Client: M/s. Sree Shardha Ambal Foundation (POA), Premier Hi-Tech Industries & Two Others (Owners)

Project: THE PROPOSED CONSTRUCTION OF HIGH RISE COMMERCIAL BUILDING CONSISTING OF BASEMENT FLOOR + GROUND FLOOR + 10 FLOORS AT T.S.No; 1, BLOCK No: 5, WARD No: AD-UPPILIPALAYAM VILLAGE, T.S.No: 22 & 18, BLOCK No: 9, WARD No: AC-SOWRIPALAYAM VILLAGE, TRIVHY MAIN ROAD, COIMBATORE CORPORATION, COIMBATORE DISTRICT

Structural Consultant: M/s. UNITED CONSULTANTS
41/A, Beach road, Sea point apartments
Kalashetra colony, Besant nagar, Chennai-90

Title: COMMERCIAL BUILDING

For SREE SHARADHA AMBAL FOUNDATIONS

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For SREE SHARADHA AMBAL FOUNDATIONS

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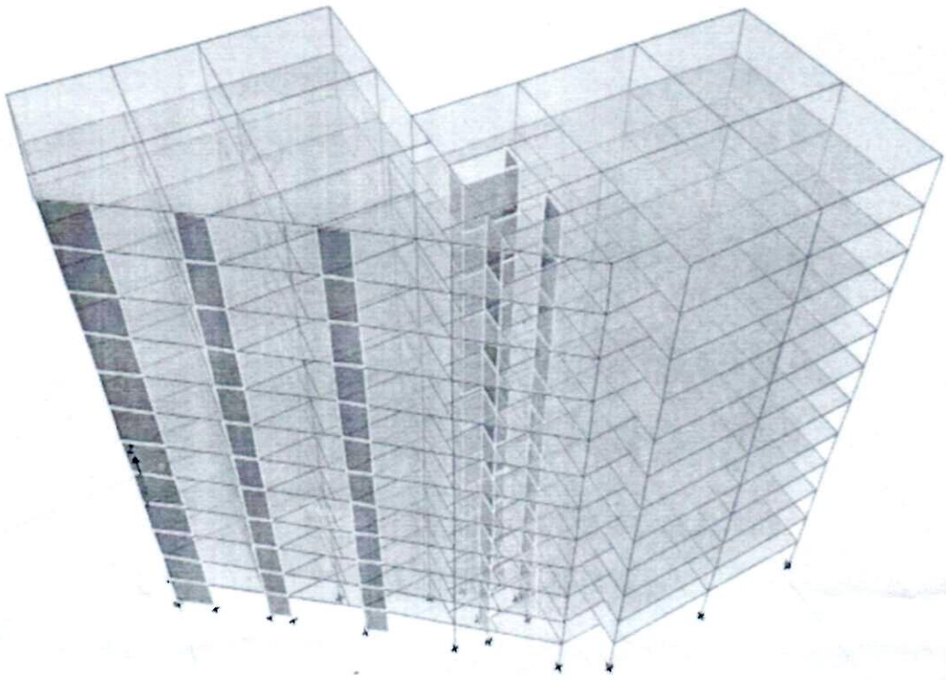
REG No. SE/GR-I/24/02/001
REG No. RSE100392025

BUILDING DESCRIPTION

- The Proposed Construction of commercial building Extended Single Basement + Ground Floor + 10 Floors.
- Height of Building above ground level is 34.93m. (From Ground floor to Terrace floor)
- Basement floor used for Parking and the remaining upper floors used for Commercial purpose.
- The structure comprises of RC Shear wall, column, Beam & Slab.
- Raft foundation provided as per soil test report.



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3D VIEW

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GRADE OF CONCRETE & STEEL

• Raft foundation	:	M35
• Columns	:	M40
• RC Wall	:	M25
• Beams	:	M25
• Slabs	:	M25
• Staircase	:	M25

• Reinforcement of Grade Fe-500 is used for RCC design

LOADS

- Following Codes are used for designing members.
- IS 875 : 1987 (Part 1) Dead loads
- IS 875 : 1987 (Part 2) Live loads
- IS 875 : 2015 (Part 3) Wind loads
- IS 1893 : 2016 (Part 1) Earthquake loads
- IS 13920 : 2016 Ductile Design and Detailing of Reinforced concrete Structures

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SUPER STRUCTURE DATA

Number of floors - Single Basement + Ground + 10 upper floors Height of each

Floors - 3.11 m

Total height of Building - 34.93 m, excluding Headroom & LMR

WALL PROPERTIES

- Lift RC wall thickness - 0.2m
- Modelling Type - Shell Thin

SLAB PROPERTIES

- Basement floors RC slab thickness - 0.45/0.2/0.15/0.12m
- Typical Floor RC slab thickness - 0.45/0.2/0.15/0.12m
- Modelling Type - Shell Thin

DEAD & LIVE LOADS

DEAD LOADS

- This comprises of self-weight of various structural elements indicated below:
- Self-weight of RC wall, column, Beam, slab and staircase.
- Floor and Roof finishes.
- Self-weight of the modelled elements is calculated by ETABS through SELF WEIGHT command.

LIVE LOADS

These loads are considered for the analysis in addition to dead loads as follows,

- Bath/Shower & Toilet = 2.0 kN/m^2
- commercial floor area = 5.0 kN/m^2
- Activity room = 5.0 kN/m^2
- Cafeteria = 5.0 kN/m^2
- Lobby, Balcony, Staircase = 4.0 kN/m^2
- AHU & Electrical Rooms = 5.0kN/m^2 or as per actuals

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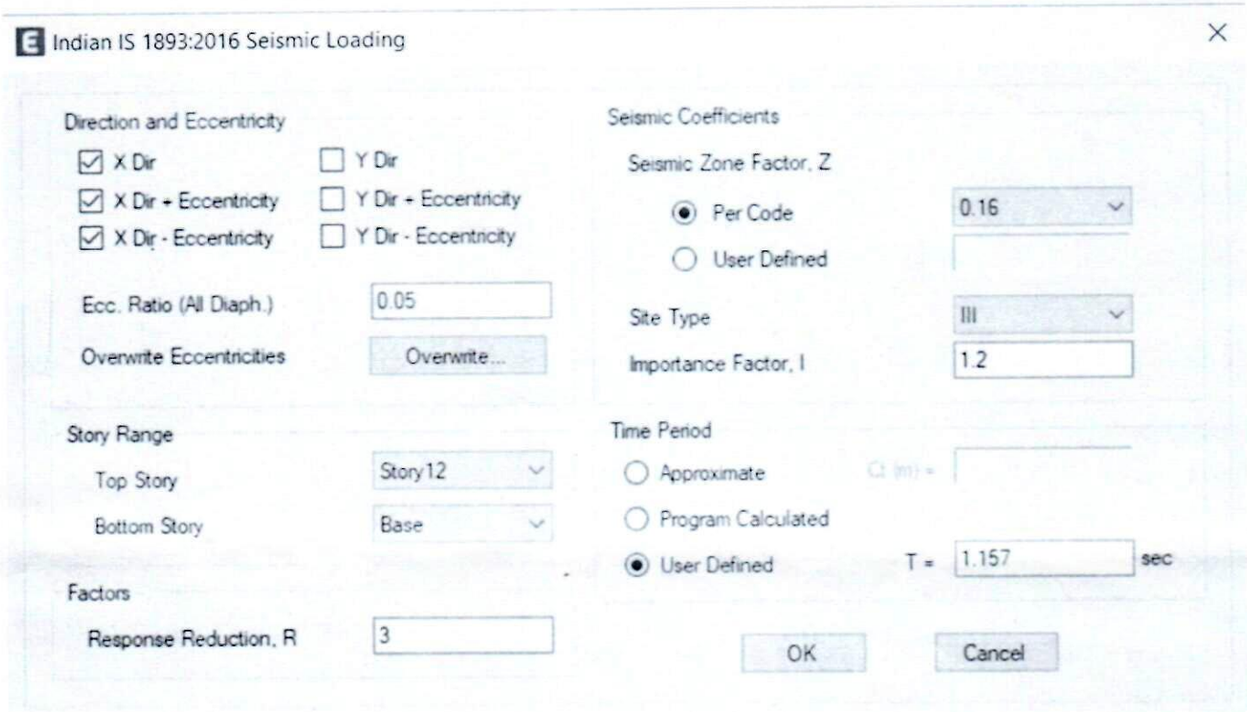
- Ramp, Parking = 5.0 kN/m^2
- Lift Machine rooms = 10.0 kN/m^2 or as per actuals
- Live Load on Roof =2 kN/m^2

SEISMIC INPUT

- Height of the Building, H = 34.9 m
- Seismic Zone = III
- Seismic Zone Factor, Z = 0.16
- Importance Factor, I = 1.2
- Response Reduction Factor, R = 3
- Percentage Damping = 5%
- Soil Type = III
- Avg. response acc. coefft. Sa/g = As per IS: 1893: 2016



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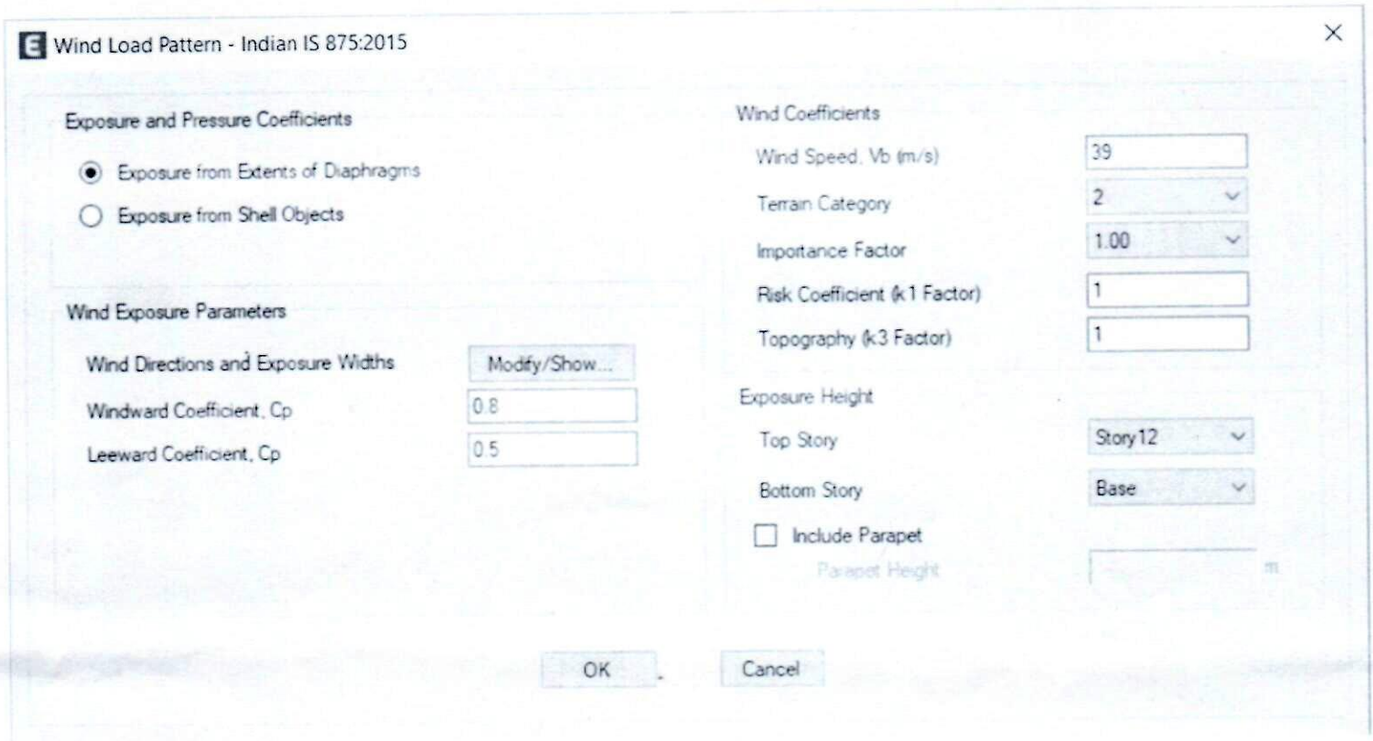
WIND LOAD INPUT

The building located in Coimbatore region and the wind parameters are considered as per IS 875 part: 3

- Wind Speed = 39 m/s
- Terrain Category = 2
- Importance factor = 1
- Risk Coefficient, K1 = 1
- Topography, K3 = 1
- Importance factor for Cyclonic Region, k4 = 1



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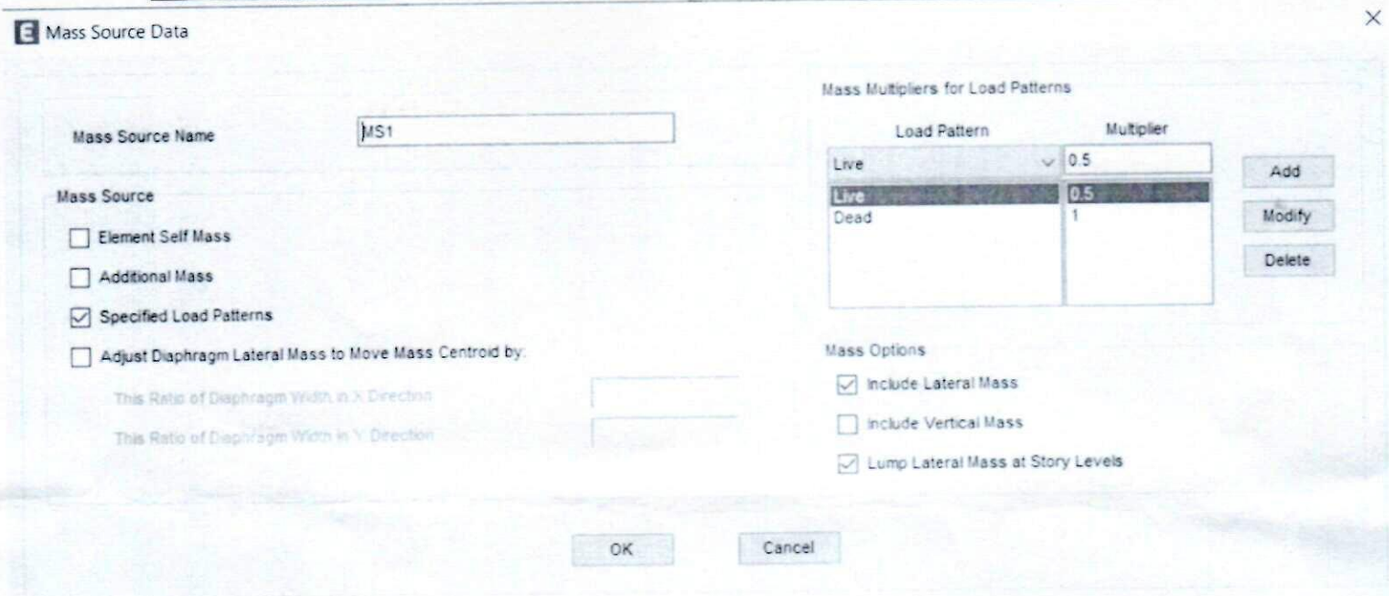
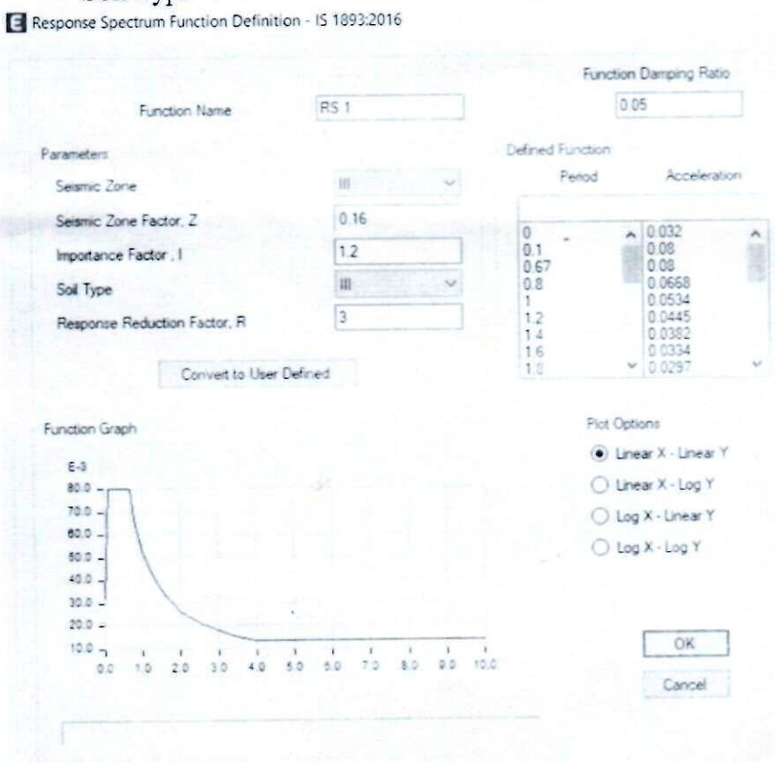
MASS SOURCE



DYNAMIC ANALYSIS

- Height of the Building, H = 34.9 m
- Seismic Zone = III
- Seismic Zone Factor, Z = 0.16
- Importance Factor, I = 1.2
- Response Reduction Factor, R = 3
- Percentage Damping = 5%
- Soil Type = III



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LOAD COMBINATIONS

Load combinations as per IS 1893:2016

1.5(DL+LL)
1.2(DL+LL+EQX)
1.2(DL+LL-EQX)
1.2(DL+LL+EQY)
1.2(DL+LL-EQY)
1.2(DL+LL+WLX)
1.2(DL+LL-WLX)
1.2(DL+LL+WLY)
1.2(DL+LL-WLY)
1.2(DL+LL+RSX)
1.2(DL+LL-RSX)
1.2(DL+LL+RSY)
1.2(DL+LL-RSY)
0.9DL+1.5EQX
0.9DL-1.5EQX
0.9DL+1.5EQY
0.9DL-1.5EQY
0.9DL+1.5WLX
0.9DL-1.5WLX
0.9DL+1.5WLY
0.9DL-1.5WLY
0.9DL+1.5RSX
0.9DL-1.5RSX
0.9DL+1.5RSY
0.9DL-1.5RSY
1.5(DL+EQX)
1.5(DL-EQX)
1.5(DL+EQY)
1.5(DL-EQY)
1.5(DL+WLX)
1.5(DL-WLX)
1.5(DL+WLY)
1.5(DL-WLY)
1.5(DL+RSX)
1.5(DL-RSX)
1.5(DL+RSY)
1.5(DL-RSY)

MAXIMUM DISPLACEMENT

ALLOWABLE MAXIMUM DISPLACEMENT = 139.6 mm for wind & 69.8mm for seismic

- EQ-X = 34 mm
- EQ-Y = 29.5 mm
- RS-X = 40.7 mm
- RS-Y = 34.4 mm

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MAXIMUM STOREY DRIFT

ALLOWABLE STOREY DRIFT = 0.004*H

- EQ-X = 0.0012
- EQ-Y = 0.0011
- RS-X = 0.0014
- RS-Y = 0.0010

STOREY SHEAR

- EQ-X = 4824 kN
- EQ-Y = 4801 Kn
- RS-X = 6275 kN
- RS-Y = 5999 kN

MODEL MASS PARTICIPATING RATIOS

Modal Participating Mass Ratios

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Modal Participating Mass Ratios

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX	RY	RZ	SumRX	SumRY	SumRZ
Modal	1	1.688	0.5154	0.1983	0	0.5154	0.1983	0	0.0753	0.184	0.0264	0.0753	0.184	0.0264
Modal	2	1.513	0.0307	0.2505	0	0.5462	0.4488	0	0.1029	0.0091	0.4476	0.1781	0.193	0.4741
Modal	3	1.026	0.1847	0.2657	0	0.7309	0.7145	0	0.1152	0.0833	0.2538	0.2933	0.2764	0.7279
Modal	4	0.481	0.091	0.0218	0	0.8219	0.7364	0	0.0665	0.2971	0.0102	0.3598	0.5734	0.7381
Modal	5	0.416	0.0002	0.062	0	0.8221	0.7984	0	0.1603	0.0013	0.0733	0.5201	0.5748	0.8115
Modal	6	0.269	0.044	0.0657	0	0.8661	0.8641	0	0.144	0.0956	0.0586	0.6642	0.6704	0.8701
Modal	7	0.234	0.0401	0.0068	0	0.9062	0.8709	0	0.013	0.075	0.006	0.6771	0.7454	0.8761
Modal	8	0.201	3.025E-05	0.0262	0	0.9063	0.8971	0	0.0505	4.693E-05	0.0282	0.7277	0.7454	0.9043
Modal	9	0.176	1.427E-05	8.497E-07	0	0.9063	0.8971	0	2.761E-06	1.465E-05	0.0001	0.7277	0.7455	0.9044
Modal	10	0.157	0.0003	0.0001	0	0.9066	0.8971	0	0.0001	0.0007	0.0014	0.7278	0.7461	0.9057
Modal	11	0.141	0.0196	0.0051	0	0.9261	-0.9022	0	0.0134	0.0561	0.0045	0.7412	0.8022	0.9102
Modal	12	0.135	0.0153	0.0195	0	0.9414	0.9217	0	0.0401	0.0331	0.0138	0.7812	0.8353	0.924

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Design of column with Biaxial Moment SHORT COLUMN

The values are Displayed in Blue color are the Input valu

Column No = C1, STAAD - 17

Design Forces From STAAD Load Case = 100

1. Axial Load on column	=	25300 KN			
2. Bending moment along x-x, Mux	=	861 KN.m	Load Case	=	1
3. Bending moment along y-y, Muy	=	600 KN.m	Load Case	=	1

Design Datas

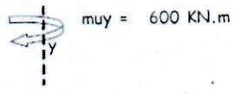
1. Compressive strength of Concrete, Fck	=	40 N/mm^2
2. Yield Strength of steel, Fy	=	500 N/mm^2
3.Diameter of Longitudinal Reinforcement,	=	32 mm
4.Diameter of lateral Reinforcement,	=	8 mm
5. Clear cover to the reinforcement, C	=	40 mm
6. Type of column	=	Rectangular
7. Size of Column	=	b x d
	=	900 x 900 mm
8. Unsupported Length of Column along x-x,L_x	=	3.2 m
9. Unsupported Length of Column along y-y,Ly	=	3.2 m
10. Effective length factor,	=	0.65
11. Effective Length of Column, along x-x, L_x	=	2.08 m
12. Effective Length of Column, along y-y, Ly	=	2.08 m

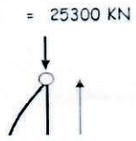
Check for leff/D

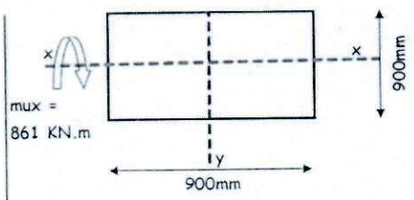
Effective length,lex/Lateral dimensions = L_{ex} / D
= 2.31
= 2.31< 12
= Short Column

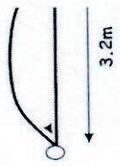
Effective length,ley/Lateral dimensions = L_{ex} / b
= 2.31
= 2.31< 12
= Short Column

Section Geometry









4 Check for Minimum Eccentricity

Applied eccentricties

ex = Mux/Pu
= 861/25300
= 34.032 mm

ey = Muy/Pu
= 600/25300
= 23.715 mm

Minimum eccenticity

e_{xx} = (lex/500)+(D/30)
= (2080/500) + (900/30)
= 34.16 mm or 20 mm
= 34.16 mm

e_{yy} = (ley/500)+(D/30)
= (2080/500) + (900/30)
= 34.16 mm or 20 mm
= 34.16 mm

5 Moment due to Eccentricity

m_{uex} = Pu x e_{xx}
= (25300x34.16)/1000
= 864.25 KN.m

m_{uey} = Pu x e_{yy}
= (25300x34.16)/1000
= 864.25 KN.m

6 Design Moment

mux = Mux or muex
= 864.25 KN.m

muy = Mux or muey
= 864.25 KN.m

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7 Calculation of Longitudinal reinforcement

Assume percentage of reinforcement = 4.7 %

Asc, required = 4.7/100x 900x900

= 38070 mm^2

No of bars = 48 Nos

Asc,,Provided = 38584 mm^2

pt, provided = 4.763 %

Moment Capacity Along x Direction

(Pu/fck b D) = (25300000/40 x 900 x 900)

= 0.78

p/fck = 4.763/40

= 0.12

d'/D = 40/900

= 0.04

From interaction chart, SP16 [chart 48]

$Mux1/fck\ b\ D^2$ = 0.1

Mux1 = 0.1 x 900x900x900x40

= 2916 KN.m

Moment Capacity Along y Direction

(Pu/fck b D) = (25300000/40 x 900 x 900)

= 0.78

p/fck = 4.763/40

= 0.1191

b'/D = 40/900

= 0.04

From interaction chart, SP16 [chart 50]

$Muy1/fck\ b\ D^2$ = 0.09

Muy1 = 0.09 x 900x900x900x40

= 2624.4 KN.m

8 Check for Moment Capcity

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an} < 1$

Puz = (0.45 fck.Ac) +(0.75 fy -0.45fck)Asc

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Ac	=	810000 mm^2	
Puz	=	28354.488 KN	For an v
Pu/Puz	=	0.892	
an	=	2	

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an}$ = 0.196

0.196 < 1

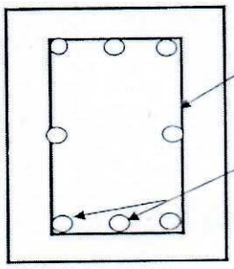
O.K

9 Calculation of Lateral Reinforcement

Spacing of ties

1. Least Lateral Dimensions of column	=	900 mm
2. Sixteen times the least dia of Longi bar	=	512 mm
3. 300mm	=	300 mm
Adopt Spacing	=	300 mm

10 Details



Y8@300mm c/c

No of bars = 32mm 48 Nos

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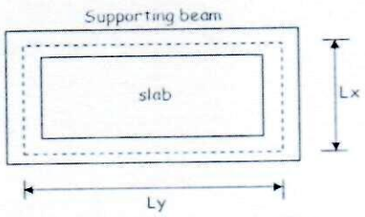
SLAB DETAILS

	Design of Two way Slab	The values are Displayed in Blue color are the Input values	References
1	Design Datas		
			
	1. Eff. Shorter span between c/c support, Lx	= 6.9 m	(Eff. Span,As per IS456:2000, clause 22.2 (b))
	2. Eff.Longer span between c/c support, Ly	= 7.1 m	
	3. Compressive strength of Concrete, Fck	= 25 N/mm^2	
	4. Yield Strength of steel, Fy	= 500 N/mm^2	
	5.Diameter of Reinforcement, (Shoter span)	= 12 mm	
	6.Diameter of Reinforcement, (Longer span)	= 12 mm	
	7. Fire resistance in hours	= 1.5 hrs	(Nominal cover, As per IS456:2000, Table 16A, clauses 21.4 and 26.4.3 and Fig 1
	8. Nominal cover to the reinforcement, C	= 20 mm	
2	Assume trial depth of slab		
	Span/depth, ratio l/d (Basic value)	= 26	(Span/depth ratio,As per IS:456:2000, Clause 23.2.1)
	Assume modification factor, M.F	= 1.5	
	depth of slab	= (Span/B.V x M.F)	
		= (6.9 x 1000) / (26 x 1.5)	
		= 176.92 mm	
	Overall depth required, D	= (d+cc+1/2 dia of bars)	
		= 176.92 + 20+ 12 /2	
		= 202.92 mm	
		= 230 mm	
	Eff. Depth,d	= 204 mm	
3	Load Calculations		
	Unit weight of Concrete	= 25 KN/m^3	
	Dead load of Slab	= 5.75 KN/m^2	
	Floor finishes	= 1.5 KN/m^2	
	Partitions	= 0 KN/m^2	
	Extra loads due to filling, surki , etc., if any	= 0 KN/m^2	
	Live Load	= 5 KN/m^2	
	Total Load	= 12.25 KN/m^2	
	Design Load	= 18.375 KN/m^2	
4	Calculation of Bending Moment		
	Edge condition of Slab	= 9 9.Four Edges discontmeous	Edge conditions,As per IS456:2000, D-1.1and 24.4.1
	Ly/Lx, ratio	= 7.1 / 6.9	
		= 1.029	
		= The slab is Two way Slab	

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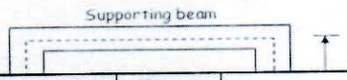
Design of Two way Slab	The values are Displayed in Blue color are the Input values	References

1 Design Datas



S.No	Direction & Sign	Moment Co-efficients	Moment KN.m	
1	X - Negative	0	0	(alpha x * wu *lx^2)
2	X - Positive	0.058	50.74	(alpha x * wu *lx^2)
3	Y- Negative	0	0	(alpha y * wu *lx^2)
4	Y- Positive	0.056	48.99	(alpha y * wu *lx^2)

(B.M co-eff fromm Annex D, clause D.1.1, IS:456:2000)

M,max = 50.74 KN/m

5 Effective depth required

Mu,lim = (0.36 x Fck x (xu,max/d) x (1- 0.42(xu,max/d)) x bd^2

xu,max/d = 0.46

Mu,lim = 3.34 bd^2

d,reqd = (Mu,lim/Qb)$^{1/2}$

= (50740000 / (3.34 x 1000))$^{1/2}$

= 123.25 mm

123.25 < 204

O.K

(IS:456:2000, Annex G, clause G.1.1.c)

6 Reinforcement Calculations

S. N	Dn & Sign	Mu/bd^2	pt from SP16	pt, min	pt,provided	Ast, mm^2
1	x -ve	0	0	0.12	0.12	244.8
2	x +ve	1.22	0.298	0.12	0.298	607.92
3	y -ve	0	0	0.12	0.12	244.8
4	y +ve	1.18	0.287	0.12	0.287	585.48

pt = 100Ast/bd

Ast = (pt/100)xbd

(Minimum reinforcement of slab shall be provide as per IS456:2000, clause 26.5.2.1)

7 Spacing of reinforcement

Spacing, mm		Spacing provided, mm	Ast provided, mm^2
Actual	Maximum		
461.76	300	150	753.6
185.95	300	150	753.6
461.76	300	150	753.6
193.07	300	150	753.6

Spacing = (ast x 1000)/Ast

where,
ast= C/s area of bar
Ast=Area of reinforcement provided

max distance of tension reinforcement bars 3d or 300mm which ever is less As per IS:456:2000, Clause 26.3.3.b

8 Check for deflection

close

close

lx/d, Actual = 33.82

l/d, Max = B.V x M.F

pt, = 100Ast/bd

= 0.3694

fs = 0.58x fyx(Ast required/Ast provided)

fs = 233.94 N/mm^2

Modification Factor = 1.41

l/d, Max = 1.41 X 26

= 36.66

36.66>33.82

O.K

From Fig 4, IS456:2000

For SREE SHARADHA AMBAL FOUNDATIONS

Partner

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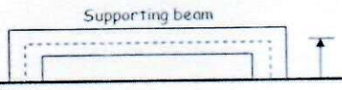


9	Torsional Reinforcement					As per IS456:2000, ANNEX D, clause D-1.8
			lx		ly	
	Size of torsinal reinforcement mesh (lx/5 and ly/5)	=	1380	x	1420 mm	
	Ast required to resist the torsion	=	3/4 times of mid-span Ast			
		=	455.94 mm^2			
	dia of torsional reinforcement	=	8 mm			
	Spacing required	=	110 mm			
	Spacing Provided	=	200 mm			
	No of layers	=	4 Nos (Each 2 top and bottom)			

NOTE:

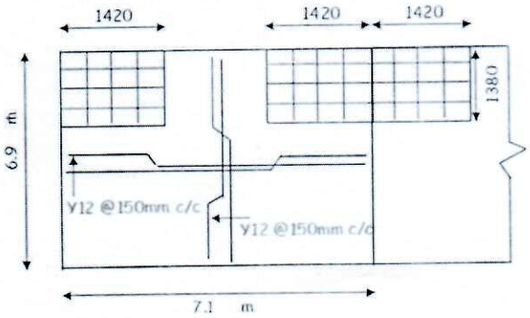
1. Torsion reinforcement shall be provided at any corner where the slab is simply supprted on both edges meeting at that corner

2. Torsion reinforcement equal to half that described above shall be provided a at corner contained by edges over only one of which the slab is continuous

3. Torsion reinforcements need not be provided at any corner contained by edges over both of which the slab is continuous

9 Reinforcement Details

Direction	Reinforcement
X	Y12 @150mm c/c
Y	Y12 @150mm c/c



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