APPENDIX – C

DESIGN BASIS REPORT

FOR PROPOSED COMMERCIAL PROJECT

"BRILLIA"

AT F.P. NO:-117+118/2/2 OF T.P.S.:-NO.57 (OGNAJ-GOTA-JAGATPUR-CHHARODI-KHODIYAR-KHORAJ) MOJE.:-CHHARODI, TALUKA.:-GHATLODIA, DISTRICT :- AHMEDABAD.

DEVELOPER: M R CONSTRUCTION

ARCHITECT: FLXBL DESIGN CONSULTANCY PVT. LTD.

DOCUMENT NO: G2111059-TB-01-DB-001

Rev-R1

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 Commercial Project “Brillia” at Chharodi, 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 FLXBL DESIGN CONSULTANCY PVT. LTD.
b. Structural DBR by HNBS ASSOCIATES LLP
c. Structural Drawings
d. Geotechnical Investigation Report by KBM ENGINEERING RESEARCH LABORATORY, Ahmedabad

1.3. Structural Description

The proposed luxurious commercial project comprises of Basement-4 (5.0m) + Basement-3 (5.0m) + Basement-2 (5.0m) + Basement-1 (4.05m) + Hollow Plinth (4.5m) + 1st to 4th floor (4.5m) + to 5th to 18th floor (3.35m) + 19th Skip floor (2.95m) + 20th to 26th floor (3.5m) + 27th to 31nd floor (3.65m)+32nd floor(3.10m). Refuge area provision is considered at 5th, 10th, 15th, 24th & 28th floor slab level.

SR.NO	Building Dimension	Meter
1	Height of Building Above Ground Level to Building Top Level(m)	127.41
2	Height of Building Above Ground Level to Terrace Level(m)	118.65
3	Terrace Level to OHWT top Height (m)	3.10
4	Building Dimension (dx) in Plan (m)	66.91
5	Building Dimension (dy) in Plan (m)	75.88

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 16 kN/m^2(including 12kN/m^2as fire tender and 4kN/m^2as Car load) is considered for design of the ground level slab.

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

On 3rd, 2nd & 1st Basement Level	1.8	kN/m^2
On 3rd, 2nd & 1st Basement Level	1.5	kN/m^2
On Ground floor level (Tower area)	1.65	kN/m^2
On Ground floor level (Tower area)	1.8	kN/m^2
On Ground floor level (non-Tower area)	2.5	kN/m^2
On Ground floor level (landscape area)	12.6	kN/m^2
On Ground floor level (Non Tower)	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 & Bathroom

Sunk Depth	100	mm
Sunk Filling Load	2.01	kN/m^2
Sunk Depth	150	mm
Sunk Filling Load	2.41	kN/m^2

For Open Terrace

Sunk Depth	300	mm
Sunk Filling Load	3.61	kN/m^2

3.2.3 Wall Load

For 230mm and 300mm Thick Light weight AAC Block at 3rd Basement slab level

Thickness of wall	230	mm	230	mm	230	mm	300	mm
Material Density	6.5	kN/m3	6.5	kN/m3	25	kN/m3	6.5	kN/m3
Depth of Beam	600	mm	1000	mm	600	mm	600	mm
Wall Load	4.560	kN/m	3.962	kN/m	17.538	kN/m	5.948	kN/m

Thickness of plaster	24	mm	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	1.464	kN/m	1.272	kN/m	1.464	kN/m	1.464	kN/m
Total Wall Load	6.02	kN/m	5.23	kN/m	19.00	kN/m	7.41	kN/m

For 230mm and 300mm Thick Light weight AAC Block at 2nd & 1st Basement slab level

Thickness of wall	230	mm	230	mm	230	mm	300	mm
Material Density	6.5	kN/m3	6.5	kN/m3	25	kN/m3	6.5	kN/m3
Depth of Beam	600	mm	1000	mm	600	mm	600	mm
Wall Load	6.728	kN/m	6.130	kN/m	25.875	kN/m	8.775	kN/m
Thickness of plaster	24	mm	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	2.160	kN/m	1.968	kN/m	2.160	kN/m	2.160	kN/m
Total Wall Load	8.89	kN/m	8.10	kN/m	28.04	kN/m	10.94	kN/m

For 230mm and 300mm Thick Light weight AAC Block at 2nd & 1st Basement slab level

Thickness of wall	450	mm	300	mm	230	mm
Material Density	6.5	kN/m3	25	kN/m3	25	kN/m3
Depth of Beam	1000	mm	600	mm	600	mm
Wall Load	11.993	kN/m	33.75	kN/m	25.875	kN/m
Thickness of plaster	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	1.968	kN/m	2.160	kN/m	2.160	kN/m
Total Wall Load	13.96	kN/m	35.91	kN/m	28.04	kN/m

For 100mm, 225mm, 230mm and 300mm Thick Light weight AAC Block at Ground floor level

Thickness of wall	100	mm	300	mm	230	mm	300	mm

Material Density	6.5	kN/m3	6.5	kN/m3	25	kN/m3	25	kN/m3
Depth of Beam	600	mm	1000	mm	600	mm	600	mm
Wall Load	2.828	kN/m	7.703	kN/m	25.013	kN/m	32.625	kN/m
Thickness of plaster	24	mm	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	2.088	kN/m	1.896	kN/m	2.088	kN/m	2.088	kN/m
Total Wall Load	4.92	kN/m	9.60	kN/m	27.10	kN/m	34.71	kN/m

For 100mm, 225mm, 230mm and 300mm Thick Light weight AAC Block at Ground floor level

Thickness of wall	100	mm	230	mm	300	mm	230	mm
Material Density	6.5	kN/m3	6.5	kN/m3	6.5	kN/m3	25	kN/m3
Depth of Beam	600	mm	1000	mm	600	mm	600	mm
Wall Load	2.535	kN/m	5.831	kN/m	7.605	kN/m	22.425	kN/m
Thickness of plaster	24	mm	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	1.872	kN/m	1.872	kN/m	1.872	kN/m	1.872	kN/m
Total Wall Load	4.41	kN/m	7.70	kN/m	9.48	kN/m	24.30	kN/m

For 100mm, 225mm, 230mm and 300mm Thick Light weight AAC Block at Ground floor level

Thickness of wall	450	mm
Material Density	6.5	kN/m3
Depth of Beam	600	mm
Wall Load	11.408	kN/m
Thickness of plaster	24	mm
Material Density	20	kN/m3
Plaster Load	1.872	kN/m
Total Wall Load	13.28	kN/m

For 115mm, 230mm, 250mm & 450mm Thick Light weight AAC Block at Typical Floor level

Thickness of wall	100	mm	230	mm	300	mm	230	mm
Material Density	6.5	kN/m3	6.5	kN/m3	25	kN/m3	25	kN/m3
Depth of Beam	600	mm	600	mm	600	mm	1000	mm
Wall Load	2.389	kN/m	5.494	kN/m	25.313	kN/m	18.831	kN/m
Thickness of plaster	24	mm	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	1.764	kN/m	1.764	kN/m	1.764	kN/m	1.572	kN/m
Total Wall Load	4.15	kN/m	7.26	kN/m	29.33	kN/m	20.40	kN/m

For 115mm, 230mm, 250mm & 450mm Thick Light weight AAC Block at Typical Floor level

Thickness of wall	450	mm	100	mm	230	mm	230	mm
Material Density	6.5	kN/m3	6.5	kN/m3	6.5	kN/m3	25	kN/m3
Depth of Beam	600	mm	600	mm	600	mm	1000	mm
Wall Load	10.749	kN/m	2.194	kN/m	5.046	kN/m	17.106	kN/m
Thickness of plaster	24	mm	24	mm	24	mm	24	mm
Material Density	20	kN/m3	20	kN/m3	20	kN/m3	20	kN/m3
Plaster Load	1.764	kN/m	1.620	kN/m	1.620	kN/m	1.428	kN/m
Total Wall Load	12.51	kN/m	3.81	kN/m	6.67	kN/m	18.23	kN/m

Find For 115mm, 230mm, 250mm & 450mm Thick Light weight AAC Block at Typical Floor level

Thickness of wall	300	mm
Material Density	25	kN/m3
Depth of Beam	600	mm
Wall Load	25.313	kN/m
Thickness of plaster	24	mm

Material Density	20	kN/m3
Plaster Load	1.620	kN/m
Total Wall Load	26.93	kN/m

Parapet Wall

Thickness of wall	150	mm
Height of wall	1.2	m
Material Density	25	kN/m^3
Total Wall Load	5.46	kN/m

Thickness of wall	230	mm
Height of wall	1.2	m
Material Density	25	kN/m^3
Total Wall Load	7.86	kN/m

Facade Load = 2 kN/m^2

RCC wall on OHWTB Bottom slab

Thickness of wall	300	mm
Height of wall	3.100	m
Material Density	25	kN/m^3
Total Wall Load	25.73	kN/m

Lift Machine Room Load = 10 KN/m^2

Overhead Water Tank Load

Water tank Total Height	3.100	m
Free board	0.6	m
Water Load on Slab	25	kN/m^2

3.3 Live Load (LL)

At Basement 3 -Parking	5	kN/m^2
At Basement 1 & Basement 2	5	kN/m^2
At Ground Floor	4	kN/m^2
At Ground Floor (Amenities)	5	kN/m^2
At Typical Floor Level	4	kN/m^2
Bathroom	2	kN/m^2
At Terrace Floor Level	2	kN/m^2
Foyer, Balcony	4	kN/m^2
Refuge Floor	5	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, the ground water Table was encountered at a depth of 19M below existing G.L.

4. Loading Diagram

Refer ETABS Model and DBR from the Same.

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

For All Floors Level	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
Shear wall	0.9Ig	0.7Ig

5.2 Reinforcement

The reinforcement shall be High strength deformed steel bars conforming to IS 1786 - minimum design characteristic strength 500D N/mm2 and 550D N/mm2, with a condition that it should have been produced by Thermo-mechanical treatment & have at least 16% 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	Fe550D	Fe550D	Fe550D	Fe550D

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
Isolated Footing	50mm	For 2Hr Fire Rating
Raft	75mm	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)	5.0	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)	118.65
2.	Building Dimension (dx) in Plan (m)	66.91
3.	Building Dimension (dy) in Plan (m)	75.88
4.	Time Period in X Direction (sec)	1.30
5.	Time Period in Y Direction (sec)	1.22

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

8 Construction 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

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.

Durability requirements:

This could be in the form of: Enhance Concrete Performance by using especially designed concrete mix to improve the concrete quality and durability to protect reinforcement in the concrete. Implement other measures to improve durability of concrete to protect reinforcement from corrosion. These measures included concrete admixtures and coatings etc. Extended testing would be required to come up with a proper mix and understand the environmental conditions on site and within the ground.

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 KBM ENGINEERING RESEARCH LABORATORY– Ahmedabad (Report Reference No : 3209 – May 2023)

Table 5: SBC recommendations for isolated column footing

Type of Foundation	Depth of Foundation (m)	Width of Foundation (m)	Net S.B.C/Allowable Bearing Pressure for 50mm permissible settlement -(KN/m²) (as per IS 6403 and IS 8009 P1)
Isolated Column Footing (without considering basement)	3.0	1 to 4	180
Isolated Column Footing (considering basement)	21.5	1 to 4	650

Table 6: SBC recommendations for raft with UDL

Type of Foundation	Depth of Foundation (m)	Size of Foundation	Net S.B.C - (KN/m²) (as per IS 6403)	Maximum Settlement corresponding to UDL of 650KN/m² (as per IS 8009 P1	Maximum Settlement corresponding to UDL of 650KN/m² (as per SIGMA/W)
Raft Foundation (considering basement)	21.5	50m x 50m	1443	72.2	73.2

4.2.4 The modulus of subgrade reaction (ks) as per IS 2950 P1 Appendix B.4 may be considered as Average Contact Pressure/Average settlement of raft. For raft of size 50m x 50m and UDL of 650KN/m², the average settlement as per settlement profile above (Section 4.2.3) is 63.5mm. The ks value varies from 8874KN/m³ to 18641KN/m³ with an average value of 10244KN/m³. The design ks-value conservatively may be considered as 9000 KN/m³.

Recommended SBC is 144.3 t/m2 and Soil sub grade Modulus is 9000 kN/m2/m at depth of 21.50m.

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.