FAQs

1. **Analyse and design the reinforcement required for a two way slab simply supported on all the four sides with corners free to lift or the slabs do not having adequate provisions to prevent lifting of corners. The effective dimension of the room is 3.5m x 3.5m. It is supported on 230mm thick wall. Live load on slab is 3 kN/m^2. Consider other dead loads also. Use M20 and Fe415 as materials.**

Size of slab = 3.5m x 3.5m effective

The ratio l_y/l_x = 3.5/3.5 = 1 < 2; it is two way slab.

a. Load calculations:

i. Dead loads

Assume thickness of slab from cl. 24.1 of IS 456:2000

l/D = 35 x 0.8;

D = 125mm

Assume D = 125mm

Self-weight of slab = 0.125 x 25 = 3.125 kN/m^2

Weight of floor finish = 0.025 x 24 = 0.60 kN/m^2

Total dead loads $\mathbf{w_d}$ = **3.725 kN/m^2**

ii. Live load on slab $\mathbf{w_l}$ = **3.00 kN/m^2**

iii. Total load on slab **w = 6.725 kN/m^2**

b. Bending moment calculations

$M_x = \boldsymbol{\alpha_x w l_x^2}$

$M_x = \boldsymbol{\alpha_y w l_x^2}$

As per Table 27 of IS 456: 2000; bending moment coefficients are

l_y/l_x = 3.5/3.5 = 1; $\boldsymbol{\alpha_x = \alpha_y = 0.062}$

$M_X = M_Y = 0.062 \times 6.725 \times 3.5^2$ = 5.11 kNm

$M_{ux} = M_{uy}$ = 1.5 x 5.11 = 7.665 kNm

c. Effective depth of slab

Consider 1m width of the slab and by equating M_u to M_{ulim}

$M_{ulim} = 0.138 f_{ck} b d^2 = M_u$

d = 52.70mm < 105mm

Hence safe against flexure.

Keep D = 125mm; d = 105mm

d. Area of reinforcement (along both directions)

Main Steel:

$\mathbf{M_u}$ = $\mathbf{0.87f_yA_{st}(d\text{-}o.416x_u)}$

$A_{st,\ reg}$ = 210.87mm^2

Check for Minimum steel as per IS 456:2000

A_{st} = 0.12% cross sectional area

= 126 mm^2 < 210.87mm^2

Hence $A_{st\ reg}$ = 210.87mm^2

Provide 8mm diameter bar

Spacing = 238.37mm

Provide 8mm diameter bar at 200mm c/c

$A_{st\ pro}$ = 284.10mm^2

Torsion Steel:

A_{st} = ¾ of Main steel A_{st} = ¾ x 210.87 = 128.13mm^2

Use 8mm dia bars;

Spacing = 390mm

Provide 8mm dia bars at 300mm c/c at each corners both top as well as bottom in two layers at a distance of l/5 from the face of support.

e. Check for deflection

As per cl.23.2.1 of IS 456:2000

l/D = 35 x 0.8

D = 125mm

Hence safe against deflection.