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To

M/s. SPR Construction Pvt. Ltd.
No. 1, Cooks Road,
SPR City, Perambur,
Chennai – 600 011.

Sir,

Sub: Vetting of the Structural Design of Proposed Construction of Multi Storied residential buildings for Block - 1 (S + 38 Floors), Block - 2 (B1 + S + 38 Floors), Block - 3 (B1 + S + 47 Floors), Block - 4 (B2 + B1 + S + 45 Floors), Block 7 (B2+B1+P1+P1(M)+45 floors) at RS. No 218/5, 218/2, 219/1 to 6, 220/2 of Block No 11 and Rs.No 221/2, 222/1 & 2 of Block No 12, Stephenson Road, New Farrens Road & Cooks Road, Perambur, Perambur Taluk. Division No 73, Zone VI, Chennai 600 011. – Reg.

Ref: Letter dated 01.10.2022 from your office.

As requested in the letter cited, we have accepted to offer our services to verify the structural design of Proposed Construction of Multi storied buildings as, **Block - 1** (S + 38 Floors), **Block - 2** (B1 + S + 38 Floors), **Block - 3** (B1 + S + 47 Floors), **Block - 4** (B2 + B1 + S + 45 Floors) **Block 7**- B2+B1+P1+P1(M)+45 floors(For **Block 7 - DBR and Model checking is in progress**) abutting Stephenson Road, New Farrens Road & Cooks Road, Perambur, Chennai 600 011. Comprised in the RS. No 218/5, 218/2, 219/1 to 6, 220/2 of Block No 11 and Rs.No 221/2, 222/1 & 2 of Block No 12, Perambur Town, Perambur Taluk. Division No 73, Zone VI, based on the inputs given by you, such as (i) Copy of the soil investigation report, (ii) Structural design and detailing provided by Mr.V.Rukmangathan, the structural consultant, and (iii) Architectural Drawings.

Our team has completed the proof checking of structural design and stability of the structure as per the model given by Mr.V. Rukmangathan. We have checked the stability of this tall structure based on the model analysis and it is found that all the responses are within permissible limit. It is certified that the Structural Design and the list of enclosed detailed drawing for the Proposed Residential building is found to be satisfied with the codal requirement as per relevant I.S.Codes.

It is advised that the same specifications and detailing provided in the drawing should be followed during the construction of the building. The quality of workmanship is very much important in the structural performance of the buildings.

Thanking you

Yours sincerely

A. MEHER PRASAD

**EPICONS CONSULTANTS PVT. LTD**

Project: Proposed Residential Highrise Building Tower
A & B in block 7 at SPR CITY, Perambur,
Chennai
Title: **DESIGN BASIS REPORT**

Job No. 9394

Rev: R0

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Consulting Civil & Structural Engineers

Thane-Mumbai

**EPICONS CONSULTANTS PVT. LTD**evolution planning investigation concrete & steel
(ISO 9001:2008 certified)**DESIGN BASIS REPORT (Structural)(R-0)**

Project : Proposed Residential Highrise Building Tower A & B in
block 7 at SPR CITY, Perambur, Chennai

Client : M/s. SPR Construction Pvt Ltd.

Architects : M/s. The Black Ink

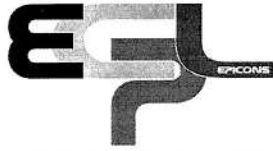
Service Consultants : M/s. S. N. Joshi Consultants Pvt. Ltd.

Prepared By: Mr. Harshad Shelar

Approved By: Mr. Yogesh Rangari
Sr. Manager (Design)

Rev. No.	Date	Details of Revision	Status
R-0	01/03/2024	Final	Approved
R-H	18/01/2024	Updated as per IIT(Madras)	Advance copy
R-G	03/01/2024	Updated as per IIT(Madras)	Advance copy
R-F	07/11/2023	Updated as per IIT(Madras)	Advance copy
R-E	20/10/2023	Updated as per IIT (Madras)	Advance copy
R-D	03/10/2023	Updated as per IIT (Madras)	Advance copy
R-C	22/08/2023	Revised	Advance copy
R-B	23/06/2022	Updated as per IIT (Madras) comments	Advance copy
R-A	18/06/2022	Preliminary	Preliminary report



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1. Objective

The objective of presenting this design basis report is to share the information related to design assumptions, design loads, design methodology & philosophy with the project team and Client.

It is expected that this process will further ensure that structural design is comprehensive & correct.

Design basis report will be revised duly as per the requirements & improvisations during the design development stage.

This design basis report is based on Design Prerequisite sheet received from Client's representative on 14.06.2022 and the same is added to this document as Annexure – 1.

We certify that design is sound and safe.

2. Brief Description of the Structure

The project consists of two buildings namely Tower A & Tower B.
Tower A and B is separated by expansion joint.

Design Basis of Tower A & B is covered in this Report.

External podium is connected to tower and the same is considered in analysis and design.

The basic configuration of the tower is as follows:

Configuration	Dimension		Height (above Podium) H	Height (above Foundation) H1	Aspect Ratio
	LX	Ly			
Tower A – 2 Basements + Ground+ MEZZANINE + 5 Podium (Part residential at Tower area + 41 residential floors (including 1 floor future provisions	59.375m Typical floor	16.325m Typical floor	132.3m	159.1m	H/Ly 8.10
	59.375m Podium Level	38.475m Podium Level	132.3m	159.1m	H1/Ly 3.52
Tower B – 2 Basements + Ground + MEZZANINE + 5 Podium (Part residential at Tower area + 41 residential floors (including 1 floor future provisions	67.75m Typical floor	16.325m Typical floor	132.3m	159.1m	H/Ly 8.10
	67.75m Podium Level	38.475m Podium Level	132.3m	159.1m	H1/Ly 3.52

Total height of building above pile cap = 159.10m



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The floor height for various floors is as follows –

- Basement 2 Floor - 3.20m
- Basement 1 Floor - 4.05m
- Ground floor - 3.25m
- Mezzanine - 3.25m
- Podium 1 - 3.25m
- Podium 2 - 3.50m
- Podium 3 - 3.15m
- Podium 4 - 3.15m
- Podium 5 - 3.15m
- Typical Residential floor - 3.15m

3. Structural System**A) Floor system:**

The structural system proposed for floors is beam-slab floor construction.

B) Lateral load resisting system:

The lateral load resisting system consists with RC ductile structural shear walls.

4. Foundation Design

Geotechnical Soil Investigation report is submitted by M/s Geo Foundations & Structures Private Limited. For other structures on the same plot and as per the report:

- 1) Weathered Bed Rock is available at depth 21m to 30m. From existing Ground Lvl.
- 2) Ground water table is observed @ 3.0m below Existing Ground Lvl.
- 3) As per soil investigation report pile foundation will be adopted for this structure.
- 4) Pile capacity for 750 dia. Pile is 325 T, 900 dia. is 500 T & 1000 dia. is 620T as per initial Pile load test report.
- 5) The permissible settlement for pile is 18mm.

5. Basement Design

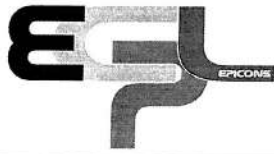
- 1) R.C.C. Slab with beams is proposed for the basement.
- 2) Counterweight of plum concrete is considered above basement stitch raft.
- 3) Basement slab shall be provided with temporary pressure release pipes till the time counter weight on the slab is constructed. Later on, these pipes shall be grouted permanently.

6. Materials**A. Concrete**

Grade of concrete for RCC work will be as follows: -

1. Piles – M40
2. Pile caps, Stitch raft– M45
3. Basement Retaining walls – M40



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4. Columns, shear walls, Lift walls – M65/M60/M50/M40/M30 (Floor wise Variation in Grade as per Design requirement)
5. Floor slabs & beams – M65/M60/M50/M40/M30 (Floor wise Variation in Grade as per Design requirement)
6. Water tanks, STP, Lift machine Room – M30 (Minimum)

B. Steel

The reinforcement steel proposed to be used shall be Fe550D (Fe500D is preferred) for shear walls and Fe550 for all other R.C.C. members (With elongation strictly more than 14.5%)-Clause 5.3, IS 13920.

7. Design Loads**A Walls**

External Walls	200/150 Thk. R.C.C. walls (Non-Structural)
Internal Walls	100/150/300 Thk. R.C.C. walls (Non-Structural)

B Sunken areas

1) Toilets	65 mm
2) Service slab	65 mm
3) Utility & Balcony	150 mm

C Dead Loads (DL)

Material	Density (Unit wt.)
1) Concrete Reinforced	25.0 KN /m ³
2) Cement mortar screed	20.4 KN /m ³
3) Water Proofing (brick bat coba)	20.0 KN /m ³
4) AAC blocks	7.0 KN /m ³
5) Flooring Tiles	24.0 KN /m ³
6) Granite	27.45 KN /m ³
7) Gypsum Plaster	12.0 KN /m ³
8) Water	10.0 KN /m ³
9) Murum / soil	18.0 KN /m ³
10) Structural Steel	78.5 KN /m ³

Load Component	Thickness (mm)	Load intensity (kN/m ²)
1) Floor finish (For residential)	50 (Avg.)	1.25
2) Floor finish Parking area	100 (Avg.)	2.0
2) Terrace water proofing	150 (Avg.)	3.0

*Detailed calculation of Dead load intensity will be provided in load calculation document.



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D Live Loads (LL)

	Load Intensity (kN/Sq.m)
1) All habitable rooms	2.0
2) Toilet areas	2.0
3) Staircases, Passages & Refuge areas	3.0
4) Terrace with solar panel	3.0
5) Podium Car Parking	3.0
6) Driveway	5.0
7) Fire Tender (80T)	30.0
8) Balcony	3.0
9) Service slab	2.0
10) Electrical room, Fire command room	5.0
11) Landscape	3.0
12) Gym, Library	4.0
13) Group exercise, Board games, coffee lounge	3.0
14) Mini Theater	4.0

E Super imposed load

	Load Intensity (kN/Sq.m)
1) Podium Car Parking	3.0
2) Driveway	5.0
3) Fire Tender (80T)	30.0

F Other Loads:

- 1) Overhead tank load will be considered over Lift core area above Terrace lvl. The Capacity is yet to be confirmed.
- 2) Structural provision for future addition of one floor has been considered for design purpose.
- 3) Fire tender vehicle movement of 80T is considered for driveway area on last Podium floor.
- 4) Soil filling of 1.5m depth at column locations and 450mm thick filling on rest area is considered for last Podium floor excluding driveways.
- 5) We have considered 10°C temperature for Terrace floor only.





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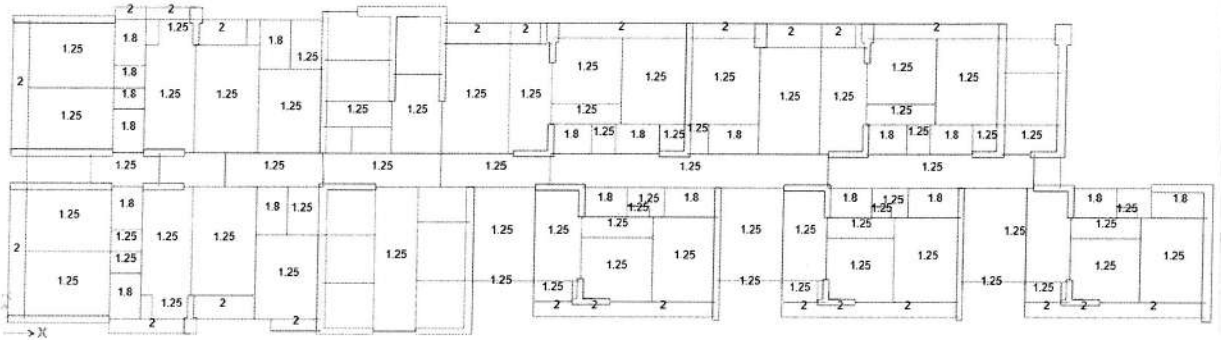
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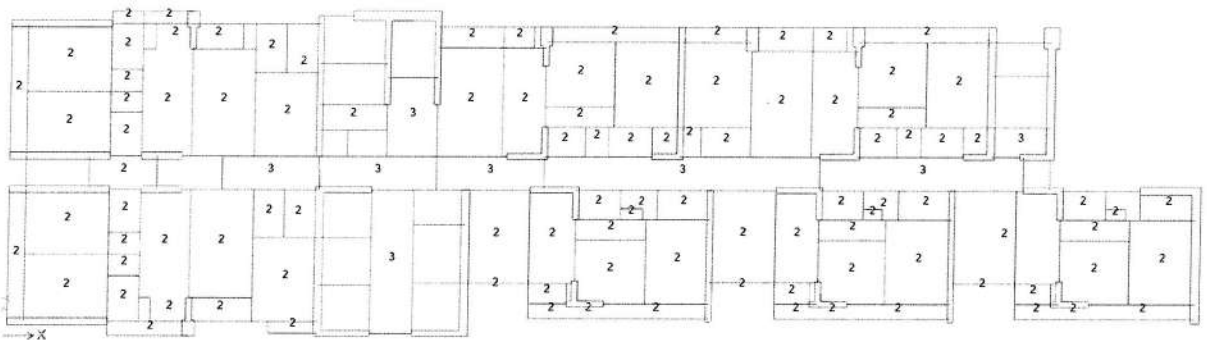
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G Load application in Etabs:

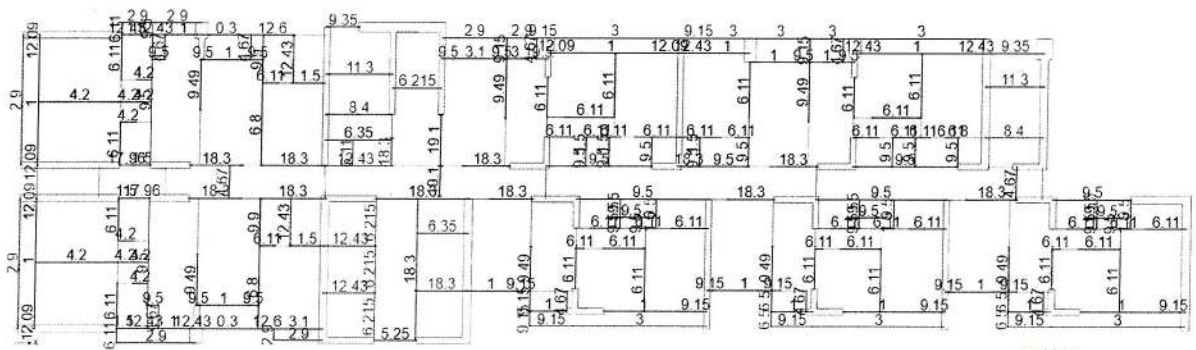
Floor finish load on Typical floor.

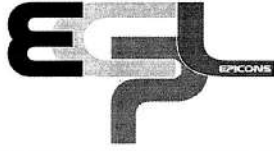


Live load on Typical floor.



Wall load on Typical floor



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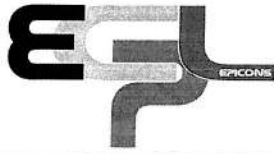
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8 | Page**8. Design Codes of Practice and Standards**

The following is the list of codes that will be referred while designing the structure:

Code No.	Description
IS 875 Part 1 : 1987	Code of practice for design loads (Other than Buildings and Structures) Part 1: Dead Loads
IS 875 Part 2 : 1987	Code of practice for design loads (Other than Buildings and Structures) Part 2: Imposed Loads
IS 875 Part 3 : 2015	Code of practice for design loads (Other than Buildings and Structures) Part 3: Wind Loads
IS 456 : 2000	Plain and Reinforced Concrete – Code of Practice
IS 1893 : 2016	Criteria for Earthquake Resistant Design of Structures
IS 4326 : 1993	Earthquake Resistant Design and construction of Code of Practice
IS 13920 : 2016	Ductile detailing of Reinforced Concrete Structures to seismic forces - Code of Practice
IS 3370 : 2021	Code of practice for concrete structures for the storage of Liquids
IS 800 : 2007	Code of practice for general Construction in steel
SP: 16	Design Aids for Reinforced Concrete
IS 16700 : 2017	Criteria for Structural Safety of Tall Concrete Buildings
ACI:318 -19	Building code requirements for structural concrete.





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9. Seismic Design Parameters- (As per IS 1893-(part 1)2016)

Structural design will be earthquake resistant design with ductile detailing.

Sr. no.	Parameter	Description	Reference
1.	Analysis	Static & Modal Analysis (Dynamic Analysis)	
2.	Seismic Zone	Zone III – Chennai	Fig-1: I.S1893 (Part 1): 2016)
3.	Zone factor: Z	0.16	Table-3 : I.S1893 (Part 1) : 2016)
4.	Importance factor : I	1.2	Table-8: I.S 1893 (Part 1) : 2016
5.	Soil Type	I	Soil Investigation Report
6.	Damping	5%	Clause 7.8.2:I.S 1893 (Part 1):2016
6.	Response Reduction Factor : R	4	Table-9 : I.S1893 (Part 1) : 2016)
7.	Seismic resisting structural system	Buildings with Ductile RC structural shear	
8.	Fundamental Time Period	$A_w = \sum_{i=1}^{N_w} \left[A_{wi} \left\{ 0.2 + \left(\frac{L_{wi}}{h} \right) \right\}^2 \right]$	Clause 7.6.2:I.S 1893 (Part 1):2016 refer (annexure 01)
9.	Seismic Weight of Building for Earthquake force calculation	DL + 0.25 LL+0.5 LL	Clause 7.4 & Table 8 of IS1893(Part1):2016
10.	Number of Modes considered	25 (Ritz Vector)	
11.	Modal combination method	Complete Quadratic Combination (CQC)	Clause 7.7.5.3 IS1893(Part1):2016





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9.1 Time Period calculation:

9.1.1 Time period by code IS1893 (clause 7.6.2.b)- Tower A

	h = 136.0806 m		dx = 59.375 m	
Floor Area, m ²	6277.47	Sum	27.5676	0.50 5.532047
Wall in x Direction	B	L	Awl	Lwl/h Aw
SW1	450	5025	2.26125	0.04 0.455333
SW6	450	5025	2.26125	0.04 0.455333
SW7	450	2000	0.9	0.01 0.180194
SW10	450	5025	2.26125	0.04 0.455333
SW11	450	2000	0.9	0.01 0.180194
SW14	400	2189	0.8756	0.02 0.175347
SW19	450	5025	2.26125	0.04 0.455333
LW1	500	4250	2.125	0.03 0.427073
SW15A	400	1850	0.74	0.01 0.148137
LW2A	300	2600	0.78	0.02 0.156285
LW2B	300	2400	0.72	0.02 0.144224
LW2C	300	2400	0.72	0.02 0.144224
LW3A	300	2600	0.78	0.02 0.156285
LW3B	300	2600	0.78	0.02 0.156285
SW3A	400	1375	0.55	0.01 0.110056
SW4A	300	1425	0.4275	0.01 0.085547
SW5A	300	1500	0.45	0.01 0.090055
LW2D	300	2600	0.78	0.02 0.156285
SW8A	400	1850	0.74	0.01 0.148137
SW9A	400	1850	0.74	0.01 0.148137
LW3C	300	2600	0.78	0.02 0.156285
P6	1020	1475	1.5045	0.01 0.301077
P7	400	1475	0.59	0.01 0.118069
P8	400	1475	0.59	0.01 0.118069
SW13A	400	2300	0.92	0.02 0.184263
SW17A	400	2825	1.13	0.02 0.226487

Wall Area percentage	Aw	0.439151%
Without infill 0.075h*0.75	Tx =	2.988 Sec
Shear wall-0.075h*0.75/(AW)*0.5	Tx =	1.270 Sec
With infill 0.09h/(dy)*0.5	Tx =	1.589 Sec
clause 7.6.2 (a) < 7.6.2 (b) < 7.6.2 (c)		
Time Period for Analysis		1.589 Sec

Amendment No. 2 to IS 1893 (Part 1) : 2016

(Page 20, Table 9, Note 3) — Substitute the following for the existing note:
“See 7.2.7.”

(Page 20, Table 9, Note 4) — Substitute the following for the existing:

“4 In these buildings, (a) punching shear failure shall be avoided, and (b) lateral drift at the roof under lateral force shall not exceed 0.1 percent. Lateral drift of the flat slab buildings shall be estimated: (i) considering total lateral displacement, including torsional effects, and (ii) using three-dimensional models. Sealing need not be done for displacement response quantities, as stated in 7.7.3.2.”

(Page 21, clause 7.6.2 (b) (see also Amendment No. 1)) — Substitute the following for the existing expression of A_w :

$$A_w = \sum_{i=1}^n \left[A_{wi} \left(0.2 + \left(\frac{L_{wi}}{h} \right)^2 \right) \right]$$

(Page 21, clause 7.6.2 (c)) — Insert the following at the end of (c):

7.6.2.1 The value of T_x obtained shall neither be taken to be more than that given in 7.6.2 (a) nor less than that given in 7.6.2 (c).¹

	h = 136.0806 m		dy = 38.475 m	
Floor Area, m ²	6277.47	Sum	26.95254	0.08 5.390885
Wall in y Direction	B	L	Awl	Lwl/h Aw
SW8	1475	400	0.59	0.00 0.118005
SW9	1475	400	0.59	0.00 0.118005
SW13	6600	489.4	3.23004	0.00 0.64605
SW15	6600	400	2.64	0.00 0.528023
SW16	1475	400	0.59	0.00 0.118005
SW17	6600	450	2.97	0.00 0.594032
P2	1025	400	0.41	0.00 0.082004
P3	1200	700	0.84	0.01 0.168022
P4	1025	400	0.41	0.00 0.082004
P5	1125	400	0.45	0.00 0.090004
LW1A	4450	300	1.335	0.00 0.267006
LW1B	4450	300	1.335	0.00 0.267006
SW14A	1475	400	0.59	0.00 0.118005
LW2	7200	400	2.88	0.00 0.576025
LW3	7200	400	2.88	0.00 0.576025
P2A	950	750	0.7125	0.01 0.142522
P4A	950	750	0.7125	0.01 0.142522
P5A	800	700	0.56	0.01 0.112015
P1A	800	750	0.6	0.01 0.120018
P7A	1150	800	0.92	0.01 0.184032
SW5B	1050	750	0.7875	0.01 0.157524
P8A	1150	800	0.92	0.01 0.184032

Wall Area percentage	Aw	0.429154%
Without infill 0.075h*0.75	Ty =	2.988 Sec
Shear wall-0.075h*0.75/(AW)*0.5	Ty =	1.287 Sec
With infill 0.09h/(dy)*0.5	Ty =	1.974 Sec
clause 7.6.2 (a) < 7.6.2 (b) < 7.6.2 (c)		
Time Period for Analysis		1.974 Sec

Amendment No. 2 to IS 1893 (Part 1) : 2016

(Page 20, Table 9, Note 3) — Substitute the following for the existing note:
“See 7.2.7.”

(Page 20, Table 9, Note 4) — Substitute the following for the existing:

“4 In these buildings, (a) punching shear failure shall be avoided, and (b) lateral drift at the roof under lateral force shall not exceed 0.1 percent. Lateral drift of the flat slab buildings shall be estimated: (i) considering total lateral displacement, including torsional effects, and (ii) using three-dimensional models. Sealing need not be done for displacement response quantities, as stated in 7.7.3.2.”

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$$A_w = \sum_{i=1}^n \left[A_{wi} \left(0.2 + \left(\frac{L_{wi}}{h} \right)^2 \right) \right]$$

(Page 21, clause 7.6.2 (c)) — Insert the following at the end of (c):

7.6.2.1 The value of T_y obtained shall neither be taken to be more than that given in 7.6.2 (a) nor less than that given in 7.6.2 (c).¹





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Effective height Calculation Tower with Podium Podium and typical floor different area					Effective Height, m
Sum	42591.44				69.94
	At	Hs	Hs	At X Hs	
Terrace	701.57	3.15	159.1	111619.8	
EXTRA	701.57	3.15	155.95	109409.8	
45	701.57	3.15	152.8	107199.9	
44	701.57	3.15	149.65	104990	
43	701.57	3.15	146.5	102780	
42	701.57	3.15	143.35	100570.1	
41	701.57	3.15	140.2	98360.11	
40	701.57	3.15	137.05	96150.17	
39	701.57	3.15	133.9	93940.23	
38	701.57	3.15	130.75	91730.28	
37	701.57	3.15	127.6	89520.33	
36	701.57	3.15	124.45	87310.39	
35	701.57	3.15	121.3	85100.44	
34	701.57	3.15	118.15	82890.5	
33	701.57	3.15	115	80680.55	
32	701.57	3.15	111.85	78470.6	
31	701.57	3.15	108.7	76260.66	
30	701.57	3.15	105.55	74050.71	
29	701.57	3.15	102.4	71840.77	
28	701.57	3.15	99.25	69630.82	
27	701.57	3.15	96.1	67420.88	
26	701.57	3.15	92.95	65210.93	
25	701.57	3.15	89.8	63000.99	
24	701.57	3.15	86.65	60791.04	
23	701.57	3.15	83.5	58581.1	
22	701.57	3.15	80.35	56371.15	
21	701.57	3.15	77.2	54161.2	
20	701.57	3.15	74.05	51951.26	
19	701.57	3.15	70.9	49741.31	
18	701.57	3.15	67.75	47531.37	
17	701.57	3.15	64.6	45321.42	
16	701.57	3.15	61.45	43111.48	
15	701.57	3.15	58.3	40901.53	
14	701.57	3.15	55.15	38691.59	
13	701.57	3.15	52	36481.64	
12	701.57	3.15	48.85	34271.69	
11	701.57	3.15	45.7	32061.75	
10	701.57	3.15	42.55	29851.8	
9	701.57	3.15	39.4	27641.86	
8	701.57	3.15	36.25	25431.91	
7	701.57	3.15	33.1	23221.97	
6	701.57	3.15	29.95	21012.02	
5	706.73	3.15	26.8	18802.08	
4	706.73	3.15	23.65	16592.14	
3	706.73	3.15	20.5	14382.2	
2	706.73	3.15	17.35	12172.26	
1	706.73	3.15	14.2	9962.32	
ME2	1215.18	3.15	10.5	12759.39	
GR/PO	2033.29	4.05	7.25	14668.13	
B1	2037.6	3.2	3.2	6520.31	

Effective height Calculation Tower with Podium Podium has same area as of typical floor					Effective Height, m
Sum	35119.78				81.78
	At	Hs	Hs	At X Hs	
Terrace	701.57	3.15	159.1	111619.79	
EXTRA	701.57	3.15	155.95	109409.84	
45	701.57	3.15	152.8	107199.9	
44	701.57	3.15	149.65	104990.95	
43	701.57	3.15	146.5	102780.01	
42	701.57	3.15	143.35	100570.06	
41	701.57	3.15	140.2	98360.114	
40	701.57	3.15	137.05	96150.169	
39	701.57	3.15	133.9	93940.223	
38	701.57	3.15	130.75	91730.278	
37	701.57	3.15	127.6	89520.332	
36	701.57	3.15	124.45	87310.387	
35	701.57	3.15	121.3	85100.441	
34	701.57	3.15	118.15	82890.496	
33	701.57	3.15	115	80680.55	
32	701.57	3.15	111.85	78470.605	
31	701.57	3.15	108.7	76260.659	
30	701.57	3.15	105.55	74050.714	
29	701.57	3.15	102.4	71840.768	
28	701.57	3.15	99.25	69630.823	
27	701.57	3.15	96.1	67420.877	
26	701.57	3.15	92.95	65210.932	
25	701.57	3.15	89.8	63000.986	
24	701.57	3.15	86.65	60791.041	
23	701.57	3.15	83.5	58581.095	
22	701.57	3.15	80.35	56371.15	
21	701.57	3.15	77.2	54161.204	
20	701.57	3.15	74.05	51951.259	
19	701.57	3.15	70.9	49741.313	
18	701.57	3.15	67.75	47531.368	
17	701.57	3.15	64.6	45321.422	
16	701.57	3.15	61.45	43111.477	
15	701.57	3.15	58.3	40901.531	
14	701.57	3.15	55.15	38691.586	
13	701.57	3.15	52	36481.64	
12	701.57	3.15	48.85	34271.695	
11	701.57	3.15	45.7	32061.749	
10	701.57	3.15	42.55	29851.804	
9	701.57	3.15	39.4	27641.858	
8	701.57	3.15	36.25	25431.913	
7	701.57	3.15	33.1	23221.967	
6	701.57	3.15	29.95	21012.022	
5	706.73	3.15	26.8	18802.076	
4	706.73	3.15	23.65	16592.13	
3	706.73	3.15	20.5	14382.184	
2	706.73	3.15	17.35	12172.238	
1	706.73	3.15	14.2	9962.292	
ME2	706.73	3.15	10.5	12759.347	
GR/PO	706.73	4.05	7.25	5123.7925	
B1	706.73	3.2	3.2	2261.536	

But for same floor area of podium and typical
floor effective height should be

158.30 m

So correction factor

1.946

So corrected effective height should be

136.081 m

9.1.2 Time period by code IS1893 (clause 7.6.2.b)- Tower

h= 137.1106 m		d= 67.15 m	
Floor Area, m ²	5277.47	Sum	22.12075
W in x Direction	B	L	Aw
EW6	130	5013	1.75875
EW7	130	4829	1.5875
EW5	130	5013	1.75875
EW0	130	5013	1.75875
EW3	130	5013	1.75875
EW32A	130	1876.4	0.41292
EW32A	1431	0.41292	0.01
EW38A	130	1849.9	0.55497
EW42B	130	1175	0.41292
EW98A	130	1850	0.553
EW55A	130	1500	0.6
EW60A	130	1850	0.553
EW98A	130	1850	0.553
EW67A	130	1850	0.553
EW65A	130	1850	0.553
EW55A	130	1850	0.553
EW6A	130	2025	0.6075
EW9A	130	2025	0.6075
EW6A	130	2025	0.6075
EW52A	400	600	0.24
EW71A	300	2450	0.735
EW71B	300	2450	0.735
EW51B	300	2300	0.25
EW59A	300	2300	0.75
EW58B	300	2400	0.72
EW58C	300	2400	0.72
EW58D	300	2300	0.75

Wall Area, m ²	Aw	0.112861
7.6.2 (d)	Without info 0.075h/0.75	Tx= 1.005
7.6.2 (b)	Shear wall 0.075h/0.75/(Aw)0.5	Tx= 1.425
7.6.2 (c)	With info 0.09h/(dy)0.5	Tx= 1.506
clause 7.6.2 (b) & 7.6.2 (c) & 7.6.2 (d)		
Time Period for Analysis		1.506

Amendment No. 2 to IS 1893 (Part 1), 2016

Clause 20, Table 4, Note 3: - Substitute the following for the existing note 3, clause 7.6.2 (c)

Clause 20, Table 4, Note 4: - Substitute the following for the existing note 4

4. In these buildings, the punching shear failure shall be avoided and the lateral drift at the roof level from long drifts shall be limited to 1/1000 of the height. For such buildings, the following shall be followed: (i) considering local data of displacement, (ii) taking into account effects, and (iii) using other dimensionless models. Such a model may be used for displacement response, as stated in 7.6.2 (c)

Clause 21, clause 7.6.2 (c) this clause shall be substituted by the following: (i) For the following expression (ii)

$$C_d = \frac{C_d}{C_d} \cdot \frac{C_d}{C_d} \cdot \frac{C_d}{C_d} \cdot \frac{C_d}{C_d}$$

Clause 21, clause 7.6.2 (c) - Substitute the following for the existing note 4

7.6.2 (c) The value of C_d obtained shall neither be taken to be more than that given in 7.6.2 (c) nor less than that given in 7.6.2 (c)





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Floor Area, m ²	h	117.1105	m	dy	38.477	m
Wall in y Direction	B	L	Aw	Lw/h	Aw	
W131	300	4200	1.35	0.03	0.133182	
W132	430	3369.2	1.24724	0.04	0.303318	
W133	300	3451.2	1.53325	0.04	0.129657	
W134	400	5487.2	1.29885	0.05	0.323612	
W135	300	7026	2.1078	0.05	0.427095	
W136	300	5268	1.5804	0.04	0.318413	
W137	300	1475	0.4425	0.01	0.088531	
W138	300	1475	0.4425	0.01	0.088531	
W139	300	2273	0.6829	0.02	0.136567	
W140	430	3369.2	1.24724	0.04	0.473945	
W141	300	1350	0.405	0.01	0.081039	
W142	300	6450	1.935	0.05	0.391282	
W143	300	1304.8	0.40967	0.01	0.081134	
W144	300	6450.8	1.93944	0.05	0.392158	
W145	300	11350	0.405	0.01	0.081039	
W146	300	11350	0.405	0.01	0.129139	
W147	400	7200	1.28	0.03	0.383842	
W148	800	948	0.7584	0.01	0.151716	
C13	300	1975	0.3925	0.01	0.118813	
C14	2615	1140	0.38	0.02	0.117737	
C15	500	1200	0.72	0.01	0.144033	
C16	444.3	1975	0.877493	0.01	0.175681	
C17	444.1	1975	0.876209	0.01	0.175413	
C18	447.4	1874	0.838428	0.01	0.157842	
C19	300	1075.5	0.31268	0.01	0.064536	
C20	300	1070.8	0.31224	0.01	0.064258	
C21	300	1075.5	0.31268	0.01	0.064536	
C22	447.8	1879.1	0.886241	0.01	0.177433	
W1522	730	1046	0.7843	0.01	0.136946	
W1544	800	1229.2	0.98336	0.01	0.196751	
W158	400	7200	1.28	0.03	0.383942	
W1534	300	4200	1.35	0.03	0.133182	

Wall Area percentage	Aw	0.29313
7.5.2 (a)	Without infill 0.075h ² /0.75	Tv = 3.005 sec
7.5.2 (b)	Shear wall 0.075h ² /0.75/AWP ^{0.5}	Tv = 1.097 sec
7.5.2 (c)	With infill 0.09h ² /dy ^{0.5}	Tv = 1.989 sec
choose 7.5.2 (a) < 7.5.2 (b) < 7.5.2 (c)		
Time Period for Analysis		1.989 sec

Amendment No. 2 to IS 1893 (Part 1): 2015

Clause 7.5.2 (a) - Substitute the following for the existing one:
See 7.5.2

Clause 7.5.2 (b) - Substitute the following for the existing one:

4. In these buildings, (a) punching shear failure shall be avoided, and (b) lateral drift at the roof under lateral force shall not exceed 0.3 percent. Lateral drift of the flat slab buildings shall be estimated (a) considering total lateral displacement including torsional effects, and (b) using three-dimensional models. Scaling need not be done for displacement response quantities, as stated in 7.5.3.2.

Clause 7.5.2 (c) - Substitute the following for the existing one:
See 7.5.2

$$A_s = \frac{F_y}{f_y} \left(1 + \frac{F_y}{f_y} \right) \left(\frac{L}{d} \right)^2$$

Clause 7.5.2 (c) - Substitute the following for the existing one:

7.6.2.4 The value of F_y obtained shall neither be taken to be more than that given in 7.6.2 (a) nor less than that given in 7.6.2 (c).

Effective height Calculation Tower with Podium Podium and typical floor different area					Effective Height, m
Sum	49163.18			3468013	70.54
	At	Hs	Hi	At x Hi	
Terrace	819.78	3.15	159.1	130427	
EXTRA	819.78	3.15	155.95	127844.7	
45	819.78	3.15	152.8	125262.4	
44	819.78	3.15	149.65	122680.1	
43	819.78	3.15	146.5	120097.8	
42	819.78	3.15	143.35	117515.5	
41	819.78	3.15	140.2	114933.2	
40	819.78	3.15	137.05	112350.8	
39	819.78	3.15	133.9	109768.5	
38	819.78	3.15	130.75	107186.2	
37	819.78	3.15	127.6	104603.9	
36	819.78	3.15	124.45	102021.6	
35	819.78	3.15	121.3	99439.31	
34	819.78	3.15	118.15	96857.01	
33	819.78	3.15	115	94274.7	
32	819.78	3.15	111.85	91692.39	
31	819.78	3.15	108.7	89110.09	
30	819.78	3.15	105.55	86527.78	
29	819.78	3.15	102.4	83945.47	
28	819.78	3.15	99.25	81363.17	
27	819.78	3.15	96.1	78780.858	
26	819.78	3.15	92.95	76198.55	
25	819.78	3.15	89.8	73616.24	
24	819.78	3.15	86.65	71033.937	
23	819.78	3.15	83.5	68451.63	
22	819.78	3.15	80.35	65869.323	
21	819.78	3.15	77.2	63287.016	
20	819.78	3.15	74.05	60704.709	
19	819.78	3.15	70.9	58122.402	
18	819.78	3.15	67.75	55540.095	
17	819.78	3.15	64.6	52957.788	
16	819.78	3.15	61.45	50375.481	
15	819.78	3.15	58.3	47793.174	
14	819.78	3.15	55.15	45210.867	
13	819.78	3.15	52	42628.56	
12	819.78	3.15	48.85	40046.253	
11	819.78	3.15	45.7	37463.946	
10	819.78	3.15	42.55	34881.639	
9	819.78	3.15	39.4	32299.332	
8	819.78	3.15	36.25	29717.023	
7	819.78	3.15	33.1	27134.718	
6	819.78	3.15	29.95	24552.411	
5	1640.42	3.15	26.8	43035.26	
4	1690.66	3.15	23.65	39984.11	
3rd	1690.66	3.5	20.5	34658.53	
2nd	1690.66	3.25	17	28741.22	
1st	1690.66	3.25	13.75	23146.58	
Mez	1690.66	3.25	10.5	17751.93	
GR/PD	2299.35	4.05	7.25	16670.29	
B1	2299.35	3.2	3.2	7357.92	

Effective height Calculation Tower with Podium Podium has same areas as of typical floor					Effective Height, m
Sum	40989			3355113.6	81.85
	At	Hs	Hi	At x Hi	
Terrace	819.78	3.15	159.1	130427	
EXTRA	819.78	3.15	155.95	127844.69	
45	819.78	3.15	152.8	125262.38	
44	819.78	3.15	149.65	122680.08	
43	819.78	3.15	146.5	120097.77	
42	819.78	3.15	143.35	117515.46	
41	819.78	3.15	140.2	114933.16	
40	819.78	3.15	137.05	112350.85	
39	819.78	3.15	133.9	109768.54	
38	819.78	3.15	130.75	107186.24	
37	819.78	3.15	127.6	104603.93	
36	819.78	3.15	124.45	102021.62	
35	819.78	3.15	121.3	99439.314	
34	819.78	3.15	118.15	96857.007	
33	819.78	3.15	115	94274.7	
32	819.78	3.15	111.85	91692.393	
31	819.78	3.15	108.7	89110.086	
30	819.78	3.15	105.55	86527.779	
29	819.78	3.15	102.4	83945.472	
28	819.78	3.15	99.25	81363.165	
27	819.78	3.15	96.1	78780.858	
26	819.78	3.15	92.95	76198.551	
25	819.78	3.15	89.8	73616.244	
24	819.78	3.15	86.65	71033.937	
23	819.78	3.15	83.5	68451.63	
22	819.78	3.15	80.35	65869.323	
21	819.78	3.15	77.2	63287.016	
20	819.78	3.15	74.05	60704.709	
19	819.78	3.15	70.9	58122.402	
18	819.78	3.15	67.75	55540.095	
17	819.78	3.15	64.6	52957.788	
16	819.78	3.15	61.45	50375.481	
15	819.78	3.15	58.3	47793.174	
14	819.78	3.15	55.15	45210.867	
13	819.78	3.15	52	42628.56	
12	819.78	3.15	48.85	40046.253	
11	819.78	3.15	45.7	37463.946	
10	819.78	3.15	42.55	34881.639	
9	819.78	3.15	39.4	32299.332	
8	819.78	3.15	36.25	29717.023	
7	819.78	3.15	33.1	27134.718	
6	819.78	3.15	29.95	24552.411	
5	819.78	3.15	26.8	21970.104	
4	819.78	3.15	23.65	19387.797	
3rd	819.78	3.5	20.5	16805.49	
2nd	819.78	3.25	17	13936.26	
1st	819.78	3.25	13.75	11271.975	
Mez	819.78	3.25	10.5	8607.69	
GR/PD	819.78	4.05	7.25	5943.405	
B1	819.78	3.2	3.2	2623.296	

But for same floor area of podium and
typical floor effective height should be
159.10 m

So correction factor
1.944

So corrected effective height should be
137.111 m





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9.2 Response Spectrum Function

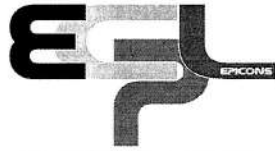
TABLE: Functions - Response Spectrum - IS1893 2016				
Function	Seismic Zone	Soil Type	Period sec	Acceleration
IS 1893 2016	III	I	0	0.024
			0.1	0.06
			0.4	0.06
			0.6	0.04
			0.8	0.03
			1	0.024
			1.2	0.02
			1.4	0.017143
			1.6	0.015
			1.8	0.013333
			2	0.012
			2.5	0.0096
			3	0.008
			3.5	0.006857
			4	0.006
			4.5	0.006
			5	0.006
			5.5	0.006
			6	0.006
			6.5	0.006
			7	0.006
			7.5	0.006
			8	0.006
			8.5	0.006
			9	0.006
			9.5	0.006
			10	0.006

9.3 EQ loading details.

9.3.1. EQ loading details (TOWER A)

a) Zone Factor	= 0.16 (Zone 3)
b) Importance factor	= 1.2
c) Response Reduction factor	= 4
d) Soil Type	= 1
e) % LL considered in seismic	= 25%
f) Time Period in the horizontal X-direction (from formula in code)	= 1.59 sec
g) Time Period in the horizontal Y-direction (from formula in code)	= 1.986 sec
h) Total Seismic weight (SW) of building (in KN)	= 827547 KN
i) Static Base-shear in X-direction (as % of SW)	= 12491 KN (1.5%)
j) Static Base-shear in Y-direction (as % of SW)	(Forces greater than 1.1% of Seismic wt.) = 10081 KN (1.2%)
k) Table of distribution for static base shear	(Forces greater than 1.1% of Seismic wt.) = Refer Model
l) Max. deflection at roof level	= 140.50 mm (X-Dir.) 126.70 mm (Y-Dir.)
m) Max. inter storey drift	= 0.001 (X-Dir.) 0.001 (Y-Dir.)



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9.3.2 EQ loading details. (TOWER B)

a) Zone Factor	= 0.16 (Zone 3)
b) Importance factor	= 1.2
c) Response Reduction factor	= 4
d) Soil Type	= 1
e) % LL considered in seismic	= 25%
f) Time Period in the horizontal X-direction i. (from formula in code)	= 1.506 sec
g) Time Period in the horizontal Y-direction a. (from formula in code)	= 1.989 sec
h) Total Seismic weight (SW) of building (in KN)	= 914432 KN
i) Static Base-shear in X-direction (as % of SW)	= 14572 KN (1.59%) (Forces greater than 1.1% of Seismic wt.)
j) Static Base-shear in Y-direction (as % of SW)	= 11033 KN (1.2%) (Forces greater than 1.1% of Seismic wt.)
k) Table of distribution for static base shear	= Refer Model
l) Max. deflection at roof level	= 116.64 mm (X-Dir.) 146.33 mm (Y-Dir.)
m) Max. inter storey drift	= 0.0009 (X-Dir.) 0.001 mm (Y-Dir.)

9.4. Modal Participating Mass Ratios**9.4.1 Modal Participating Mass Ratios Tower A**

Case	Mode	Period sec	Frequency cyc/sec	UX	UY	RZ
Modal	1	5.719	0.175	0.05	57.17	0.05
Modal	2	5.137	0.195	59.65	0.04	4.05
Modal	3	4.757	0.21	2.72	0.00	50.65
Modal	4	1.608	0.622	14.13	0.17	0.01
Modal	5	1.482	0.675	0.09	12.89	3.91
Modal	6	1.237	0.809	0.13	4.81	13.11
Modal	7	0.864	1.157	7.34	0.11	0.34
Modal	8	0.73	1.371	0.00	4.19	3.52
Modal	9	0.595	1.679	2.75	1.52	4.36
Modal	10	0.556	1.8	1.62	1.96	1.75
Modal	11	0.47	2.126	0.00	2.25	2.05
Modal	12	0.415	2.412	1.74	0.40	0.08
Modal	13	0.349	2.865	0.12	2.67	1.59
Modal	14	0.343	2.911	0.00	0.04	0.02
Modal	15	0.32	3.125	0.23	0.78	0.81
Modal	16	0.302	3.312	0.22	0.08	0.21
Modal	17	0.279	3.586	1.36	0.53	0.44
Modal	18	0.246	4.065	0.48	0.79	0.23
Modal	19	0.24	4.165	0.50	0.18	0.23





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Modal	20	0.203	4.918	0.56	1.85	0.03
Modal	21	0.167	6.004	1.14	0.90	0.04
Modal	22	0.152	6.564	0.32	0.04	0.08
Modal	23	0.102	9.79	1.34	3.31	0.17
Modal	24	0.093	10.743	1.57	1.59	0.03
Modal	25	0.086	11.61	0.88	0.11	0.00

9.4.2 Modal Participating Mass Ratios (Tower B)

Case	Mode	Period sec	Frequency cyc/sec	UX	UY	RZ
Modal	1	5.555	0.18	2.50	49.65	5.61
Modal	2	4.906	0.204	56.11	4.55	4.36
Modal	3	4.437	0.225	5.92	3.59	48.44
Modal	4	1.524	0.656	12.91	0.14	0.46
Modal	5	1.328	0.753	0.58	10.88	6.17
Modal	6	1.179	0.848	0.26	7.70	9.76
Modal	7	0.799	1.252	6.35	0.00	0.00
Modal	8	0.623	1.604	0.37	1.98	5.64
Modal	9	0.567	1.763	0.27	5.22	1.35
Modal	10	0.52	1.923	3.28	0.05	0.07
Modal	11	0.403	2.479	0.63	0.09	2.73
Modal	12	0.365	2.737	1.01	0.39	1.04
Modal	13	0.36	2.781	0.04	3.73	0.04
Modal	14	0.347	2.882	0.00	0.00	0.00
Modal	15	0.322	3.107	0.01	0.00	0.00
Modal	16	0.276	3.628	0.25	0.00	0.00
Modal	17	0.264	3.794	1.79	0.02	0.09
Modal	18	0.253	3.946	0.02	2.34	0.00
Modal	19	0.224	4.46	0.09	0.00	0.02
Modal	20	0.188	5.328	1.93	0.19	0.07
Modal	21	0.177	5.659	0.16	2.21	0.12
Modal	22	0.138	7.243	0.02	0.00	0.00
Modal	23	0.1	9.994	4.17	0.21	0.16
Modal	24	0.091	11.036	0.14	5.44	0.19
Modal	25	0.075	13.379	0.02	0.01	0.00





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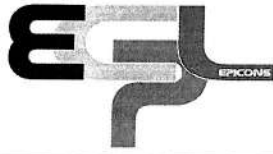
9.5 STOREY SHEAR

9.5.1) Storey Shear in X -Direction (Tower A)

Story	Story Height	Elevation from Base	Seismic Force(EX)	Seismic Force(SPECX)
TERRACE	3.15	159.1	-828.95	939.59
PROVISION	3.15	155.95	-1511.09	1623.00
45TH	3.15	152.8	-2165.94	2178.24
44TH	3.15	149.65	-2794.08	2614.52
43RD	3.15	146.5	-3396.05	2949.61
42ND	3.15	143.35	-3972.42	3208.34
41ST	3.15	140.2	-4523.73	3418.42
40TH	3.15	137.05	-5050.55	3605.00
39TH	3.15	133.9	-5553.42	3785.84
38TH	3.15	130.75	-6032.96	3969.36
37TH	3.15	127.6	-6489.67	4156.18
36TH	3.15	124.45	-6924.07	4343.06
35TH	3.15	121.3	-7336.76	4526.80
34TH	3.15	118.15	-7728.30	4706.26
33RD	3.15	115	-8099.23	4882.31
32ND	3.15	111.85	-8450.12	5056.46
31ST	3.15	108.7	-8781.53	5229.37
30TH	3.15	105.55	-9094.01	5400.35
29TH	3.15	102.4	-9388.11	5567.91
28TH	3.15	99.25	-9664.42	5730.84
27TH	3.15	96.1	-9923.53	5888.91
26TH	3.15	92.95	-10165.86	6042.60
25TH	3.15	89.8	-10392.04	6192.55
24TH	3.15	86.65	-10602.63	6338.85
23RD	3.15	83.5	-10798.18	6480.36
22ND	3.15	80.35	-10979.26	6615.83
21ST	3.15	77.2	-11146.43	6744.57

Story	Story Height	Elevation from Base	Seismic Force(EX)	Seismic Force(SPECX)
20ST	3.15	74.05	-11300.22	6866.88
19TH	3.15	70.9	-11441.23	6983.75
18TH	3.15	67.75	-11570.02	7096.28
17TH	3.15	64.6	-11687.08	7205.35
16TH	3.15	61.45	-11793.00	7311.63
15TH	3.15	58.3	-11888.34	7416.59
14TH	3.15	55.15	-11973.66	7522.63
13TH	3.15	52	-12049.51	7632.07
12TH	3.15	48.85	-12116.44	7745.00
11TH	3.15	45.7	-12175.04	7857.74
10TH	3.15	42.55	-12225.84	7964.03
9TH	3.15	39.4	-12269.40	8058.54
8TH	3.15	36.25	-12306.28	8141.65
7TH	3.15	33.1	-12337.02	8220.49
6TH	3.15	29.95	-12362.19	8304.21
5TH	3.15	26.8	-12414.00	8776.13
4TH	3.15	23.65	-12392.54	8858.36
3RD	3.5	20.5	-12459.51	9241.59
2ND	3.25	17	-12473.37	9546.08
1ST	3.25	13.75	-12482.26	9899.42
MEZZANINE	3.25	10.5	-12486.74	10246.02
GROUND/PO	4.05	7.25	-12490.60	10821.14
BASEMENT 1	3.2	3.2	-12491.21	12523.04





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9.5.2) Storey Shear in Y -Direction (Tower A)

Story	Story Height	Elevation from Base	Seismic Force(EY)	Seismic Force(SPECY)
TERRACE	3.15	159.1	-669.0526	578.4855
PROVISION	3.15	155.95	-1219.611	1006.8097
45TH	3.15	152.8	-1748.152	1374.4408
44TH	3.15	149.65	-2255.126	1683.9088
43RD	3.15	146.5	-2740.981	1939.6568
42ND	3.15	143.35	-3206.168	2147.9566
41ST	3.15	140.2	-3651.137	2316.7606
40TH	3.15	137.05	-4076.334	2455.3595
39TH	3.15	133.9	-4482.21	2573.7853
38TH	3.15	130.75	-4869.248	2681.974
37TH	3.15	127.6	-5237.863	2788.7673
36TH	3.15	124.45	-5588.472	2900.9558
35TH	3.15	121.3	-5921.557	3022.5989
34TH	3.15	118.15	-6237.566	3154.7656
33RD	3.15	115	-6536.95	3295.7983
32ND	3.15	111.85	-6820.157	3441.984
31ST	3.15	108.7	-7087.637	3588.4566
30TH	3.15	105.55	-7339.839	3730.1428
29TH	3.15	102.4	-7577.212	3862.6151
28TH	3.15	99.25	-7800.225	3982.7741
27TH	3.15	96.1	-8009.354	4089.2894
26TH	3.15	92.95	-8204.937	4182.7581
25TH	3.15	89.8	-8387.488	4265.7207
24TH	3.15	86.65	-8557.458	4342.5023
23RD	3.15	83.5	-8715.293	4417.6444
22ND	3.15	80.35	-8861.446	4495.5683
21ST	3.15	77.2	-8996.362	4579.6959

Story	Story Height	Elevation from Base	Seismic Force(EY)	Seismic Force(SPECY)
20ST	3.15	74.05	-9120.493	4671.6895
19TH	3.15	70.9	-9234.299	4771.0068
18TH	3.15	67.75	-9338.251	4875.0136
17TH	3.15	64.6	-9432.729	4979.8508
16TH	3.15	61.45	-9518.218	5081.1485
15TH	3.15	58.3	-9595.167	5175.1942
14TH	3.15	55.15	-9664.026	5259.89
13TH	3.15	52	-9725.243	5335.3515
12TH	3.15	48.85	-9779.268	5403.8875
11TH	3.15	45.7	-9826.565	5469.2974
10TH	3.15	42.55	-9867.566	5535.6345
9TH	3.15	39.4	-9902.725	5605.0209
8TH	3.15	36.25	-9932.486	5677.2129
7TH	3.15	33.1	-9957.298	5750.1414
6TH	3.15	29.95	-9977.609	5822.135
5TH	3.15	26.8	-10019.43	6121.1309
4TH	3.15	23.65	-10024.03	6259.0044
3RD	3.5	20.5	-10056.16	6719.9921
2ND	3.25	17	-10067.35	7103.3083
1ST	3.25	13.75	-10074.52	7476.3838
MEZZANINE	3.25	10.5	-10078.14	7743.2048
GROUND/PO	4.05	7.25	-10081.26	8404.2064
BASEMENT 1	3.2	3.2	-10081.74	10117.6176





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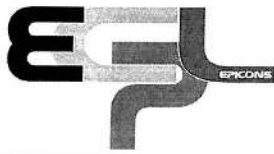
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9.5.3) Storey Shear in X -Direction (Tower B)

TABLE: Story Forces				
Story	Story Height	Elevation from Base	Seismic force (EX)	Seismic force (SPECX)
TERRACE	3.15	159.1	-826.687	919.1167
PROVISION	3.15	155.95	-1632.09	1714.1296
45TH FLOOR	3.15	152.8	-2405.29	2367.0306
44TH FLOOR	3.15	149.65	-3146.94	2880.3383
43RD FLOOR	3.15	146.5	-3857.69	3267.0507
42ND FLOOR	3.15	143.35	-4538.21	3550.8276
41ST FLOOR	3.15	140.2	-5189.15	3763.3929
40TH FLOOR	3.15	137.05	-5811.16	3939.0692
39TH FLOOR	3.15	133.9	-6404.91	4107.4264
38TH FLOOR-RF	3.15	130.75	-6971.11	4286.75
37TH FLOOR-RF	3.15	127.6	-7510.36	4481.5424
36TH FLOOR	3.15	124.45	-8023.26	4685.5706
35TH FLOOR	3.15	121.3	-8510.52	4888.4727
34TH FLOOR	3.15	118.15	-8972.81	5082.2069
33RD FLOOR	3.15	115	-9410.77	5264.768
32ND FLOOR	3.15	111.85	-9825.07	5440.1127
31ST FLOOR	3.15	108.7	-10216.4	5614.9533
30TH FLOOR	3.15	105.55	-10585.3	5794.2516
29TH FLOOR	3.15	102.4	-10932.6	5977.8249
28TH FLOOR-RF	3.15	99.25	-11258.8	6159.9796
27TH FLOOR-RF	3.15	96.1	-11564.7	6332.3257
26TH FLOOR	3.15	92.95	-11850.8	6488.4004
25TH FLOOR	3.15	89.8	-12117.9	6627.8219
24TH FLOOR	3.15	86.65	-12366.7	6757.0078
23RD FLOOR	3.15	83.5	-12597.7	6885.086
22ND FLOOR	3.15	80.35	-12811.6	7020.3964
21ST FLOOR	3.15	77.2	-13009.1	7165.8759

TABLE: Story Forces				
Story	Story Height	Elevation from Base	Seismic force (EX)	Seismic force (SPECX)
20TH FLOOR	3.15	74.05	-13190.7	7316.9504
19TH FLOOR-RF	3.15	70.9	-13356.9	7463.1436
18TH FLOOR-RF	3.15	67.75	-13509	7595.167
17TH FLOOR	3.15	64.6	-13647.5	7709.1966
16TH FLOOR	3.15	61.45	-13772.8	7809.0993
15TH FLOOR	3.15	58.3	-13885.6	7905.6657
14TH FLOOR	3.15	55.15	-13986.5	8010.9372
13TH FLOOR	3.15	52	-14076.2	8131.1023
12TH FLOOR	3.15	48.85	-14153.4	8258.1034
11TH FLOOR	3.15	45.7	-14222.6	8386.827
10TH FLOOR	3.15	42.55	-14282.6	8503.0544
9TH FLOOR	3.15	39.4	-14334	8603.15
8TH FLOOR	3.15	36.25	-14377.5	8694.9722
7TH FLOOR	3.15	33.1	-14413.8	8792.6916
6TH FLOOR	3.15	29.95	-14443.5	8905.0225
5TH FLOOR	3.15	26.8	-14494.5	9359.3633
4TH FLOOR	3.15	23.65	-14513.7	9494.84
3RD	3.5	20.5	-14541.3	9835.343
2ND	3.25	17	-14554.5	10107.1354
1ST	3.25	13.75	-14563.2	10467.7014
MEZZANINE	3.25	10.5	-14567.2	10786.0481
GROUND/P0	4.05	7.25	-14571.9	11661.4419
BASEMENT 1	3.2	3.2	-14572.6	14570.8544





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9.5.4) Storey Shear in Y -Direction (Tower B)

TABLE: Story Forces				
Story	Story Height	Elevation from Base	Seismic force (Ey)	Seismic force (SPECY)
TERRACE	3.15	159.1	-625.938	789.3167
PROVISION	3.15	155.95	-1235.76	1460.6858
45TH FLOOR	3.15	152.8	-1821.2	1993.5482
44TH FLOOR	3.15	149.65	-2382.75	2390.0656
43RD FLOOR	3.15	146.5	-2920.91	2659.5753
42ND FLOOR	3.15	143.35	-3436.17	2819.0994
41ST FLOOR	3.15	140.2	-3929.04	2893.509
40TH FLOOR	3.15	137.05	-4400	2914.5598
39TH FLOOR	3.15	133.9	-4849.57	2917.8872
38TH FLOOR-RF	3.15	130.75	-5278.28	2937.2273
37TH FLOOR-RF	3.15	127.6	-5686.58	2996.6496
36TH FLOOR	3.15	124.45	-6074.93	3104.3919
35TH FLOOR	3.15	121.3	-6443.87	3252.612
34TH FLOOR	3.15	118.15	-6793.89	3423.2277
33RD FLOOR	3.15	115	-7125.5	3595.8582
32ND FLOOR	3.15	111.85	-7439.2	3753.923
31ST FLOOR	3.15	108.7	-7735.47	3887.6619
30TH FLOOR	3.15	105.55	-8014.82	3994.578
29TH FLOOR	3.15	102.4	-8277.75	4078.1299
28TH FLOOR-RF	3.15	99.25	-8524.77	4145.3684
27TH FLOOR-RF	3.15	96.1	-8756.36	4204.1464
26TH FLOOR	3.15	92.95	-8973	4260.7254
25TH FLOOR	3.15	89.8	-9175.28	4318.7487
24TH FLOOR	3.15	86.65	-9363.63	4380.1812
23RD FLOOR	3.15	83.5	-9538.53	4445.0879
22ND FLOOR	3.15	80.35	-9700.49	4513.973
21ST FLOOR	3.15	77.2	-9850	4588.3614

TABLE: Story Forces				
Story	Story Height	Elevation from Base	Seismic force (Ey)	Seismic force (SPECY)
20TH FLOOR	3.15	74.05	-9987.55	4670.3867
19TH FLOOR-RF	3.15	70.9	-10113.4	4761.1604
18TH FLOOR-RF	3.15	67.75	-10228.6	4860.2947
17TH FLOOR	3.15	64.6	-10333.4	4964.3645
16TH FLOOR	3.15	61.45	-10428.3	5066.6595
15TH FLOOR	3.15	58.3	-10513.7	5159.9266
14TH FLOOR	3.15	55.15	-10590.1	5238.7984
13TH FLOOR	3.15	52	-10658	5302.35
12TH FLOOR	3.15	48.85	-10716.4	5353.6682
11TH FLOOR	3.15	45.7	-10768.9	5405.5884
10TH FLOOR	3.15	42.55	-10814.3	5470.7812
9TH FLOOR	3.15	39.4	-10853.2	5559.2853
8TH FLOOR	3.15	36.25	-10886.2	5674.4543
7TH FLOOR	3.15	33.1	-10913.6	5811.5596
6TH FLOOR	3.15	29.95	-10936.1	5960.6815
5TH FLOOR	3.15	26.8	-10974.7	6381.1066
4TH FLOOR	3.15	23.65	-10989.2	6608.2332
3RD	3.5	20.5	-11010.1	7101.7085
2ND	3.25	17	-11020.1	7487.8635
1ST	3.25	13.75	-11026.7	7859.479
MEZZANINE	3.25	10.5	-11029.7	8078.7146
GROUND/PO	4.05	7.25	-11033.3	8895.9761
BASEMENT 1	3.2	3.2	-11033.9	11046.7951





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10. Wind Design Parameters-(As per IS875-part 3 2015)

Wind loads are calculated considering the gust factor

Sr. no.	Parameter	Description	Reference
1.	Basic Wind Speed	50m/sec (For Chennai)	Appendix A, I.S 875 (Part 3): 2015)
2.	Probability factor : k1	1.0	Table-1, I.S 875 Part3):2015
3.	Terrain Factor : k2	Refer Gust calculation (Category -3)	Table-2, I.S 875 (Part 3) 2015)
4.	Topography Factor : k3	1.0	Clause 6.3.3, I.S 875 (Part 3): 2015
5.	Importance Factor for Cyclonic Region : k4	1.0	Clause 6.3.4, I.S 875 (Part 3): 2015

Wind tunnel reports are submitted by RWDI.

Wind tunnel calculation will be submitted separately.

For Tower A

- a) Max. deflection at roof level = 53.20 mm (X-Dir.)
296 mm (Y-Dir.)
(Allowable deflection= 310mm)
- b) Max. inter storey drift = 0.0004 (X-Dir.)
0.0024 (Y-Dir.)

For Tower B

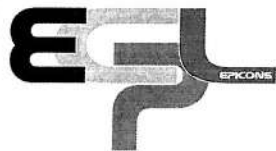
- a) Max. deflection at roof level = 46.03 mm (X-Dir.)
322.6 mm (Y-Dir.)
(Allowable deflection= 318mm)
- b) Max. inter storey drift = 0.0007 (X-Dir.)
0.0025 (Y-Dir.)



11. Maximum Deflection & Torsional Irregularity at Roof level.

a) Table for lateral deflections at Terrace Level (Tower A)

Load case	Dx-max	H/Dx	Drift-X	Dy-max	H/Dy	Drift-Y
DL	11.6	83736	0.0009	39.2	4058	0.0016
DL + LL	12.92	12314	0.0009	43.5	3657	0.0018
EQx	260.1	611.68	0.002	34.3	4638	0.0001
EQy	17.5	9091	0.0001	340.2	467.66	0.002
Wx	53.2	2990	0.0004	84.1	1891	0.0007
Wy	90	1767	0.0007	296	537	0.0024



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Table for lateral deflections at Terrace Level (Tower B)

Load case	Dx-max	H/Dx	Drift-X	Dy-max	H/Dy	Drift-Y
DL	1.9	83736	0.0005	9.5	16747	0.001
DL + LL	4.3	37000	0.0006	6.3	25253	0.001
EQx	244.2	651.5	0.0019	59.1	2692	0.0004
EQy	7.0	22728	0.00011	246	646	0.002
Wx	46.03	346.44	0.0003	76.4	2082	0.0023
Wy	58.7	2710	0.0007	322	494	0.0025

b) Table for Torsional Irregularity (Tower A)
(along x-direction).

Load Case	Corner-1	Corner-2	Corner-3	Corner-4	Avg -X	% Max. /Avg	Max / min	$\frac{\{(Max+Min)/2\}}{Max} < 1.4$
Eq-x	243.7	259.53	258.65	242.96	251.21	1.03	1.06	1.03
WI-x	53.12	49.748	49.864	52.793	51.38	1.06	1.06	1.03

(along y-direction)

Load Case	Corner-1	Corner-2	Corner-3	Corner-4	Avg -X	% Max. /Avg	Max / min	$\frac{\{(Max+Min)/2\}}{Max} < 1.4$
Eq-y	227.27	227.27	326.25	341.23	280.505	1.21	1.5	1.2
WI-y	243.25	243.28	289.95	295.99	268.11	1.21	1.21	1.09

c) Table for Torsional Irregularity (Tower B)
(along x-direction)

Load Case	Corner-1	Corner-2	Corner-3	Corner-4	Avg -X	% Max. /Avg	Max / min	$\frac{\{(Max+Min)/2\}}{Max} < 1.4$
Eq-x	224.33	224.66	242.67	243.51	233.79	1.04	1.08	1.04
WI-x	36.825	37.591	46	46.03	42.251	1.12	1.28	1.12

(along y-direction)

Load Case	Corner-1	Corner-2	Corner-3	Corner-4	Avg -X	% Max. /Avg	Max / min	$\frac{\{(Max+Min)/2\}}{Max} < 1.4$
Eq-y	246.4	244.2	243.6	246.14	245.085	1.00	1.01	1.00
WI-y	168.226	305.489	322.6	167.848	241.45	1.34	1.93	1.31





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Load Cases & Load Combinations

1) Abbreviation used for load cases:

- DL = Dead Load
- LL = Live Load
- SPx = Response spectrum case X direction
- SPy = Response spectrum case Y direction
- SPz = Response spectrum case in Z (Vertical) direction
- WLx = Wind Load in the X direction
- WLy = Wind Load in the Y direction

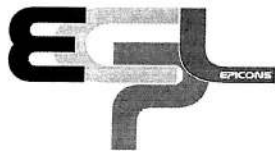
Loads and load combinations from wind tunnel test will be added once we receive Wind Tunnel test results.

2) Accidental torsion is allowed for by displacing the center of mass in each direction by 5% of the building dimension and the resulting storey drifts should be amplified if a torsional irregularity exists. Hence, in analysis 5% eccentricity will be considered for the earthquake force in each direction.

The structure will be designed for the following load combinations:

Combo No.	Load Combination	Load factors					
		DL	LL	WLx	WLy	SPx	SPy
1	DL + LL	1.5	1.5				
2	DL + WLx	1.5		1.5			
3	DL - WLx	1.5		-1.5			
4	DL + WLy	1.5			1.5		
5	DL - WLy	1.5			-1.5		
6	DL + LL + WLx	1.2	1.2	1.2			
7	DL + LL - WLx	1.2	1.2	-1.2			
8	DL + LL + WLy	1.2	1.2		1.2		
9	DL + LL - WLy	1.2	1.2		-1.2		
10	0.9DL + WLx	0.9		1.5			
11	0.9DL - WLx	0.9		-1.5			
12	0.9DL + WLy	0.9			1.5		
13	0.9DL - WLy	0.9			-1.5		
14	DL + SPx	1.5				1.5	
15	DL - SPx	1.5				-1.5	
16	DL + SPy	1.5					1.5
17	DL - SPy	1.5					-1.5
18	DL + LL + SPx	1.2	1.2			1.2	
19	DL + LL - SPx	1.2	1.2			-1.2	
20	DL + LL + SPy	1.2	1.2				1.2
21	DL + LL - SPy	1.2	1.2				-1.2
22	0.9DL + SPx	0.9				1.5	
23	0.9DL - SPx	0.9				-1.5	
24	0.9DL + SPy	0.9					1.5
25	0.9DL - SPy	0.9					-1.5





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Service load combinations (Limit state of serviceability):

(Ref: Table 18/page 68 of I.S 456-2000)

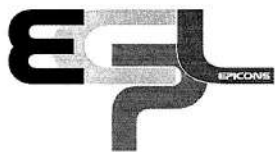
Combo No.	Load Combination	Load factors					
		DL	LL	WLx	WLy	SPx	SPy
1	DL + LL	1.0	1.0				
2	DL + WLx	1.0		1.0			
3	DL - WLx	1.0		-1.0			
4	DL + WLy	1.0			1.0		
5	DL - WLy	1.0			-1.0		
6	DL + LL + WLx	1.0	0.8	0.8			
7	DL + LL - WLx	1.0	0.8	-0.8			
8	DL + LL + WLy	1.0	0.8		0.8		
9	DL + LL - WLy	1.0	0.8		-0.8		
10	DL + SPx	1.0				1.0	
11	DL - SPx	1.0				-1.0	
12	DL + SPy	1.0					1.0
13	DL - SPy	1.0					-1.0
14	DL + LL + SPx	1.0	0.8			0.8	
15	DL + LL - SPx	1.0	0.8			-0.8	
16	DL + LL + SPy	1.0	0.8				0.8
17	DL + LL - SPy	1.0	0.8				-0.8

- 3) Non orthogonal building part will be designed for the effects due to full design earthquake load in one direction plus 30 percent design earthquake load along the other direction.

The structure will be designed for the above load combinations.

Combo No.	Load Combination	Load factors					
		DL	LL	WLx	WLy	SPx	SPy
1	DL + LL	1.5	1.5				
2	DL + WLx	1.5		1.5			
3	DL - WLx	1.5		-1.5			
4	DL + WLy	1.5			1.5		
5	DL - WLy	1.5			-1.5		
6	DL + LL + WLx	1.2	1.2	1.2			
7	DL + LL - WLx	1.2	1.2	-1.2			
8	DL + LL + WLy	1.2	1.2		1.2		
9	DL + LL - WLy	1.2	1.2		-1.2		
10	0.9DL + WLx	0.9		1.5			
11	0.9DL - WLx	0.9		-1.5			
12	0.9DL + WLy	0.9			1.5		
13	0.9DL - WLy	0.9			-1.5		
14	DL + SPx + SPy	1.5				1.5	0.45
15	DL - SPx - SPy	1.5				-1.5	-0.45
16	DL + SPy + SPx	1.5				0.45	1.5





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17	DL – SPy - SPx	1.5				-0.45	-1.5
18	DL+LL + SPx+SPy	1.2	1.2			1.2	0.36
19	DL+LL – SPx-SPy	1.2	1.2			-1.2	-0.36
20	DL+LL + SPy+SPx	1.2	1.2			0.36	1.2
21	DL+LL – SPy-SPx	1.2	1.2			-0.36	-1.2
22	0.9DL + SPx+SPy	0.9				1.5	0.45
23	0.9DL – SPx -SPy	0.9				-1.5	0.45
24	0.9DL + SPy+SPx	0.9				0.45	1.5
25	0.9DL – SPy-SPx	0.9				-0.45	-1.5

Service load combinations (Limit state of serviceability):

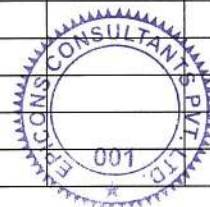
(Ref: Table 18/page 68 of I.S 456-2000)

Combo No.	Load Combination	Load factors					
		DL	LL	WLx	WLy	SPx	SPy
1	DL + LL	1.0	1.0				
2	DL + WLx	1.0		1.0			
3	DL - WLx	1.0		-1.0			
4	DL + WLy	1.0			1.0		
5	DL - WLy	1.0			-1.0		
6	DL + LL + WLx	1.0	0.8	0.8			
7	DL + LL - WLx	1.0	0.8	-0.8			
8	DL + LL + WLy	1.0	0.8		0.8		
9	DL + LL - WLy	1.0	0.8		-0.8		
10	DL + SPx + SPy	1.0				1.0	0.3
11	DL – SPx - SPy	1.0				-1.0	-0.3
12	DL + SPy + SPx	1.0				0.3	1.0
13	DL – SPy - SPx	1.0				-0.3	-1.0
14	DL+LL + SPx+SPy	1.0	0.8			0.24	
15	DL+LL – SPx-SPy	1.0	0.8			-0.24	
16	DL+LL + SPy+SPx	1.0	0.8				0.24
17	DL+LL – SPy-SPx	1.0	0.8				-0.24

4) Load combinations with vertical earthquake forces.

Strength load combinations

Combo No.	Load Combination	Load factors						
		DL	LL	WLx	WLy	SPx	SPy	SPz
1	DL + LL	1.5	1.5					
2	DL + WLx	1.5		1.5				
3	DL - WLx	1.5		-1.5				
4	DL + WLy	1.5			1.5			
5	DL - WLy	1.5			-1.5			
6	DL + LL + WLx	1.2	1.2	1.2				
7	DL + LL - WLx	1.2	1.2	-1.2				
8	DL + LL + WLy	1.2	1.2		1.2			





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9	DL + LL - WL _y	1.2	1.2		-1.2			
10	0.9DL + WL _x	0.9		1.5				
11	0.9DL - WL _x	0.9		-1.5				
12	0.9DL + WL _y	0.9			1.5			
13	0.9DL - WL _y	0.9			-1.5			
14	DL + SP _x + SP _z	1.5				1.5		0.45
15	DL - SP _x - SP _z	1.5				-1.5		-0.45
16	DL + SP _y + SP _z	1.5					1.5	0.45
17	DL - SP _y + SP _z	1.5					-1.5	-0.45
18	DL + LL + SP _x + SP _z	1.2	1.2			1.2		0.36
19	DL + LL - SP _x - SP _z	1.2	1.2			-1.2		-0.36
20	DL + LL + SP _y + SP _z	1.2	1.2				1.2	0.36
21	DL + LL - SP _y - SP _z	1.2	1.2				-1.2	-0.36
22	0.9DL + SP _x + SP _z	0.9				1.5		0.45
23	0.9DL - SP _x - SP _z	0.9				-1.5		-0.45
24	0.9DL + SP _y + SP _z	0.9					1.5	0.45
25	0.9DL - SP _y - SP _z	0.9					-1.5	-0.45

Service load combinations – Limit state of serviceability

Combo No.	Load Combination	Load factors						SP _z
		DL	LL	WL _x	WL _y	SP _x	SP _y	
1	DL + LL	1.0	1.0					
2	DL + WL _x	1.0		1.0				
3	DL - WL _x	1.0		-1.0				
4	DL + WL _y	1.0			1.0			
5	DL - WL _y	1.0			-1.0			
6	DL + LL + WL _x	1.0	0.8	0.8				
7	DL + LL - WL _x	1.0	0.8	-0.8				
8	DL + LL + WL _y	1.0	0.8		0.8			
9	DL + LL - WL _y	1.0	0.8		-0.8			
10	DL + SP _x + SP _z	1.0				1.0		0.3
11	DL - SP _x + SP _z	1.0				-1.0		-0.3
12	DL + SP _y + SP _z	1.0					1.0	0.3
13	DL - SP _y + SP _z	1.0					-1.0	-0.3
14	DL+LL+SP _x +SP _z	1.0	0.8			0.8		0.24
15	DL+LL-SP _x -SP _z	1.0	0.8			-0.8		-0.24
16	DL+LL+SP _y +SP _z	1.0	0.8				0.8	0.24
17	DL+LL-SP _y -SP _z	1.0	0.8				-0.8	-0.24

Strength load combinations for Wind Tunnel Forces



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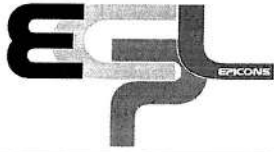
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Combo No.	Load Combination	Load factors		
		DL	LL	WLD1/ WLD2/ WLD3/ WLD4/ WLD4/ WLD5/ WLD6/ WLD7/ WLD8/ WLD9/ WLD10/ WLD11/ WLD12/ WLD13/ WLD14/ WLD15/ WLD 16/ WLD17/ WLD18/ WLD19/ WLD20/ WLD21/WLD22/ WLD23/ WLD24
1	0.9DL+1.5WLD1	0.9		1.5
2	0.9DL+1.5WLD2	0.9		1.5
3	0.9DL+1.5WLD3	0.9		1.5
4	0.9DL+1.5WLD4	0.9		1.5
5	0.9DL+1.5WLD5	0.9		1.5
6	0.9DL+1.5WLD6	0.9		1.5
7	0.9DL+1.5WLD7	0.9		1.5
8	0.9DL+1.5WLD8	0.9		1.5
9	0.9DL+1.5WLD9	0.9		1.5
10	0.9DL+1.5WLD10	0.9		1.5
11	0.9DL+1.5WLD11	0.9		1.5
12	0.9DL+1.5WLD12	0.9		1.5
13	0.9DL+1.5WLD13	0.9		1.5
14	0.9DL+1.5WLD14	0.9		1.5
15	0.9DL+1.5WLD15	0.9		1.5
16	0.9DL+1.5WLD16	0.9		1.5
17	0.9DL+1.5WLD17	0.9		1.5
18	0.9DL+1.5WLD18	0.9		1.5
19	0.9DL+1.5WLD19	0.9		1.5
20	0.9DL+1.5WLD20	0.9		1.5
21	0.9DL+1.5WLD21	0.9		1.5
22	0.9DL+1.5WLD22	0.9		1.5
23	0.9DL+1.5WLD23	0.9		1.5
24	0.9DL+1.5WLD24	0.9		1.5
25	1.2DL+1.2LL+1.2WLD1	1.2	1.2	1.2
26	1.2DL+1.2LL+1.2WLD2	1.2	1.2	1.2
27	1.2DL+1.2LL+1.2WLD3	1.2	1.2	1.2
28	1.2DL+1.2LL+1.2WLD4	1.2	1.2	1.2
29	1.2DL+1.2LL+1.2WLD5	1.2	1.2	1.2
30	1.2DL+1.2LL+1.2WLD6	1.2	1.2	1.2
31	1.2DL+1.2LL+1.2WLD7	1.2	1.2	1.2
32	1.2DL+1.2LL+1.2WLD8	1.2	1.2	1.2
33	1.2DL+1.2LL+1.2WLD9	1.2	1.2	1.2



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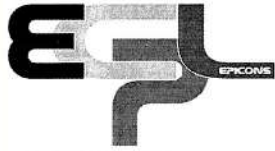
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34	1.2DL+1.2LL+1.2WLD10	1.2	1.2	1.2
35	1.2DL+1.2LL+1.2WLD11	1.2	1.2	1.2
36	1.2DL+1.2LL+1.2WLD12	1.2	1.2	1.2
37	1.2DL+1.2LL+1.2WLD13	1.2	1.2	1.2
38	1.2DL+1.2LL+1.2WLD14	1.2	1.2	1.2
39	1.2DL+1.2LL+1.2WLD15	1.2	1.2	1.2
40	1.2DL+1.2LL+1.2WLD16	1.2	1.2	1.2
41	1.2DL+1.2LL+1.2WLD17	1.2	1.2	1.2
42	1.2DL+1.2LL+1.2WLD18	1.2	1.2	1.2
43	1.2DL+1.2LL+1.2WLD19	1.2	1.2	1.2
44	1.2DL+1.2LL+1.2WLD20	1.2	1.2	1.2
45	1.2DL+1.2LL+1.2WLD21	1.2	1.2	1.2
46	1.2DL+1.2LL+1.2WLD22	1.2	1.2	1.2
47	1.2DL+1.2LL+1.2WLD23	1.2	1.2	1.2
48	1.2DL+1.2LL+1.2WLD24	1.2	1.2	1.2
49	1.5DL+1.5WLD1	1.5		1.5
50	1.5DL+1.5WLD2	1.5		1.5
51	1.5DL+1.5WLD3	1.5		1.5
52	1.5DL+1.5WLD4	1.5		1.5
53	1.5DL+1.5WLD5	1.5		1.5
54	1.5DL+1.5WLD6	1.5		1.5
55	1.5DL+1.5WLD7	1.5		1.5
56	1.5DL+1.5WLD8	1.5		1.5
57	1.5DL+1.5WLD9	1.5		1.5
58	1.5DL+1.5WLD10	1.5		1.5
59	1.5DL+1.5WLD11	1.5		1.5
60	1.5DL+1.5WLD12	1.5		1.5
61	1.5DL+1.5WLD13	1.5		1.5
62	1.5DL+1.5WLD14	1.5		1.5
63	1.5DL+1.5WLD15	1.5		1.5
64	1.5DL+1.5WLD16	1.5		1.5
65	1.5DL+1.5WLD17	1.5		1.5
66	1.5DL+1.5WLD18	1.5		1.5
67	1.5DL+1.5WLD19	1.5		1.5
68	1.5DL+1.5WLD20	1.5		1.5
69	1.5DL+1.5WLD21	1.5		1.5
70	1.5DL+1.5WLD22	1.5		1.5
71	1.5DL+1.5WLD23	1.5		1.5
72	1.5DL+1.5WLD24	1.5		1.5





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12. Method of Analysis and Design

- The structural design will be based on limit state method.
- The crack width limit of structural elements will be restricted to 0.2mm for water retaining structures and 0.3mm for all other R.C.C members
- Space frame analysis will be carried out for gravity loads/ wind loads & seismic loads.
- The analysis and design will be carried out using commercial soft wares/ in house spreadsheets/ RCDC and manual calculations.

The following soft wares shall be used

ETABS V 20.3

Etabs is specialist software for analysis and design of buildings.

SAFE V 20

SAFE is used for the analysis and design PILE foundation.

- Following effects will be considered in the analysis and design

- Effect due to Slab- diaphragm action
- Soft story effect
- P-Delta effect

- Appropriate Stiffness Modifiers as per IS1893 (part 1):2016 clause 6.4.3.1 & IS 16700:2017 clause 7.2 will be applied to check serviceability & strength condition.

1. Serviceability condition Stiffness modifiers

FOR BEAMS		FOR COLUMNS	
Cross section (axial) Area	1	Cross section (axial) Area	1
Shear area in 2 direction	1	Shear area in 2 direction	1
Shear area in 3 direction	1	Shear area in 3 direction	1
Torsional Constant	0.001	Torsional Constant	0.001
Moment of inertia about 2 axis	0.7	Moment of inertia about 2 axis	0.9
Moment of inertia about 3 axis	0.7	Moment of inertia about 3 axis	0.9
Mass	1	Mass	1
Weight	1	Weight	1
For slabs (shell slabs only)		For shear walls	
Membrane f11 Modifier	0.35	Membrane f11 Modifier	0.9
Membrane f22 Modifier	0.35	Membrane f22 Modifier	0.9
Membrane f12 Modifier	0.35	Membrane f12 Modifier	0.9
Bending m11 Modifier	0.35	Bending m11 Modifier	0.9
Bending m22 Modifier	0.35	Bending m22 Modifier	0.9
Bending m12 Modifier	0.35	Bending m12 Modifier	0.9



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**2. STRENGTH Condition Stiffness
modifiers**

FOR BEAMS		FOR COLUMNS	
Cross section (axial) Area	1	Cross section (axial) Area	1
Shear area in 2 direction	1	Shear area in 2 direction	1
Shear area in 3 direction	1	Shear area in 3 direction	1
Torsional Constant	0.001	Torsional Constant	0.001
Moment of inertia about 2 axis	0.35	Moment of inertia about 2 axis	0.7
Moment of inertia about 3 axis	0.35	Moment of inertia about 3 axis	0.7
Mass	1	Mass	1
Weight	1	Weight	1
For slabs (shell slabs only)		For shear walls	
Membrane f11 Modifier	0.25	Membrane f11 Modifier	0.7
Membrane f22 Modifier	0.25	Membrane f22 Modifier	0.7
Membrane f12 Modifier	0.25	Membrane f12 Modifier	0.7
Bending m11 Modifier	0.25	Bending m11 Modifier	0.7
Bending m22 Modifier	0.25	Bending m22 Modifier	0.7
Bending m12 Modifier	0.25	Bending m12 Modifier	0.7

- g) The lateral sway at top will be limited to $H/500$ under transient wind load.
Where/ H is the total height of building.
- h) Story drift due to earthquake loading will be limited to $H/250$
Where/ H is the story height.
- i) Ductile detailing norms will be adopted as per IS13920:2016

13. Durability Criteria

Environmental Exposure condition from durability criteria will be considered as 'Severe' (As per IS 456: 2000).

- i) Nominal Cover for various element will be as follows:

- a) Piles :75mm
- b) Pile Caps
 - 1) Top- 75mm
 - 2) Bottom-75mm
 - 3) Sides-75mm
 - 4) Retaining wall-50mm
- c) Basement Beams:
 - 1) Top – 50mm
 - 2) Bottom – 50mm
 - 3) Sides - 50
- d) Floor Beams :
 - 1) Top – 40mm
 - 2) Bottom – 40mm
 - 3) Sides - 40



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- e) Slabs = 25mm
- f) Staircase waist slab = 35mm.
- g) R.C.C. walls of Lift shaft = 50 mm
- h) Columns/ shear walls = Above ground: 40mm
Below ground: 65mm
- ii) Minimum Grade of Concrete provided for RCC work = M:30
- iii) Fire Rating: (As per NBC – Table-1 – Clause 3.3.1)
2.0 hrs (for all R.C.C members)



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ANNEXURE -1 Design Pre requisite sheet.



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DESIGN PREREQUISITE SHEET

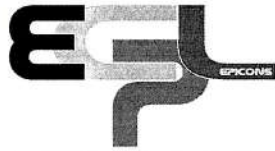
CLIENT:	M/s SPR Construction (P) Ltd.	DATE:	14/06/2022
PROJECT:	'SPR Sky' Tower 'A' & 'B' proposed residential buildings at Chennai, Tamilnadu	JOB NO.:	9394

BLDG No : Residential Buildings

(Following information to be filled by Clients Representative)

1.	Number of stories to be considered for structural design including provision for future extension (if any) :	2 Basement+6 Levels Podium including 3 level podium as future floors - 41 floors including 1 floor as future floor
1A.	No. of floors for future extension to be considered in design	1 floor for Tower & 3 floors for podium
2.	Floor Heights 1)Lobby/Ground/Suit 2)Typical Floor	Basement 2 - 3.70 M Basement 1 - 4.05 M Podium 1 - 5.60 M Podium 2 - 3.15 M Podium 3 - 4.50 M Typical residential floors - 3.15 M
3.	Preferred structural system for floors slab	Beam - Slab system
4.	Walls	
	External Walls	200mm TK NS RC wall
	Internal walls	100mm/150mm/200mm TK NS RC Walls
5.	Floor finish	Ave 50mm TK - Vitrified / Marble / Granite flooring
6.	Preferred Beam Depth	External Beams 700 mm
7.	Water proofing	
	Toilets	Cementitious Based





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	Terrace	Epoxy / Poly-urea with protection screed as 100mm TK
	Basement	VDF - Ave 100mm TK
8.	Podium floor	
	1. Parking	6 levels including 3 levels considered for future
	2. b. Landscaping	1.50M depth manure mixed soil filling at column locations and rest of area - 450mm tk filling
	3. c. Fire engine movement	Drive way for 80MT Fire tender movement all-round the tower.
9.	Terrace floor (Extra Loading)	
	a. Roof Garden	Soil mixture for 1.50M deep with density 1T / Cum at column location and balance areas are 450mm filling
	b. AC equipments	As per vendor
	c. Solar panel	As per vendor
10.	Water tanks	
	a. Overhead tank	Above Lift core area
	b. Underground Water Tank	-
11.	Any extra loading to be considered for	False ceiling
		Nil
		Nil
		Vertical transportation
12.	Soil investigation Report	Enclosed
13.	Any other requirements	



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DESIGN PREREQUISITE SHEET

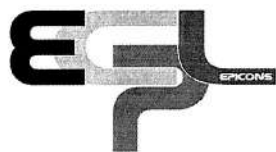
Client's representative: Name: V. RUKMANGATHAN

Signature: 

Designation: GM (STRUCTURAL DESIGN)

Date:





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ANNEXURE -2 HRC check list

No. of basements	2	
Minimum clearance between outermost basement retaining wall and compound wall	NA	
Has a shoring system been installed? Submit sectional detail of the shoring system	NA	
Give details of methodology used to resist uplift pressure due to ground water for tower portion as well as the portion outside the tower.	Stitch slab in between pile cap I to be designed for uplift	
Description of the foundation for the tower block		RCC Pile cap
Nature of Foundation	Piles/ Piled Raft/ etc.	Pile Raft
SBC assumed T/sq.m.(pile capacity)		325T (for 800Dia pile)
Sub- grade Elastic Modulus		-
Flooring system of the Basements	RCC beam- slab	
Retaining wall types & Sequence of backfilling	Whether Propped cantilever/ Cantilever Supported between Buttresses/ Counter forts/ etc.	Propped Cantilever
Intended Use of basements		parking
If rock anchors are used/ are they grouted after installation and stressing ?		NA
Is structural steel used in the construction of the sub-structure?		NO
If yes/ what are the measures taken for its fire proofing and corrosion resistance?		N.A
Whether Expansion / Separation joints provided ?	Yes. 50 mm expansion joint between Tower & Extended Basement. Separation joint Of 600mm between adjacent Towers	For tower $\frac{R1 \times \Delta 1 + R2 \times \Delta 2}{2}$ $= \frac{4 \times 140.5 + 4 \times 116.64}{2}$ $= 514.28 \text{mm} < 600 \text{mm}$
Whether expansion joint/separation joint continues through basement?	yes	For Podium $\frac{R1 \times \Delta 1 + R2 \times \Delta 2}{2}$ $= \frac{4 \times 6.2 + 4 \times 5.6}{2}$ $= 23.6 \text{mm} < 50 \text{mm}$
If yes/ detail at Basement level & retaining wall junction.	---	





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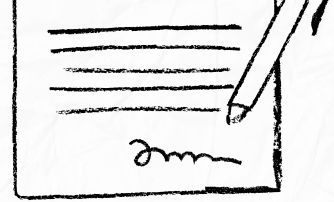
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DESCRIPTION OF SUPER –STRUCTURE

No. of Floors	2 Basements + Ground+ MEZZANINE + 5 Podium (Part residential at Tower area + 41 residential floors (including 1 floor future provisions	
Shape of Building Plan/ Elevation/ Whether Symmetric in Elevation	Rectangular Unsymmetric in elevation	
Maximum plan dimension in either direction in mt.	67.75	
Ratio of plan dimension	4.15	
Typical Floor to Floor height in mt. Maximum floor to floor height in entire height of building in mt.	3.15 4.05	
Aspect ratio (Height of Building till Terrace / Minimum Dimension of Building)	8.3	
Type of floor slab	R.C.C. Slab with beams	
Average thickness of floor slab in mm.	175mm	
Whether column are RCC. Composite or in structural steel	RCC columns	
<u>Lateral System</u> Whether the Geometry of Building is Symmetric	Unsymmetric	
Whether the lateral load resisting system is symmetrically placed in Geometry	No	
Use of floor at different levels (Residential / Commercial / Industrial)	Parking & Residential	
Is there any Transfer level ? If yes/ depth of Transfer Girder.	No.	
Whether expansion joint is provided? If yes/ what is the maximum plan dimension in mt.	Yes 67.75	
Whether separation gap is sufficiently joint is provided?	NA	
Maximum cantilever projection in mt.	0.60	





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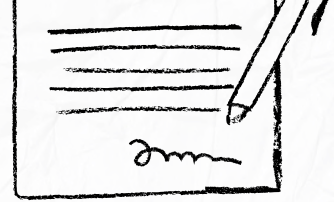
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