FAQs

1. Design a RCC circular cover slab of 7.5m clear diameter supported on 230mm thick beams which can provide complete fixity of the slab. The slab is used to support a parking load of 7.5 kN/m^2. Consider floor finish of 1.0 kN/m^2. Use M20 mix and Fe415 grade steel.

Diameter of slab = 7.5m clear and 7.73m effective

a. Load calculations:

i. Dead loads

Assume thickness of slab from l_x/d = 20;

d = $l_x/20$

= 386.5mm

D = 386.5 + 15 + 10/2

= 406.5mm

Assume D = 300mm; d = 280mm

Self-weight of slab = 0.30 x 25 = 7.50 kN/m^2

Weight of floor finish = = 1.00 kN/m^2

Total dead loads $\mathbf{w_d}$ = **8.50 k N/m²**

ii. Live load on slab $\mathbf{w_l}$ = **7.50 kN/m²**

iii. Total load on slab **w** = **16.00 kN/m²**

b. Effective span l_x = 7.5 + 0.23 = 7.73m

= 7.5 + 0.28 = 7.78m whichever is less

Hence l_x = 7.73m

c. Bending moment calculations

- Circumferential moment at the centre of slab $(M_\theta)_c = + 1/16\ wa^2$ = 14.94 kNm
- Circumferential moment at the edge of slab $(M_\theta)_e = 0$
- Radial moment at the centre of slab $(M_r)_c = + 1/16\ wa^2$ = 14.94 kNm
- Radial moment at edge $(M_r)_e = - 2/16\ wa^2$ = 29.88 kNm

d. Effective depth of slab

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

M_{umax} = 1.5 x 29.88 = 44.82 kNm

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

d = 127.44mm < 280mm

Hence safe against flexure.

Keep D = 300mm; d = 280mm

e. Area of reinforcement

a. Main Steel for radial and circumferential moment at centre

$\mathbf{M_u}$ = $(M_\theta)_c = (M_r)_c$ = $\mathbf{0.87 f_y A_{st}(d-0.416x_u)}$

$A_{st,\ reg}$ = 228.97mm^2

i. Check for Minimum steel as per IS 456:2000

A_{st} = 0.12% cross sectional area

= 336 mm^2 > 228.97 mm^2

Hence $A_{st\ reg}$ = 336mm^2

Provide 8mm diameter bar

Spacing = 149.60 mm

Provide 8mm diameter bar at 125mm c/c

$A_{st\ pro}$ = 402.12mm^2

b. Main Steel for radial moment at edge at top

$\mathbf{M_u}$ = $(M_r)_e$ = $\mathbf{0.87 f_y A_{st}(d-0.416x_u)}$

$A_{st,\ reg}$ = 459.16mm^2

i. Check for Minimum steel as per IS 456:2000

A_{st} = 0.12% cross sectional area

= 336 mm^2 < 459.16mm^2

Hence $A_{st\ reg}$ = 459.16mm^2

Provide 10mm diameter bar

Spacing = 171.05mm

Provide 10mm diameter bar at 150mm c/c as radial reinforcement at the edge at top for a length of $[7.96/2 - 3.98/\sqrt{3}]$ = 1.75m from the face of support. Provide 8mm diameter bar at 175mm c/c (minimum) as circumferential reinforcement at the edge. The circumferential reinforcement is a anchorage reinforcement which are used to avoid slippage of radial reinforcement at the edge at top.

Check for deflection

As per cl.23.2.1 of IS 456:2000

l/d = 20 x M.F

p_t = 0.46%

f_s = $0.58\ f_y\ A_{st\ reg} / A_{st\ pro}$ = 220.77 N/mm^2

As per Fig.4; M.F = 1.8

Hence d = 183.33mm < 280mm; Hence safe against deflection.