

Example 1-

For the flat plate shown below; check whether slab thickness ($t = 140 \text{ mm}$) is satisfactory; $f_y = 350 \text{ MPa}$; $f'_c = 25 \text{ MPa}$

Solution 2-

Flat plate without edge beam

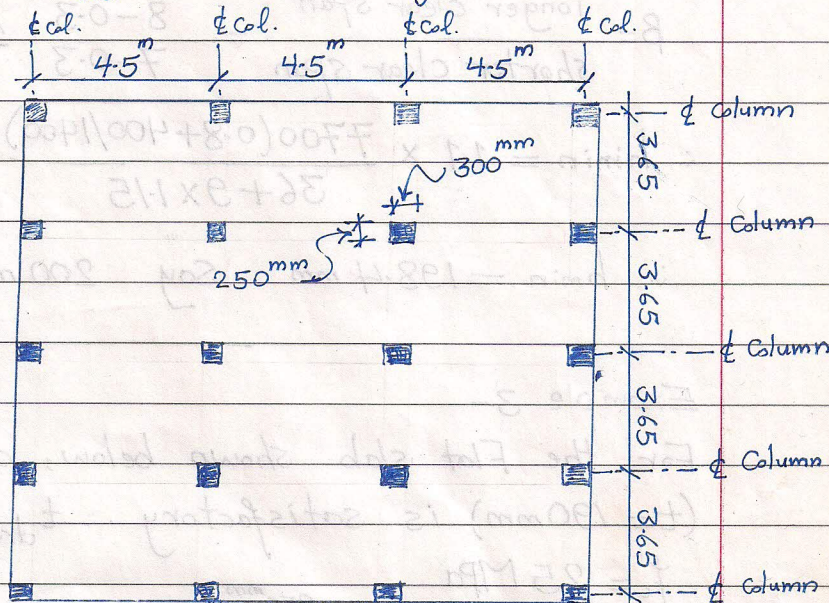
→ Use Table 9.5C

$$h_{min} = \frac{l_n}{31.5}$$

$$l_n = 4.5 - 0.3 = 4.2 \text{ m}$$

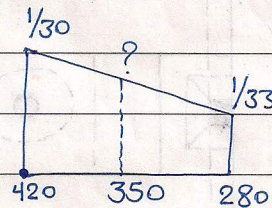
$$h_{min} = \frac{4.2 \times 1000}{31.5} \approx 133.3 \text{ mm} > 125 \text{ mm}$$

$$t = 140 \text{ mm} > h_{min} \quad \text{OK} //$$



$$\text{Coeff} = \frac{1}{33} + \frac{(\frac{1}{30} - \frac{1}{33})}{(420 - 280)} (350 - 280)$$

$$\approx \frac{1}{31.5}$$



Exterior panel: $\alpha = 2.5$ (for h_{min})
Interior panel: $\alpha = 8$ (for h_{min})

Example - 2-

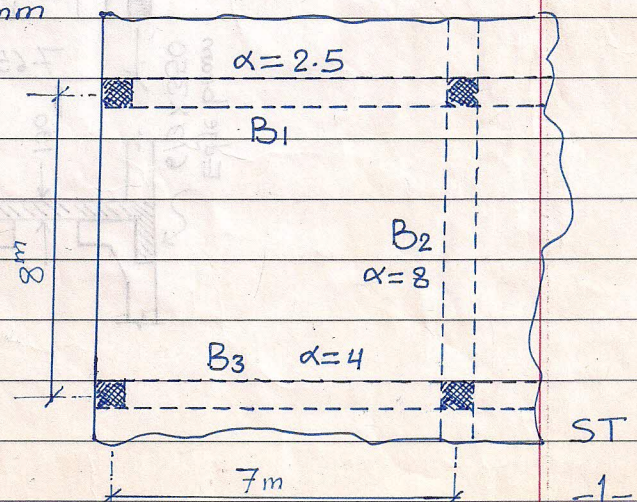
Find the slab thickness for the following panel. $f_y = 400 \text{ MPa}$

Solution 2- All columns = $300 \times 300 \text{ mm}$

Slab with interior beams.

$$\alpha_m = \frac{2.5 + 8 + 4 + 0}{4} = 3.625$$

$\alpha_m > 2.0 \rightarrow$ use equation (9.13)



Also, (α) for edge beam = $0 < 0.8$

Increase slab thickness by (10%)

$$\therefore h_{min} = 1.1 \times \frac{l_n (0.8 + f_y/1400)}{36 + 9\beta} \gg 90 \text{ mm}$$

$$\beta = \frac{\text{longer clear span}}{\text{shorter clear span}} = \frac{8-0.3}{7-0.3} \approx 1.15 ; l_n = 8-0.3 = 7.7 \text{ m}$$

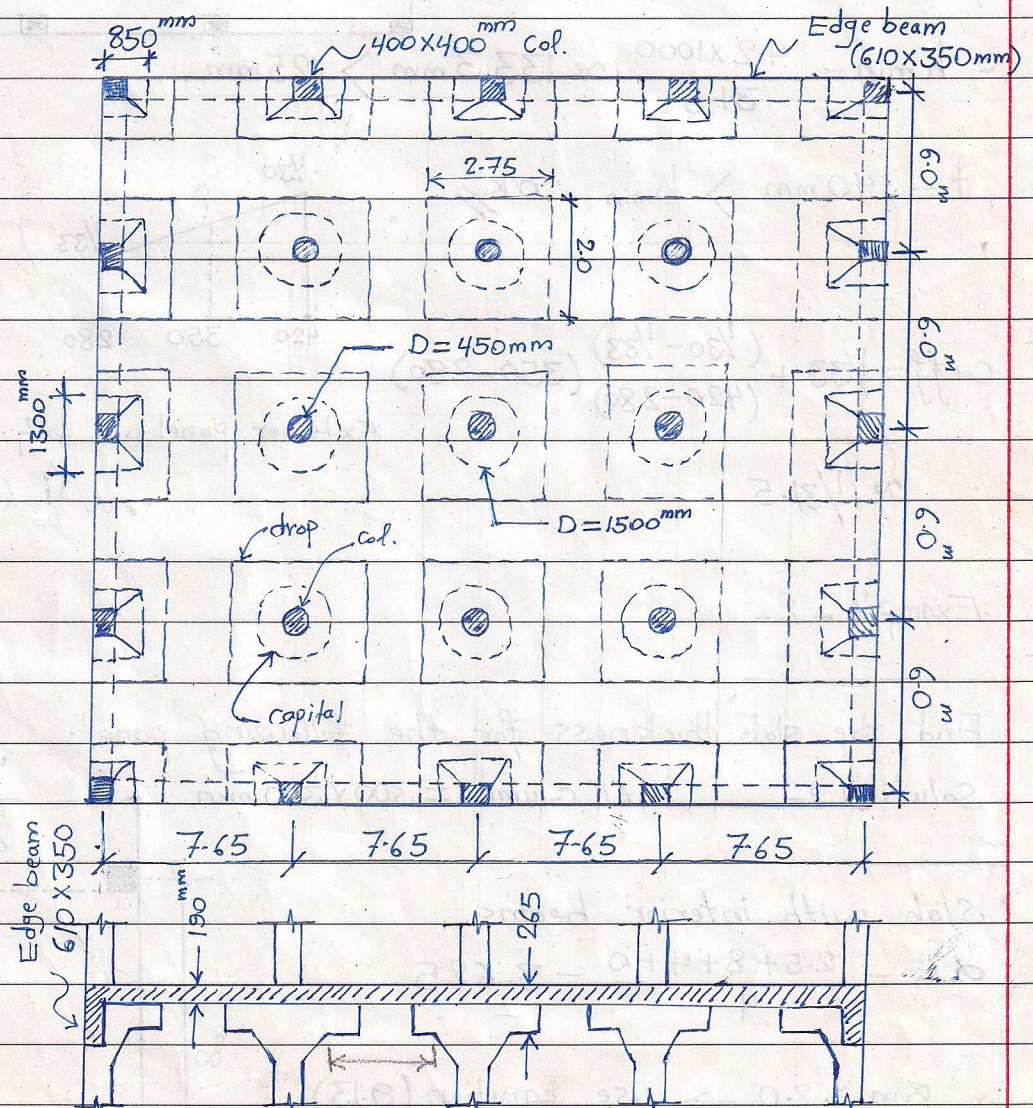
$$\therefore h_{min} = 1.1 \times \frac{7700(0.8 + 400/1400)}{36 + 9 \times 1.15} = 198.4 \text{ mm} > 90 \text{ mm}$$

$$\therefore h_{min} = 198.4 \text{ mm} \quad \text{Soy} \quad 200 \text{ mm}$$

ok //

Example 3-

For the Flat slab shown below, check whether slab thickness ($t = 190 \text{ mm}$) is satisfactory. $t_{drop+slab} = 265 \text{ mm}$; $f_y = 350 \text{ MPa}$
 $f'_c = 25 \text{ MPa}$



Section

Solution:-

Slab without interior beams

Use Table 9.5(c)

* check drop panel dimensions

$$\frac{2.75}{2} = 1.375 \text{ m} < \frac{l_1}{6} = \frac{7.65}{6} = 1.275 \text{ m} \quad \text{OK} // \quad \text{See page - 8}$$

$$\frac{2.0}{2} = 1.0 \text{ m} < \frac{l_2}{6} = \frac{6}{6} = 1.0 \text{ m} \quad \text{OK} //$$

$$t_{\text{drop}} < 190 + \frac{190}{4} = 237.5 \text{ mm}$$
$$265 \text{ mm} < 237.5 \text{ mm} \quad \text{OK} //$$

in slab with drop panel

* check edge beam

$$\alpha_1 = \frac{E_{cb} \cdot I_b}{E_{cs} \cdot I_s} = \frac{(350 \times (610)^3 / 12) \times 1.5}{3200 \times (190)^3 / 12} = 5.4 > 0.8 \quad \longleftrightarrow$$

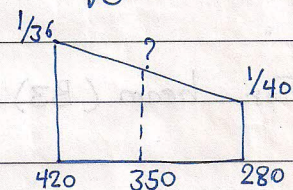
$$\alpha_2 = \frac{(350 \times (610)^3 / 12) \times 1.5}{4025 \times (190)^3 / 12} = 4.32 > 0.8 \quad \updownarrow$$

in slab with edge beam

since $f_y = 350 \text{ MPa}$ (between $f_y = 280 \text{ MPa}$ and $f_y = 420 \text{ MPa}$)
use linear interpolation.

$$\text{Coeff.} = \frac{1}{40} + \frac{(\frac{1}{36} - \frac{1}{40})}{(420 - 280)} (350 - 280)$$

see page - 5



$$\approx \frac{1}{38}$$

$$h_{\text{min}} = \frac{l_n}{38} = \frac{(7.65 - \frac{0.89 \times 1.5}{2} - \frac{0.89 \times 1.5}{2}) \times 10^3}{38} \approx 167 \text{ mm} > 100 \text{ mm}$$

(Int.)

$$h_{\text{provided}} = 190 \text{ mm} > 167 \text{ mm}$$

Note/

$$h_{\text{min}} = \frac{(7.65 - 0.65 - \frac{0.89 \times 1.5}{2}) \times 10^3}{38} = 167 \text{ mm}$$

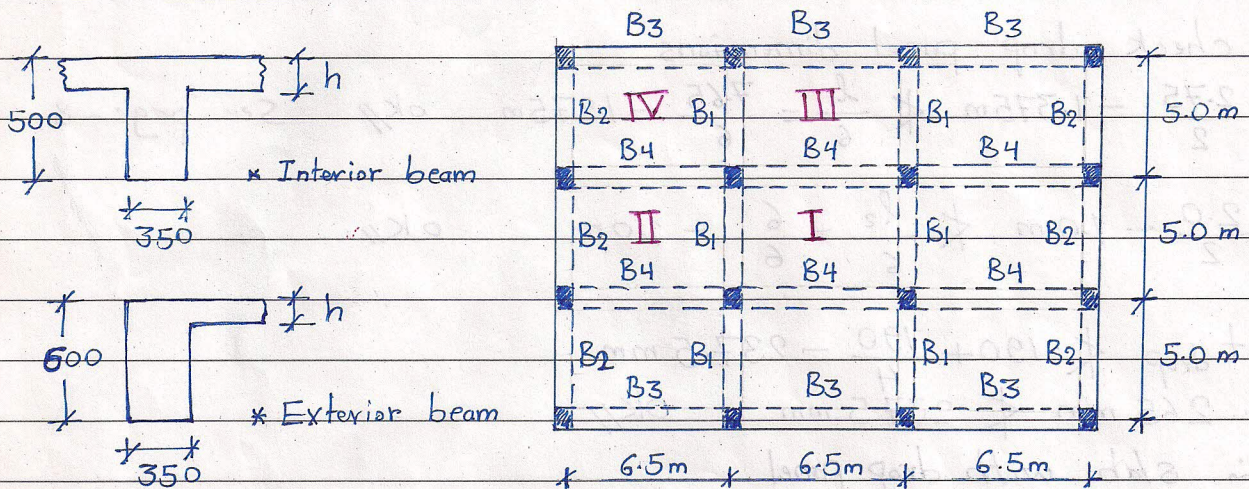
(Ext.)

ST

-3-

Example - 4 -

Estimate the slab thickness for the following slab beam system ; $f_y = 420 \text{ MPa}$; $f'_c = 25 \text{ MPa}$; Columns = $450 \times 450 \text{ mm}$



Solution -

Try $h = 150 \text{ mm}$

Find (α) for beams

$$\alpha = \frac{I_b}{I_s} = \frac{(bh^3/12) \times 2}{l_s \cdot hf^3/12} \leftrightarrow \text{Interior beams}$$

$$\alpha = \frac{I_b}{I_s} = \frac{(bh^3/12) \times 1.5}{l_s \cdot hf^3/12} \leftrightarrow \text{Exterior beams}$$

a- For beam (B1), $\alpha = \frac{(350 \times 500^3/12) \times 2}{6500 \times 150^3/12} = 3.99$

b- For beam (B2), $\alpha = \frac{(350 \times 600^3/12) \times 1.5}{3475 \times 150^3/12} = 9.66$

c- For beam (B3), $\alpha = \frac{(350 \times 600^3/12) \times 1.5}{2725 \times 150^3/12} = 12.33$

d- For beam (B4); $\alpha = \frac{(350 \times 500^3/12) \times 2}{5000 \times 150^3/12} = 5.18$

Find (α_m) for panels

For panel (I), $\alpha_m = 1/4 (3.99 + 3.99 + 5.18 + 5.18) = 4.58$

For panel (II), $\alpha_m = 1/4 (3.99 + 9.66 + 5.18 + 5.18) = 6.0$

For panel (III), $\alpha_m = 1/4 (3.99 + 3.99 + 12.33 + 5.18) = 6.37$

For panel (IV), $\alpha_m = 1/4 (3.99 + 9.66 + 12.33 + 5.18) = 7.79$

$\therefore$ All $\alpha_m > 2.0 \Rightarrow$ use equation 9-13

$$\therefore h = \frac{l_n (0.8 + f_y/1400)}{36 + 9\beta} \gg 90 \text{ mm}$$

Find l_n , S_n

see next page!

→ a- Exterior

$$l_n = 6500 - 450 + 50 + 100 = 6200 \text{ mm} \quad \leftrightarrow \text{From faces of beams}$$

$$S_n = 5000 - 450 + 50 + 100 = 4700 \text{ mm}$$

→ b- Interior

$$l_n = 6500 - 450 + 50 + 50 = 6150 \text{ mm}$$

$$S_n = 5000 - 450 + 50 + 50 = 4650 \text{ mm}$$

Find (β) and (h)

For panel (I)

$$\beta = \frac{l_n}{S_n} = \frac{6150}{4650} = 1.322 \Rightarrow h_{\min} = \frac{6150(0.8 + 420/1400)}{36 + 9(1.322)} = 141.2 \text{ mm}$$

For panel (II)

$$\beta = \frac{l_n}{S_n} = \frac{6200}{4650} = 1.33 \Rightarrow h_{\min} = \frac{6200(0.8 + 420/1400)}{36 + 9(1.33)} = 142.17 \text{ mm}$$

For panel (III)

$$\beta = \frac{l_n}{S_n} = \frac{6150}{4700} = 1.3 \Rightarrow h_{\min} = \frac{6150(0.8 + 420/1400)}{36 + 9(1.3)} = 141.8 \text{ mm}$$

For panel (IV)

$$\beta = \frac{l_n}{S_n} = \frac{6200}{4700} = 1.319 \Rightarrow h_{\min} = \frac{6200(0.8 + 420/1400)}{36 + 9(1.319)} = 142.4$$

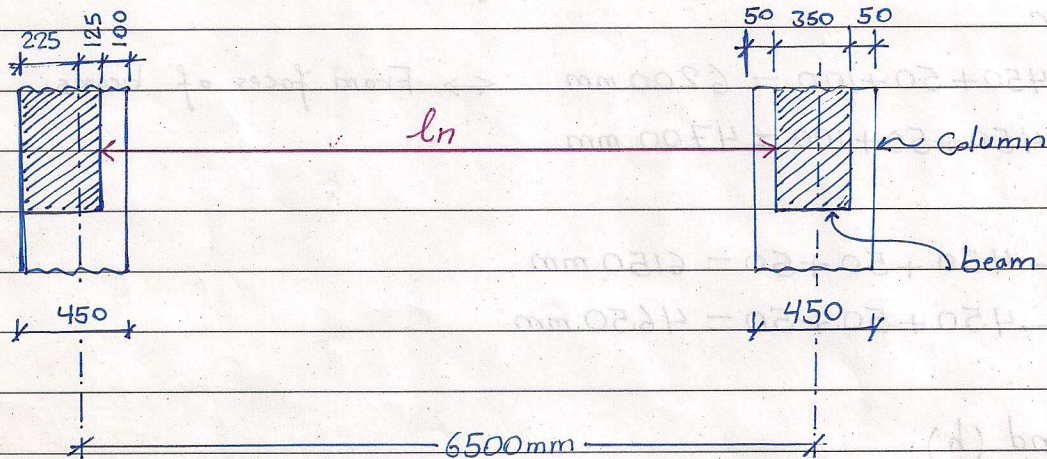
$\therefore h = 150 \text{ mm}$ adequate

OK//

Note

clear spans calculations

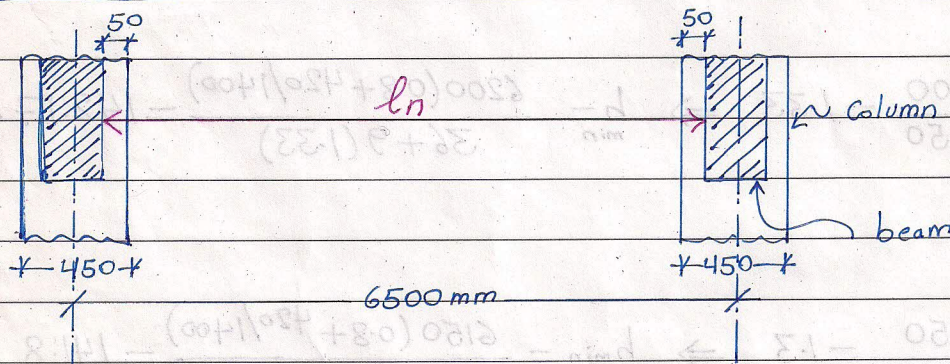
* Exterior



$B = \frac{l_n}{S_n}$; l_n = clear longer span measured from face to face of beams

$$l_n = 6500 - 450 + 50 + 100 = 6200 \text{ mm}$$

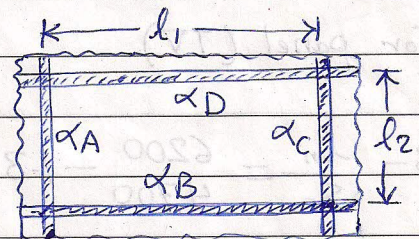
* Interior



$$l_n = 6500 - 450 + 50 + 50 = 6150 \text{ mm}$$

Note / $\left(\frac{\alpha_1 l_2^2}{\alpha_2 l_1^2} \right) \leftrightarrow$ For slab-beam system

$$\alpha_1 = \frac{\alpha_B + \alpha_D}{2} ; \alpha_2 = \frac{\alpha_A + \alpha_C}{2}$$



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