FAQs

1. Design a reinforced concrete slab for a room of size 4m x 5m clear subjected to a live load of 2.5 kN/m^2. Three edges discontinuous (one long edge continuous). The load due to floor finish is 1 kN/m^2 and partition is 2 kN/m^2. Use M20 and Fe415 as materials.

Three edges discontinuous (one long edge continuous)

Size of slab = 4.23m x 5.23m effective

The ratio l_y/l_x = 5.23/4.23 = 1.24 < 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 = = 1.00 kN/m^2

Partitions = = 2.00 kN/m^2

Total dead loads **w_d = 6.75 kN/m^2**

ii. Live load on sla **w_l = 2.5 kN/m^2**

iii. Total load on slab **w = 9.25 kN/m^2**

b. Effective span

l_{eff} = 4.00 + 0.13 = 4.13m

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

Hence l_{eff} = 4.13m

c. Bending moment calculations: one long edge discontinuous

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

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

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

l_y/l_x = 5.23/4.23 = 1.24;

Short span coefficients

-ve BM at continuous edge α_x **= 0.073**

+ve BM @ mid span α_x **= 0.0548**

Long span coefficients

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

+ve BM @ mid span α_y **= 0.043**

Max $M_X = 0.073 \times 9.25 \times 4.13^2$ = 11.52 kNm

Max $M_Y = 0.043 \times 9.25 \times 4.13^2$ = 6.78 kNm

M_{ux} = 1.5 x 11.52 = 17.28 kNm

M_{uy} = 1.5 x 6.78 = 10.17 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 = 79.13mm < 130mm

Hence safe against flexure

Keep D = 150mm; d = 130mm

e. Area of reinforcement (along Shorter direction)

Main Steel:

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

$A_{st, reg}$ = 393.25 mm^2

Check for Minimum steel as per IS 456:2000

A_{st} = 0.12% cross sectional area

= 216 mm^2 < 393.25 mm^2

Hence $A_{st\ reg}$ = 393.25 mm^2

Provide 8mm diameter bar

Spacing = 127.82mm

Provide 8mm diameter bar at 110mm c/c

$A_{st\ pro}$ = 456.96mm^2

f. Area of reinforcement (along Longer direction)

Main Steel:

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

$A_{st, reg}$ = 224.72 mm^2

Check for Minimum steel as per IS 456:2000

A_{st} = 0.12% cross sectional area

= 216 mm^2 < 224.72 mm^2

Hence $A_{st\ reg}$ = 224.72 mm^2

Provide 8mm diameter bar

Spacing = 223.68mm

Provide 8mm diameter bar at 200mm c/c

g. Check for deflection

As per cl.23.2.1 of IS 456:2000

l/d	=	20 x M.F
p_t	=	0.35%
f_s	=	207.14 N/mm^2
M.F	=	1.6
d	=	129.06mm < 130mm

Hence safe against deflection