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Dated 26/02/2025
F.No.

BELLIAPPA & ASSOCIATES
CONSULTING ENGINEERS & VALUERS

STABILITY CERTIFICATE

It is certified that the proposed construction **residential building with stilt floor + 5 floors [18.30 m ht] with 50 dwelling units at s.no. 240 / 8a4a of Vilangadupakkam village, Ponneri taluk, Thiruvallur district.** has been designed for dead loads, live loads, earthquake loads (static & dynamic), wind loads & temperature loads. The design has been checked and found to be ***safe and sound***. I hereby certify the following:

1. The minimum grade of concrete used is M25 grade.
2. The design & analysis were done using the code of practice for plain & reinforced concrete as per IS 456:2000. Design loads as per IS 875:1987 part 2 & earthquake loads as per IS 1893:2016 have been carried out.

The building will be ***safe and sound*** if used for the designated purpose.

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L.I.C. N.I.C. Panel Valuer
Gazetted Valuer-C.B.D.T. CI / 189 of 90

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
Thalamuthu Natarajan Building, No.1, Gandhi Irwin Road, Egmore,
Chennai - 600 008
Phone : 28414855 Fax: 91-044-28548416
E-mail: mscmda@tn.gov.in
Web site: www.cmdachennai.gov.in.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the Thiru / Tmt. / M/s. **B. B. BOPAYYA**has enrolled as **Registered Structural Engineer Grade-I (SE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E Structures** and experience in the relevant field for **14** years.

He/She has been given the Registration No. **SE/I/2024/6/0125** on **26-Jun-2024** He/She 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 **25-Jun-2029**.

Signature Not Verified
Name :A Meganathan
Designation :Superintendent
Date :06/26/2024 3:13:32 PM



A Meganathan

Superintendent

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Dated.....
F.No.

BELLIAPPA & ASSOCIATES
CONSULTING ENGINEERS & VALUERS

I/We M/s. Belliappa Associates – Mr.Bopayya B. B have undertaken assignment as Structural Engineer for the detailed design and construction of the **residential building with stilt floor + 5 floors [18.30 m ht] with 50 dwelling units at s.no. 240 / 8a4a of Vilangadupakkam village, Ponneri taluk, Thiruvallur district.**

It is certified that the building has been designed as a RCC structure to withstand the dead load, imposed load and wind load/earthquake loads ensuring structural safety and serviceability as per the norms and guidelines prescribed in applicable relevant standards and Codes of Bureau of Indian Standards. It is certified that the design is structurally safe and sound.

Yours faithfully,

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STRUCTURAL BASIS DESIGN REPORT

STRUCTURAL CONSULTANTS : M/s. Belliappa Associates

1. PREAMBLE

We have designed for **proposed construction of residential building in stilt floor + 5 floors [18.30 m ht] with 50 dwelling units at s.no. 240 / 8a4a of Vilangadupakkam village, Ponneri taluk, Thiruvallur district.**

We hereby certify that

BLOCK	BASEMENT FLOOR	STILT FLOOR	TYPICAL FLOOR	TOTAL SLABS
RESIDENTIAL	0	1	5	6

- The usage of the building is for Residential (S + 5 floors) purpose.
- This is RC frame structure with AAC Block walls used as partition walls.
- Foundations are designed as strip raft foundation with SBC as 15T/m^2 as per the geotechnical investigation report.
- Based on the design parameters the building is found to be ***"structurally safe & sound"***.

2. DESIGN LOADS

Super Imposed Dead Loads

The self-weight of the various elements are computed based on the built weight of materials as given below.

Materials	Unit Weight in KN/m^3
AAC Block	6.80
Steel	78.50
Plain Cement Concrete	24.00
Reinforced Concrete	25.00
Soil	18.00
Water	10.00

The Super Imposed Loads that are envisaged to act permanently (wherever applicable) are as follows.

Item	Intensity in KN/m^2
Floor finish	1
Weathering Proof course on Terrace - 115 thick brickbat coba with IPS finish	2.30
SUNK – 13"	6.60

Live Loads

The superimposed load or otherwise live load is assessed on the basis of occupancy classifications as per IS: 875 (Part —2) — 1987 and are listed below.

Type of Structure — Residential Building

Occupancy Classification	UDL (KN/m^2)
Residential Living and bedrooms	2.0
Baths and toilets	2.0
Corridors, passages, staircases including fire escapes, lobbies — as per the floor serviced excluding stores and the like but not less than	3.0
Open terrace	1.5

3 CHECK FOR LATERAL SWAY AS PER IS - 456-2000

The allowable lateral sway at top due to wind force should not exceed H/500, where H is total height of Building.

4 CHECK FOR LATERAL SWAY (STOREY DRIFT) AS PER IS- 1893-2002

The allowable lateral sway (storey drift) due to earthquake force should not exceed L/250, where L is the storey height

5 BASIC LOADS AND LOAD COMBINATIONS

The various loads are combined in accordance with the stipulations in IS: 875 (Part 5) - 1987. Wherever imposed load is combined with earthquake load the appropriate part of the imposed load as specified in IS: 1893-2002 is adopted both for evaluating earthquake effect and for combined load effects, used in such combination.

6 BASIC LOADS AND LOAD COMBINATIONS

The various loads are combined in accordance with the stipulations in IS:875 (Part 5)-1987. Wherever imposed load is combined with earthquake load the appropriate part of the imposed load as specified in IS:1893-2002 is adopted both for evaluating earthquake effect and for combined load effects, used in such combination.

Type	Load Combinations
Primary	DEAD LOAD (DL)
Primary	WALL LOAD (WAL
Primary	SUPERIMPOSED DEAD LOAD (SDL)
Primary	LIVE LOAD (LL)
Primary	WIND LOAD X (+) WLX
Primary	WIND LOAD Z (+) WLZ
Primary	SIESMIC LOAD ALONG-X SLX
Primary	SIESMIC LOAD ALONG-Z SLZ
Combination	DL + WAL + SDL
Combination	DL + WAL +SDL+LL

Combination	DL+ WAL + SDL +LL + WLX
Combination	DL + WAL + SDL+LL + WLZ
Combination	DL + WAL+SDL+LL-WLX
Combination	DL + WAL +SDL+LL - WLZ
Combination	DL + WAL +SDL+LL+ SLX
Combination	DL + WAL +SDL+LL +SLZ
Combination	DL+ WAL +SDL+LL - SLX
Combination	DL + WAL + SDL +LL - SLZ
Combination	DL + WAL + SDL + WLX
Combination	DL + WAL +SDL+ WLZ
Combination	DL + WAL + SDL - WLX
Combination	DL + WAL + SDL - WLZ
Combination	DL + WAT + SDL + SLX
Combination	DL + WAL + SDL + SLZ
Combination	DL + WAL + SDL - SLX

7: LOAD FACTORS FOR DESIGN

Description of Load Combination	Load Factor for Primary Load Cases				
	Dead Load	Live Load	Wind Load	Seismic Load	Temp Load
Dead load	1.5	0.0	0.0	0.0	0.0
Dead load + Live load	1.5	1.5	0.0	0.0	0.0
Dead load + Wind load	1.5	0.0	±1.5	0.0	0.0
Dead load + Seismic load	1.5	0.0	0.0	±1.5	0.0
Dead load + Live load + Wind load	1.2	1.2	±1.2	0.0	0.0

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Dead load + Live load + Seismic	1.2	1.2	0	±1.2	0.0
Dead Load + Wind Load	0.9	0.0	±1.5	0.0	0.0
Dead Load + Seismic Load	0.9	0.0	0.0	±1.5	0.0

8. ANALYSIS METHOD

The modeling has been generated in ETABS for analysis. The structure will be analyzed for Static and Dynamic load cases. In house design worksheets used along with ETABS.

8.1 Static Analysis:

Following Static loads cases are considered in the analysis

DL - Dead Load: Includes self-weight of the structure.
SDL - Super Imposed Dead Load: Includes Finishes, wall Loads, Soil filling loads etc...
LL - Live Load: Includes Live loads based on functionality as per IS: 875 (Part-2)

8.2 Dynamic Analysis:

Earthquake:

Response spectrum method of Dynamic Analysis is considered. Following are the details pertaining to dynamic analysis.

Base Shear Enhancement	: Initial Scale factor of Ig/2R is used to enhance the base shear.
Number of modes Considered	: Number of modes considered should be enough to obtain 90% mass participation in each principle plan direction.
Modal Combination Method Used	: Complete Quadratic combination (CQC).
Spatial Combination Method used	: Square root of the sum of Square (SRSS).
Modal case type	: Ritz vector Method
Orthogonal directional seismic effect	: Not applicable
Accidental torsion considered	: 5% of the building plan dimension
Missing mass correction	: Missing mass correction is taken care with Ritz vector method.

Wind:

Dynamic wind response – Along wind response (Gust Factor Analysis) and Across wind response as per Clause 10 of IS 875 (part 3)-2015 shall be followed. if

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Case (i) – Ratio of height of the building to minimum lateral dimension is exceeding 5

Case (ii) – Fundamental natural frequency in first mode is less than 1.0Hz

9. DESIGN METHODOLOGY

All structural members will be designed according to the Limit State Method as specified in IS: 456-2000. Appropriate loads and its combinations, as per relevant clauses in Code IS 456:2000 Code IS 875 (Part-5) 1987, for the most unfavorable effects are chosen for design.

10. MATERIAL

Reinforced cement concrete

Footing	- **M25**
Shear wall and Column	- **M40**
Slab and Beam	- **M25**
Grade of steel	- **Fe 500** (All reinforcing steel)

11. EXPOSURE CONDITION

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

12. COVER TO REINFORCEMENT

As per Table 16A-IS: 456-2000.

Member	Clear Cover (mm)
Pile cap	75 mm
Pile	75 mm
Column	40 mm
Shear Walls	25 mm
Beams	30 mm

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Slabs	20 mm
Water Tanks	25 mm

13. FOUNDATION SYSTEM

Raft foundation.

~~Pile foundation~~ is proposed based on the soil capacity as per Geotechnical investigation report Chennai.

Slabs	20 mm
Water Tanks	25 mm

13. FOUNDATION SYSTEM

Strip raft foundation is proposed based on the soil capacity as per Geotechnical investigation report Chennai.

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12. CODES AND STANDARDS

All the designs are conforming to the relevant Indian Standards, Some of the relevant Indian Standard Codes, which have been followed for the structural designs, are given below.

Code	Description
IS:875 (Part-1)-1987	Code of Practice for Design Loads (Other than Earthquake) for Building and Structures - Unit Weights of Buildings Materials and Stored Material.
IS:875 (Part-2)-1987	Code of Practice for Design Loads (Other than Earthquake) for Building and Structures-Imposed loads
IS:875 (Part-3)-2015	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Wind Load.
IS:875 (Part-5)-1987	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Special Loads and Load Combinations
IS:456-2000 / 456: 2016	Code of Practice for Plain and Reinforced Concrete
IS:1893 (Part-1)-2016	Indian Standard Criteria for Earthquake Resistant Design of Structures
IS:1786-1985	Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement
IS:13920-1993	Ductile Detailing of reinforced concrete structures subjected to seismic forces - code of practice
SP : 16-1980	Design Aids for reinforced concrete to IS:456 -1987
SP : 24-1983	Explanatory Hand Book on Indian Standard Code of Practice for Plain and Reinforced Concrete to IS:456-1987
SP : 7-2005	National Building Code – Part –IV (Fire & Life Safety)
IS:3370-2009	Indian Standard Code of practice for Concrete Structures for Storage of Liquids

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