



Your trusted partner for buying, selling, and managing property,
ensuring hassle-free service with 100% transparency.

3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai, India

hello@verified.realestate

+91 9996 12 9996

Official Property Record

Digitally Verified Record - Powered by Verified  RealEstate™





BURO ENGINEERS (I) PRIVATE LTD.,

Civil & Structural Consultants

New No.31, (Old No.14), Besant Avenue Road, Adyar, Chennai - 600 020, TN, India. Tel : 91 44 2491 2755

e-mail : buroindia@buroengineers.in, admin@buroengineers.in

CIN : U45201TN2005PTC055334

A. PERAMAIYAN (M.E. Struct., M.I.E.,)
Registered Structural Engineer,
Chennai Metropolitan Development Authority,
Registration No.SE/GR-I/19/03/026.
New No. 31/Old No. 14, Besant Avenue Road,
Adyar, Chennai – 600 020.

E-mail: peram@buroengineers.in
Mobile: +91 9962545630

STABILITY CERTIFICATE

(To be furnished while filing application for registration of building)

The detailed engineering and structure design of the proposed building comprising of AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART)/GROUND FLOOR (PART) + 14 UPPER FLOORS + ROOF STRUCTURE HAVING HEIGHT OF 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2(part) CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK WITHIN THE LIMIT OF GREATER CHENNAI CORPORATION, has been done by me/us based on the report of geotechnical investigation (soil test) done by M/s. Geo Engineering Consultant, Chennai vide Soil Investigation Report No. GEC-JC-GT-6073/2024-2025 dated 18th October, 2024 and considering the functional requirement of the building.

2. It is certified that among other factors, the proposed building has been designed to resist earthquake. I/We have checked various parameters and found that the proposed building would be safe.

3. I/We further certify that:

(i) The minimum grade of concrete is M35.

(ii) The design and analysis has been done using the code of practice for plain and reinforced concrete as per IS 456, design loads as per IS Codes No. IS 875 Part 1 to 2, wind forces as per IS 875-2015 (Part3) and design of earthquake resistant structure as per IS Code No. IS 1893-2016.

4. The building will be safe and sound when used for the purpose for which it is designed.

Date : 13-06-2025

Place : Chennai-600 020

Encl.: Structural Design Calculation

Stamp and Signature

A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630



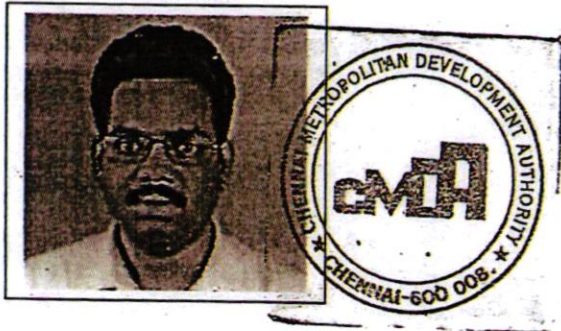
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
'ThalamuthuNatarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the Thiru. A. PERAMAIYAN has enrolled as Registered Structural Engineer Grade-I (SE) with Chennai Metropolitan Development Authority (CMDA) who has the qualification of M.E.,(Structural Engg.) and experience in the relevant field for 17years.

He has been given the Registration No. SE/GR-I/2019/03/026 Renewed on 22.03.2024. He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part-V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O.(Ms) No.18 MAWS (MA1) Dept. dated 04.02.2019.

This Registration is valid upto 21.03.2029.




(A. MEGANATHAN)
Superintendent


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI-600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 9962545630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

STRUCTURAL DESIGN BASIS REPORT

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK WITHIN THE LIMIT OF GREATER CHENNAI CORPORATION.

CLIENT:

M/S AMARA HOMES,
CHENNAI.

ARCHITECT:

DK DESIGNS,
VIRUGAMBAKKAM, CHENNAI.

**STRUCTURAL
CONSULTANT:**

BURO ENGINEERS (I) PVT LTD,
CHENNAI.

AP
A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-1/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99623 45630

R0	11-04-2025	Design Basis Report	OKAY	PRAGATHEESWARAN	PERAM	PERAM
REV NO.	DATE	DESCRIPTION	STATUS	PREPARED BY	REVIEWED BY	APPRVD. BY

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

Index

- ◆ □ Design Information and criteria
- ◆ □ 3D Model & Analysis summary report
- ◆ □ Design of Pile cap
- ◆ □ Design of Column
- ◆ □ Design of Wall
- ◆ □ Design of Beam
- ◆ □ Design of Slab
- ◆ □ Structural Drawings

A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF
RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

DESIGN INFORMATION AND CRITERIA

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF
RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

1.0 INTRODUCTION

M/s. Amara Homes, proposed to construct a Residential building at T.Nagar, Chennai within the limits of Greater Chennai Corporation. Architecturally it is designed with Single Basement + Stilt + 14 Upper Floors + Roof. In which the Basement and Stilt are designed to facilitate car parking. All other floors are designed for Residential use.

1.1 Scope of the Report

This report provides the information on Codes of Practice, Design loads, Materials considered for the Design and Analysis of the building. In addition, this report summaries the main design criteria, Structural system, Foundation system, Parameters & Methodology to be adopted in the design.

1.2 Project Overview

The proposed development is a Multi-storied High Rise Residential Apartment building comprises of Single Basement + Stilt floor + 14 Upper Floors + Roof. Plan dimension of the building at the Basement level is 35.54mx47.20m whereas above ground it is 14.13x26.05. Vertical access systems like Lift & Staircases are provided adequately & at the right location in order to fulfil the NBC norms and to satisfy the functional requirements as well. The building height & its storey details are as follows,

Sl.No.	No. Of Storey	Building Height	Plan dimension at Basement/Typical floor Level	Remarks
1	One Basement + Stilt (Parking) + 14 Upper Floors + Roof	48.0m (measuring from Stilt floor to Terrace)	35.54mx47.20m 14.13mx26.05m	With covered car parking

Building Floor Height Details	Single Basement + Stilt + 14floors + Roof
Basement (Car Parking)	3.50m
Stilt Floor (Car Parking)	3.10m
1 st Floor to 14 th Floors	3.10m
Head Room	3.00m
LMR	1.50m(from Terrace floor)

A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

1.3 Proposed Structures and its Usage.

1.3.1 Structural Type

The building structures are mainly cast in situ reinforced concrete structure. The structural system comprises of R.C walls/Columns as vertical supporting structural elements with RC conventional Beam-slab system. Foundation is designed with Bored Cast In-situ Pile foundation as per sub-soil condition.

1.3.2 Foundation Type

The foundation system For the kind of proposed structure and the sub soil conditions, it is not possible to adopt any kind of open foundation system from both shear and settlement considerations. Hence, it is advisable to adopt deep pile foundation system.

The Foundation will be designed for the recommended Working compression Capacity as laid down in the Soil Investigation report No. GEC-JC-GT-6073/2024-2025 dated 18-10-2024, is carried out by M/s. Geo Engineering Consultants situated at # 15, 2ndFloor, Murphy Das Street, Dr.Seethapathy Nagar, Velachery, Chennai.

1.4 Concrete

Characteristic concrete strength (concrete grade) for the project shall be based on exposure condition and forces to be supported by specified structural elements. The minimum cement content and maximum water-cement ratio shall be as per IS code 456:2000. The minimum 28-day compressive strength of concrete for specified structural elements shall be as follows

Table 1.4.1 Grade of Concrete for Individual Structural elements of Tower/Non-Tower areas

Sl.No.	Structural Elements	Grade of Concrete
1.	Pile	M35
2.	Pile Cap	M35
3.	RC Shear wall	M50
4.	RC Columns	M50
5.	RC Beams	M35
6.	RC Slabs	M35
7.	Basement Slab & Basement RC Walls	M35
8.	PT Beams	M35

Table 1.4.2 Concrete Properties

Young's Modulus of Elasticity of Concrete	$5000\sqrt{f_{ck}}$
Poisson Ratio's Ratio $\nu =$	0.2
Coefficient of Thermal expansion	5.5×10^{-6}


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 93625 49 31

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

1.4.3 Reinforcement

The characteristic tensile properties of steel used in design shall be as follows.

Reinforcement Characteristic yield strength f_{yk} (N/mm²)	550 N/mm²
Welded Steel Fabric yield strength $f_{0.2k}$ (N/mm ²)	485 N/mm ²
Young's Modulus E (kN/mm ²)	200 kN/mm ²
Poisson's ratio	0.3
Coefficient of Thermal expansion, α (°C ⁻¹)	12x10 ⁻⁶

1.4.4 Structural steel

All structural steel shall conform to Indian standard IS: 2062-2011.

Structural steel	Grade E=250	Grade E-350
Tensile strength	410 N/mm ²	490 N/mm ²
Yield stress $t < 20\text{mm}$	250 N/mm ²	350 N/mm ²
Yield stress $t = 20\text{mm to } 40\text{mm}$	240 N/mm ²	330 N/mm ²
Yield stress $t > 40\text{mm}$	230 N/mm ²	320 N/mm ²
Young's Modulus (E)	200,000 N/mm ²	200,000 N/mm ²
Density	78.5 kN/m ³	78.5 kN/m ³

1.5 SUB-SOIL CONDITION

Soil Investigation report no. GEC-JC-GT-6073/2024-2025 dated 18-10-2024 was carried out by M/s. Geo Engineering Consultants, Chennai. Field investigation carried out for Four (4) boreholes to ascertain subsoil condition in the proposed site. All four Bore holes are terminated at 20m to 21.50m below ground level where Completely Weathered Rock descended from Charnockite formation encountered with a N value >100. During the time of soil investigation (Oct 2024), the water table is met at 1.20m from EGL.

Taking the recommendation given by the soil consultant in to consideration, the building is designed with deep pile foundation system i.e. Bored Cast in situ piles are recommended as the suitable foundation system.

As per the evaluation reported by the geotechnical consultant the sub-soil in the project site is not susceptibility to "Liquefaction".

Refer the soil report for detailed profile of boreholes and the sub soil conditions.


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 Email: peram@buroengineers.in
 +91 99635 11111

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

2.0 DESIGN CRITERIA

2.1 DESIGN LIFE

The design life of the building is assumed as 50 years. This requirement is applicable only for concrete works and not applicable to replaceable finishing materials, water proofing and thermal insulation, facades etc. Hence periodic maintenance/refurbishment is required for all replaceable materials.

2.2 CODES, STANDARDS & REFERENCES

All design of structures shall comply with the requirements specified in the following.

- Relevant Indian Standard Codes of Practice
- National Building Code.
- Local Building regulations.
- Other relevant International codes where required.

All applicable latest editions of codes and standards will be referred and adopted in the analysis of structures and the design and detailing of structural members. All structural elements design shall be carried out primarily based on Indian Standards and Codes with latest revision, with amendments if any, as on date. In addition, other international codes and standards shall also be referred when required and relevant.

In the analysis, design and detailing of the building, the following Indian Standard codes of latest amendment will be used.

Table 2.2.1 Codes and Standards for Design Loads (Other Than Earthquake loads)

IS Code	Description
IS 875 (Part 1): 1987	Dead Loads (Unit Weight of Building Material and Stored Material)
IS 875 (Part 2): 1987	Imposed Load
IS 875 (Part 3): 2015	Wind Load
IS 875 (Part 5): 1987	Special Loads and Combinations

Table 2.2.2 Codes and Standards for Design of Earthquake Resistance structures

IS Code	Description
IS 1893(Part-1) :2016	Criteria for Earthquake Resistance design of structures.
IS 4326: 1993	Earthquake Resistant Design and Construction of Buildings – Code of Practice
IS 13920: 2016	Ductile Detailing of Reinforced Concrete Structures subject to Seismic Forces - Code of Practice.

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

Table 2.2.3 Codes and Standards for Design of Concrete Structures

IS Code	Description
IS 456: 2000	Plain and Reinforced Concrete - Code of practice
IS 6403 -1981	Code of practice for determination of bearing capacities of shallow foundations.
IS 8009-1976 (Part I):	Code of practice for calculation of settlement of foundations – Shallow foundation
IS 1904-1986(RA-2015)	Indian Standard Code of practice for design & construction foundations in Soil: General Requirements
IS 2950-1981(RA-2018)	Code of practice for design and construction of raft foundations : Part 1 Design (second revision).
IS 1080-1985(Raf.2011)	Code of Practice for Design and Construction of Shallow foundation in Soils
IS 6403-1981(Raf.2011)	Code of practice for determination of bearing capacity of Shallow foundations
IS 2950-1981(Raf.2011)	Code of Practice for Design and Construction of Raft foundations
SP 16	Structural use of concrete, Design charts for singly reinforced beams, doubly reinforced beams and columns.
SP 34	Hand book on Concrete Reinforcement & Detailing
SP 7(Part IV)	National Building code of India
IS 1786-2008(RA-2018)	Specification for high strength deformed bars and wires for concrete Reinforcement.
IS 432 (Part 2) 1982	Specification for Mild Steel and Medium Tensile Steel Bars and Hard Drawn Steel Wire for concrete reinforcement – Hard Drawn Steel Wire
IS 3370 (part I)-2009	Code of practice for concrete structure for the storage of liquids

The building is a RCC structure designed with Structural wall System. The slabs of all floor is used as diaphragms in redistribution of lateral forces.

Materials specified will conform to the latest edition of the relevant Indian Standard or other accepted standard. Specifications for materials will include sampling and testing as stipulated in the design standards. Detailed material specifications will be included in the Technical Specification.

2.3 LOADS

Table A: Unit Weight of Materials:

Material	Density
Reinforced Cement Concrete	25.00 kN/m ³
Plain Cement Concrete	24.00 kN/m ³
Screed Concrete	24.00 kN/m ³
Cement Mortar	20.00 kN/m ³


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

Solid Block	20.00 kN/m³
Structural Steel	78.50 kN/m ³
Cinder Concrete (Filling material)	08.00 kN/m ³
Dry soil	18.00 kN/m ³
Wet Soil	22.00 kN/m ³
Landscape soil	16.00 kN/m ³
Glass	28.00 kN/m ³
water	10.00 kN/m ³

2.3.1 Superimposed Dead Loads and Live Loads

The following are the imposed loads such as SDL and LL to be considered for the design of floor system depending usage floor. In addition to these loads, self-weight of structural elements will be considered depending on member sizes shown in the floor plans.

Basement +Stilt Floor (Parking)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes	2.4	0.0
Services load (ceiling)	0.0	0.0
Live Load Parking	0.0	3.0
Partition Load	0.0	0.0
Total	2.4	3.0
Stilt Floor (Electrical Room/Pump Room)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes	1.8	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	7.5
Partition/Filling Load	0.0	0.0
Total	1.8	7.5
Stilt Floor (Fire Vehicle Movement)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes	6.0	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	15.0
Partition/Filling Load	0.0	0.0
Total	6.0	15.0
Stilt Floor (Lobby)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes	1.8	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	3.0

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF
RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

Partition/Filling Load	0.0	0.0
Total	1.8	3.0
First Floor (1st Floor) to (14th floor) (Living/Bedroom/Dining/Kitchen)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes	1.8	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	2.0
Partition/Filling Load	0.0	0.0
Total	1.8	2.0
First Floor (1st Floor) to (14th floor) (Toilet)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes + Filling Load	3.8	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	2.0
Partition Load	0.0	0.0
Total	3.8	2.0
First Floor (1st Floor) to (14th floor) (Corridor/Lobby)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes	1.8	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	3.0
Partition Load	0.0	0.0
Total	1.8	3.0
First Floor (1st Floor) to (14th floor) (Servant Room)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes + Filling Load	1.8	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	2.0
Partition Load	0.0	0.0
Total	1.8	2.0
First Floor (1st Floor) to (14th floor) (Balcony)		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes + Filling Load	4.8	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	3.0
Partition Load	0.0	0.0
Total	4.8	3.0
Roof		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes (weathering courses)	3.0	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	3.0


A. PERAMAYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

Partition Load	0.0	0.0
Total	3.0	3.0
OHT/LMR		
	SDL (kN/Sq.mt.)	LL (kN/Sq.mt.)
Finishes	3.0	0.0
Services load (ceiling)	0.0	0.0
Live Load	0.0	20.0
Partition Load	0.0	0.0
Total	3.0	20.0

In the analysis and design reduction to imposed load (Live load) shall be considered as per IS 875 Part (2), clause.3.2 where it is applicable.

2.4 WIND LOAD

Design wind load for the buildings shall be estimated as per IS 875 (Part 3): 2015. Design wind speed (V_z) is based on such as location, basic wind speed, terrain, cyclone condition and topography.

Location of the building	Chennai
Basic Wind speed - V_b m/sec	50 m/sec
Risk Coefficient (Probability factor) - k_1	1.0
Terrain factor (Terrain-2) - k_2 for the height of 48.0m	1.17
Topography factor - k_3	1.0
Importance factor (Cyclonic region) - k_4	1.0

Design wind speed (V_z) = $V_b * k_1 * k_2 * k_3 * k_4 = 50 \times 1.0 \times 1.17 \times 1.0 \times 1.0 = 58.50 \text{ m/sec}$

Wind pressure (P_z) = $0.6 V_z^2 = 0.6 \times 58.50^2 = 2053.35 \text{ N/m}^2$

For design of building wind pressure 2.05 kN/m^2 is considered.

Design wind pressure (P_d) = $K_d * K_a * K_c * P_z$

Where K_d - Wind Directionality factor = 1.0

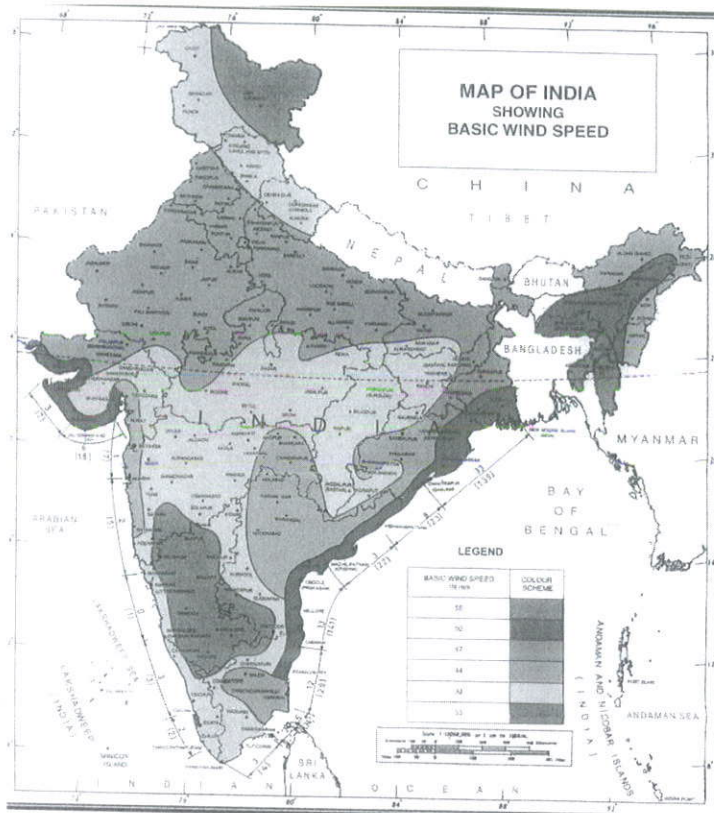
K_a - Area averaging factor = 0.9

K_c - Combination factor = 0.9

Design Wind pressure = $2.05 \times 1.0 \times 0.9 \times 0.9 = 1.66 \text{ kN/m}^2$


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK



2.5 SEISMIC LOAD

Design of lateral force under seismic condition shall be as per IS1893 – 2016. Total lateral force (base shear) of the building shall be estimated as per clause 7.2.1 of IS1893 – 2016 which provides by

$$\text{Base shear } V_b = A_h W$$

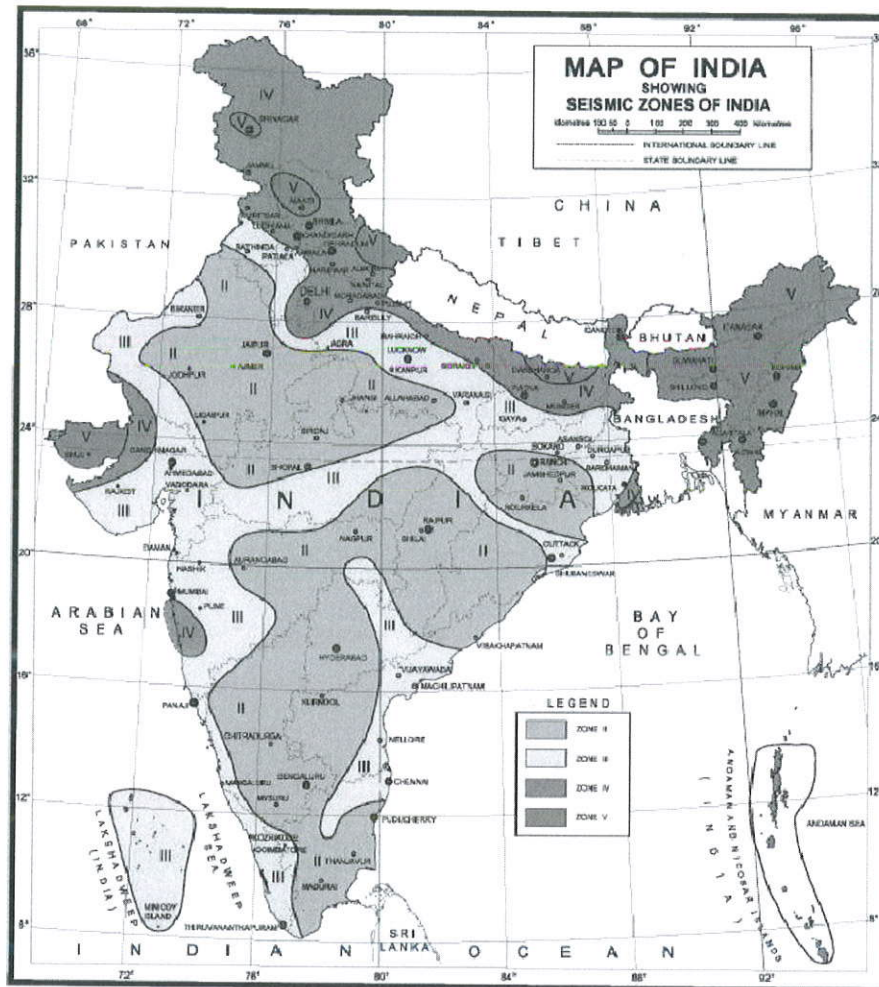
A_h is horizontal seismic coefficient and W is seismic weight of the building, Horizontal seismic coefficient depends on location of the building (Zone factor Z), usage of the building (Importance factor, I), building lateral resisting system (Response reduction factor, R) and design acceleration coefficient (S_a / g) which is based on subsoil condition and fundamental natural period (T_a).

For the proposed development is for residential use. Considering it, the seismic weight is summation of total dead load and 25% of live load where live load is less than 3 kN/sq.m. The fundamental natural period (T_a) for building

$$T_a = 0.09h/(d)^{0.5}$$

Where h - height of the building & d – width of the building under consideration of earthquake.

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK



2.5.1 Design Parameters for estimation of seismic loading

Sl.No.	Description	Parameters as per IS-1893-2016
1.	Location - Chennai	Seismic zone III
2.	Seismic Zone Factor	0.16
3.	Response Reduction Factor: Structural Wall System	4.0
4.	Importance factor	1.2
5.	Type of Soil (Medium)	Type II
6.	Damping coefficient	5%

A. PERAMAYAN, M.E., (Struct), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

2.5.2 Base Shear

Height of the building (h) (measured from Stilt floor)
d (along the length of the building)
b (along the breadth of the building)

a) Ta (along x) = Refer - 2.6.2

b) Ta (along y) = Refer - 2.6.2

From IS 1893: 2002, Clause 6.4.2, Design horizontal seismic coefficient

$$Ah = \frac{Z}{2} \times \frac{I}{R} \times \frac{Sa}{g}$$

Where,

Z for Zone III = 0.16

I for Residential Building = 1.2 (Refer to IS 1893-2016, Table.9)

R for Structural wall system = 4.0 as per (Table 9)

Sa/g (For Rocky) x direction = (Refer to IS 1893-2016, page 13, Fig 1)

Sa/g (For Rocky) y direction = (Refer to IS 1893-2016, page 13, Fig 1)

Design horizontal seismic coefficient and base shear

X- direction $V_{bx} = Ah_x * W$

Y- direction $V_{by} = Ah_y * W$

2.5.3 Dynamic Analysis

Response spectrum method of Dynamic Analysis carried out with following parameters pertaining to dynamic analysis.

Time period : Calculated with the assumption of wall system

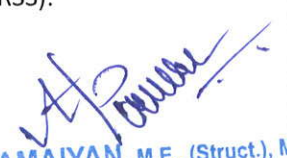
Number of modes Considered : 12 Numbers (Min)

Modal Combination Method Used : Complete Quadratic combination (CQC).

Spatial Combination Method used : Square root of the sum of Square (SRSS).

Modal case type : Ritz Method.

Orthogonal directional seismic effect : Not applicable.


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-1/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

3.0 Structural Analysis and design

3.1 Assumptions considered in the design

The assumptions for structural analysis and design are as below

- Elastic analysis (plane remains plane).
- Structure shall be analysed for the most adverse load conditions and envelope of forces shall be designed for.
- Cracked section properties of structural RC structural elements are used in the analysis as per IS 16700-2017, clause 7.2, Table 6.

3.2 Concrete Cover

Concrete cover to the reinforcement in structural elements is based on durability and fire rating. The fire rating of 2hrs is considered for structural elements for the commercial development.

Sl. No.	Structural Elements	Cover in mm
1.	Pile/Pile Cap	75
2.	RC Wall	30
3.	Column	40
4.	Beams	30
5.	Slabs	25
6.	UG Tank Base Slab/Wall	40

3.3 Method for analysis

Computer-aided analysis using finite element method (FEM) shall be carried out for the design of structural elements. For 3D or 2D structural frame analysis latest version of software ETABS, SAFE shall be used, Prokon, RCDC and verified in-house spread sheets will be used for the design of reinforced concrete (RC) and steel elements in consideration of flexure, shear and axial forces.

3.4 Assumptions for 3D model analysis using ETABS

Column:	Frame Element
RC Wall:	Wall (Shell) Element
Beam Element:	Frame Element
Slab:	membrane Element

The following are general parameters adopted in the analysis and design,

Modulus of Elasticity of Concrete -5000Vfck

Consideration of Diaphragm - Rigid Diaphragm.

Slab element considered as membrane element


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

Stiffness modification factors are adopted in the analysis as per IS -16700-2017, Table.6.

Table 6 Cracked RC Section Properties
(Clause 7.2)

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	$1.0 A_g$	$0.9 I_g$	$1.00 A_g$	$0.70 I_g$

The following parameters and methods are adopted in creating ETABS 3D model for the buildings and design of structural elements.

- The 3D ETABS model generated based on the preliminary floor plans (shuttering drawings) prepared using preliminary sizes.
- Sectional properties are assigned to all the structural elements as per the preliminary floor plans (shuttering drawings).
- External & Internal in fill wall loads are assigned as uniformly distributed line load on beams and as area load if the wall is intend to distribute on slab directly. These loads are assigned under SIDL type load case.
- Slabs are modelled as shell element if floor system is Flat slab and the slab has been modelled as membrane in Beam-slab as floor system and slabs are assigned with horizontal diaphragms.
- Live Load reduction is considered in the design of Foundation and Column as per the Code: IS 875-1987 (Part-II), clause.3.2.1.
- Area design load i.e. Live load/SIDL or any other load is applied at floor relevant to its usage.
- All lateral loads & parameters are assigned as per Codes IS 1893-2016 & IS 875-2015.
- Temperature loads are applied on to the terraces and to areas directly exposed to sun.
- Beams under Torsion is required to maintain Equilibrium will be designed for Torsion in accordance with IS 456-2000, clause 41.1 to 41.4 and for all other beams torsional stiffness is neglected in the analysis by applying stiffness modifier as 0.0001 to torsional constant "J". Hence no specific design for Torsion is required for these beams.
- Chennai falls under zone-III. Hence ductile detailing is followed in the design and detailing of structural elements.
- Concrete cover to reinforcement complied accordance with IS 456-2000, Tabl.16 & 16A.
- UG Sump is designed for the crack width of 0.2mm.
- Secondary beams are not designed for ductile detailing.

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

- Long term deflections are checked by manual calculation using excel spread sheet wherever necessary. Crack width calculation will be done using spread sheet wherever necessary.

Area Load & Application: Applied as uniformly distributed area load with intensity proportionate to its usage as mentioned in the Loading items in the DBR.

Line (Wall) Load & Application: non load bearing or infill wall loads are calculated appropriately and Applied as uniformly distributed line load.

Lateral Load Resisting Systems: The proposed structure is a Structural RC wall with Beam-slab system.

4.0 LOAD COMBINATIONS

The various loads shall be combined in accordance with the stipulations in IS 875 (Part 5) 1987 and IS 456: 2000. The structure will be checked for serviceability Limit State and Ultimate Limit State (Limit State of Collapse) conditions. The load factors to be used for the load combinations are shown in the Table below. The structural elements shall be designed and checked for the critical forces from the combinations.

Load Combination	LOAD FACTORS								
	D.L.	I.L.	T.L.	EQX	EQY	SPECX	SPECY	WX	WY
Limit State Of Serviceability (LSS) Combinations									
LC1	1.0	-	1.0	-	-	-	-	-	-
LC2	1.0	1.0	1.0	-	-	-	-	-	-
LC3	1.0	-	1.0	1.0	-	-	-	-	-
LC4	1.0	-	1.0	-1.0	-	-	-	-	-
LC5	1.0	-	1.0	-	1.0	-	-	-	-
LC6	1.0	-	1.0	-	-1.0	-	-	-	-
LC7	1.0	-	1.0	-	-	-	-	1.0	-
LC8	1.0	-	1.0	-	-	-	-	-1.0	-
LC9	1.0	-	1.0	-	-	-	-	-	1.0
LC10	1.0	-	1.0	-	-	-	-	-	-1.0
LC11	1.0	-	1.0	-	-	1.0	-	-	-
LC12	1.0	-	1.0	-	-	-1.0	-	-	-
LC13	1.0	-	1.0	-	-	-	1.0	-	-
LC14	1.0	-	1.0	-	-	-	-1.0	-	-
LC15	1.0	0.8	1.0	0.8	-	-	-	-	-
LC16	1.0	0.8	1.0	-0.8	-	-	-	-	-
LC17	1.0	0.8	1.0	-	0.8	-	-	-	-
LC18	1.0	0.8	1.0	-	-0.8	-	-	-	-
LC19	1.0	0.8	1.0	-	-	-	-	0.8	-
LC20	1.0	0.8	1.0	-	-	-	-	-0.8	-
LC21	1.0	0.8	1.0	-	-	-	-	-	0.8
LC22	1.0	0.8	1.0	-	-	-	-	-	-0.8

BURO ENGINEERS (I) PVT LTD

A. PERAMAKAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

LC23	1.0	0.8	1.0	-	-	0.8	-	-	-
LC24	1.0	0.8	1.0	-	-	-0.8	-	-	-
LC25	1.0	0.8	1.0	-	-	-	0.8	-	-
LC26	1.0	0.8	1.0	-	-	-	-0.8	-	-
Limit State Of Collapse (LSC) Combinations									
COMB1	1.5	-	1.0	-	-	-	-	-	-
COMB2	1.5	1.5	1.0	-	-	-	-	-	-
COMB3	1.2	1.2	1.0	1.2	-	-	-	-	-
COMB4	1.2	1.2	1.0	-1.2	-	-	-	-	-
COMB5	1.2	1.2	1.0	-	1.2	-	-	-	-
COMB6	1.2	1.2	1.0	-	-1.2	-	-	-	-
COMB7	1.2	1.2	1.0	-	-	-	-	1.2	-
COMB8	1.2	1.2	1.0	-	-	-	-	-1.2	-
COMB9	1.2	1.2	1.0	-	-	-	-	-	1.2
COMB10	1.2	1.2	1.0	-	-	-	-	-	-1.2
COMB11	1.2	1.2	1.0	-	-	1.2	-	-	-
COMB12	1.2	1.2	1.0	-	-	-1.2	-	-	-
COMB13	1.2	1.2	1.0	-	-	-	1.2	-	-
COMB14	1.2	1.2	1.0	-	-	-	-1.2	-	-
COMB15	1.5	-	1.0	1.5	-	-	-	-	-
COMB16	1.5	-	1.0	-1.5	-	-	-	-	-
COMB17	1.5	-	1.0	-	1.5	-	-	-	-
COMB18	1.5	-	1.0	-	-1.5	-	-	-	-
COMB19	1.5	-	1.0	-	-	-	-	1.5	-
COMB20	1.5	-	1.0	-	-	-	-	-1.5	-
COMB21	1.5	-	1.0	-	-	-	-	-	1.5
COMB22	1.5	-	1.0	-	-	-	-	-	-1.5
COMB23	1.5	-	1.0	-	-	1.5	-	-	-
COMB24	1.5	-	1.0	-	-	-1.5	-	-	-
COMB25	1.5	-	1.0	-	-	-	1.5	-	-
COMB26	1.5	-	1.0	-	-	-	-1.5	-	-
COMB27	0.9	-	1.0	1.5	-	-	-	-	-
COMB28	0.9	-	1.0	-1.5	-	-	-	-	-
COMB29	0.9	-	1.0	-	1.5	-	-	-	-
COMB30	0.9	-	1.0	-	-1.5	-	-	-	-
COMB31	0.9	-	1.0	-	-	-	-	1.5	-
COMB32	0.9	-	1.0	-	-	-	-	-1.5	-
COMB33	0.9	-	1.0	-	-	-	-	-	1.5
COMB34	0.9	-	1.0	-	-	-	-	-	-1.5
COMB35	0.9	-	1.0	-	-	1.5	-	-	-
COMB36	0.9	-	1.0	-	-	-1.5	-	-	-
COMB37	0.9	-	1.0	-	-	-	1.5	-	-
COMB38	0.9	-	1.0	-	-	-	-	-	-

BURO ENGINEERS (I) PVT LTD

A. PERAMATHAN, M.E., (Struct.), M.T.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-1/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

5.0 ACCEPTANCE CRITERIA

Under Serviceability Limit State the limiting structural deflection shall be as follows.

Total deflection under all imposed loads including temperature, creep and shrinkage shall not exceed **L/250**.

In the above limiting value, the deflection contribution due to temperature, creep and shrinkage shall not be more than **L/350**.

Lateral deflection (sway) due to wind shall not exceed **H/500 (0.002 H)** where H is the height of the building above ground.

5.1 Crack width Limits

The Limiting values of crack width as per clause 35.3 of IS: 456-2000 is followed in the design

- In general, for slabs crack width is limited to 0.3mm.
- For water retaining structures, sump slab crack width is limited to 0.2mm

6.0 Design of Structural Elements and Foundation

6.1. Pile Foundation

The load intensity of column is moderate and it is proportionate to the no. of stories. Bored Cast In-situ Pile Foundation is designed taking the sub-soil condition reported in the soil investigation report report no. GEC-JC-GT-6073/2024-2025 dated 18-10-2024, was carried out by M/s. Geo Engineering Consultants, Chennai. The working compression capacity used as 100t, 145t & 260t for Pile diameters of 500mm, 600mm & 800mm respectively. The expected pile length shall be 20m from EGL and it is to be around 18.5m to 19m (approx).

6.2. RC Walls/Column

RC walls/Columns which are supporting both vertical loads and lateral forces are designed for the most adverse load conditions and envelope of the forces which will be the maximum for that structural element from the load combinations considered in the 3D analysis. The design of structural elements are designed in ETABS for the maximum forces obtained from the load combinations. As the buildings are located in Zone III, ductile design & detailing is followed in the design & detailing.

6.3. Beams

Each Beam will be designed for maximum forces from the 3D analysis using ETABS or RCDC concrete design software shall be used to design of RC members. Also, the detailing shall be followed as per SP-34 & IS-456 etc.

A. PERAMATHAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

6.4. Slabs

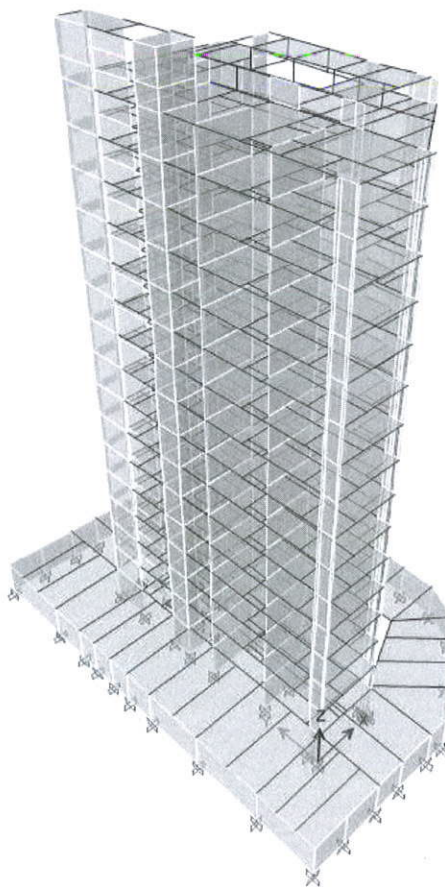
Slabs are designed using SAFE 20 for irregular shaped slabs and regular slabs are designed using in house spread sheet formed as per IS-456 Annexe-D, Table-26.


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF
RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

3D MODEL
&
ANALYSIS SUMMARY REPORT

ETABS[®]



A. Peramayan
A. PERAMAYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-1/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

Table of Contents

1. Structure Data	5
1.1 Story Data	5
2. Properties	6
2.1 Frame Sections	6
2.2 Shell Sections	8
3. Loads	9
3.1 Load Patterns	9
3.2 Load Sets	9
3.3 Auto Wind Loading	10
3.4 Auto Seismic Loading	14
3.5 Functions	19
3.5.1 Response Spectrum Functions	19
3.6 Load Cases	19
4. Analysis Results	21
4.1 Story Results	21
4.2 Modal Results	22


A. PERAMAYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

List of Figures

Figure 3-1 Set 1	16
Figure 3-2 Set 1	18


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

List of Tables

Table 1.1 Story Definitions	5
Table 2.1 Frame Section Property Definitions - Summary	6
Table 2.2 Area Section Property Definitions - Summary	8
Table 3.1 Load Pattern Definitions	9
Table 3.2 Shell Uniform Load Sets	9
Table 3.3 Load Pattern Definitions - Auto Wind - Indian IS 875 2015	10
Table 3.4 Load Pattern Definitions - Auto Seismic - IS 1893 2016	14
Table 3.5 Functions - Response Spectrum - IS1893 2016	19
Table 3.6 Functions - Response Spectrum - User Defined	19
Table 3.7 Load Case Definitions - Summary	19
Table 4.1 Story Stiffness	21
Table 4.2 Modal Participating Mass Ratios	22


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

1.1 Story Data

Table 1.1 - Story Definitions

Tower	Name	Height m	Master Story	Similar To	Splice Story	Splice Height m	Color
T1	LMR	3	Yes	None	No		Yellow
T1	HEAD ROOM	2.4	Yes	None	No		Yellow
T1	SWIMMING POOL TOP LVL	1.5	Yes	None	No		Yellow
T1	ROOF	3.1	No	None	No		Yellow
T1	14TH	3.1	No	2ND	No		Yellow
T1	13TH	3.1	No	2ND	No		Yellow
T1	12TH	3.1	No	2ND	No		Yellow
T1	11TH	3.1	No	2ND	No		Yellow
T1	10TH	3.1	No	2ND	No		Yellow
T1	9TH	3.1	No	2ND	No		Yellow
T1	8TH	3.1	No	2ND	No		Yellow
T1	7TH	3.1	No	2ND	No		Yellow
T1	6TH	3.1	No	2ND	No		Yellow
T1	5TH	3.1	No	2ND	No		Yellow
T1	4TH	3.1	No	2ND	No		Yellow
T1	3RD	3.1	No	2ND	No		Yellow
T1	2ND	3.1	Yes	None	No		Gray8Dark
T1	1ST	3.1	No	None	No		Blue
T1	STILT	3.5	No	None	No		Green

A. Peramaiyan
A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

2 Properties

This chapter provides property information for materials, frame sections, shell sections, and links.

2.1 Frame Sections

Table 2.1 - Frame Section Property Definitions - Summary (Part 1 of 4)

Name	Material	Shape	Color	Area cm ²	J cm ⁴	I33 cm ⁴	I22 cm ⁴	I23 cm ⁴	IMajor cm ⁴
B 200X375	M35	Concrete Rectangular	Gray8Dark	750	66626.5	87890.6	25000	0	
B 200X450	M35	Concrete Rectangular	Yellow	900	86509.3	151875	30000	0	
B 200X500	M35	Concrete Rectangular	Yellow	1000	99805	208333.3	33333.3	0	
B 200X600	M35	Concrete Rectangular	Magenta	1200	126434.6	360000	40000	0	
B 200X625	M35	Concrete Rectangular	Blue	1250	133096	406901	41666.7	0	
B 200X750	M35	Concrete Rectangular	Magenta	1500	166414.2	703125	50000	0	
B 200X900	M35	Concrete Rectangular	Green	1800	206406.8	1215000	60000	0	
B 200X950	M35	Concrete Rectangular	Blue	1900	219738.8	1428958.3	63333.3	0	
B 250X375	M35	Concrete Rectangular	Green	937.5	114928.3	109863.3	48828.1	0	
B 300X500	M35	Concrete Rectangular	Yellow	1500	281737.1	312500	112500	0	
B 300X600	M35	Concrete Rectangular	Gray8Dark	1800	370785.9	540000	135000	0	
B 300X750	M35	Concrete Rectangular	Cyan	2250	505262.9	1054687.5	168750	0	
B 300X900	M35	Concrete Rectangular	Cyan	2700	640075	1822500	202500	0	
B 400X900	M35	Concrete Rectangular	Cyan	3600	1385537.3	2430000	480000	0	
B 450X375	M35	Concrete Rectangular	Gray8Dark	1687.5	392421.7	197753.9	284765.6	0	
B 450X500	M35	Concrete Rectangular	Cyan	2250	704701.1	468750	379687.5	0	
B 450X600	M35	Concrete Rectangular	Blue	2700	984074.4	810000	455625	0	
B 450X750	M35	Concrete Rectangular	Blue	3375	1426294	1582031.3	569531.3	0	
B 450X900	M35	Concrete Rectangular	Red	4050	1877103.8	2733750	683437.5	0	
B 500X900	M35	Concrete Rectangular	Green	4500	2450883.4	3037500	937500	0	
B 600X800	M35	Concrete Rectangular	Green	4800	3110160.9	2560000	1440000	0	
C 230X230	M50	Concrete Rectangular	Yellow	529	39410.9	23320.1	23320.1	0	
C 300X400	M35	Concrete Rectangular	Cyan	1200	195279	160000	90000	0	
C 600X650	M50	Concrete Rectangular	Cyan	3900	2123062.5	1373125	1170000	0	
C 600X800	M50	Concrete Rectangular	Yellow	4800	3110160.9	2560000	1440000	0	
DUMMY	DUMMY	Concrete Rectangular	Magenta	100	1408.3	833.3	833.3	0	
PT 600X575	M35	Concrete Rectangular	Red	3450	1667969.3	950546.9	1035000	0	

Table 2.1 - Frame Section Property Definitions - Summary (Part 2 of 4)

Name	IMinor cm ⁴	MajorAngle deg	As2 cm ²	As3 cm ²	S33Pos cm ³	S33Neg cm ³	S22Pos cm ³	S22Neg cm ³	Z33 cm ³	Z22 cm ³	R33 mm
B 200X375			625	625	4687.5	4687.5	2500	2500	7031.3	3750	108.3
B 200X450			750	750	6750	6750	3000	3000	10125	4500	129.9
B 200X500			833.3	833.3	8333.3	8333.3	3333.3	3333.3	12500	5000	144.3
B 200X600			1000	1000	12000	12000	4000	4000	18000	6000	173.2
B 200X625			1041.7	1041.7	13020.8	13020.8	4166.7	4166.7	19531.3	6250	180.4
B 200X750			1250	1250	18750	18750	5000	5000	28125	7500	216.5
B 200X900			1500	1500	27000	27000	6000	6000	40500	9000	259.8
B 200X950			1583.3	1583.3	30083.3	30083.3	6333.3	6333.3	45125	9500	274.2
B 250X375			781.2	781.2	5859.4	5859.4	3906.3	3906.3	8789.1	5859.4	108.3
B 300X500			1250	1250	12500	12500	7500	7500	18750	11250	144.3
B 300X600			1500	1500	18000	18000	9000	9000	27000	13500	173.2
B 300X750			1875	1875	28125	28125	11250	11250	42187.5	16875	216.5

Table 2.1 - Frame Section Property Definitions - Summary (Part 2 of 4, continued)

Name	IMinor cm4	MajorAngle deg	As2 cm2	As3 cm2	S33Pos cm3	S33Neg cm3	S22Pos cm3	S22Neg cm3	Z33 cm3	Z22 cm3	R33 mm
B 300X900			2250	2250	40500	40500	13500	13500	60750	20250	259.8
B 400X900			3000	3000	54000	54000	24000	24000	81000	36000	259.8
B 450X375			1406.2	1406.2	10546.9	10546.9	12656.3	12656.3	15820.3	18984.4	108.3
B 450X500			1875	1875	18750	18750	16875	16875	28125	25312.5	144.3
B 450X600			2250	2250	27000	27000	20250	20250	40500	30375	173.2
B 450X750			2812.5	2812.5	42187.5	42187.5	25312.5	25312.5	63281.3	37968.8	216.5
B 450X900			3375	3375	60750	60750	30375	30375	91125	45562.5	259.8
B 500X900			3750	3750	67500	67500	37500	37500	101250	56250	259.8
B 600X800			4000	4000	64000	64000	48000	48000	96000	72000	230.9
C 230X230			440.8	440.8	2027.8	2027.8	2027.8	2027.8	3041.8	3041.8	66.4
C 300X400			1000	1000	8000	8000	6000	6000	12000	9000	115.5
C 600X650			3250	3250	42250	42250	39000	39000	63375	58500	187.6
C 600X800			4000	4000	64000	64000	48000	48000	96000	72000	230.9
DUMMY			83.3	83.3	166.7	166.7	166.7	166.7	250	250	28.9
PT 600X575			2875	2875	33062.5	33062.5	34500	34500	49593.8	51750	166

Table 2.1 - Frame Section Property Definitions - Summary (Part 3 of 4)

Name	Cw cm6	Fillet Radius mm	CG Offset 3 mm	CG Offset 2 mm	PNA Offset 3 mm	PNA Offset 2 mm	SC Offset 3 mm	SC Offset 2 mm	Area Modifier	As2 Modifier	As3 Modifier
B 200X375			0	0	0	0			1	1	1
B 200X450			0	0	0	0			1	1	1
B 200X500			0	0	0	0			1	1	1
B 200X600			0	0	0	0			1	1	1
B 200X625			0	0	0	0			1	1	1
B 200X750			0	0	0	0			1	1	1
B 200X900			0	0	0	0			1	1	1
B 200X950			0	0	0	0			1	1	1
B 250X375			0	0	0	0			1	1	1
B 300X500			0	0	0	0			1	1	1
B 300X600			0	0	0	0			1	1	1
B 300X750			0	0	0	0			1	1	1
B 300X900			0	0	0	0			1	1	1
B 400X900			0	0	0	0			1	1	1
B 450X375			0	0	0	0			1	1	1
B 450X500			0	0	0	0			1	1	1
B 450X600			0	0	0	0			1	1	1
B 450X750			0	0	0	0			1	1	1
B 450X900			0	0	0	0			1	1	1
B 500X900			0	0	0	0			1	1	1
B 600X800			0	0	0	0			1	1	1
C 230X230			0	0	0	0			1	1	1
C 300X400			0	0	0	0			1	1	1
C 600X650			0	0	0	0			1	1	1
C 600X800			0	0	0	0			1	1	1
DUMMY			0	0	0	0			1	1	1
PT 600X575			0	0	0	0			1	1	1

Table 2.1 - Frame Section Property Definitions - Summary (Part 4 of 4)

Name	I33 Modifier	I22 Modifier	Mass Modifier	Weight Modifier
B 200X375	1	1	1	1
B 200X450	1	1	1	1
B 200X500	1	1	1	1
B 200X600	1	1	1	1
B 200X625	1	1	1	1
B 200X750	1	1	1	1
B 200X900	1	1	1	1
B 200X950	1	1	1	1
B 250X375	1	1	1	1
B 300X500	1	1	1	1
B 300X600	1	1	1	1
B 300X750	1	1	1	1
B 300X900	1	1	1	1
B 400X900	1	1	1	1
B 450X375	1	1	1	1
B 450X500	1	1	1	1
B 450X600	1	1	1	1
B 450X750	1	1	1	1
B 450X900	1	1	1	1
B 500X900	1	1	1	1
B 600X800	1	1	1	1
C 230X230	1	1	1	1
C 300X400	1	1	1	1
C 600X650	1	1	1	1
C 600X800	1	1	1	1
DUMMY	1	1	1	1
PT 600X575	1	1	1	1

2.2 Shell Sections

Table 2.2 - Area Section Property Definitions - Summary

Name	Type	Element Type	Material	Total Thickness mm	Deck Material	Deck Depth mm
S 125	Slab	Shell-Thin	M35	125		
S 150	Slab	Shell-Thin	M35	150		
S 175	Slab	Shell-Thin	M35	175		
S 200	Slab	Shell-Thin	M35	200		
S 225	Slab	Shell-Thin	M35	225		
S 250	Slab	Shell-Thin	M35	250		
S 275	Slab	Shell-Thin	M35	275		
W 1020	Wall	Shell-Thin	M50	1020		
W 200	Wall	Shell-Thin	M50	200		
W 250	Wall	Shell-Thin	M50	250		
W 300	Wall	Shell-Thin	M50	300		
W 450	Wall	Shell-Thin	M50	450		
W 525	Wall	Shell-Thin	M50	525		
W 550	Wall	Shell-Thin	M50	550		
W 690	Wall	Shell-Thin	M50	691		

3 Loads

This chapter provides loading information as applied to the model.

3.1 Load Patterns

Table 3.1 - Load Pattern Definitions

Name	Is Auto Load	Type	Self Weight Multiplier	Auto Load
~LLRF	Yes	Other	0	
~SPEC X(D)ECC	Yes	Other	0	
~SPEC X(S)ECC	Yes	Other	0	
~SPEC Y(D)ECC	Yes	Other	0	
~SPEC Y(S)ECC	Yes	Other	0	
~SPEC Z(D)ECC	Yes	Other	0	
Dead	No	Dead	1	
EQ X	No	Seismic	0	IS 1893:2016
EQ Y	No	Seismic	0	IS 1893:2016
Live<3	No	Reducible Live	0	
Live>3	No	Reducible Live	0	
ROOF	No	Roof Live	0	
SDL	No	Super Dead	0	
TEMP	No	Temperature	0	
WALL	No	Super Dead	0	
WL X	No	Wind	0	Indian IS 875:2015
WL Y	No	Wind	0	Indian IS 875:2015

3.2 Load Sets

Table 3.2 - Shell Uniform Load Sets

Name	Load Pattern	Load Value kN/m2
BALCONY	Live<3	3
BALCONY	SDL	4.8
BED/KITCHEN/LIVING/DINING	Live<3	2
BED/KITCHEN/LIVING/DINING	SDL	1.8
ELETRICAL ROOM	Live<3	7.5
ELETRICAL ROOM	SDL	1.8
FIRE TRACK	Live>3	15
FIRE TRACK	SDL	6
LIFT	Live<3	1.8
LIFT	SDL	15
LMR/OHT	Live<3	3
LMR/OHT	SDL	20
LOBBY	Live<3	3
LOBBY	SDL	1.8
SERVENT ROOM	Live<3	2
SERVENT ROOM	SDL	1.8
SWIMMING POOL	Live<3	3
SWIMMING POOL	SDL	15
TERRACE	Live<3	3
TERRACE	SDL	3

Table 3.3 - Load Pattern Definitions - Auto Wind - Indian IS 875 2015 (Part 2 of 3)

Name	Exposure Set	Terrain Category	Importance Factor	Risk Coefficient	Topography	Width Type	Direction Angle deg	Story
WL X	1	2	1.00	1	1	Auto	0	HEAD ROOM
WL X	1							ROOF
WL X	1							14TH
WL X	1							13TH
WL X	1							12TH
WL X	1							11TH
WL X	1							10TH
WL X	1							9TH
WL X	1							8TH
WL X	1							7TH
WL X	1							6TH
WL X	1							5TH
WL X	1							4TH
WL X	1							3RD
WL X	1							2ND
WL X	1							1ST
WL X	1							STILT
WL Y	1	2	1.00	1	1	Auto	90	HEAD ROOM
WL Y	1							ROOF
WL Y	1							14TH
WL Y	1							13TH
WL Y	1							12TH
WL Y	1							11TH
WL Y	1							10TH
WL Y	1							9TH
WL Y	1							8TH
WL Y	1							7TH
WL Y	1							6TH
WL Y	1							5TH
WL Y	1							4TH
WL Y	1							3RD
WL Y	1							2ND
WL Y	1							1ST
WL Y	1							STILT

Table 3.3 - Load Pattern Definitions - Auto Wind - Indian IS 875 2015 (Part 3 of 3)

Name	Exposure Set	Width m	Depth m	X m	Y m
WL X	1	10.246	3	1.4	20.715
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844

Table 3.3 - Load Pattern Definitions - Auto Wind - Indian IS 875 2015 (Part 3 of 3, continued)

Name	Exposure Set	Width m	Depth m	X m	Y m
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	25.988	14.127	6.9635	12.844
WL X	1	39.698	27.525	6.6125	13.679
WL Y	1	3	10.246	1.4	20.715
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	14.127	25.988	6.9635	12.844
WL Y	1	27.525	39.698	6.6125	13.679


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

3.4 Auto Seismic Loading

Table 3.4 - Load Pattern Definitions - Auto Seismic - IS 1893 2016 (Part 1 of 3)

Name	Period Used sec	Coeff Used	Weight Used kN	Base Shear kN	Is Auto Load	X Dir?	X Dir Plus Ecc?	X Dir Minus Ecc?	Y Dir?	Y Dir Plus Ecc?	Y Dir Minus Ecc?
EQ X	1.359	0.024018	78353.1378	1881.859	No	Yes	No	No	No	No	No
EQ Y	1.296	0.025185	78353.1378	1973.3383	No	No	No	No	Yes	No	No

Table 3.4 - Load Pattern Definitions - Auto Seismic - IS 1893 2016 (Part 2 of 3)

Name	Period Used sec	Coeff Used	Weight Used kN	Base Shear kN	Ecc Ratio	Top Story	Bottom Story	Ecc Overwrite Story	Ecc Overwrite Diaphragm
EQ X	1.359	0.024018	78353.1378	1881.859	0.05	HEAD ROOM	STILT		
EQ Y	1.296	0.025185	78353.1378	1973.3383	0.05	HEAD ROOM	STILT		

Table 3.4 - Load Pattern Definitions - Auto Seismic - IS 1893 2016 (Part 3 of 3)

Name	Period Used sec	Coeff Used	Weight Used kN	Base Shear kN	Period Type	Ct	User T sec	Z	Site Type	I
EQ X	1.359	0.024018	78353.1378	1881.859	User Defined		1.359	0.16	II	1.2
EQ Y	1.296	0.025185	78353.1378	1973.3383	User Defined		1.296	0.16	II	1.2


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern EQ X according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = X

Structural Period

Period Calculation Method = User Specified

User Period

$$T = 1.359 \text{ sec}$$

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3]

$$Z = 0.16$$

Response Reduction Factor, R [IS Table 9]

$$R = 4$$

Importance Factor, I [IS Table 8]

$$I = 1.2$$

Site Type [IS Table 1] = II

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2]

$$\frac{S_a}{g} = \frac{1.36}{T}$$

$$\frac{S_a}{g} = 1.000736$$

Equivalent Lateral Forces

Seismic Coefficient, A_h [IS 6.4.2]

$$A_h = \frac{Z I \frac{S_a}{g}}{2 R}$$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V _b (kN)
X	1.359	78353.1378	1881.859

Applied Story Forces

Story	Elevation m	X-Dir kN	Y-Dir kN
LMR	56.9	0	0
HEAD ROOM	53.9	47.6947	0
SWIMMING POOL TOP LVL	51.5	68.2951	0
ROOF	50	330.8626	0
14TH	46.9	277.0748	0
13TH	43.8	238.9063	0
12TH	40.7	203.5651	0
11TH	37.6	171.0513	0
10TH	34.5	141.3647	0
9TH	31.4	114.5054	0
8TH	28.3	90.4734	0
7TH	25.2	69.2687	0
6TH	22.1	50.8913	0


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
5TH	19	35.3412	0
4TH	15.9	22.6167	0
3RD	12.8	12.7229	0
2ND	9.7	5.6812	0
1ST	6.6	1.5437	0
STILT	3.5	0	0
Base	0	0	0

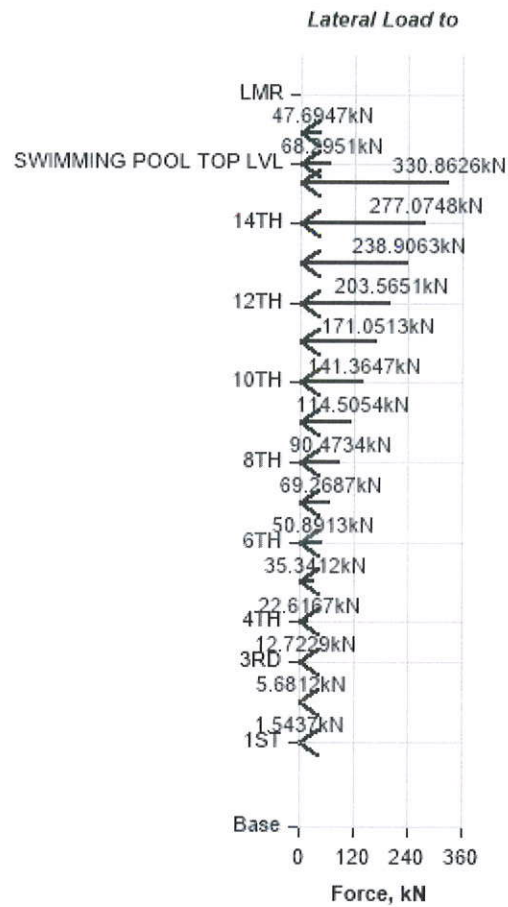


Figure 3-1-Set 1


A. PERAMAYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern EQ Y according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = Y

Structural Period

Period Calculation Method = User Specified

User Period

$$T = 1.296 \text{ sec}$$

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3]

$$Z = 0.16$$

Response Reduction Factor, R [IS Table 9]

$$R = 4$$

Importance Factor, I [IS Table 8]

$$I = 1.2$$

Site Type [IS Table 1] = II

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2]

$$\frac{S_a}{g} = \frac{1.36}{T}$$

$$\frac{S_a}{g} = 1.049383$$

Equivalent Lateral Forces

Seismic Coefficient, A_h [IS 6.4.2]

$$A_h = \frac{Z I \frac{S_a}{g}}{2 R}$$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V _b (kN)
Y	1.296	78353.1378	1973.3383

Applied Story Forces

Story	Elevation m	X-Dir kN	Y-Dir kN
LMR	56.9	0	0
HEAD ROOM	53.9	0	50.0132
SWIMMING POOL TOP LVL	51.5	0	71.615
ROOF	50	0	346.9462
14TH	46.9	0	290.5437
13TH	43.8	0	250.5198
12TH	40.7	0	213.4607
11TH	37.6	0	179.3663
10TH	34.5	0	148.2366
9TH	31.4	0	120.0716
8TH	28.3	0	94.8714
7TH	25.2	0	72.6359
6TH	22.1	0	53.3652

A. Peramaiyan
A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
5TH	19	0	37.0591
4TH	15.9	0	23.7161
3RD	12.8	0	13.3414
2ND	9.7	0	5.9573
1ST	6.6	0	1.6187
STILT	3.5	0	0
Base	0	0	0

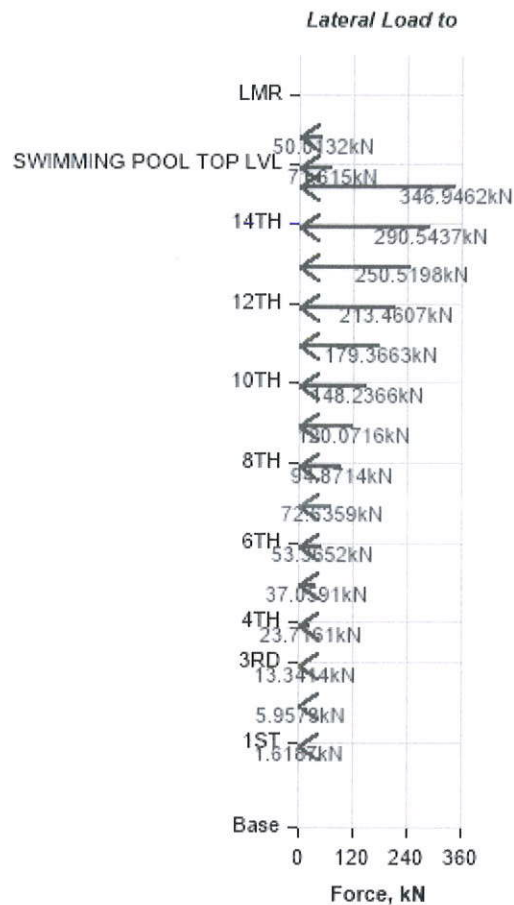


Figure 3-2-Set 1


A. PERUMAYYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

3.5 Functions

3.5.1 Response Spectrum Functions

Table 3.5 - Functions - Response Spectrum - IS1893 2016

Name	Period sec	Value	Seismic Zone	I	Soil Type	R	Damping Ratio
Func2	0	0.024	III	1.2	II	4	0.05
Func2	0.1	0.06					
Func2	0.55	0.06					
Func2	0.8	0.0408					
Func2	1	0.03264					
Func2	1.2	0.0272					
Func2	1.4	0.023314					
Func2	1.6	0.0204					
Func2	1.8	0.018133					
Func2	2	0.01632					
Func2	2.5	0.013056					
Func2	3	0.01088					
Func2	3.5	0.009326					
Func2	4	0.00816					
Func2	4.5	0.00816					
Func2	5	0.00816					
Func2	5.5	0.00816					
Func2	6	0.00816					
Func2	6.5	0.00816					
Func2	7	0.00816					
Func2	7.5	0.00816					
Func2	8	0.00816					
Func2	8.5	0.00816					
Func2	9	0.00816					
Func2	9.5	0.00816					
Func2	10	0.00816					

Table 3.6 - Functions - Response Spectrum - User Defined

Name	Period sec	Value	Damping Ratio
UnifRS	0	0.04	0.05
UnifRS	10	0.04	

3.6 Load Cases

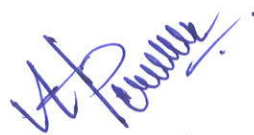
Table 3.7 - Load Case Definitions - Summary

Name	Type	Notes
Dead	Linear Static	
Live<3	Linear Static	
Modal	Modal - Ritz	
SDL	Linear Static	
WALL	Linear Static	
Live>3	Linear Static	
ROOF	Linear Static	
TEMP	Linear Static	
EQ X	Linear Static	
EQ Y	Linear Static	

A. Peramayan
A. PERAMAYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

Table 3.7 - Load Case Definitions - Summary (continued)

Name	Type	Notes
WL X	Linear Static	
WL Y	Linear Static	
SPEC X(D)	Response Spectrum	
SPEC Y(D)	Response Spectrum	
SPEC X(S)	Response Spectrum	
SPEC Y(S)	Response Spectrum	
SPEC Z(D)	Response Spectrum	


A. PERAMAIYAN, M.E., (Struct.), M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

4 Analysis Results

This chapter provides analysis results.

4.1 Story Results

Table 4.1 - Story Stiffness (Part 1 of 2)

Story	Output Case	Case Type	Step Type	Step Number	Step Label	Shear X kN	Drift X mm	Stiff Xh kN
LMR	EQ X	LinStatic	Step By Step			0	0	
HEAD ROOM	EQ X	LinStatic	Step By Step			47.6947	3.31	
SWIMMING POOL TOP LVL	EQ X	LinStatic	Step By Step			115.9898	1.139	
ROOF	EQ X	LinStatic	Step By Step			446.8592	5.016	
14TH	EQ X	LinStatic	Step By Step			723.9341	5.197	
13TH	EQ X	LinStatic	Step By Step			962.8406	5.383	
12TH	EQ X	LinStatic	Step By Step			1166.4058	5.56	
11TH	EQ X	LinStatic	Step By Step			1337.4572	5.701	
10TH	EQ X	LinStatic	Step By Step			1478.822	5.783	
9TH	EQ X	LinStatic	Step By Step			1593.3275	5.788	
8TH	EQ X	LinStatic	Step By Step			1683.8009	5.703	
7TH	EQ X	LinStatic	Step By Step			1753.0697	5.514	
6TH	EQ X	LinStatic	Step By Step			1803.961	5.207	
5TH	EQ X	LinStatic	Step By Step			1839.3022	4.765	
4TH	EQ X	LinStatic	Step By Step			1861.9189	4.166	
3RD	EQ X	LinStatic	Step By Step			1874.6419	3.385	
2ND	EQ X	LinStatic	Step By Step			1880.3231	2.447	
1ST	EQ X	LinStatic	Step By Step			1881.8667	1.484	
STILT	EQ X	LinStatic	Step By Step			1881.8667	0.16	
LMR	EQ Y	LinStatic	Step By Step			0	0	
HEAD ROOM	EQ Y	LinStatic	Step By Step			1.891E-06	0.186	
SWIMMING POOL TOP LVL	EQ Y	LinStatic	Step By Step			1.976E-06	0.221	
ROOF	EQ Y	LinStatic	Step By Step			0.0002	0.339	
14TH	EQ Y	LinStatic	Step By Step			0.0002	0.34	
13TH	EQ Y	LinStatic	Step By Step			0.0002	0.342	
12TH	EQ Y	LinStatic	Step By Step			0.0002	0.34	
11TH	EQ Y	LinStatic	Step By Step			0.0002	0.343	
10TH	EQ Y	LinStatic	Step By Step			0.0002	0.33	
9TH	EQ Y	LinStatic	Step By Step			0.0002	0.323	
8TH	EQ Y	LinStatic	Step By Step			0.0002	0.32	
7TH	EQ Y	LinStatic	Step By Step			0.0002	0.306	
6TH	EQ Y	LinStatic	Step By Step			0.0002	0.274	
5TH	EQ Y	LinStatic	Step By Step			0.0002	0.24	
4TH	EQ Y	LinStatic	Step By Step			0.0002	0.217	
3RD	EQ Y	LinStatic	Step By Step			0.0002	0.188	
2ND	EQ Y	LinStatic	Step By Step			0.0002	0.145	
1ST	EQ Y	LinStatic	Step By Step			0.0002	0.125	
STILT	EQ Y	LinStatic	Step By Step			0.0002	0.01	

Table 4.1 - Story Stiffness (Part 2 of 2)

Story	Stiff X kN/m	Shear Y kN	Drift Y mm	Stiff Yh kN	Stiff Y kN/m	Irregular	Modifier
LMR	0	0	0		0		
HEAD ROOM	14408.712	0	0.571		0		
SWIMMING POOL TOP LVL	101809.08	0	0.337		0		

Table 4.1 - Story Stiffness (Part 2 of 2, continued)

Story	Stiff X kN/m	Shear Y kN	Drift Y mm	Stiff Yh kN	Stiff Y kN/m	Irregular	Modifier
ROOF	89088.805	2.723E-06	0.513		0		
14TH	139291.022	5.76E-06	0.509		0		
13TH	178865.808	1.068E-05	0.52		0		
12TH	209781.097	1.432E-05	0.533		0		
11TH	234611.281	1.808E-05	0.543		0		
10TH	255714.02	1.999E-05	0.548		0		
9TH	275299.867	2.259E-05	0.545		0		
8TH	295265.037	2.455E-05	0.532		0		
7TH	317926.121	2.554E-05	0.507		0		
6TH	346453.011	2.689E-05	0.461		0		
5TH	386039.385	2.808E-05	0.401		0		
4TH	446904.481	2.744E-05	0.328		0		
3RD	553823.673	2.81E-05	0.24		0		
2ND	768576.572	2.857E-05	0.142		0		
1ST	1268189.912	3.153E-05	0.115		0		
STILT	11741074.169	3.014E-05	0.014		0		
LMR	0	0	0		0		
HEAD ROOM	0	50.0132	3.396		14725.082		
SWIMMING POOL TOP LVL	0	121.6282	1.785		68134.009		
ROOF	0	468.5745	4.274		109633.71		
14TH	0	759.1181	4.521		167923.977		
13TH	0	1009.6379	4.792		210699.762		
12TH	0	1223.0986	5.059		241758.096		
11TH	0	1402.4648	5.293		264952.477		
10TH	0	1550.7014	5.472		283389.279		
9TH	0	1670.773	5.577		299583.139		
8TH	0	1765.6444	5.606		314941.548		
7TH	0	1838.2803	5.532		332282.284		
6TH	0	1891.6455	5.337		354411.313		
5TH	0	1928.7046	5.001		385629.568		
4TH	0	1952.4207	4.498		434029.849		
3RD	0	1965.7621	3.8		517258.333		
2ND	0	1971.7194	2.804		703248.381		
1ST	0	1973.3383	1.658		1190038.166		
STILT	0	1973.3383	0.122		16224269.517		

4.2 Modal Results

Table 4.2 - Modal Participating Mass Ratios (Part 1 of 2)

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX	RY	RZ
Modal	1	2.462	0.3619	0.0383	5.01E-07	0.3619	0.0383	5.01E-07	0.0239	0.268	0.1224
Modal	2	2.269	0.0482	0.5268	1.657E-05	0.4101	0.5652	1.707E-05	0.3234	0.0347	0.0013
Modal	3	1.932	0.1505	0.0102	1.366E-05	0.5606	0.5754	3.073E-05	0.0062	0.1155	0.3071
Modal	4	0.607	0.0595	0.0257	0.0001	0.6201	0.6011	0.0001	0.0212	0.0412	0.0307
Modal	5	0.59	0.028	0.0875	0	0.6481	0.6887	0.0001	0.0783	0.023	0.0035
Modal	6	0.506	0.0474	0.0039	0.0002	0.6955	0.6926	0.0003	0.0022	0.0431	0.0508
Modal	7	0.278	0.0027	0.0001	0.0755	0.6982	0.6927	0.0758	0.0002	1.585E-06	0.0001
Modal	8	0.266	0.0037	0.047	0.0003	0.7019	0.7397	0.0761	0.0256	0.0027	4.551E-06
Modal	9	0.223	0.0226	0.0024	0.254	0.7245	0.7421	0.3301	0.0158	0.0275	0.0009

Table 4.2 - Modal Participating Mass Ratios (Part 1 of 2, continued)

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX	RY	RZ
Modal	10	0.187	0.0716	0.0057	0.1499	0.7961	0.7478	0.4801	0.001	0.0667	0.0007
Modal	11	0.13	0.0072	0.0006	0.3644	0.8033	0.7484	0.8445	0.0069	0.0023	0.0002
Modal	12	0.109	0.009	0.091	0.0001	0.8123	0.8394	0.8446	0.1038	0.0111	4.597E-06

Table 4.2 - Modal Participating Mass Ratios (Part 2 of 2)

Case	Mode	SumRX	SumRY	SumRZ
Modal	1	0.0239	0.268	0.1224
Modal	2	0.3473	0.3028	0.1237
Modal	3	0.3535	0.4182	0.4308
Modal	4	0.3747	0.4594	0.4615
Modal	5	0.453	0.4824	0.4649
Modal	6	0.4552	0.5254	0.5157
Modal	7	0.4553	0.5254	0.5158
Modal	8	0.481	0.5281	0.5158
Modal	9	0.4967	0.5556	0.5167
Modal	10	0.4977	0.6223	0.5174
Modal	11	0.5046	0.6247	0.5175
Modal	12	0.6085	0.6357	0.5175

A. Peramaiyan
A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

DESIGN OF PILE CAP

Project : ONE PARAMOUNT

Location : CHENNAI

Subject : Pilecap Design

Marking : PC2H

TYPE : 2-Pile Group

Material

f_{cu} = 35 N/mm²

f_y = 550 N/mm²

Cover = 75 mm

Reinforcement

B1 = 25 mm

B2 = 20 mm

Pile (1 = Rect, 2=Circular)

Pile type = 2

Diameter = 800 mm

Capacity = 2600 kN

Column (1 = Rect, 2=Circular)

Col. type = 1

B_c = 800 mm

L_c = 600 mm

Load factor = 1.5

Ultimate Column Load = 7800 kN

Pilecap Dimensions

Pile spacing, S = 2.5 x pile diameter

B = 550 mm

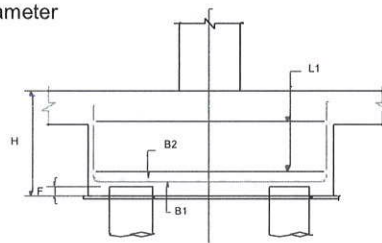
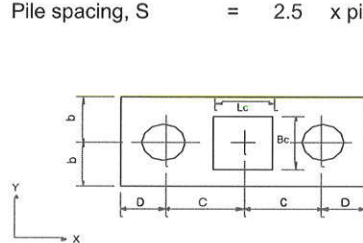
C = 1000 mm

D = 550 mm

F = 75 mm

H = 1800 mm

L1 = 3T13



Bending Moment & Reinforcement (By bending theory)

Choice of moment - 1 = column face, 2 = center of column

1

	About Y - Y axis	
Moment arm (mm)	775	
Maximum Moment (kNm)	3023	
Width, b	1100	
Effective depth, d	1713	
$K = M/bd^2f_{cu}$	0.027	
Lever arm, Z	1627	
$A_{s_{req}}$ (mm ²)	3883	or 3530 mm ² /m
No. of bars & spacing required	8 T 25 @ 132	
No. of bars & spacing provided	10 T 25 @ 103 (B1)	
$A_{s_{prov}}$ (mm ²)	27 4911	or 4464.3 mm ² /m

About X - X axis

Provide min. rein^{ft} = 0.12%bH

	6696	or	2160 mm ² /m
22 T 20 @ 139			
22 T 20 @ 139 (B2)			
	6914	or	2230 mm ² /m

Shear Check

Shear force	3900 kN
(100 A_s/bd)	0.26
(400/d) ^{1/4}	1.00
Allowable shear stress, V_c	0.3752 mm ² /m
Shear span, a_v	535.00 mm
Enhancement factor = 2d/ a_v	6.40
Enhanced shear stress (N/mm ²), V_c	2.40 mm ² /m

i) Shear at column face

$$v = 1.63 < 3.70 \quad \text{ok!}$$

ii) Shear along a vertical section at 20% inside pile across the full width of pilecap

$$v = 2.07 < 2.40 \quad \text{ok!}$$

iii) Since pile spacing less or equal to 3 x pile diameter, no check is required

iv) Punching shear check

5.8102 Punching Area
9650 Perimeter bo
0.472 Punching Shear Stress v_v
1.479 Permissible shear stress

O.K

A. Peramaiyan
A. PERAMAIYAN, M.E., (Struct.) M.I.E.
REGISTERED STRUCTURAL ENGINEER
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
REGISTRATION No. SE/GR-I/19/03/026
NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
ADYAR, CHENNAI - 600 020.
E-Mail: peram@buroengineers.in
Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF
RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

DESIGN OF SHEAR WALL

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
4TH	P9	2850	6722	4500	200	0.5

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

Design Code Parameters

Γ_s	Γ_c	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	600	6722	5100	6722	4500	200
Bottom	Leg 1	600	6722	5100	6722	4500	200

Flexural Design for P_u , M_{u2} and M_{u3} (Part 1 of 2)

Station Location	Required Rebar Area (mm ²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo
Top	7502	0.0083	0.0042	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL
Bottom	12551	0.0139	0.0042	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL

Flexural Design for P_u , M_{u2} and M_{u3} (Part 2 of 2)

P_u kN	M_{u2} kN-m	M_{u3} kN-m	Pier A_g mm ²
12970.4847	364.1958	4228.7986	900000
13075.5939	366.7211	6591.4296	900000

Shear Design (Part 1 of 2)

Station Location	ID	Rebar mm ² /m	Shear Combo	P_u kN	M_u kN-m	V_u kN
Top	Leg 1	500	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL	8371.4739	4228.7986	1059.0581
Bottom	Leg 1	500	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL	8475.5529	6591.4296	1059.0581

Shear Design (Part 2 of 2)

V_c kN	$V_c + V_s$ kN
504.0564	1153.6216
627.4919	1277.0571


A. PERAMATHAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P _u kN	M _u kN-m
Top-Left	Leg 1	1200	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL	12970.4847	-4018.2375
Top-Right	Leg 1	1200	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL	12970.4847	4228.7986
Bottom-Left	Leg 1	1200	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL	13075.5939	-5590.7481
Bottom-Right	Leg 1	1300	24 1.5DL+1.5SPEC X(D)+0.45SPEC Y(D)+0.45SPEC Z(D)+1.0TL	13075.5939	6591.4296

Boundary Element Check (Part 2 of 2)

Stress Comp MPa	Stress Limit MPa
20.36	10
20.68	10
22.81	10
24.29	10

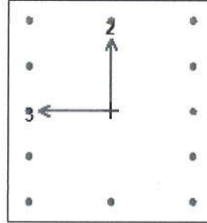
A. Peramaiyan
A. PERAMAIYAN, M.E., (Struct.), M.A. E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No. 14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF
RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

DESIGN OF COLUMN

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design (Summary)



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
2ND	C4	174	C 600X650	25 1.5DL+0.45SPEC X(D)+1.5SPEC Y(D)+0.45SPEC Z(D)+1.0TL	0

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
3100	0.5	Ductile Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
600	650	60	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm ²	Rebar % %
5713.6471	149.6976	139.348	149.6976	159.2203	3120	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	1	3100	61.6463	0	159.2203
Minor Bend(M2)	1	3100	36.5629	0	149.6976

Axial Compression Check for Seismic Design per IS 13920:2016 Section 7.1

Limit Compression Factor Unitless	Limit Compression Strength kN	Compression D/C Ratio Unitless	Status
0.4	7800	0.732519	OK

Shear Design for V_{u2} , V_{u3}

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm ² /m
Major, V_{u2}	39.0562	254.4304	141.6005	0	665.06
Minor, V_{u3}	54.8328	253.3055	140.4005	0	720.48

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm ²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g cm ²	A_{sc} cm ²	P_{uz} kN	P_b kN	P_u kN	k Unitless
3900	31.2	10062	3675.0064	5713.6471	0.680814

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (kN-m)
Major Bending (M_3)	Yes	1	650	4.769	12	No	0
Minor Bending (M_2)	Yes	1	600	5.167	12	No	0

Notes:

N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

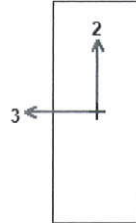
A. PERAMAIYAN
A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

DESIGN OF BEAM

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
3RD	B72	1069	B 200X500	25 1.5DL+0.45SPEC X(D)+1.5SPEC Y(D)+0.45SPEC Z(D)+1.0TL	28.6

Beam Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
5593	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b _f (mm)	d _s (mm)	d _{cl} (mm)	d _{cb} (mm)
200	500	200	0	30	30

Material Properties

E _c (MPa)	f _{ck} (MPa)	Lt.Wt Factor (Unitless)	f _y (MPa)	f _{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

γ _c	γ _s
1.5	1.15

Factored Forces and Moments

Factored M _{u3} kN-m	Factored T _u kN-m	Factored V _{u2} kN	Factored P _u kN
-161.8907	0.0012	112.2825	0

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M _t kN-m	Positive Moment kN-m	Negative Moment kN-m
-161.8907	0.0024	0	-161.893

A. PERAMANYAN, M.E., (Struct), M.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

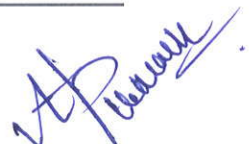
	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm ²	+Moment Rebar mm ²	Minimum Rebar mm ²	Required Rebar mm ²
Top (+2 Axis)	-161.893		840	0	840	243
Bottom (-2 Axis)		0	210	0	0	210

Shear Force and Reinforcement for Shear, V_{u2} & T_u

Shear V_o kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv}/s mm ² /m
148.6814	0	148.6906	56.3789	876.67

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{u2}

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm ² /m
0.0008	112.2825	160	460	0



A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-I/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630

PLAN SHOWING THE PROPOSED CONSTRUCTION OF HIGH RISE RESIDENTIAL BUILDING CONSISTING OF AN EXTENDED BASEMENT FLOOR + STILT FLOOR (PART) + 14 UPPER FLOORS + ROOF RESIDENTIAL BUILDING OF HEIGHT 48.0M WITH 14 DWELLING UNITS & AN OPEN SWIMMING POOL @ TERRACE FLOOR LEVEL AVAILING PREMIUM FSI WITH TOD BENEFIT AT DOOR NO. 52 & 53, NEW NO. 04 & 06, ABUTTING VIJAYA RAGHAVA ROAD AND DR. B NARASIMHAN ROAD (NORTH BOAG ROAD), T.NAGAR, CHENNAI-600017, COMPRISED ORIGINALLY IN OLD S.NO. 58/2, THEN T.S.NO. 4887/2 CURRENTLY IN T.S.NO. 4887/4 & T.S.NO. 4887/6, BLOCK NO.114, T.NAGAR VILLAGE, GUINDY TALUK

DESIGN OF SLAB

PROJECT					
DESIGN OF SLAB No:					
1.00	Grade of concrete	=	35.00	N/mm ²	Case No: 8 D+(C-D)*(E-A)/(B-A) Negative Positive A 1.50000 1.50000 B 1.75000 1.75000 C 0.00000 0.07600 D 0.00000 0.08700 E 1.61905 1.61905 Value 0.00000 0.08124
2.00	Grade of steel	=	550.00	N/mm ²	
3.00	Cover to reinforcement	=	25.00	mm	
	Diameter of bar	=	10.00	mm	
4.00	Aspect ratio $\frac{l_y}{l_x} =$	6.00	6.12	1.619	< 2
		3.66	3.78		
5.00	Edge condition: One Short Edge Continuous	Two way slab			
6.00	Modification factor assumed	1.40			
7.00	Depth required for deflection:	D =	150.00	mm	ok qa
			150.00	mm	
		d =	120.00	mm	
			3.60	kN/m ²	
8.00	Dead Load	=	3.60	kN/m ²	
9.00	Live load	=	3.00	kN/m ²	
10.00	Partitions & FF	=	5.00	kN/m ²	
11.00	Total load	=	11.60	kN/m ²	
12.00	Factored load	=	17.40	kN/m ²	
STEP I Details					
		S-SPAN		L-SPAN	
		(-ve) support (α_x)	(+ve) span (α_x)	(-ve) support (α_y)	(+ve) span (α_y)
Co-efficient (IS:456, Table :26)		0.000	0.081	0.057	0.043
$M_u = \text{Co-efficient} * w * l_x^2$		0.00	20.20	14.17	10.69
$K = M_u / bd^2$		0.00	1.40	0.98	0.74
Percentage of steel required		0.00	0.31	0.21	0.16
Ast required (in mm ²)		0.00	369.66	255.35	190.97
Ast min (in mm ²)		180.00	180.00	180.00	180.00
Ast to be provided (in mm ²)		180.00	369.66	255.35	190.97
Provided bars spacing (c/c)		436.51	212.55	307.70	411.43
max spacing		250.00	250.00	250.00	250.00
spacing		250.00	212.55	250.00	250.00
Reqd bars spacing (c/c)		250.00	210.00	250.00	250.00
Pvd bars spacing (c/c)		125.00	125.00	200.00	200.00
Ast Provided (in mm ²)		628.57	628.57	392.86	392.86
Percentage of steel provided		0.52	0.52	0.33	0.33
STEP II					
$F_s = 0.58 * f_y * (\text{Ast required} / \text{Ast provided})$				187.60	
F_s				1.50	
M.F					
if assumed modification factor is less than or equal to calculated the section is safe for deflection				safe	
OVERALL DEPTH		D	150.00	mm	
EFFECTIVE DEP1		d	120.00	mm	
STEP III Crack width calculation					
m		=	6.8		
E_s		=	200000.0		
E_c		=	29580.4		
Pt		=	0.5		
k		=	0.2		
x		=	28.0		
A_{st}		=	628.6		
l_{cr}		=	43288612.35		
M		=	20.2		
f_{st}		=	290.3		
ϵ_m		=	0.0		
Spacing		=	125.0		
a_{cr}		=	67.3		
ω_{cr}		=	0.18		
		=	<		
			0.20 mm (safe)		

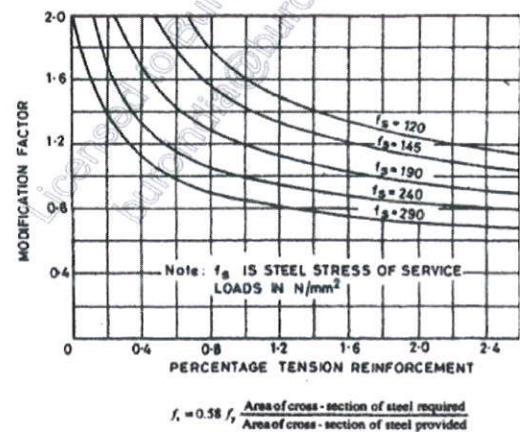
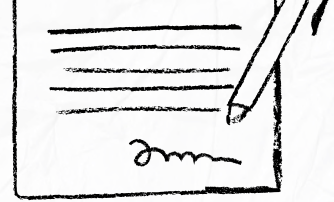


FIG. 4 MODIFICATION FACTOR FOR TENSION REINFORCEMENT

A. PERAMAIYAN, M.E., (Struct.), M.I.E.
 REGISTERED STRUCTURAL ENGINEER
 CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
 REGISTRATION No. SE/GR-1/19/03/026
 NEW No. 31 (OLD No.14), BESANT AVENUE ROAD,
 ADYAR, CHENNAI - 600 020.
 E-Mail: peram@buroengineers.in
 Mobile: +91 99625 45630



our services doesn't just end there



Buying & Selling Services

Property Buying Assistance, Property Selling Support, Market Price Analysis, Owner Outreach and Negotiation.



Legal & Documentation Services

Certified EC, Patta, legal opinions, property verification, due diligence, litigation solutions, and legal heir certificates.



Property Development & Approvals

Building plan approvals, construction, layout and sub-division approvals, zone conversion, and occupancy certification.



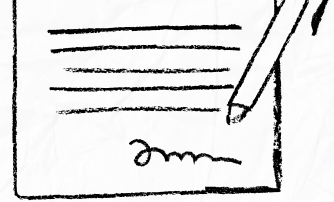
NRI & Investment Services

Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management



Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



 **empowering your real estate decisions**
with smart tools



Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter



Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer



Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator



Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary



Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management



We're honored to be part of your
real estate journey

3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai, India

hello@verified.realestate
[+91 9996 12 9996](tel:+919996129996)
www.verified.realestate