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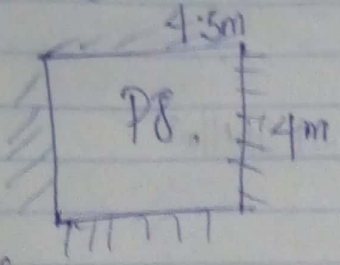
H/SC/14/013
Civil Engr
CVE 308



Capital dropping = 1.2m
Concrete grade = 25-410 N/mm²
Slab thickness = 250mm
Finishes = 1.2KN/m²
Partitions = 1.0KN/m²
Slab = 0.25x25 = 6.25 ≈ 6KN/m²
Total = 8.2KN/m²

Factory design = 5.0
Area = 4x4.5 = 18m²
Design load = 1.4Gk + 1.6Qk
= (1.4x8.2x18) + (1.6x5x18)
= 206.64 + 144
= 350.64

Short span
span = lx - 2/3h = 4 - 2/3 x 1.2 = 3200mm
Moment = 45% x 0.071 fL = 45/100 x 0.071 x 350.64 x 4 = 44.811KN/m²
Width, b = lx/2 = 4/2 = 2 = 2000mm
d = h - cover - 1/2Φ = 250 - 25 - 6 = 219mm
K = N/fcu = 44.81x10⁶ / 2000x219²x25 = 0.018
Z = 0.5 + √(0.25 - K/0.9) = 0.5 + √(0.25 - 0.018/0.9) = 0.787 0.95
= 0.95

$z = \frac{I_{ef}}{} = 0.95 \times 219 = 208.05\,mm$

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

Provide Y12 @ 2

Support

$M_2 = 25\% \times 0.071 fL = \frac{25}{100} \times 0.071 \times 350.64 \times 4 = 24.9\,KN/m^2$

$H = 2000mm$

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

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

$= 0.95$

$z = 0.95 \times 219 = 208.05mm$

$A_s = \frac{24.7 \times 10^6}{0.95 \times 410 \times 208.05} = 307.27mm^2$

Provide Y12 @ 377mm

Column strip (Span)

Span = 3200mm b = 2000mm

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

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

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

$= 0.95$

$z = 0.95 \times 219 = 208.05mm$

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

Provide Y12 @

Support

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

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

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

$= 0.95$

$z = 0.95 \times 217 = 208.05mm$

$A_s = \frac{77.69 \times 10^6}{410 \times 208.05 \times 0.95} = 921.7mm^2$

Provide Y12 @ 1150mm

Longspan ($b = 2500$)

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

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

$K = \frac{50.41 \times 10^6}{2500 \times 217^2 \times 25} = 0.01$

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

$= 0.95$

$z = 0.95 \times 217 = 205.05mm$

$A_s = \frac{50.41 \times 10^6}{410 \times 2080.5 \times 0.95} = 622.07mm^2$

Provide Y12 @ 646mm

Support

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

$K = \frac{28 \times 10^6}{2500 \times 217^2 \times 25} = 7.34 \times 10^{-3}$

$I_a = 0.5 + \sqrt{0.25 - \frac{7.34 \times 10^{-3}}{0.9}} = 0.99 > 0.95$

$= 0.95$

$z = 0.95 \times 217 = 208.05mm$

$A_s = \frac{28 \times 10^6}{410 \times 0.95 \times 208.05} = 345.53mm^2$

Provide Y12 @ 377mm

Column Strip

$span = 3700mm$

$b = l_x/2 = 2000mm$

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

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

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

$= 0.95$

$Z = 0.95 \times 219 = 208.05mm$

$A_s = \frac{61.61 \times 10^6}{410 \times 0.95 \times 208.05} = 960.28mm^2$

Provide Y12 @ ~~754mm~~ 705mm

Support

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

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

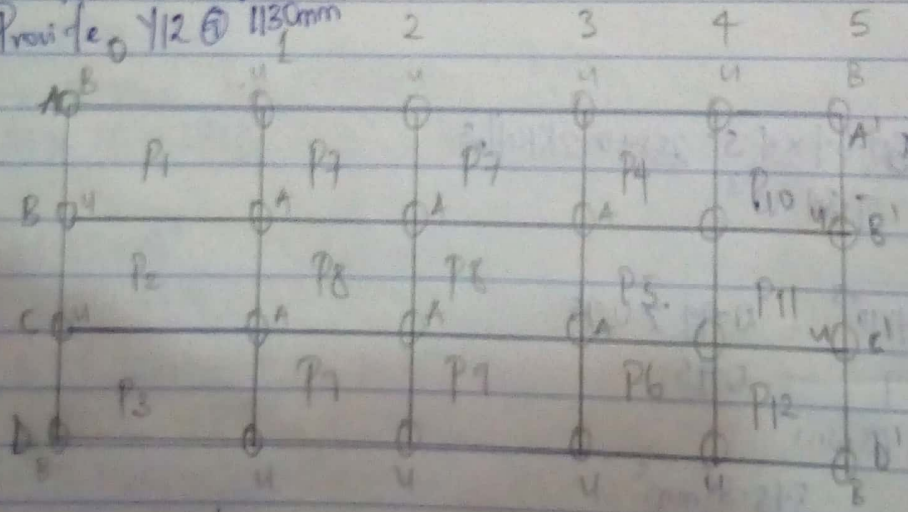
$I_a = 0.5 + \sqrt{0.25 - \frac{0.035}{0.9}} = 0.96 > 0.95$

$= 0.95$

$Z = 0.95 \times 219 = 208.05mm$

$A_s = \frac{84.02 \times 10^6}{0.95 \times 208.05 \times 410} = 1037.2mm^2$

Provide Y12 @ 113mm

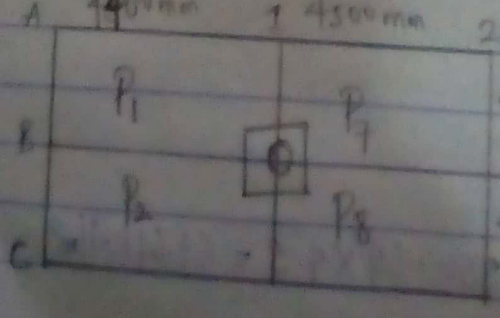


Key = A = Axial

B = Biaxially

U = Uniaxially

Design of Column B1



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

Slab load

wt of slab $= 0.15 \times 24 = 8.6 KN/m^2$

finishes $= 1.2 KN/m^2$

partitions $= 1.0 KN/m^2$

Total $= 5.8 KN/m^2$

Design Load $= 1.4G_K + 1.6Q_K$

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

$= 12.12 KN/m^2$

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 $\times 1.5 \times 1.5$

$= 17.6 \times 1.5 \times 1.5 = 39.6 KN$

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 $= 3.43 (4.4)_n 1.4$

Column load $= 10 KN$

Total load $= 89.94 KN$

3rd Floor → 2nd floor

Load above $= 89.94 KN$

column load $= 10 KN$

slab load $= 17.6 \times 12.12 = 213.312 KN$

Beam load $= 19.11 \times (8.4) = 160.524 KN$

Total $= 473.776 KN$

2nd – 1st floor

Load above = 473.776KN

Column load = 10KN

slab " = 213.312KN

beam & wall " = 160.524KN

Total = 857.61KN

1st – ground floor

Load above = 857.61KN

colum load = 10KN

slab " = 213.312KN

beam & wall " = 160.524

Total = 1241.446KN

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

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

$$A_s = \frac{1241.446 \times 10^3 - 0.35 \times (25 \times 225^2)}{0.7 \times 410 - 0.35 \times 25}$$

$= 2869.64\ mm^2$

Provide 8y25 @ 2950mm