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STRUCTURAL DESIGN BASIS REPORT

FOR

PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS COMMERCIAL BUILDING AT OLD NO. 97, NEW NO.72,G.N. CHETTY ROAD, T. NAGAR CHENNAI ,TAMIL NADU, INDIA

DESIGNAGE
Consulting Structural Engineers

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MARS SYNERGY GEOTECH PVT LTD

R2–21 NOV. 2022

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1. INTRODUCTION

2. DESIGN LOADS
   - 2.1 Material Dead Loads
   - 2.2 Weight of Walls
   - 2.3 Dead Loads
   - 2.4 Wind Loads
   - 2.5 Earthquake Load

3. CHECK FOR LATERAL SWAY

4. CHECK FOR LATERAL SWAY (STOREY DRIFT)

5. BASIC LOAD CASES

6. BASIC LOADS AND LOAD COMBINATIONS

7. ANALYSIS METHOD

8. DESIGN METHODOLOGY

9. CONSTRUCTION DETAILS

10. REINFORCEMENT

11. EXPOSURE CONDITION

12. COVER TO REINFORCEMENT

13. FOUNDATION SYSTEM

14. FIRE RATING

15. CODES AND STANDARDS

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1. INTRODUCTION

The proposed development consists of **Stilt + 4 Floors + Terrace**. Tower is mean for use as commercial apartments. The Stilt Floor to be used as Parking Area & for Services. The 1st to 4th floor to be used for office purposes. Tower is meant for use as commercial building. Lift machine rooms are above the terrace level.

The Structural system for building consists of column, shear walls, beams & slabs. Shear walls are the part of Lateral Load Resistance system.

The floor to floor height of respective floors is as shown below.

Floor level	Floor to Floor Ht (m)
Stilt Floor	3.00
1st Floor to 4th Floor	3.25

The total height of building up to Terrace level is 16.00 meter (excluding parapet) from Stilt Floor level.

2. DESIGN LOADS

2.1 Material Dead Loads as per IS875 (part-1) :

The self-weight of the various elements are computed based on the built weight of materials as given below.

The self-weight of the various elements are computed based on size and density of materials as given below:-

Density of Reinforced Cement Concrete	=	25 kN/m^3
Density of Plain Cement Concrete	=	24 kN/m^3
Density of Steel	=	78.5 kN/m^3
Density of Soil	=	18 kN/m^3
Density of Saturated Soil	=	20 kN/m^3
Density of Water	=	10 kN/m^3
Density of Brickwork	=	18 kN/m^3
Density of Plum Concrete	=	24 kN/m^3

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2.2 Weight of Walls:

External Brick Wall with 200 thk = 4.0 kN/m^2

Internal Brick Wall with 150 thk = 3 kN/m^2

Typical calculations for wall load :

External Wall with 200 thick Brick wall

Brick wall Density = 18 kN/ cu. meter

Plaster Density = 20.4 kN/ cu. meter

Plaster thickness = 15mm (Internal + External)

Wall Load = (0.20x18+0.015x20.4)=3.91KN/m^2≈4KN/m^2

Internal Wall with 100 thick Brick wall

Brick wall Density = 18 kN/ cu. meter

Plaster Density = 20.4 kN/ cu. meter

Plaster thickness = 15mm (Internal+ External)

Wall Load = (0.15x18+0.015x20.4)=3.006KN/m^2≈3KN/m^2

Note: For localized design of slabs, wall loading shall be applied as per actual layout.

2.3 DEAD& LIVE LOADS:

The construction load, super imposed dead load that are envisaged to act permanently (wherever applicable) as per IS:875(part-1)–1987 & Live loads for each occupancy category as per IS:875(part-2)–1987 and Live load reduction is considered as per IS:875(part-2) CL.3.2.

2.3.1 PARKING AREA

Description		KN/m^2
Dead Load	Slab & beam	Self-weight
Superimposed Dead Load	Floor Finishes including screed (50mm Thk Tremix)	1.0
	Services	0.5
Live Load	Parking Area	4.0

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2.3.2 1ST TO 4TH TYPICAL COMMERCIAL FLOORS

Description		KN/m²
Dead Load	Slab & Beam	Self-weight
Superimposed Dead Load	Floor Finishes	1
	Toilet Sunk 200 mm (Including Finish)	4
	Services	0.5
Live Load	Offices	4
	Toilet	2
	Balconies	3
	Corridors, Passages, Staircase including fire escapes, Lift lobbies,	4
	Parking Area	4

2.3.3 TERRACE LEVEL

Description		
Dead Load	Slab & Beam	Self-weight
	Water proofing & Floor Finishes including screed (150mm)	4.00 KN/m²
Live Load	Live	3.00 KN/m²

Description		
	Lift Machine Room	400KN per lift (as per architectural drawings)
	Head Room	200KN (Including Self Weight)

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2.4 WIND LOADS

The wind pressure is calculated on the basis of data furnished below and other provisions laid in IS875 (Part-3) – 2015

Basic Wind Speed	V_b	=	50 m/sec
Risk Coefficient	K_1	=	1 (Based on 50 years return period)
Terrain, Height Factor	K_2	=	1.06 (as per Table 2 of IS: 875 (Part 3) – 2015)
Terrain Category		=	II
	K_3	=	1
	K_4	=	1

Design Wind Speed (V_z)

$V_z = V_b \times K_1 \times K_2 \times K_3 \times K_4$

Where,
V_b =Basic Wind Speed
K_1 = Risk Co-efficient for different classes of structures in different wind speed zones.
K_2 = Terrain roughness & height factor.
K_3 = Topography factor.
K_4 = Importance factor for cyclonic region.

Design Wind Pressure

$P_z = 0.6V_z^2$

2.4.1 GUST FACTOR

Gust factor method shall be used as per clause No. 10.0 IS 875 (part 3) - 2015. (If required.)

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2.5 EARTHQUAKE LOAD

The loading due to earthquake is assessed as per the provisions of IS: 1893 (Part-1):2016

Seismic Zone		=	III
Soil type		=	I
Table-2	Zone factor (Z)	=	0.16
Table-6	Importance Factor (I)	=	1
Table-7	Response Reduction Factor (R)	=	4.0
	Height of buildings (H)	=	16.00m

Height of building considered from stilt floor for time period calculation.

Fundamental natural time period (Ta)

Ta(x) = 0.09H / √ d from CL.7.6.1– IS1893 (part – I):2016

Ta(y) = 0.09H / √ d from CL.7.6.1 – IS1893 (part – I):2016

Sa/g from FIG-2 IS 1893 (part I):2016.

Horizontal Seismic Co-Efficient

$$Ahx = \frac{Z \times I \, Sa}{2 \times R \, g}$$

$$Ahy = \frac{Z \times I \, Sa}{2 \times R \, g}$$

Dynamic analysis is performed using response reduction as per IS-1893(2016) Clause 7.7.

3. CHECK FOR LATERAL SWAY AS PER IS 456-2000 & IS 1893-2016

It is generally recognized that absolute sway is not a perceivable parameter; however, limiting sway is used to provide a reasonable level of stiffness and in order to limit damage to non-structural elements as well as limit size of curtain wall joints, etc.

Generally tall building lateral load resisting systems are sized on the basis of limiting overall lateral sways to limits of approximately Overall Height/500 under the 50 year return period wind loads, Overall Height/400 under the 20 year return period wind loads and Overall Height/250 under seismic loads.

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4. CHECK FOR LATERAL SWAY (STOREY DRIFT) AS PER IS- 1893-2016

The allowable lateral sway (storey drift) due to earthquake force should not exceed L/250, Where L is the storey height

5. BASIC LOAD CASES

The various loads are combined in accordance with the stipulations in IS: 875 (Part 5)-1987. Wherever imposed load is combined with earthquake load the appropriate part of the imposed

Load as specified in IS: 1893-2016 is adopted both for evaluating earthquake effect and for combined load effects, used in such combination.

5.1 Basic Load Cases

Load Case Type	Mark	Description
Primary	DL	SELF WEIGHT OF STRUCTURAL MEMBER
Primary	SDL	SUPERIMPOSED DEAD LOAD
Primary	LL1	LIVE LOAD =<3 kN/m^2 (Live 1)
Primary	LL2	LIVE LOAD > 3 kN/m^2 (Live 2)
Primary	LL3	NON REDUCIBLE LIVE LOAD
Primary	EQX	SEISMIC LOAD IN X DIRECTION
Primary	EQY	SEISMIC LOAD IN Y DIRECTION
Primary	WLX	WIND LOAD IN X DIRECTION
Primary	WLY	WIND LOAD IN Y DIRECTION
Primary	SLX	SEISMIC LOAD IN X DIRECTION
Primary	SLY	SEISMIC LOAD IN Y DIRECTION

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6. BASIC LOADS AND LOAD COMBINATIONS

The various loads are combined in accordance with the stipulations in IS: 875 (Part 5)-1987. Wherever imposed load is combined with earthquake load the appropriate part of the imposed load as specified in IS: 1893-2016 is adopted both for evaluating earthquake effect and for combined load effects, used in such combination.

Description of Load Combination	Load Factor for Primary Load Cases				
	Dead Load	Live Load	Wind Load	Seismic Load	Temp Load
Dead load	1.5	0.0	0.0	0.0	0.0
Dead load + Live load	1.5	1.5	0.0	0.0	0.0
Dead load+Wind load	1.5	0.0	±1.5	0.0	0.0
Dead load+Seismic load	1.5	0.0	0.0	±1.5	0.0
Dead load+Live load+Wind	1.2	1.2	±1.2	0.0	0.0
Dead load+Live load+Seismic	1.2	1.2	0	±1.2	0.0
Dead Load + Wind Load	0.9	0.0	±1.5	0.0	0.0
Dead Load + Seismic Load	0.9	0.0	0.0	±1.5	0.0

7. ANALYSIS METHOD

The structure is analyzed for Static loads (both dead and live loads) and Lateral loads due to Earthquake/Wind loads and its combinations. Software used is E-Tabs version 19.0.0 & for foundation safe version 16.0.2.
The structure will be modeled as 3D space frame. Floor slabs shall be modeled as membrane elements for diaphragm effect only.

8. DESIGN METHODOLOGY

All structural members will be designed according to the Limit State Method as specified in IS: 456-2000. Appropriate loads and its combinations, as per relevant clauses in Code IS 456:2000 Code IS 875 (Part-5) 1987, for the most unfavorable effects are chosen for design.
Limit state method is adopted for design of overhead water tanks by using IS-3370(2009)

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9. CONSTRUCTION DETAILS

1. Pile, Pile caps -M: 30
2. Water Tanks -M: 30
3. Columns/Walls -M: 30
4. Beams & Slabs -M: 30

10. REINFORCEMENT

Steel reinforcement shall be of Grade Fe 500 conforming to IS: 1786-1985.

11. EXPOSURE CONDITION

Structural elements below ground level and Exterior External faces of walls are designed for severe exposure condition and internal faces of walls, floor beams and slabs are designed for Mild exposure conditions per Table 16 of IS 456-2000.

12. COVER TO REINFORCEMENT

As per Table 16A-IS: 456-2000.

Member	Clear Cover (mm)
Pile, Pile Cap	75 mm
Column	40 mm
Shear Walls	40 mm
Beams	40 mm
Slabs	20 mm
Staircase waist slab	30 mm
Water Tanks	40 mm

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13. FOUNDATION SYSTEM

The building has been supported on Pile Foundation.

Pile diameter & Pile capacity are considered as per soil investigation report provided by MARS SYNERGY GEOTECH Pvt. Ltd.

14. FIRE RATING

Fire rating of 2 hours is considered for columns and 1.5 hours for beam and slabs.

15. CODES AND STANDARDS

All the designs are conforming to the relevant Indian Standards. Some of the relevant Indian Standard Codes, which have been followed for the structural designs, are given below.

Code	Description
IS:875 (Part-1)-1987	Code of Practice for Design Loads (Other than Earthquake) for Building 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 Building and Structures-Imposed loads
IS:875 (Part-3)-2015	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Wind Load.
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:1893 (Part-1)-2016	Indian Standard Criteria for Earthquake Resistant Design of Structures
IS:432 (Part-1)-1982	Specification of Mild Steel and Medium Tensile Steel bars and Hard drawn Steel Wire for concrete reinforcement -Mild Steel and Medium Tensile Steel Bars
IS:432 (Part-2)-1982	Specification of Mild Steel and Medium Tensile Steel bars and Hard drawn Steel Wire for concrete reinforcement -Hard drawn Steel Wire.
IS:1786-1985	Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement
IS:13920-2016	Ductile Detailing of reinforced concrete structures subjected to seismic forces - code of practice.
IS:1904	Indian Standard Code of practice for Design & Construction foundations in Soil: General Requirements.
IS:1642-1989	Indian Standard Code of practice for Fire Safety of Buildings (General): Details of Construction.

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IS:3370-2009	Indian Standard Code of practice for Concrete Structures for Storage of Liquids.
IS:1343-1980	Indian Standard Code of practice for Pre-stressed Concrete.

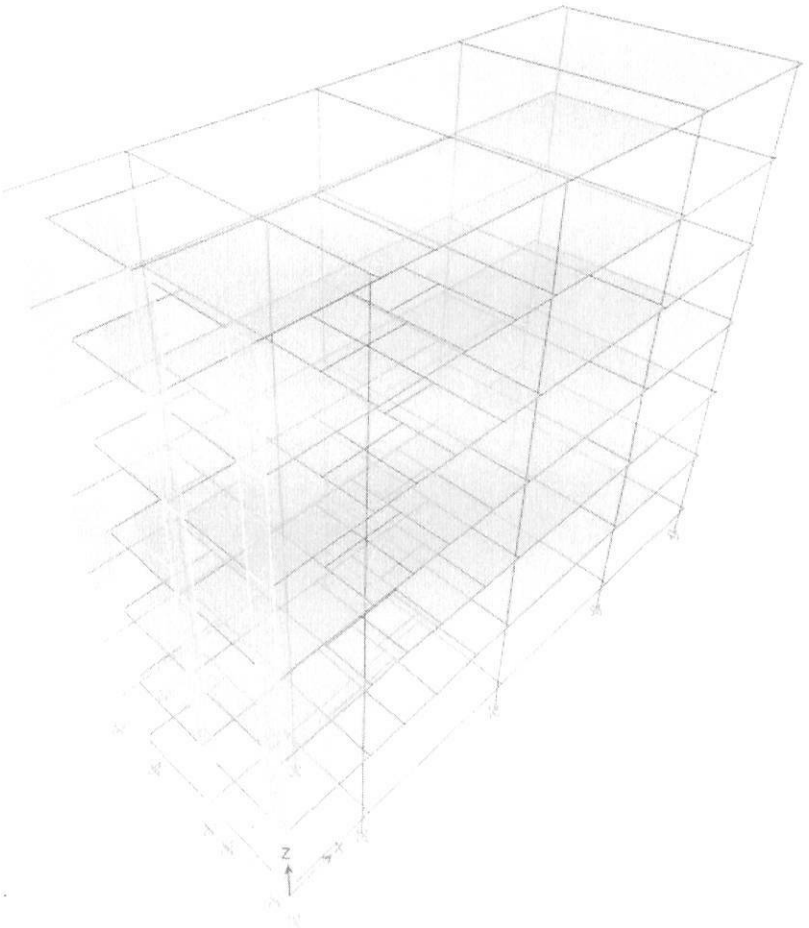
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1 Structure Data

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 Data

Name	Height mm	Elevation mm	Master Story	Similar To	Splice Story
TERRACE	3250	19250	Yes	None	No
FIFTH(PROV.)	3250	16000	No	None	No
FOURTH	3250	12750	No	None	No
THIRD	3250	9500	No	None	No
SECOND	3250	6250	No	None	No
FIRST	3000	3000	No	TERRACE	No
STILT	1500	0	No	None	No
Base	0	-1500	No	None	No

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2 Loads

This chapter provides loading information as applied to the model.

2.1 Load Patterns

Table 2.1 - Load Patterns

Name	Type	Self Weight Multiplier	Auto Load
Dead	Dead	1	
Finish	Superimposed Dead	0	
Sunk	Superimposed Dead	0	
Wall	Superimposed Dead	0	
Services	Superimposed Dead	0	
Live	Live	0	
Eqx	Seismic	0	IS 1893:2016
Eqy	Seismic	0	IS 1893:2016
LMR OHWT	Superimposed Dead	0	
Wind	Wind	0	Indian IS 875:2015

2.2 Auto Seismic Loading

Table 2.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)

R	Period Used sec	Coeff Used	Weight Used kN	Base Shear kN
4	0.729	0.027429	21748.6135	596.5361
4	0.729	0.027429	21748.6135	596.5361
4	0.729	0.027429	21748.6135	596.5361
4	0.729	0.027429	21748.6135	596.5361
4	0.729	0.027429	21748.6135	596.5361
4	0.729	0.027429	21748.6135	596.5361

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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 = Multiple

Eccentricity Ratio = 5% for all diaphragms

Structural Period

Period Calculation Method = Approximate

Structure Height Above Base, h_n		$h_n = 20.75$ m
Coefficient, C_t [IS 7.6.1]		$C_t = 0.075$m
Approximate Fundamental Period, T_a [IS 7.6.2]	$T_a = C_t h_n^{0.75}$	$T_a = 0.729$ 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]	$I = 1$

Site Type [IS Table 1] = I

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

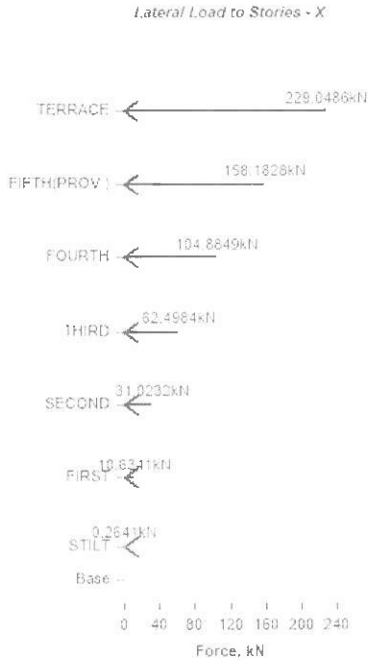
Seismic Coefficient, A_h [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
X	0.729	21748.6135	596.5361
X + Ecc. Y	0.729	21748.6135	596.5361
X - Ecc. Y	0.729	21748.6135	596.5361

Applied Story Forces

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Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
TERRACE	19.25	229.0486	0
FIFTH(PROV.)	16	158.1828	0
FOURTH	12.75	104.8849	0
THIRD	9.5	62.4984	0
SECOND	6.25	31.0232	0
FIRST	3	10.6341	0
STILT	0	0.2641	0
Base	-1.5	0	0

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IS 1893:2016 Auto Seismic Load Calculation

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Direction and Eccentricity

Direction = Multiple

Eccentricity Ratio = 5% for all diaphragms

Structural Period

Period Calculation Method = Approximate

Structure Height Above Base, h_n		$h_n = 20.75$ m
Coefficient, C_t [IS 7.6.1]		$C_t = 0.075$m
Approximate Fundamental Period, T_a [IS 7.6.2]	$T_a = C_t h_n^{0.75}$	$T_a = 0.729$ 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]	$I = 1$

Site Type [IS Table 1] = I

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

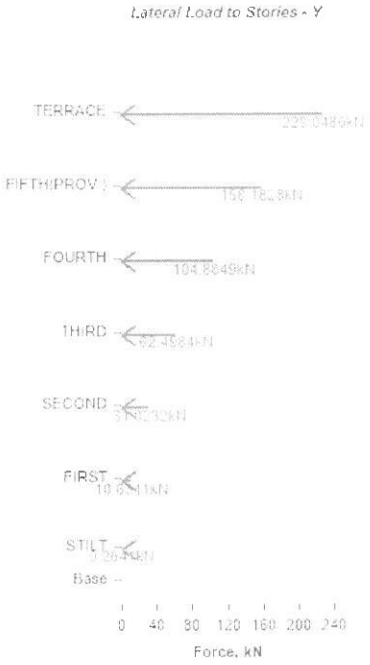
Seismic Coefficient, A_h [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
Y	0.729	21748.6135	596.5361
Y + Ecc. X	0.729	21748.6135	596.5361
Y - Ecc. X	0.729	21748.6135	596.5361

Applied Story Forces

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Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
TERRACE	19.25	0	229.0486
FIFTH(PROV.)	16	0	158.1828
FOURTH	12.75	0	104.8849
THIRD	9.5	0	62.4984
SECOND	6.25	0	31.0232
FIRST	3	0	10.6341
STILT	0	0	0.2641
Base	-1.5	0	0

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2.3 Load Cases

Table 2.6 - Load Cases - Summary

Name	Type
Dead	Linear Static
Finish	Linear Static
Sunk	Linear Static
Wall	Linear Static
Services	Linear Static
LMR OHWT	Linear Static
Live	Linear Static
Eqx	Linear Static
Eqy	Linear Static
Specx	Response Spectrum
Specy	Response Spectrum
Wind	Linear Static
1	Linear Static

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3 Analysis Results

This chapter provides analysis results.

3.1 Structure Results

Table 3.1 - Base Reactions

Load Case/Combo	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m	X m	Y m	Z m
Dead	0	0	11393.4032	54639.0735	-132683.4487	0	0	0	-1.5
Finish	0	0	1834.5721	8242.9075	-19280.9963	0	0	0	-1.5
Sunk	0	0	411.285	852.9351	-2425.4017	0	0	0	-1.5
Wall	0	0	5115.6286	21779.0022	-50890.6437	0	0	0	-1.5
Services	0	0	392.2277	1973.1184	-5507.5141	0	0	0	-1.5
LMR OHWT	0	0	500	2901.9287	-1199.9682	0	0	0	-1.5
Live	0	0	4369.2571	20457.6524	-53073.727	0	0	0	-1.5
Eqx 1	-596.5361	0	0	0	-9991.7289	2772.257	0	0	-1.5
Eqx 2	-596.5361	0	0	0	-9991.7289	3034.4841	0	0	-1.5
Eqx 3	-596.5361	0	0	0	-9991.7289	2510.0299	0	0	-1.5
Eqy 1	0	-596.5361	0	9991.7289	-1.166E-06	-6402.1646	0	0	-1.5
Eqy 2	0	-596.5361	0	9991.7289	-1.253E-06	-7055.9677	0	0	-1.5
Eqy 3	0	-596.5361	0	9991.7289	-1.08E-06	-5748.3614	0	0	-1.5
Specx Max	596.5361	174.9491	0	2370.4965	7924.1467	3985.207	0	0	-1.5
Specy Max	181.3893	596.5362	0	7900.344	2459.0777	7277.1185	0	0	-1.5
Wind 1	-381.0296	0	0	0	-4551.29	1793.6299	0	0	-1.5
Wind 2	0	-947.8364	0	11344.4872	-1.415E-06	-10864.8727	0	0	-1.5
1	0	0	0	0	0	0	0	0	-1.5
UDCon1	0	0	29470.675	135583.4482	-317981.9591	0	0	0	-1.5
UDCon2	0	0	36024.5606	166269.9268	-397592.5497	0	0	0	-1.5
UDCon3 Max	0	0	28819.6485	146629.326	-318074.0397	2152.3559	0	0	-1.5
UDCon3 Min	-457.2355	-1137.4036	28819.6485	133015.9414	-323535.5877	-13037.8473	0	0	-1.5
UDCon4 Max	457.2355	1137.4036	28819.6485	133015.9414	-312612.4918	13037.8473	0	0	-1.5
UDCon4 Min	0	0	28819.6485	119402.5569	-318074.0397	-2152.3559	0	0	-1.5
UDCon5 Max	0	0	29470.675	152600.1789	-317981.9591	2690.4449	0	0	-1.5
UDCon5 Min	-571.5444	-1421.7545	29470.675	135583.4482	-324808.8941	-16297.3091	0	0	-1.5
UDCon6 Max	571.5444	1421.7545	29470.675	135583.4482	-311155.0241	16297.3091	0	0	-1.5
UDCon6 Min	0	0	29470.675	118566.7174	-317981.9591	-2690.4449	0	0	-1.5
UDCon7 Max	0	0	17682.405	98366.7996	-190789.1755	2690.4449	0	0	-1.5
UDCon7 Min	-571.5444	-1421.7545	17682.405	81350.0689	-197616.1104	-16297.3091	0	0	-1.5
UDCon8 Max	571.5444	1421.7545	17682.405	81350.0689	-183962.2405	16297.3091	0	0	-1.5
UDCon8 Min	0	0	17682.405	64333.3382	-190789.1755	-2690.4449	0	0	-1.5

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Load Case/Combo	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m	X m	Y m	Z m
UDCon9 Max	-715.8433	0	28819.6485	133015.9414	-330064.1144	3641.3809	0	0	-1.5
UDCon9 Min	-715.8433	0	28819.6485	133015.9414	-330064.1144	3012.0359	0	0	-1.5
UDCon10 Max	715.8433	0	28819.6485	133015.9414	-306083.965	-3012.0359	0	0	-1.5
UDCon10 Min	715.8433	0	28819.6485	133015.9414	-306083.965	-3641.3809	0	0	-1.5
UDCon11 Max	0	-715.8433	28819.6485	145006.0161	-318074.0397	-6898.0337	0	0	-1.5
UDCon11 Min	0	-715.8433	28819.6485	145006.0161	-318074.0397	-8467.1613	0	0	-1.5
UDCon12 Max	0	715.8433	28819.6485	121025.8667	-318074.0397	8467.1613	0	0	-1.5
UDCon12 Min	0	715.8433	28819.6485	121025.8667	-318074.0397	6898.0337	0	0	-1.5
UDCon13 Max	-894.8042	0	29470.675	135583.4482	-332969.5525	4551.7262	0	0	-1.5
UDCon13 Min	-894.8042	0	29470.675	135583.4482	-332969.5525	3765.0449	0	0	-1.5
UDCon14 Max	894.8042	0	29470.675	135583.4482	-302994.365	-3765.0449	0	0	-1.5
UDCon14 Min	894.8042	0	29470.675	135583.4482	-302994.365	-4551.7262	0	0	-1.5
UDCon15 Max	0	-894.8042	29470.675	150571.0415	-317981.9591	-8622.5422	0	0	-1.5
UDCon15 Min	0	-894.8042	29470.675	150571.0415	-317981.9591	-10583.9516	0	0	-1.5
UDCon16 Max	0	894.8042	29470.675	120595.8548	-317981.9591	10583.9516	0	0	-1.5
UDCon16 Min	0	894.8042	29470.675	120595.8548	-317981.9591	8622.5422	0	0	-1.5
UDCon17 Max	-894.8042	0	17682.405	81350.0689	-205776.7688	4551.7262	0	0	-1.5
UDCon17 Min	-894.8042	0	17682.405	81350.0689	-205776.7688	3765.0449	0	0	-1.5
UDCon18 Max	894.8042	0	17682.405	81350.0689	-175801.582	-3765.0449	0	0	-1.5
UDCon18 Min	894.8042	0	17682.405	81350.0689	-175801.582	-4551.7262	0	0	-1.5
UDCon19 Max	0	-894.8042	17682.405	96337.6623	-190789.1755	-8622.5422	0	0	-1.5
UDCon19 Min	0	-894.8042	17682.405	96337.6623	-190789.1755	-10583.9516	0	0	-1.5
UDCon20 Max	0	894.8042	17682.405	66362.4755	-190789.1755	10583.9516	0	0	-1.5
UDCon20 Min	0	894.8042	17682.405	66362.4755	-190789.1755	8622.5422	0	0	-1.5
UDCon21 Max	715.8433	209.9389	28819.6485	135860.5372	-308565.0638	4782.2484	0	0	-1.5

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Load Case/Combo	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m	X m	Y m	Z m
UDCon21 Min	-715.8433	-209.9389	28819.6485	130171.3456	-327583.0157	-4782.2484	0	0	-1.5
UDCon22 Max	217.6671	715.8435	28819.6485	142496.3543	-315123.1465	8732.5422	0	0	-1.5
UDCon22 Min	-217.6671	-715.8435	28819.6485	123535.5286	-321024.933	-8732.5422	0	0	-1.5
UDCon23 Max	894.8041	262.4236	29470.675	139139.1929	-306095.7391	5977.8105	0	0	-1.5
UDCon23 Min	-894.8041	-262.4236	29470.675	132027.7034	-329868.179	-5977.8105	0	0	-1.5
UDCon24 Max	272.0839	894.8043	29470.675	147433.9642	-314293.3426	10915.6777	0	0	-1.5
UDCon24 Min	-272.0839	-894.8043	29470.675	123732.9321	-321670.575	-10915.6777	0	0	-1.5
UDCon25 Max	894.8041	262.4236	17682.405	84905.8136	-178902.9555	5977.8105	0	0	-1.5
UDCon25 Min	-894.8041	-262.4236	17682.405	77794.3242	-202675.3954	-5977.8105	0	0	-1.5
UDCon26 Max	272.0839	894.8043	17682.405	93200.5849	-187100.5589	10915.6777	0	0	-1.5
UDCon26 Min	-272.0839	-894.8043	17682.405	69499.5529	-194477.792	-10915.6777	0	0	-1.5
DWal1	0	0	29470.675	135583.4482	-317981.9591	0	0	0	-1.5
DWal2	0	0	36024.5606	166269.9268	-397592.5497	0	0	0	-1.5
DWal3 Max	0	0	28819.6485	146629.326	-318074.0397	2152.3559	0	0	-1.5
DWal3 Min	-457.2355	-1137.4036	28819.6485	133015.9414	-323535.587	-13037.8473	0	0	-1.5
DWal4 Max	457.2355	1137.4036	28819.6485	133015.9414	-312612.4918	13037.8473	0	0	-1.5
DWal4 Min	0	0	28819.6485	119402.5569	-318074.0397	-2152.3559	0	0	-1.5
DWal5 Max	0	0	29470.675	152600.1789	-317981.9591	2690.4449	0	0	-1.5
DWal5 Min	-571.5444	-1421.7545	29470.675	135583.4482	-324808.8941	-16297.3091	0	0	-1.5
DWal6 Max	571.5444	1421.7545	29470.675	135583.4482	-311155.0241	16297.3091	0	0	-1.5
DWal6 Min	0	0	29470.675	118566.7174	-317981.9591	-2690.4449	0	0	-1.5
DWal7 Max	0	0	17682.405	98366.7996	-190789.1755	2690.4449	0	0	-1.5
DWal7 Min	-571.5444	-1421.7545	17682.405	81350.0689	-197616.1104	-16297.3091	0	0	-1.5
DWal8 Max	571.5444	1421.7545	17682.405	81350.0689	-183962.2405	16297.3091	0	0	-1.5
DWal8 Min	0	0	17682.405	64333.3382	-190789.1755	-2690.4449	0	0	-1.5

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Load Case/Combo	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m	X m	Y m	Z m
DWal9 Max	-715.8433	0	28819.6485	133015.9414	-330064.1144	3641.3809	0	0	-1.5
DWal9 Min	-715.8433	0	28819.6485	133015.9414	-330064.1144	3012.0359	0	0	-1.5
DWal10 Max	715.8433	0	28819.6485	133015.9414	-306083.965	-3012.0359	0	0	-1.5
DWal10 Min	715.8433	0	28819.6485	133015.9414	-306083.965	-3641.3809	0	0	-1.5
DWal11 Max	0	-715.8433	28819.6485	145006.0161	-318074.0397	-6898.0337	0	0	-1.5
DWal11 Min	0	-715.8433	28819.6485	145006.0161	-318074.0397	-8467.1613	0	0	-1.5
DWal12 Max	0	715.8433	28819.6485	121025.8667	-318074.0397	8467.1613	0	0	-1.5
DWal12 Min	0	715.8433	28819.6485	121025.8667	-318074.0397	6898.0337	0	0	-1.5
DWal13 Max	-894.8042	0	29470.675	135583.4482	-332969.5525	4551.7262	0	0	-1.5
DWal13 Min	-894.8042	0	29470.675	135583.4482	-332969.5525	3765.0449	0	0	-1.5
DWal14 Max	894.8042	0	29470.675	135583.4482	-302994.365	-3765.0449	0	0	-1.5
DWal14 Min	894.8042	0	29470.675	135583.4482	-302994.365	-4551.7262	0	0	-1.5
DWal15 Max	0	-894.8042	29470.675	150571.0415	-317981.9591	-8622.5422	0	0	-1.5
DWal15 Min	0	-894.8042	29470.675	150571.0415	-317981.9591	-10583.9516	0	0	-1.5
DWal16 Max	0	894.8042	29470.675	120595.8548	-317981.9591	10583.9516	0	0	-1.5
DWal16 Min	0	894.8042	29470.675	120595.8548	-317981.9591	8622.5422	0	0	-1.5
DWal17 Max	-894.8042	0	17682.405	81350.0689	-205776.7688	4551.7262	0	0	-1.5
DWal17 Min	-894.8042	0	17682.405	81350.0689	-205776.7688	3765.0449	0	0	-1.5
DWal18 Max	894.8042	0	17682.405	81350.0689	-175801.582	-3765.0449	0	0	-1.5
DWal18 Min	894.8042	0	17682.405	81350.0689	-175801.582	-4551.7262	0	0	-1.5
DWal19 Max	0	-894.8042	17682.405	96337.6623	-190789.1755	-8622.5422	0	0	-1.5
DWal19 Min	0	-894.8042	17682.405	96337.6623	-190789.1755	-10583.9516	0	0	-1.5
DWal20 Max	0	894.8042	17682.405	66362.4755	-190789.1755	10583.9516	0	0	-1.5
DWal20 Min	0	894.8042	17682.405	66362.4755	-190789.1755	8622.5422	0	0	-1.5
DWal21 Max	715.8433	209.9389	28819.6485	135860.5372	-308565.0638	4782.2484	0	0	-1.5

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Load Case/Combo	FX kN	FY kN	FZ kN	MX kN-m	MY kN-m	MZ kN-m	X m	Y m	Z m
DWal21 Min	-715.8433	-209.9389	28819.6485	130171.3456	-327583.0157	-4782.2484	0	0	-1.5
DWal22 Max	217.6671	715.8435	28819.6485	142496.3543	-315123.1465	8732.5422	0	0	-1.5
DWal22 Min	-217.6671	-715.8435	28819.6485	123535.5286	-321024.933	-8732.5422	0	0	-1.5
DWal23 Max	894.8041	262.4236	29470.675	139139.1929	-306095.7391	5977.8105	0	0	-1.5
DWal23 Min	-894.8041	-262.4236	29470.675	132027.7034	-329868.1791	-5977.8105	0	0	-1.5
DWal24 Max	272.0839	894.8043	29470.675	147433.9642	-314293.3426	10915.6777	0	0	-1.5
DWal24 Min	-272.0839	-894.8043	29470.675	123732.9321	-321670.575	-10915.6777	0	0	-1.5
DWal25 Max	894.8041	262.4236	17682.405	84905.8136	-178902.9555	5977.8105	0	0	-1.5
DWal25 Min	-894.8041	-262.4236	17682.405	77794.3242	-202675.3954	-5977.8105	0	0	-1.5
DWal26 Max	272.0839	894.8043	17682.405	93200.5849	-187100.5589	10915.6777	0	0	-1.5
DWal26 Min	-272.0839	-894.8043	17682.405	69499.5529	-194477.792	-10915.6777	0	0	-1.5

3.2 Story Results

Table 3.2 - Story Max/Avg Displacements

Story	Load Case/Combo	Direction	Maximum mm	Average mm	Ratio
TERRACE	Wind 1	X	16.516	16.022	1.031
FIFTH(PROV.)	Wind 1	X	15.257	14.813	1.03
FOURTH	Wind 1	X	13.262	12.884	1.029
THIRD	Wind 1	X	10.493	10.202	1.028
SECOND	Wind 1	X	7.056	6.869	1.027
FIRST	Wind 1	X	3.319	3.235	1.026
STILT	Wind 1	X	0.506	0.492	1.028
TERRACE	Wind 2	Y	56.089	33.141	1.692
FIFTH(PROV.)	Wind 2	Y	51.514	30.122	1.71
FOURTH	Wind 2	Y	44.549	25.787	1.728
THIRD	Wind 2	Y	34.967	20.034	1.745
SECOND	Wind 2	Y	23.226	13.156	1.765
FIRST	Wind 2	Y	10.775	6.025	1.788
STILT	Wind 2	Y	1.647	0.918	1.793

Table 3.3 - Story Drifts

Story	Load Case/Combo	Direction	Drift	Label	X m	Y m	Z m
TERRACE	Dead	X	6.4E-05	134	0.1	0	19.25
TERRACE	Dead	Y	2.8E-05	132	2.0998	9.4146	19.25
TERRACE	Finish	X	1.5E-05	134	0.1	0	19.25
TERRACE	Finish	Y	1.8E-05	131	0.1	9.4146	19.25
TERRACE	Sunk	X	1.8E-05	134	0.1	0	19.25
TERRACE	Sunk	Y	7E-06	37	22.8256	9.1146	19.25
TERRACE	Wall	X	4.6E-05	134	0.1	0	19.25
TERRACE	Wall	Y	3.7E-05	131	0.1	9.4146	19.25

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Story	Load Case/Combo	Direction	Drift	Label	X m	Y m	Z m
TERRACE	Eqx 1	X	0.001258	134	0.1	0	19.25
TERRACE	Eqx 2	X	0.001233	134	0.1	0	19.25
TERRACE	Eqx 3	X	0.001284	134	0.1	0	19.25
TERRACE	Eqy 1	Y	0.001594	40	22.8256	0.15	19.25
TERRACE	Eqy 2	Y	0.001783	40	22.8256	0.15	19.25
TERRACE	Eqy 3	Y	0.001404	40	22.8256	0.15	19.25
TERRACE	Specx Max	X	0.00112	134	0.1	0	19.25
TERRACE	Specx Max	Y	0.00064	40	22.8256	0.15	19.25
TERRACE	Specy Max	X	0.000501	132	2.0998	9.4146	19.25
TERRACE	Specy Max	Y	0.001614	40	22.8256	0.15	19.25
FIFTH(PROV.)	Eqx 1	X	0.001799	134	0.1	0	16
FIFTH(PROV.)	Eqx 2	X	0.001765	134	0.1	0	16
FIFTH(PROV.)	Eqx 3	X	0.001833	134	0.1	0	16
FIFTH(PROV.)	Eqy 1	Y	0.002238	40	22.8256	0.15	16
FIFTH(PROV.)	Eqy 2	Y	0.002502	40	22.8256	0.15	16
FIFTH(PROV.)	Eqy 3	Y	0.001975	40	22.8256	0.15	16
FIFTH(PROV.)	Specx Max	X	0.001492	134	0.1	0	16
FIFTH(PROV.)	Specx Max	Y	0.000852	40	22.8256	0.15	16
FIFTH(PROV.)	Specy Max	X	0.000658	132	2.0998	9.4146	16
FIFTH(PROV.)	Specy Max	Y	0.002121	40	22.8256	0.15	16
FOURTH	Eqx 1	X	0.002207	134	0.1	0	12.75
FOURTH	Eqx 2	X	0.002165	134	0.1	0	12.75
FOURTH	Eqx 3	X	0.002248	134	0.1	0	12.75
FOURTH	Eqy 1	Y	0.002771	40	22.8256	0.15	12.75
FOURTH	Eqy 2	Y	0.003095	40	22.8256	0.15	12.75
FOURTH	Eqy 3	Y	0.002447	40	22.8256	0.15	12.75
FOURTH	Specx Max	X	0.001758	134	0.1	0	12.75
FOURTH	Specx Max	Y	0.00102	40	22.8256	0.15	12.75
FOURTH	Specy Max	X	0.000754	132	2.0998	9.4146	12.75
FOURTH	Specy Max	Y	0.002492	40	22.8256	0.15	12.75
THIRD	Eqx 1	X	0.002415	134	0.1	0	9.5
THIRD	Eqx 2	X	0.002371	134	0.1	0	9.5
THIRD	Eqx 3	X	0.00246	134	0.1	0	9.5
THIRD	Eqy 1	Y	0.003033	40	22.8256	0.15	9.5
THIRD	Eqy 2	Y	0.003388	40	22.8256	0.15	9.5
THIRD	Eqy 3	Y	0.002679	40	22.8256	0.15	9.5
THIRD	Specx Max	X	0.001951	134	0.1	0	9.5
THIRD	Specx Max	Y	0.001135	40	22.8256	0.15	9.5
THIRD	Specy Max	X	0.000827	132	2.0998	9.4146	9.5
THIRD	Specy Max	Y	0.002753	40	22.8256	0.15	9.5
SECOND	Eqx 1	X	0.002325	134	0.1	0	6.25
SECOND	Eqx 2	X	0.002283	134	0.1	0	6.25
SECOND	Eqx 3	X	0.002366	134	0.1	0	6.25
SECOND	Eqy 1	Y	0.002881	40	22.8256	0.15	6.25
SECOND	Eqy 2	Y	0.003218	40	22.8256	0.15	6.25
SECOND	Eqy 3	Y	0.002545	40	22.8256	0.15	6.25
SECOND	Specx Max	X	0.001992	134	0.1	0	6.25
SECOND	Specx Max	Y	0.001141	40	22.8256	0.15	6.25
SECOND	Specy Max	X	0.000847	132	2.0998	9.4146	6.25
SECOND	Specy Max	Y	0.002782	40	22.8256	0.15	6.25
FIRST	Eqx 1	X	0.001711	134	0.1	0	3
FIRST	Eqx 2	X	0.001682	134	0.1	0	3
FIRST	Eqx 3	X	0.00174	134	0.1	0	3

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Story	Load Case/Combo	Direction	Drift	Label	X m	Y m	Z m
FIRST	Eqy 1	Y	0.002085	40	22.8256	0.15	3
FIRST	Eqy 2	Y	0.002329	40	22.8256	0.15	3
FIRST	Eqy 3	Y	0.001841	40	22.8256	0.15	3
FIRST	Specx Max	X	0.001574	134	0.1	0	3
FIRST	Specx Max	Y	0.000879	40	22.8256	0.15	3
FIRST	Specy Max	X	0.000668	131	0.1	9.4146	3
FIRST	Specy Max	Y	0.002162	40	22.8256	0.15	3
STILT	Eqx 1	X	0.000582	134	0.1	0	0
STILT	Eqx 2	X	0.000572	134	0.1	0	0
STILT	Eqx 3	X	0.000592	134	0.1	0	0
STILT	Eqy 1	Y	0.000715	38	22.8256	0.3	0
STILT	Eqy 2	Y	0.000799	38	22.8256	0.3	0
STILT	Eqy 3	Y	0.000631	38	22.8256	0.3	0
STILT	Specx Max	X	0.000555	134	0.1	0	0
STILT	Specx Max	Y	0.000312	38	22.8256	0.3	0
STILT	Specy Max	X	0.000236	132	2.0998	9.4146	0
STILT	Specy Max	Y	0.00077	38	22.8256	0.3	0

3.3 Modal Results

Table 3.4 - Modal Periods and Frequencies

Case	Mode	Period sec	Frequency cyc/sec	Circular Frequency rad/sec	Eigenvalue rad²/sec²
Modal	1	1.779	0.562	3.5326	12.4791
Modal	2	1.686	0.593	3.7257	13.8812
Modal	3	0.832	1.202	7.5523	57.0366
Modal	4	0.534	1.872	11.762	138.3435
Modal	5	0.504	1.986	12.478	155.7003
Modal	6	0.274	3.652	22.9488	526.6457
Modal	7	0.253	3.946	24.792	614.641
Modal	8	0.22	4.555	28.6202	819.1186
Modal	9	0.167	6.001	37.7075	1421.8591
Modal	10	0.15	6.663	41.8665	1752.8043
Modal	11	0.114	8.792	55.2424	3051.7227
Modal	12	0.1	9.991	62.778	3941.0721
Modal	13	0.096	10.449	65.6535	4310.3774
Modal	14	0.087	11.453	71.9583	5177.9958
Modal	15	0.076	13.208	82.9888	6887.1333
Modal	16	0.052	19.077	119.8631	14367.1562
Modal	17	0.033	30.015	188.5917	35566.8477
Modal	18	0.028	36.265	227.8579	51919.2443
Modal	19	0.024	41.801	262.6439	68981.8367
Modal	20	0.023	44.438	279.2126	77959.684
Modal	21	0.021	46.615	292.89	85784.554

Table 3.5 - Modal Participating Mass Ratios (Part 1 of 2)

Case	Mode	Period sec	UX	UY	UZ	Sum UX	Sum UY	Sum UZ
Modal	1	1.779	0.3941	0.2615	0	0.3941	0.2615	0
Modal	2	1.686	0.4041	0.2842	0	0.7982	0.5457	0
Modal	3	0.832	0.0018	0.2215	0	0.8	0.7672	0
Modal	4	0.534	0.0807	0.0201	0	0.8806	0.7873	0
Modal	5	0.504	0.0286	0.0672	0	0.9093	0.8545	0
Modal	6	0.274	0.0372	0.0022	0	0.9465	0.8567	0
Modal	7	0.253	0.004	0.0176	0	0.9505	0.8743	0
Modal	8	0.22	1.117E-05	0.0566	0	0.9505	0.9309	0
Modal	9	0.167	0.0175	0.0004	0	0.968	0.9313	0
Modal	10	0.15	0.0007	0.0102	0	0.9687	0.9415	0

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Case	Mode	Period sec	UX	UY	UZ	Sum UX	Sum UY	Sum UZ
Modal	11	0.114	0.0069	0.0001	0	0.9756	0.9415	0
Modal	12	0.1	0.0001	0.0054	0	0.9757	0.9469	0
Modal	13	0.096	1.185E-05	0.0187	0	0.9757	0.9656	0
Modal	14	0.087	0.0018	5.398E-06	0	0.9776	0.9656	0
Modal	15	0.076	2.815E-05	0.001	0	0.9776	0.9667	0
Modal	16	0.052	1.088E-06	0.0087	0	0.9776	0.9754	0
Modal	17	0.033	0	0.0034	0	0.9776	0.9788	0
Modal	18	0.028	0.0223	0.0001	0	0.9999	0.9789	0
Modal	19	0.024	8.524E-06	0.0007	0	0.9999	0.9795	0
Modal	20	0.023	0.0001	0.0106	0	1	0.9901	0
Modal	21	0.021	0	1.319E-06	0	1	0.9901	0

Table 3.5 - Modal Participating Mass Ratios (Part 2 of 2)

Case	Mode	RX	RY	RZ	Sum RX	Sum RY	Sum RZ
Modal	1	0.0611	0.0982	0.1436	0.0611	0.0982	0.1436
Modal	2	0.0697	0.1045	0.1092	0.1308	0.2028	0.2528
Modal	3	0.1135	0.0002	0.5223	0.2443	0.203	0.7751
Modal	4	0.0831	0.3904	0.0098	0.3274	0.5934	0.7849
Modal	5	0.2423	0.1407	0.0178	0.5697	0.7341	0.8027
Modal	6	0.0047	0.0801	0.0021	0.5745	0.8142	0.8048
Modal	7	0.0368	0.0087	0.0235	0.6112	0.8229	0.8282
Modal	8	0.1685	0.0001	0.0804	0.7797	0.8231	0.9086
Modal	9	0.0013	0.0639	0.0004	0.7811	0.887	0.9089
Modal	10	0.0357	0.0026	0.0077	0.8168	0.8896	0.9166
Modal	11	0.0002	0.0203	0.0001	0.817	0.9099	0.9167
Modal	12	0.0158	0.0003	0.0015	0.8328	0.9103	0.9182
Modal	13	0.0454	2.802E-05	0.0341	0.8782	0.9103	0.9523
Modal	14	2.261E-05	0.0066	5.451E-06	0.8783	0.9168	0.9523
Modal	15	0.0036	0.0001	0.0006	0.8819	0.9169	0.9529
Modal	16	0.028	4.573E-06	0.0147	0.9099	0.917	0.9676
Modal	17	0.011	2.117E-06	0.0061	0.9209	0.917	0.9737
Modal	18	0.0002	0.0825	4.166E-05	0.9211	0.9994	0.9737
Modal	19	0.0023	3.194E-05	0.0024	0.9234	0.9995	0.9762
Modal	20	0.0392	0.0005	0.0082	0.9625	1	0.9844
Modal	21	5.065E-06	0	7.227E-07	0.9625	1	0.9844

Table 3.6 - Modal Participation Factors

Case	Mode	Period sec	UX kN-m	UY kN-m	UZ kN-m	RX kN-m	RY kN-m	RZ kN-m	Modal Mass kN-m-s²	Modal Stiffness kN-m
Modal	1	1.779	3E-05	2.4E-05	0	-0.068178	0.086437	0.142567	1E-06	1E-05
Modal	2	1.686	3E-05	-2.5E-05	0	0.072815	0.089152	-0.12433	1E-06	1E-05
Modal	3	0.832	2E-06	2.2E-05	0	-0.092897	0.004335	-0.271875	1E-06	6E-05
Modal	4	0.534	1.3E-05	7E-06	0	0.079499	-0.172305	0.037191	1E-06	0.00014
Modal	5	0.504	8E-06	-1.2E-05	0	-0.135736	-0.103427	-0.050242	1E-06	0.00016
Modal	6	0.274	9E-06	2E-06	0	0.018998	-0.078035	0.017118	1E-06	0.00053
Modal	7	0.253	3E-06	-6E-06	0	-0.052865	-0.025793	-0.057621	1E-06	0.00061
Modal	8	0.22	-1.574E-07	-1.1E-05	0	-0.113208	0.003282	0.106651	1E-06	0.00082
Modal	9	0.167	-6E-06	-1E-06	0	-0.01013	0.069717	-0.007101	1E-06	0.00142
Modal	10	0.15	1E-06	-5E-06	0	-0.052125	-0.014109	-0.032928	1E-06	0.00175
Modal	11	0.114	4E-06	3.58E-07	0	0.003546	-0.039306	0.002929	1E-06	0.00305
Modal	12	0.1	1E-06	-3E-06	0	-0.034654	-0.005112	-0.014598	1E-06	0.00394
Modal	13	0.096	1.621E-07	6E-06	0	0.058786	-0.00146	-0.069519	1E-06	0.00431
Modal	14	0.087	-2E-06	-1.094E-07	0	-0.001311	0.022333	-0.000878	1E-06	0.00518
Modal	15	0.076	-2.499E-07	2E-06	0	0.01657	0.002793	0.008867	1E-06	0.00689
Modal	16	0.052	-4.912E-08	-4E-06	0	-0.046161	0.00059	0.045618	1E-06	0.01437
Modal	17	0.033	-3.291E-08	3E-06	0	0.028888	0.000401	-0.029399	1E-06	0.03557
Modal	18	0.028	7E-06	3.516E-07	0	0.003931	-0.079204	0.002428	1E-06	0.05192
Modal	19	0.024	1.375E-07	1E-06	0	0.013221	-0.001558	-0.018529	1E-06	0.06898
Modal	20	0.023	-1E-06	5E-06	0	0.054575	0.006257	0.034162	1E-06	0.07796

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Case	Mode	Period sec	UX kN-m	UY kN-m	UZ kN-m	RX kN-m	RY kN-m	RZ kN-m	Modal Mass kN-m-s²	Modal Stiffness kN-m
Modal	21	0.021	0	5.408E-08	0	0.000621	1.6E-05	-0.00032	1E-06	0.08578

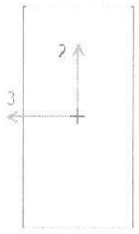
Table 3.7 - Modal Load Participation Ratios

Case	Item Type	Item	Static %	Dynamic %
Modal	Acceleration	UX	100	100
Modal	Acceleration	UY	100	99.01
Modal	Acceleration	UZ	0	0

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ETABS Concrete Frame Design

IS 456:2000 Beam Section Design



Beam Element Details Type: Ductile Frame (Summary)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF
FIRST	B77	10	B600X300M30	UDCon14	0	6600	1

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
300	600	300	0	60	60

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	500	415

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} N-mm	Factored T_u N-mm	Factored V_{u2} N	Factored P_u N
-193363167	20141024.05	113216.86	0

Design Moments, M_{u3} & M_t

Factored Moment N-mm	Factored M_t N-mm	Positive Moment N-mm	Negative Moment N-mm
-193363167	35542983.61	0	-228906150

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

	Design -Moment N-mm	Design +Moment N-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	228906150		1102	0	1102	275
Bottom (-2 Axis)		0	551	0	0	551

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

Shear V_e N	Shear V_c N	Shear V_s N	Shear V_p N	Rebar A_{sv}/s mm²/mm
176002.13	0	283420.92	76315.53	1.45

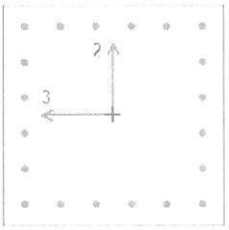
Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{u2}

T_u N-mm	V_u N	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
20141024.05	113216.86	200	500	0.81

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ETABS Concrete Frame Design

IS 456:2000 Column Section Design



Column Element Details Type: Ductile Frame (Summary)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF
FIRST	C2	36	C600X600M30	UDCon2	2400	3000	0.6

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
600	600	58	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	500	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 N	Design M_{u2} N-mm	Design M_{u3} N-mm	Minimum M_2 N-mm	Minimum M_3 N-mm	Rebar Area mm²	Rebar % %
4491444.46	-221834395	111387822.67	111387822.67	111387822.67	3000	0.83

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment N-mm	Additional Moment N-mm	Minimum Moment N-mm
Major Bend(M3)	1.2	2400	6037255.68	0	111387822.67
Minor Bend(M2)	1.2	2400	-88733757.89	0	111387822.67

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

	Shear V_u N	Shear V_c N	Shear V_s N	Shear V_p N	Rebar A_{sv}/s mm²/mm
Major, V_{u2}	1860.03	234064.18	130079.19	0	0.67
Minor, V_{u3}	138880.12	234064.18	130079.19	0	0.67

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Joint Shear Check/Design

	Joint Shear Force N	Shear V_{Top} N	Shear $V_{u,Tot}$ N	Shear V_c N	Joint Area mm²	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 mm²	A_{sc} mm²	P_{uz} N	P_b N	P_u N	k Unitless
360000	2999.8	5984931.88	2245141.97	4491444.46	0.399351

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 (N-mm)
Major Bending (M_3)	Yes	0.8	600	4.8	12	No	0
Minor Bending (M_2)	Yes	0.8	600	4.8	12	No	0

Notes:

N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

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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
SECOND	C2	2099.8	8314.6	2200	200	0.6

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
27386.13	30	1	500	415

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	2099.8	7214.7	2099.8	9414.6	2200	200
Bottom	Leg 1	2099.8	7214.7	2099.8	9414.6	2200	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 N	M_{u2} N-mm	M_{u3} N-mm	Pier A_g mm^2
Top	5036	0.0114	0.0023	DWal18	535642.95	-177529655	43959617.11	440000
Bottom	5132	0.0117	0.0023	DWal18	567808.44	182053385.07	45330021.65	440000

Shear Design

Station Location	ID	Rebar mm^2/mm	Shear Combo	P_u N	M_u N-mm	V_u N	V_c N	$V_c + V_s$ N
Top	Leg 1	0.5	DWal24	906237.37	161412155.65	154272.75	223301.51	540866.59
Bottom	Leg 1	0.5	DWal24	959846.52	483749901.49	154272.75	227240.49	544805.57

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u N	M_u N-mm	Stress Comp MPa	Stress Limit MPa
Top-Left	Leg 1	0	DWal2	1038994.1	90895346.92	2.92	6
Top-Right	Leg 1	0	DWal2	947693.65	161412155.65	3.15	6
Bottom-Left	Leg 1	0	DWal24	1001302.8	-436575985	4.98	6
Botttom-Right	Leg 1	0	DWal24	1092603.25	35006356.16	2.7	6

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	DESIGNAGE Consulting structural Engineer. Office No 402, 4th Floor, Wing-C, Audumbar Apartments Pune-411052, Maharashtra.	Project:	Chandan LITES	Date:- 10-Apr-2023
		Floor Level	First Floor	Revision -
		Job No.	1116	Sheet No. -

Design Of One Way Slab

Slab Marked : S6

span = 5.700 m

Thickness of slab D = 225 mm

d_{eff} = 225 - 25 = 200 mm

Loading :

Self wt. Of slab	=	0.225	x	2.5	=	0.5625	t/m^2
L.L.	=					0.45	
F.F	=					0.1	
Filling/steps	=					0.0	
						1.1125	t/m^2

Bending Moment :

$$M = \frac{1.1125}{8} \times 5.7^2 = 4.518 \text{ tm}$$

$$Qu = \frac{Mu}{b \times d^2} = \frac{4.518 \times 1.5 \times 10^7}{1000 \times 200 \times 200} = 1.6941 \text{ N/mm}^2$$

fck = 30 N/mm^2 & fy = 500 N/mm^2

Main Reinforcement.

$$pt = \frac{50 \times fck}{fy}\left[1 - \sqrt{1 - ((4.6 \times Qu)/(fck))}\right]$$

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	DESIGNAGE Consulting structural Engineer. Office No-402, 4th Floor, Wing-C, Audumbar Apartments Pune-411052, Maharashtra.	Project:	Chandan LITES	Date:- 10-Apr-2023
		Floor Level	First Floor	Revision -
		Job No.	1116	Sheet No. -

pt = 0.419 %

Ast = pt x 1000 x deff. = 837.88 mm²

Min Steel Reqd = 0.12 % of c/s. area

Min Ast Reqd = $\frac{0.12 \times 1000 \times 225}{100}$ = 270 mm²

Main steel Reqd. 12 Tor @ 135.0 mm c/c.

Main steel Provided 12 Tor @ 100.0 mm c/c.

Ast provided = 1131 mm² > 837.88 mm²

Distribution Reinforcement.

= 0.12 % of c/s. area

Ast = 270 mm²

Dist steel Reqd. 8 Tor @ 186.2 mm c/c.

Dist steel Provided 8 Tor @ 150 mm c/c.

Check for Shear.

Vu = $\frac{1.11}{25} \times 1.5 \times 5.700$ = 4.756 t

Tv = $\frac{Vu}{b \times d}$

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$$= \frac{4.75}{1000} \times \frac{6}{200} \times 10^{-4} = 0.23 \text{ N/m}^2 \quad 78$$

$$\% \text{ steel provided} = \frac{1131}{1000} \times \frac{100}{200} = 0.56 \quad 5 \%$$

$$Tc = 0.52 \quad 3 \text{ N/mm}^2$$ (Refer Table 19 of IS 456 : 2000)

For D = 225

K = 1.15 (Refer Cl : 40.2.1.1 of IS 456 : 2000)

$$\therefore \quad K\,Tc = 1.15 \times 0.523 = 0.60 \quad 1 \text{ N/m}^2$$

$Tv < K\,Tc$ Hence OK

Check for Deflection.

Refer fig.4 page. 38 of IS 456 : 2000

$$fs = 0.58 \times fy \times \frac{\text{Area of cross-section of steel required}}{\text{Area of cross-section of steel provided}}$$

$$= 0.58 \times 500 \times \frac{837.8}{1130.98}$$

$$= 214.85 \text{ N/mm}^2$$

$$\% \text{ steel provided} = 0.56 \quad 5 \%$$

Modification factor = 1.32

$$\frac{\text{Span}}{d} < 26 \times M.F$$

Required d d = $\frac{5700}{27} = 166.$ mm

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1.3
2 x 26

Require d D = 166. 27 + 25 = 191.2 7

Provide d D = 225 m Hence OK

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GENERAL NOTES :

STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ARCHITECTURAL & SERVICES DRAWINGS AND SPECIFICATIONS

1. MATERIALS

1. GENERAL ALL MATERIALS TO BE USED SHALL COMPLY WITH THE REQUIREMENTS OF CURRENT RELEVANT BIS CODES SPECIFICATION UNLESS NOTED OTHERWISE.

1.1) ALL STRUCTURAL KEY PLANS AND DETAILS ARE TO BE READ IN CONJUNCTION WITH THE RELEVANT ARCHITECTURAL DRAWINGS , SERVICES DRAWINGS, SPECIFICATIONS , BILLS OF QUANTITIES AND ALL OTHER RELEVANT DOCUMENTS. DISCREPANCIES MUST BE REPORTED IMMEDIATELY TO THE STRUCTURAL ENGINEER.

1.2) THE CONTRACTOR SHALL WORK FROM FIGURED DIMENSIONS ONLY.

1.3) THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCEMENT OF WORKS AND ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER BEFORE EXECUTION.

1.4) ALL CONCRETE SIZES AND LEVELS ARE FOR STRUCTURAL ELEMENTS UNLESS OTHERWISE NOTED.

1.5) ALL OPENINGS FOR PIPING AND CONDUITS SHALL BE FORMED IN POSITION BEFORE THE CASTING OF CONCRETE.

1.6) NO HOLES OR CHASES ARE PERMITTED IN THE CONCRETE MEMBERS UNLESS OTHER THAN AS DETAILED OR UNLESS APPROVED BY THE STRUCTURAL ENGINEER.

1.7) CONSTRUCTION JOINTS SHALL BE LOCATED AS PER THE APPROVAL OF THE PROJECT ENGINEERS.

1.8) ANY DAMAGE CAUSED TO ANY CIVIL / STRUCTURAL WORK SHALL BE REINSTATED TO ITS ORIGINAL CONDITION WITHOUT ANY COST IMPLICATIONS TO THE CLIENT.

1.9) ALL DIMESIONS ARE IN MILLIMETRES. ALL LEVELS ARE IN METRES.

1.10) THE DESIGN LIVE LOADS ARE AS PER CODAL PROVISIONS.THE ROOF STRUCTURE HAS BEEN DESIGNED FOR NORMAL ROOF LOADS ONLY, AND DOES NOT ALLOW FOR ANY EXTRANEOUS LOADS AS HOISTS, MONORAILS ETC.

1.11) NO PROVISIONS ARE MADE FOR ADDITIONAL STOREY.

1.12) ALL PROPS & FORMWORK FOR BEAMS AND SLABS SHALL BE REMOVED BEFORE CONSTRUCTION OF ANY WALLS OR OTHER PERMANENT LOADING ON THE SLAB.(CLAUSE '17' TO BE FOLLOWED).

ALL OPENINGS TO BE FORMED IN THE FLOORS AND WALLS, INCLUDING THOSE FOR CONSTRUCTION PURPOSES SHALL BE TO THE APPROVAL OF THE ENGINEER.

1.13) ALL WORKS TO BE CARRIED OUT AS PER THE RELAVENT LATEST BIS STANDARDS.

2. CONCRETE UNLESS OTHERWISE NOTED CONCRETE GRADE MUST BE OF GRADE SPECIFIED IN THE DRAWINGS:-

2.1 BLINDING CONCRETE GRADE M25
MAXIMUM AGGREGATE SIZE 20mm.

2.2 1. THE CONCRETE GRADES ARE AS FOLLOWS :-

COMPONENTS	FLOORS	CONC.GRADE
1.COLUMNS AND SHEAR WALLS	ALL FLOORS	M30
2.BEAMS AND SLAB	STILT FLOOR	M30
	FIRST FLOOR TO TERRACE FLOOR	M30
3.FOUNDATION	PILE & PILE CAP	M30

2. MINIMUM CONTENT OF ORDINARY PORTLAND CEMENT TO BE AS PER TABLE '5' OF IS 456 DURABILITY REQUIREMENTS.

3. MAXIMUM AGGREGATE SIZE 20mm.
MAXIMUM FREE WATER / CEMENT RATIO AS PER TABLE '5' OF IS 456

2.3 ALL REINFORCED CONCRETE IS TO MADE FROM CEMENT, FINE AGGREGATE (SAND AND CRUSHER FINES) COARSE AGGREGATE (10mm AND 20mm) AND WATER.

2.4 THE CONTRACTOR IS TO SUBMIT PROPOSED MIX DESIGNS, TOGETHER WITH NOT LESS THAN 4 Nos. 7 DAYS AND 4 Nos. 28 DAYS CUBE TEST RESULTS FOR APPROVAL WELL BEFORE COMMENCEMENT OF CONCRETE WORKS.

DETAILS OF ADMIXTURE AND ADDITIVES ARE TO BE SUBMITTED ALONG WITH THE PROPOSED MIX DESIGNS.

3. REINFORCEMENT

3.1 THE FOLLOWING TEST RESULTS, FOR EACH BAR DIAMETER AND EACH SOURCE OF SUPPLY, ARE TO BE SUBMITTED FOR APPROVAL.
- TENSION TESTS (YIELD AND ULTIMATE)
- ELONGATION
- CROSS - SECTIONAL AREA
- CHEMICAL ANALYSIS
- BEND AND REBEND TESTS

3.2) CONCRETE COVER TO OUTERMOST REINFORCEMENT , INCLUDING LINKS AND STIRRUPS , SHALL BE AS FOLLOWS :(2 HOURS FIRE RESISTANCE/MODERATE EXPOSURE CONSIDERED.)

STRUCTURAL ELEMENTS	IN CONTACT WITH GROUND	OTHERS	
		SIMPLY SUPPORTED	CONTINOUS
SLABS	20	35	25
BEAMS	50 (TOP) 40 (SIDE & BOT.)	40	30
WALLS/SHEAR WALLS	40	—	—
COLUMNS	40/25	—	—
FOOTING	50	—	—

3.3) ALL REINFORCEMENT ARE TO BE FIRMLY SUPPORTED ON APPROVED CHAIRS OR CONCRETE BLOCKS GENERALLY AT NOT GREATER THAN 1000MM CENTRES BOTH WAYS. WHERE LONGITUDINAL REINFORCEMENT ARE PLACED IN 2 LAYERS OR MORE, SPACER BARS OF 25MM DIAMETER OR THE DIAMETER OF THE LONGITUDINAL, WHICHEVER IS LARGER, ARE TO BE PROVIDED AT 1000MM INTERVALS TO SEPARATE THE LAYERS.

3.4) WELDING OF REINFORCEMENT WILL NOT BE PERMITTED WITHOUT THE APPROVAL OF THE ENGINEER.

3.5) ALL BARS SHALL BE CUT AND BENT TO CONFORM TO LATEST EDITION OF IS 1786

UNLESS OTHERWISE SHOWN IN THE DRAWINGS, THE MINIMUN LAP LENGTH FOR REINFORCEMENT SHALL BE PROVIDED AS TABULATED IN 5.7

4. CONCRETE BLOCKS FOR WALLS & SLABS

4.1 AGGREGATE FOR CONCRETE BLOCKS SHALL COMPLY WITH THE REQUIREMENTS OF BIS.

4.2 COMPRESSIVE STRENGTH OF BLOCKS SHALL BE :-

MINIMUM	AVERAGE OF 10
3.5 N/mm2	4.0 N/mm2

4.3 MORTAR IS TO BE 1 : 4 CEMENT : SAND.

5. FOUNDATIONS

5.1 EXCAVATIONS FOR FOUNDATIONS SHALL BE CARRIED OUT BY MECHANICAL MEANS, EXCEPT FOR THE LAST 200mm OF EXCAVATION WHICH IS TO BE CARRIED OUT BY MANUAL METHODS.

5.2 ASSUMED SAFE BEARING PRESSURE BELOW PAD AND STRIP FOUNDATIONS IS REF. TO SOIL REPORT THE DEPTH SHOWN ON THE DRAWINGS, SHOULD A SUITABLE BEARING LAYER NOT BE FOUND AT THE DEPTH SHOWN THE EXCAVATION SHALL CONTINUE DOWN TO A DEPTH DEEMED SUITABLE BY THE ENGINEER, AND BACK FILLED WITH CONCRETE GRADE 15 UP TO THE LEVEL, SHOWN ON THE DRAWINGS.

5.3 FORMATION LEVELS OF FOUNDATIONS SHALL BE DETERMINED BY THE SITE ENGINEER BASED UPON EXISTING ROAD LEVELS, WATER TABLE LEVEL, SERVICES REQUIREMENTS.

5.4 SHOULD THE FORMATION LEVELS OF TWO OR MORE FOUNDATIONS ADJACENT TO EACH OTHER BE DIFFERENT, THE DIFFERENCE IN LEVEL IS TO BE MADE UP BY CONCRETE GRADE 15 (ie THE AREA SHALL BE EXCAVATED TO THE FORMATION LEVEL OF THE LOWER FOUNDATION AND A THICKER BLINDING USED FOR THE FOUNDATION HAVING THE HIGHER FORMATION LEVEL.

5.5 THE FORMATION LEVELS OF FOUNDATIONS SHALL BE WATERED AND MECHANICALLY COMPACTED PRIOR TO PLACING BLINDING CONCRETE.

5.6 THE FORMATION LEVELS OF FOUNDATIONS ARE TO BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE BLINDING CONCRETE IS PLACED.

5.7 A 75mm LAYER OF BLINDING CONCRETE GRADE M15 IS TO BE PLACED UNDER ALL PAD AND STRIP FOUNDATIONS.

UNLESS OTHERWISE SHOWN IN THE DRAWINGS, MIN. LAP LENGTH FOR REINFORCEMENT SHALL BE PROVIDED AS TABULATED

Development length of bars Fe 500 Grade					
DIA OF BARS	GRADE OF CONC				
	M-20	M-25	M-30	M-35	M-40 & ABOVE
8	460	390	370	320	290
10	570	490	460	400	360
12	680	585	550	480	430
16	910	780	730	640	575
20	1150	980	910	800	720
25	1450	1220	1200	1000	900
32	1820	1560	1450	1280	1150

6. FOUNDATION ADJACENT TO EXISTING STRUCTURES

6.1 THE CONTRACTOR IS TO EXCAVATE TRIAL PITS NEXT TO EXISTING FOUNDATIONS TO DETERMINE THE NATURE AND LEVEL OF EXISTING FOUNDATIONS.

6.2 THE CONTRACTOR IS TO INFORM THE ENGINEER OF THE NATURE AND LEVEL OF EXISTING FOUNDATIONS, THE ENGINEER WILL MODIFY THE PROPOSED FOUNDATION DETAILS AS REQUIRED.

6.3 THE CONTRACTOR IS TO TAKE ALL PRECAUTIONS TO ENSURE THE INTEGRITY OF NEIGHBOURING PROPERTY DURING EXCAVATIONS AND THE CONSTRUCTION OF THE WORKS.

7. FOUNDATIONS OF MAIN STRUCTURE ADJACENT TO UNDERGROUND STRUCTURES

7.1 EXCAVATION AND CONSTRUCTION OF FOUNDATIONS AROUND UNDERGROUND STRUCTURES (SEPTIC TANKS, SOAKAWAYS, MANHOLES, UNDERGROUND WATER TANKS AND THE LIKE) SHALL PROCEED CONCURRENTLY WITH THE CONSTRUCTION OF THE UNDERGROUND STRUCTURES.

7.2 THE FORMATION LEVELS OF FOUNDATIONS AROUND UNDERGROUND STRUCTURES SHALL BE TAKEN DOWN TO THE FORMATION LEVEL OF THE UNDERGROUND STRUCTURE.

8. CONCRETE WORKMANSHIP

8.1 ALL DAYWORK AND CONSTRUCTION JOINTS IN CONCRETE MEMBERS SHALL BE AT PREDETERMINED LOCATIONS AS APPROVED BY THE ENGINEER.

8.2 VERTICAL JOINTS SHALL BE FORMED WITH TIMBER FORWWORK COATED WITH AN APPROVED SURFACE RETARDER, THE VERTICAL FACE IS TO BE WASHED TO EXPOSE THE AGGREGATE BEFORE FINAL SET OF THE CONCRETE HAS TAKEN PLACE.

8.3 HORIZONTAL JOINTS SHALL BE SCABBLED TO REMOVE ALL LAITANCE AND WEAK CONCRETE BEFORE CONCRETE FOR THE NEXT LIFT IS PLACED.

8.4 ALL UNPLASTERED CONCRETE IS TO BE FAIRFACE FINISH UNLESS NOTED TO THE CONTRARY.

8.5 ALL CONCRETE IS TO BE CURED BY AN APPROVED METHOD-WATER PONDING, POLYTHENE/HESSIAN SHEET, CURING COMPOUND.

9. R.C. WALLS FOR BASEMENTS, SWIMMING POOLS AND U.G. WATER TANKS

9.1 THE CONTRACTOR IS TO VERIFY THE LEVEL OF THE WATER TABLE ON SITE AND COMPARE THIS WITH THE ASSUMED WATER TABLE LEVEL SHOWN ON THE DRAWINGS, IN THE EVENT THAT THE SITE WATER TABLE IS HIGHER, THE BASE SLAB THICKNESS WILL BE INCREASED BY A SUITABLE AMOUNT TO COMPENSATE FOR HYDROSTATIC UPLIFT.

9.2 75mm CONCRETE BLINDING GRADE M15 IS TO BE PLACED BELOW THE WATER TANK BASE SLAB.

9.3 THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL A PLAN MARKED UP TO SHOW LOCATIONS OF CONSTUCTION JOINTS.

9.4 CONCRETE COVER TO MAIN REINFORCEMENT IS TO BE :-

WATER RETAINING FACES	25 mm
EXPOSED AND EARTH RETAINING FACES	40 mm

9.5 WATER BARS ARE TO BE INCORPORATED IN ALL VERTICAL AND HORIZONTAL CONSTRUCTION JOINTS.

9.6 ALL WALL KICKERS ARE TO BE CAST MONOLITHICALLY WITH THE BASE SLAB.

10. GROUND BEARING SLABS(SLAB ON GRADE)

10.1 BACKFILL IS TO COMPRISE SELECTED GRANULAR MATERIAL PLACED IN LAYERS 150mm THICK AND COMPACTED TO A MINIMUM OF 97% OF MAXIMUM DRY DENSITY.

11. FOOTINGS / COMBINED FOOTING / RAFT

1) THE FOOTINGS/COMBINED FOOTINGS/RAFTS ETC. HAVE BEEN DESIGNED FOR A SAFE BEARING CAPACITY OF -T/m2. THE CLIENT SHOULD ENSURE THIS BEFORE CONCRETING, THE SOFT SPOTS TO BE EXCAVATED & REPLACED WITH BLINDING CONCRETE AFTER THE APPROVAL OF STRUCTURAL ENGINEER.

2) BACKFILLING SHALL BE UNIFORMLY PLACED IN LAYERS NOT EXCEEDING 150MM AND CONSOLIDATED BY SUITABLE COMPACTOR TO THE SATISFACTION OF THE ENGINEER.BACKFILLING MATERIAL SHALL BE GOOD EARTH AS PER APPROVED SPECIFICATIONS.

12. STRIKING OF FORMWORK

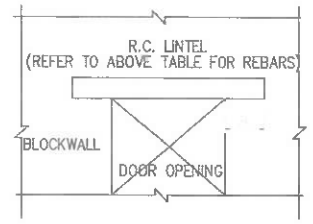
TYPE OF FORMWORK	MINIMUM PERIOD BEFORE STRIKING FORMWORK
a. VERTICAL FORMWORK TO COLUMNS/WALL/BEAMS .	24-48 H
b. PROPS / SHUTTERING TO SLABS:	
1.) SPANNING UP TO 4.5M	7 DAYS
2.) SPANNING OVER 4.5M	14 DAYS
c. PROPS / SHUTTERING TO BEAMS,FLAT SLABS / DROPS ETC.	
1.0 SPANNING UP TO 6.0M	14 DAYS
2.0 SPANNING OVER 6.0M	21 DAYS

13. CONCRETE TESTING / BLOCKWORK / BRICKWORK

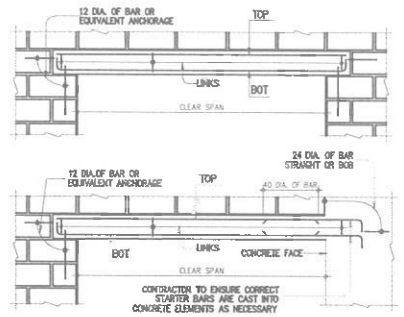
1) ALL SAMPLING AND TESTING OF THE MIXED CONCRETE WILL BE CARRIED OUT BY THE CONTRACTOR UNDER THE ENGINEER'S SUPERVISION IN ACCORDANCE WITH I.S. 1199.

2) ALL TEST CUBES BE CAST AND CURED IN ACCORDANCE WITH I.S. 516 METHOD OF TESTING CONCRETE. THE MINIMUM RATE OF SAMPLING AND TESTING OF CUBES SHALL AS INDICATED IN THE SPECIFICATIONS.

3) ALL BLOCKWORK AND ITS TESTING SHALL COMPLY WITH THE CURRENT BIS STANDARD.



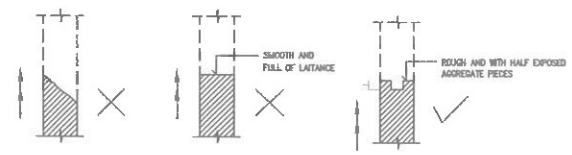
TYPICAL LINTEL ELEVATION



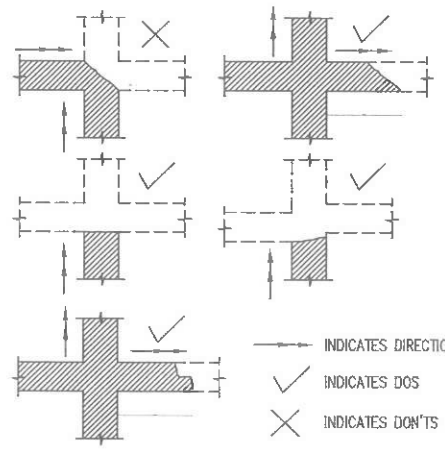
NOTES:

1. BEARING ON BLOCK WALL ON EITHER SIDE OF OPENING SHALL BE AT LEAST EQUAL TO THE OVERALL DEPTH OF THE LINTEL.
2. OVERALL LINTEL DEPTHS COULD BE INCREASED TO SUIT BLOCK WORK COURSING

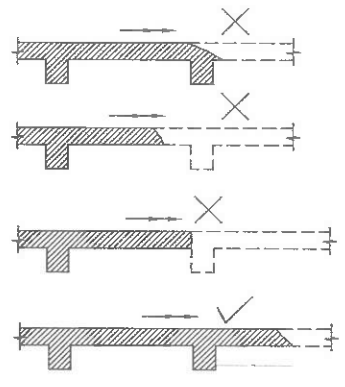
TYPICAL DETAILS OF LINTEL
(NON LOAD BEARING BLOCK WALLS)



CONSTRUCTION JOINTS IN COLUMNS



CONSTRUCTION JOINTS IN BEAMS / BEAM COLUMN JUNCTIONS



CONSTRUCTION JOINTS IN SALBS

NOTES

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KEY PLAN

KEY SECTION

REVISION	DATE	DESCRIPTION	SIGN.

DRG. TITLE :- GENERAL NOTES

PROJECT :- PROPOSED CONSTRUCTION OF COMMERCIAL BUILDING AT ADYAR

ARCHITECT :- Kharche & Associates
ARCHITECTURE TOWN PLANNING INTERIOR DESIGN
PROJECT MANAGEMENT ENGINEERING CONSULTANCY
20, Shaffee Mohamed Road, Chennai - 6, T.N., India. Tel: +91 (44) 829 1291/3874/3261
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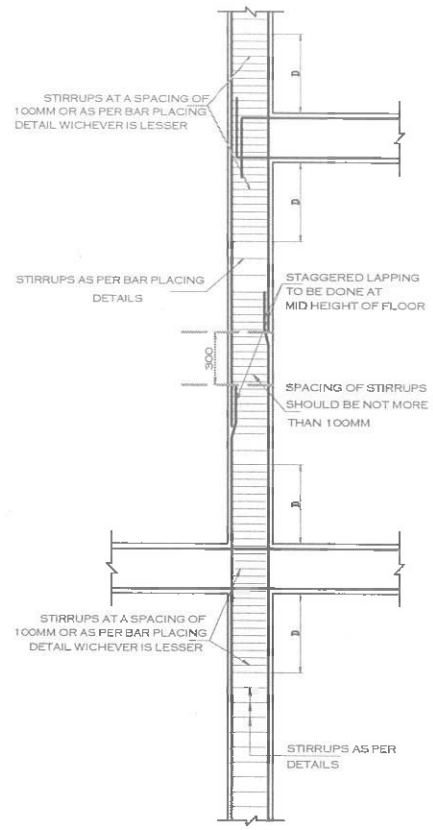
CLIENT :- MR. KETAN M CHANANN

DRAWN BY :-	CHECKED BY :-	SCALE :-
SWAPNIL	T.S.P./S.S.S.	N.T.S
DRG. NO.	REVISION	DATE
1116/GN	*R0	19/03/2023

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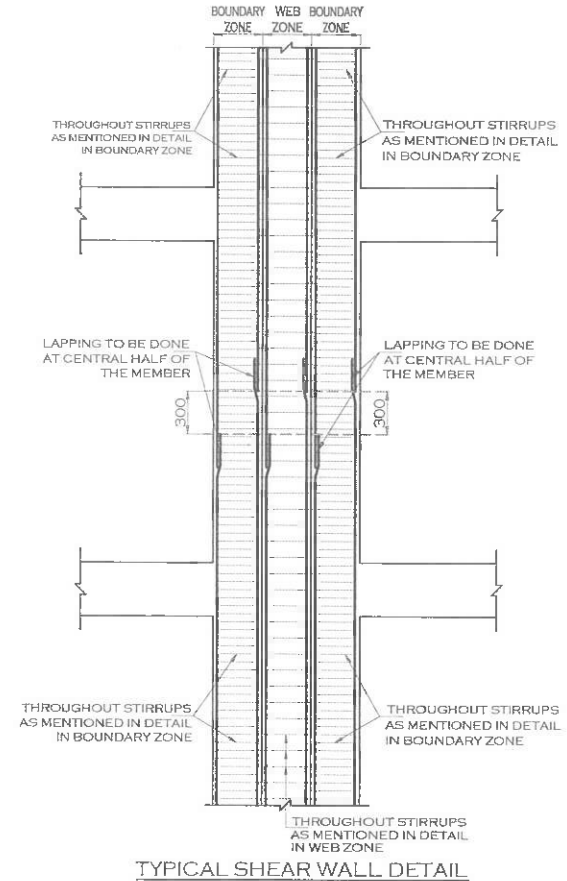
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FOURTH FLOOR TO TERRACE FLOOR	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 2200 (300 | 1600 | 300) 6T20 | 12T10 | 6T20 200 •T10 ◦T20	M30: Fe500 : COVER=40MM 8T@100c 600 20T16 600 •T16	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 900 (300 | 300 | 300) 6T12 | 4T10 | 6T12 200 •T10 •T12	M30: Fe500 : COVER=40MM 8T@100c 900 10T16+10T12 375 •T12 •T16
THIRD FLOOR TO FOURTH FLOOR	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 2200 (300 | 1600 | 300) 6T20 | 12T10 | 6T20 200 •T10 ◦T20	M30: Fe500 : COVER=40MM 8T@100c 600 20T16 600 •T16	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 900 (300 | 300 | 300) 4T16+2T12 | 4T10 | 4T16+2T12 200 •T10 •T12 •T16	M30: Fe500 : COVER=40MM 8T@100c 900 10T16+10T12 375 •T12 •T16
SECOND FLOOR TO THIRD FLOOR	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 2200 (400 | 1400 | 400) 8T20 | 10T12 | 8T20 200 •T12 ◦T20	M30: Fe500 : COVER=40MM 8T@100c 600 20T16 600 •T16	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 900 (300 | 300 | 300) 4T16+2T12 | 4T10 | 4T16+2T12 200 •T10 •T12 •T16	M30: Fe500 : COVER=40MM 8T@100c 900 10T16+10T12 375 •T12 •T16
FIRST FLOOR TO SECOND FLOOR	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 2200 (400 | 1400 | 400) 8T20 | 10T12 | 8T20 200 •T12 ◦T20	M30: Fe500 : COVER=40MM 8T@100c 600 20T16 600 •T16	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 900 (300 | 300 | 300) 6T16 | 4T10 | 6T16 200 •T10 •T16	M30: Fe500 : COVER=40MM 8T@100c 900 10T16+10T12 375 •T12 •T16
GROUND FLOOR TO FIRST FLOOR	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 2200 (400 | 1400 | 400) 8T20 | 10T12 | 8T20 200 •T12 ◦T20	M30: Fe500 : COVER=40MM 8T@100c 600 20T16 600 •T16	M30: Fe500 : COVER=40MM 8T@100c | 8T@200c | 8T@100c 900 (300 | 300 | 300) 6T16 | 4T10 | 6T16 200 •T10 •T16	M30: Fe500 : COVER=40MM 8T@100c 900 10T16+10T12 375 •T12 •T16
COLUMN NO:	C1,C2	C3,C4,C5,C6,C11,C12,C13	C7,C9	C8,C10



TYPICAL COLUMN DETAIL

D = LARGER LATERAL DIMENTION OF COLUMN
(REFER TABLE-A)



TYPICAL SHEAR WALL DETAIL

NOTES

REFER ARCHITECTURAL DRAWINGS PLAN, SECTION & ELEVATION ALONG WITH THIS DRAWING.
THIS DRAWING IS NOT TO BE SCALED.
BUILDIND IS DESIGNED FOR STILT FLOOR + 4 TYPICAL FLOORS + TERRACE FLOOR
USE MIX M:30 & Fe:500 STEEL FOR COLUMN & SHEAR WALL
"T" INDICATES TOR STEEL
READ THIS DRAWING ALONG WITH GENERAL NOTES - 1116/GN
FOR PILE/PILE CAP REFER DWG NO. 1116/01

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KEY PLAN

KEY SECTION

REVISION	DATE	DESCRIPTION	SIGN.
R0	19/03/2023	FOR SUBMISSION	

DRG. TITLE :-
COLUMN & SHEAR WALL DETAILS

PROJECT :-
PROPOSED COMMERCIAL BUILDING
@ G N CHETTY ROAD, CHENNI.

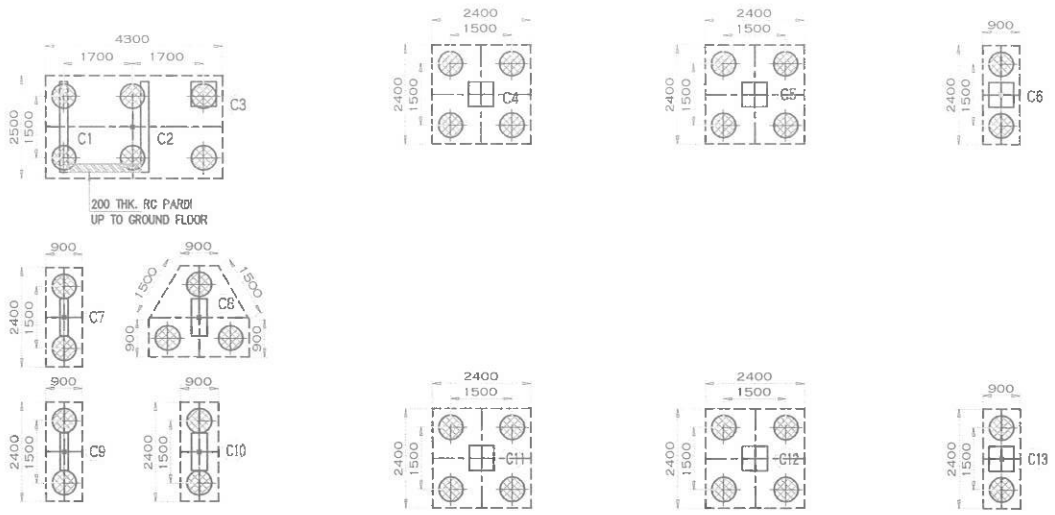
ARCHITECT :-
Kharche & Associates
ARCHITECTURE TOWN PLANNING INTERIOR DESIGN
PROJECT MANAGEMENT ENGINEERING CONSULTANCY
10, Sheffie Mohamed Road, Chennai - 6, T.N., India. Tel.: +91 (44) 329 1261/3874/3261
Fax: +91 (44) 329 0851 e-mail: kharche@vsnl.com URL : http://www.kharche.com

CLIENT :-
MR. KETAN M CHANANN

DRAWN BY :-	CHECKED BY :-	SCALE :-
SWAPNIL	T.S.P.	1:100
DRG. NO.	REVISION	DATE
1116/02	R0	19/03/2023

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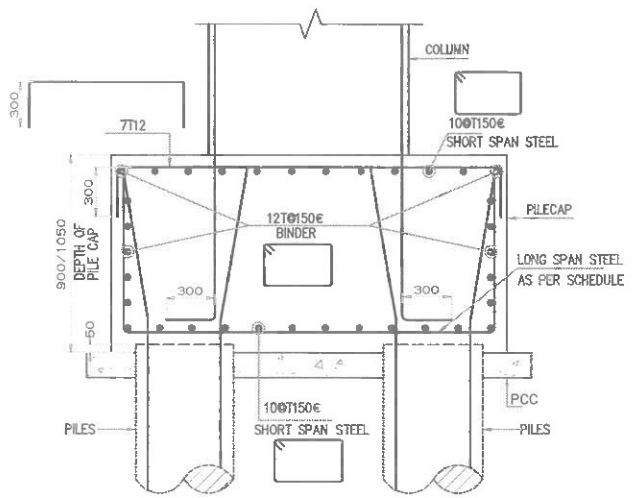


LAYOUT OF PILE/PILE CAP

PILE SCHEDULE:-

LEGEND	Nos.	PILE DIA CAST IN SITU	STEEL	CONCRETE GRADE	SAFE VERTICAL CAPACITY	SAFE UPLIFT CAPACITY	SAFE LATERAL CAPACITY
⊕	35	600 Ø	10T16 8T@150c/c HELICAL RINGS	M:30	125 Ton.	70 Ton.	5.2 Ton.

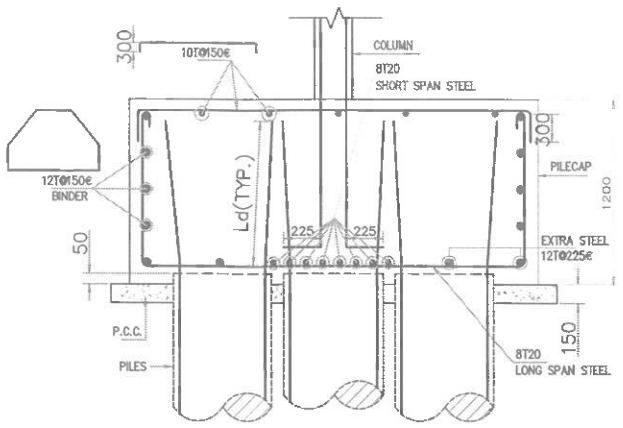
NOTE:- PROVIDE 12T@1000c/c MASTER RING.



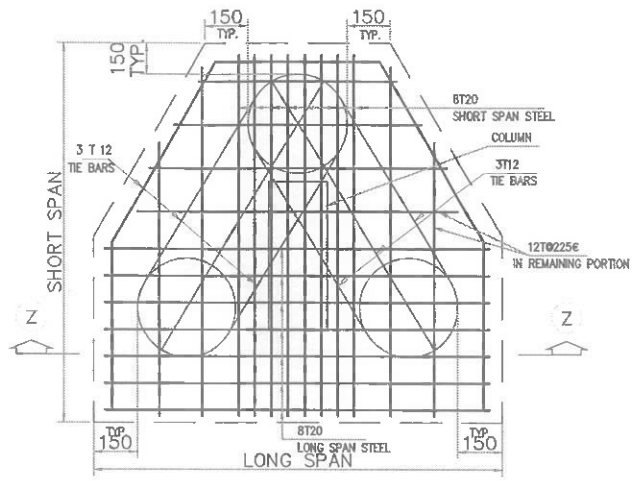
SECTION : 1-1

(PLAN)
TYPICAL PILE/PILE CAP DETAIL
FOR 600 DIA. TWO PILES

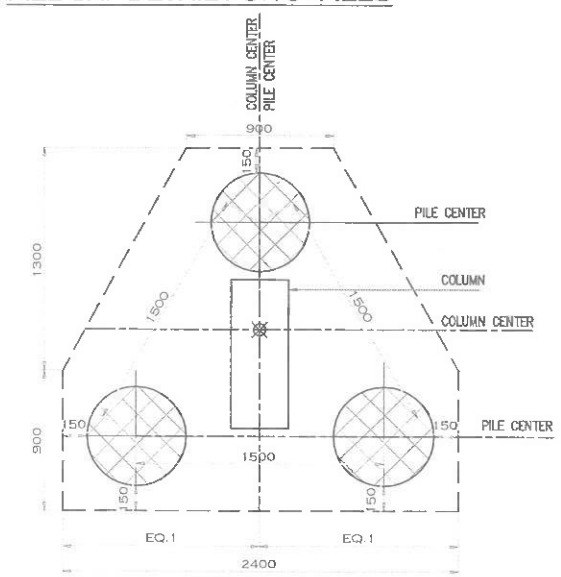
COLUMN/PILE-PILE CAP SCHEDULE											
GROUND FLOOR TO FIRST FLOOR	SIZE	200X2200	600X600	600X600	600X600	600X600	200X900	375X900	375X900	600X600	600X600
	STEEL	REFER DETAIL	REFER DETAIL	REFER DETAIL	REFER DETAIL	REFER DETAIL	REFER DETAIL	REFER DETAIL	REFER DETAIL	REFER DETAIL	REFER DETAIL
CAST-IN-SITU PILES	NO			4	4	2	2	3	2	4	4
	DIA.	REFER PILE CAP DETAIL	REFER PILE CAP DETAIL	600	600	600	600	600	600	600	600
PILE CAP	SIZE			2400X2400	2400X2400	900X2400	900X2400	REFER DETAIL	900X2400	2400X2400	2400X2400
	DEPTH			900	900	900	900	1050	900	900	900
STEEL IN PILE CAP	LONG SPAN STEEL			REFER DETAIL	REFER DETAIL	8T20	8T16	8T20	8T25	REFER DETAIL	REFER DETAIL
	SHORT SPAN STEEL			REFER DETAIL	REFER DETAIL	10T@150c/c	10T@150c/c	8T20	10T@150c/c	REFER DETAIL	REFER DETAIL
	BINDER			12T@150c/c	12T@150c/c	12T@150c/c	12T@150c/c	12T@150c/c	12T@150c/c	12T@150c/c	12T@150c/c
COLUMN NO:		C1,C2	C3	C4	C5	C6,C13	C7,C9	C8	C10	C11	C12



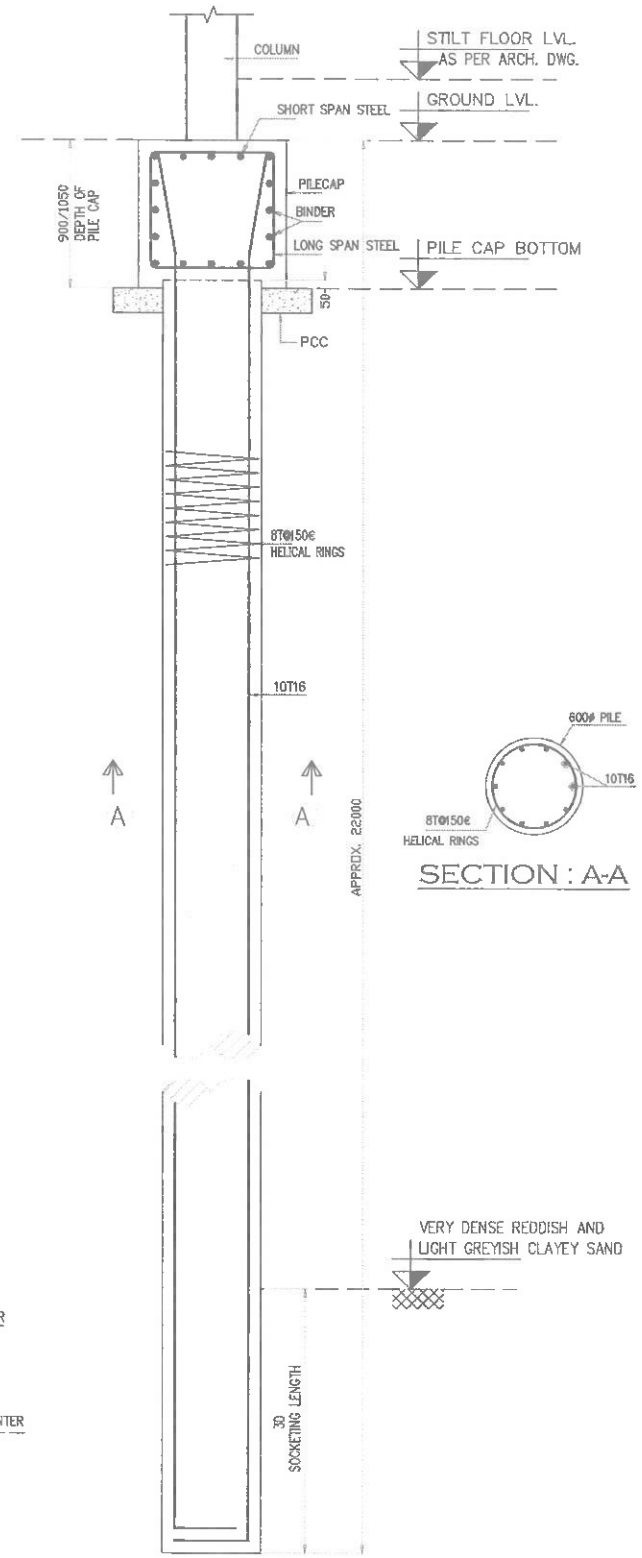
SECTION Z-Z



PLAN
PILE CAP DETAIL FOR 3 - PILES



(PLAN)
TYPICAL PILE/PILE CAP DETAIL
FOR 600 DIA. THREE PILES



TYPICAL SECTION OF PILE & PILECAP

NOTES

REFER ARCHITECTURAL DRAWINGS PLAN, SECTION & ELEVATION. ALONG WITH THIS DRAWING.
THIS DRAWING IS NOT TO BE SCALED.
BUILDIND IS DESIGNED FOR STILT FLOOR + 4 TYPICAL FLOORS + TERRACE FLOOR
USE MIX M:30 & Fe:500 STEEL FOR COLUMN & SHEAR WALL
USE MIX M:30 & Fe:500 STEEL FOR PILE & PILE CAP
" T " INDICATES TOR STEEL.
READ THIS DRAWING ALONG WITH GENERAL NOTES - 1116/GN
FOR PILE CAP DETAILS REFER DWG NO. 1116/1A
FOR COLUMN & SHEAR WALL DETAILS REFER DWG NO. 1116/02
C.G. OF PILES SHALL COINCIDE WITH C.G. OF COLUMNS.
CONCRETING SHALL BE DONE BY TREMIE PIPE.
MINIMUM SLUMP FOR CONCRETE TO BE 125MM.
CLEAR COVER FOR PILE AND PILECAP REINFORCEMENT TO BE 75MM.
MINIMUM 15 MINUTES FLUSHING TO BE DONE TO CLEAN THE BOTTOM PRIOR TO LOWERING THE TREMIE.
BENTONITE SLURRY TO BE USED TO STABILIZE BORE HOLES IF REQUIRED.
FOR CHISELLING RATE AND ROCK INDENTIFICATION PLEASE REFER TO GEOTECH REPORT.
PILE CAPS FOR LIFT SHAFT TO BE CAST AT A DEPTH AS SPECIFIED BY THE LIFT MANUFACTURER
PILE ECCENTRICITY RECORD (IF ANY) SHALL BE MADE AVAILABLE TO THE STRUCTURAL CONSULTANTS BEFORE CONSTRUCTION OF PILE CAPS.
PILE REINFORCEMENT TO BE EXTENDED IN TO PILE CAP FOR Ld=45Ø
PILE LOAD TESTS TO BE CARRIED OUT AS PER CODAL SPECIFICATIONS AND REQUIREMENTS.
SOCKETING LENGTH OF PILES MUST BE 3D IN HARD STRATA
PILE LENGTH BELOW PILE CAP - MINIMUM 22000MM

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Structural Engineer (Grade-I), CMDA
Reg. No. SE/GR-I/19/07/184
RSE100932019 dt.03.02.2020
E2-607, Purva Windermere, Pallikaranai,
Chennai - 600 100

KEY PLAN | KEY SECTION

REVISION	DATE	DESCRIPTION	SIGN.
R0	19/03/2023	FOR SUBMISSION	

DRG. TITLE :- LAYOUT & SCHEDULE OF PILE/PILE CAP

PROJECT :- PROPOSED COMMERCIAL BUILDING @ G N CHETTY ROAD, CHENNI.

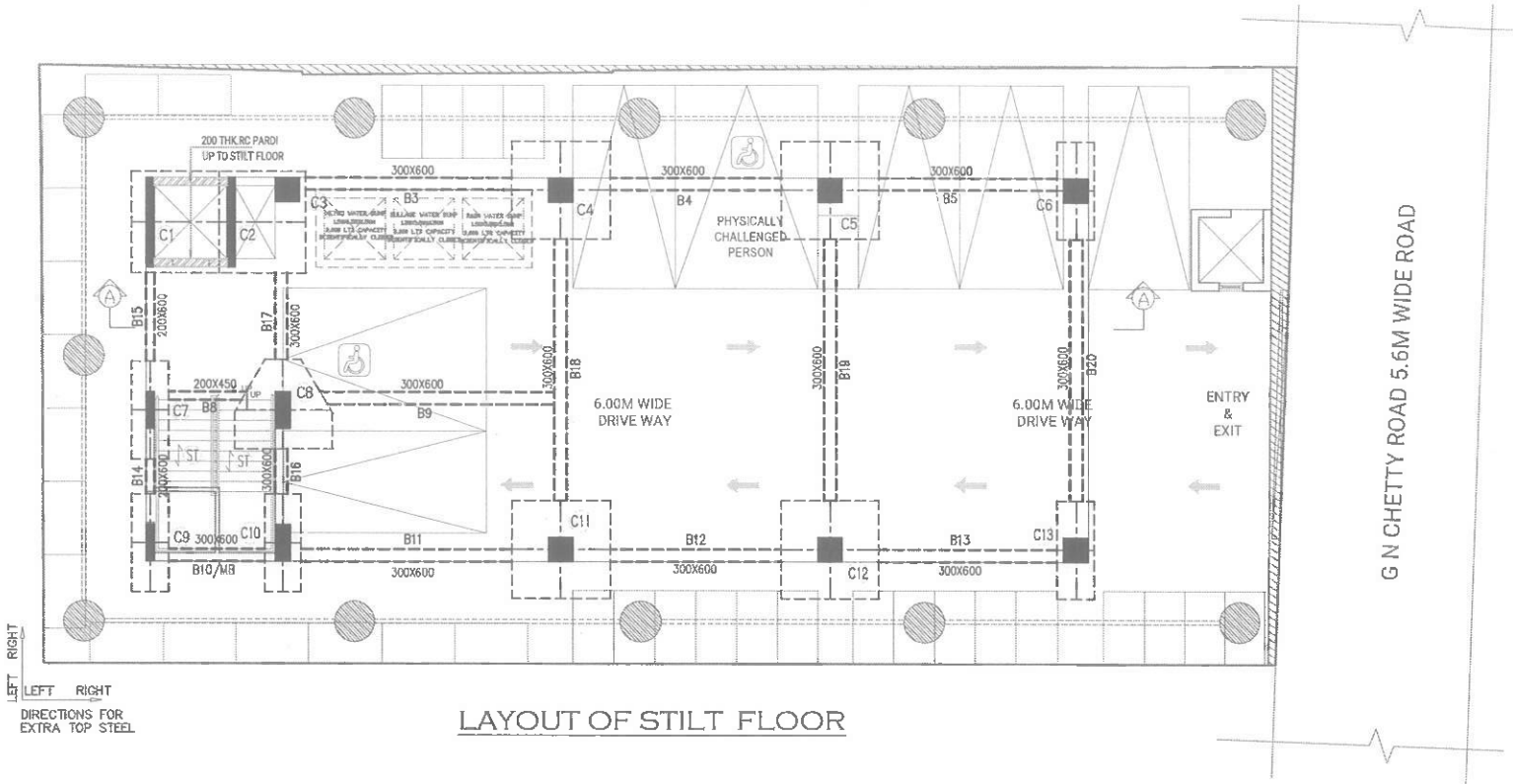
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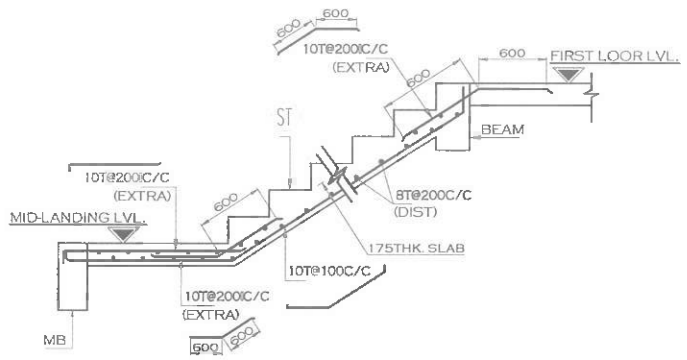
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DRG. NO.	REVISION	DATE
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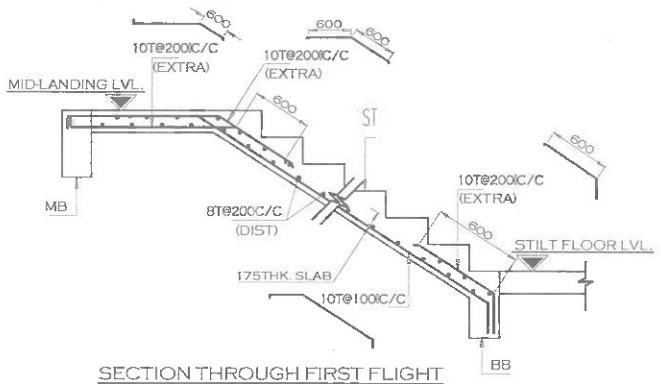
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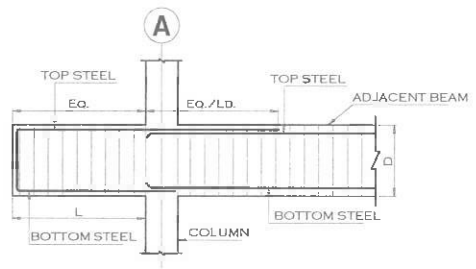
LAYOUT OF STILT FLOOR



SECTION THROUGH SECOND FLIGHT



SECTION THROUGH FIRST FLIGHT



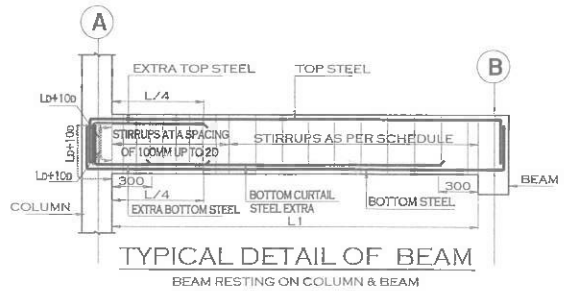
TYPICAL DETAIL OF CANTILEVER BEAM

BEAM SCHEDULE — STILT FLOOR

BEAM NUMBERS	SIZE B	SIZE D	BOTTOM STEEL	BOTTOM CURTAIL STEEL EXTRA	TOP STEEL	EXTRA TOP STEEL AT SUPPORT LEFT	EXTRA TOP STEEL AT SUPPORT RIGHT	STIRRUPS DIA.	STIRRUPS LEFT L/4	STIRRUPS REST L/2	STIRRUPS RIGHT L/4	REMARK
B3,B4,B5 B11,B12,B13	300	600	2T16+1T12		3 T 12			8T	100€	200€	100€	FRAME BEAM
B8,B10,B14 B15,B16,B17	200	600	2T16+1T12		2T16+1T12			8T	100€	100€	100€	FRAME BEAM
B9	300	600	2T16+1T12		3 T 12	1 T 12		8T	100€	200€	200€	FRAME BEAM
B18,B19,B20	300	600	3 T 16		3 T 12	2 T 16	2 T 16	8T	100€	150€	100€	FRAME BEAM
MB	200	600	2 T 16		2 T 12			8T	100€	150€	100€	FRAME BEAM @MIDLANDING LVL.

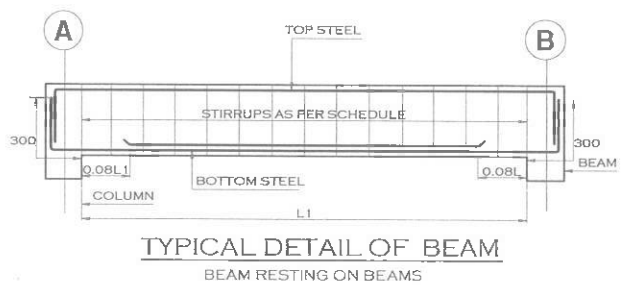
SLAB SCHEDULE — STILT FLOOR

NOTE	SLAB NUMBERS	THICK.	SHORT SPAN STEEL	LONG SPAN STEEL	REMARK
STAIRCASE	ST	175	8T@200€ (DISTRIBUTION)	10T@100€ (ALT BAR BENT UP)	ONE WAY



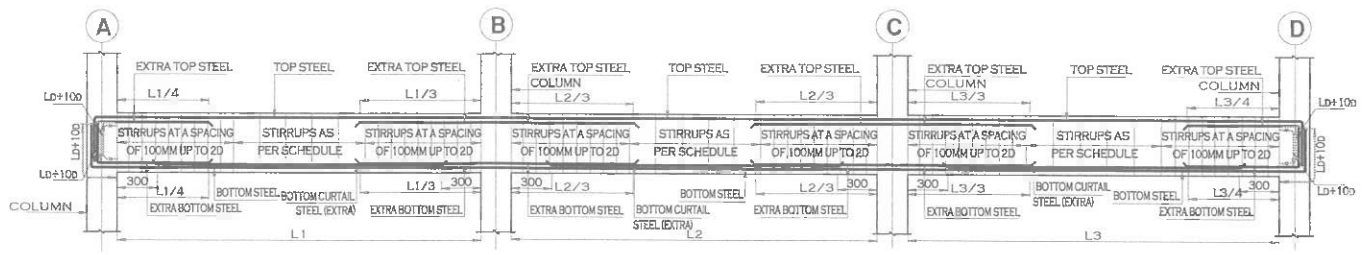
TYPICAL DETAIL OF BEAM

BEAM RESTING ON COLUMN & BEAM

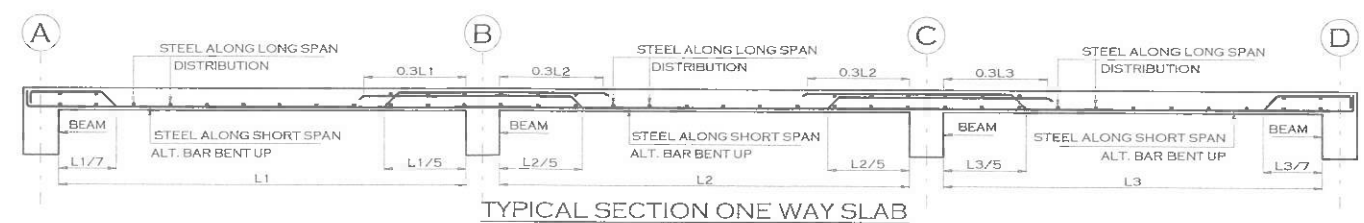


TYPICAL DETAIL OF BEAM

BEAM RESTING ON BEAMS



TYPICAL DETAIL OF CONTINUOUS BEAM



TYPICAL SECTION ONE WAY SLAB

NOTES

REFER ARCHITECTURAL DRAWINGS PLAN, SECTION & ELEVATION. ALONG WITH THIS DRAWING.
THIS DRAWING IS NOT TO BE SCALED.
USE MIX M:30 & FE:500 STEEL FOR BEAM & SLAB
BUILDIND IS DESIGNED FOR STILT FLOOR + 4 TYPICAL FLOORS + TERRACE FLOOR
"T" INDICATES TOR STEEL

P. PRADEEP, B.E., M.TECH.(Struct)
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KEY PLAN

KEY SECTION

REVISION	DATE	DESCRIPTION	SIGN.
R0	19/03/2023	FOR SUBMISSION	

DRG. TITLE :- LAYOUT & SCHEDULE OF STILT FLOOR

PROJECT :- PROPOSED COMMERCIAL BUILDING @ G N CHETTY ROAD, CHENNI.

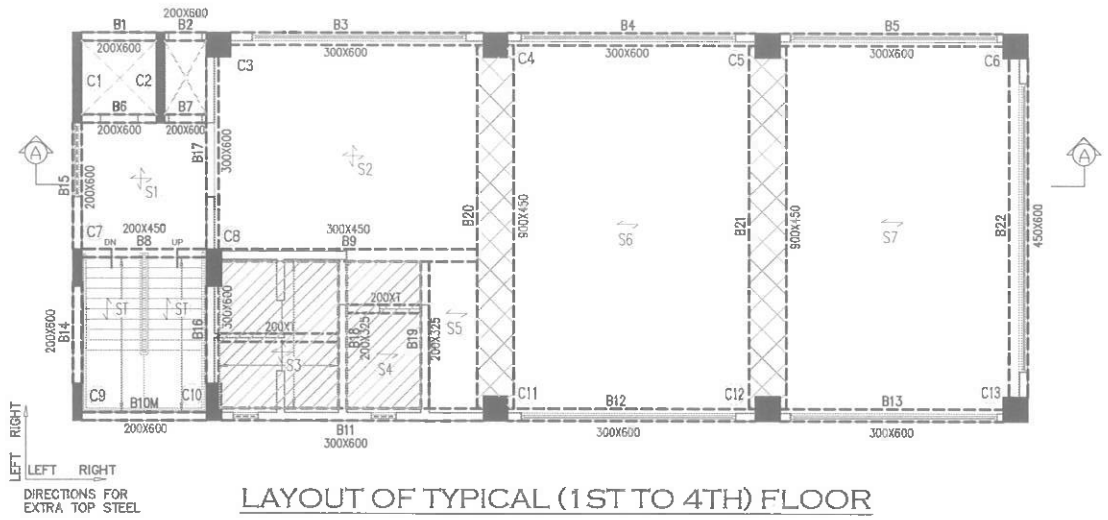
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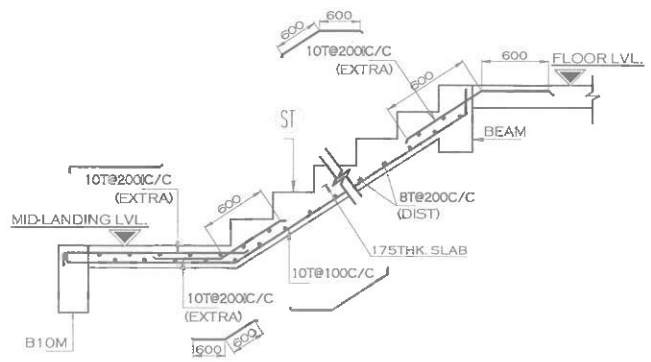
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DRG. NO. 1116/03	REVISION R0	DATE 19/03/2023

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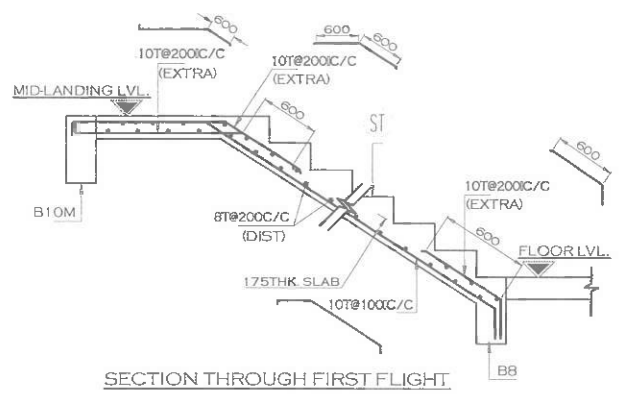
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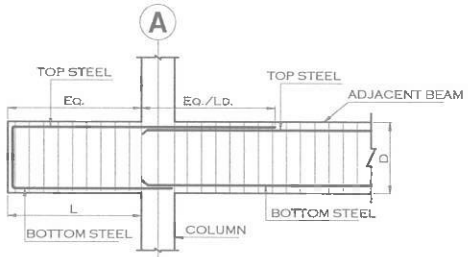
LAYOUT OF TYPICAL (1ST TO 4TH) FLOOR



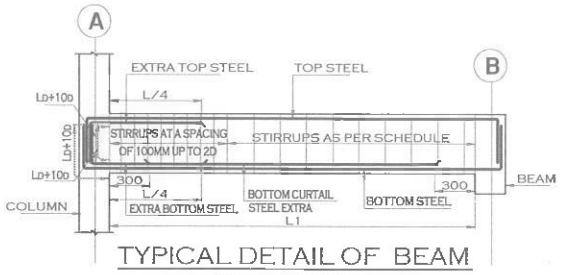
SECTION THROUGH SECOND FLIGHT



SECTION THROUGH FIRST FLIGHT

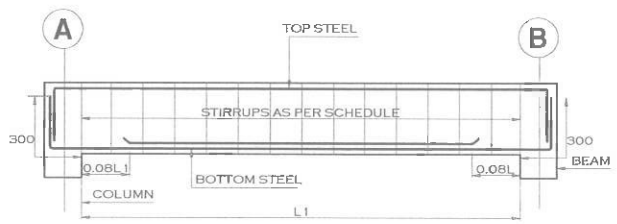


TYPICAL DETAIL OF CANTILEVER BEAM



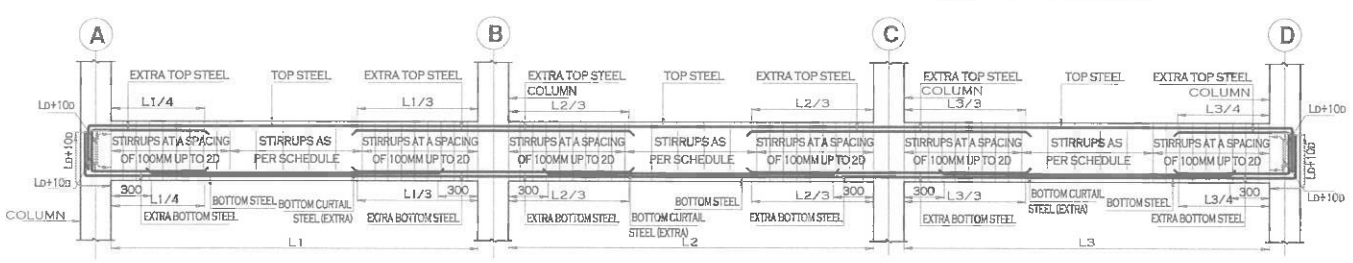
TYPICAL DETAIL OF BEAM

BEAM RESTING ON COLUMN & BEAM

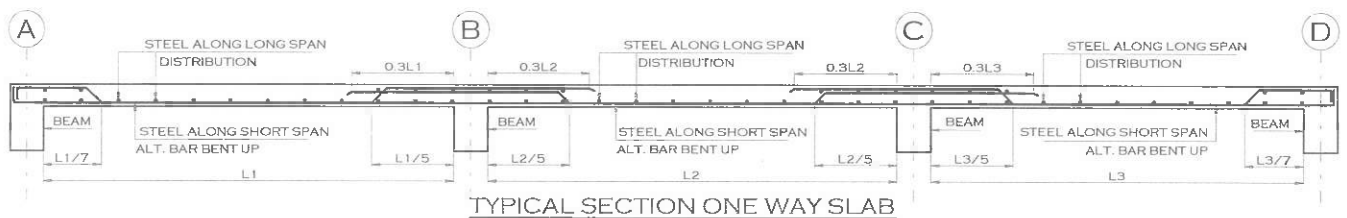


TYPICAL DETAIL OF BEAM

BEAM RESTING ON BEAMS



TYPICAL DETAIL OF CONTINUOUS BEAM



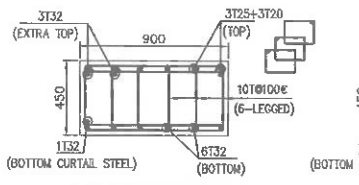
TYPICAL SECTION ONE WAY SLAB

BEAM SCHEDULE — TYPICAL FLOOR

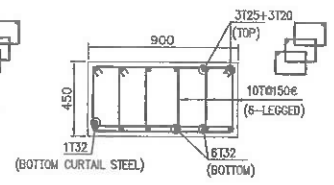
BEAM NUMBERS	SIZE B	SIZE D	BOTTOM STEEL	BOTTOM CURTAIL STEEL EXTRA	TOP STEEL	EXTRA TOP STEEL AT SUPPORT LEFT	EXTRA TOP STEEL AT SUPPORT RIGHT	STIRRUPS DIA.	STIRRUPS LEFT L/4	STIRRUPS REST L/2	STIRRUPS RIGHT L/4	REMARK
B1	200	600	2T16+1T12		2 T 12	2 T 16	2 T 12	8T	100€	100€	100€	FRAME BEAM
B2	200	600	2 T 16		2 T 12	2 T 12	2 T 20	10T	100€	100€	100€	FRAME BEAM
B3	300	600	3 T 16	1 T 16	2 T 16	2 T 20	2 T 25	12T	100€	150€	100€	FRAME BEAM
B4	300	600	3 T 16	1 T 16	2 T 16	2 T 25	2 T 25	12T	100€	150€	100€	FRAME BEAM
B5	300	600	3 T 16	1 T 16	2 T 12	2 T 25	2 T 25	10T	100€	125€	90€	FRAME BEAM
B6	200	600	2 T 20		2 T 20			10T	100€	100€	100€	FRAME BEAM
B7	200	600	2 T 20		2 T 20			8T	100€	100€	100€	FRAME BEAM
B8	200	450	2 T 16		2 T 12		2 T 25	8T	100€	100€	100€	FRAME BEAM
B9	300	450	3 T 25	2 T 25	2T20+1T16	2 T 25		12T	100€	150€	150€	FRAME BEAM
B10M	200	600	2 T 16		2 T 12		2 T 20	10T	100€	100€	100€	FRAME BEAM @LANDING LVL.
B11	300	600	3 T 20		2T20+1T16	2 T 20	2 T 25	12T	100€	100€	90€	FRAME BEAM
B12	300	600	3 T 16		3 T 12	2 T 25	2 T 20	12T	100€	150€	100€	FRAME BEAM
B13	300	600	3 T 16		3 T 12	2 T 20	2 T 20	10T	100€	125€	90€	FRAME BEAM
B14	200	600	2 T 16		2 T 12	2 T 16	2 T 16	10T	100€	100€	100€	FRAME BEAM
B15	200	600	2 T 16		2 T 12	2 T 16	2 T 16	8T	100€	125€	100€	FRAME BEAM
B16	300	600	2T16+1T12		3 T 12	2 T 16	2 T 16	12T	100€	125€	100€	FRAME BEAM
B17	300	600	3 T 16		2 T 12	2 T 16	2 T 16	12T	100€	150€	100€	FRAME BEAM
B18	200	325	2 T 16		2 T 12			8T	150€	150€	150€	
B19	200	325	2 T 16		2 T 12			8T	150€	150€	150€	
B20,B21	900	450	6 T 32	1 T 32	3T25+3T20	3 T 32	3 T 32	10T	100€	150€	100€	FRAME BEAM 10MM CAMBER @ MID SPAN
									(6-LEGGED)			
B22	450	600	2T25+2T20		2T25+2T20	3 T 25	3 T 25	10T	100€	150€	100€	FRAME BEAM
									(4-LEGGED)			
HB	200	T	2 T 12		2 T 12			8T	150€	150€	150€	HIDDEN BEAM

SLAB SCHEDULE — TYPICAL FLOOR

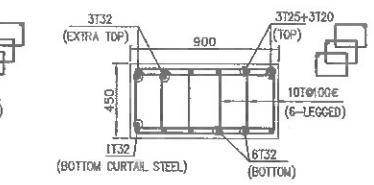
NOTE	SLAB NUMBERS	THICK.	SHORT SPAN STEEL	LONG SPAN STEEL	REMARK
	S1	150	8T@150€ (ALT BAR BENT UP)	8T@200€ (ALT BAR BENT UP)	TWO WAY
	S2	200	12T@125€ (ALT BAR BENT UP)	12T@150€ (ALT BAR BENT UP)	TWO WAY
200 SUNK	S3	125	8T@150€ (ALT BAR BENT UP)	8T@150€ (ALT BAR BENT UP)	TWO WAY
200 SUNK	S4	125	8T@200€ (ALT BAR BENT UP)	8T@275€ (DISTRIBUTION)	ONE WAY
	S5	125	8T@200€ (ALT BAR BENT UP)	8T@275€ (DISTRIBUTION)	ONE WAY
	S6	225	12T@100€ (ALT BAR BENT UP)	8T@150€ (DISTRIBUTION)	ONE WAY
	S7	200	12T@100€ (ALT BAR BENT UP)	8T@175€ (DISTRIBUTION)	ONE WAY
STAIRCASE	ST	175	8T@200€ (DISTRIBUTION)	10T@100€ (ALT BAR BENT UP)	ONE WAY



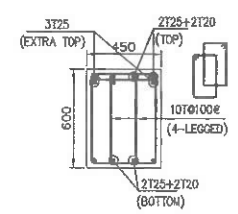
C/S OF BEAM-B20,B21 @ LEFT SUPPORT



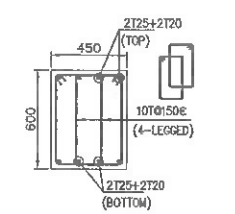
C/S OF BEAM-B20,B21 @ MID SPAN



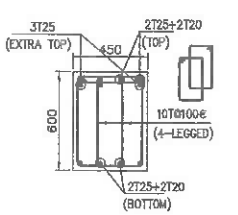
C/S OF BEAM-B20,B21 @ RIGHT SUPPORT



C/S OF BEAM-B22 @ LEFT SUPPORT



C/S OF BEAM-B22 @ MID SPAN



C/S OF BEAM-B22 @ RIGHT SUPPORT

NOTES

REFER ARCHITECTURAL DRAWINGS PLAN, SECTION & ELEVATION. ALONG WITH THIS DRAWING.
THIS DRAWING IS NOT TO BE SCALED.
USE MIX M:30 & Fe:500 STEEL FOR BEAM & SLAB
BUILDIND IS DESIGNED FOR STILT FLOOR + 4 TYPICAL FLOORS + TERRACE FLOOR
" T " INDICATES TOR STEEL

P. PRADEEP, B.E., M.TECH.(Struct)
Structural Engineer (Grade-I), CMDA,
Reg. No. SE/GR-I/19/07/184
RSE100932019 dt.03.02.2020
E2-607, Purva Windermore, Pallikaranai,
Chennai - 600 100. Ph: 9500702114

KEY PLAN | KEY SECTION

REVISION	DATE	DESCRIPTION	SIGN.
R0	10/04/2023	FOR SUBMISSION	

DRG. TITLE :- LAYOUT & SCHEDULE OF TYPICAL FLOOR

PROJECT :- PROPOSED COMMERCIAL BUILDING @ G N CHETTY ROAD, CHENNI.

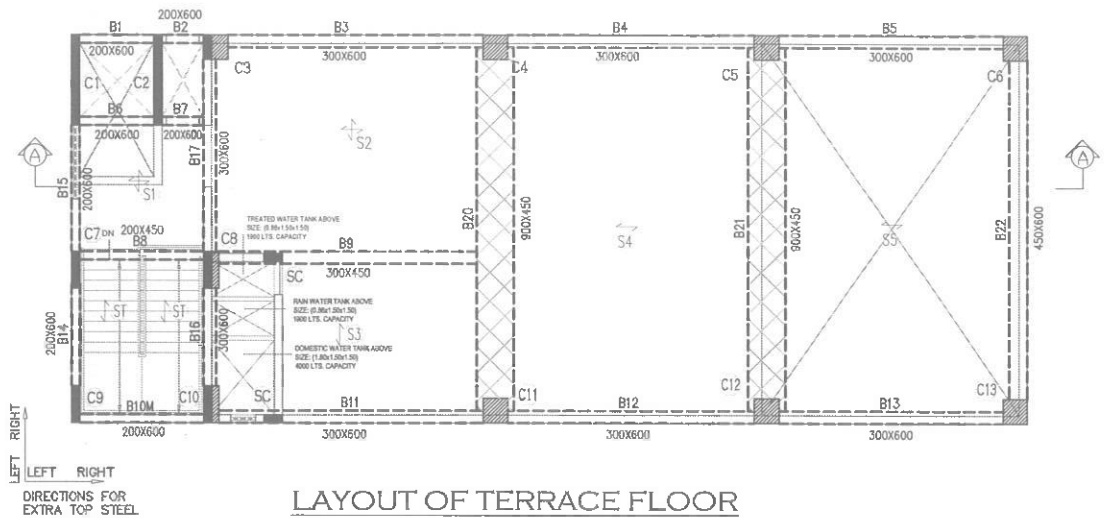
ARCHITECT :-
Kharche & Associates
ARCHITECTURE TOWN PLANNING INTERIOR DESIGN
PROJECT MANAGEMENT ENGINEERING CONSULTANCY
20, Sheffee Mohamed Road, Chennai - 6. T.N., India. Tel.: +91 (44) 829 52917/52981
Fax: +91 (44) 829 0691 e-mail: kharche@vsnl.com URL: http://www.kharche.com

CLIENT :- MR. KETAN M CHANANN

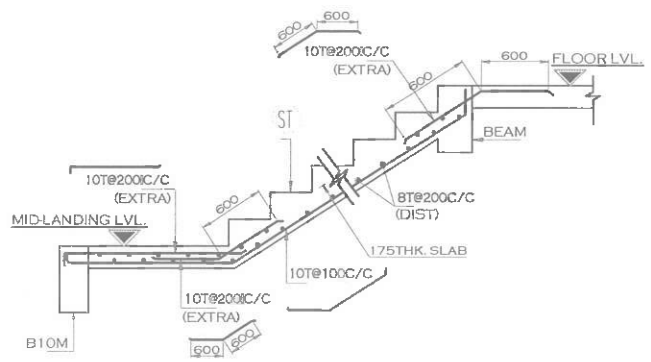
DRAWN BY :-	CHECKED BY :-	SCALE :-
SWAPNIL	T.S.P.	1:100
DRG. NO.	REVISION	DATE
1116/04	*R0	10/04/2023

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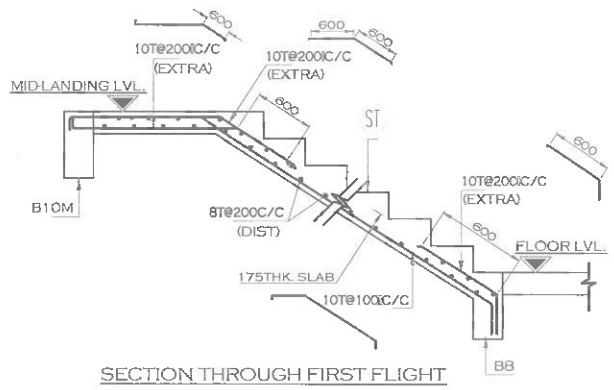
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Consulting Structural Engineers
Office No-402, 4th Floor, Wing-C,
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Tel-9011076507, 9011016556
Email : structure.pune@gmail.com
Web : www.designageconsultants.com



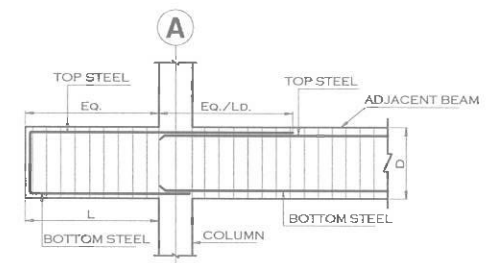
LAYOUT OF TERRACE FLOOR



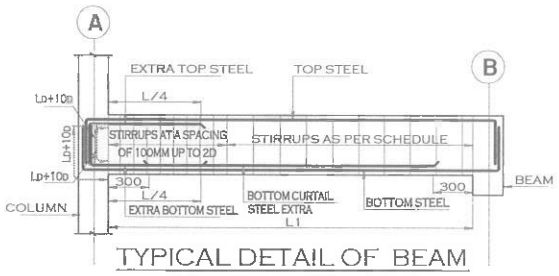
SECTION THROUGH SECOND FLIGHT



SECTION THROUGH FIRST FLIGHT

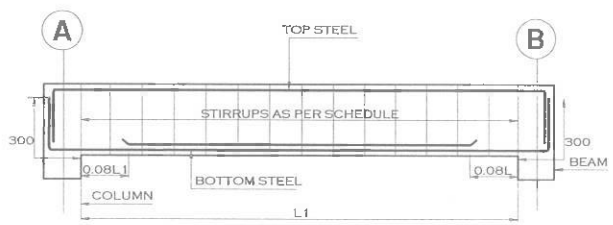


TYPICAL DETAIL OF CANTILEVER BEAM



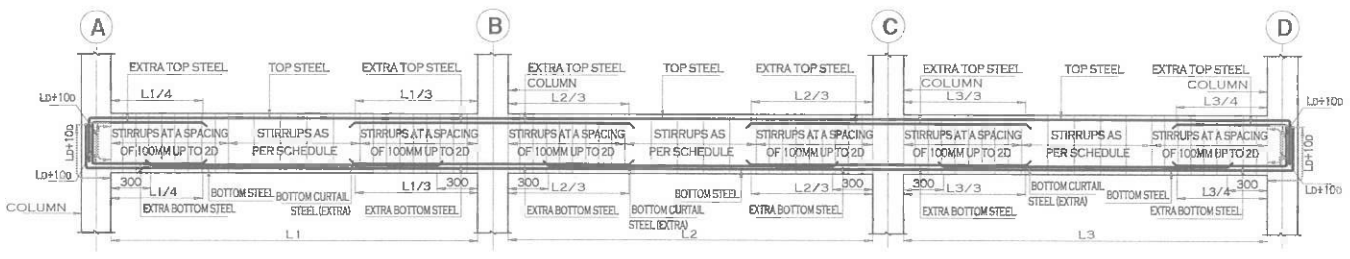
TYPICAL DETAIL OF BEAM

BEAM RESTING ON COLUMN & BEAM

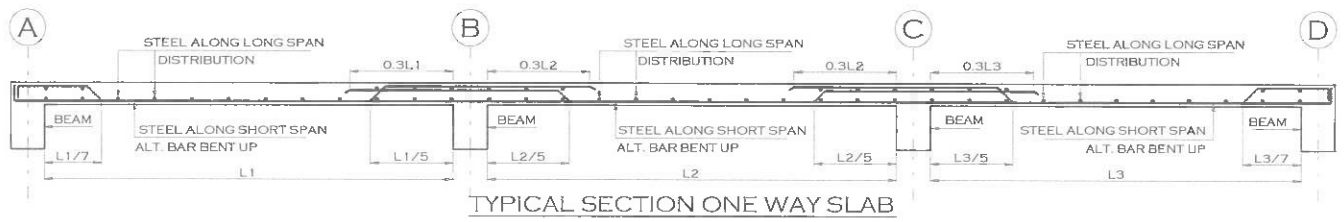


TYPICAL DETAIL OF BEAM

BEAM RESTING ON BEAMS



TYPICAL DETAIL OF CONTINUOUS BEAM



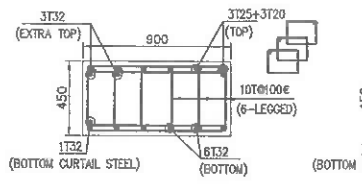
TYPICAL SECTION ONE WAY SLAB

BEAM SCHEDULE — TERRACE FLOOR

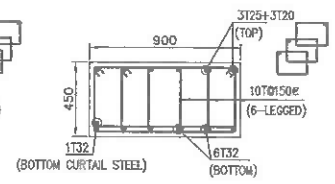
BEAM NUMBERS	SIZE B	SIZE D	BOTTOM STEEL	BOTTOM CURTAIL STEEL EXTRA	TOP STEEL	EXTRA TOP STEEL AT SUPPORT LEFT	EXTRA TOP STEEL AT SUPPORT RIGHT	STIRRUPS DIA.	STIRRUPS LEFT L/4	STIRRUPS REST L/2	STIRRUPS RIGHT L/4	REMARK
B1	200	600	2T16+1T12		2 T 12			8T	100€	100€	100€	FRAME BEAM
B2	200	600	2 T 16		2 T 12		2 T 20	10T	100€	100€	100€	FRAME BEAM
B3	300	600	3 T 16	1 T 16	2 T 16	2 T 20	2 T 20	10T	100€	125€	100€	FRAME BEAM
B4	300	600	3 T 16	1 T 16	2 T 16	2 T 20	2 T 20	10T	100€	150€	100€	FRAME BEAM
B5	300	600	3 T 16	1 T 16	2 T 12	2 T 20	2 T 20	10T	100€	125€	90€	FRAME BEAM
B6	200	600	2 T 20		2 T 16			10T	100€	100€	100€	FRAME BEAM
B7	200	600	2 T 20		2 T 16			8T	100€	100€	100€	FRAME BEAM
B8	200	450	2 T 16		2 T 12		2 T 25	8T	100€	100€	100€	FRAME BEAM
B9	300	450	3 T 25	2 T 25	2T20+1T16	2 T 25		12T	100€	150€	150€	FRAME BEAM
B10M	200	600	2 T 16		2 T 12		2 T 20	10T	100€	100€	100€	FRAME BEAM @MIDLANDING LVL.
B11	300	600	3 T 20		2T16+1T12	2 T 20	2 T 20	12T	100€	100€	100€	FRAME BEAM
B12	300	600	3 T 16		3 T 12	2 T 20	2 T 20	10T	100€	150€	100€	FRAME BEAM
B13	300	600	3 T 16		3 T 12	2 T 20	2 T 20	10T	100€	125€	90€	FRAME BEAM
B14	200	600	2 T 16		2 T 12		2 T 12	8T	100€	100€	100€	FRAME BEAM
B15	200	600	2 T 16		2 T 12	2 T 12	2 T 12	8T	100€	125€	100€	FRAME BEAM
B16	300	600	2T16+1T12		3 T 12	2 T 12	2 T 16	12T	100€	125€	100€	FRAME BEAM
B17	300	600	3 T 16		2 T 12	2 T 16	2 T 16	12T	100€	150€	100€	FRAME BEAM
B20,B21	900	450	6 T 32	1 T 32	3T25+3T20	3 T 32	3 T 32	10T	100€	150€	100€	FRAME BEAM 10MM CAMBER @ MID SPAN
									(6—LEGGED)			
B22	450	600	2T25+2T20		2T25+2T20	3 T 25	3 T 25	10T	100€	150€	100€	FRAME BEAM
									(4—LEGGED)			

SLAB SCHEDULE — TERRACE FLOOR

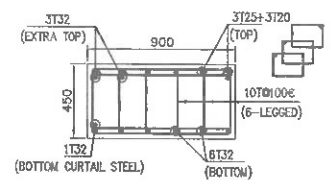
NOTE	SLAB NUMBERS	THICK.	SHORT SPAN STEEL	LONG SPAN STEEL	REMARK
	S1	150	8T@150€ (ALT BAR BENT UP)	8T@200€ (ALT BAR BENT UP)	TWO WAY
	S2	200	12T@125€ (ALT BAR BENT UP)	12T@150€ (ALT BAR BENT UP)	TWO WAY
	S3	175	8T@100€ (ALT BAR BENT UP)	8T@200€ (DISTRIBUTION)	ONE WAY
	S4	225	12T@100€ (ALT BAR BENT UP)	8T@150€ (DISTRIBUTION)	ONE WAY
	S5	200	12T@100€ (ALT BAR BENT UP)	8T@175€ (DISTRIBUTION)	ONE WAY
STAIRCASE	ST	175	8T@200€ (DISTRIBUTION)	10T@100€ (ALT BAR BENT UP)	ONE WAY



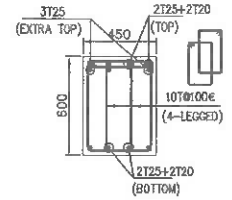
C/S OF BEAM-B20,B21 @ LEFT SUPPORT



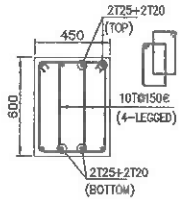
C/S OF BEAM-B20,B21 @ MID SPAN



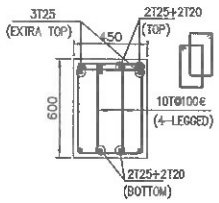
C/S OF BEAM-B20,B21 @ RIGHT SUPPORT



C/S OF BEAM-B22 @ LEFT SUPPORT



C/S OF BEAM-B22 @ MID SPAN



C/S OF BEAM-B22 @ RIGHT SUPPORT

NOTES

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P. PRADEEP, B.E., M.TECH.(Struct)
Structural Engineer (Grade-I), CMDA,
Reg. No. SE/GR-I/19/07/184
RSE100932019 dt.03.02.2020
E2-607, Purva Windermore, Pallikaranai,
Chennai - 600 100. Ph:9500702114

KEY PLAN | KEY SECTION

REVISION	DATE	DESCRIPTION	SIGN.
R0	10/04/2023	FOR SUBMISSION	

DRG. TITLE :- LAYOUT & SCHEDULE OF TERRACE FLOOR

PROJECT :- PROPOSED COMMERCIAL BUILDING @ G N CHETTY ROAD, CHENNI.

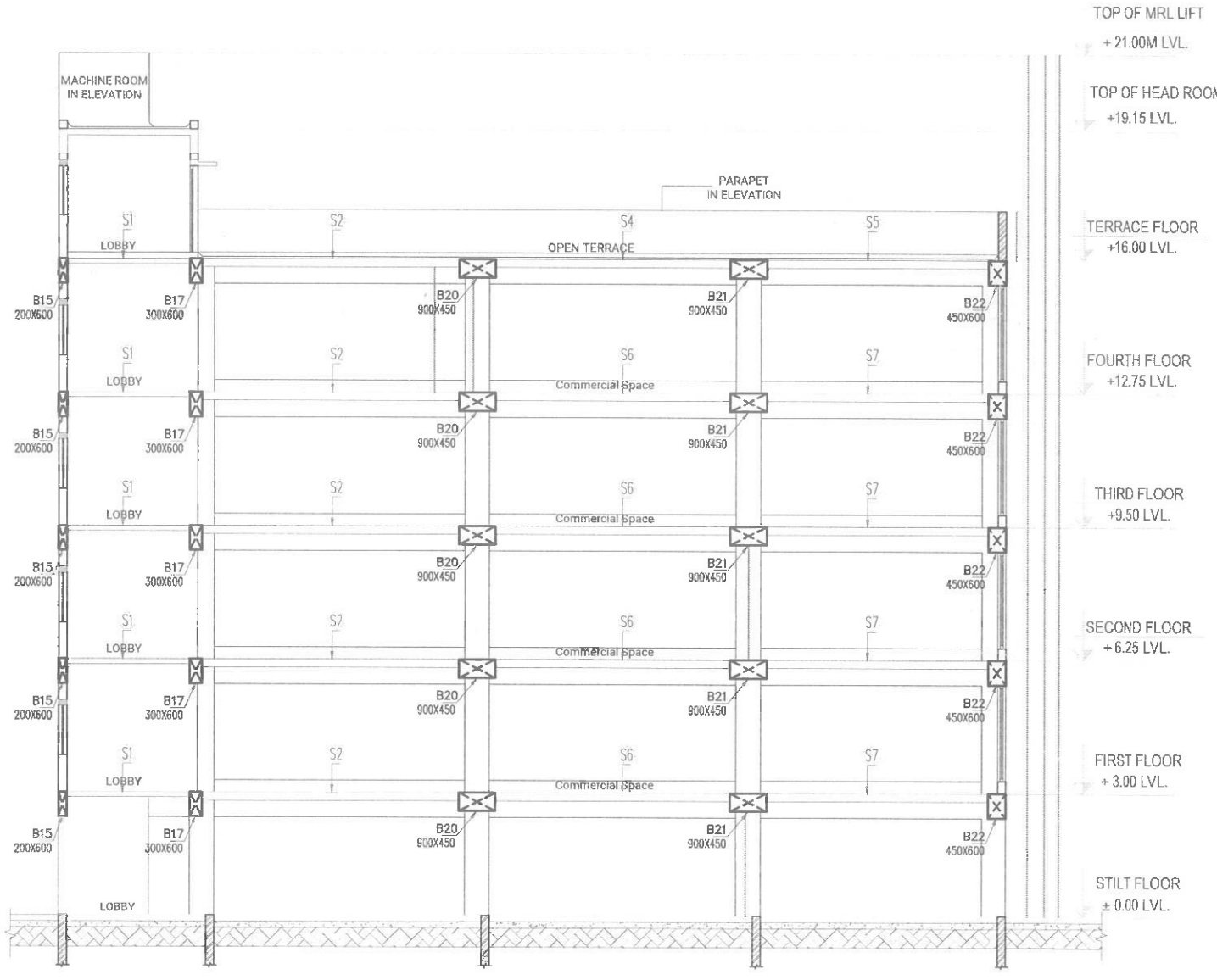
ARCHITECT :-
Kharche & Associates
ARCHITECTURE TOWN PLANNING INTERIOR DESIGN
PROJECT MANAGEMENT ENGINEERING CONSULTANCY
20, Shaffee Mohamed Road, Chennai - 6, T.N., India. Tel: +91 (44) 829 1291/3874/3281
Fax: +91 (44) 829 0681 e-mail: kharche@md4.com URL : http://www.kharche.com

CLIENT :- MR. KETAN M CHANANN

DRAWN BY :-	CHECKED BY :-	SCALE :-
SWAPNIL	T.S.P.	1:100
DRG. NO.	REVISION	DATE
1116/05	R0	10/04/2023

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Near Vardhman Petrol Pump, Warje, Pune-411052
Tel-9011078607, 9011016556
Email : structure.pune@gmail.com
Web : www.designageconsultants.com



SECTION : A-A

NOTES

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BUILDIND IS DESIGNED FOR STILT FLOOR + 4 TYPICAL FLOORS + TERRACE FLOOR
" T " INDICATES TOR STEEL

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KEY PLAN

KEY SECTION

REVISION	DATE	DESCRIPTION	SIGN.
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DRG. TITLE :-
KEY SECTION A-A

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@ G N CHETTY ROAD, CHENNI.

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