KEM MORTUARY BUILDING, MUMBAI

DESIGN BASIS REPORT

FOR

PROPOSED MORTUARY BUILDING FOR KEM HOSPITAL AT MUMBAI

DOCUMENT RELEASE AUTHORIZATION

Consultant

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History of Revisions

Revision No.	Issue Date	Chapter/clause no. & text affected	Reason for revision
R0	17.09.2026	New	First Issue

1. **INTRODUCTION**

1.1 The document describes analysis and design approach for structural works for the KEM MORTURY building by providing new structure by Demolishing Existing Structure / Renovation / Repairing old structure in the campus of KEM hospital

2. **SCOPE**

2.1 The scope of this Design Basis Report (DBR) is to highlight only basis of design, including material properties, loading, applicable codes and standards, software used, and analysis and design methodology.

3.2 DESCRIPTION OF THE BUILDING

Height of the building as per floors is as under

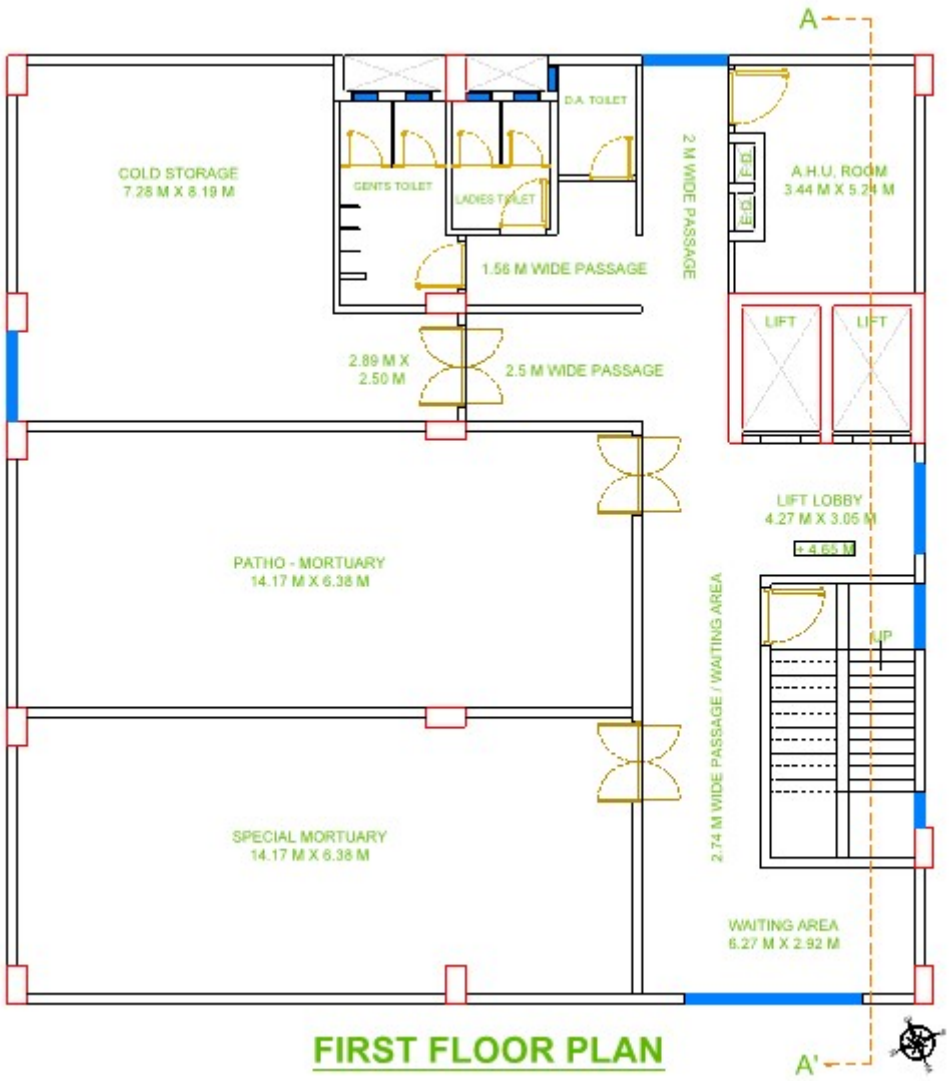
Ground to 1st floor (Stilt)– 4.65m

1st to 5th floor - 4.2 m

5th to Terrace floor- 4.2m

Terrace to OHT Level (1.95m+3.15m) – 5.10 m

Total height of Building above Ground level to Terrace Floor Level is 26.85m



Layout Plan

4 STRUCTURAL SYSTEM

Structural System envisaged for Special Moment Resisting Frame System (SMRF) Building.

5 FUNCTIONAL REQUIREMENTS

The structure is Mortuary Building mainly used for Hospital purpose. Ground Floor will be used for Mortuary & Cold Storage purpose. First Floor will be

used for Patho Mortuary & Special Mortuary Second to Sixth Floor will be used for Lab, Auditorium Wet lab, Storage & FMT lab.

6 SEISMIC CLASSIFICATION

The structure is at Wadala, Mumbai, Zone III as per IS:1893, Zone factor is 0.16

7 METEOROLOGICAL CONDITION

Structural elements below Plinth level and Exterior External faces of walls are designed for severe exposure condition and internal faces of walls & floor beams are designed for moderate exposure condition, as per Table 3, clause 8.2.2.1 of IS 456-2000.

8 FIRE RATING

All structural elements are designed for 2 hours fire rating.

9 COVER

Based on the exposure condition and fire rating, clear cover to main reinforcement shall be as follows.

Staircase waist slab	=	35mm
Slab	=	30mm
Floor Beams	=	35mm
Shear walls /Columns	=	45mm
Foundation	=	75mm

10 GEOTECHNICAL PARAMETERS

A. Geotechnical investigation report –Spread foundation for proposed building, supported on completely weathered rock encountered at a depth of 10.3m below ground can be designed for a maximum net allowable bearing capacity of 40 t/m2 . Solid raft foundation can be designed for a higher gross allowable bearing capacity of up to 60 t/m2 .

B. Maximum settlement of spread and raft foundations will be less than 12mm and 20mm respectively. A Modulus of subgrade reaction of 3300 t/m3 can be utilized for design of foundations.

11 MATERIAL GRADES

11.2 CONCRETE

Grade of Concrete – All elements are a particular level are in same grade of concrete. Concrete grade of M30 to M40 is used for various level of structure.

Concrete of Grade M10 or equivalent shall be used in filling, plum concrete, levelling courses and other non-structural items. Minimum cement content, water cement ratio etc. shall conform to IS 456:2000 - provisions for durability and strength criteria.

11.3 REINFORCEMENT

Steel reinforcement shall be of Grade Fe500D conforming to IS: 1786-2008

12 CONSTRUCTIONAL FEATURES

12.1 Placing temperature of concrete shall be limited to 28^0c

13 DESIGN LOAD

13.1 Dead Load / Superimposed Dead load

The construction load, super imposed dead load that are envisaged to act permanently (wherever applicable) & Live loads for each occupancy category as per IS:875(part-2)–1987 are as follows: -

a. 1^{st} to 6^{th} floor LL considered is 5 KN/m2.
b. At cold storage location loading will be considered as per IS 875:1987(Part -2) Table No-1 (Point No. viii)-(b)
c. Contractor to contact the machine manufacturer and capture additional point loads as per equipment, if any
d. Partition Wall

Brick Wall = 150mm Thick = 0.150 (m) thk X 3 (m) ht X 20 (KN/cum) density = 9 KN/m

13.2 SEISMIC LOAD

$$\text{Design horizontal Seismic coefficient Ah} = \frac{ZISa}{2Rg}$$

where,

Z =Zone factor, Refer Table 2 of IS-1893:2016 = 0.16

I =Importance factor;

Refer Table 6 of IS-1893:2016 = 1.5 (For Institutional building)

R = Response reduction factor, refer Table 7 of IS-1893:2016 = 5

Sa /g = Average response acceleration coefficient for hard soil = Depend on Geotech report

Based on the natural period Sa/g will be worked out.

Time Period as per code IS: 1893 (Part 1)-2016

$$Tx = \frac{0.09h}{\sqrt{dx}} =$$

$$Ty = \frac{0.09h}{\sqrt{dy}}$$

Static base shear = Ah x W

W = Total seismic weight.

13.2.1 Modal combination method - NRC 10% grouping method is used for modal combination in which if modes are closely spaced (closer to each other by 10%) responses are combined by absolute sum and for modes which are not closely spaced, responses are combined by SRSS. This method automatically converges to SRSS if all modes are not closely spaced

13.2.2 All modes upto 33h are considered in the analysis

13.2.3 Missing mass correction is done in case mass participation is less than 90%, after considering all modes upto 33 Hz

13.2.4 Damping used for seismic analysis – 5%

13.3 TEMPERATURE LOADS

Temperature change applied in E-tabs (**25°C**) = Maximum Avg.– Minimum temp (°C)

13.4 WIND LOADS

13.4.1 Analysis of Wind

The wind pressure has been calculated based on the data furnished below and other provisions laid in IS875 (Part-3) – 2015.

Basic Wind Speed:	Vb = 44 m/s
(Fig.1 page 6 & Annex A)	
Probability factor (50 years design life):	K1 = 1.0
(Table.1 page 7 & clause 6.3.1)	
Terrain category:	3
Terrain, height and structure size factor:	K2 (As per IS875 (Part-3) – 2015
Topography factor:	K3 = 1.0
Importance Factor for Cyclonic Region	K4 = 1.0
Design wind speed (Vz = VbxK1xK2xK3xK4)	
Wind pressure at height, Z (Pz = 0.6 x V^2_z)	
Wind Directionality Factor,	Kd = 0.9
Area Averaging Factor,	Ka = 1.0
Combination Factor,	Kc = 1.0
Design wind pressure (Pd = KdxKaxKcxPz),	
Where, Pd > 0.7Pz	

14 ANALYTICAL APPROACH

14.1 MATHEMATICAL MODEL

After preliminary sizing of various structural members, a computer model of the structural frame of Building will be generated for carrying out computer

analysis for the effects of vertical and lateral loads that are likely to be imposed on the structure.

The building structure will be analyzed using latest version of ETABS. Above mentioned Analysis/Design software has been thoroughly tested, validated and recognized internationally by several organizations and is well suited for the analysis of building system.

Geometrical dimensions, member properties and member-node connectivity, including eccentricities will be modeled in the analysis problem. Variation in material grades, if present, will also be considered. The permissible values of the load factors and stresses will be utilized within the purview of the Indian standards.

The computer analysis will evaluate individual internal forces, reactions at foundation level and deflection pattern of the entire structure and in the individual members. This data will then be used to verify adequacy of the member sizes adopted and after further iteration to arrive at the most optimized design of the structural members. Some re-runs of the analysis programs might be required for arriving at the optimum 3-Dimensional structural frame that satisfies the strength and stability criteria in all respects.

Beams and columns in the structure will be modeled as line members. The shear walls will be modeled as “shell” elements. All slabs shall be modeled as. Rigid Diaphragm is given to reduce degrees of freedom and make problem size smaller. The Structure is analyzed for all possible load combinations i.e. gravity loads, wind, earthquake etc. acting on it throughout its life span.

14.2 DESIGN LOAD COMBINATIONS

14.2.1 Load combination for strength criteria

1	1.5 (DL+LL)
2	1.2 (DL+LL+WLX+TL)
3	1.2 (DL+LL-WLX-TL)
4	1.2 (DL+LL+WLY+TL)
5	1.2 (DL+LL-WLY-TL)
6	1.5 (DL+WLX+TL)
7	1.5 (DL-WLX-TL)
8	1.5 (DL+WLY+TL)
9	1.5 (DL-WLY-TL)
10	0.9DL+1.5(WLX+TL)
11	0.9DL-1.5(WLX+TL)

12	0.9DL+1.5(WLY+TL)
13	0.9DL-1.5(WLY+TL)
14	1.2(DL+LL+GUST+TL)
15	1.2 (DL+LL+SPECX+TL)
16	1.2 (DL+LL-SPECX-TL)
17	1.2 (DL+LL+SPECY+TL)
18	1.2 (DL+LL-SPECY-TL)
19	1.5 (DL+SPECX+TL)
20	1.5 (DL-SPECX-TL)
21	1.5 (DL+SPECY+TL)
22	1.5 (DL-SPECY-TL)
23	1.5(DL+GUST+TL)
24	0.9DL+1.5(EQX+TL)
25	0.9DL-1.5(EQX+TL)
26	0.9DL+1.5(EQY+TL)
27	0.9DL-1.5(EQY+TL)
28	0.9DL+1.5(GUST+TL)

14.2.2 Load combination for serviceability criteria

1. DL+LL
2. DL + SPECX
3. DL - SPECX
4. DL + SPECY
5. DL- SPECY
6. DL + 0.8LL + 0.8SPECX
7. DL + 0.8LL - 0.8SPECX
8. DL + 0.8LL + 0.8SPECY
9. DL + 0.8LL - 0.8SPECY
10. DL + WLX
11. DL - WLX
12. DL + WLY
13. DL- WLY

14. DL + 0.8LL + 0.8WLX
15. DL + 0.8LL - 0.8WLX
16. DL + 0.8LL +0.8WLY
17. DL + 0.8LL - 0.8WLY

Temperature loads will be considered for checking serviceability criterion.

15 DURABILITY

15.1 Steel reinforcement shall be of Grade Fe500D conforming to IS: 1786-2008

15.2 The nominal cover to main reinforcement shall be as follows.

a. Staircase waist slab = 35mm
b. Slab = 30mm
c. Shear walls & Columns = 45mm
d. Floor Beams = 45mm
e. Pile Foundation = 75mm

15.3 Cover for Wall/Columns below ground is increased by 25mm on all sides.

CRACKED RC SECTION PROPERTIES:

Sl No.	Structural Element	Un-factored Loads		Factored Loads	
		Area	Moment of Inertia	Area	Moment of Inertia
(1)	(2)	(3)	(4)	(5)	(6)
i)	Slabs	1.0 A_g	0.35 I_g	1.00 A_g	0.25 I_g
ii)	Beams	1.0 A_g	0.7 I_g	1.00 A_g	0.35 I_g
iii)	Columns	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g
iv)	Walls	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g

When design lateral forces are applied on the building the maximum inter storey elastic lateral drift ratio under working load (unfactored wind load combination with return period of 50 years), which is estimated based on realistic properties mentioned in table above, shall be limited to H/500. For earthquake load (factored) combinations the drift shall be limited to H/250.

16 COMPUTER PROGRAMS

16.1 Design software

a. ETABS v20.3.0
b. SAFE v20.0
c. RCDC v11.0

16.2 Drafting software

a. Auto-cad

17 APPLICABLE CODES

a. **IS 456:2000**:- Plain and reinforced concrete code of practice (Forth Revision).

b. **IS 875 (Part 1):1987:-** Code of practice for unit weight of buildings materials and stored materials (Second Revision) (Other than earthquake) for building and structure. (Dead Loads).

c. **IS 875 (Part 2):1987:-** Code of practice for design loads (Second Revision) (Other than Earthquake) for buildings and structures. (Imposed Loads).

d. **IS 875 (Part 3):2015:-** Code of practice for design loads. (Third Revision) (Other than Earthquake) for buildings & structures. (Wind Loads).

e. **IS 875 (Part 5):1987:-** Code of practice for design loads. (Third Revision) (Other than Earthquake) for buildings & structures. (Special Loads & Combination).

f. **IS 1893 (Part 1):2016:-** Criteria for earthquake resistant design of structures. (Sixth Revision).

g. **IS 1893 (Part 4):2005:-** Criteria for earthquake resistant design of structures.

h. **IS 13920:2016:-** Ductile detailing of reinforced concrete structure subjected to seismic forces code of practice (First Revision).

i. **IS 16700:2017:-** Criteria for structural safety of tall concrete building.

j. **IS 800:2007:-** General Construction in Steel (Third Revision).