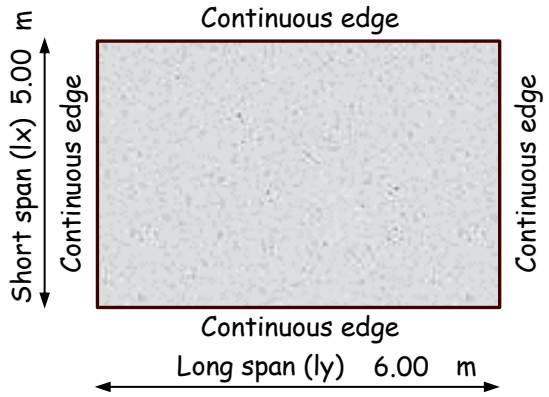
SLAB DESIGN (Limit State Design of IS 456:2000)

DESIGN INPUT:

(a) Materials:
Slab thk. (D) = 250 mm
Floor finish thk. (ff) = 75 mm
Concrete cover (cc) = 15 mm
Min. dia. of main steel = 10 mm
Min. dia. of distn. steel = 8 mm
Limiting basic 'span/ eff. depth' value = 26
Concrete grade (fcu) = 25 MPa
Reinf't. type: HYSD Bars
Reinf't. grade (fy) = 500 MPa



Slab dimensions/ Edge conditions

(b) Loads:
[i] Dead Load (DL):
Self weight of slab = 25 x D = 6.25 kN/m²
Floor finish load = 20 x ff = 1.5 kN/m²
Ceiling load @ 0.5 kN/m²
Services @ 0.5 kN/m²
Other loads (if any) @ 0.25 kN/m²
i.e. Total DL = 9 kN/m²
[ii] Live Load (LL):
Live Load @ 3 kN/m²
Other loads (if any) @ 0.5 kN/m²
i.e. Total LL = 3.5 kN/m²
[iii] Blast Load, BL @ 20.7 kN/m²
[iv] Factored Load (w):
w = 1.5 DL + 1.5 LL + 1.5 BL = 1.5 x 9 + 1.5 x 3.5 + 1.5 x 20.7 = 49.8 kN/m²

FLEXURE:
Aspect ratio = ly/ lx = 6/ 5 = 1.2 <= 2 (2-way slab)
Eff. depth, d1 = D - cc - Dx,bot/ 2 = 250 - 15 - 16/ 2 = 227 mm
Eff. depth, d2 = D - cc - Dx,bot - Dy,bot/ 2 = 250 - 15 - 16 - 10/ 2 = 214 mm
(a) Short span moments:
Mx (+ve) = 0.032 w.lx² = 0.032 x 49.8 x 5² = 39.84 kN.m/m
Mx (-ve) = 0.043 w.lx² = 0.043 x 49.8 x 5² = 53.54 kN.m/m

(b) Long span moments:
My (+ve) = 0.024 w.lx² = 0.024 x 49.8 x 5² = 29.88 kN.m/m
My (-ve) = 0.032 w.lx² = 0.032 x 49.8 x 5² = 39.84 kN.m/m

SLAB REINFORCEMENT:

(a) Distribution Steel:

Distn. steel in each dirn @ 0.12% = 300 mm^2/m

Max. spg. of main bars = Min (3d, 300 mm) = 200 mm

Max. spg. of distn. bars = Min (5d, 450 mm) = 300 mm

Steel in edge strips @ Lx (2 nos. 0.75 m wide) & @ Ly (2 nos. 0.6 m wide):

Provide T8 @ 300 c/c (T&B) => As = 167.6 mm^2/m (i.e. pt = 0.12%)

=> MRmin = 0.87 x Fy x (As/(b x d) x [1 - 1.005 x {As/(b x d) x Fy/Fcu}] x ($b \times d^2$)

= 15.35 kN.m

(b) Steel @ short span (Middle strip 4.5m wide):

Provide T16 @ 125 c/c @ Bottom => As = 1608.5 mm^2/m (i.e. pt = 0.71%)

=> MR = 0.87 x Fy x (As/(b x d) x [1 - 1.005 x {As/(b x d) x Fy/Fcu}] x ($b \times d^2$)

= 136.21 kN.m > = Mu (= 39.84), OK

Provide T16 @ 100 c/c @ Top => As = 2010.6 mm^2/m (i.e. pt = 0.89%)

=> MR = 0.87 x Fy x (As/(b x d) x [1 - 1.005 x {As/(b x d) x Fy/Fcu}] x ($b \times d^2$)

= 163.19 kN.m > = Mu (= 53.54), OK

(c) Steel @ long span (Middle strip 3.75m wide):

Provide T10 @ 175 c/c @ Bottom => As = 448.8 mm^2/m (i.e. pt = 0.21%)

=> MR = 0.87 x Fy x (As/(b x d) x [1 - 1.005 x {As/(b x d) x Fy/Fcu}] x ($b \times d^2$)

= 40.02 kN.m > = Mu (= 29.88), OK

Provide T10 @ 125 c/c @ Top => As = 628.3 mm^2/m (i.e. pt = 0.29%)

=> MR = 0.87 x Fy x (As/(b x d) x [1 - 1.005 x {As/(b x d) x Fy/Fcu}] x ($b \times d^2$)

= 55.04 kN.m > = Mu (= 39.84), OK

SHEAR:

Shear force, V = 0.6 x w x lx = 149.4 kN/m

Nominal shear stress, vu = V / (b x d1) = 0.66 MPa

[Note: b = slab width = 1000 mm in above equation]

Tension steel considered for shear check, pt,she = 0.89%

Max. shear stress, Tc,max (Table 20) = 3.1 MPa; vu (= 0.66) < Tc,max/ 2 (= 1.55), OK

Design shear strength of concrete, vc (Table 19) = 0.61 MPa

Modification factor for shear strength of slab, k (Clause 40.2.1.1) = 1.1

Modified shear strength of slab, k x vc (Clause 40.2.1.1) = 0.67

Since vu (= 0.66) < = k.vc (= 0.67), OK

DEFLECTION:

As,pro = 1608.5 mm^2 & As,req = 1608.5 x (39.84/ 136.21) = 470.5 mm^2

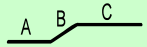
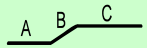
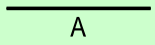
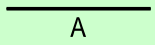
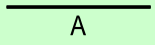
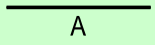
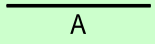
fs = Max [(0.58 fy.As,req/ As,pro), 120] = Max [(0.58 x 500 x 470.5/ 1608.5), 120] = 120 MPa

fs = 120 MPa & pt = 0.71 => MFt = 1.89; pc = 0.89/ 2 = 0.45 => MFc = 1.14

lx/ (d1.MFt.MFc) = 5000/ (227 x 1.89 x 1.14) = 10.2 <= 26 (OK)

StrSof
SOFTWARE SOLUTIONS

Client:	EPCENTER CONSULTING ENGINEERS PVT. LTD.	Rev.:	0	Date:	20-12-2025
		Prep. by:	-	Chd. By:	-
Project:	1001	Rev.:	0	Date:	
Structure:	A-BUILDING	Prep. by:		Chd. By:	
Area/Unit:	PEB	Rev.:	0	Date:	
Member:	SLAB	Prep. by:		Chd. By:	

Member	Bar mark	Type	Dia. (mm)	No of mbrs	Bars in each	Shape code	Bar dimensions (mm)					Total bars	Bar length (mm)	Tot. bar length (m)	Total weight (kg)	Shape
							A	B	C	D	E					
S1	01	T	16	1	46	26	546	288.5	4450	-	-	46	5284	243.09	383.67	
	02	T	10	1	28	26	656	274.4	5350	-	-	28	6280	175.85	108.42	
	03	T	16	1	57	0	1500	-	-	-	-	57	1500	85.50	134.95	
	04	T	16	1	57	0	1500	-	-	-	-	57	1500	85.50	134.95	
	05	T	10	1	38	0	1800	-	-	-	-	38	1800	68.40	42.17	
	06	T	10	1	38	0	1800	-	-	-	-	38	1800	68.40	42.17	
	07	T	8	1	6	0	5400	-	-	-	-	6	5400	32.40	12.78	
	08	T	8	1	8	0	6400	-	-	-	-	8	6400	51.20	20.20