.95 \times 410 \times 208.05}$$

$$= 921.82 \text{ mm}^2$$

Provide 4 T 12 @ 100 c/c ($A_s = 1130 \text{ mm}^2$)

$$Z = Iad = 0.95 \times 219$$

$$= 208.05 mm$$

$$A_s = \frac{M_1}{0.95 f_y Z} = \frac{50.41 \times 10^6}{0.95 \times 410 \times 209.05}$$

$$= 622.07 mm^2$$

Provide 16 @ 175 c/c ($A = 644.6 mm^2$)

- Width, $b = 2000\ mm$
- Depth $= 219\ mm$

$$K = \frac{M_R}{b d^2 f_{cu}} = \frac{94.02 \times 10^6}{2000 \times 219^2 \times 25}$$

$$= 0.035$$

Wall & Beam Loading = 19.11 x 8.4 = 160.52KN

Total = 471.06KN ≡ 471KN

2nd floor - 1st floor

Load from above = 471KN

Column load = 10KN

Slab load = 17.4 x 12.12 = 211KN

Wall & Beam load = 19.11 x 8.4 = 160.52KN

Beam Loading

Self Weight = 0.6 × 0.225 × 24 = 3.24 kN/m²

Wall Load = 3.41 × 3 = 10.41 kN/m²

Total G.L = 13.65 kN/m²

The heavily loaded columns include:

C_2, C_8, C_5, C_9, C_{13}, C_{14}, C_{19}, C_{12}, C_{16}, C_{20}, C_{22}, C_{23}

Provide 4 12 @ 300 c/c (A = 377 mm²)

Column Strip

Span: • Effective span = 3700 mm

• Width = $\frac{l_x}{2} = \frac{4}{2}$

= 2m ≡ 2000 mm

• Moment, m_x = 0.65 0.031 L

= 0.65 . 0.031 x 350.64 x 4.5

Span: • Effective Span = $l_x - \frac{2}{3}h = 4 - \frac{2}{3} \times 1.2$

$= 3200mm$

• Width $= \frac{l_x}{2} = \frac{4000}{2}$

$= 2000mm$

• Moment, $M_1 = 55\% \times 0.071FL = \frac{55}{100} \times 0.071 \times 350.64 \times 4$

$= 54.77$

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

$= 0.023$

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

$= 0.97 \ (\geq 0.95)$

$Z = I_a d = 0.95 \times 219$

$= 208.05mm$

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

$= 675.87mm^2$

Provide 412 @ 150c/c ($A = 754mm^2$)

Support: • $M_2 = 75\% \times 0.071FL = \frac{75}{100} \times 0.071 \times 350.64 \times 4$

$= 74.7$

$= 552.9 mm^2$

Provide 412 @ 200 c/c ($A_s = 566 mm^2$)

(b) Support :

- Moment, $M_2 = 25\% \times 0.071 FL$

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

$$= 24.9$$

- Width, $b = 2000 mm$
- $d = 219 mm$

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

$= 3.2m = 3200mm$

- $Moment_2 = 45\% \times 0.011 l$

$= \frac{45}{100} \times 0.011 \times 350.64 \times 4$

$= 44.81$

- Width =
- $Width = \frac{l_x}{2} = \frac{4}{2}$

$= 2m = 2000mm$

$d = \text{n. cover} - 1/2\ \phi$

$= 250 - 25 - \frac{1}{2} \times 1.2$