APPENDIX – C

DESIGN BASIS REPORT

FOR PROPOSED RESIDENTIAL PROJECT

"ARISTO THE OPUS AND ARISTO AATMANTAN"

PROPOSED COMMERCIAL & RESIDENTIAL BUILDING ON TPS NO. 32 (GOTA)
FP NO. 40/2, SURVEY/BLOCK NO. 86/1/2/P
AT GOTA, AHMEDABAD

DEVELOPER: ARISTO GROUP

ARCHITECT: 99 STUDIO

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

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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 & Commercial Project "ARISTO THE OPUS AND ARISTO AATMANTAN" TPS no. 32 (Gota), FP no. 40/2, Survey/Block no. 86/1/2/P at Gota, 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 99 STUDIO
b. Structural DBR by HNBS ASSOCIATES LLP
c. Structural Drawings
d. Geotechnical Investigation Report by KCT Consultancy Services, Ahmedabad

1.3. Structural Description

FOR BLOCK-A RESIDENTIAL

The proposed luxurious Residential project comprises of Basement-3 (4m) + Basement-2 (4.5m)+ Basement-1 (4.35m) + Ground Floor (4.95m) + 1st floor (4.5m) + 2nd floor to 19th floor (3.2m) + 20th skip floor (3.2m) + 21th floor to 33th floor (3.2m) + Stair Cabin & Terrace floor (3m). Refuge area provision is considered at 6th,10th,14th,18th,22nd,26th & 30th floor Staircase Mid landing level.

SR.NO	Building Dimension	
1	Height of Building Above Ground floor to Building Top Level(m)	118.85
2	Height of Building Above Ground floor to Terrace Level(m)	111.85
3	Terrace Level to Lightning Arrester top Height (m)	7.00
4	Building Dimension (dx) in Plan (m)	27.58
5	Building Dimension (dy) in Plan (m)	17.54

FOR BLOCK-B&C RESIDENTIAL

The proposed luxurious Residential project comprises of Basement-3 (4m) + Basement-2 (4.5m)+ Basement-1 (4.35m) + Ground Floor (4.95m) + 1st floor (4.5m) +2nd floor to 18th floor (3.4m) + 19th skip floor (3.4m) + 20th floor to 28th floor (3.4m) + 29th floor (4.5m)+ 30th & 31th floor(3.4m) + Stair Cabin & Terrace floor (3m). Refuge area provision is considered at 6th,10th,14th,18th,22nd,26th,29th floor level.

SR.NO	Building Dimension	
1	Height of Building Above Ground floor to Building Top Level(m)	119.55
52	Height of Building Above Ground floor to Terrace Level(m)	112.55
3	Terrace Level to Lightning Arrester top Height (m)	7.00
4	Building Dimension (dx) in Plan (m)	38.43
5	Building Dimension (dy) in Plan (m)	38.86

FOR BLOCK-D COMMERCIAL

The proposed luxurious Commercial project comprises of Basement-3 (4m) + Basement-2 (4.5m) + Basement-1 (4.8m) + Ground Floor (4.5m) + 1st floor to 4th floor (4.5m) + 5th floor to 16th floor (3.7m) + 17th skip floor (3.7m) + 18th floor to 26th floor (3.7m) + (27th floor(3.7m), 28th floor(3.7m))(27th Part floor-7.40m) + 29th floor (3.7m) + Stair cabin & L.M.R. & O.H.W.T. (3.1m). Refuge area provision is considered at 5th, 9th, 13th, 17th, 21th, 25th, 29th floor level.

SR.NO	Building Dimension	
1	Height of Building Above Ground floor to Building Top Level(m)	119.55
2	Height of Building Above Ground floor to Terrace Level(m)	115.45
3	Terrace Level to Lightning Arrester top Height (m)	4.10
4	Building Dimension (dx) in Plan (m)	42.91
5	Building Dimension (dy) in Plan (m)	28.45

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^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)

FOR BLOCK ABC RESIDENTIAL

On 1st,2nd & 3rd Basement Roof Slab Level	1.8	kN/m^2
On Ground floor level (For Tower Area)	2.5	kN/m^2
On Ground floor level (For Non Tower Area including 300mm filling)	6.6	kN/m^2
On Typical floor Level	1.5	kN/m^2
On Terrace floor Level	2.5	kN/m^2

FOR BLOCK DCOMMERCIAL

On 1st,2nd & 3rd Basement Roof Slab Level	1.8	kN/m^2
On Ground floor level (For Tower Area)	2.5	kN/m^2
On Ground floor level (For Non Tower Area including 300mm filling)	6.6	kN/m^2
On Typical floor Level	1.65	kN/m^2
On Terrace floor Level	2.5	kN/m^2

3.2.2 Sunk Load

For Balcony and Foyer

Sunk Depth	150	mm
Sunk Filling Load	2.2	kN/m^2

For Bathroom

Sunk Depth	300	mm
Sunk Filling Load	3.2	kN/m^2

3.2.3 Wall Load

FOR BLOCK A RESIDENTIAL

Wall Load

At Basement 3 & 2	**125 Thk Wall**	**230 Thk Wall**
Thickness of wall	125 mm	230 mm
Material Density	6.5 kN/m3	6.5 kN/m3
Depth of Beam	600 mm	600 mm
Wall Load	**3.17 kN/m**	**5.83 kN/m**
Thickness of plaster	24 mm	24 mm
Material Density	20 kN/m3	20 kN/m3
Plaster Load	**2.160 kN/m**	**2.160 kN/m**
Total Wall Load	**5.33 kN/m**	**7.99 kN/m**

At Basement 1	**125 Thk Wall**	**230 Thk Wall**
Thickness of wall	125 mm	230 mm
Material Density	6.5 kN/m3	6.5 kN/m3
Depth of Beam	600 mm	600 mm
Wall Load	**3.41 kN/m**	**6.28 kN/m**
Thickness of plaster	24 mm	24 mm
Material Density	20 kN/m3	20 kN/m3
Plaster Load	**2.304 kN/m**	**2.304 kN/m**
Total Wall Load	**5.72 kN/m**	**8.58 kN/m**

At Ground Floor & 1st Floor	**125 Thk Wall**	**125 Thk Wall(Peri.)**	**230 Thk Wall(Int.)**	**230 Thk Wall(Peri.)**
Thickness of wall	125 mm	125 mm	230 mm	230 mm
Material Density	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3
Depth of Beam	575 mm	575 mm	575 mm	750 mm
Wall Load	**3.19 kN/m**	**3.19 kN/m**	**5.87 kN/m**	**5.61 kN/m**
Thickness of plaster	24 mm	36 mm	24 mm	36 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.160 kN/m**	**3.240 kN/m**	**2.160 kN/m**	**3.240 kN/m**
Total Wall Load	**5.35 kN/m**	**6.43 kN/m**	**8.03 kN/m**	**8.85 kN/m**

At Typical Floor (2nd to 33th Floor)	**125 Thk Wall(Int.)**	**125 Thk Wall(Peri.)**	**230 Thk Wall(Int.)**	**230 Thk Wall(Peri.)**
Thickness of wall	125 mm	125 mm	230 mm	230 mm
Material Density	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3
Depth of Beam	575 mm	575 mm	575 mm	750 mm
Wall Load	**2.13 kN/m**	**2.13 kN/m**	**3.92 kN/m**	**3.66 kN/m**
Thickness of plaster	24 mm	36 mm	24 mm	36 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**1.536 kN/m**	**2.304 kN/m**	**1.536 kN/m**	**2.304 kN/m**
Total Wall Load	**3.67 kN/m**	**4.44 kN/m**	**5.46 kN/m**	**5.97 kN/m**

At Stair Cabin level	**125 Thk Wall**	**230 Thk Wall**
Thickness of wall	125 mm	230 mm
Material Density	6.5 kN/m3	6.5 kN/m3
Depth of Beam	575 mm	575 mm
Wall Load	**1.97 kN/m**	**3.63 kN/m**
Thickness of plaster	24 mm	24 mm
Material Density	20 kN/m3	20 kN/m3
Plaster Load	**1.440 kN/m**	**1.440 kN/m**
Total Wall Load	**3.41 kN/m**	**5.07 kN/m**

Parapet Wall		
Thickness of wall	230 mm	230 mm
Height of wall	1.35 m	1.15 m
Material Density	19 kN/m3	6.5 kN/m3
Total Wall Load	**6.87 kN/m**	**2.55 kN/m**

OHWT Wall	
Thickness of wall	230 mm
Height of wall	1.83 m
Material Density	25 kN/m3
Total Wall Load	**12.0 kN/m**

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Wall Load

At Basement 3 & 2	**125 Thk Wall**	**230 Thk Wall**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 mm	150 mm
Material Density	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	600 mm	600 mm	600 mm
Wall Load	**3.17 kN/m**	**5.83 kN/m**	**14.63 kN/m**
Thickness of plaster	24 mm	24 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.160 kN/m**	**2.160 kN/m**	**0.000 kN/m**
Total Wall Load	**5.33 kN/m**	**7.99 kN/m**	**14.63 kN/m**

At Basement 1	**125 Thk Wall**	**230 Thk Wall**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 mm	150 mm
Material Density	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	600 mm	600 mm	600 mm
Wall Load	**3.41 kN/m**	**6.28 kN/m**	**15.75 kN/m**
Thickness of plaster	24 mm	24 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.304 kN/m**	**2.304 kN/m**	**0.000 kN/m**
Total Wall Load	**5.72 kN/m**	**8.58 kN/m**	**15.75 kN/m**

At Ground Floor & 1st Floor	**100 Thk Wall(Int.)**	**125 Thk Wall(Ext.)**	**230 Thk Wall**	**Non-Stru. Pardi**
Thickness of wall	100 mm	125 mm	230 mm	150 mm
Material Density	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	575 mm	575 mm	575 mm	575 mm
Wall Load	**2.55 kN/m**	**3.19 kN/m**	**5.87 kN/m**	**14.72 kN/m**
Thickness of plaster	24 mm	24 mm	24 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.160 kN/m**	**2.160 kN/m**	**2.160 kN/m**	**0.000 kN/m**
Total Wall Load	**4.71 kN/m**	**5.35 kN/m**	**8.03 kN/m**	**14.72 kN/m**

At 2nd to 28th Floor, 30th & 31th Floor	**100 Thk Wall(Int.)**	**125 Thk Wall(Ext.)**	**230 Thk Wall**	**Non-Stru. Pardi**
Thickness of wall	100 mm	125 mm	230 mm	150 mm
Material Density	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	575 mm	575 mm	575 mm	575 mm
Wall Load	**1.84 kN/m**	**2.30 kN/m**	**4.22 kN/m**	**10.59 kN/m**
Thickness of plaster	24 mm	36 mm	24 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**1.632 kN/m**	**2.448 kN/m**	**1.632 kN/m**	**0.000 kN/m**
Total Wall Load	**3.47 kN/m**	**4.74 kN/m**	**5.86 kN/m**	**10.59 kN/m**

At Lower Pent House (29th floor)	**100 Thk Wall(Int.)**	**125 Thk Wall(Ext.)**	**230 Thk Wall**	**Non-Stru. Pardi**
Thickness of wall	100 mm	125 mm	230 mm	150 mm
Material Density	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	575 mm	575 mm	575 mm	575 mm
Wall Load	**2.55 mm**	**3.19 kN/m**	**5.87 kN/m**	**14.72 kN/m**
Thickness of plaster	24 mm	36 mm	24 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.160 kN/m**	**3.240 kN/m**	**2.160 kN/m**	**0.000 kN/m**
Total Wall Load	**4.71 kN/m**	**6.43 kN/m**	**8.03 kN/m**	**14.72 kN/m**

At Terrace	**100 Thk Wall**	**230 Thk Wall**	**Non-Stru. Pardi**
Thickness of wall	100 mm	230 mm	150 mm
Material Density	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	575 mm	575 mm	575 mm
Wall Load	**1.58 kN/m**	**3.63 kN/m**	**9.09 kN/m**
Thickness of plaster	24 mm	24 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**1.440 kN/m**	**1.440 kN/m**	**0.000 kN/m**
Total Wall Load	**3.02 kN/m**	**5.07 kN/m**	**9.09 kN/m**

Parapet Wall			
Thickness of wall	**230** mm	**125** mm	**100** mm
Height of wall	**1.35** m	**1.35** m	**1.35** m
Material Density	**19** kN/m3	**6.5** kN/m3	**6.5** kN/m3
Total Wall Load	**6.87 kN/m**	**2.07 kN/m**	**1.85 kN/m**

OHWT Wall	
Thickness of wall	**230** mm
Height of wall	**1.83** m
Material Density	**25** kN/m3
Total Wall Load	**12.0 kN/m**

FOR BLOCK D COMMERCIAL

Wall Load

At Basement 3 & 2	**125 Thk Wall**	**230 Thk Wall**	**Non-Stru. Pardi**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 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	600 mm	600 mm	600 mm
Wall Load	**3.17 kN/m**	**5.83 kN/m**	**22.43 kN/m**	**29.25 kN/m**
Thickness of plaster	24 mm	24 mm	0 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.160 kN/m**	**2.160 kN/m**	**0.000 kN/m**	**0.000 kN/m**
Total Wall Load	**5.33 kN/m**	**7.99 kN/m**	**22.43 kN/m**	**29.25 kN/m**

At Basement 1	**125 Thk Wall**	**230 Thk Wall**	**Non-Stru. Pardi**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 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	600 mm	600 mm	600 mm
Wall Load	**3.41 kN/m**	**6.28 kN/m**	**24.15 kN/m**	**31.50 kN/m**
Thickness of plaster	24 mm	24 mm	0 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.304 kN/m**	**2.304 kN/m**	**0.000 kN/m**	**0.000 kN/m**
Total Wall Load	**5.72 kN/m**	**8.58 kN/m**	**24.15 kN/m**	**31.50 kN/m**

At Ground Floor & 1st Floor	**125 Thk Wall**	**230 Thk Wall(Int.)**	**230 Thk Wall(Peri.)**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 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	575 mm	575 mm	750 mm	575 mm
Wall Load	**3.19 kN/m**	**5.87 kN/m**	**5.61 kN/m**	**22.57 kN/m**
Thickness of plaster	24 mm	24 mm	36 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**2.160 kN/m**	**2.160 kN/m**	**3.240 kN/m**	**0.000 kN/m**
Total Wall Load	**5.35 kN/m**	**8.03 kN/m**	**8.85 kN/m**	**22.57 kN/m**

At 5th Floor to 28th Floor	**125 Thk Wall(Int.)**	**230 Thk Wall(Int.)**	**230 Thk Wall(Peri.)**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 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	575 mm	575 mm	750 mm	575 mm
Wall Load	**2.54 kN/m**	**4.67 kN/m**	**4.41 kN/m**	**17.97 kN/m**
Thickness of plaster	24 mm	24 mm	36 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**1.776 kN/m**	**1.776 kN/m**	**2.664 kN/m**	**0.000 kN/m**
Total Wall Load	**4.32 kN/m**	**6.45 kN/m**	**7.07 kN/m**	**17.97 kN/m**

At Terrace	**125 Thk Wall**	**230 Thk Wall(Int.)**	**230 Thk Wall(Peri.)**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 mm	230 mm	300 mm
Material Density	6.5 kN/m3	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	575 mm	575 mm	750 mm	575 mm
Wall Load	**2.54 mm**	**4.67 kN/m**	**4.41 kN/m**	**23.44 kN/m**
Thickness of plaster	24 mm	24 mm	36 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**1.776 kN/m**	**1.776 kN/m**	**2.664 kN/m**	**0.000 kN/m**
Total Wall Load	**4.32 kN/m**	**6.45 kN/m**	**7.07 kN/m**	**23.44 kN/m**

At Stair Cabin level	**125 Thk Wall**	**230 Thk Wall**	**Non-Stru. Pardi**
Thickness of wall	125 mm	230 mm	300 mm
Material Density	6.5 kN/m3	6.5 kN/m3	25 kN/m3
Depth of Beam	575 mm	575 mm	575 mm
Wall Load	**2.05 kN/m**	**3.77 kN/m**	**18.94 kN/m**
Thickness of plaster	24 mm	24 mm	0 mm
Material Density	20 kN/m3	20 kN/m3	20 kN/m3
Plaster Load	**1.488 kN/m**	**1.488 kN/m**	**0.000 kN/m**
Total Wall Load	**3.54 kN/m**	**5.26 kN/m**	**18.94 kN/m**

Parapet Wall			
Thickness of wall	230 mm	230 mm	230 mm
Height of wall	1.35 m	1.15 m	1.15 m
Material Density	25 kN/m3	19 kN/m3	6.5 kN/m3
Total Wall Load	**8.73 kN/m**	**5.85 kN/m**	**2.55 kN/m**

OHWT Wall	
Thickness of wall	230 mm
Height of wall	3.10 m
Material Density	25 kN/m3
Total Wall Load	**20.31 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

Swimming Pool Water Load

	BLOCK BC	
Water Height	1.2	m
Water Load on Slab	12	kN/m^2

Overhead Water Tank Load

	BLOCK ABC	BLOCK D	
Water tank Total Height	1.83	3.1	m
Free board	0.3	0.3	m
Water Load on Slab	15.3	28	kN/m^2

3.3 Live Load (LL)

FOR BLOCK ABC RESIDENTIAL

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)	4	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

FOR COMMERCIAL

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)	4	kN/m^2
At Typical Floor Level	4	kN/m^2
At Terrace Floor Level	4	kN/m^2
Foyer, Balcony	4	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 Soft Copy).

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	M55/M60	M40	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	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
Footing	50mm	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	BLOCK A	BLOCK BC	BLOCK D
1.	Height of Building Above Ground floor to Terrace Level (h)	111.85	112.55	115.45
2.	Building Dimension (dx) in Plan (m)	27.58	38.43	42.91
3.	Building Dimension (dy) in Plan (m)	17.54	38.86	28.45
4.	Time Period in X Direction (sec)	1.92	1.63	1.59
5.	Time Period in Y Direction (sec)	2.31	1.62	1.95

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=Vb * k1 * k2 * k3*k4

Design wind pressure pz=0.6 * Vz^2

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 WLxor GUSTX
D13/D14	1.5DL + 1.5 SDL ± 1.5 WLyor 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 WLxor GUSTX
D19/D20	0.9DL + 0.9 SDL ± 1.5 WLyor 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 WLyor GUSTX ± 1.05TL
T13/T14/T15/T16	T13/T14/T15/T16 - 1.05 DL + 1.05 SDL + 1.28 LL ± 1.28 WLyor 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 WLyor 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 WLyor 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 WLxor GUSTX
S16/S17	1.0DL + 1.0 SDL ± 1.0 WLyor 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

11Software Used

All R.C.C structures shall be designed according to the Limit State Method as specified in IS: 456 – 2000 usingETABS 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 K.C.T CONSULTANCY – Ahmadabad (Report Reference No: ST/23/01/17566 –JAN2023)

KCT Consultancy Services, Ahmedabad

APPENDIX - 1

SUMMARY OF ALLOWABLE BEARING PRESSURE BASED ON SHEAR AND SETTLEMENT CRITERION

Project : Proposed Structure of Aristo at TP-32, FP-40-2, S No. 86-1-2, Gota, Ahmedabad.

Depth of Foundation (m)	Length of Foundation (m)	Width of Foundation (m)	Safe Bearing Capacities calculated based on Shear Criteria (See Appendix 1.1) (t/m^2)	Safe Bearing Pressures calculated based on Settlement Criteria (See Appendix 1.2)		Allowable Bearing Pressure suggested (Min. of Shear and Settlement Criterion)	
				For 100 mm Settlement (t/m^2)	For 125 mm Settlement (t/m^2)	For 100 mm Settlement (t/m^2)	For 125 mm Settlement (t/m^2)
14.80	31.58	19.40	73	63	73	63	73
14.80	44.91	29.84	89	50	56	50	56
14.80	42.86	40.20	95	44	49	44	49
15.50	31.58	19.40	78	64	73	64	73
15.50	44.91	29.84	95	50	56	50	56
15.50	42.86	40.20	102	44	49	44	49
16.00	31.58	19.40	83	64	73	64	73
16.00	44.91	29.84	99	50	56	50	56
16.00	42.86	40.20	106	45	49	45	49

Notes :

1) The factor of safety of 2.5 is considered.

2) The depth of foundation is considered from the NGL at the time of exploration.

3) Calculations are considering the effect of water table at 20 m.

4) Basement upto 13 m depth from NGL has been considered for calculations. The effective overburden pressure has been considered for soil between basement bottom and foundation bottom.

Recommended AVG. GROSS SBCis50 t/m^2 and AVG. Soil sub grade Modulus is 4000$kN/m^2/m$ at depth of 16.00m.

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