1.0 Introduction:-

Substation No. 2 is a closed, 30M x 14M x 13M(Approx.) tall,RC framed structure supported on isolated footing.

There is one staircase at the north-west corner for access to first floor level and another Staircase is placed at the south-east corner for access to the first floor level .

Plinth Level at FFL	=	+100.450	M	FOR A/2 TO A/5 TOC +100.000
First floor lower Level at TOC EL	=	+106.100	M	
First floor upper Level at TOC EL	=	+107.450	M	
Roof Level at TOC EL	=	+110.450	M	
Roof Level at TOC EL	=	+112.350	M	

Electrical panels are supported on secondary beams provided around the openings as per electrical requirement.

Mezannine Floor is provided at appx. 4m above ground floor supported on suspenders from FF beams

Reference Documents

Substation Equipment Layout	-	6469-EL-UCI-0002
General Engineering Specification	-	6469-CI-DOC-0001

2.0 Foundation System:-

Isolated and combined footings shall be provided.
SBC shall be considered as specified in GES Section 5.0.
Finished Ground level is at EL(+)99.750M.
Underside of foundation is assumed at 2.5m below NGL +98.700
with an allowable bearing capacity of 12 T/m2 (average)

3.0 Materials:-

As per GES Section 2.0 : M30 & Fe500

4.0 Dead load & Imposed load

Dead loads

1	Self weight of structure,				
2	Floor finishes		=	125	kg/m^2
3	Brick Work	wall density	=	20	kN/m^2
		wall thickness 230 bricks	=	270	mm
		355 bricks	=	430	mm
4	Water proofing		=	350	kg/m^2
5	False Floor		=	300	kg/m^2

Imposed loads

1	MCC room excluding panel area	=	5.00	kN/m^2
2	VFD floor	=	4.55	kN/m^2
3	Mezannine Floor	=	100	kg/m^2
4	Staircase	=	500	kg/m^2
5	Roof (Accessible)	=	1.5	kN/m^2

5.0 Equipment Load

Mezannine floor load applied on floor beams of MCC rooms, as point loads

load from Grating plate + 80kg/m per tray of 0.7m wide (6trays per suspender)

supported as shown in Equipment layout

Monorail Load

Monorail Capacity		=	30	kN			(Refer 6469-EL-USS-0002)	
Impact Factor		=	1.2					
Load from Monorail	(for local design)	=	30.0	×	1.20	=	**36.00**	kN

Surge Load from monorail

25% vertical Impact from Monorail	=	0.25	x	30.00	=	**7.50** kN
10% Horizontal surge from Monorail	=	0.10	x	30.00	=	**3.00** kN

Panel load

MCC room over panel width	=	1000	kg/m^2
VFD room	=	90	kg/m^2

Battery load

Battery Room at First Floor	=	1000	kg/m^2

6.0 Wind load

Wind loads are calculated in accordance with IS 875 (Part 3) -1987. The building is considered as a closed structure.

Basic wind speed	Vb	=	44	m/sec	(Refer GES,Section 6.1)
Risk coefficient	K1	=	1		
For Category 2,class B,Terrain factor	K2	=	1	(upto 10m)	(IS875:(Part3), Table2)
Topography factor	K3	=	1		

As per section 6.6 of GES, Design wind pressure for different heights,

Height of the structure less than 10 m	=	1.12	kN/m^2	
Height of the structure less than 15 m	=	1.21	kN/m^2	is applied uniformly full height of column
Height of the structure, h	=	13.0	m	
Width of the structure w	=	14	m	
Length of the structure l	=	30	m	
h/w	=	13m/14m	=	0.93
l/w	=	30m/14m	=	2.14

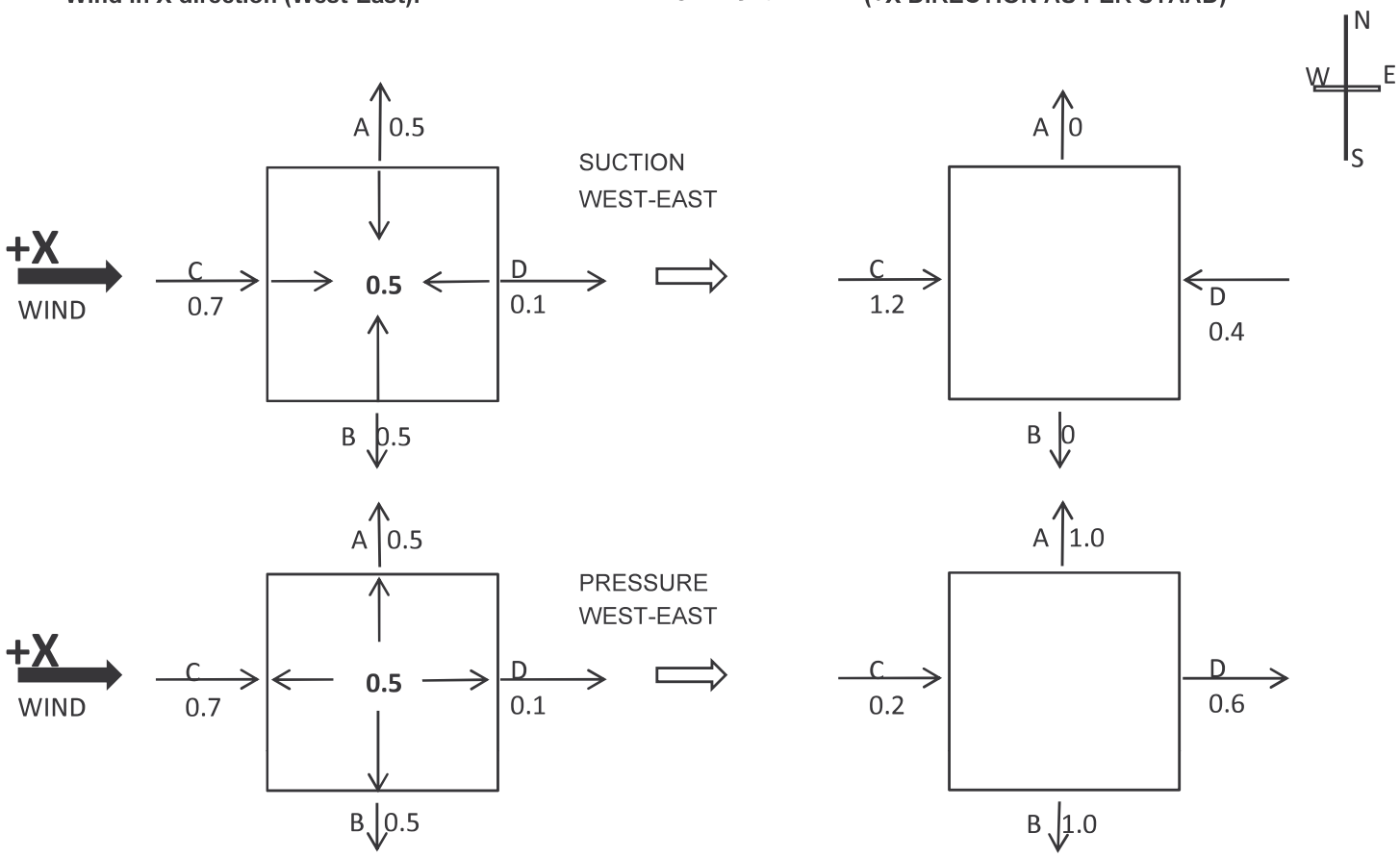
From Table 4 of IS:875 (Part 3)-1987, the external pressure coefficients obtained are shown below.(For 1/2<h/w<3/2 & 3/2<l/w<4)

As per IS:875(Part 3)-1987, clause 6.2.3.2, for buildings with medium openings between about 5 to 20 % of wall area, internal pressure coefficient is 0.5

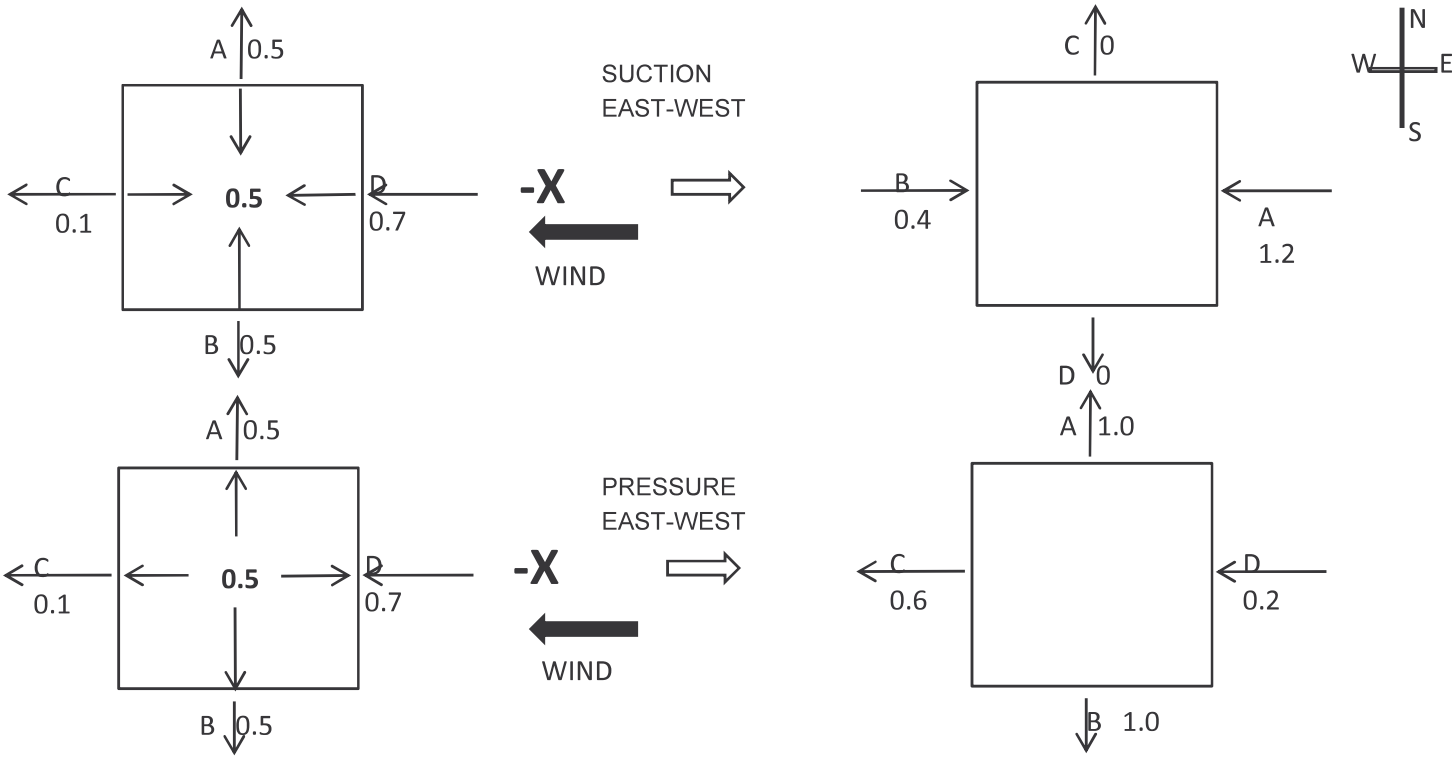
Wind force is applied as udl loads at column members above FGL.

Wind load at column members (KN/M) = Wind pressure(1.21KN/M2) x Pressure coefficient x Contributory Span

Wind in X direction (West-East): $\theta = 90^{O}$ **(+X DIRECTION AS PER STAAD)**



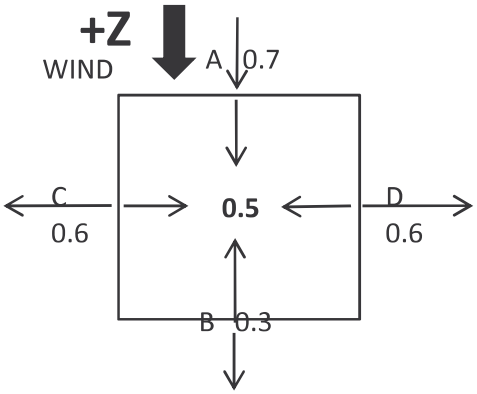
Wind in X direction (East-West): $\theta = 90^{O}$ **(-X DIRECTION AS PER STAAD)**



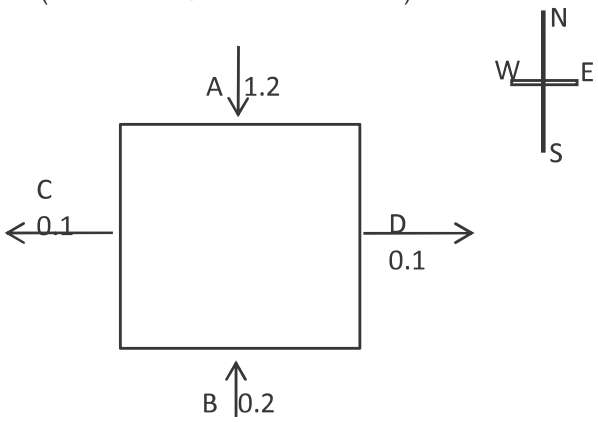
Wind in Z direction(North-South) :

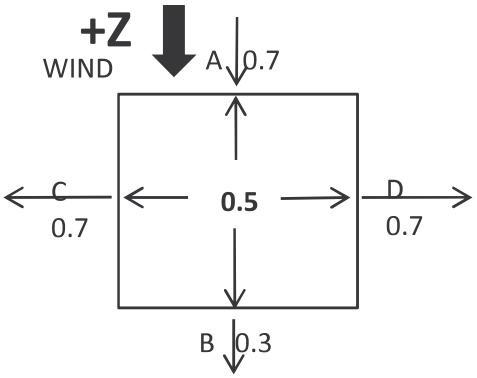
$\theta = 0^{O}$

(+Z DIRECTION AS PER STAAD)

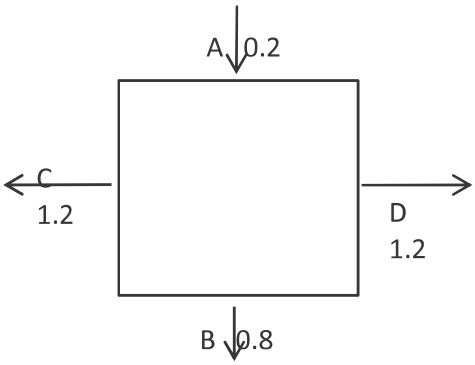


SUCTION
NORTH-SOUTH





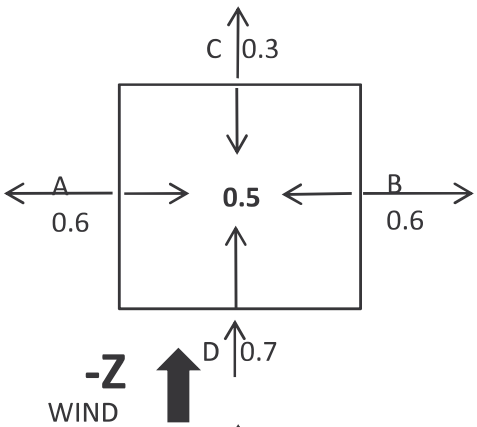
PRESSURE
NORTH-SOUTH



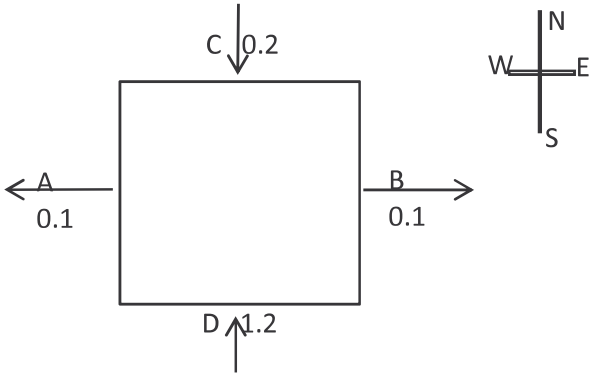
Wind in Z direction(South-North) :

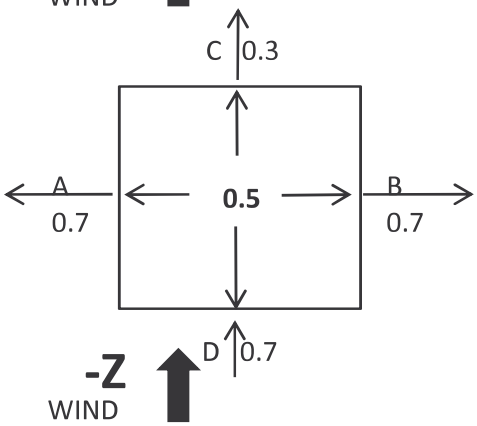
$\theta = 0^{O}$

(-Z DIRECTION AS PER STAAD)

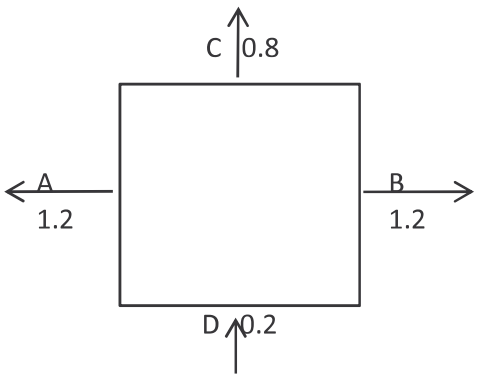


SUCTION
SOUTH-NORTH





PRESSURE
SOUTH-NORTH



7.0 Seismic Load

Seismic loads are calculated in accordance with IS 1893 (Part 4) -2005. As per GES, Seismic coefficient method is used for seismic analysis and ductile detailing is adopted.

Seismic Zone		=	III	(Refer GES,Section 7)
Zone factor	Z	=	0.16	(Refer GES,Section 7)
Importance factor	I	=	1.75	(As per Table 5 & Table 2, IS:1983(Part 4): 2005
(Category-2, Substation Building)				
Response Reduction Factor,	R	=	5	(As per Table 3, IS:1983(Part 4): 2005
(Ductile detailing adopted)				
Design horizontal seismic coefficient, Ah		=	$\frac{(Z/2)(Sa/g)}{(R/I)}$	(As per IS:1893 (Part 4), Cl. No. 8.3.2)
		=	0.028 (Sa/g)	
Assuming type of Soil		=	Medium	
Damping ratio for RCC		=	0.05 (i.e. 5% for DBE)	(As per IS:1893 (Part 4) 2005, Cl. No. 9.4 & Table 4)

Avg. response acceleration coefficeint Sa/g, (As per Annex B, IS:1983(Part 4): 2005)

Considering Structure with brick infill panels, fundamental natural period of vibration,

$$T = \frac{0.09h}{\sqrt{d}}$$ (As per IS:1893 (Part 1), Cl. No. 7.6.2)

Seismic analysis shall be performed only for two horizontal components of earthquate motion i.e. X & Z in STAAD.

8.0 Load Combinations

Load combinations for design by limit state design are taken as per GES Section 10.

PRIMARY LOADS: -

LOAD 1 EARTHQUAKE LOAD WEST TO EAST (Ex)
LOAD 2 EARTHQUAKE LOAD NORTH TO SOUTH (Ez)
LOAD 3 DEAD LOAD (DL)
LOAD 4 PIPE LOAD (PL)
LOAD 5 EQUIPMENT OPERATING LOAD (EOL)
LOAD 6 PIPE FRICTION LOAD (Pfx)
LOAD 7 PIPE FRICTION LOAD (Pfz)
LOAD 8 LIVE LOAD (LL)
LOAD 9 IMPACT LOAD DUE TO MONORAIL (IL)
LOAD 10 BUNDLE PULL LOAD (BP)
LOAD 11 EQUIPMENT TESTING LOAD (ET)
LOAD 12 EQUIPMENT EMPTY LOAD (EE)
LOAD 13 BLAST LOAD (B)
LOAD 14 WIND LOAD SUCTION INSIDE (WEST TO EAST) (Wsx+ve)
LOAD 15 WIND LOAD PRESSURE INSIDE (WEST TO EAST) (Wpx+ve)
LOAD 16 WIND LOAD SUCTION INSIDE (EAST TO WEST) (Wsx-ve)
LOAD 17 WIND LOAD PRESSURE INSIDE (EAST TO WEST) (Wpx-ve)

LOAD 18 WIND LOAD SUCTION INSIDE (NORTH TO SOUTH) (Wsz+ve)
LOAD 19 WIND LOAD PRESSURE INSIDE (NORTH TO SOUTH) (Wpz+ve)
LOAD 20 WIND LOAD SUCTION INSIDE (SOUTH TO NORTH) (Wsz-ve)
LOAD 21 WIND LOAD PRESSURE INSIDE (SOUTH TO NORTH) (Wpz-ve)
LOAD 22 PIPE ANCHOR LOAD (Pa)

LOAD COMBINATIONS: -

****

*LOAD COMBINATIONS: -

****

* Unfactored load combinations for sizing of foundation / deflection check shall be as follows

****

* Load combinations for OPERATING condition

****

* (DL + LL)
LOAD COMB 101 (DL + EOL) + LL
3 1.0 5 1.0 8 1.0

****

* (DL + WL)
LOAD COMB 102 ((DL + EOL) + WSX+VE)
3 1.0 5 1.0 14 1.0
LOAD COMB 103 ((DL + EOL) + WPX+VE)
3 1.0 5 1.0 15 1.0
LOAD COMB 104 ((DL + EOL) + WSX-VE)
3 1.0 5 1.0 16 1.0
LOAD COMB 105 ((DL + EOL) + WPX-VE)
3 1.0 5 1.0 17 1.0
LOAD COMB 106 ((DL + EOL) + WSZ+VE)
3 1.0 5 1.0 18 1.0
LOAD COMB 107 ((DL + EOL) + WPZ+VE)
3 1.0 5 1.0 19 1.0
LOAD COMB 108 ((DL + EOL) + WSZ-VE)
3 1.0 5 1.0 20 1.0
LOAD COMB 109 ((DL + EOL) + WPZ-VE)
3 1.0 5 1.0 21 1.0

****

* Seismic load generated is for operating condition. The same loads are used

****

* (DL + EQ)
* This combination is not applicable here.
*LOAD COMB 110 ((DL + EOL) + EQX)
*3 1.0 5 1.0 1 1.0
*LOAD COMB 111 ((DL + EOL) - EQX)
*3 1.0 5 1.0 1 -1.0
*LOAD COMB 112 ((DL + EOL) + EQZ)
*3 1.0 5 1.0 2 1.0
*LOAD COMB 113 ((DL + EOL) - EQZ)
*3 1.0 5 1.0 2 -1.0

****

* (DL + LL + WL)
LOAD COMB 114 ((DL + EOL) + LL + WSX+VE)
3 1.0 5 1.0 8 1.0 14 1.0
LOAD COMB 115 ((DL + EOL) + LL + WPX+VE)
3 1.0 5 1.0 8 1.0 15 1.0
LOAD COMB 116 ((DL + EOL) + LL + WSX-VE)
3 1.0 5 1.0 8 1.0 16 1.0

```
LOAD COMB 117 ((DL + EOL) + LL + WPX-VE)
3 1.0 5 1.0 8 1.0 17 1.0
LOAD COMB 118 ((DL + EOL) + LL + WSZ+VE)
3 1.0 5 1.0 8 1.0 18 1.0
LOAD COMB 119 ((DL + EOL) + LL + WPZ+VE)
3 1.0 5 1.0 8 1.0 19 1.0
LOAD COMB 120 ((DL + EOL) + LL + WSZ-VE)
3 1.0 5 1.0 8 1.0 20 1.0
LOAD COMB 121 ((DL + EOL) + LL + WPZ-VE)
3 1.0 5 1.0 8 1.0 21 1.0
*******************************************************************************
* (DL + 0.5LL + EQ)
LOAD COMB 122 ((DL + EOL) + 0.5LL + EQX)
3 1.0 5 1.0 8 0.5 1 1.0
LOAD COMB 123 ((DL + EOL) + 0.5LL - EQX)
3 1.0 5 1.0 8 0.5 1 -1.0
LOAD COMB 124 ((DL + EOL) + 0.5LL + EQZ)
3 1.0 5 1.0 8 0.5 2 1.0
LOAD COMB 125 ((DL + EOL) + 0.5LL - EQZ)
3 1.0 5 1.0 8 0.5 2 -1.0
*******************************************************************************
* Factored load combinations for design of R.C. Structure shall be as follows
*******************************************************************************
* Load combinations for OPERATING condition
* for design of R.C. Structure
*******************************************************************************
* 1.5 (DL + LL)
LOAD COMB 201 (1.5 DL + 1.5 EOL) + 1.5 LL
3 1.5 5 1.5 8 1.5
*******************************************************************************
* 1.5 (DL + WL)
LOAD COMB 202 (1.5(DL + EOL) + 1.5 WSX+VE)
3 1.5 5 1.5 14 1.5
LOAD COMB 203 (1.5(DL + EOL) + 1.5 WPX+VE)
3 1.5 5 1.5 15 1.5
LOAD COMB 204 (1.5(DL + EOL) + 1.5 WSX-VE)
3 1.5 5 1.5 16 1.5
LOAD COMB 205 (1.5(DL + EOL) + 1.5 WPX-VE)
3 1.5 5 1.5 17 1.5
LOAD COMB 206 (1.5(DL + EOL) + 1.5 WSZ+VE)
3 1.5 5 1.5 18 1.5
LOAD COMB 207 (1.5(DL + EOL) + 1.5 WPZ+VE)
3 1.5 5 1.5 19 1.5
LOAD COMB 208 (1.5(DL + EOL) + 1.5 WSZ-VE)
3 1.5 5 1.5 20 1.5
LOAD COMB 209 (1.5(DL + EOL) + 1.5 WPZ-VE)
3 1.5 5 1.5 21 1.5
*******************************************************************************
* Seismic load generated is for operating condition. The same loads are used
*******************************************************************************
* 1.5 (DL + EQ)
* This combination is not applicable here.
*LOAD COMB 210 (1.5(DL + EOL) + 1.5 EQX)
*3 1.5 5 1.5 1 1.5
*LOAD COMB 211 (1.5(DL + EOL) - 1.5 EQX)
*3 1.5 5 1.5 1 -1.5
*LOAD COMB 212 (1.5(DL + EOL) + 1.5 EQZ)
*3 1.5 5 1.5 2 1.5
*LOAD COMB 213 (1.5(DL + EOL) - 1.5 EQZ)
*3 1.5 5 1.5 2 -1.5
```

```
*********************************************************************************
* 1.2 (DL + LL + WL)
LOAD COMB 214 (1.2(DL + EOL) + 1.2 LL + 1.2 WSX+VE)
3 1.2 5 1.2 8 1.2 14 1.2
LOAD COMB 215 (1.2(DL + EOL) + 1.2 LL + 1.2 WPX+VE)
3 1.2 5 1.2 8 1.2 15 1.2
LOAD COMB 216 (1.2(DL + EOL) + 1.2 LL + 1.2 WSX-VE)
3 1.2 5 1.2 8 1.2 16 1.2
LOAD COMB 217 (1.2(DL + EOL) + 1.2 LL + 1.2 WPX-VE)
3 1.2 5 1.2 8 1.2 17 1.2
LOAD COMB 218 (1.2(DL + EOL) + 1.2 LL + 1.2 WSZ+VE)
3 1.2 5 1.2 8 1.2 18 1.2
LOAD COMB 219 (1.2(DL + EOL) + 1.2 LL + 1.2 WPZ+VE)
3 1.2 5 1.2 8 1.2 19 1.2
LOAD COMB 220 (1.2(DL + EOL) + 1.2 LL + 1.2 WSZ-VE)
3 1.2 5 1.2 8 1.2 20 1.2
LOAD COMB 221 (1.2(DL + EOL) + 1.2 LL + 1.2 WPZ-VE)
3 1.2 5 1.2 8 1.2 21 1.2
*********************************************************************************
* 1.2 (DL + 0.5LL + EQ)
LOAD COMB 222 (1.2(DL + EOL) + 0.6 LL + 1.2 EQX)
3 1.2 5 1.2 8 0.6 1 1.2
LOAD COMB 223 (1.2(DL + EOL) + 0.6 LL - 1.2 EQX)
3 1.2 5 1.2 8 0.6 1 -1.2
LOAD COMB 224 (1.2(DL + EOL) + 0.6 LL + 1.2 EQZ)
3 1.2 5 1.2 8 0.6 2 1.2
LOAD COMB 225 (1.2(DL + EOL) + 0.6 LL - 1.2 EQZ)
3 1.2 5 1.2 8 0.6 2 -1.2
*********************************************************************************
```

9.0 Structural Analysis and Design

The reinforced concrete structure shall be designed as per Limit State design method. Three dimensional analysis of the structure is carried out using STAAD.Pro.

1.0 DEAD LOAD & LIVE LOAD

Dead and live loads shall be considered as per GES.

Levels:-

Plinth Level at TOC EL	=	+100.450	m
Lower Tie Beam Level at TOC EL	=	+103.050	m
Tie Beam Level at TOC EL	=	+103.850	m
Lower First floor Level at TOC EL	=	+106.100	m
First floor Level at TOC EL	=	+107.450	m
Stair Roof Level at TOC EL	=	+110.450	m
Main Roof Level at TOC EL	=	+112.350	m

Unit Weight of different materials:-

Brick wall	=	20.0	kN/m^3
Concrete	=	25.0	kN/m^3
Floor finish	=	1.25	kN/m2
Water proofing	=	3.50	kN/m^2
False Floor	=	3.00	kN/m^2

1] Load from Brick wall

a] @ PLINTH BEAMS (EL+100.450 TOC)

	Height of wall	=	2.80	m					
i)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**15.50**	kN/m
ii)	Brick wall 430 mm thk	=	0.430	x	20.0	kN/m^3	=	**8.60**	kN/m^2
	UDL in kN/m						=	**24.00**	kN/m
	Height of wall	=	2.00	m					
iii)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**11.00**	kN/m
iv)	Brick wall 430 mm thk	=	0.430	x	20.0	kN/m^3	=	**8.60**	kN/m^2
	UDL in kN/m						=	**17.50**	kN/m

b] LOWER TIE BEAMS @ EL+103.050 TOC

	Height of wall	=	2.50	m					
i)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**13.50**	kN/m
ii)	Brick wall 430 mm thk	=	0.430	x	20.0	kN/m^3	=	**8.60**	kN/m^2
	UDL in kN/m						=	**21.50**	kN/m
	Height of wall	=	3.70	m					
iii)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**20.00**	kN/m

c] TIE BEAMS @ EL+103.850 TOC

	Height of wall	=	2.90	m					
i)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**16.00**	kN/m
ii)	Brick wall 430 mm thk	=	0.430	x	20.0	kN/m^3	=	**8.60**	kN/m^2
	UDL in kN/m						=	**25.00**	kN/m
	Height of wall	=	1.70	m					
iii)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**9.20**	kN/m
	Height of wall	=	1.55	m					
iv)	Brick wall 430 mm thk	=	0.430	x	20.0	kN/m^3	=	**8.60**	kN/m^2
	UDL in kN/m						=	**13.50**	kN/m

d] LOWER FIRST FLOOR BEAMS @ EL+106.100 TOC

	Height of wall	=	5.65	m					
i)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**30.50**	kN/m

e] FIRST FLOOR BEAMS @ EL+107.450 TOC

	Height of wall	=	4.30	m					
i)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**23.00**	kN/m
ii)	Brick wall 430 mm thk	=	0.430	x	20.0	kN/m^3	=	**8.60**	kN/m^2
	UDL in kN/m						=	**37.00**	kN/m
	Height of wall	=	3.00	m					
iii)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**16.20**	kN/m
iv)	Brick wall 430 mm thk	=	0.430	x	20.0	kN/m^3	=	**8.60**	kN/m^2
	UDL in kN/m						=	**25.80**	kN/m

f] STAIR BEAMS

	Height of wall (EL+100.45)	=	1.95	m					
i)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**10.50**	kN/m
	Height of wall (EL+102.80)	=	2.40	m					
ii)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**13.00**	kN/m

	Height of wall (EL+105.55)	=	1.50	m					
iii)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**8.00**	kN/m
	Height of wall (EL+110.45)	=	1.90	m					
iv)	Brick wall 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**10.26**	kN/m
g]	**ROOF BEAMS (EL = +110.450/+112.350 TOC)**								
i)	Load due to Roof Pardi								
	Height of roof pardi	=	0.40	m					
	Roof Pardi= 270 mm thk	=	0.270	x	20.0	kN/m^3	=	**5.40**	kN/m^2
	UDL in kN/m						=	**2.20**	kN/m
2]	**Dead Load from TXR on plinth beams**								
i)	Load from TRANSFORMER (TR-21,22&23)						=	**54.00**	kN
3]	**Load from Slab**								
a]	**VFD Room @ FIRST FLOOR LEVEL (EL = +106.100 TOC)**								
	Thickness of Floor Slab	=	200	mm					
i)	Dead Load								
	a) Self weight of slab	=	0.20	x	25.00	kN/m^3	=	5.00	kN/m^2
	no floor finish								
	b) Self weight of false floor						=	3.00	kN/m^2
						Total	=	**8.00**	**kN/m^2**
ii)	VFD Room @ FIRST FLOOR LEVEL (EL = +106.100 TOC)								
	Live Load						=	**4.55**	**kN/m^2**
b]	**Battery Room @ FIRST FLOOR LEVEL (EL = +107.450 TOC)**								
	Thickness of Floor Slab	=	150	mm					
i)	Dead Load								
	a) Self weight of slab	=	0.15	x	25.00	kN/m^3	=	3.75	kN/m^2
	b) Floor finish						=	1.25	kN/m^2
						Total	=	**5.00**	**kN/m^2**
c)	**MCC Room @ FIRST FLOOR LEVEL (EL = +107.450 TOC)**								
	Thickness of Floor Slab	=	150	mm					
i)	Dead Load								
	a) Self weight of slab	=	0.15	x	25.00	kN/m^3	=	3.75	kN/m^2
	b) Floor finish						=	1.25	kN/m^2
						Total	=	**5.00**	**kN/m^2**
ii)	MCC Room @ FIRST FLOOR LEVEL (EL = +107.450 TOC)								
	Live Load						=	**5.00**	**kN/m^2**

d)	**Main Roof - VFD Room, Battery Room, MCC Room Roof (@ EL = +107.450 TOC)**							
	Thickness of Roof Slab	=	150	mm				
i)	Dead Load							
	a) Self weight of slab	=	0.15 x 25.00	kN/m^3	=	3.75	kN/m^2	
	b) Water Proofing				=	3.50	kN/m^2	
				Total	=	**7.25**	**kN/m^2**	
ii)	Main Roof - VFD Room, Battery Room, MCC Room Roof (@ EL = +107.450 TOC)							
	Live Load				=	**1.50**	**kN/m^2**	
e]	**Staircase Landing slabs**							
	Thickness of Floor Slab	=	150	mm				
i)	Dead Load							
	a) Self weight of slab	=	0.15 x 25.00	kN/m^3	=	3.75	kN/m^2	
	b) Floor finish				=	1.25	kN/m^2	
				Total	=	**5.00**	**kN/m^2**	
ii)	Staircase Landing slabs							
	Live Load				=	**5.00**	**kN/m^2**	
f]	**Staircase Flights**							
i)	Dead Load							
	Thickness of waist slab	=	0.150	m				
	Riser, R	=	0.188	m				
	Tread, T	=	0.250	m				
	$\sqrt{R^2 + T^2}$	=	0.313	m				
	Self weight of waist slab	=	0.15 x 0.313 / 0.25 x 25		=	4.70	kN/m^2	
	Self weight of steps	=	0.1875 / 2 x 25		=	2.30	kN/m^2	
	Finishes				=	1.25	kN/m^2	
				Total	=	**8.25**	**kN/m^2**	
ii)	Staircase Flights							
	Live load				=	**5.00**	**kN/m^2**	
g)	**Stair Roof (@ EL = +110.450 TOC)**							
	Thickness of Roof Slab	=	150	mm				
i)	Dead Load							
	a) Self weight of slab	=	0.15 x 25.00	kN/m^3	=	3.75	kN/m^2	
	b) Water Proofing				=	3.50	kN/m^2	
				Total	=	**7.25**	**kN/m^2**	
ii)	Stair Roof (@ EL = +110.450 TOC)							
	Live Load				=	**1.50**	**kN/m^2**	

2.0 EQUIPMENT OPERATING LOAD

i)	Panel Load @ MCC ROOM, FIRST FLOOR LEVEL (EL = +107.450 TOC)	=	**10.00**	**kN/m2**

ii)	Panel Load @ VFD ROOM, FIRST FLOOR LEVEL (EL = +106.100 TOC)						=	**0.90**	**kN/m2**
iii)	Monorail Load on supporting beams at Roof Level								
	Monorail Capacity						=	**30.00**	**kN**
	25% vertical Impact from Monorail	=	0.25	x	30.00	kN	=	**7.50**	**kN**
	10% Horizontal surge from Monorail	=	0.10	x	30.00	kN	=	**3.00**	**kN**
iv)	Load from Suspender @ MCC ROOM, FIRST FLOOR BEAMS (EL = +107.450 TOC)								
	Max contributary width for grating suppo	=	1.8	m					
	a) selfweight from Grating plate @ mezz	=	1.8	x	0.50	kN/m2	=	0.90	kN/m
	b) Live load from Grating plate @ mezz	=	1.8	x	1.00	kN/m2	=	1.80	kN/m
	c) load from cable tray (6nos) @ mezzanine floor						=	4.80	kN/m
	Total Load for contributary span of 2.3m	=	2.30	x	7.50	kN/m	=	**17.00**	**kN**
v)	Battery Room @ FIRST FLOOR LEVEL (EL = +107.450 TOC)								
	Battery Load						=	**10.00**	**kN/m^2**

3.0 WIND LOAD

Wind loads are calculated in accordance with IS 875 (Part 3) -1987.

For wind load parameters refer Concept Note. For wind load Calculation Refer ANNEX

4.0 SEISMIC LOAD

Seismic loads are calculated in accordance with IS 1893 (Part 4) -2005.

As per GES, Seismic co-efficient method is used for seismic analysis and ductile detailing is adopted.

For Seismic load parameters refer Concept Note.