FAQs

1. Analyse and design the reinforcement required for a two way slab simply supported on all the four sides when the corners of the slabs are prevented from lifting. The clear dimension of the room is 4m x 4m with one long edge discontinuous. 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.

One long edge discontinuous

Size of slab = 4.23m x 4.23m effective

The ratio l_y/l_x = 4.23/4.23 = 1 < 2; it is two way slab.

a. Load calculations:

i. Dead loads

Assume thickness of slab from cl. 23.2.1 of IS 456:2000

l/d = 20;

d = 211.50mm

D = 231.5mm

Assume D = 150mm

Self-weight of slab	=	0.150 x 25 =	3.75 kN/m^2
Weight of floor finish	=	=	0.60 kN/m^2
Partitions	=	=	1.96 kN/m^2
Total dead loads		$\mathbf{w_d}$ =	**6.31 kN/m^2**
ii. Live load on sla		$\mathbf{w_l}$ =	**3.0 kN/m^2**

iii. Total load on slab **w = 9.31 kN/m^2**

b. Effective span

l_{eff} = 4.00 + 0.13 = 4.13m

= c/c distance between supports= 4.23 whichever is less.

Hence l_{eff} = 4.13m

c. Bending moment calculations: one long edge discontinuous

$M_x = \alpha_x w l_x^2$

$M_x = \alpha_y w l_x^2$

From Table 26 of IS 456: 2000; bending moment coefficients are

l_y/l_x = 4.23/4.23 = 1.0;

Short span coefficients

-ve BM at continuous edge α_x **= 0.037**

+ve BM @ mid span α_x **= 0.028**

Long span coefficients

-ve BM at continuous edge α_y **= 0.037**

+ve BM @ mid span α_y **= 0.028**

Max $M_X = 0.037 \times 9.31 \times 4.13^2$ = 5.88 kNm

Max $M_Y = 0.037 \times 9.31 \times 4.13^2$ = 5.88 kNm

$M_{ux} = M_{uy}$ = 1.5 x 5.88 = 8.82 kNm

d. Effective depth of slab

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

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

d = 56.53mm < 130mm

Hence safe against flexure

Keep D = 150mm; d = 130mm

e. Area of reinforcement (along both directions)

Main Steel:

$\mathbf{M_{ux} = M_{uy}} = \mathbf{0.87 f_y A_{st} (d - o.416 x_u)}$

$A_{st, reg}$ = 193.17 mm^2

Check for Minimum steel as per IS 456:2000

A_{st} = 0.12% cross sectional area

= 156 mm^2 < 193.17 mm^2

Hence $A_{st\ reg}$ = 193.17 mm^2

Provide 8mm diameter bar

Spacing = 260.21mm

Provide 8mm diameter bar at 230mm c/c

$A_{st\ pro}$ = 218.55mm^2

f. Check for deflection

As per cl.23.2.1 of IS 456:2000

l/d = 20 x M.F

p_t = 0.17%

f_s = 212.75 N/mm^2

M.F = 2.0

d = 103.25mm < 130mm

Hence safe against deflection.