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16.11.2023

STABILITY CERTIFICATE

For the proposed construction of residential apartments of stilt + five floors @ S.No: 365/5B, 366/1, Modern Layout Second Main Road, Padur, Thiruporur Taluk, Chengalpet District, Chennai – 603 103, the structural design is done. I am enclosing the analysis and design calculations for critical members for reference.

The modeling and analysis is done using ETAB software and the designing part by manual calculations. The member loads are taken as per IS 875 and IS 1893 – 2016 and the designing is done based on IS 456 and SP-16.

Based on the analysis and design I certify that the structural design is **SAFE and SOUND** if the recommendations are followed during construction.

N. KANAGAVEL M.E, M.B.A., M.I.E., FIV
Registered Structural Engineer Grade-I,
DTCP Reg.No.CGLDIST/SE/Gr-I/2023/10/006
CA-12, Tarangini Compex, Ambattur Industrial Estate,
Mogappair West, Chennai - 58.

For NEST ZONE INDIA (P) LTD.

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Design Specifications:

The proposed structure are to be designed for stilt + five floors and to be of framed structure to resist the seismic effect of zone III as per IS 1893 – 2016. The usage of the building is for residential purpose.

Soil Investigation:

As per Nagadi Consultants (P) Ltd., geo technical report G(C) 9853 dated 22.08.2023, the foundation recommendations are:

(i) type of foundation	=	Isolated / combined
(ii) Depth of foundation	=	2.00 m
(ii) SBC @ 2.00 m depth	=	300kn/m^2

Floor Heights Considered:

Foundation depth	=	2.00m
Car parking level	=	0.60m
Stilt and typical floors height	=	3.05m

Analysis and Design:

Analysis part is done using ETAB software and the designing part by manual calculations in accordance with IS 456 – 2000, IS 1893 - 2016 and SP – 16.

Materials:

The following recommendations of materials are to be used

(i) Grade of concrete : M30 grade for all RCC members

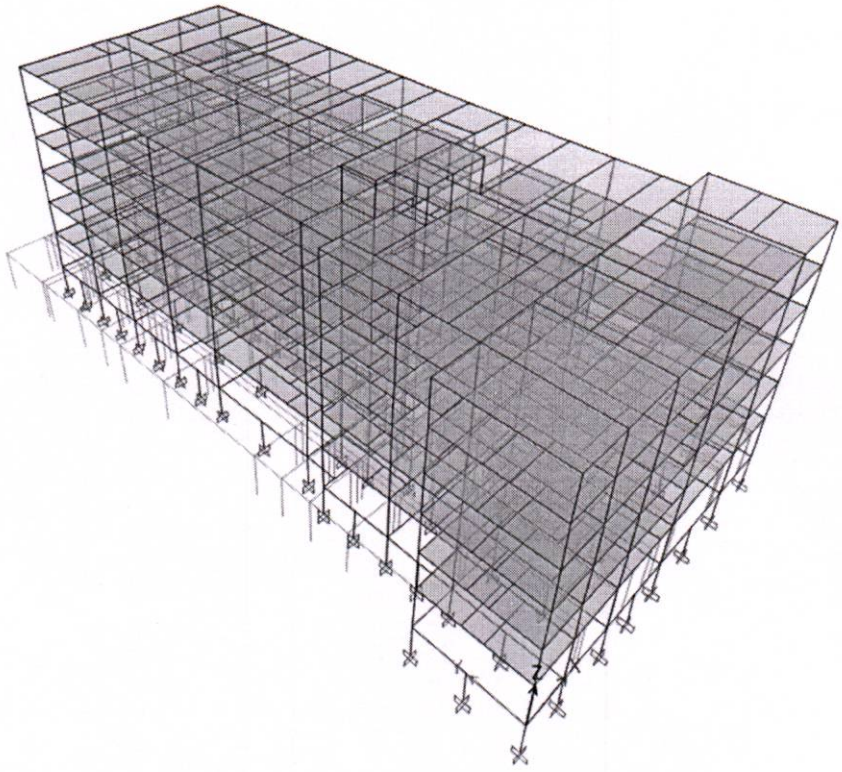
(ii) Grade of steel : Fe 550 for all diameter

(iii) Potable quality of water to be used for all construction activities including curing.

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ETABS®



User Report

Model File: A - stilt+5 floors, Revision 0
16-Nov-23

For NEST ZONE INDIA (P) LTD.

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1 Properties

This chapter provides property information for materials, frame sections, shell sections, and links.

1.1 Materials

Table 1.1 - Material Properties - General

Material	Type	SymType	Grade	Color	Notes
4000Psi	Concrete	Isotropic	f'c 4000 psi	Gray8Dark	
A416Gr270	Tendon	Uniaxial	Grade 270	Green	
A992Fy50	Steel	Isotropic	Grade 50	Yellow	
HYSD500	Rebar	Uniaxial	HYSD Grade 500	Red	
HYSD550	Rebar	Uniaxial	HYSD Grade 550	Cyan	
M30	Concrete	Isotropic	M30	Cyan	

1.2 Frame Sections

Table 1.2 - Frame Section Property Definitions - Summary (Part 1 of 3)

Name	Material	Shape	Color	Area m2	J m4	I33 m4	I22 m4	As2 m2	As3 m2	S33Pos m3	S33Neg m3	S22Pos m3
B230x125	M30	Concrete Rectangular	Cyan	0.0288	9.9E-05	3.7E-05	0.000127	0.024	0.024	0.000599	0.000599	0.001102
B230x380	M30	Concrete Rectangular	Red	0.0874	0.00096	0.001052	0.000385	0.0728	0.0728	0.005535	0.005535	0.00335
B230x450	M30	Concrete Rectangular	Magenta	0.1035	0.001241	0.001747	0.000456	0.0862	0.0862	0.007763	0.007763	0.003968
B230x525	M30	Concrete Rectangular	16744448	0.1208	0.001543	0.002773	0.000532	0.1006	0.1006	0.010566	0.010566	0.004629
B230x600	M30	Concrete Rectangular	Green	0.138	0.001847	0.00414	0.000608	0.115	0.115	0.0138	0.0138	0.00529
B230x675	M30	Concrete Rectangular	Blue	0.1553	0.002151	0.005895	0.000684	0.1294	0.1294	0.017466	0.017466	0.005951
B230x750	M30	Concrete Rectangular	Red	0.1725	0.002455	0.008086	0.00076	0.1437	0.1437	0.021563	0.021563	0.006613
C230x300	M30	Concrete Rectangular	Gray8Dark	0.069	0.000646	0.000518	0.000304	0.0575	0.0575	0.00345	0.00345	0.002645
C230x450	M30	Concrete Rectangular	Magenta	0.1035	0.001241	0.001747	0.000456	0.0862	0.0862	0.007763	0.007763	0.003968
C230x525	M30	Concrete Rectangular	Yellow	0.1208	0.001543	0.002773	0.000532	0.1006	0.1006	0.010566	0.010566	0.004629
C300x525	M30	Concrete Rectangular	16744448	0.1575	0.003039	0.003618	0.001181	0.1312	0.1312	0.013781	0.013781	0.007875
C300x600	M30	Concrete Rectangular	Blue	0.18	0.003708	0.0054	0.00135	0.15	0.15	0.018	0.018	0.009
C300x750	M30	Concrete Rectangular	Green	0.225	0.005053	0.010547	0.001688	0.1875	0.1875	0.028125	0.028125	0.01125
C380x750	M30	Concrete Rectangular	Red	0.285	0.009363	0.013359	0.00343	0.2375	0.2375	0.035625	0.035625	0.01805
ConcBm	M30	Concrete Rectangular	Cyan	0.1875	0.004746	0.003906	0.002197	0.1562	0.1562	0.015625	0.015625	0.011719
ConcCol	M30	Concrete Rectangular	Green	0.1406	0.002785	0.001648	0.001648	0.1172	0.1172	0.008789	0.008789	0.008789
D230x230	M30	Concrete Rectangular	Red	0.0529	0.000394	0.000233	0.000233	0.0441	0.0441	0.002028	0.002028	0.002028
SteelBm	A992Fy50	Steel I/Wide Flange	Blue	0.0071	2.567E-07	0.000303	1E-05	0.0031	0.0037	0.001214	0.001214	0.000116
SteelCol	A992Fy50	Steel I/Wide Flange	Gray8Dark	0.0306	6E-06	0.001506	0.000521	0.0063	0.0223	0.006026	0.006026	0.002084

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Table 1.2 - Frame Section Property Definitions - Summary (Part 2 of 3)

S22Neg m3	Z33 m3	Z22 m3	R33 m	R22 m	Cw m6	CG Offset 3 m	CG Offset 2 m	PNA Offset 3 m	PNA Offset 2 m	Area Modifier	As2 Modifier	As3 Modifier
0.001102	0.000898	0.001653	0.03608	0.0664		0	0	0	0	1	1	1
0.00335	0.008303	0.005026	0.1097	0.0664		0	0	0	0	1	1	1
0.003968	0.011644	0.005951	0.1299	0.0664		0	0	0	0	1	1	1
0.004629	0.015848	0.006943	0.15155	0.0664		0	0	0	0	1	1	1
0.00529	0.0207	0.007935	0.17321	0.0664		0	0	0	0	1	1	1
0.005951	0.026198	0.008927	0.19486	0.0664		0	0	0	0	1	1	1
0.006613	0.032344	0.009919	0.21651	0.0664		0	0	0	0	1	1	1
0.002645	0.005175	0.003968	0.0866	0.0664		0	0	0	0	1	1	1
0.003968	0.011644	0.005951	0.1299	0.0664		0	0	0	0	1	1	1
0.004629	0.015848	0.006943	0.15155	0.0664		0	0	0	0	1	1	1
0.007875	0.020672	0.011813	0.15155	0.0866		0	0	0	0	1	1	1
0.009	0.027	0.0135	0.17321	0.0866		0	0	0	0	1	1	1
0.01125	0.042188	0.016875	0.21651	0.0866		0	0	0	0	1	1	1
0.01805	0.053438	0.027075	0.21651	0.1097		0	0	0	0	1	1	1
0.011719	0.023438	0.017578	0.14434	0.10825		0	0	0	0	1	1	1
0.008789	0.013184	0.013184	0.10825	0.10825		0	0	0	0	1	1	1
0.002028	0.003042	0.003042	0.0664	0.0664		0	0	0	0	1	1	1
0.000116	0.001368	0.000178	0.20622	0.03678	0	0	0	0	0	1	1	1
0.002084	0.00657	0.003143	0.22178	0.13042	2.938E-05	0	0	0	0	1	1	1

Table 1.2 - Frame Section Property Definitions - Summary (Part 3 of 3)

J Modifier	I33 Modifier	I22 Modifier	Mass Modifier	Weight Modifier
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1

1.3 Shell Sections

Table 1.3 - Area Section Property Definitions - Summary

Name	Type	Element Type	Material	Total Thickness m	Deck Material	Deck Depth m
Deck1	Deck	Membrane	4000Psi	0.1625	A992Fy50	0.075
Slab1	Slab	Shell-Thin	M30	0.125		
Wall1	Wall	Shell-Thin	M30	0.23		
Wall2	Wall	Shell-Thin	M30	0.23		
Wall3	Wall	Shell-Thin	M30	0.23		

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2 Loads

This chapter provides loading information as applied to the model.

2.1 Load Patterns

Table 2.1 - Load Pattern Definitions

Name	Is Auto Load	Type	Self Weight Multiplier	Auto Load
~LLRF	Yes	Other	0	
Dead	No	Dead	1	
Floor finish	No	Super Dead	0	
Live	No	Reducible Live	0	
sesmic - X	No	Seismic	0	IS 1893:2016
sesmic - Y	No	Seismic	0	IS 1893:2016
sunken filling	No	Super Dead	0	
wall load	No	Super Dead	0	

2.2 Auto Seismic Loading

IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern sesmic - X according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = X

Structural Period

Period Calculation Method = User Specified

User Period — $T = 0.33$ sec

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3] — $Z = 0.16$

$R = 5$

$I = 1.2$

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2] — $\frac{S_a}{g} = 2.5$

Equivalent Lateral Forces

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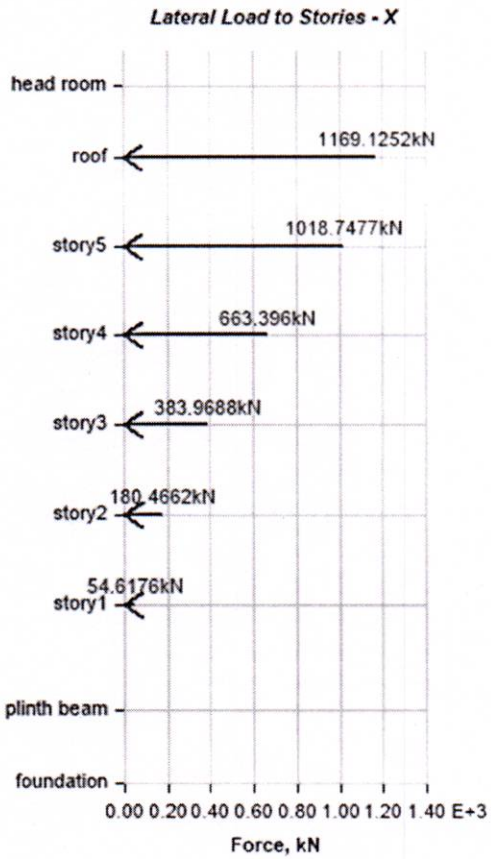
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Seismic Coefficient, A_h [IS 6.4.2] $$A_h = \frac{ZI\frac{S_a}{g}}{2R}$$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
X	0.33	72298.3636	3470.3215

Applied Story Forces



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Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
head room	21.35	0	0
roof	18.85	1169.1252	0
story5	15.8	1018.7477	0
story4	12.75	663.396	0
story3	9.7	383.9688	0
story2	6.65	180.4662	0
story1	3.6	54.6176	0
plinth beam	0	0	0
foundation	-2.5	0	0

IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern sesmic - Y according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = Y

Structural Period

Period Calculation Method = User Specified

User Period $T = 0.233$ sec

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3] $Z = 0.16$

$R = 5$

$I = 1.2$

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

Equivalent Lateral Forces

Seismic Coefficient, A_h [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

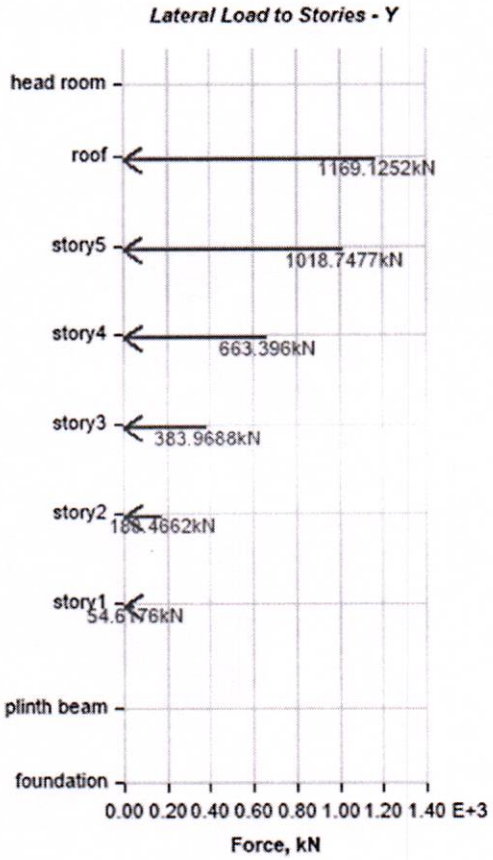
Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
Y	0.233	72298.3636	3470.3215

For NEST ZONE INDIA (P) LTD.

Managing Director

Applied Story Forces



Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
head room	21.35	0	0
roof	18.85	0	1169.1252
story5	15.8	0	1018.7477
story4	12.75	0	663.396
story3	9.7	0	383.9688
story2	6.65	0	180.4662
story1	3.6	0	54.6176
plinth beam	0	0	0
foundation	-2.5	0	0

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2.3 Functions

2.3.1 Response Spectrum Functions

Table 2.4 - Functions - Response Spectrum - User Defined

Name	Period sec	Value	Damping Ratio
RS	0	0.0192	0.05
RS	0.1	0.048	
RS	0.55	0.048	
RS	0.8	0.0326	
RS	1	0.0261	
RS	1.2	0.0218	
RS	1.4	0.0187	
RS	1.6	0.0163	
RS	1.8	0.0145	
RS	2	0.0131	
RS	2.5	0.0104	
RS	3	0.008704	
RS	3.5	0.007461	
RS	4	0.006528	
RS	4.5	0.006528	
RS	5	0.006528	
RS	5.5	0.006528	
RS	6	0.006528	
RS	6.5	0.006528	
RS	7	0.006528	
RS	7.5	0.006528	
RS	8	0.006528	
RS	8.5	0.006528	
RS	9	0.006528	
RS	9.5	0.006528	
RS	10	0.006528	

2.4 Load Combinations

Table 2.6 - Load Combination Definitions

Name	Type	Is Auto	Load Name	SF	Notes
0.9DL-1.5RSX	Linear Add	No	Dead	0.9	
0.9DL-1.5RSX			Floor finish	0.9	
0.9DL-1.5RSX			sunken filling	0.9	
0.9DL-1.5RSX			wall load	0.9	
0.9DL-1.5RSX			RSX	-1.5	
0.9DL-1.5RSY	Linear Add	No	Dead	0.9	
0.9DL-1.5RSY			Floor finish	0.9	
0.9DL-1.5RSY			sunken filling	0.9	
0.9DL-1.5RSY			wall load	0.9	
0.9DL-1.5RSY			RXY	-1.5	
0.9DL+1.5RSX	Linear Add	No	Dead	0.9	
0.9DL+1.5RSX			Floor finish	0.9	
0.9DL+1.5RSX			sunken filling	0.9	
0.9DL+1.5RSX			wall load	0.9	
0.9DL+1.5RSX			RSX	1.5	

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Name	Type	Is Auto	Load Name	SF	Notes
0.9DL+1.5RSY	Linear Add	No	Dead	0.9	
0.9DL+1.5RSY			Floor finish	0.9	
0.9DL+1.5RSY			sunken filling	0.9	
0.9DL+1.5RSY			wall load	0.9	
0.9DL+1.5RSY			RXY	1.5	
1.2(DL+LL+EQX)	Linear Add	No	Dead	1.2	
1.2(DL+LL+EQX)			Live	1.2	
1.2(DL+LL+EQX)			Floor finish	1.2	
1.2(DL+LL+EQX)			sunken filling	1.2	
1.2(DL+LL+EQX)			wall load	1.2	
1.2(DL+LL+EQX)			sesmic - X	1.2	
1.2(DL+LL+EQY)	Linear Add	No	Dead	1.2	
1.2(DL+LL+EQY)			Live	1.2	
1.2(DL+LL+EQY)			Floor finish	1.2	
1.2(DL+LL+EQY)			sunken filling	1.2	
1.2(DL+LL+EQY)			wall load	1.2	
1.2(DL+LL+EQY)			sesmic - Y	1.2	
1.2(DL+LL+RSX)	Linear Add	No	Dead	1.2	
1.2(DL+LL+RSX)			Live	1.2	
1.2(DL+LL+RSX)			Floor finish	1.2	
1.2(DL+LL+RSX)			sunken filling	1.2	
1.2(DL+LL+RSX)			wall load	1.2	
1.2(DL+LL+RSX)			RSX	1.2	
1.2(DL+LL+RSY)	Linear Add	No	Dead	1.2	
1.2(DL+LL+RSY)			Live	1.2	
1.2(DL+LL+RSY)			Floor finish	1.2	
1.2(DL+LL+RSY)			sunken filling	1.2	
1.2(DL+LL+RSY)			wall load	1.2	
1.2(DL+LL+RSY)			RXY	1.2	
1.2(DL+LL-EQX)	Linear Add	No	Dead	1.2	
1.2(DL+LL-EQX)			Live	1.2	
1.2(DL+LL-EQX)			Floor finish	1.2	

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Name	Type	Is Auto	Load Name	SF	Notes
1.2(DL+LL-EQX)			sunken filling	1.2	
1.2(DL+LL-EQX)			wall load	1.2	
1.2(DL+LL-EQX)			sesmic - X	-1.2	
1.2(DL+LL-EQY)	Linear Add	No	Dead	1.2	
1.2(DL+LL-EQY)			Live	1.2	
1.2(DL+LL-EQY)			Floor finish	1.2	
1.2(DL+LL-EQY)			sunken filling	1.2	
1.2(DL+LL-EQY)			wall load	1.2	
1.2(DL+LL-EQY)			sesmic - Y	-1.2	
1.2(DL+LL-RSX)	Linear Add	No	Dead	1.2	
1.2(DL+LL-RSX)			Live	1.2	
1.2(DL+LL-RSX)			Floor finish	1.2	
1.2(DL+LL-RSX)			sunken filling	1.2	
1.2(DL+LL-RSX)			wall load	1.2	
1.2(DL+LL-RSX)			RSX	-1.2	
1.2(DL+LL-RSY)	Linear Add	No	Dead	1.2	
1.2(DL+LL-RSY)			Live	1.2	
1.2(DL+LL-RSY)			Floor finish	1.2	
1.2(DL+LL-RSY)			sunken filling	1.2	
1.2(DL+LL-RSY)			wall load	1.2	
1.2(DL+LL-RSY)			RXY	-1.2	
1.5(DL+EQX)	Linear Add	No	Dead	1.5	
1.5(DL+EQX)			Floor finish	1.5	
1.5(DL+EQX)			sunken filling	1.5	
1.5(DL+EQX)			wall load	1.5	
1.5(DL+EQX)			sesmic - X	1.5	
1.5(DL+EQY)	Linear Add	No	Dead	1.5	
1.5(DL+EQY)			Floor finish	1.5	
1.5(DL+EQY)			sunken filling	1.5	
1.5(DL+EQY)			wall load	1.5	
1.5(DL+EQY)			sesmic - Y	1.5	
1.5(DL+LL)	Linear Add	No	Dead	1.5	
1.5(DL+LL)			Live	1.5	
1.5(DL+LL)			Floor finish	1.5	
1.5(DL+LL)			sunken filling	1.5	
1.5(DL+LL)			wall load	1.5	
1.5(DL+RSX)	Linear Add	No	Dead	1.5	
1.5(DL+RSX)			Floor finish	1.5	
1.5(DL+RSX)			sunken filling	1.5	
1.5(DL+RSX)			wall load	1.5	

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Name	Type	Is Auto	Load Name	SF	Notes
1.5(DL+RSX)			RSX	1.5	
1.5(DL+RSY)	Linear Add	No	Dead	1.5	
1.5(DL+RSY)			Floor finish	1.5	
1.5(DL+RSY)			sunken filling	1.5	
1.5(DL+RSY)			wall load	1.5	
1.5(DL+RSY)			RXY	1.5	
1.5(DL-EQX)	Linear Add	No	Dead	1.5	
1.5(DL-EQX)			Floor finish	1.5	
1.5(DL-EQX)			sunken filling	1.5	
1.5(DL-EQX)			wall load	1.5	
1.5(DL-EQX)			sesmic - X	-1.5	
1.5(DL-EQY)	Linear Add	No	Dead	1.5	
1.5(DL-EQY)			Floor finish	1.5	
1.5(DL-EQY)			sunken filling	1.5	
1.5(DL-EQY)			wall load	1.5	
1.5(DL-EQY)			sesmic - Y	-1.5	
1.5(DL-RSX)	Linear Add	No	Dead	1.5	
1.5(DL-RSX)			Floor finish	1.5	
1.5(DL-RSX)			sunken filling	1.5	
1.5(DL-RSX)			wall load	1.5	
1.5(DL-RSX)			RSX	-1.5	
1.5(DL-RSY)	Linear Add	No	Dead	1.5	
1.5(DL-RSY)			Floor finish	1.5	
1.5(DL-RSY)			sunken filling	1.5	
1.5(DL-RSY)			wall load	1.5	
1.5(DL-RSY)			RXY	-1.5	
09DL-1.5EQX	Linear Add	No	Dead	0.9	
09DL-1.5EQX			Floor finish	0.9	
09DL-1.5EQX			sunken filling	0.9	
09DL-1.5EQX			wall load	0.9	
09DL-1.5EQX			sesmic - X	-1.5	
09DL-1.5EQY	Linear Add	No	Dead	0.9	
09DL-1.5EQY			Floor finish	0.9	
09DL-1.5EQY			sunken filling	0.9	
09DL-1.5EQY			wall load	0.9	
09DL-1.5EQY			sesmic - Y	-1.5	
09DL+1.5EQX	Linear Add	No	Dead	0.9	
09DL+1.5EQX			Floor finish	0.9	
09DL+1.5EQX			sunken filling	0.9	
09DL+1.5EQX			wall load	0.9	
09DL+1.5EQX			sesmic - X	1.5	
09DL+1.5EQY	Linear Add	No	Dead	0.9	
09DL+1.5EQY			Floor finish	0.9	
09DL+1.5EQY			sunken filling	0.9	
09DL+1.5EQY			wall load	0.9	
09DL+1.5EQY			sesmic - Y	1.5	
(DL+LL)	Linear Add	No	Dead	1	
(DL+LL)			Live	1	
(DL+LL)			Floor finish	1	
(DL+LL)			sunken filling	1	
(DL+LL)			wall load	1	
DL+0.8LL-0.8EQX	Linear Add	No	Dead	1	
DL+0.8LL-0.8EQX			Floor finish	1	
DL+0.8LL-			sunken filling	1	

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Name	Type	Is Auto	Load Name	SF	Notes
0.8EQX					
DL+0.8LL-0.8EQX			wall load	1	
DL+0.8LL-0.8EQX			Live	0.8	
DL+0.8LL-0.8EQX			sesmic - X	-0.8	
DL+0.8LL-0.8EQY	Linear Add	No	Dead	1	
DL+0.8LL-0.8EQY			Floor finish	1	
DL+0.8LL-0.8EQY			sunken filling	1	
DL+0.8LL-0.8EQY			wall load	1	
DL+0.8LL-0.8EQY			Live	0.8	
DL+0.8LL-0.8EQY			sesmic - Y	-0.8	
DL+0.8LL-0.8RSX	Linear Add	No	Dead	1	
DL+0.8LL-0.8RSX			Floor finish	1	
DL+0.8LL-0.8RSX			sunken filling	1	
DL+0.8LL-0.8RSX			wall load	1	
DL+0.8LL-0.8RSX			Live	0.8	
DL+0.8LL-0.8RSX			RSX	-0.8	
DL+0.8LL-0.8RSY	Linear Add	No	Dead	1	
DL+0.8LL-0.8RSY			Floor finish	1	
DL+0.8LL-0.8RSY			sunken filling	1	
DL+0.8LL-0.8RSY			wall load	1	
DL+0.8LL-0.8RSY			Live	0.8	
DL+0.8LL-0.8RSY			RXY	-0.8	
DL+0.8LL+0.8EQX	Linear Add	No	Dead	1	
DL+0.8LL+0.8EQX			Floor finish	1	
DL+0.8LL+0.8EQX			sunken filling	1	
DL+0.8LL+0.8EQX			wall load	1	
DL+0.8LL+0.8EQX			Live	0.8	
DL+0.8LL+0.8EQX			sesmic - X	0.8	
DL+0.8LL+0.8EQY	Linear Add	No	Dead	1	
DL+0.8LL+0.8EQY			Floor finish	1	
DL+0.8LL+0.8EQY			sunken filling	1	
DL+0.8LL+0.8EQY			wall load	1	
DL+0.8LL+0.8			Live	0.8	

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Name	Type	Is Auto	Load Name	SF	Notes
EQY					
DL+0.8LL+0.8 EQY			sesmic - Y	0.8	
DL+0.8LL+0.8 RSX	Linear Add	No	Dead	1	
DL+0.8LL+0.8 RSX			Floor finish	1	
DL+0.8LL+0.8 RSX			sunken filling	1	
DL+0.8LL+0.8 RSX			wall load	1	
DL+0.8LL+0.8 RSX			Live	0.8	
DL+0.8LL+0.8 RSX			sesmic - Y	0.8	
DL+0.8LL+0.8 RSY	Linear Add	No	Dead	1	
DL+0.8LL+0.8 RSY			Floor finish	1	
DL+0.8LL+0.8 RSY			sunken filling	1	
DL+0.8LL+0.8 RSY			wall load	1	
DL+0.8LL+0.8 RSY			Live	0.8	
DL+0.8LL+0.8 RSY			RXY	0.8	
DL+EQX	Linear Add	No	Dead	1	
DL+EQX			Floor finish	1	
DL+EQX			sunken filling	1	
DL+EQX			wall load	1	
DL+EQX			sesmic - X	1	
DL+EQY	Linear Add	No	Dead	1	
DL+EQY			Floor finish	1	
DL+EQY			sunken filling	1	
DL+EQY			wall load	1	
DL+EQY			sesmic - Y	1	
DL+RSX	Linear Add	No	Dead	1	
DL+RSX			Floor finish	1	
DL+RSX			sunken filling	1	
DL+RSX			wall load	1	
DL+RSX			RSX	1	
DL+RSY	Linear Add	No	Dead	1	
DL+RSY			Floor finish	1	
DL+RSY			sunken filling	1	
DL+RSY			wall load	1	
DL+RSY			RXY	1	
DL-EQX	Linear Add	No	Dead	1	
DL-EQX			Floor finish	1	
DL-EQX			sunken filling	1	
DL-EQX			wall load	1	
DL-EQX			sesmic - X	-1	
DL-EQY	Linear Add	No	Dead	1	
DL-EQY			Floor finish	1	
DL-EQY			sunken filling	1	
DL-EQY			wall load	1	
DL-EQY			sesmic - Y	-1	
DL-RSX	Linear Add	No	Dead	1	
DL-RSX			Floor finish	1	

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Name	Type	Is Auto	Load Name	SF	Notes
DL-RSX			sunken filling	1	
DL-RSX			wall load	1	
DL-RSX			RSX	-1	
DL-RSY	Linear Add	No	Dead	1	
DL-RSY			Floor finish	1	
DL-RSY			sunken filling	1	
DL-RSY			wall load	1	
DL-RSY			RXY	-1	
seismic weight	Linear Add	No	Dead	1	
seismic weight			Live	0.25	
seismic weight			Floor finish	1	
seismic weight			sunken filling	1	
seismic weight			wall load	1	
ultimate envelope	Envelope	No	1.2(DL+LL+EQX)	1	
ultimate envelope			1.2(DL+LL-EQX)	1	
ultimate envelope			1.2(DL+LL+RSX)	1	
ultimate envelope			1.2(DL+LL-RSX)	1	
ultimate envelope			1.2(DL+LL+EQY)	1	
ultimate envelope			1.2(DL+LL-EQY)	1	
ultimate envelope			1.2(DL+LL+RSY)	1	
ultimate envelope			1.2(DL+LL-RSY)	1	
ultimate envelope			1.5(DL+EQX)	1	
ultimate envelope			1.5(DL+EQY)	1	
ultimate envelope			1.5(DL+RSX)	1	
ultimate envelope			1.5(DL+RSY)	1	
ultimate envelope			1.5(DL-EQX)	1	
ultimate envelope			1.5(DL-EQY)	1	
ultimate envelope			1.5(DL-RSX)	1	
ultimate envelope			1.5(DL-RSY)	1	
ultimate envelope			1.5(DL+LL)	1	
ultimate envelope			09DL+1.5EQX	1	
ultimate envelope			09DL-1.5EQX	1	
ultimate envelope			0.9DL+1.5RSX	1	
ultimate envelope			0.9DL-1.5RSX	1	
ultimate envelope			09DL+1.5EQY	1	
ultimate			09DL-1.5EQY	1	

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Name	Type	Is Auto	Load Name	SF	Notes
envelope					
ultimate envelope			0.9DL+1.5RSY	1	
ultimate envelope			0.9DL-1.5RSY	1	

3 Analysis Results

This chapter provides analysis results.

3.1 Modal Results

Table 3.1 - Modal Periods And Frequencies

Case	Mode	Period sec	Frequency cyc/sec	CircFreq rad/sec	Eigenvalue rad2/sec2
Modal	1	1.728	0.579	3.6354	13.2158
Modal	2	1.415	0.707	4.4411	19.7237
Modal	3	1.28	0.781	4.909	24.0982
Modal	4	0.536	1.865	11.717	137.2887
Modal	5	0.427	2.34	14.7014	216.1315
Modal	6	0.391	2.558	16.0702	258.2505
Modal	7	0.294	3.4	21.3599	456.2458
Modal	8	0.22	4.54	28.5281	813.8497
Modal	9	0.212	4.71	29.5959	875.9199
Modal	10	0.202	4.942	31.0504	964.1303
Modal	11	0.183	5.461	34.3131	1177.3922
Modal	12	0.179	5.582	35.0709	1229.9689

Table 3.2 - Modal Participating Mass Ratios (Part 1 of 2)

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX	RY	RZ	SumRX
Modal	1	1.728	0.0001	0.8977	0	0.0001	0.8977	0	0.0995	8.446E-06	0.0032	0.0995
Modal	2	1.415	0.641	0.0016	0	0.6412	0.8993	0	0.0002	0.085	0.238	0.0997
Modal	3	1.28	0.2381	0.0019	0	0.8793	0.9012	0	0.0003	0.0394	0.6426	0.1
Modal	4	0.536	2.237E-06	0.061	0	0.8793	0.9622	0	0.7451	4.377E-05	0.0002	0.8451
Modal	5	0.427	0.0577	0.0001	0	0.937	0.9623	0	0.0008	0.5241	0.0177	0.8459
Modal	6	0.391	0.0195	0.0001	0	0.9565	0.9624	0	0.0012	0.1821	0.0551	0.847
Modal	7	0.294	2.396E-06	0.0125	0	0.9565	0.9749	0	0.0264	8.141E-06	6.813E-06	0.8735
Modal	8	0.22	0.0136	6.808E-07	0	0.9701	0.9749	0	2.705E-05	0.0337	0.0041	0.8735
Modal	9	0.212	0.0012	0.0016	0	0.9713	0.9764	0	0.0129	0.0029	0.0026	0.8865
Modal	10	0.202	0.0026	0.0009	0	0.9739	0.9773	0	0.0068	0.0063	0.0095	0.8932
Modal	11	0.183	0.0001	6.999E-07	0	0.974	0.9773	0	2.729E-06	0.0006	0	0.8932
Modal	12	0.179	0.0004	1.374E-05	0	0.9744	0.9773	0	0.0001	0.0017	0	0.8933

Table 3.2 - Modal Participating Mass Ratios (Part 2 of 2)

SumRY	SumRZ
8.446E-06	0.0032
0.085	0.2412
0.1244	0.8838
0.1245	0.884
0.6485	0.9018
0.8306	0.9569
0.8307	0.9569
0.8643	0.9609

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SumRY	SumRZ
0.8672	0.9635
0.8735	0.973
0.8741	0.973
0.8758	0.973

Table 3.3 - Modal Load Participation Ratios

Case	ItemType	Item	Static %	Dynamic %
Modal	Acceleration	UX	99.99	97.44
Modal	Acceleration	UY	99.99	97.73
Modal	Acceleration	UZ	0	0

DESIGN OF ISOLATED SQUARE FOOTING: C18

Load in kn (P)	2440	Size of pedestal	450
SBC in kn/m^2	300	Free end thickness	230
Size of the footing required (B)	2.8519	Size provided	2.9
Net upward pressure (Po)	290.131	Size in feet	9.512
Maximum bending moment @ face of the column (Mu)	946.946		
Depth required (d)	726.223	Depth provided (d)	900
K	2.59793		
Pt	0.8767		
Ast in mm^2	3550.64		
Spacing of 10mm dia	64.148		
Spacing of 12mm dia	92.375		
Spacing of 16mm dia	164.217		

Check for one way shear:

Shear force (V)	410.172
Eff. Depth (d')	407.755
Top width	2250
Tv	0.44708
Pt	0.4333
Ast in mm^2	3975.31
Spacing of 10mm dia	57.2952
Spacing of 12mm dia	82.5068
Spacing of 16mm dia	146.674

Check for two way shear:

Punching shear (F)	1911.24
Eff. Depth (d')	653.878
Tv	0.81192
Tc	0.96825

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Check for transfer of load @ the column base:

Permissible bearing stress	13.5
Actual bearing stress	12.0494

Design of short column with bi axial bending:C18

Description	FF
Axial load in Kn	2600
Moment in Knm (Mux)	78
Moment in Knm (Muy)	300
Assumed length of column in mm (D)	750
Assumed breadth of column in mm (B)	300
Assumed % of steel	3.77
Grade of concrete	30
p/fck	0.1256
d'/D	0.0666
d'/B	0.1666
Pu/(fck*B*D)	0.5777
Referring to chart in SP-16	chart-36
Value from chart	0.16
Mux1 in Knm	810
Referring to chart in SP-16	chart-38
Value from chart	0.15
Muy1 in Knm	303.75
Referring to chart-63 of SP-16	
Puz/ Ag	26
Puz in Kn	5850
Pu/Puz	0.4444
Mux/Mux1	0.0962
Muy/Muy1	0.9876
Referring to chart-64 of SP-16	
Permissible Muy/Muy1	0.99
Check	safe and assumed % of steel is correct
Ast required	8482.5
Provide steel	

Dia of lateral ties:		
Dia of main rod provided	20	
6mm	6mm	
1/4 times Dia of main rod	6.25	
Dia of lateral ties choosen	8mm	
Spacing of lateral ties:		
16 times the dia of main rod		400
Least lateral dimension of column		300
Provide 8mm dia 2 legged lateral ties @	175 mm c/c	

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Design of Floor Slab:

Assume the slab thickness as 150 mm

Dead load of slab (0.15 x 25)	=	3.75 kn/m^2
Live load	=	2.00 kn/m^2
Partition wall load	=	1.00 kn/m^2
Floor finish load	=	1.00 kn/m^2
		7.75 kn/m^2

Say w = 8.0 kn/m^2

Long span L_y = 7.30 m

Short span L_x = 3.20 m

L_y / L_x = 2.28 > 2.0

To design as one way slab and slab thickness as 125mm

Positive moment @ mid span = (1.5 x 8 x 3.20^2)/8

= 15.36knm

Referring to the table – 37 of SP – 16 and assuming the slab thickness as 125mm

Provide 8mm dia @ 100mm c/c along shorter span and 8mm dia @ 150mm c/c along the longer span with alternate rods cranked @ 0.2 times of respective span

Check for deflection:

Permissible span / depth = 23 x 1.3 (referring to chart 23)

= 29.90

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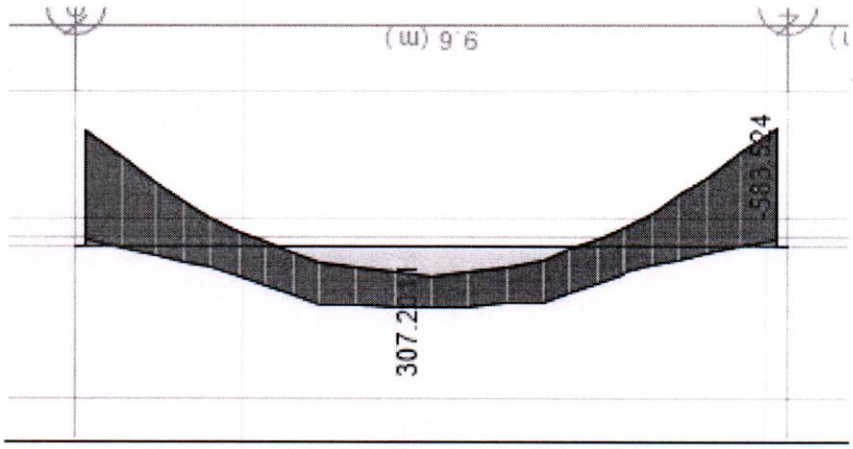
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Actual deflection = 3200 / 125

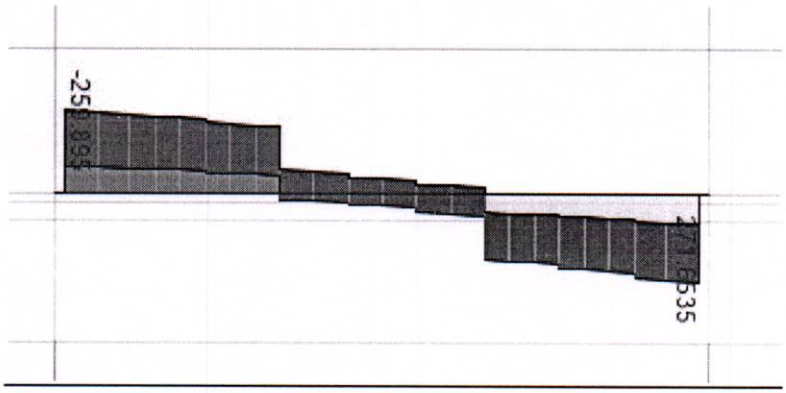
= 25.60 < 29.90

Hence safe

Design of critical floor beam:



Critical Bending Moment Diagram



Critical Shear Force Diagram

Assume beam size as 230mm x 750mm

Max factored B.M @ top of support = 583knm

K = 5.17, Pt= 1.426, Pc = 0.310

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A_{st} = 2296 mm^2 A_{sc} = 500 mm^2

Therefore provide 3-25+3-20mm dia@ top of support

Max factored moment @ bottom = 308knm

K = 2.74, Pt = 0.719

A_{st} = 1158 mm^2

Therefore provide 5-20mm dia @ bottom

Factored shear force @ support = 272kn

V_{us} = 272000 – (0.74 x 230 x 700)

V_{us}/d = 2.19kn/cm

Referring to Table – 62 of SP-16, provide 8mm dia stirrups @ 130mm c/c

end of report

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Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

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