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# STRUCTURAL DESIGN BASIS REPORT

**ANALYSIS AND DESIGN OF PROPOSED CONSTRUCTION OF STILT + 5 FLOORS (18.30M HEIGHT) RESIDENTIAL BUILDING WITH 5 DWELLING UNITS AT PLOT NO: 58 OF L A NO: 115/77, DOOR NO: 6 (OLD NO: 32), 1st MAIN ROAD, KARPAGAM GARDENS, BESANT AVENUE, ADAYAR, CHENNAI- 600020, COMPRISED IN S.NO.56/1, T.S.NO.2/20, BLOCK NO.20, OF URUR VILLAGE,VELACHERY TALUK CHENNAI DISTRICT WITH THE LIMITS OF GREATER CHENNAI CORPORATION ZONE: 13 DIVISION: 176.**

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SUBMITTED BY

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**Date: 20-09-2024**

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**Date:** 20-09-2024

## STRUCTURAL STABILITY CERTIFICATE

We certify that **ANALYSIS AND DESIGN OF PROPOSED CONSTRUCTION OF STILT + 5 FLOORS (18.30M HEIGHT) RESIDENTIAL BUILDING WITH 5 DWELLING UNITS AT PLOT NO: 58 OF L A NO: 115/77, DOOR NO: 6 (OLD NO: 32), 1st MAIN ROAD, KARPAGAM GARDENS, BESANT AVENUE, ADAYAR, CHENNAI- 600020, COMPRISED IN S.NO.56/1, T.S.NO.2/20, BLOCK NO.20, OF URUR VILLAGE, VELACHERY TALUK CHENNAI DISTRICT WITH THE LIMITS OF GREATER CHENNAI CORPORATION ZONE: 13 DIVISION: 176.** is designed by us is safe and stable against all possible Seismic Loads, Wind Load, Vibrations from Railway lines and Combination of loads as per IS Code, the structure is intended to carry.

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For Jays Civil TecDesign Private Limited

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# STRUCTURAL DESIGN BASIS REPORT

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## GENERAL PROJECT DETAILS

### 1)Structural Design Introduction:

The proposed structure is a residential project Building consists of Stilt floor + 5 Floors

In this brief report we are presenting the data and assumptions related to the project, which has lead to the conceptual design at this preliminary stage.

The document attempts to record all inputs assumed in design and will form the basis for all future detailed structural work.

The report most importantly clarifies the load criteria assumed in the design and it is therefore expected that all related consultants, including the architects, would go through the document and refer to it at every stage of detailed design. Recommendations or revisions on assumed parameters are requested at this stage.

Besides this the report will also form the outline of the design criteria and methods of both analysis and design to be adopted in this project with the aim of achieving a design that satisfies all sorts of seismic, and serviceability requirements.

### 2)List of References:

| | |
|---|---|
| IS 456-2000 | Plain and reinforced concrete-code of practice |
| IS 875 | Code Of practice for design loads for buildings and structures |
| Part 1: 1987 | dead loads- unit weights of building material and stored material |
| Part 2: 1987 | Imposed loads |
| Part 3: 2015 | Wind loads |
| IS 1893: 2016 | Criteria for earthquake resistant design of structures |
| IS 4326:2013 | Code of practice for earthquake resistant design and construction of buildings |
| IS 13920:2016 | Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces |

### 3)Material, Workmanship, Inspection and Testing:

The proposed structure consists of following mentioned main materials to be used during the construction.

#### 3.1 Concrete:

The concrete shall be in grades designated as per Table 2 IS 456-2000.

Recommended grades for the different members is as follows:

| | |
|---|---|
| Columns | M30 |
| Beams/Slabs | M30 |
| Retaining Walls | M30 |
| Water Tanks | M30 |
| Footing /Raft | M30 |

The mix proportions for the above-mentioned mixes shall be conforming to IS: 10262 -2009.

### 3.2 Durability of concrete

Structural elements below ground level and Exterior External faces of walls are designed for severe exposure condition and internal faces of walls, floor beams and slabs are designed for Mild exposure conditions per Table 16 of IS 456-2000.

The cover to the various structural elements is to be as follows,

| Structural Element | Clear Cover in mm |
|---|---|
| Footing | 50 |
| Columns | 40 |
| Beams | 25 |
| Slabs | 20 |
| Staircase waist slab | 30 |

### 3.3 Reinforcement:

The reinforcement shall be high strength deformed steel bars with yield strength of Fe 500.

### 3.4 Construction Joint

Construction joints and shrinkage strips will be planned with the contractor and only be used in locations pre-approved by consultants.

### 3.5 Fire Rating

Fire rating of 2 hours is considered for columns and 1.5 hours for beam and slabs.

## 4) Foundation system:

As per Geotechnical Investigation report, the allowable bearing pressures are as below:

| Building Type | SBC ($t/m^2$) | Depth(m) |
|---|---|---|
| Residential building | 12.5 | 2.1 m |

The Proposed Foundation is of Raft Foundation.

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## 5) General design considerations:

### 5.1 Method of Design

The aim of design is the achievement of an acceptable probability that structures being designed will perform satisfactorily during their intended life. With an appropriate degree of safety, they should sustain all the loads and deformations of normal construction and use and have adequate durability and adequate resistance to the effects of misuse and fire.

Structures and structural elements will be designed by Limit State Method. Due consideration will given to the accepted theories, experience and modern philosophy of design.

### 5.2Loads and Forces

In structural design, account is taken of the dead, imposed and wind loads and forces such as those caused by earthquake etc, where applicable.

### 5.2(a) Dead Loads

The dead loads are calculated on the basis of unit weights of materials given in IS 875 (Part 1). The data provided by consultant and other service consultants will be used for the specific materials/equipments.

Unless otherwise specified the unit weight of materials will be used as follows.

| | |
|---|---|
| Reinforced Concrete | 25 kN/cum |
| Plain concrete | 24 kN/cum |
| Steel | 78.5 kN/cum |
| Brickwork | 20kN/cum |
| Stone cladding | 25 kN/cum |
| Floor finishes | 20 kN/cum |

**Weight of Walls**:

For 230mm Thick wall with Brickwork–11.15 kN/m

For 115mm Thick wall with Brick work–5.6 kN/m

Note: For localized design of slabs, wall loading shall be applied as per actual arch dwg.

### 5.2(b) Wind Loads

Wind load for design of structures shall be based on the design wind speed arrived from IS: 875 (Part3)-2015.

The parameters for calculation of design wind speed as per IS: 875 (Part 3)-2015:

Basic wind speed, $V_b$ : 50 m/ sec.

Risk Coefficient, $K_1$ : 1(Table no.1), Clause no. 6.3.1

For design life of 50 years.

Terrain roughness & height factor, $K_2$ : 1.063 (Table no.2. Clause. 6.3.2.2)

Terrain category-2, Max.Height 18.3 m.

Topography factor, $K_3$ : 1.0 (upwind slope < 3 degree).

Importance factor, $K_4$ : 1 (Other structure) Clause. 6.3.4.

Design Wind Speed $V_z$ : $V_b \times K_1 \times K_2 \times K_3 \times K_4$.

: 50 X 1 x 1.063 x 1 x 1 = 53.15 m/sec.

Design Wind Pressure $P_z$ : $0.6 \times (53.15)^2 = 1694.95$ N/m²

The external & internal pressure coefficients shall be as per respective clauses of IS: 875 (Part 3)-2015.

**5.3 Load Combinations considered:**

The load combination indicated in IS: 875 (Part 5)-1987, IS 456 -2000 and IS: 1893 (Part 1) – 2016 will be adopted for the design of structural members. The load combination with corresponding load factor is indicated below.

1. 1.5DL+1.5LL
2. 1.5DL+1.5ELX
3. 1.5DL+1.5ELZ
4. 1.5DL+1.5EL-X
5. 1.5DL+1.5EL-Z
6. 0.9DL+1.5ELX
7. 0.9DL+1.5EL-X
8. 0.9DL+1.5ELZ
9. 0.9DL+1.5EL-Z
10. 1.2DL+1.2ELX+1.2LL
11. 1.2DL+1.2EL-X+1.2LL
12. 1.2DL+1.2ELZ+1.2LL
13. 1.2DL+1.2EL-Z+1.2LL
14. 1DL+1ELX
15. 1DL+1EL-X
16. 1DL+1ELZ
17. 1DL+1EL-Z
18. 1DL+1ELX+1LL
19. 1DL+1EL-X+1LL
20. 1DL+1ELZ+1LL
21. 1DL+1EL-Z+1LL
22. DL+LL
23. 1.5DL+1.5WLX
24. 1.5DL+1.5WL-X
25. 1.5DL+1.5WLZ
26. 1.5DL+1.5WL-Z
27. 0.9DL+1.5WLX
28. 0.9DL+1.5WL-X
29. 0.9DL+1.5WLZ
30. 0.9DL+1.5WL-Z
31. 1.2DL+1.2WLX+1.2LL
32. 1.2DL+1.2WL-X+1.2LL
33. 1.2DL+1.2WLZ+1.2LL
34. 1.2DL+1.2WL-Z+1.2LL
35. 1DL+1WLX
36. 1DL+1WL-X
37. 1DL+1WLZ
38. 1DL+1WL-Z

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39. 1DL+1WLX+1LL
40. 1DL+1WL-X+1LL
41. 1DL+1WLZ+1LL
42. 1DL+1WL-Z+1LL
43. 1DL+0.25LL

Where,

DL – Dead Load
LL – Live Load
EL – Earthquake Load
WL – Wind Load

**5.4 Software's for the Analysis & Design:**

1.Staad Connect Modeling and Analysis of Structure.

2. MS Excel 2016 General Design Calculations and Verification

## 6.0 Residential Building

### 6.1 Imposed Loads:

Imposed loads are assumed in accordance with IS 875 part 2.The table listed below is a summary of these loads.

**First Floor& Typical(1st TO 5th floor):**

| S.No. | Area Description | Floor Finish | Services | Live load | Super imposed dead load | Remark / comment |
|---|---|---|---|---|---|---|
| | | kN/sq.m | kN/sq.m | kN/sq.m | kN/sq.m | |
| 1 | Room(BHK, Study) | 2.0 | 0 | 2 | - | |
| 2 | Kitchen | 2.0 | 0 | 2 | 0 | |
| 3 | Utility & Service | 2.0 | - | 3 | 5 | |
| 4 | Staircase | 2.0 | 0 | 3 | 2 | |
| 5 | Balcony | 2.0 | 0 | 3 | 1.5 | |
| 6 | Toilet | 2.0 | 0 | 2 | 5 | |

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**Terrace Floor& Above:**

| Sr.No. | Area Description | Floor Finish | Services | Live load | Super imposed dead load | Remark / comment |
|---|---|---|---|---|---|---|
| | | kN/sq.m | kN/sq.m | kN/sq.m | kN/sq.m | |
| 1 | Terrace | 2.5 | - | 1.5 | - | |
| 2 | LMR | 0 | 0 | 1.5 | 10 | |
| 3 | OHT | 2 | 0 | - | 12 | |

**6.2 Structural Geometry:**

The structure consists of 6 slabs. The slabs with their description, levels, and heights are given in table below:

| Floor | Height |
|---|---|
| | m |
| Stilt Floor | 3.175 |
| Typical($1^{st}$ to $5^{th}$) | 3.023 |

The total height of building up to Terrace level is 18.3 m excluding parapet from Stilt Floor level.

**6.3 Seismic Analysis:**

The Proposed structure is designed for RC building with special moment resisting frame with R=5 as per IS 1893-2016. Floor slabs are considered as horizontal diaphragm transferring earthquake & wind loads to the RC frame.

**6.3 (i) General Principles and design criteria**

The structure is located in the seismic zone III. The design lateral force will calculated as per the method described in the following paragraphs. The structure is primarily column and beam framing system although due considerations will be given to the major suggestions/clauses from IS13920, The basic structure is Special Moment Resisting Frame as per table 9 (IS1893-2016).

**6.3 (ii) Design Spectrum**

Seismic Analysis (Initial analysis for preliminary column sizing)

The design Horizontal seismic coefficient for a structure

$$A_h = \frac{Z\ I\ S_a}{2\ R\ g}$$ IS 1893-2016 Clause 6.4.2

Where,

Z = Zone factor 0.16 for Zone III Table 2

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I = Importance Factor (1.00) Table 8

R = Response reduction factor = 5

For RC building with Special Moment Resisting Frame Table 9

Sa/g = Average Response acceleration coefficient

T = (0.09h / (d^0.5) Clause 7.6.2.c

Where,

T = Fundamental natural period

h = Height of the structure

d = Base dimension of the building at plinth lvl.

Design Seismic Base shear

$V_b = A_h W$

Where,

W = Seismic weight in KN

$A_h$ = Horizontal. Seismic coefficient value

## 7 Conclusions

**7.1 Other loads:** Any other loads like those of services, storage etc will be obtained from time to time from the relevant consultants and incorporated. The base slab of the lift shaft will be designed for lift loads as obtained from the manufacturer.

This DBR attempts to briefly cover all design related methods and assumptions at this stage of the project. As the project progresses certain revisions to the DBR might be warranted and such timely revisions of this report will be promptly provided by us.

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