APPENDIX – C

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DESIGN BASIS REPORT

FOR PROPOSED RESIDENTIAL PROJECT

"ROYCE ONE"

PROPOSED RESIDENTIAL BUILDING ON F.P. NO.: - 134, OF T.P.S.NO. 51 (BODAKDEV- MAKARBA - VEJALPUR) (DRAFT SANCTIONED), REVENUE SURVEY NO.: - 122/1, (O.P.NO.: - 134) OF MOJE: BODAKDEV, TAL. GHATLODIYA, DIST: AHMEDABAD.

DEVELOPER: SHREEM CONSTRUCTION PVT. LTD

ARCHITECT: P.D.C. ARCHITECTS

DOCUMENT NO: G2202004-TB-01-DB-001

CONTENTS

1. Brief Description of the Project

1.1 Objective:

This document sets the Structural Design Basis for all structures which are part of the Proposed Residential Project "ROYCE ONE" on F.P. NO.: - 134, OF T.P.S.NO. 51 (BODAKDEV-MAKARBA - VEJALPUR) (DRAFT SANCTIONED), REVENUE SURVEY NO.: - 122/1, (O.P.NO.: - 134) OF MOJE: BADAKDEV, TAL. GHATLODIYA, DIST: AHMEDABAD.

This Design Basis Report (DBR) will form a reference document developed by HNBS ASSOCIATES LLP to maintain a current summary of design assumptions.

This document is essentially a thought process by which overall structural integrity and economy can be assured for a building life span of 50 years while withstanding the forces of nature. The basic aim or objective of the DBR is to spell out all the assumptions & considerations in structural design.

1.2 Project / Input Documents:

Drawings and Documents:

a. Architectural Drawings by P.D.C. ARCHITECTS
b. Structural DBR by HNBS ASSOCIATES LLP
c. Structural Drawings
d. Geotechnical Investigation Report by KCT Consultancy Services, Ahmedabad

1.3. Structural Description

The proposed luxurious Residential project comprises of of Basement-3 (4.5m) + Basement-2 (4.5m)+ Basement-1 (4.5m) + Hollow Plinth (4.2m) + 1st floor (4.2m) + 2nd floor (4.2m) + 3rd floor to 17th floor (3.65m) + 18th Skip floor (3.9m) + 19th floor to Terrace floor (3.65m). Refuge area provision is considered at 4th, 6th, 10th, 14th, 18th, 22th, 26th & 30th floor Staircase Mid landing level. Last refuge Cover Slab at terrace floor Midlanding Level.

SR.NO	Building Dimension	
1	Height of Building Above Ground floor to Building Top Level(m)	155.00
2	Height of Building Above Ground floor to Terrace Level(m)	144.45
3	Terrace Level to Solar panel top Height (m)	10.55
4	Building Dimension (dx) in Plan (m)	68.05
5	Building Dimension (dy) in Plan (m)	27.5

2.List of Codes:

Design will be done in accordance with Indian standard Codes of Practice. The various codes of practice being referred to are listed below:

S.No.	Code	Description
1.	IS-875 (Part 1) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Unit weights of buildings materials and stored material.
2.	IS-875 (Part 2) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Imposed loads.
3.	IS-875 (Part 3) – 2015	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Wind loads.
4.	IS-875 (Part 4) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Snow loads.
5.	IS-875 (Part 5) – 1987	Code of Practice for Design Loads (other than earthquake) for buildings and structures – Special loads and load combinations.
6.	IS: 456 – 2000	Code of Practice for Plain and Reinforced Concrete.
7.	IS: 1786 – 2008	High Strength Deformed Steel Bars and Wires for Concrete Reinforcement - Specification.
8.	IS: 13920 – 2016	Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice
9	IS: 800 – 1984/2007	Code of Practice for General Construction in Steel.
10.	IS: 1893(Part 1) – 2016	Criteria for Earthquake resistant design of structures.
11.	IS3370-(PART II)-1965	Code of Practice for Concrete structures for the storage of liquids – Reinforced concrete structures
12.	IS 2950 (Part I) -1981	Code of Practice for Design and construction of Raft foundation
13.	IS 16700 : 2017	Criteria for structural safety of Tall Concrete Buildings

14.	SP16	Design Aids for Reinforced Concrete to IS : 456-1978
15.	SP34	Handbook on Concrete Reinforcement and Detailing
16.	SP6	Handbook for Structural Engineers
17.	SP22	Explanatory Handbook on Codes for Earthquake Engineering
18.	2950 (Part 1) 1981	Code of Practice for Design and Construction of Raft Foundations

Reference will be made to specialist literature and International codes to seek solutions for any critical aspect not covered by Indian Standards.

3. Loading Parameters:

3.1 Dead Load (DL):

Dead loads are defined as weight of all permanent structural components (primary & secondary) of the building, including slabs, beams, columns, RC walls, foundations etc. Following are the densities of basic structural materials proposed for project as per IS 875 (part1): 1987.

Reinforced cement concrete	= 25.0 kN/m^3
Reinforcement Steel	= 78.5 kN/m^3

3.2 Super Imposed Dead Load (SDL):

Super imposed dead load covers all other permanent load on the structure which does not contribute to strength but adds weight on the structure. E.g. floor finishes, false ceiling, services, brick walls, claddings, earth fills etc will be covered under SDL. Following densities (as per IS 875 (part1): 1987) of all non-structural material are adopted to calculate SDL on structure.

Brick	19	kN/m^3
R.C.C.	25	kN/m^3
Light weight Aerated block (Sand)	6.5	kN/m^3
Light Weight Fly ash Material	8	kN/m^3
Light weight Cinder filling Material	12	kN/m^3
Soil (Unsaturated)	18	kN/m^3
Soil (Saturated)	21	kN/m^3
Plain Concrete	20	kN/m^3
Steel	78.5	kN/m^3

Total fire tender load 16kN/m^2(including 12kN/m^{2}as fire tender and 3kN/m^{2}as Car load) is considered for design of the ground level slab.

3.2.1 Floor Finish Load (Including Service and false ceiling load)

On 1st,2nd & 3rd Basement Roof Slab Level	1.8	kN/m^2
On Ground floor level (For Tower Area)	2.0	kN/m^2
On Ground floor level (For Non Tower Area including 450mm filling)	8.55	kN/m^2
On Typical floor Level	1.5	kN/m^2
On Terrace floor Level	2.5	kN/m^2

3.2.2 Sunk Load

For Balcony and Foyer

Sunk Depth	75	mm
Sunk Filling Load	1.81	kN/m^2

For Bathroom

Sunk Depth	75	mm
Sunk Filling Load	1.81	kN/m^2

3.2.3 Wall Load

Wall load at at 2nd & 1st Basement slab level

Thickness of wall	100	230	150	300	mm
Material Density	6.5	6.5	25	6.5	kN/m3
Depth of Beam	600	600	600	600	mm
Wall Load	2.535	5.831	14.625	7.605	kN/m
Thickness of plaster	24	24	24	24	mm
Material Density	20	20	20	20	kN/m3
Plaster Load	2.160	2.160	2.160	2.160	kN/m
Total Wall Load	4.70	7.99	16.79	9.77	kN/m

Wall load at Ground, 1st and 2nd floor level

Thickness of wall	100	150	300	230	150	350	mm
Material Density	6.5	6.5	6.5	25	25	6.5	kN/m3
Depth of Beam	600	600	600	600	600	600	mm
Wall Load	2.340	3.510	7.020	20.700	13.500	8.190	kN/m
Thickness of plaster	24	24	24	24	24	24	mm
Material Density	20	20	20	20	20	20	kN/m3
Plaster Load	2.016	2.016	2.016	2.016	2.016	2.016	kN/m
Total Wall Load	4.36	5.53	9.04	22.72	15.52	10.21	kN/m

Wall load at Typical floor level

Thickness of wall	100	150	150	200	300	230	300	350	mm
Material Density	6.5	6.5	25	25	25	25	6.5	6.5	kN/m3
Depth of Beam	600	600	600	600	600	600	600	600	mm
Wall Load	1.983	2.974	11.438	15.250	22.875	17.538	5.948	6.939	kN/m
Thickness of plaster	24	24	24	24	24	24	24	24	mm
Material Density	20	20	20	20	20	20	20	20	kN/m3
Plaster Load	1.752	1.752	1.752	1.752	1.752	1.752	1.752	1.752	kN/m
Total Wall Load	3.73	4.73	13.19	17.00	24.63	19.29	7.70	8.69	kN/m

Parapet Wall

Thickness of wall	150	mm	230	mm	300	mm
Height of wall	1.5	m	1.5	m	1.5	m
Material Density	25	kN/m3	25	kN/m3	25	kN/m3
Total Wall Load	6.825	kN/m	9.825	kN/m	12.450	kN/m
Thickness of plaster	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	0.720	kN/m	0.720	kN/m	0.720	kN/m
Total Wall Load	7.55	kN/m	10.55	kN/m	13.17	kN/m

RCC wall on OHWTB Bottom slab

Thickness of wall	230	mm
Height of wall	2.25	m
Material Density	25	kN/m^3
Total Wall Load	15.82	kN/m

Porch Load at 2nd floor = 8 x 17 x (3.75+2) = (782) / 17 = 46 kN/m = 50 kN/m

Elevation Pardi at Terrace = 2.25 x 0.200 x 25 = 11.25 = 12 kN/m

Lift Machine Room Load = 10 KN/m^2

Electric room/ELV room/Meter room = 7.5 KN/m^2

Pump room = 7.5 KN/m^2

DG set = 15 tonne

Ac Unit = 5 KN/m^2

Overhead Water Tank Load

Water tank Total Height	2.4	m
Free board	0.2	m
Water Load on Slab	22	kN/m^2

3.3 Live Load (LL)

At Basement 3 and 2 Roof slab	3	kN/m^2
At Basement 1 Roof slab (Tower Area)	4	kN/m^2
At Basement 1 Roof slab (Non Tower Area)	3	kN/m^2
At Typical Floor Level	2	kN/m^2
Bathroom	2	kN/m^2
At Terrace Floor Level	3	kN/m^2
Foyer, Balcony	3	kN/m^2

3.4 Staircase Load

Live load	=	3	kN/m^2
SDL	=	4.3	kN/m^2

3.5 Water Pressure

As per Geotechnical soil report, water table is encountered at 35m to 36m depth. Whereas, founding depth is considered at 20.0m from Existing ground level.

4. Loading Diagram

Refer attached Loading diagram for each floor (Attached ETAB Model).

5. Material, clear cover, Grade of concrete & Exposure condition

5.1 Concrete

Concrete is adopted here as a preferred construction material due to ease of formulation at project site / procurement.

Concrete grades designated with a prefix M refers to the mix & suffixed number refers to specified compressive strength (fck) of 150mm size cube tested at 28days

Grade of Concrete

	COLUMN/SHEAR WALL	FOOTING	BEAM	SLAB
Concrete	M60	M35	M45	M45

Concrete Properties:

Modulus of elasticity, Ec	= 5000√fck N/mm2
Shrinkage Strain (Approx.)	= $300x10^{-6}$
Poisson's Ratio	= 0.2
Coefficient of Thermal Expansion	= 0.0000055 1/C

Creep coefficient:

Age at Loading	Creep Coefficient
7 days	2.2
28 days	1.6
1 year	1.1

Cracked RC Section Properties

Structural element	Un-factored Loads	Factored Loads
Slabs	0.35Ig	0.25Ig
Beams	0.7Ig	0.35Ig
Columns	0.9Ig	0.7Ig
Shearwall	0.9Ig	0.7Ig

5.2 Reinforcement

The reinforcement shall be High strength deformed steel bars conforming to IS 1786 - minimum design characteristic strength 500 N/mm2 and 550 N/mm2, with a condition that it should have been produced by Thermo-mechanical treatment & have at least 14.5% elongation.

Reinforcement Steel Properties:

Modulus of elasticity, Es	= 2.0 X 10^5 N/mm2
Poisson's Ratio (μ)	= 0.30
Coefficient of Thermal Expansion (α_s)	= 0.0000117 1/C

Grade of Reinforcement

	COLUMN/ SHEAR WALL	FOOTING	BEAM	SLAB
Reinforcement Grade	Fe550	Fe550	Fe550	Fe550

Clear Cover to Reinforcement and Exposure condition

Exposure Condition for column, shear wall and foundation is Moderate.

Exposure Condition for slab and beam is Mild.

Slab	25mm	For 2Hr Fire Rating
Beam	30mm	For 2Hr Fire Rating
Column	40mm	For 2Hr Fire Rating
Shear wall	40mm	For 2Hr Fire Rating
Footing	50mm	For 2Hr Fire Rating
Water Retaining Structures	40mm	For 2Hr Fire Rating

6 Seismic Load (EQ):

Inertial loads due to earthquake will be applied at the mass centres of each level. These forces would be either calculated manually or auto generated by using the Auto Seismic Loads function of the software used for analysis. For all structures, the seismic base will be considered at foundation level.

Seismic Coefficient Method for Static Analysis & Response Spectrum Method for Dynamic Analysis will be used depending on the building height and geometric configuration as specified in clause 7.7 of IS 1893. Appropriate actions would be taken as recommended by IS

code for Structural irregularities. Appropriate percentage of imposed load will be considered in seismic weight calculations as per table 10 of IS 1893.

Parameters	Values	IS 1893 - Related Section
Seismic Zone	Zone III	Annex E
Importance factor (I)	1.2	7.2.3 and Table 8
Soil Type	Type I (Hard Soil)	Table 4
Zone Factor (Z)	0.16	Annex E
Response Reduction Factor (R)	4.0	7.2.6 and Table 9

$$\text{Time Period Ta} = \frac{0.09 \times h}{\sqrt{d}}$$

Time Period Calculation

Sr.No	Building Dimension	
1.	Height of Building Above Ground floor to Terrace Level (h)	144.45
2.	Building Dimension (dx) in Plan (m)	68.05
3.	Building Dimension (dy) in Plan (m)	27.5
4.	Time Period in X Direction (sec)	2.60
5.	Time Period in Y Direction (sec)	2.57

7 Wind Tunnel testing:

Wind Load considerations will be as defined in IS 875 (Part 3). Various design parameters to be adopted are listed below:

Parameters	Values	IS 875 (Part 3) - Related Sections
Terrain category	Varies	6.3.2.1
Regional basic wind speed (Vb)	39 m/s	ANNEX A
Risk coefficient (k1)	1.0	6.3.1
Terrain, height and structure size (k2)	Varies	6.3.2
Topography Factor (k3)	1.0	6.3.3
Importance factor for cyclonic region	1.0	6.3.4

Design wind speed, Vz=Vbk1 * k2 * k3*k4

Design wind pressure pz=0.6 * Vz2

Whereas, Ka= 1.0

Kc = 1.0

Kd = 1.0

8Construction Sequence and loading parameters for the same:

NA

9 Proposed Approach to structural Analysis

The analysis of the structures will be carried out using the ETABS Plus Version 19.1.0and SAFE software package. The entire superstructure is modelled using frame and shell elements as appropriate. Beams and columns are modelled as frame elements while RC walls are modelled as shell elements and slabs as Shell or membrane elements.The lateral load resisting system is Buildings with ductile RC structural walls

10 Load Combinations

ULTIMATE LOAD COMBINATIONS

D1	1.5DL + 1.5 SDL
D2	1.5DL + 1.5 SDL + 1.5 LL
D3	1.2DL + 1.2 SDL + 1.2 LL* ± 1.2 SPECX
D4	1.2DL + 1.2 SDL + 1.2 LL* ± 1.2 SPECY
D5 / D6	1.2DL + 1.2 SDL + 1.2 LL± 1.2WLx or GUSTX
D7 / D8	1.2DL + 1.2 SDL + 1.2 LL± 1.2WLy or GUSTY
D9	1.5DL + 1.5 SDL ± 1.5 SPECX
D10	1.5DL + 1.5 SDL ± 1.5 SPECY
D11/D12	1.5DL + 1.5 SDL ± 1.5 WLx or GUSTX
D13/D14	1.5DL + 1.5 SDL ± 1.5 WLy or GUSTY
D15	0.9DL + 0.9 SDL ± 1.5 SPECX
D16	0.9DL + 0.9 SDL ± 1.5 SPECY
D17/D18	0.9DL + 0.9 SDL ± 1.5 WLx or GUSTX
D19/D20	0.9DL + 0.9 SDL ± 1.5 WLy or GUSTY
*D21	1.2DL + 1.2 SDL + 1.2 LL + 1.2 WTT (*WTT-WIND TUNNEL TEST IF APPLICABLE)
*D22	1.5DL + 1.5 SDL + 1.5 WTT (*WTT-WIND TUNNEL TEST IF APPLICABLE)
*D23	0.9DL + 0.9 SDL + 1.5 WTT (*WTT-WIND TUNNEL TEST IF APPLICABLE)
D24	1.2DL + 1.2 SDL + 1.2 LL + 1.05 FIRE TENDER+1.0 SOLAR

ULTIMATE LOAD COMBINATIONS WITH TEMPERATURE

T1/T2	T1/T2 - 1.4DL + 1.4 SDL ± 1.4 TL

T3/T4	T3/T4 - 1.4DL + 1.4 SDL + 1.4 LL ± 1.4 TL
T5/T6	T5/T6 - 1.05DL + 1.05 SDL + 1.28 LL ± 1.28 SPECX ± 1.05 TL
T7/T8	T7/T8 - 1.05DL + 1.05 SDL + 1.28 LL ± 1.28 SPECY ± 1.05 TL
T9/T10/T11/T12	T9/T10/T11/T12 - 1.05 DL + 1.05 SDL + 1.28 LL ± 1.28 WLy or GUSTX ± 1.05TL
T13/T14/T15/T16	T13/T14/T15/T16 - 1.05 DL + 1.05 SDL + 1.28 LL ± 1.28 WLy or GUSTY ± 1.05 TL
T17/T18	T17/T18 - 0.9DL + 0.9 SDL ± 1.28 SPECX ± 1.05 TL
T19/T20	T19/T20 - 0.9DL + 0.9 SDL ± 1.28 SPECY ± 1.05 TL
T21/T22/T23/T24	T21/T22/T23/T24 - 0.9DL+ 0.9 SDL ± 1.28 WLx or GUSTX ± 1.05 TL
T25/T26/T27/T28	T25/T26/T27/T28 - 0.9DL + 0.9 SDL ± 1.28 WLy or GUSTY ± 1.05 TL
*T29/T30	1.05DL + 1.05 SDL + 1.28 LL + 1.28 WTT ± 1.05TL (*WTT-WIND TUNNEL TEST IF APPLICABLE)
*T31/T32	0.9DL+ 0.9 SDL + 1.28 WTT ± 1.05 TL (*WTT-WIND TUNNEL TEST IF APPLICABLE)

SERVICE LOAD COMBINATIONS

S1	1.0DL + 1.0 SDL + 1.0 LL
S2/S3	1.0DL + 1.0 SDL + 0.8 LL* ± 0.8 SPECX or EQX
S4/S5	1.0DL + 1.0 SDL + 0.8 LL* ± 0.8 SPECY or EQY
S6/S7	1.0DL + 1.0 SDL + 0.8 LL ± 0.8 WLx or GUSTX
S8/S9	1.0DL + 1.0 SDL + 0.8 LL ± 0.8 WLy or GUSTY
S10/S11	1.0DL + 1.0 SDL ± 1.0 SPECX or EQX
S12/S13	1.0DL + 1.0 SDL ± 1.0 SPECY or EQY
S14/S15	1.0DL + 1.0 SDL ± 1.0 WLx or GUSTX
S16/S17	1.0DL + 1.0 SDL ± 1.0 WLy or GUSTY
S18/S19/S20/S21	1.0DL + 1.0 SDL + 1.0 LL ± 1.0 SPECX or EQX ± 1.0 TL
S22/S23/S24/S25	1.0DL + 1.0 SDL + 1.0 LL ± 1.0 SPECY or EQY ± 1.0 TL
S26/S27/S28/S29	1.0DL + 1.0 SDL + 1.0 LL ± 1.0 GUSTX or WLX ± 1.0 TL
S30/S31/S32/S33	1.0DL + 1.0 SDL + 1.0 LL ± 1.0 GUSTY or WLY ± 1.0 TL
*S34	1.0DL + 1.0 SDL + 0.8 LL + 0.8 WTT
*S35	1.0DL + 1.0 SDL + 1.0 WTT
*S36/*S37	1.0DL + 1.0 SDL + 1.0 LL + 1.0 WTT ± 1.0 TL
FIRE TENDER	1.0DL + 1.0 SDL + 1.0 LL + 1.05 FIRE TENDER + 1.05 SOLAR

VERTICAL EARTHQUAKE COMBINATIONS

1	1.2(DL+LL)+1.2(SPECX+SPECZ)
2	1.2(DL+LL)+1.2(SPECY+SPECZ)
3	1.5(DL)+1.5(SPECX+SPECZ)
4	1.5(DL)+1.5(SPECY+SPECZ)

5	0.9(DL)+1.5(SPECX+SPECZ)
6	0.9(DL)+1.5(SPECY+SPECZ)

11 Software Used

All R.C.C structures shall be designed according to the Limit State Method as specified in IS: 456 – 2000 using ETABS Plus Version 19.1.0, SAFE software package, RCDC &In-house Design programs.

12 DESIGN LIFE

The design life of the structure is assumed as 50 years. This requirement is not applicable to replaceable materials.

Vertical Deflection:

The clause 23.2 of IS 456: 2000 states that, the deflection of the structure or part there of shall not adversely affect the appearance or efficiency of the structure or finishes or partitions. The deflection shall generally be limited to the following,

Type of Member	Deflection to be considered	Deflection Limitation
Supports of floors, roofs and all other horizontal members	The final deflection due to all loads including the effects of temperature, creep and shrinkage	L/250
Supports of floors, roofs and all other horizontal members	The deflection due to live load and the effects of temperature creep and shrinkage	L/350 or 20mm (whichever is less)

Long term deflection check would be only undertaken if deemed necessary due to serviceability concerns.

Lateral Sway:

As per clause 20.5 of IS 456:2000, permissible lateral sway at top of the structure due to transient wind load is to be limited to H/500.

Storey drift in any storey under seismic load is to be limited to Hs/250 as per clause 7.11 of IS 1893.

Stability Checks:

All structures will be checked for the following global stability indexes:

Stability against overturning would be checked. (If no column experiences pure tension for ULS lateral loads combination, structure can be treated as stable against overturning).

It would be ensured during detailed design that the lateral drift, inter storey drifts are within permissible limits.

Factors for sliding and overturning would be checked for any isolated foundation during foundation design by standard excel sheets.

All retaining Walls would be checked against bearing pressure, sliding and overturning checks are not required since the retaining wall is propped at the ground level.

Raft/Isolated footing with Stitch slab foundation would be checked for uplift and safe bearing pressure.

13 Construction Joint

Construction Joint is predefined and detail as per General Detail provide by Structural Consultant.

14 Soil Profile & Foundation System

Geotechnical Investigation was carried out by ANANDJIWALA TECHNICAL CONSULTANCY – Ahmadabad (Report Reference No: 925/ATEC-03/21-22– April 2022)

BH No.	Type of Footing	Width of Footing (m)	Length of Footing (m)	Depth of footing from Basement Level (m)	Depth of footing from E.G.L (m)	SBC As Per Shear Failure Criteria (T/m^2)	SBC as per SPT N value Criteria (T/m^2) (For Permissible settlement of 50mm)	Recommended SBC (T/m^2)
1	Isolated	3.50	3.50	3.00	16.50	62.64	39.42	39.00
		4.00	4.00			63.39	36.11	36.00
		4.50	4.50			64.32	35.75	35.00
		5.00	5.00			65.37	33.38	33.00
		3.50	3.50	3.50	17.00	72.52	40.16	40.00
		4.00	4.00			72.97	38.61	38.00
		4.50	4.50			73.68	37.28	37.00
		5.00	5.00			74.55	34.64	34.00
		3.50	3.50	4.00	17.50	82.74	47.19	47.00
		4.00	4.00			82.87	44.39	44.00
		4.50	4.50			83.32	43.74	43.00
		5.00	5.00			83.98	41.48	41.00
	Raft	6.00	6.00	2.00	15.50	50.54	38.98	38.00
		10.00	10.00			62.31	36.93	36.00
		12.00	12.00			68.36	36.76	36.00
		15.00	15.00			77.52	36.59	36.00
		6.00	6.00	2.50	16.00	59.03	40.08	40.00
		10.00	10.00			70.43	37.62	37.00
		12.00	12.00			76.39	36.99	36.00
		15.00	15.00			85.45	36.76	36.00
2	Isolated	3.50	3.50	3.00	16.50	41.82	66.76	41.00
		4.00	4.00			41.30	63.01	41.00
		4.50	4.50			40.97	60.88	40.00
		5.00	5.00			40.75	59.33	40.00
		3.50	3.50	3.50	17.00	45.00	68.85	45.00
		4.00	4.00			44.31	66.40	44.00
		4.50	4.50			43.85	65.02	43.00
		5.00	5.00			43.53	63.05	43.00
		3.50	3.50	4.00	17.50	48.24	72.31	48.00
		4.00	4.00			47.38	66.15	47.00
		4.50	4.50			46.78	64.93	46.00
		5.00	5.00			46.36	63.99	46.00

Recommended SBC is 39 t/m2 and Soil sub grade Modulus is 7657.7 kN/m2/m at depth of 16.00 m.

Foundation System is raft Foundation (refer Attached drawing for raft foundation)

15 Soil Retention System

Diaphragm wall is proposed for soil retention system.

16 Key Plan-Showing Expansion /Separation Joint (if Any).

N.A.

17 Added Features

N.A.

18 Facade, Crown and other elevation feature

N.A.

19 References

The following Indian Codes and Standards shall generally be used for design of structural work. All applicable Indian Standard (IS) Codes shall be used. In all cases, the latest revisions with amendments, if any, shall be followed (as on date of LOI):

LOADS:

IS: 875 - 1987 (PART - I, II, IV, V)	Code of Practice for Design Loads (other than Earthquake) for Buildings and Structures
IS: 875 - 2015 (PART-III)	Design Loads (Other Than Earthquake) For Buildings and Structures (Wind Loads)
IS: 1893 - 2016 (PART-I)	Criteria for Earthquake Resistant Design of Structures
IS: 16700 - 2017	Criteria for Structural Safety of Tall Concrete Buildings

FOUNDATION:

IS: 1080 - 1997	Code of Practice for Design and Construction of Shallow Foundations in Soils (other than Raft, Ring and Shell)
IS: 1904 - 1986	Code of Practice for Design and Construction of Foundations in Soils: General Requirements
IS: 2911 - 1997 (PART - I TO IV)	Code of Practice for Design and Construction of Pile Foundations
IS: 2950 - 1988	Code of Practice for Design and Construction of Raft Foundations - Part 1: Design.

REINFORCED CEMENT CONCRETE:

IS: 456 - 2000	Code of Practice for Plain and Reinforced Concrete
IS: 13920 - 2016	Code of Practice for Ductile Design and Detailing of Reinforced Structures Subjected to Seismic Forces
ACI: 318 – 19	Building Code Requirements for Structural Concrete
ASCE: 7-16/ 7-22	Minimum Design Loads and Associated Criteria for Buildings and Other Structures
IS: 3370 - 2009	Code of Practice for Concrete Structure for The Storage of Liquids

STRUCURAL STEEL:

IS: 800 - 2007	Code of Practice for General Construction in Steel
IS: 1642 - 2000	Code of Practice for Fire Safety of Buildings (General): Details of Construction
IS: 1786 - 2008	Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement

HANDBOOK, SPECIAL PUBLICATIONS & DOCUMENTS (Addressing the Special Issues)

SP: 6 - 1964	Handbook for Structural Engineering
SP: 16 - 1980	Design Aids for Reinforced Concrete
SP:24 - 1980	Explanatory Hand Book on IS:456-2000
SP: 34 - 1987	Handbook of Concrete Reinforcement and Detailing
NBC - 2016	National Building Code of India
GSDMA Guidelines	General Guidelines & Criteria for Structural Safety and Assessment by GUJARAT STATE DISASTER MANAGEMENT AUTHORITY
CEB-FIP-34	Model Code for Service Life Design
EBB (IITK)	Earthquake Behaviour Of Buildings
IITGN (WB-EQ2-V3.0)	Final Report On World Bank Project On Seismic Codes
ATC (Documents)	Applied technology Council
NIST (Documents)	National Institute of Standards and Technology
FEMA (Documents)	Federal Emergency Management Authority
LATBSDC (Documents)	Los Angeles Tall Buildings Structural Design Council
JGJ-3-2010	Code of China For Tall Building Design
PEER (Documents)	Pacific Earthquake Engineering Research Centre
CTBUH (Documents)	Council of Tall Building and Urban Habitat
Finite Elements Analysis & Design (Book)	Plesha, Cook & Malkus

Dynamic Of Structures (Book)	E.D.Wilson
Three Dimensional Dynamic Analysis of Building Structure (Book)	Ray Clough & Peinzin
Cross Section Analysis & Design (Book)	Dr.Naveed Anwar & Fawad Najam
Modelling techniques Using Computational Tool (Book)	Dr. Graham Powel
NEHRP (Documents)	National Earthquake Hazards Reduction Program
GSA (Documents)	General Service Administration