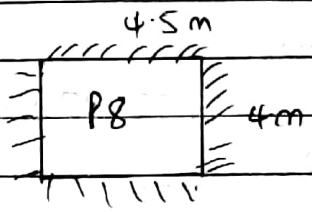
MKPouto Ubong Obot
Civil Engineering
17/ENG03/015

CVE 308



Capital dropping = 1·2m
Concrete grade = 25 - 410 N/mm²
Slab thickness = 250mm
finishes = 1·2 kN/m²
Partitions = 1·0kN/m²
Slab = ~~0·0~~ 0·25 X 25 = 6·25 ≈ 6kN/m²
Total = 8·2kN/m²

Factory design = 5·0
Area = 4x4·~~5~~ = 18m²
Design load = 1·4 G_K + 1·6 Q_K
= (1·4 x 8² X 18) + (1·6 x 5 x 18)
= 206·64 + 144
= 350·64

Short Span
Span = $L_x - \frac{2}{3}h = 4 - \frac{2}{3} \times 1·2 = 3200mm$
Moment = $\frac{45}{100}$ % X 0·071 f_L = $\frac{45}{100}$ X 0·071 X 350·64 X 4 = 44·81 KN/m²
Width, $b = \frac{l_x}{2} = \frac{4}{2} = 2 = 2000mm$
d - h - cover - ½ ϕ = 250 - 25 - 6 = 219mm
$K = \frac{N}{bd^2 f_{cu}} = \frac{44·81 \times 10^6}{2000 \times 219^2 \times 25} = 0·018$
$I_a = 0·5 + \sqrt{0·25 - \frac{K}{0·9}} \Rightarrow 0·5 + \sqrt{0·25 - \frac{0·018}{0·9}} = 0·98 > 0·95$
$= 0·95$

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

$A_s = \frac{M}{0.95 f_y Z} = \frac{44.81 \times 10^6}{0.95 \times 410 \times 208.05} = 552.97 mm^2$

Provide y12 @

$N_2 = 25\% \times 0.071 f_L = \frac{25}{100} \times 0.071 \times 350.64 \times 4 = 24.9 KN/m^2$

$W = 2000 m$

$K = \frac{24.9 \times 10^6}{2000 \times 217^2 \times 25} = 0.01$

$I_a = 0.5 + \sqrt{0.25 - \frac{0.01}{0.9}} = 0.99 > 0.95$

$= 0.95$

$Z = 0.95 \times 219 = 208.05 mm$

$A_s = \frac{24.9 \times 10^6}{0.95 \times 410 \times 208.05} = 307.27 mm^2$

Provide y12 @ 377mm

Column Strip (Span)

Span = 32000mm $b = 2000 mm$

$M = 55\%$ of $0.071 f_L = \frac{55}{100} \times 0.071 \times 350.64 \times 4 = 54.78 KN/m^2$

$K = \frac{54.78 \times 10^6}{2000 \times 219^2 \times 25} = 0.023$

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

$= 0.95$

$Z = 0.95 \times 219 = 208.05 mm$

$A_s = \frac{54.78 \times 10^6}{410 \times 0.95 \times 208.05} = 676 mm^2$

Provide Y12 @

Support

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

$K = \frac{74.69 \times 10^6}{2000 \times 219^2 \times 25} = 0.03$

$I_a = 0.5 + \sqrt{0.25 - \frac{0.03}{0.9}} = 0.97 > 0.95$

$= 0.95$

$Z = 0.95 \times 219 = 208.05\ mm$

$A_s = \frac{74.69 \times 10^6}{410 \times 208.05 \times 0.95} = 921.7\ mm^2$

Provide Y12 @ 1130mm

Long span ($b = 2500$)

$Span = Ly - \frac{2}{3}h = 4.5 - \frac{2}{3} \times 1.2 = 2700\ mm$

$Moment = 0.45 \times 0.071 \times 350.64 \times 4.5 = 50.41\ kN/m^2$

$K = \frac{50.41 \times 10^6}{2500 \times 219^2 \times 25} = 0.01$

$I_a = 0.5 + \sqrt{0.25 - \frac{0.01}{0.9}} = 0.99 > 0.95$

$= 0.95$

$Z = 0.95 \times 219 = 208.05\ mm$

$A_s = \frac{50.41 \times 10^6}{410 \times 20805 \times 0.95} = 622.07\ mm^2$

Provide Y12 @ 646mm

Support

$M = 0.25 \times 0.071 \times 350.64 \times 4.5 = 28\ kN/m^2$

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

$I_a = 0.5 + \sqrt{0.25 - \frac{9.34 \times 10^{-3}}{0.9}} = 0.99 > 0.95$

$= 0.95$

$z = 0.95 \times 219 = 208.05\ mm$

$A_s = \frac{28 \times 10^6}{710 \times 0.95 \times 208.05} = 345.53\ mm^2$

Provide Y12 @ 377mm

Column Strip

Span = 3700mm

$b = by_2 = 2000\ mm$

Moment $= 0.55 \times 0.071 \times 350.64 \times 4.5 = 61.61\ KN/m^2$

$K = \frac{61.61 \times 10^6}{2000 \times 219^2 \times 25} = 0.026$

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

$\frac{0.026}{0.9} = 0.95$

$Z = 0.95 \times 219 = 208.05\ mm$

$A_s = \frac{61.61 \times 10^6}{410 \times 0.95 \times 208.05} = 760.28\ mm^2$

Provide Y12 @ 905 mm

Support

Moment $= 0.75 \times 0.071 \times 350.64 \times 4.5 = 84.02\ KN/m^2$

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

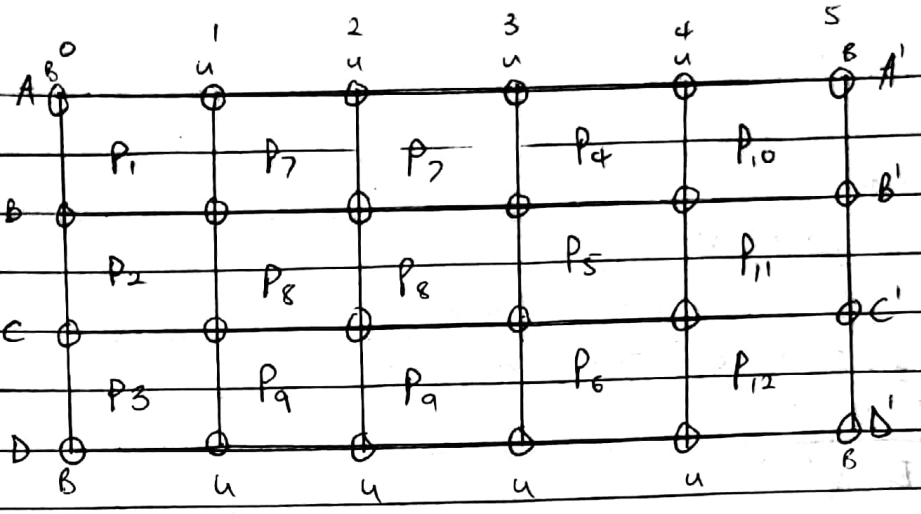
$I_a = 0.5 + \sqrt{0.25 + \frac{0.035}{0.9}} = 0.96 > 0.95$

$\frac{0.035}{0.9} = 0.95$

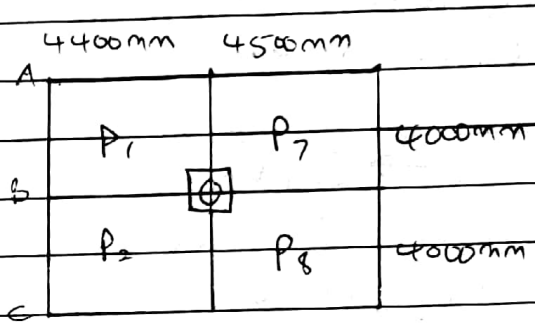
$Z = 0.95 \times 219 = 208.05\ mm$

$A_s = \frac{84.02 \times 10^6}{0.95 \times 208.05 \times 410} = 1087.2\ mm^2$

Provide Y12 @ 1130mm



Key => A = Axial
b = Biaxially
u = Uniaxilly



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

Slab Load

wt of slab = $0.15 \times 24 = 3.6 KN/m^2$

finishes = $1.2 KN/m^2$

Partitions = $1.0 KN/m^2$

Total = $5.8 KN/m^2$

Design load = $1.4 G_K + 1.6 Q_K$

$= (1.4 \times 5.8) + (1.6 \times 2.5)$

$= 12.12 KN/m^2$

Beam Load

wt of beam = $0.225 \times 0.6 \times 24 = 3.24 KN/m^2$

wall load = $3.47 \times 3 = 10.41 KN/m^2$

$13.65 KN/m^2$

Design Load = $1.4 \times 13.65 = 19.11 KN/m^2$

Design

Roof of 3rd floor

Roof load = Area × 1.5 × 1.5

= 17.6 × 1.5 × 1.5 = 39.6 KN

Roof beam = 0.225 × 0.45 × 24 = 2.43 KN/m²

finishes = 1.0 KN/m²

3.43 KN/m²

Roof beam = 3.43 (44)n 1.4

column load = 10 KN

Total load = 89.94 KN

3rd floor → 2nd floor

load 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 KN

Total = 473.776 KN

2nd - 1st floor

Load above = 473.776 KN

Column load = 10 KN

Slab load = 213.312 KN

beam wall load = 160.524 KN

Total = 857.61 KN

1st - ground floor

load above = 857.61 KN

Column load = 10 KN

Slab load = 213.312 KN

beam & wall = 160.534

Total = 1241.446 KN

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

$N = 1241.446$ $f_{cu} = 25$ $f_y = 410$ $b = 25$

$$A_s = \frac{1241.446 \times 10^3 - 0.35 \times (25 \times 225)}{0.7 \times 410 - 0.35 \times 25}$$

$= 2869.64 mm^2$

Provide 6 Y25 @ 250mm