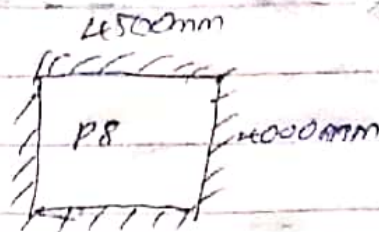


Designing for ps



$$\text{Capital / dropping} = 1.2 \text{ m}$$

25 - concrete grade

$$\text{slab thickness} = 250 \text{ mm}$$

$$\text{Finishes} = 1.2 \text{ k/m}^2$$

$$\text{Partitions} = 1.0 \text{ k/m}^2$$

$$\text{Slab} = 0.25 \times 25 = 6 \text{ k/m}^2$$

$$\text{Total} = 8.2 \text{ k/m}^2$$

$$\text{Designing for factory} = 5.0$$

$$\text{Area} = 4.5 \times 4 = 18 \text{ m}^2$$

$$\text{D.L per area} = 1.4 \text{ GK} + 1.6 \text{ QLK}$$

$$= (1.4 \times 8.2 \times 18) + (1.6 \times 5 \times 18)$$

$$206.64 + 135$$

$$341.64$$

Short span \rightarrow Middle strip \rightarrow span

$$\text{span} = l_{oc} - \frac{2}{3} h = 4 - \frac{2}{3} \times 1.2 = 3200 \text{ mm}$$

$$\text{Moment} = 45\% \times 0.071 \text{ k} = \frac{4.5}{100} \times 0.071 \times 341.64 \times 100 = 43.68 \text{ k/m}$$

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

$$d = h - \text{cover} - \frac{1}{2} \phi = 200 - 25 - 6 = 219 \text{ mm}$$

$$k = \frac{M}{b d^2} = \frac{43.66 \times 10^6}{2000 \times 219^2 \times 25} = 0.018$$

$$z_a = 0.5 + \sqrt{0.25 - \frac{k}{24}} = 0.5 + \sqrt{0.25 - \frac{0.018}{24}} = 0.974 > 0.95$$

$$= 0.95$$

$$z = z_a \cdot d = 0.95 \times 219 = 208.05$$

$$A_s = \frac{M}{0.95 f_y z} = \frac{43.66 \times 10^6}{0.95 \times 410 \times 208.05} = 538.8$$

Provide $4 \phi 12$ at 200% ($A_s = 566 \text{ mm}^2$)

Spart

$$M_2 = 25\% \times 0.071 f_l = \frac{25}{100} \times 0.071 \times 341.64 \times A = 26.25$$

$$W = 2000 \text{ m} = b$$

$$k = \frac{26.25 \times 10^6}{2000 \times 219^2 \times 25} = 0.01$$

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

$$z = e_a \cdot d = 0.95 \times 219 = 208.05$$

$$A_s = \frac{26.25 \times 10^6}{2000 \times 219^2 \times 25} = \frac{26.25 \times 10^6}{0.95 \times 208.05 \times 410} = 299.25$$

Provide $\varnothing 12 @ 300 \text{ c/c}$ ($A_s = 377 \text{ mm}^2$)

Column slab (S.p.)

$$l_{\text{span}} = 3200 \text{ mm}$$

$$b = 2000 \text{ mm}$$

$$M = 55\% \times 0.071 f_l = \frac{55}{100} \times 0.071 \times 364.64 \times 4 = 53.36 \text{ kNm}$$

$$k = \frac{M}{b d^2} = \frac{53.36 \times 10^6}{2000 \times 219^2 \times 25} = 0.022$$

$$e_a = 0.5 + \sqrt{0.25 + \frac{0.022}{0.9}} = 0.977 > 0.95 = 0.95$$

$$z = e_a \cdot d = 0.95 \times 219 = 208.05$$

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

Provide $\varnothing 12 @ 150 \text{ c/c}$ ($A_s = 754 \text{ mm}^2$)

Moment (Support)

$$M_s = \frac{25}{100} \times 0.071 \times 341.64 \times 4.5 = 72.07 \approx 72.77$$

$$k = \frac{72.77 \times 10^6}{2500 \times 219^2 \times 25} = 0.030$$

$$k_{cr} = 0.5 + \sqrt{0.25 - \frac{0.030}{0.19}} = 0.967 \approx 0.95$$

$$Z = 208.05$$

0.95

$$A_s = \frac{0.95 \times 72.77 \times 10^6}{208.05 \times 410 \times 0.95} = 950 \text{ mm}^2$$

Provide $\forall 12 @ 105/c$ ($A_s = 915 \text{ mm}^2$)

Support \rightarrow middle strip \rightarrow (span)

$$\text{Effective span} = l_y - \frac{2}{3}h = 4.5 - \frac{2}{3} \times 1.2 = 3.70 \text{ m}$$

$$\text{Moment} = 0.125 \times 0.071 \times 341.64 \times 4.5 = 81.99 \text{ kN-m}$$

$$\text{Width} = b = l_y - \frac{l_x}{2} = 4.5 - 2 = 2.5 = 2500$$

$$k = \frac{81.99 \times 10^6}{2500 \times 219^2 \times 25} = 0.018$$

$$2500 \times 219^2 \times 25$$

$$k_{cr} = 0.5 + \sqrt{0.25 - \frac{0.018}{0.19}} = 0.987 \approx 0.95$$

$$Z = 208.05$$

$$A_s = \frac{0.95 \times 81.99 \times 10^6}{208.05 \times 410 \times 0.95} = 606.15$$

$$0.95 \times 208.05 \times 410$$

Provide $\forall 12 @ 175/c$ ($A_s = 646 \text{ mm}^2$)

Spalte

$$M_1 = 0.25 = 0.0071 \times 32167 \times 4.5 = 29.81$$

$$b = 2500$$

$$d = 219$$

$$k = \frac{29.81 \times 10^6}{2500 \times 219^2 \times 25} = 9.18 \times 10^{-3}$$

$$l_a = 0.5 + \sqrt{0.25 - \frac{9.18 \times 10^{-3}}{0.10}} = 0.9597 \times 0.95 = 0.95$$

$$z = l_a \cdot d = 208.05$$

$$A_s = \frac{29.81 \times 10^6}{0.95 \times 228.05 \times 410} = 336.86$$

Provide 4/2 @ 300 c/c $A_s = 336.86$ (377 mm²)

Column strip

$$\text{span} = 3700 \text{ mm}$$

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

$$\text{Moment} = 0.55 \times 0.071 \times 32167 \times 4.5 = 60.50$$

$$k = \frac{60.50 \times 10^6}{2000 \times 219^2 \times 25} = 0.025$$

$$l_a = 0.5 + \sqrt{0.25 - \frac{0.025}{0.10}} = 0.977 \times 0.95 = 0.95$$

$$z = 208.05$$

$$A_s = \frac{60.50 \times 10^6}{0.95 \times 410 \times 208.05} = 720.91$$

Provide 4/2 @ 150 c/c ($A_s = 720.91$)

speed

$$\text{Moment} = 0.75 \times 0.071 \times 361.62 \times 4.5 = 81.87$$

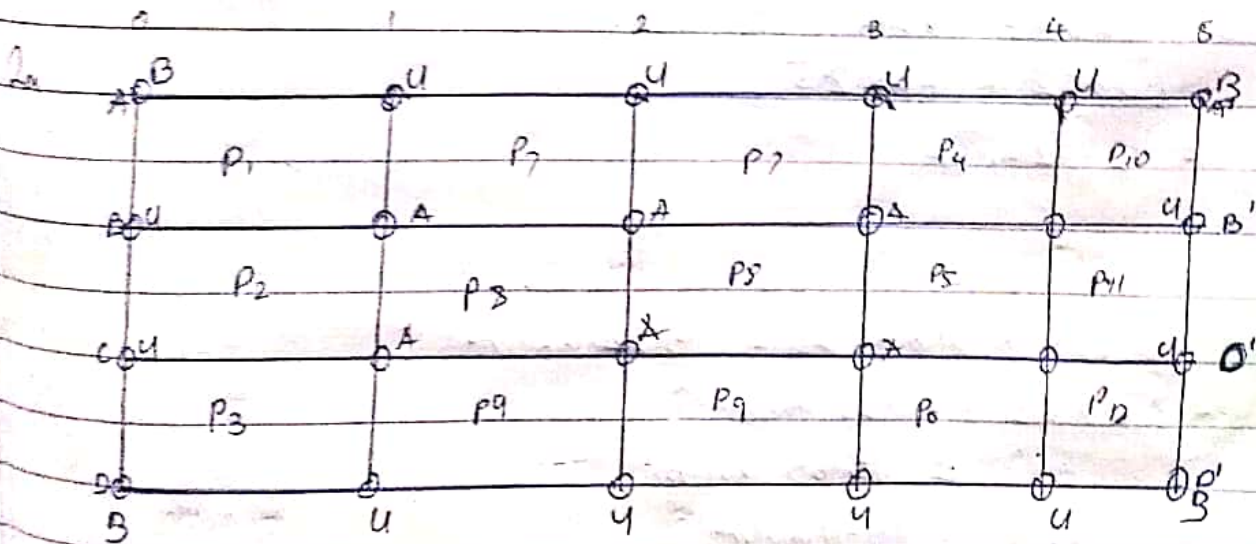
$$k = \frac{81.87 \times 10^6}{20000 \times 219^2 \times 25} = 0.034$$

$$I_0 = 0.5 + \sqrt{0.25 - \frac{0.034}{0.4}} = 0.967 \text{ or } 0.95$$

$$v = 205.05$$

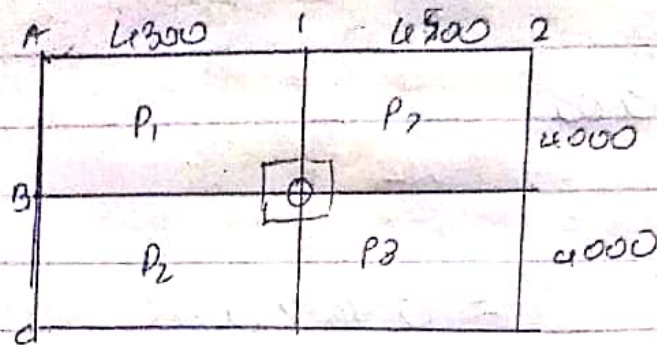
$$L_s = \frac{81.87 \times 10^6}{0.95 \times 4100 \times 205.05} = 1010.298$$

Provide V12 @ 100 c/c (A_s = 1130)



key = A = Axial
 B = Biaxially
 U = Uniaxially

Designing for column B1



$$A = 6 \times 4 = 24 = 17.6 \text{ m}^2$$

Slab load

$$\text{Weight of slab} = 0.15 \times 24 = 3.6 \text{ kN/m}^2$$

$$\text{Finished} = 1.2 \text{ kN/m}^2$$

$$\text{Partition} = 1.0 \text{ kN/m}^2$$

$$5.8 \text{ kN/m}^2$$

$$\text{Design load} = 1.4 \times 5.8 + 1.6 \times 2.5$$

$$1.4 \times 5.8 + 1.6 \times 2.5$$

$$= 12.12 \text{ kN/m}^2$$

Beam load

$$\text{beam wt} = 0.225 \times 0.6 \times 24 = 3.24 \text{ kN/m}^2$$

$$\text{wall load} = 3.47 \times 3 = 10.41 \text{ kN/m}^2$$

$$= 13.65 \text{ kN/m}^2$$

$$\text{DL} = 1.4 \times 13.65 = 19.11 \text{ kN/m}^2$$

Design

Roof - 3rd floor

$$\text{Roof load} = A_{\text{area}} \times 1.5 \times 1.5$$

$$= 17.6 \times 1.5^2 = 39.6 \text{ kN}$$

$$\text{Roof beam} = 0.225 \times 0.45 \times 24 = 2.437 \text{ kN/m}^2$$

$$\text{Finished} = 1.0 \text{ kN/m}^2$$

$$= 3.43 \text{ kN/m}^2$$

$$\text{Load beam} = 3.43 (10.5) \times 1.4$$

$$\text{Column load} = 10 \text{ kN}$$

$$\text{Total load} = 89.94 \text{ kN}$$

2nd floor \rightarrow 2nd floor

$$\text{Load from above} = 89.94 \text{ kN}$$

$$\text{Column load} = 10 \text{ kN}$$

$$\text{Slab load} = 12.6 \times 12 \times 12 = 213.312 \text{ kN}$$

$$\text{Beam load} = 19.11 \times (8.4) = 160.524 \text{ kN}$$

$$\text{Total} \Rightarrow 463.776 \text{ kN}$$

2nd floor to 1st floor

$$\text{Load from above} = 463.78 \text{ kN}$$

$$\text{Column load} = 10 \text{ kN}$$

$$\text{Slab} = 213.312 \text{ kN}$$

$$\text{Wall \& beam} = 160.524 \text{ kN}$$

$$\text{Total} \Rightarrow 865.61 \text{ kN}$$

1st floor to ground floor

$$\text{Load from above} = 865.61 \text{ kN}$$

$$\text{Column load} = 10 \text{ kN}$$

$$\text{slab} = 213.312 \text{ kN}$$

$$\text{Wall \& beam} = 160.524$$

$$= 1249.45 \approx 1300 \text{ kN}$$

$$A_s = N = 0.85 f_{cu} b b$$

$$0.7 f_y = 0.35 f_{cu}$$

$$N = 1300 \text{ kN}$$

$$f_{cu} = 25$$

$$f_y = 410$$

$$b = 300$$

$$A_s = \frac{1300 \times 10^6 - 0.35 (225 \times 225^2)}{0.7 \times 410 - 0.35 \times 25}$$

$$= 3080.07 \text{ mm}^2$$

Provide 8 y 25 ($A_s = 3930 \text{ mm}^2$)

$$A_{smin} = 0.4\% bh = 0.004 \times 225^2 = 202.5 \text{ mm}^2$$