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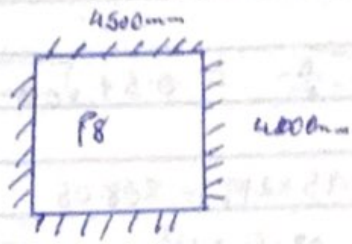
17/ENG03/033
Civil Engineering

CVE 308 Assignment III

Designing for P8



Capital / dropping = 1.2m
25 - 40N/mm² Concrete grade
Slab thickness = 250mm

Finishes = 1.2KN/m²
Partition = 1.0KN/m²
Slab = 0.25x25 = 6KN/m²
Total = 8.2KN/m²

Designing for factory = 5.0
Area = 4.5x4 = 18m²

D.L per area = 1.4GK + 1.6QK
= (1.4 x 8.2x18) + (1.6x5x18)
= 206.64 + 144
= ~~347.64~~ 350.64

Short span → Middle strip → Span
Span = $l_x - \frac{2}{3}h = 4 - \frac{2}{3} \times 1.2 = 3200$mm

Moment = 45% x 0.071 FL = $\frac{45}{100} \times 0.071 \times 350.64 \times 4$ = ~~45.68~~ 44.81 KN/m

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

d = h - cover - ½ Ø = 250 - 25 - 6 = 219mm

$K = \frac{M}{bd^2 f_{cu}} = \frac{43.66 \times 10^6}{2000 \times 219^2 \times 26} = 0.018$

$I_a = 0.5 + \sqrt{0.25 - \frac{K}{0.9}} = 0.5 + \sqrt{0.25 - \frac{0.018}{0.9}} = 0.97 > 0.95$

$= 0.95$

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

$A_s = \frac{M}{0.95 f_{y2}} = \frac{43.66 \times 10^6}{0.95 \times 410 \times 208.05} = 552.9$

Provide Y12 @ 200 c/c $(A_s = 566mm)$

Support.

$M_2 = 25\% \times 0.071 f l = \frac{25}{100} \times 0.071 \times 350.64 \times 4 \doteq 24.89$

$W = 2000m = b$

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

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

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

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

Column strip (span)

Span = 3200mm

$b = 2000mm$

$M = 55\%\ 0.071 f l$

$\frac{55}{100} \times 0.071 \times 350.64 \times 4 = 54.76\ KN/m^2$

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

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

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

$A_s = \frac{53.36 \times 10^6}{0.95 \times 410 \times 208.05} = 658.47$

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

Column Strip Support.

$M = \frac{75}{100} \times 0.0711 \times 350.64 \times 4 = 74.69$

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

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

$Z = 208.05$

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

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

Longspan — Middle strip — Span

Effective span $= L_y - \frac{2}{3} L$

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

Moment $= 0.46 \times 0.0711 \times 350.64 \times 4.5 = 50.41$

Width $= b = L_y - \frac{L_x}{2} = 4.5 - 2 = 2.5 = 2500$

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

$I_a = 0.5 + \sqrt{0.25 - \frac{0.0168}{0.9}} = 0.98 > 0.95 \quad = 0.95$

$Z = 208.05$

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

Provide Y12 @ 175 c/c $(A_s = 646 mm^2)$

Support.

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

$b = 2500$

$d = 219$

$K = \frac{28.01 \times 10^6}{2500 \times 219^2 \times 25} = 9.54 \times 10^{-3}$

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

$Z = I_a d = 208.05$

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

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

Column strip

Span = 3700mm

$\text{width} = \frac{l_x}{2} = 2000mm$

$\text{Moment} = 0.55 \times 0.071 \times 350.64 \times 4.5 = 61.62$

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

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

$Z = 208.05$

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

Provide Y12 @ 150 c/c $(A_s = 756)$

Support

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

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

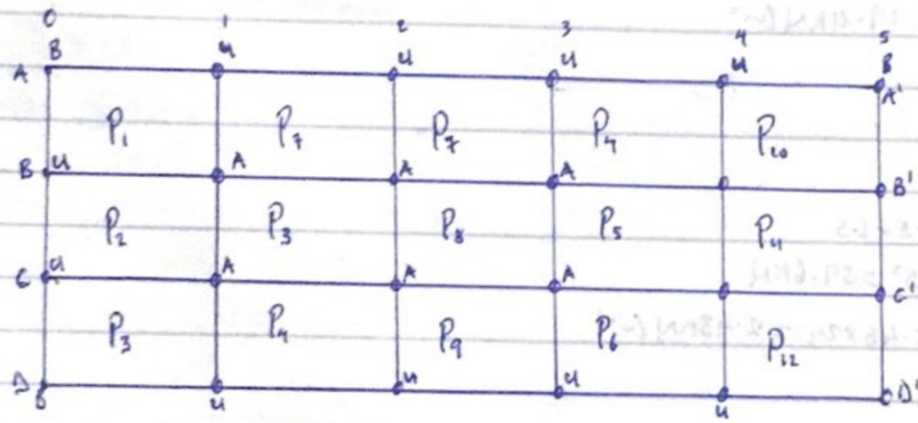
$$I_a = 0.5 + \sqrt{0.25 - \frac{0.035}{0.9}} = 0.96 > 0.95$$

$Z = 208.05$

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

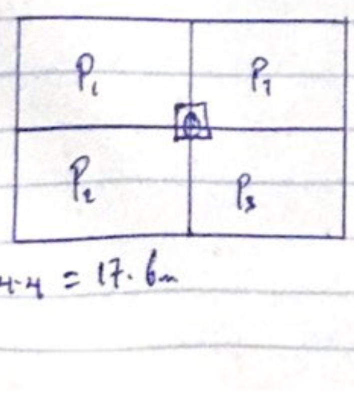
Provide Y12 @ 100 c/c ($A_s = 1130$)

(2a)



Key = A = Axial
B = Biaxially
U = Uniaxially

Designing for column B1



$A = 4 \times 4.4 = 17.6m$

Slab load

Weight of slab = 0.15x24 = 3.6KN/m²

Finishes = 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 = 0.225x0.6x24 = 3.24KN/m²

Wall load = 3.47x3 = 10.41KN/m²

= 13.65KN/m²

DL = 1.4 x 13.65 = 19.11KN/m²

Design

Roof - 3rd floor

Roof Load = Area x1.5x1.5

= 17.6x1.5² = 39.6KN

Roof beam = 0.225x0.45x24 = 2.43KN/m²

Finishes = 1.0KN/m²

= 3.43KN/m²

Column Load = 6KN

Total Load = 89.94KN

3rd floor - 2nd floor

Load from above = 89.94KN

Column Load = 6KN

Slab = 17.6x12.12 = 213.312KN

Beam Load = 19.11 x (8.4) = 160.524KN

Total = 463.776KN.

2nd floor – 1st floor

Load from above = 465.78KN

Column Load = 10KN

Slab = 213.312KN

Wall & Beam = 160.52KN

Total = 856.61KN.

1st floor – Ground floor

Load from above = 856.61KN

Column load = 10KN

Slab = 213.312KN

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

$f_{cu} = 25$

$f_y = 460$

$b = 25$

$$A_s = \frac{1300 \times 10^6 - 0.35 (25 \times 225^2)}{0.7 \times 460 - 0.35 \times 25}$$

Provide 8 Y25 ($A_s = 3930 mm^2$)

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