MITHRAN STRUCTURES PRIVATE LIMITED

STRUCTURAL CONSULTANTS

" MARAGATHAM "#1, Jawahar Nagar, S.A.H.S. Post, Coimbatore - 641 043.
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Phone : 0422 - 2445500, Fax : 0422 - 2434021

Date : 05-01-2026

STABILITY CERTIFICATE

(To be furnished while filing application for registration of building)

1) The detailed engineering and structure design of the proposed building comprising of *Basement + Ground +5* floors (Total Nos. of Dwelling- 182 Units) at Ward *No: Z (26), Block No:6, T.S. No-89/1, 89/2 (old S.F.No-435/1) at VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION*. Has been done by me/us based on the report of geotechnical investigation (soil test) done by *GEODESIGN INDIA PRIVATE LIMITED, Coimbatore Ref: G-105-2025-2026, Date 01/08/2025 -04/08/2025* and considering the functional requirement of the building.

2) It is certified that among other factors, the proposed building has been designed to resist earthquake. I/We have checked various parameters and found that the proposed building would be safe.

3) I/We. Further certify that:
   a. The minimum grade of concrete is M25
   b. The design and analysis has been done using the code of practice for plain and reinforced concrete as per IS 456, design loads as per IS Codes No IS 875 and design of earthquake resistant structure as per IS Code No IS 1893

4) The building will be safe and sound when used for the purpose for which it is designed.

Encl.: Structural Design Calculation

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Signature & Stamp & Date

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Client **TNCD LLP**

Structural Consultants **MITHRAN STRUCTURES (P) LTD.**

Project **NEXUS CITY (BASEMENT+ STILT + 5)**

Date: 03-12-2025 Dealt by: Mr. K.Bhuvanesh Checked by: Dr. L.S.J

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 General

This document details the input data, principles, methods and performance criteria to be used in the structural engineering design of the project.

1.2 Scope

The Proposed Basement+Stilt+5 residential building located at Block No: 6 BR Puram, Vilankurichi Village, Coimbatore. This report presents details of structural analysis and design of the building for static loading. The sizes and details of the sections of RC elements are based on detailed analysis, which is elaborated in this report. This report specifies the details of structural layout, mathematical model, material properties, loads and load combinations, static analysis results, design summary for footings, walls, columns, beams and slabs.

2 DESCRIPTIONS OF BUILDING

The Proposed Building consists of Basement+Stilt+5 floors. Basement floor comprises of parking space, remaining floors comprises of residential flats. Isolated footings are provided. Safe bearing capacity of the soil is taken as per Geo-technical Investigation report.

3 LOADS & LOAD COMBINATIONS

3.1 General

This chapter discusses applicable loading for design of the proposed building. The loading is classified and described in the following paragraphs.

3.2 Description of types of loading & Load calculation

Dead loads and Live Loads are considered for the design as per relevant Indian Standards and Specifications applicable to Coimbatore region.

The sizes of members have been fixed based on stiffness criterion and based on compatibility with architectural drawings.

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3.2.1 Dead load comprises of self-weight of various structural elements indicated below:

- Self-weight of Walls, Columns, beams, slabs, brick walls.
- Floor & roof finishes.

Self-weight of the modeled elements is calculated by Etabs by default. The applied floor loads are distributed on the beams as trapezoidal or triangular loads in two way slabs and as rectangular loads in one way slab.

Loads from components like brick walls are applied explicitly as member loads and UDL (Uniformly Distributed Load) as applicable.

Component	Unit weight (kN/m^3)	Thickness (mm)	Area load (kN/m^2)
RCC Slab	25	125	3.125
Floor Finish	-	-	1.00
Terrace Floor Finish	-	-	1.50

Self-weight of the elements is calculated by the following procedure

Slab

Slab thickness = 125 mm
Density of RCC = 25 kN/cu.m
Dead Weight of slab = 3.125 (25*0.125) kN/m^3

Wall

Wall thickness = 200 mm
Density of AAC Brick = 8 kN/cu.m
Height of the wall = 2.5m (2.95m - 0.45m)
Dead load of 200mm Thk wall = 4 (0.20*8*2.5) kN/m
Dead load of 100mm Thk wall 2 (0.10*8*2.5) kN/m

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Beam

Beam depth	=	450 mm
Density of RCC	=	25 kN/cu.m
Dead load of beam	=	2.25 (0.2*0.45*25) kN/m

3.2.2 Live Loads are considered for the analysis in addition to dead loads as follows,

Living, Kitchen, Bedroom, Toilet	-	2 kN/sq.m
Staircase, Balcony, Corridor	-	3 kN/sq.m
Lift	-	5 kN/sq.m
Roof Garden	-	3 kN/sq.m
Terrace	-	1.5 kN/sq.m

3.3 LOAD COMBINATIONS

STRENGTH LOAD COMBINATIONS

- 1.5 (DL)
- 1.5 (DL + LL)

SERVICE LOAD COMBINATIONS

- 1.0 (DL + LL)

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4. MATERIAL PROPERTIES

4.1 General

This chapter describes the physical and elastic properties for various materials used. These are used for defining the stiffness calculation of the modelled structural members and lumped mass calculations for static analysis model.

4.2 Elastic & Physical Properties

The elastic properties of materials used are tabulated below in Table 1

Table.1 – **Elastic properties of materials**

S.No.	Material	Elastic Modulus (kPa)	Poisson's Ratio
1	Normal density reinforced concrete (M25 Grade)	25×10^3 calculated using $5000\sqrt{fck}$	0.2

4.3 Grade of Reinforcement

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

4.4 Unit Weight of Materials

Unit weight of various materials used are given below

Reinforced cement concrete = 25 kN/m^3

Light Weight Brick (AAC Blocks) = 8 kN/m^3

5 ANALYSIS

5.1 General

The analysis of the structure is carried out by mathematical modelling of the structure in Etabs and performing an analysis run.

5.2 Mathematical Modeling of Structure

The Proposed building is modeled and analyzed using Etabs. The physical structure of building is transformed into a mathematical model for structural analysis using 3D frame elements. Entire structure is composed of integrated three dimensional structure of columns and beams forming frames tied together with slabs to act as one unit responding to the loading on the structure. The discretization of the structure involves structural components such as RC walls & columns, RC beams and RC slabs.

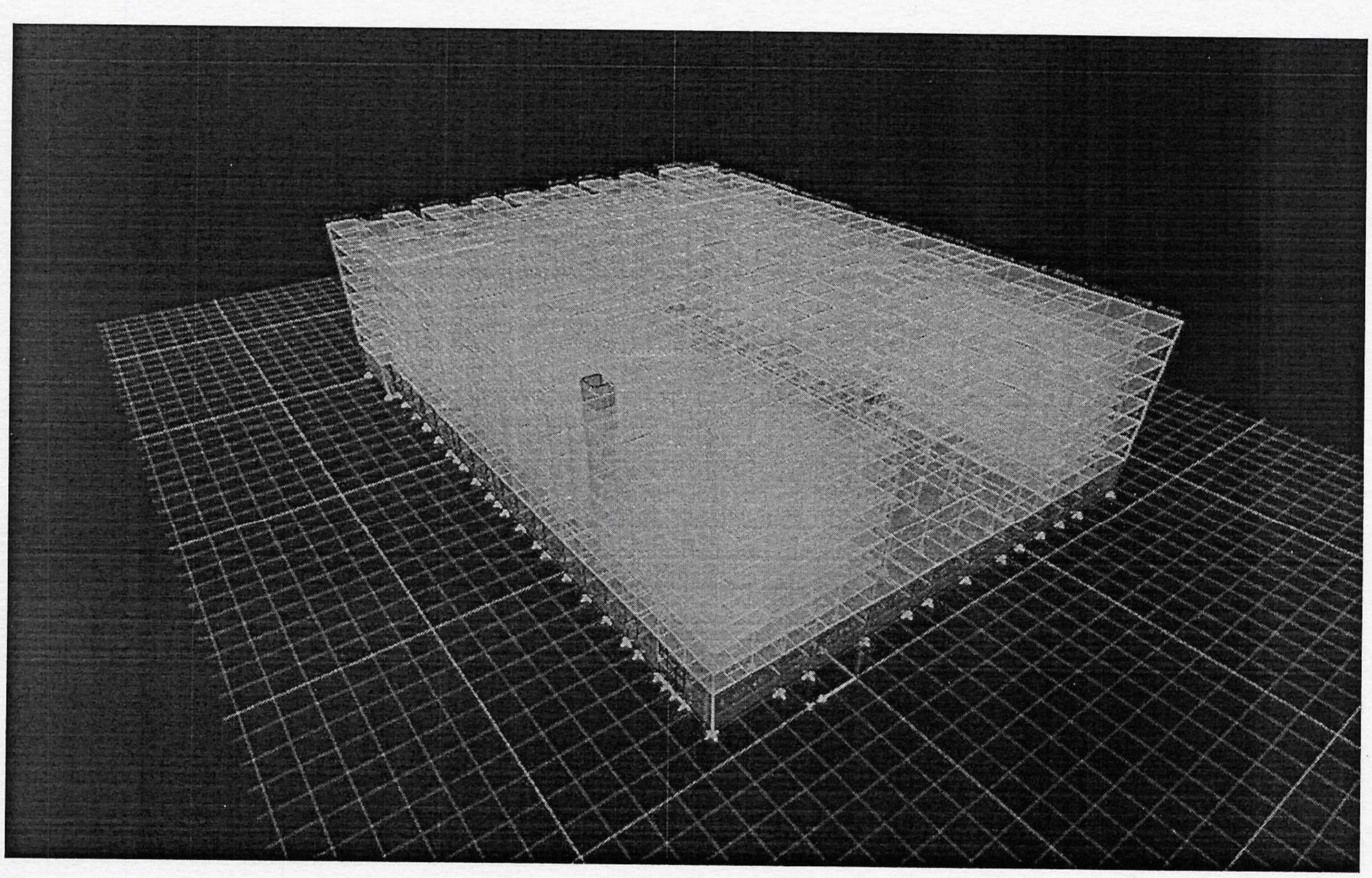

Fig. 1 – 3D Model of the Structure – Nexus City

5.3 Approximations in Modelling

Following approximations are made in the modelling of the building:

Offset eccentricities between centre-line of column & beams are ignored. Accordingly, nodal co-ordinates are fixed.

The non-structural components like brick walls are neglected in modelling, but their loading effect on the structure is accounted.

Column positions are shifted marginally for aligning them along the grid lines.

5.4. Boundary Conditions

For the purpose of analysis and design, the bottoms of the columns are pinned at the foundation level.

5.5 Analysis for Static Loading

The static analysis is carried out to obtain the internal forces and moments on all the member of the structure under static loads. Analysis is performed for each of the load cases mentioned below.

1. Dead load
2. Live load

6 DESIGN OF RC MEMBERS

6.1 General

Limit State design using IS: 456-2000 is carried out for RC beams and columns using the forces obtained from the critical combination of loads from the analysis results in Etabs. Other components like foundations and Slabs are designed using simplified provisions as per applicable codes with the help of spread sheets developed in-house.

6.2 Nominal Clear Cover to Reinforcement

Nominal clear cover used for various elements are listed below:

Footing	:	50mm
Column	:	40mm
Grade beam	:	25mm
Floor & other beam	:	25mm
Slab	:	15mm

6.3 Foundation Parameters

The following parameters are used in the design of foundation.

Safe Bearing capacity of the soil	=	365 kN/m^2 @ -2.5m from N.G.L.
Settlement of soil	=	50mm
Factor of Safety	=	3

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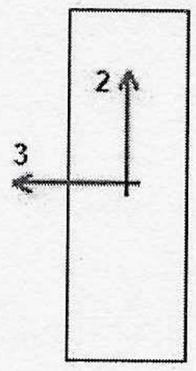
6.4 Beam Design

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design



Beam Element Details Type: Ductile Frame (Summary)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF
G3 Roof	B2187	6302	B - 200x600	1.5DL + 1.5SDL + 1.5LL	0	1750	1

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	600	200	0	60	60

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
25000	25	1	500	500

Design Code Parameters

γ_C	γ_S
1.5	1.15

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Factored Forces and Moments

Factored M_{u3} kN-m	Factored T_u kN-m	Factored V_{u2} kN	Factored P_u kN
156.5792	2.7323	55.9562	0.213

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M_t kN-m	Positive Moment kN-m	Negative Moment kN-m
156.5792	6.4289	163.0081	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		65	0	0	65
Bottom (-2 Axis)		163.0081	821	821	0	259

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
55.9562	61.8781	43.2	0	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
2.7323	55.9562	100	500	275.48

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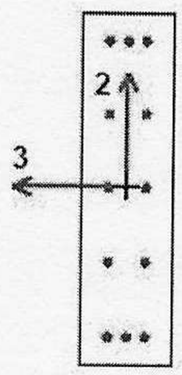
6.5 Column Design

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design



Column Element Details Type: Ductile Frame (Summary)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF
WT	C24	8622	C - 200 x 750	1.5DL + 1.5SDL + 1.5LL	1900	2500	1

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
200	750	60	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
25000	25	1	500	500

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 % %
243.1656	11.1167	-153.1821	4.8633	7.0032	1200	0.8

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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	1900	-61.2729	0	7.0032
Minor Bend(M2)	1	1900	-7.2789	0	4.8633

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}	150.5359	75.184	75.3519	0	302.62
Minor, V_{u3}	15.4507	64.3261	42.0006	0	831.33

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/A	N/A	N/A	N/A	N/A	N/A
Minor Shear, V_{u3}	N/A	N/A	N/A	N/A	N/A	N/A

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/A	N/A

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
1500	12	2137.5	699.3439	243.1656	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	0.76	750	2.533	12	No	0
Minor Bending (M_2)	Yes	0.76	200	9.5	12	No	0

Notes:

N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

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6.6 Slab Design

Design of Two-Way Slab

1	Size of the slab				
	Breadth of the slab	l_x	=	3.70	m
	Length of the slab	l_y	=	6.70	m
2	Assumed thickness of slab	D	=	125	mm
3	Grade of concrete	f_{ck}	=	25	N/mm2
4	Grade of steel	f_y	=	500	N/mm2
5	Condition of slab		=	**One short edge continuos**	
6	**Load considerations :**				
	Self weight of the slab	W_{se}	=	3.13	kN/m2
	Floor finish loads on slab	W_{ff}	=	1.00	kN/m2
	Live load on slab	W_{LL}	=	2.00	kN/m2
			=	3.13	kN/m2
	Total dead load on slab	W_{td}	=	4.13	kN/m2
	Total live load on slab	W_{tL}		2.00	kN/m2

7 **Bending moment & Ast Calculations :**

Edge condition of the slab = **One short edge continuos**

Shorter direction steel requirements :

Support condition	Coeff a	BM M_u	M_u/bd^2	P_t % A_{st}	A_{st} mm^2	Bar spacing (mm) 8f	10f	12f
Continues support	0.000	0.0	0.0	0.00	150.0	0	0	0
Span moment	0.098	12.3	1.12	0.27	285.8	180	280	315
Discontinuous Support	0.042	5.2	0.48	0.11	150.0	315	315	315

Longer direction steel requirements :

Support condition	Coeff a	BM M_u	M_u/bd^2	P_t % A_{st}	A_{st} mm^2	Bar spacing (mm) 8f	10f	12f
Continues support	0.058	7.3	0.66	0.16	165.0	310	315	315

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Span moment	0.044	5.5	0.50	0.12	150.0	315	315	315
Discontinuous Support	0.042	5.2	0.48	0.11	150.0	315	315	315

8 **Check for under reinforced section :**

Limiting moment of resistance Mu lim = 0.138 x fck x bd^2

= 38.0 kN.m > 12.3 kN.m

Depth required for flexure d = 59.8 mm < 105 mm

Depth is sufficient

9 **Check the depth for deflection :**

Diameter of the rod used	f	=	8	mm			
Provided spacing			100	mm			
Percentage of steel	% Ast	=	0.48	%			
MF due to effect of tension steel	MF	=	1.80				
Depth required for deflection	d	=	79	mm	<	105	mm

Slab safe for deflection

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6.7 Foundation Design

Factored load on the column	P_u	=	2532		kN
Safe bearing capacity of soil	SBC	=	365		kN/m^3
Grade of concrete	f_{ck}	=	25		N/mm^2
Grade of steel	f_y	=	500		N/mm^2
Size of column	b	=	300		mm
	D	=	600		mm
	A	=	5.1		m^2
Footing Dimensions	l	=	2.30		m
	b		2.30		m
Ultimate pressure below foundation		=	478.6		kN/m^2

Depth for Punching shear

Design shear strength	t_c	=	1.25			N/mm^2
Actual punching shear eqn.		=	d^2	d	constant	
			-0.15	-430.78	2445845	
Allowable punching shear eqn.		=	d^2	d	constant	
			5.0	2250.0	0	
Depth required for punching d		=		**466.9**		mm

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shear

Depth for Bending moment

BM about minor axis of column	m_u	=	293.3	kN.m
Depth required for bending moment	d	=	***268.3***	mm
Depth taken for iteration calculations	D	=	525.0	mm

Depth for one-way shear

Iterated Percentage of steel	p_t	=	0.21	%
Design shear strength	t_c	=	0.34	N/mm^2
Depth required for One way shear	d	=	***499.0***	mm
	D	=	550.0	mm
Governing depth of footing	D	=	**575**	mm
Size of footing to provide		=	2.3x2.3x0.575	m

Area of steel calculation

A_{st}^2	A_{st}	Constant
8.7	-228375	239319471

A_{st} = **2515** mm^2

Provide 16mm dia rods @ 125 mm c/c

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6.5 RC Wall Design

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
B Roof	P1	7850	12296	3500	200	0.667

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	413.69	413.69

Design Code Parameters

Γ_s	Γ_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	6100	12296	9600	12296	3500	200
Bottom	Leg 1	6100	12296	9600	12296	3500	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm^2)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN	M_{u2} kN-m	M_{u3} kN-m	Pier A_g mm^2
Top	1750	0.0025	0.0022	DWalS2	854.6398	-17.0928	-142.7024	700002
Bottom	1750	0.0025	0.0022	DWalS2	1564.9798	35.1945	-61.2372	700002

Shear Design

Station Location	ID	Rebar mm^2/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	DWalS2	854.6398	-142.7024	110.934	1279.4841	1783.1024
Bottom	Leg 1	500	DWalS2	1564.9798	-61.2372	16.0374	1279.4841	1783.1024

******** END OF REPORT ********

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