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PROPOSED RESIDENTIAL APARTMENT - EAST GATE PHASE II AT VILANKURICHI VILLAGE, COIMBATORE

DESIGN BRIEF REPORT FOR STRUCTURAL SERVICES

Client : **Ms. MAYFLOWER ENTERPRISES Pvt Ltd**

Project Information :

T.S.No. 5/1, BLOCK No.7,
WARD No.Z (26), VILANKURICHI VILLAGE,
COIMBATORE CORPORATION,
COIMBATORE DISTRICT.

Structural Consultant :

BURO ENGINEERS (I) PVT LTD
Civil & Structural Consultants
New No.31, (old No. 14), Besant Avenue,
Adyar, Chennai 600 020.

DOCUMENT NO : STR - DBR/Rev-R0

DATE	PREPARED	CHECKED	APPROVED	REVISION
20/03/2025	ARVIND	JOSHI	P.J	R0

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1.0 INTRODUCTION

This Design Brief Report (DBR) is for the Proposed Residential Apartment - EAST GATE PHASE II at Vilankurichi Village, Coimbatore, for M/s. Mayflower Enterprises Pvt Ltd.

The proposed residential building having 1 Basement + Ground + 9 storey + Roof.

This report provides the information on Codes of Practice, Design loading's, Material Strength considered for the Design and Analysis of the building. In addition this report includes Structural system, Foundation system, Method statement of structural analysis which will be adopted for design and analysis for the building.

1.1 Facilities:

Basement : Parking.

Ground Floor : Swimming Pool, Lobby, Electrical Transformer Room, Meter Room, DG set, Parking.

1st Floor: Residential units, Gym, Multipurpose Hall.

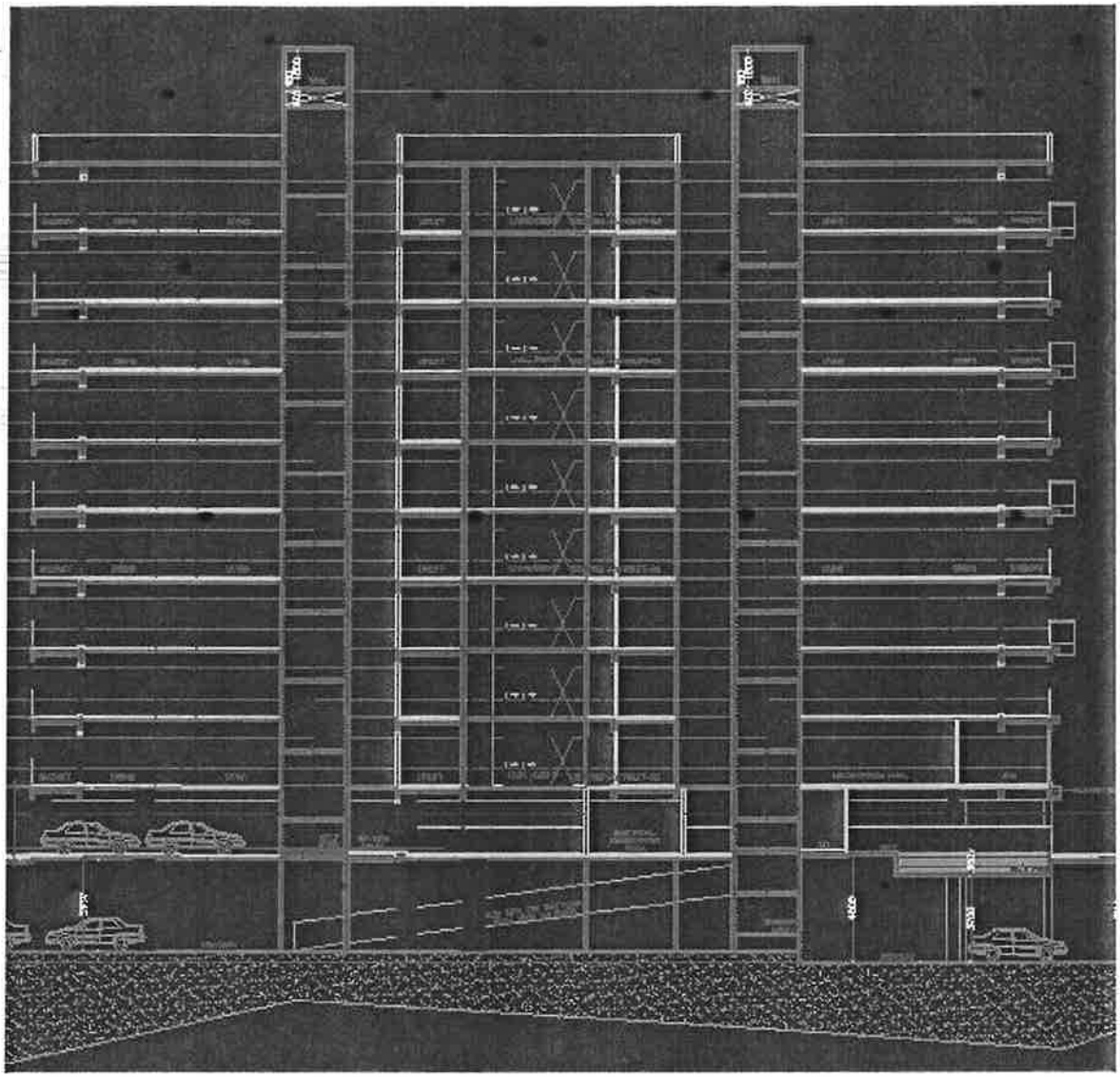
2nd Floor to 9th floor: Residential units.

Terrace: Open terrace, OHT & LMR, Children Play area, Badminton Court.

1.2 Floor to floor height:

Basement floor	- 4.75m
Ground floor	- 3.15m
1st to 9th floor each floor height	- 3.00m

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SECTION

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2.0 CODES OF PRACTICE

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The relevant Indian Standard codes below are followed.

2.1 CODES, STANDARDS & REFERENCES

All design of structures shall comply with the requirements specified in the following.

a. Relevant Indian Standard Codes of Practice
b. National Building Code.
c. Local Building regulations.
d. Other relevant International codes where required.

All applicable latest edition of codes and standards will be referred and adopted in the analysis of structures and the design and detailing of structural members. All structural elements design shall be carried out primarily based on. Indian Standards and Codes with latest revision, with amendments if any, as on date.In addition, other international codes and standards shall also be referred when required and relevant.

In the analysis, design and detailing of the building, the following Indian Standard codes of latest amendment will be used.

CODE	DESCRIPTION
IS 875(Part 1) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Unit weights of buildings materials and stored material
IS 875 (Part 2) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Imposed Loads
IS 875 (Part 3) 2015	Code of practice for Design Loads (other than earthquake) for buildings and structures – Wind Loads
IS 875 (Part 5) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Special Loads and load combinations
IS 456 – 2000	Code of Practice for Plain and Reinforced Concrete
IS 16700 – 2017	Criteria for Structural Safety of Tall Concrete Buildings
IS 1343 – 2012	Code of Practice for Prestressed Concrete
IS 1893 – 2016	Criteria for earthquake resistant design of structures
IS 4326 –1993	Code of practice for Earthquake Resistant Design and Construction of Buildings
IS 3370 – 2009	Code of Practice for Concrete structures for the storage of liquids
IS 1904-1995	Code of Practice for design and construction of

	Foundation
IS 1080 – 1997	Code of Practice for design and construction of shallow Foundation
IS 2950 - 1998	Code of Practice for design and construction of Raft Foundation
IS 800 – 2007	Code of practice for General Construction in steel
BS 8110 : 1997	Plain and reinforced concrete-code of practice(British standard)
ACI 318	Plain and reinforced concrete-code of practice (American standard)
IS 13920: 2016	Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces
SP24	Explanatory Hand book on Indian standard code of practice
SP34	Handbook on concrete reinforcement and detailing

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3.0 DESIGN OF LOADINGS

a) SUPERIMPOSED DEAD LOADS AND LIVE LOADS

The following are the imposed loads such as SDL and LL to be considered for the design of floor system depending usage floor. In addition to these loads, self-weight of structural elements will be considered depending member sizes shown in the floor plans.

LOADINGS	DEAD LOAD (KN/m2)				LIVE LOAD (KN/m2
	FINISHES	SERVICES	SDL / Non Reduce LL	PARTITION	
STAIRCASE	1.80	0.00	1.80 (STEP)	0.00	3.00
TOILET	6	0.00	0.00	0.00	2.00
BALCONY	1.80	0.00	0.00	0.00	3.00
UTILITY ROOM	3.6	0.00	0.00	0.00	2.00
LOBBY & CORRIDOR	1.80	0.00	0.00	0.00	3.00
BED,LIVING,DINNING & KITCHEN	1.20	0.00	0.00	0.00	2.00
TERRACE	3.60	0.00	0.00	0.00	5
LMR	3.60	0.00	12.40	0.00	0.00
OHT	1.80	0.00	10 X WATER HEIGHT	0.00	0.00

Permissible reduction in imposed load on each floor is considered for design of columns and footings as per IS 875 Part (2).

b) SUPER IMPOSED DEAD LOADS (kN/m²)

For apartment floor Finishes of 50 mm thickness have been considered on all the typical floors. Filling is considered for toilet 100mm (typical floor), utility=150mm, balcony=150mm.

TERRACES (Load in kN/m2)

Waterproofing + Screed 3.60 (0.15(average finishes Thk.) x 24=3.60)

c) SELF-WEIGHT OF SOLID BLOCK WALLS (kN/m)

Infill walls (20mm for External wall & internal wall 15mm plastering on Either side)

(i) 200mm thick wall 4.40kN/m
(ii) 100mm thick wall 2.20kN/m

Water Tank Water height x 10

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d) **Material Density**

Unit weight of materials are as per IS: 875 (Part-I) 1987.

Unit weight of concrete	-	25 KN / Cum.
Unit weight of steel	-	78.5 KN / Cum.
Screed concrete	-	24 KN / Cum.
Unit weight of dry soil	-	18 KN / Cum.
Unit weight of saturated soil	-	20 KN / Cum.
Unit weight of Glass	-	27.2 KN / Cum.
Unit weight of water	-	9.81 KN / Cum.
Unit weight of Solid block wall	-	22 KN / Cum.
Light weight concrete filling	-	16 KN / Cum.

e) SEISMIC LATERAL FORCE

Design of lateral force under seismic condition shall be as per IS1893 – 2016. Total lateral force (base shear) of the building shall be estimated at ground floor level as per clause 7.2.1 of IS1893 – 2016 which provides by

Base shear Vb = Ah W

Ah is horizontal seismic coefficient and W is seismic weight of the building, Horizontal seismic coefficient depends on location of the building (Zone factor Z), usage of the building (Importance factor, I), building lateral resisting system (Response reduction factor, R) and design acceleration coefficient (Sa /g) which is based on subsoil condition and fundamental natural period (Ta).

For the proposed development is for Residential use. Considering it, the seismic weight is summation of total dead load and 25% of live load where live load is equal and less than 3 kN/sq.m.

1) The lateral load resisting system of the buildings is Ductile shear wall with ordinary moment resisting frames.
2) As per IS 1893:2016 code, Coimbatore lies in Zone III with Zone factor Z = 0.16
3) The Design Base Shear is given by V_b = Ah x W, Where

   Ah = Z / 2 x I / R x S_a / g

   I = Importance Factor = 1.2

   Soil Type 1 (Weathered Rock)

   R (Response reduction factor) = 4.0. Building with Ductile RC structural walls with reference to IS: 1893-2016, Table-9 and the frames are designed to carry the design lateral load.

Sa/g = Average Response acceleration coefficient

With reference to IS 1893 - 2016 clause 7.6.2 (c) the time period for building each directions are as follows,

The fundamental natural period (Ta) for building,

For X and Y direction the time period is calculated

7.6.2 The approximate fundamental translational natural period T_a of oscillation, in second, shall be estimated by the following expressions:

a) Bare MRF buildings (without any masonry infills):

$$T_a = \begin{cases} 0.075h^{0.75} & \text{(for RC MRF building)} \\ 0.080h^{0.75} & \text{(for RC-Steel Composite MRF building)} \\ 0.085h^{0.75} & \text{(for steel MRF building)} \end{cases}$$

b) Buildings with RC structural walls:

$$T_a = \frac{0.075h^{0.75}}{\sqrt{A_w}}$$

where A_w is total effective area (m^2) of walls in the first storey of the building given by:

$$A_w = \sum_{i=1}^{N_w} \left[A_{wi} \left\{ 0.2 + \left(\frac{L_{wi}}{h} \right)^2 \right\} \right]$$

c) All other buildings:

$$T_a = \frac{0.09h}{\sqrt{d}}$$

dx = 18.35m,

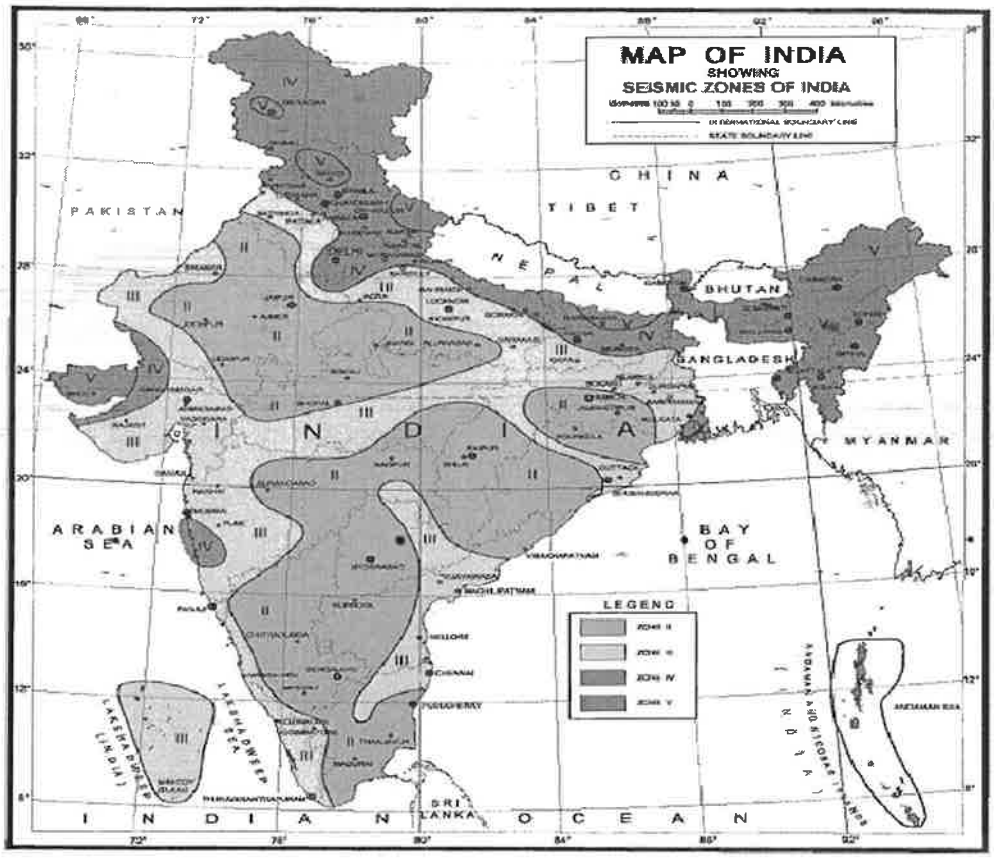
dy = 44.50m,

H = 30.00m (Ground to Roof)

T_a = 0.705 (along X direction)

T_a = 0.961 (along Y direction)

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Dynamic Analysis

Response spectrum method of Dynamic Analysis carried out with following parameters pertaining to dynamic analysis.

Number of modes Considered	: 12 Numbers (Min)
Modal Combination Method Used	: Complete Quadratic combination (CQC).
Directional Combination Method used	: Square root of the sum of Square (SRSS).
Modal case type	: Ritz vector Method

Cut off frequency in case response spectrum method of analysis - 33 Hz.

Mass participation is 90% as per our analysis

Damping 5%is used for seismic analysis

Dynamic analysis of building is carried out. The members are designed accordingly.

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f) WINDS LOADS

The wind pressure shall be calculated based on the basic wind speed and other provisions laid in IS 875 Part(3) - 2015

Design Wind speed $V_Z = V_b x k_1 x k_2 x k_3 x k_4$

V_b ⟶ Basic Wind velocity for Coimbatore = 39m/s

k_1 ⟶ Risk coefficient for all general buildings = 1.00

k_2 ⟶ Terrain category 2 = To suit the height of the structure for terrain

[k_2 (H=31.2m -GF to Roof including parapet wall) = 1.10]

k_3 ⟶ Topography factor = 1.00

k_4 ⟶ Importance Factor = 1.00

Based on the above,

Max. design wind speed (V_Z) ($V_b x k_1 x k_2 x k_3 x k_4$) = 42.9m/s

Max. design wind pressure (Pz) = $0.6 \times Vz^2$ = 1104.25 N/m2

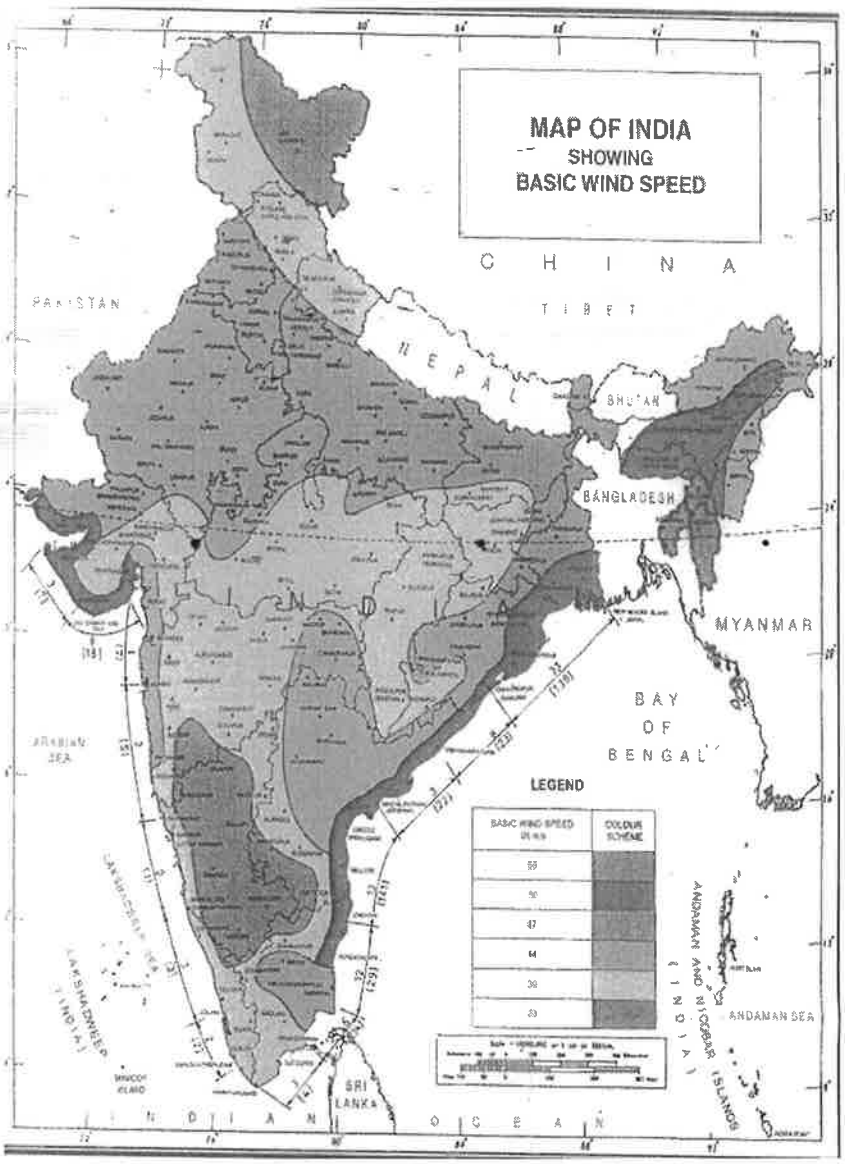
Design wind pressure: pd = Pz x Kax Kd x Kc = 805N/m2

Kd ⟶ Wind directionality factor = 0.90

ka ⟶ Area averaging factor = 0.90

k_c ⟶ Combination factor = 0.90

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g) TEMPERATURE LOAD

The building is completely covered with brick work on the sides. So there will be no appreciable differential temperature during the service life of building. The roof slab and the podium of building is to be analyzed for ± 15°C difference in temperature is applied to Etabs model and necessary load combinations are considered in analysis & Design of the building. The roof slab is assign as semi rigid diaphragm for ultimate load combination.

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3.1 LOAD COMBINATIONS

The various loads combinations used for design in accordance with IS 1893-2016 are as follows

1. 1.5 (DL + LL)
2. 1.2 (DL + LL ± SPECX-D) ± 0.36 SPECY-D ± 0.36 SPECZ-D
3. 1.2 (DL + LL ± SPECY-D) ± 0.36 SPECX-D ± 0.36 SPECZ-D
4. 1.2 (DL + LL ± SPECZ-D) ± 0.36 SPECX-D ± 0.36 SPECY-D
5. 1.2 (DL + LL ± WindX)
6. 1.2 (DL + LL ± WindY)
7. 1.5 (DL ± SPECX-D) ± 0.45 SPECY-D ± 0.45 SPECZ-D
8. 1.5 (DL ± SPECY-D) ± 0.45 SPECX-D ± 0.45 SPECZ-D
9. 1.5 (DL ± SPECZ-D) ± 0.45 SPECX-D ± 0.45 SPECY-D
10. 1.5 (DL ± WindX)
11. 1.5 (DL ± WindY)
12. 0.9DL ± 1.5 SPECX-D ± 0.45 SPECY-D ± 0.45 SPECZ-D
13. 0.9DL ± 1.5 SPECY-D ± 0.45 SPECX-D ± 0.45 SPECZ-D
14. 0.9DL ± 1.5 SPECZ-D ± 0.45 SPECX-D ± 0.45 SPECY-D
15. 0.9DL ± 1.5WindX
16. 0.9DL ± 1.5WindY

The various service loads combinations of structure as per IS 456 are as follows

17. 1.0DL +1.0 LL
18. 1.0DL ± 1.0SPECX-D ± 0.3 SPECY-D ± 0.3 SPECZ-D
19. 1.0DL ± 1.0SPECY-D ± 0.3 SPECX-D ± 0.3 SPECZ-D
20. 1.0DL ± 1.0SPECZ-D ± 0.3 SPECX-D ± 0.3 SPECY-D
21. 1.0DL ± 1.0WindX
22. 1.0DL ± 1.0WindY
23. 1.0DL + 0.8LL ± 0.8SPECX-D ± 0.24 SPECY-D ± 0.24 SPECZ-D
24. 1.0DL + 0.8LL ± 0.8SPECY-D ± 0.24 SPECX-D ± 0.24 SPECZ-D
25. 1.0DL + 0.8LL ± 0.8SPECZ-D ± 0.24 SPECX-D ± 0.24 SPECY-D
26. 1.0DL + 0.8LL ± 0.8WindX
27. 1.0DL + 0.8LL ± 0.8WindY

Where, DL - Dead load,

LL	- Live load (Live>3kN/m2, Live1<=3kN/m2)
WindX	- Wind load in x - direction
WindY	- Wind load in y-direction
SPECX	- Earthquake load in x-direction
SPECY	- Earthquake load in y-direction
TEMP	- Temperature load

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4.0 MATERIAL GRADES

i) CONCRETE

Grade M30 (fck = 30 N/mm²) for Isolated & Combined foundation, Overhead Water Tank, UG Water Tank, Pump Room, Beam & Slab

Grade M35 (fck = 35 N/mm²) for Shear wall, Column,

ii) REINFORCEMENT

Reinforcement bars of grade Fe550D conform to IS 1786-2008.

5.0 COVER AND FIRE RATING

Fire rating considered - 2hrs.

Cover to reinforcement considered for various element

Isolated footing	50 mm (Very severe exposure condition)
Columns	40 mm (2 hours fire resistance)
Tank walls	45 mm (Severe exposure condition)
Shear Walls	30 mm (2 hours fire resistance)
Beams (simply supported)	40 mm (2 hours fire resistance & Moderate)
Beams (continuous)	30 mm (2 hours fire resistance & Moderate)
Slabs (simply supported)	35 mm (2 hours fire resistance & Moderate)
Slabs (continuous)	25 mm (2 hours fire resistance & Moderate)

6.0 STRUCTURAL SYSTEM

SUPER STRUCTURE

The structural system for the super structure is R.C.C Beam with R.C.C slab. The slab thicknesses are to be 125mm.

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7.0 DEFLECTION CRITERIA

7.1 Lateral Deflection (Wind)

Overall Deflection	<	Height/500
Storey Deflection	<	Storey height/500

7.2 Lateral Deflection (Seismic)

Overall Drift	<	H / 250
Storey Drift	<	0.004 times storey height

7.3 Vertical Deflection of Beams and Slabs due to Gravity Loads

Total Deflection (DL + LL)	<	Span/250
Deflection including the effects of Temperature, Creep and Shrinkage Occurring after erection of partitions and the application of finishes	<	Span/350 or 20mm whichever is less

8.0 STRUCTURAL ANALYSIS

Computer-aided analysis using finite element method (FEM) shall be carried out for the design of structural elements. For 3D or 2D structural frame analysis latest version of software ETABS or SAFE shall be used, Prokon, RCDC and verified in-house spreadsheets will be used for the design of reinforced concrete (RC) and steel elements in consideration of flexure, shear and axial forces.

Assumptions for 3D model analysis using ETABS

Column	:	Frame Element
RC Wall	:	Wall (Shell) Element
Beam Element	:	Frame Element
Slab	:	Shell Element

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The following are general parameters adopted in the analysis and design,
Modulus of Elasticity of Concrete -5000$\sqrt{fck}$
Consideration of Diaphragm - Rigid Diaphragm.
Slab/Wall element considered as Shell element

Stiffness modification factors are adopted in the analysis as per IS -16700-2017, Table.6.

Table 6 Cracked RC Section Properties

(Clause 7.2)

Sl No.	Structural Element	Un-factored Loads		Factored Loads	
		Area	Moment of Inertia	Area	Moment of Inertia
(1)	(2)	(3)	(4)	(5)	(6)
i)	Slabs	1.0 A_g	0.35 I_g	1.00 A_g	0.25 I_g
ii)	Beams	1.0 A_g	0.7 I_g	1.00 A_g	0.35 I_g
iii)	Columns	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g
iv)	Walls	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g

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The following parameters and methods are adopted in creating ETABS 3D model for the buildings and design of structural elements.,

- The 3D ETABS model generated based on the preliminary floor plans (shuttering drawings) prepared using preliminary sizes.
- Sectional properties are assigned to all the structural elements as per the preliminary floor plans (shuttering drawings).
- External & Internal in fill wall loads are assigned as uniformly distributed line load on beams and as area load if the wall is intending to distribute on slab directly.
- Slabs are modelled as shell element if floor system and slabs are assigned with horizontal diaphragms.
- Live Load reduction is considered in the design of Foundation and Column as per the Code: IS 875-1987 (Part-II), clause.3.2.1.
- Area design load i.e. Live load/SDL or any other load is applied at floor relevant to its usage.
- All lateral loads & parameters are assigned as per Codes IS 1893-2016 & IS 875-Part-3, 2015.
- Temperature loads are applied on to the terraces and to areas directly exposed to atmosphere.
- Beams under Torsion is required to maintain Equilibrium will be designed for Torsion in accordance with IS 456-2000, clause 41.1 to 41.4 and for all other beams torsional stiffness is neglected in the analysis by applying stiffness modifier as 0.000001 to torsional constant "J". Hence no specific design for Torsion is required for these beams.
- Concrete cover to reinforcement complied accordance with IS 456-2000, Tabl.16 & 16A.
- All vertical wall elements are assigned with auto meshing/manual messing appropriately in order to achieve accuracy in results.

Design approach of structural elements

Shear wall/Column:

RC Structural Walls & Columns which are supporting both vertical loads and lateral forces are designed for the most adverse load conditions which will be the maximum for that structural element from the load combinations considered in the 3D Etabs Model.

RCDC a design software will be used to design the element for the maximum forces obtained from the Etabs model analysis results.

Beams:

Each Beam will be designed for maximum forces from the 3D analysis using Etabs and RCDC Softwares.

Area Load & Application:

Applied as uniformly distributed area load with intensity proportionate to its usage as mentioned in the Loading items in the DBR.

Line (Wall) Load & Application:

Non load bearing or infill wall loads are calculated appropriately and applied as uniformly distributed line load.

9.0 FOUNDATION

Proposed Foundation system is Isolated & combined footing and the SBC considered for the design is 450kN/m2 the founding depth is to be 4.0m from the natural ground level with reference to the soil investigation report No-SSTS/GT/270225/01from M/s.Sastha Soil Testing Services.

10.0 COMPUTER PROGRAMS

The following Software / spreadsheet to be used to carry out Structural analysis and design.

1.	PROKON Ver 2.3	- Wall & Beam design
2.	ETABS Ver 21.0.1	- Three Dimensional Program
3.	SAFE Ver 20.0	- Raft Analysis / Strip Analysis
4.	In-House Spreadsheet	- one way/ two way slab design
5.	RCDC	- Beam Design, Isolated footing design, Column design and Wall design

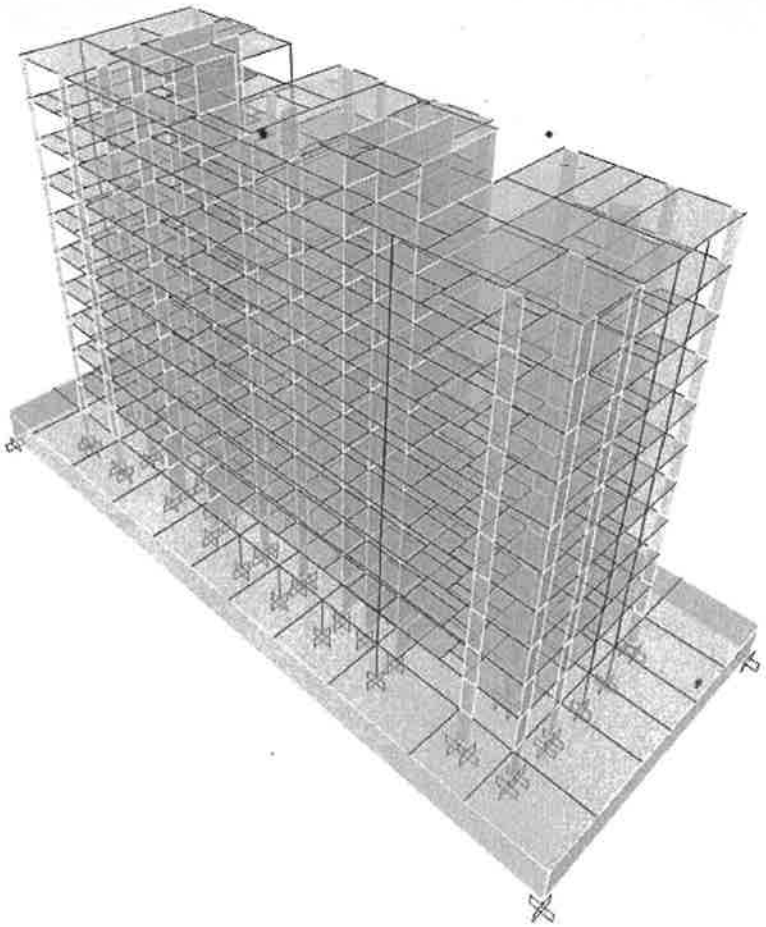
On behalf of DTCP HRB board, the structural design report is generally reviewed and found in order

7/4/25

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ETABS®



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1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

1.1 Story Data

Table 1.1 - Story Definitions

Tower	Name	Height m	Master Story	Similar To	Splice Story	Color
T1	LMR	3	No	None	No	Yellow
T1	TERRACE	3	No	None	No	Blue
T1	9TH FLOOR	3	No	2ND FLOOR	No	Cyan
T1	8TH FLOOR	3	No	2ND FLOOR	No	Magenta
T1	7TH FLOOR	3	No	2ND FLOOR	No	Gray8Dark
T1	6TH FLOOR	3	No	2ND FLOOR	No	Green
T1	5TH FLOOR	3	No	2ND FLOOR	No	Red
T1	4TH FLOOR	3	No	2ND FLOOR	No	Yellow
T1	3RD FLOOR	3	No	2ND FLOOR	No	Blue
T1	2ND FLOOR	3	Yes	None	No	Cyan
T1	1ST FLOOR	3	No	None	No	Magenta
T1	STILT	3	No	None	No	Gray8Dark

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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	
~SPEC-WXECC	Yes	Other	0	
~SPEC-WYECC	Yes	Other	0	
~SPEC-WZECC	Yes	Other	0	
~SPEC-XECC	Yes	Other	0	
~SPEC-XSECC	Yes	Other	0	
~SPEC-YECC	Yes	Other	0	
~SPEC-YSECC	Yes	Other	0	
~SPEC-ZECC	Yes	Other	0	
Dead	No	Dead	1	
EQX	No	Seismic	0	IS 1893:2016
EQY	No	Seismic	0	IS 1893:2016
FL	No	Live	0	
LIVE<3	No	Reducible Live	0	
LIVE>3	No	Reducible Live	0	
SDL	No	Super Dead	0	
WALL	No	Super Dead	0	
WX	No	Wind	0	Indian IS 875:2015
WY	No	Wind	0	Indian IS 875:2015

2.2 Auto Seismic Loading

IS 1893:2016 Auto Seismic Load Calculation

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

Direction and Eccentricity

Direction = X

Structural Period

Period Calculation Method = User Specified

User Period $T = 0.752\text{sec}$

Factors and Coefficients

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

Response Reduction Factor, R [IS Table 9] $R = 4$

Importance Factor, I [IS Table 8] $I = 1.2$

Site Type [IS Table 1] = I

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2] $\frac{S_a}{g} = \frac{1}{T}$ $\frac{S_a}{g} = 1.329787$

Equivalent Lateral Forces

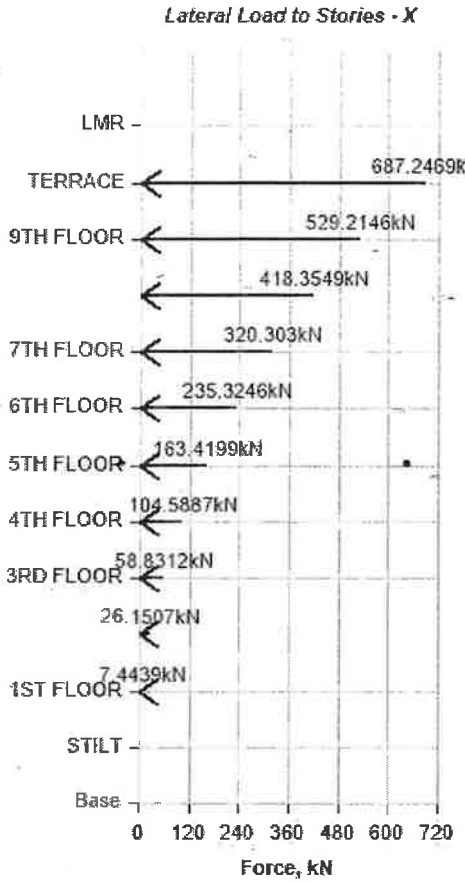
Seismic Coefficient, A_h [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
X	0.752	79927.5212	2550.8783

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Applied Story Forces



Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
LMR	36	0	0
TERRACE	33	687.2469	0
9TH FLOOR	30	529.2146	0
8TH FLOOR	27	418.3549	0
7TH FLOOR	24	320.303	0
6TH FLOOR	21	235.3246	0
5TH FLOOR	18	163.4199	0
4TH FLOOR	15	104.5887	0
3RD FLOOR	12	58.8312	0
2ND FLOOR	9	26.1507	0
1ST FLOOR	6	7.4439	0
STILT	3	0	0
Base	0	0	0

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IS 1893:2016 Auto Seismic Load Calculation

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

Direction and Eccentricity

Direction = Y

Structural Period

Period Calculation Method = User Specified

User Period $T = 0.961 sec$

Factors and Coefficients

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

Response Reduction Factor, R [IS Table 9] $R = 4$

Importance Factor, I [IS Table 8] $I = 1.2$

Site Type [IS Table 1] = I

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2] $\frac{S_a}{g} = \frac{1}{T}$ $\frac{S_a}{g} = 1.040583$

Equivalent Lateral Forces

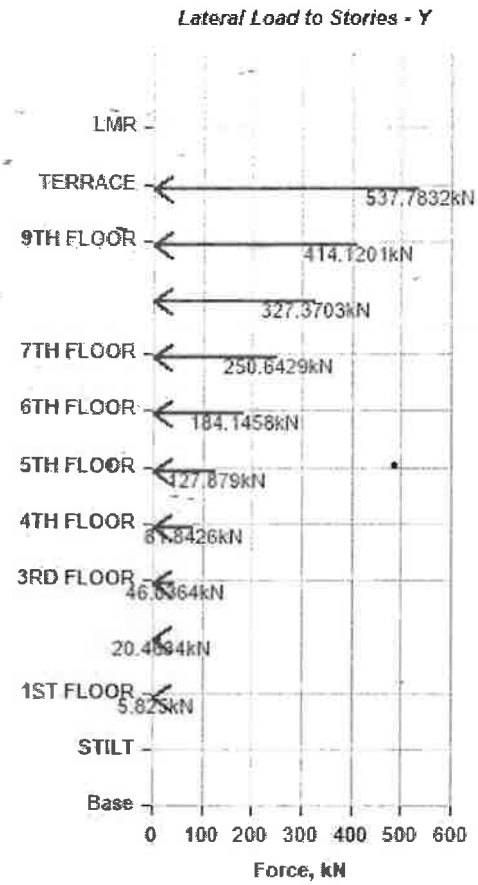
Seismic Coefficient, A_h [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
Y	0.961	79927.5212	1996.1087

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Applied Story Forces



Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
LMR	36	0	0
TERRACE	33	0	537.7832
9TH FLOOR	30	0	414.1201
8TH FLOOR	27	0	327.3703
7TH FLOOR	24	0	250.6429
6TH FLOOR	21	0	184.1458
5TH FLOOR	18	0	127.879
4TH FLOOR	15	0	81.8426
3RD FLOOR	12	0	46.0364
2ND FLOOR	9	0	20.4634
1ST FLOOR	6	0	5.825
STILT	3	0	0
Base	0	0	0

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2.3 Functions

2.3.1 Response Spectrum Functions

Table 2.4 - Functions - Response Spectrum - IS1893 2016

Name	Period sec	Value	Seismic Zone	I	Soil Type	R	Damping Ratio
IS 1893	0	0.024	III	1.2	I	4	0.05
IS 1893	0.1	0.06					
IS 1893	0.4	0.06					
IS 1893	0.6	0.04					
IS 1893	0.8	0.03					
IS 1893	1	0.024					
IS 1893	1.2	0.02					
IS 1893	1.4	0.017143					
IS 1893	1.6	0.015					
IS 1893	1.8	0.013333					
IS 1893	2	0.012					
IS 1893	2.5	0.0096					
IS 1893	3	0.008					
IS 1893	3.5	0.006857					
IS 1893	4	0.006					
IS 1893	4.5	0.006					
IS 1893	5	0.006					
IS 1893	5.5	0.006					
IS 1893	6	0.006					
IS 1893	6.5	0.006					
IS 1893	7	0.006					
IS 1893	7.5	0.006					
IS 1893	8	0.006					
IS 1893	8.5	0.006					
IS 1893	9	0.006					
IS 1893	9.5	0.006					
IS 1893	10	0.006					

Table 2.5 - Functions - Response Spectrum - User Defined

Name	Period sec	Value	Damping Ratio
Z FUNTION	0	0.04	0.05
Z FUNTION	10	0.04	

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2.4 Load Cases

Table 2.6 - Load Case Definitions - Summary

Name	Type
Modal	Modal - Ritz
Dead	Linear Static
LIVE<3	Linear Static
LIVE>3	Linear Static
SDL	Linear Static
WALL	Linear Static
WX	Linear Static
WY	Linear Static
EQX	Linear Static
EQY	Linear Static
FL	Linear Static
SPEC-X	Response Spectrum
SPEC-Y	Response Spectrum
SPEC-XS	Response Spectrum
SPEC-YS	Response Spectrum
SPEC-Z	Response Spectrum
SEQ	Nonlinear Static Staged Construction
SPEC-WX	Response Spectrum
SPEC-WY	Response Spectrum
SPEC-WZ	Response Spectrum

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FOOTING/RAFT DESIGN

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Design Code	:	IS 456 : 2000 + IS 13920 : 2016	
Footing No	:	F4	
Column No	:	HW5	(300 mm X 1000 mm)
Analysis No	:	HW5	
Concrete Grade	:	M30	N/sqmm
Steel Grade	:	Fe550	N/sqmm
Clear Cover	:	50	mm
Df	:	3 M	
Dw	:	0 M	

Density of Soil	=	18	kN/cum
Soil Bearing Capacity	=	525	kN/sqm
Permissible SBC Increase for EQ	=	50	%
Permissible SBC Increase for Wind	=	25	%
Live Load Reduction	=	50	%
Permissible area of loss of contact	=	0	%
Design cross section by	:	Average pressure	

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Footing Type	:	Pad	
Footing Size (L x B x D)	:	2900mm X 2200mm X 700mm	
Without considering Effect of Water Table			
Footing Self Wt., F1	=	111.65	kN
Soil Weight, S1	=	0.00	kN
Total Weight, W1	=	F1 + S1	
	=	111.65	kN
Offset Along L (Loff)	=	950	mm
Offset Along B (Boff)	=	950	mm

Check For Maximum Soil Pressure:

Critical Column No	=	HW5	
Critical Load Combination	=	[3] : (Dead) +(FL) +(SDL) +(WALL) -(SPEC-XMax) +(LIVE<3) +(LIVE>3)	
Pcomb	=	3108.27	kN

P	=	Pcomb + W1	
P	=	3219.92	kN
Mx	=	-128.93	kNm
My	=	-2.7	kNm
P/A	=	504.69	kN/sqm
Mx/Zx	=	-41.81	kN/sqm
My/Zy	=	-1.15	kN/sqm
Maximum Soil Pressure	=	547.65	kN/sqm
Allowable Soil Pressure	=	1.5x525	kN/sqm
	=	787.5	kN/sqm

Check For Minimum Soil Pressure:

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Critical Column No	=	VW15	
Critical Load Combination	=	[2] : (Dead) +(FL) +(SDL) +(WALL) +(SPEC-XMax) +(LIVE<3) +(LIVE>3)	
Pcomb	=	2459.24	kN
P	=	Pcomb + W1	
P	=	2570.89	kN
Mx	=	-59.74	kNm
My	=	-7.98	kNm
P/A	=	402.96	kN/sqm
Mx/Zx	=	-19.37	kN/sqm
My/Zy	=	-3.41	kN/sqm
Minimum Soil Pressure	=	380.18	kN/sqm
	>	0	

Design For Bending:

Bottom Reinforcement Along L:

Critical Column No	=	HW5	
Critical Load Combination	=	[24] : 1.5 (Dead) +1.5 (FL) +1.5 (SDL) +1.5 (WALL) -1.5 (SPEC-XMax)	
Pu	=	4339.52	kN
Mux	=	-185.44	kNm
Muy	=	-3.63	kNm

P/A	=	680.17	kN/sqm
Mx/Zx	=	-60.13	kN/sqm
My/Zy	=	-1.55	kN/sqm
Deff	=	642	mm
Beff	=	2200	mm
SPu	=	740.31	kN/sqm
Mu	=	SPu X B X Loff X Loff / 2	
	=	734.94	kNm
Pt	=	0.229	%
Ast Rqd (BM)	=	3240	sqmm
Ast Prv (Distributed Across Total Width)	=	17 - T16 @ 140	
	=	3418	sqmm

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Top Reinforcement Along L:

D	=	700	mm
	<=	1000	mm, Hence
Ast	=	Min Pt For Top Reinforcement X D X B	
	=	0.06% X 700 X 2200	
	=	924	sqmm
Ast Prv (Distributed Across Total Width)	=	12 - T10 @ 200 c/c	
	=	942	sqmm

Bottom Reinforcement Along B:

Critical Column No	=	HW5	
Critical Load Combination	=	[12] : 1.5 (Dead) +1.5 (FL) +1.5 (SDL) +1.5 (WALL) +1.5 (LIVE<3) +1.5 (LIVE>3)	
Pu	=	4371.85	kN
Mux	=	-95.12	kNm
Muy	=	-1.86	kNm
P/A	=	685.24	kN/sqm
Mx/Zx	=	-30.85	kN/sqm
My/Zy	=	-0.8	kN/sqm
Deff	=	626	mm

Leff	=	2900	mm
SPu	=	686.04	kN/sqm
Mu	=	SPu X L X Boff X Boff / 2	
	=	897.77	kNm
Pt	=	0.229	%
Ast Rqd (BM)	=	4162	sqmm
Ast Prv (Distributed Across Total Length)	=	21 - T16 @ 145	
	=	4222	sqmm

Top Reinforcement Along B:

D	=	700	mm
	<=	1000	mm, Hence
Ast	=	Min Pt For Top Reinforcement X D X L	
	=	0.06% X 700 X 2900	
	=	1218	sqmm
Ast Prv (Distributed Across Total Length)	=	16 - T10 @ 195 c/c	
	=	1257	sqmm

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Design For Shear:

One Way Shear Along L:

Critical Section @ d from Column Face			
	=	642	mm
Critical Column No	=	HW5	
Critical Load Combination	=	[24] : 1.5 (Dead) +1.5 (FL) +1.5 (SDL) +1.5 (WALL) -1.5 (SPEC-XMax)	
Pu	=	4339.52	kN
Mux	=	-185.44	kNm
Muy	=	-3.63	kNm
P/A	=	680.17	kN/sqm
Mx/Zx	=	-60.13	kN/sqm
My/Zy	=	-1.55	kN/sqm
Deff	=	642	mm
Beff	=	2200	mm

SPu	=	740.31	kN/sqm
Vu	=	SPu X (Loff - d) X B	
	=	501.63	kN
Tv	=	Vu / (Beff X Deff)	
	=	0.36	N/sqmm
Tc	=	0.36	N/sqmm
Tv	<	Tc	

One Way Shear Along B:

Critical Section @ d from Column Face

	=	626	mm
Critical Column No	=	HW5	
Critical Load Combination	=	[12] : 1.5 (Dead) +1.5 (FL) +1.5 (SDL) +1.5 (WALL) +1.5 (LIVE<3) +1.5 (LIVE>3)	
Pu	=	4371.85	kN
Mux	=	-95.12	kNm
Muy	=	-1.86	kNm
P/A	=	685.24	kN/sqm
Mx/Zx	=	-30.85	kN/sqm
My/Zy	=	-0.8	kN/sqm
Deff	=	626	mm
Leff	=	2900	mm
SPu	=	686.04	kN/sqm
Vu	=	SPu X (Boff - d) X L	
	=	644.60	kN
Tv	=	Vu / (Leff X Deff)	
	=	0.36	N/sqmm
Tc	=	0.36	N/sqmm
Tv	<	Tc	

Design For Punching Shear:

Critical Section @ d/2 from Column Face

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	=	317	mm
Critical Column No	=	HW5	
Critical Load Combination	=	[12] : 1.5 (Dead) +1.5 (FL) +1.5 (SDL) +1.5 (WALL) +1.5 (LIVE<3) +1.5 (LIVE>3)	
Pu	=	4371.85	kN
Mux	=	-95.12	kNm
Muy	=	-1.86	kNm
P/A	=	685.24	kN/sqm
Mx/Zx	=	-30.85	kN/sqm
My/Zy	=	-0.8	kN/sqm
Deff	=	634	mm
Leff	=	1634	mm
Beff	=	934	mm
Punching Perimeter	=	5136	mm
Punching Area	=	3256224	sqmm
SPu	=	Average Pressure	
	=	685.24	kN/sqm
Vu	=	SPu X ((L X B)-(Leff X Beff))	
	=	3326.06	kN
Tv	=	Vu / Punching Area	
	=	1.021	N/sqmm
Tc	=	1.095	N/sqmm
Tv	<	Tc	

Load Transfer Check For Load Transfer From Column To Footing

Critical Column No	=	HW5	
Critical Load Combination	=	[12] : 1.5 (Dead) +1.5 (FL) +1.5 (SDL) +1.5 (WALL) +1.5 (LIVE<3) +1.5 (LIVE>3)	
Pu	=	4371.85	kN
A2	=	0.3	sqm
A1	=	11.78	sqm
Base Area	=	6.38	sqm
A1	>	Base Area	

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Thus, A1	=	6.38
Modification Factor	=	SquareRoot(A1/A2) < = 2
SquareRoot(A1/A2)	=	4.6116
Thus, Modification Factor	=	2
Concrete Bearing Capacity	=	0.45 X Fck X Modification Factor X Column Area
	=	8100 kN
Concrete Bearing Capacity	>	Pu, Hence Safe.

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WALL DESIGN

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ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
BASEMENT TO TERRACE	VW12	26600	26450	1000	200	0.6

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

Γ_S	F_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	26600	25950	26600	26950	1000	200
Bottom	Leg 1	26600	25950	26600	26950	1000	200

Flexural Design for P_u, M_{u2} and M_{u3} (Part 1 of 2)

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN
Top	500	0.0025	0.0025	1.5 (DL+SPEC-WZ+0.3SPEC-WX+0.3SPEC-WY)	1214.6241
Bottom	500	0.0025	0.0025	1.5 (DL+SPEC-WZ+0.3SPEC-WX+0.3SPEC-WY)	1237.1241

Flexural Design for P_u, M_{u2} and M_{u3} (Part 2 of 2)

M_{u2} kN-m	M_{u3} kN-m	Pier A_g mm²
24.2925	-108.8484	200000
-24.7425	21.943	200000

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Shear Design

Station Location	ID	Rebar mm²/m	Shear Combo	P_u kN	M_u kN-m	V_u kN	V_c kN	$V_c + V_s$ kN
Top	Leg 1	500	1.5 (DL+SPEC-WY+0.3SPEC-WX+0.3SPEC-WZ)	722.5813	29.9323	99.2107	60.769	205.1169
Bottom	Leg 1	500	1.5 (DL+SPEC-WY+0.3SPEC-WX+0.3SPEC-WZ)	745.0813	163.1504	99.2107	61.2165	205.5643

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_u kN	M_u kN-m
Top–Left	Leg 1	200	1.5 (DL+SPEC-WY+0.3SPEC-WX+0.3SPEC-WZ)	1287.656	-164.8843
Top–Right	Leg 1	200	1.5 (DL+SPEC-WY+0.3SPEC-WX+0.3SPEC-WZ)	1287.656	29.9323
Bottom–Left	Leg 1	200	1.5 (DL+SPEC-WY+0.3SPEC-WX+0.3SPEC-WZ)	1310.156	-33.5909
Botttom–Right	Leg 1	200	1.5 (DL+SPEC-WY+0.3SPEC-WX+0.3SPEC-WZ)	1310.156	163.1504

Boundary Element Check (Part 2 of 2)

Stress Comp MPa	Stress Limit MPa
11.38	7
7.34	7
7.56	7
11.45	7

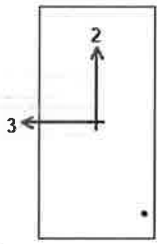
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COLUMN DESIGN

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ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



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Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
BASEMENT TO TERRACE	C	1310	COL 600X300	1.5 (DL+SPEC-X+0.3SPEC-Y+0.3SPEC-Z)	0

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
3000	0.7	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	600	54	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm²	Rebar % %
908.1617	-18.1632	104.1894	18.1632	22.5224	1440	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	1	2400	41.6758	0	22.5224
Minor Bend(M2)	1.2	2400	-2.4664	0	18.1632

Shear Design for V_{u2} , V_{u3}

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
Major, V_{u2}	69.2244	101.8006	65.5197	0	332.53
Minor, V_{u3}	6.6825	96.6435	59.0393	0	665.06

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g cm²	A_{sc} cm²	P_{uz} kN	P_b kN	P_u kN	k Unitless
1800	14.4	3429	1131.9679	908.1617	1

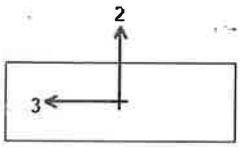
Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (kN-m)
Major Bending (M_3)	Yes	0.8	600	4	12	No	0
Minor Bending (M_2)	Yes	0.8	300	9.6	12	No	0

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ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



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Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
5TH FLOOR	C6	65	COL 200X600	1.5 (DL+SPEC-X+0.3SPEC-Y+0.3SPEC-Z)	0

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
3000	0.6	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
600	200	54	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	550	415

Design Code Parameters

γc	γs
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm²	Rebar % %
914.0884	-22.6694	-47.8919	22.6694	18.2818	1103	0.92

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	1.2	2400	-13.1423	15.0361	18.2818
Minor Bend(M2)	1.2	2400	-0.8802	0	22.6694

Shear Design for V_{u2} , V_{u3}

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
Major, V_{u2}	21.8596	71.831	35.0393	0	665.06
Minor, V_{u3}	5.8671	82.1996	43.6798	0	221.69

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g cm²	A_{sc} cm²	P_{uz} kN	P_b kN	P_u kN	k Unitless
1200	11	2075.0262	611.5447	914.0884	0.793271

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (kN-m)
Major Bending (M_3)	Yes	0.8	200	14.4	12	Yes	18.9545
Minor Bending (M_2)	Yes	0.8	600	4.8	12	No	0

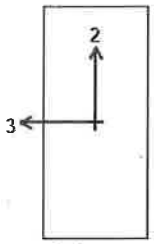
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BEAM DESIGN

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ETABS Concrete Frame Design

IS 456:2000 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
3RD FLOOR	TVB29	912	B 200X450	ENVELOPE	1425	2850	1	Ordinary Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	450	200	0	35	35

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	550	415

Design Code Parameters

γc	γs
1.5	1.15

Factored Forces and Moments

Factored M_{u3} kN-m	Factored T_u kN-m	Factored V_{u2} kN	Factored P_u kN
59.0233	0.0001	0.0423	0

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M_t kN-m	Positive Moment kN-m	Negative Moment kN-m
59.0233	0.0002	59.0234	0

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	0		0	0	0	0

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	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Bottom (-2 Axis)		59.0234	320	320	0	128

Shear Force and Reinforcement for Shear, V_{u2} & T_u

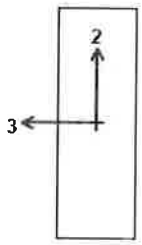
Shear V_e kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
0.0423	36.5798	33.2	24.5334	221.69

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{u2}

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{svt} /s mm²/m
0.0001	0.0122	140	390	0

ETABS Concrete Frame Design

IS 456:2000 Beam Section Design (Summary)



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Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
3RD FLOOR	LB	955	B 200X600	ENVELOPE	1425	2850	1	Ordinary Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	600	200	0	35	35

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	550	415

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} kN-m	Factored T_u kN-m	Factored V_{u2} kN	Factored P_u kN
84.5552	8.078E-06	0	-2.573

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M_t kN-m	Positive Moment kN-m	Negative Moment kN-m
84.5552	1.901E-05	84.5552	0

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	0		175	0	3	175
Bottom (-2 Axis)		84.5552	331	331	3	175

Shear Force and Reinforcement for Shear, V_{u2} & T_u

Shear V_e kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
0	44.329	45.2	45.4735	221.69

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{svt} /s mm²/m
8.078E-06	0	140	540	0

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SLAB DESIGN

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DESIGN OF SLAB : **TS29**

Panel Name : Two adjacent edges discontinuous Code : 8

Clear Longer span, ly = 4600 mm

Clear Shorter span, lx = 3850 mm

ly / lx = 1.19 < 2, Hence, Twoway slab.

Effective Longer span = 4696.00 mm

Effective Shorter span = 3946.00 mm

Assume thickness of slab = 125.00 mm

Effective depth available = 96.00 mm

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Loads :

Dead Load and Imposed Load (fixed) :

Floor finish = 1.200 kN/m^2

Self weight = 3.125 kN/m^2

w_{DL} = 4.325 kN/m^2

Imposed Load (Not fixed) :

Occupancy classification as per IS: 875(Part 2) - 1987 :

Live load = 2.000 kN/m^2

w_{LL} = 2.000 kN/m^2

Total load, $w = w_{DL} + w_{LL}$ = 6.325 kN/m^2

Span Moments:

Along Shorter span: BM = $\alpha_x w l_x^2$ = 0.045 x 6.33 x 3.946^2 = 4.38 kNm M_{ux1} = 6.57 kNm

Along Longer span: BM = $\alpha_y w l_x^2$ = 0.035 x 6.33 x 3.946^2 = 3.45 kNm M_{uy1} = 5.17 kNm

Support Moments:

Along Shorter span: BM = $\alpha_x w l_x^2$ = 0.059 x 6.33 x 3.946^2 = 5.84 kNm M_{ux2} = 8.76 kNm

Along Longer span: BM = $\alpha_y w l_x^2$ = 0.047 x 6.33 x 3.946^2 = 4.63 kNm M_{uy2} = 6.94 kNm

Check for section :

Factored Max. BM, Mu = 8.76 kNm / m

For M30 grade concrete & Fe550 grade steel , Mu, lim / bd^2 = 4.139

Effective depth required = 46.01 mm < Effective depth available, OK

Along the Shorter span

A_{st} reqd at midspan :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{ux1} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 147.33 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

A_{st} reqd at support :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{ux2} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 198.31 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

Along the Longer span

A_{st} reqd at midspan :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{uy1} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 115.15 mm^2 / m

Provide 8 mm dia bars @ 200 mm As = 251.33 mm^2 / m OK

A_{st} reqd at support :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{uy2} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 155.87 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

Min Ast = 0.12% Gross section area = 150 mm^2 / m

Distribution steel = 0.5 x (0.12/100) x 1000 x 125 = 75.00 mm^2 / m

Provide 8 mm dia bars @ 250 mm c/c As = 201.06 mm^2 / m OK

Max Spacing = 3d or 300 mm whichever is less = 288 mm or 300 mm

Check for deflection:

fs = 0.58 x fy x (Ast req/Ast pro) = 187.00 MPa

MF = $1/(0.225+0.00322\ fs - 0.625 \log 10\ (1/pt)) \leq 2$ = 2.000

Type of Slab = Continuous

Effective Shorter span = 3946.00 mm

Basic Value = 26

Allowable l/d = 52.00

Actual l/d = 41.10 Hence OK

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our services doesn't just end there

Buying & Selling Services

Property Buying Assistance, Property Selling Support, Market Price Analysis, Owner Outreach and Negotiation.

Legal & Documentation Services

Certified EC, Patta, legal opinions, property verification, due diligence, litigation solutions, and legal heir certificates.

Property Development & Approvals

Building plan approvals, construction, layout and sub-division approvals, zone conversion, and occupancy certification.

NRI & Investment Services

Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management

Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



empowering your real estate decisions with smart tools

Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter

Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer

Zoning & Land Use Analysis

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

Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

Verified RealEstate™

We're honored to be part of your real estate journey

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