DESIGN BASIS REPORT
OF
RESIDENTIAL SCHEME
ALABHYA @ SCIENCE PARK
AHMEDABAD

-: CLIENT:-

MR. ANISH PATEL

-: PREPARED BY:-

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1.0 Introduction

This document forms the Engineering Design Inputs for Structural Works. The contents of these documents form the guideline for engineering and to provide information to the other disciplines concerned.

1.1 Design Philosophy

RCC has been chosen as the basic structural material as against alternatives available like Structural Steel framework and MS Decks. RCC has many advantages and characteristics in respect of mouldability, fire resistance, weather resistance and cost effectiveness over the other alternatives indicated for this buildings.

Building is analyzed and designed in ETABS (18) software.
Ductile detailing of Reinforced concrete structures subjected to seismic forces shall be as per IS 13920.

1.2 Structural System for the BUILDINGS

The building is design for **B3+B2+B1+GF+21st** Floor Only. The structural system provided is conventional RCC frame structure (Building with ductile RC structural walls). **The building has been designed considering no provision of additional floor in future as per Architectural submission.**

Load and Stresses are taken as per relevant Indian Codes of Practices.

Gravity Loads:

For any structure the primary loads are the gravity loads or the vertical loads. The gravity loads are imposed primarily on the floors and loads then get transferred to the beams, which in turn are transferred to the columns. The columns transfer the loads to footings and then to the earth. With the available data, presently beam-slab beam system is adopted as the structural scheme for the proposed building.

Lateral Loads:

Wind and Earthquake are the primary lateral loads that are acting on any structure. The parameters for earthquake loads have been considered from relevant Indian standards. The building is designed as a special moment resisting frame as the proposed construction is located in **Zone III** of earthquake. Through the diaphragm action of the slab the loads are transferred to the vertical elements (columns /shear walls). This phenomenon is simulated by imposing the loads to the column beam junctions. Columns then transfer the lateral loads to the Foundations.
Building is designed for updated earthquake Codes IS: 1893 (part 1):2016 and IS 13920:2016. Ahmedabad is in **Zone III** as per IS: 1893 (As per Fig.1) Importance factor I should be taken as 1.2 (As per table 8) Response Reduction factor R (As per table 9) for Building with ductile RC structural walls is 4.0.

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2.0 Geo-Technical Survey and Details

The Architect / Engineer are responsible for the acquisition of a geo-technical exploratory survey to obtain accurate information about the soil conditions at the site. The depth, thickness, extent, composition of each stratum, and the depth of ground water shall be determined. Provide a geo-technical report based on survey data, which includes boring logs, field and laboratory test results, interpretation of data, building foundation and earthwork recommendations.
From the investigations following basic data are noted as:

(a) Ground Water Table : Not encountered up to foundations level.

(b) SBC of Soil : As per Geotechnical Investigation by Soilmate laboratory & Consultancy **(35T/m2 AT 12.5 m from existing G.L.)**

(c) Depth of foundation : 2.8 mt From 3RD Basement Floor Level

3.0 List of Design Codes & Standards

Foundation Engineering

IS-1080 (1985):- Design and Construction of shallow foundation on soils

IS-6403 (1981):- Determination of Bearing capacity on shallow Foundations

IS-8009 - Part I (1976) & Part II (1980):- Calculation of settlement of Foundations

Loading Standard Codes and Design Aids

IS Code No.	Description
IS: 456-2000	Code of Practice for Plain and Reinforced Concrete
IS: 875-1987 IS: 875-1987 IS: 875-2015 IS: 875-1987	Part I – Dead Loads. Part II – Imposed Loads Part III – Wind Loads Part V – Special Loads and Load Combinations
IS:1893/ 2016	Criteria for Earthquake Resistant Design of Structures

IS: 13920-2016 IS:16700-2017	Ductility detailing of RCC Structure subjected to seismic forces Criteria for Structural Safety of Tall Concrete Buildings
IS 1904	Design and Construction of Foundation in Soils
IS 3414	Design and Installation of Joints in Buildings
IS 1905	Code of Practice for structural use of Unreinforced Masonry
SP-7	National Building Code of India
SP-16	Design Aids for Reinforced Concrete to IS:456-2000
SP-24	Explanatory Hand Book on Plain and R.C.C. I.S.456
SP-34	Handbook of Concrete, Reinforcement and Detailing (SCIP)

IS-3370 (2009) –Concrete Structure for Storage of Liquids

Reinforcement
IS-1786 (1985) -High Strength Deformed Steel Bars
IS-2502 (1963) -Bending and fixing of bars for Concrete Reinforcement
IS-5525 (1969) -Recommendation for Detailing of Reinforcement in Concrete Works

Brick and Hollow block
IS-1077 (1990) -Common burnt Clay Building Bricks
IS-2212 (1991) -Brick work
IS-2185 - Cement Concrete Block. Part l (1979),
Part II (1983), Part III (1984) -Hollow Cement Concrete Blocks

Cement and Fine & Coarse aggregates
IS-269 (1989) -33 grades Ordinary Portland Cement (OPC)
IS-455 (1989) -Portland Slag Cement
IS-1489 Part 1(1991) -Portland Pozzolana Cement (PPC) fly ash based Part II (1989) -PPC Calcined clay based.
IS-8112 (1989) - 43 grade Ordinary Portland Cement (OPC) IS-12330 (1988) - Sulphate Resisting Portland cement
IS-12269 - 53 Grade ordinary Portland cement
IS-383 (1970) - Coarse and Fine aggregate

Steel design
IS-2062 (1992) -Steel for General Structural purpose
IS-800 (1984) -Use of Structural Steel for General Building construction IS-806 (1968) -Use of Steel Tubes in General Building Construction

Reference Books

Reinforced Concrete Design	- N Subramanian
Design of reinforced concrete buildings	- S.
Ramarutham Limit State Design	- A. K Jain
Reinforced Concrete Designers Handbook	- Charles E.
Reynolds Reinforced Concrete Design	- B. C. Punmia

Reinforced Concrete Design - N. KrishnaRaju

4.0 List of Input Data & Basic Material Specifications

Geometrical Data

(a) Number of stories: B3+B2+B1+GF+21st FLOOR ONLY
(b) Number of block: 03
(c) Height of building : 69.72 mt
(d) Floor Height: 3.32 mt

Support Condition

- All Column Supports are considered as Fixed.

Notes: Mechanical Couplers to be used instead of lapping [conforming to IS 16172].

Material Specification

Concrete Materials For	Material Grade
Footings	M 35
Column & Shear wall	M 45
Beam	M 30 (Otherwise Specified)
Slab	M 30 (Otherwise Specified)
PCC	M 15
Grade Slab or Any Other Lean Concrete	M 20
Reinforcing steel high yield strength Deformed (FYSD) bars to IS 1786	Fe 500D

Material Density

Material	Weight Density - T/m^3
Light weight Block Masonry	0.65
Reinforced Cement Concrete With normal aggregates	2.5
Filling in Sunk Slabs, etc.	1.2
Dry & Saturated soil	1.5 & 1.8
Plaster	2.0
Water	1.0

5.0 Load

Building Design Loads will be in accordance with the more stringent of either the following criteria or as set forth by governing local and national codes. Structural design will be coordinated with architectural, mechanical and electrical drawings to ensure all loads impacting Structural elements are adequately supported. Wind and seismic loads will be as required by governing local or national codes.

Dead loads

FLOOR LOAD:

Dead Load:

Weight of Slab (150MM THK.) = 2.5 x 0.150 = 0.3750 T/m^2

Weight of Slab (125MM THK.) = 2.5 x 0.125 = 0.3125 T/m^2

Weight of Slab (175MM THK.) = 2.5 x 0.175 = 0.4375 T/m^2

Floor Finished:-

@ Terrace Floor [with water proofing load] = 0.3T/m2

@ Typical Floor = 0.125T/m2 as per Table-1 of IS 875 (part-01)

[0.015x2.59] + [0.05x1.51] = 0.114 = say 0.125T/m2

@ Basement Slab [with water proofing load] = 0.2 T/m2

- Additional Load at Machine room area = 1.0 T/m2
- Water Tank Load and Capacity as per Architectural drawing.
- Considered 300mm depth of sunk filling [with water proofing load] = 0.36 T/m2

MEMBER LOAD:-

Considered 20mm plaster outside and 12mm plaster inside.

For 3320mm Floor Height:

200mm THK Wall Load = 0.200 X 0.65 X (3.32 - 0.6) + 0.032 X 2.0 X 3.32 = 0.567 T/m

100mm THK Wall Load = 0.100 X 0.65 X (3.32 - 0.6) + 0.032 X 2.0 X 3.32 = 0.390 T/m

For 3500mm Floor Height:

200mm THK Wall Load = 0.200 X 0.65 X (3.5 - 0.6) + 0.032 X 2.0 X 3.5 = 0.601 T/m

100mm THK Wall Load = 0.100 X 0.65 X (3.5 - 0.6) + 0.032 X 2.0 X 3.5 = 0.4125 T/m

Live Loads

Considering the functional utilities of this building, imposed loads are as:

Generally as per IS 875 (Part II) or as specified by Requirement/clients. Occupancy Classification	Floor Load in T/m^2
Basement Floor slab/ COP	0.6 / 1.2
Passage / Foyer on Typical floor / Balcony	0.3
Typical Floor	0.2
Terrace Floor Lvl.	0.15
Stair case Area	0.4

Earth Quake Loadings

The Seismic Loads are considered for Zone III as per IS: 1893-2016 with the following factors:

Zone Factor (Z)	0.16
Importance Factor	1.2
Response Reduction Factor (R)	4.0

Design acceleration coefficient (Sa/g) for Medium soil as per Cl: 6.4 [IS: 1893-2016].

Time period will be fixed building to building depends on Architectural Brick infills or without infills wall masonry as below:

Fundamental natural time period in earth quake with RC structural walls is considered.

$$T_a = 0.075h^{0.75} / \sqrt{A_w} \geq 0.09h/ \sqrt{d}$$

Where,
h = Height of building = 66.675m

Building Height	75.37	m	Above G. Level to Terrace							
Dx	18.495	m		37.5	23.5	**IS 1893 (Part 1) : 2016**				
Dy	46.185	m		38	16.5	Cl. 7.6.2, (b) Building with RC Structural Walls				
Wall No.	**W1**	**W2**	**W3**	**W4**	**W5**					
X Direction										
Length, m	1.2	1.2	1.5	3.58	3.43					
Thickness, m	0.3	0.3	0.3	0.3	0.3					
Nos	8	4	2	2	2					
Area	0.36	0.36	0.45	1.074	1.029	0	0	0	0	0
Aw	0.58	0.29	0.18	0.43	0.42	0.00	0.00	0.00	0.00	0.00
Net Aw	1.90	sec								
Tx	1.39	sec	**With out** Infill Wall			Tx	1.58 Sec			
Tx	1.58	sec	With Infill Wall							
Wall No.	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**	**W7**	**W8**		
Y Direction										
Length, m	0.9	1.2	1.5	2.85						
Thickness, m	0.3	0.3	0.3	0.3						
Nos	2	14	2	2						
Area	0.27	0.36	0.45	0.855	0	0	0	0		
Aw	0.11	1.01	0.18	0.34	0.00	0.00	0.00	0.00		
Net Aw	1.64	sec								
Ty	1.50	sec	**With out** Infill Wall			Ty	1.50 Sec			
Ty	1.00	sec	With Infill Wall							

Design Horizontal Seismic coefficient Ah = (Z/2) x (Sa/g) x (I/R)

Design Base Shear $V_B = A_h$ x Seismic weight of the building

The structure is designed as Special RC Moment Resistant Frame with ductility details as per IS: 13920-2016.
For Seismic Wt. calculation percentage of design live load considered as 25% up to 3 KN/m2 and 50% above 3 KN/m2 and ignored at terrace floor lvl.

We will perform both Static and Dynamic analysis. And dynamic analysis are perform or as the requirements case to case by Response Spectrum Method.
The Geometrical Properties (structural elements) sizes and Locations will be set to see that there will be no Torsion in First two fundamental modes.

We will consider Floor Diaphragm as a **Rigid/Semi-rigid as per Clause-7.6.4 (Semi-Rigid if temp load considered)** in their own plane and also consider actual design eccentricity e_{di},

$$e_{di} = 1.5\, e_{si} + 0.05\, b_i$$

or

$$e_{di} = e_{si} - 0.05\, b_i$$

We will check all clauses related to Irregularity of buildings likes torsional, Stiffness, Mass and Geometric etc. For all Blocks. (Clause: 7.0)

Types of Diaphragm: - Rigid Diaphragm

(Lateral Displacement, $\Delta_{max} < 1.2\, \Delta_{avg}$ of the Entire Diaphragm) for Displacement value refer Check list Clause-9.

Stiffness Modifiers (as per IS 16700-2017):-

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

<u>Wind Loads:</u>

As per IS 875(Part-3)-2015,

Basic Wind speed (Vb) = 39 m/s
Considered Coefficient as per IS code.

Conclusion: - Static Earthquake load is higher than Static wind load. So, no need to perform dynamic wind analysis.

Check List

1) Design Basis Report:

a) Description of Project-

This project consists of B3+ B2+B1+ HP +21st floor only in form of residential building. The building is classified in residential building with importance factor of 1.2 during earthquake. The building is located science park at Ahmedabad which falls under Earthquake Zone-III. No Future floor provision is made for this building.

No of Basement	- 3
Residential floors	- Hollow Plinth + 21st Floors

b) List of Codes

IS 456-2000

IS 1893-2016

IS 13920-2016

IS 16700-2017

SP 16 & SP 30

SP 34

IS 875 (Part-1)-1987

IS 875 (Part-2)-1987

IS 875 (Part-3)-2015 and All other relevant IS code

c) Loading parameters

1. Dead Load - Self weight as per calculation.
2. Floor Finish - Typical Floors: 1.25 kN/m^2
   Basement: 2.0/2.5 kN/m^2
3. Live Load - 6 kN/m^2 for Basement & Hollow Plinth
   12 kN/m^2 for Extended Basement for Fire fighting vehicle
   2 kN/m^2 for Typical Floor
   1.5 kN/m^2 for Terrace
4. Earthquake Zone III, I=1.2, R=4
   Response Spectrum method has been used for the dynamic analysis in accordance with IS 1893 (Part 1): 2016. Load cases have been defined as SPECx and SPECy.

d) Nominal cover

Column	-	40 mm
Beam	-	30 mm
Slab	-	25 mm
Shear wall	-	40 mm

e) Grade of concrete

Column	-	M50
Beam	-	M30
Slab	-	M30
Shear Walls	-	M50

f) Grade of steel - Fe 500D

g) Exposure Condition - Mild

h) Wind Tunnel Testing - NA

i) Construction Sequence and loading parameters - NA

j) Proposed Approach to Structural Analysis -

Special Moment Resisting Frame with ductile RC structural wall earthquake resistant design forces
Software used for analysis and design - ETABS, SAFE

k) Load Combinations

1.5(DL+LL)

EARTH QUAKE:-

$1.2\ [DL + LL \pm EQ_X]$
$1.2\ [DL + LL \pm EQ_Y]$
$1.5\ [DL \pm EQ_X]$
$1.5\ [DL \pm EQ_Y]$
$0.9\ DL \pm 1.5\ EQ_X$
$0.9\ DL \pm 1.5\ EQ_Y$

WIND LOAD:-

$1.2\ [DL + LL \pm WL_X]$
$1.2\ [DL + LL \pm WL_Y]$
$1.5\ [DL \pm WL_X]$
$1.5\ [DL \pm WL_Y]$
$0.9\ DL \pm 1.5\ WL_X$
$0.9\ DL \pm 1.5\ WL_Y$

l) Soil Profile

Safe Bearing Capacity - 40 T/m^2 below 12.5m from E.G.L for Raft
(For 75 mm Permissible settlement)
By soulmate consultancy report

Type of foundation - Raft / Isolated

m) Soil Retention System - Diaphragm Wall

n) Key Plan - Drawing Attached

o) Added Features - NA

2) DESCRIPTION OF SUB-STRUCTURE AND SUPER STRUCTURE

Description of Sub-Structure

1.	**No. Of Basement**		2
2.	**Minimum Clearance between outermost basement retaining wall and compound wall**		2.8m
3.	**Shoring system installed** **(Submit Sectional Detail of the shoring system)**		Diaphragm Wall
4.	**Details Of Methodology used to resist uplift pressure due to ground water for tower portion as well as the portion outside the tower**	**Bottom Level Of Raft w.r.t. ground level**	15.3 m
		Total downward load of self-weight of raft + Counterweight over raft + Rock Anchors (if any)(for raft spanning between columns)	NA .. AS PER SOIL REPORT NO GROUND WATER ENCOUNTERED
		Whether Pressure release pipes have been used?	NA

		Water Level assumed for uplift calculation	NA
5.	**Description of the foundation for the Tower Block**		RAFT
6.	**Nature Of Foundation**	**Piles, Spread Footings , Combined Raft , Piled Raft , etc.**	Raft, Isolated
7.	**SBC T/m^2 Soil Report**		40 T/m^2
8.	**Sub – grade Elastic Modulus**		NA
9.	**Flooring System of the Basements**		Tre-mix RCC floor.
10.	**Retaining Wall Types and Sequence of Backfilling**	**Whether Propped Cantilever, Cantilever Supported between Buttresses/Counter Forts, etc.**	Diaphragm Wall
11.	**Intended use of Basements**		Parking
12.	**If rock anchors are used, are they grouted after installation and stressing?**		NA
13.	**Is Structural Steel used in the construction of Sub-Structure?**		NA
13(a).	**If Yes, what are the measures taken for its fire proofing and corrosion resistance?**		NA
14.	**Whether Expansion/Separation joints provided?**		NA
14(a).	**Whether expansion joint/Separation joint**		NA

	continues through basement?		
14(b).	**If yes ,detail at Basement level and retaining wall junction**		NA

Description of Superstructure

1.	**(a) No. Of Floors** **(b) Height Of the building**	a) 3rd Basement + Hollow Plinth + 21th Floors Only b) 75.370m from ground lvl.
2.	**Shape of the Building** **(a)Plan** **(b)Elevation** **(c)Whether Symmetric in Elevation**	(a) & (b) Drawings attached (c) Symmetric in Elevation
3.	**Maximum Plan Dimension in either direction (in m.)**	46.00m
4.	**Ratio of Plan Dimension (Max. / Min.)**	2.487
5.	**(a)Typical Floor to floor height (in mt.)** **(b) Maximum floor to floor height in entire height of building (in mt.)**	(a) Typical - 3.320m (b) Basement - 4.750 m
6.	**Aspect ratio (Height of Building till Terrace/ Minimum Dimension of Building)**	4.075
7.	**Type of floor slab**	RCC
8.	**Avg. Thickness of floor slab (in mm.)**	125/150 mm
9.	**Whether column are RCC, Composite or in Structural Steel**	RCC
10.	**Lateral System**	Special Moment resisting RCC frame with ductile RC l structural wall
11.	**Whether the geometry of the building is symmetric**	Yes
12.	**Whether the lateral load resisting system is symmetrically placed in geometry**	Yes
13.	**Use of Floor at different levels(Residential/Commercial/Industrial)**	Residential
14.	**Use of floor at different levels(Residential/Commercial/Industrial)**	Residential

15.	**Is there any Transfer level?** **If yes, depth of Transfer Girder**	No
16.	**Whether expansion joint is provided?** **If yes, what is the maximum plan dimension in mt.**	No
17.	**Whether separation gap at joint is sufficiently provided?**	NA
18.	**Maximum Cantilever projection in mt.**	NA

3) DESCRIPTION OF STRUCTURAL SYSTEM

It is Special Moment Resisting Frame with Ductile shear wall for earthquake resistant design forces. Structural system attached in drawing.

4) Modelling & software used - ETABS, SAFE

5) Height of building - 75.370 m from ground lvl.

5A) Plan Dimensions- 18.495 m x 46.0 m

6) EQ loading details:

a) Zone Factor = III (Ahmedabad)

b) Importance Factor = 1.2

c) Response Reduction Factor = 4 (Special moment resisting frame with RC structural walls)

d) Soil Type = Hard

e) % L.L consideration for seismic design = 25 % for L.L <= 3 kN/m^2 & 50 % for L.L > 3 kN/m^2

f) Time Period in the horizontal X-Direction = 1.58 sec

g) Time Period in the horizontal Y-Direction = 1.50 sec

h) Total Seismic weight (W) = 20588.93 TONNE

i) Static Base shear in X-direction = 2.06 %

j) Static Base shear in Y-direction = 2.17 %

k) Table of distribution for static base shear

For Base shear – X Direction

Story	Load Case/Combo	Location	P	VX	VY	T	MX	MY
			tonf	tonf	tonf	tonf-m	tonf-m	tonf-m
OHWT	EQ X 1	Top	0	0	0	-0.578	-0.103	0.2147
Stair Cabin	EQ X 1	Top	0	0	0	-0.7789	0.1849	-7.0874
21FS-Terrace	EQ X 1	Top	0	-47.6684	0	1093.142	0.0559	-23.3093
20FS	EQ X 1	Top	-0	-96.3315	0	2210.773	0.2501	-217.5673
19FS	EQ X 1	Top	-0	-141.3564	0	3242.207	-0.1063	-596.8173
18FS	EQ X 1	Top	-0	-182.0764	0	4172.885	-0.8006	-1149.8652
17FS	EQ X 1	Top	-0	-218.7076	0	5007.856	-1.9481	-1865.1296
16FS	EQ X 1	Top	-0	-251.4665	0	5752.234	-3.5898	-2731.7984
15FS	EQ X 1	Top	-0	-280.5691	0	6411.082	-5.7779	-3739.6103
14FS	EQ X 1	Top	-0	-306.232	0	6989.508	-8.5556	-4878.7025
13FS	EQ X 1	Top	-0	-328.6868	-0	7492.618	-11.9614	-6139.511
12FS	EQ X 1	Top	-0	-348.1189	-0	7925.504	-16.0298	-7512.7814
11FS	EQ X 1	Top	-0	-364.7599	-0	8293.293	-20.7901	-8989.2819
10FS	EQ X 1	Top	-0	-378.8263	-0	8601.116	-26.2629	-10559.9758
9FS	EQ X 1	Top	-0	-390.5343	-0	8854.106	-32.4635	-12215.8916
8FS	EQ X 1	Top	-0	-400.1001	-0	9057.405	-39.3988	-13948.0744
7FS	EQ X 1	Top	-0	-407.7401	-0	9216.157	-47.0688	-15747.5172
6FS	EQ X 1	Top	-0	-413.6705	-0	9335.514	-55.4636	-17605.1022
5FS	EQ X 1	Top	-0	-418.1078	-0	9420.624	-64.5659	-19511.4844
4FS	EQ X 1	Top	-0	-421.2681	-0	9476.652	-74.3398	-21457.0372
3FS	EQ X 1	Top	-0	-423.3676	-0	9508.749	-84.7293	-23431.5909
2FS	EQ X 1	Top	-0	-424.6227	-0	9522.116	-95.6062	-25424.5109
1FS	EQ X 1	Top	-0	-425.2498	-0	9521.939	-106.7261	-27423.8667
GFS	EQ X 1	Top	-0	-425.476	-0	9513.83	-117.5045	-29417.6548
1BS	EQ X 1	Top	-0	-425.476	-0	9498.43	-130.1767	-32130.7603
2BS	EQ X 1	Top	-0	-425.476	-0	9488.526	-138.9977	-34454.3477
3BS	EQ X 1	Top	-0	-425.476	-0	9481.725	-147.1667	-37106.7072
TB	EQ X 1	Top	-0	-425.476	-0	9480.459	-152.8352	-39517.5015

For Base shear – Y Direction

Story	Load Case/Combo	Location	P	VX	VY	T	MX	MY
			tonf	tonf	tonf	tonf-m	tonf-m	tonf-m
OHWT	EQ Y 1	Top	0	0	0	0.7343	-0.3844	-0.1253
Stair Cabin	EQ Y 1	Top	0	0	2E-06	0.9688	1.4678	0.1065
21FS-Terrace	EQ Y 1	Top	0	0	-50.211	-418.1282	6.0841	0.3721
20FS	EQ Y 1	Top	0	0	-101.47	-853.4878	187.2143	0.9854
19FS	EQ Y 1	Top	0	0	-148.9	-1244.8492	552.0205	1.925
18FS	EQ Y 1	Top	0	0	-191.79	-1596.072	1087.9737	3.2401
17FS	EQ Y 1	Top	0	0	-230.37	-1909.1317	1782.7916	4.9766
16FS	EQ Y 1	Top	0	0	-264.88	-2186.1935	2624.6454	7.1801
15FS	EQ Y 1	Top	0	0	-295.53	-2429.319	3602.2605	9.8932
14FS	EQ Y 1	Top	0	0	-322.56	-2640.6503	4704.7644	13.1549
13FS	EQ Y 1	Top	0	0	-346.22	-2822.5486	5921.7027	16.9982
12FS	EQ Y 1	Top	0	0	-366.69	-2976.7133	7243.0706	21.454
11FS	EQ Y 1	Top	0	0	-384.21	-3105.5478	8659.1295	26.5408
10FS	EQ Y 1	Top	0	0	-399.03	-3211.2498	10160.584	32.2722
9FS	EQ Y 1	Top	0	0	-411.36	-3296.0197	11738.524	38.6537
8FS	EQ Y 1	Top	0	0	-421.44	-3362.0742	13384.4082	45.6826
7FS	EQ Y 1	Top	0	0	-429.49	-3411.6268	15090.0402	53.3466
6FS	EQ Y 1	Top	0	0	-435.73	-3446.9006	16847.5339	61.625
5FS	EQ Y 1	Top	0	0	-440.41	-3470.0946	18649.2311	70.4875
4FS	EQ Y 1	Top	0	0	-443.74	-3483.4165	20487.6188	79.8965
3FS	EQ Y 1	Top	0	0	-445.95	-3489.0012	22355.0811	89.8068
2FS	EQ Y 1	Top	0	0	-447.27	-3489.0007	24243.7881	100.1671
1FS	EQ Y 1	Top	0	0	-447.93	-3485.4074	26144.7511	110.9371
GFS	EQ Y 1	Top	0	0	-448.17	-3480.3873	28048.905	122.0259
1BS	EQ Y 1	Top	0	0	-448.17	-3473.142	30659.7267	137.5611
2BS	EQ Y 1	Top	0	0	-448.17	-3469.063	32913.1131	147.8922
3BS	EQ Y 1	Top	0	0	-448.17	-3466.5146	35535.893	156.536
TB	EQ Y 1	Top	0	0	-448.17	-3466.1202	37985.0843	161.3111

l) Max. Deflection at roof level (mm) =

DL+LL+SPECx = 145.83 mm (X Direction)
DL+LL+SPECy = 57.5 mm (Y Direction)

m) Maximum Inter storey Drift =

X DIRECTION
DL+LL+SPEC-X = 0.002024
Y DIRECTION
DL+LL+SPEC-Y = 0.000795

8) Data from Dynamic Analysis:

Mode	Period sec	UX	UY	RZ
1	6.472	0.6248	0.0022	0.0391
2	5.406	0.0075	0.532	0.0865
3	4.741	0.0056	0.1335	0.3933
	SUM	63.79%	66.77%	

9) Lateral Deflections (in mm) at Terrace Level:

Height = 75.370 m

Load Case	Dx-max (mm)	H/Dx	Drift-x	Dy-max (mm)	H/Dy	Drift-y
DL	40	1884.25	0.000746	2.958	67596.41	0.00005
DL+LL	48.00	1570.20	0.000907	5.561	26307.1	7.2E-05
DL+LL+SPECx	145.83	516.83	0.001834	19.712	7930	0.000223
DL+LL+SPECy	104	724.71	0.001274	57.5	1415.87	0.00051

10) Corner Displacements (in mm) for Torsional Irregularity (along x- Direction)

Load Case	Corner-1	Corner-2	Corner-3	Corner-4	Avg-x	% Max./ Avg.
DL+LL+SPECx	124.3	145.6	124.3	145.62	134.796	1.080

11) Corner Displacements (in mm) for Torsional Irregularity (along y- Direction)

Load Case	Corner-1	Corner-2	Corner-3	Corner-4	Avg-y	% Max./ Avg.
DL+LL+SPECy	45.4	58.3	45.1	58.9	51.925	1.122

13) Data Regarding Floating Columns:- NA

a) Total Gravity Load on Floating Column = NA
b) Size and span of girders supporting floating columns = NA
c) Number of floors supported by floating columns = NA
d) Deflection of girder under column (from model) = NA
e) Deflection of girder under column (from S/S action) = NA
f) Specific Details about floating columns on cantilever girders = NA

Column	**Supporting Girder**		**Deflection Values**		**Floors Above**	**Total Load in Column**
	Size	**Span**	**Model**	**S/S Action**		
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Note: S/S denotes simply supported

15) Data Regarding Soft Storey Effect

Story	Load Case	Stiffness X kN/m	STIFFNESS RATIO	Load Case	Stiffness Y kN/m	STIFFNESS RATIO
21FS-Terrace	EQ X 1	63322.38	1.9588268	EQ Y 1	143470.7	1.8056233
20FS	EQ X 1	124037.6	1.3900349	EQ Y 1	259054	1.3126104
19FS	EQ X 1	172416.6	1.2185175	EQ Y 1	340036.9	1.1662383
18FS	EQ X 1	210092.6	1.1385655	EQ Y 1	396564.1	1.1017137
17FS	EQ X 1	239204.2	1.0945286	EQ Y 1	436900.1	1.0675669
16FS	EQ X 1	261815.8	1.0679099	EQ Y 1	466420	1.0478288
15FS	EQ X 1	279595.7	1.0509883	EQ Y 1	488728.3	1.0356828
14FS	EQ X 1	293851.8	1.0399386	EQ Y 1	506167.5	1.0279763
13FS	EQ X 1	305587.9	1.0325481	EQ Y 1	520328.2	1.02287
12FS	EQ X 1	315534.2	1.0277686	EQ Y 1	532228.1	1.0195834
11FS	EQ X 1	324296.1	1.0248401	EQ Y 1	542650.9	1.0175243
10FS	EQ X 1	332351.6	1.0233302	EQ Y 1	552160.5	1.0163754
9FS	EQ X 1	340105.5	1.0230002	EQ Y 1	561202.4	1.0159595
8FS	EQ X 1	347928	1.0237024	EQ Y 1	570158.9	1.0161853
7FS	EQ X 1	356174.7	1.0254497	EQ Y 1	579387.1	1.0170799
6FS	EQ X 1	365239.3	1.0281949	EQ Y 1	589283	1.0173011
5FS	EQ X 1	375537.2	1.0323054	EQ Y 1	599478.3	1.0180721
4FS	EQ X 1	387669	1.0375318	EQ Y 1	610312.1	1.0196548
3FS	EQ X 1	402219	1.0456939	EQ Y 1	622307.7	1.0224322
2FS	EQ X 1	420597.9	1.0533546	EQ Y 1	636267.4	1.0205516
1FS	EQ X 1	443038.7	0.790755	EQ Y 1	649343.7	0.752087
GFS	EQ X 1	350335.1	1.3808106	EQ Y 1	488362.9	1.293469
1BS	EQ X 1	483746.4	1.0230438	EQ Y 1	631682.3	1.0052478

d) Level of Soft Storey = There is no soft storey in this building.

e) Number of floors above soft storey = There is no soft storey in this building.

16) Data for each Cantilever -

a) Cantilever Span = NA
b) Structural System = Frame structure
c) Nature of Usage = Residential
d) Maximum elastic deformation under gravity loads = 6 mm

17) Stability Calculations for uplift and overturning

There is no ground water encountered so no need of uplift calculations

18) Typical Design Calculations for footings:

Design calculations based on SAFE and RCDC model for Raft foundation and isolated footing

19) Typical Design Calculations for RCC Columns (Or Composite Columns)

As per E-tabs. There are no composite columns.

20) Typical Design Calculations for RCC Walls

As per E-tabs

21) Typical Design Calculations for RC Beams (Or Steel Beams) -

RCC beams are designed as per analysis result from ETABS.

22) Typical Design Calculations for Steel Bracings-NA

23) Wind tunnel – NA

24) Special provision for building – NA