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STRUCTURAL STABILITY CERTIFICATE

The detailed engineering and structure design of the proposed construction of stilt floor + 5 floors residential building (height -18.30m) with 45 dwelling units, at plot no. 02, (as per CMDA subdivision ppd/lo no. 137/2021), Mudichur, Chengalpattu 600043 comprised in s.no. 292./1, 293/1a & 315/1a, Mudichur village, Tambaram taluk, Chengalpattu district. has been done by me based on the report of geotechnical investigation (soil test) done by Geo Foundations & Structures Pvt. Ltd. Report N0. 1793 Dated 19-04-2025 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 have checked various parameters and found that the proposed building would be safe.

3. I further certify that:

(i) The minimum grade of concrete is M25

(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 IS875 and design of earthquake resistant structure as per IS 1893

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

ENCL: Structural Design Calculations


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PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOORS
RESIDENTIAL BUILDING (HEIGHT -18.30M) WITH 45 DWELLING UNITS, AT PLOT
NO. 02, (AS PER CMDA SUBDIVISION PPD/LO NO. 137/2021), MUDICHUR,
CHENGALPATTU 600043 COMPRISED IN S.NO. 292./1, 293/1A & 315/1A,
MUDICHUR VILLAGE, TAMBARAM TALUK, CHENGALPATTU DISTRICT

TYPICAL STRUCTURAL DESIGN CALCULATION

1 **General:**

Proposed building is **Stilt + 5** upper floors for residential purpose.
Stilt is used for car parking. Upper floors are for residential use.

2 **Design Basis:**

Latest Design codes of BIS-456, 875 and 1893 are followed with SP-16
Design Aid book. A typical 2-D Frame was taken for analysis to arrive at the
bending moment for column design. Since the building is **6** stories, wind
force is taken into account. And live load reduction factor 0.5 is applied
Independent foundation is proposed since $sbc=25$ t/sqm at 2.5m depth.
Fe- 500D steel is used as main steel and M25 concrete adopted

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3 **Earthquake consideration:**

For better stability during earthquake, the columns are tied with plinth beams. Continuous lintels are specified for outer walls and column ties are closely spaced for better ductility. For building on stilt, minimum size of column is taken as 300 mm

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WIND LOAD

$$V_z = V_b \times K_1 \times K_2 \times K_3$$

$$V_b = 50 \text{ m/sec in Chennai}$$

$$K_1 = \text{Probability Factor} = 1$$

$$K_2 = \text{Terrain, Height Factor} = 1$$

$$K_3 = \text{Topography Factor} = 1$$

$$p = 0.6 \times V_z \times V_z$$

$$= 0.6 \times 50 \times 50$$

$$= 1500 \text{ N/Sq.m}$$

$$150 \text{ Kg/Sq.m}$$

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5 **Design Loads:**

Slab 130 mm thk avg	= 3.25 KN/sq.m
Live load	= 2.00 KN/sq.m
Finishes	= <u>1.25</u> KN/sq.m
	<u>6.50</u> KN/sq.m

Applying live load reduction of = 0.5 ,
For column and foundation design, 6.1 Kn/sqm is taken.

This value is also taken for frame analysis

Porothrm work 200 thick for exterior walls

$$0.2 \times 2.59 \times 7.5 = 4 \text{ KN/m/floor}$$

100 thk for interior panels

$$0.1 \times 2.59 \times 8 = 2.07 \text{ KN/m/floor}$$

$$\text{Beams } 0.2 \times 0.55 \times 25 = 2.75 \text{ KN/m/floor}$$

$$\text{Columns } 0.3 \times 0.90 \times 3.00 \times 25 = 20.25 \text{ KN/floor}$$

These are taken for analysis with WL+LL+DL combination.

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SLAB DESIGN:

Refer drawing

SLAB - S1

Thickness = 130 mm
 Cover = 20 mm
 Eff.Depth = 105 mm

Fck = M 25 N/sq.mm
 Fy = Fe 500 N/sq.mm

Panel (3.6 x 8.03) m

Twoway slab $L_y / L_x = 8.03 / 3.60 = 2.2$

Support condition - One way slab

Designed for 0.070 co.efficient

$$M_u = 0.065 \times 6.5 \times 1.5 \times 3.60 \times 3.60 = 8.21 \text{ KNm/m}$$

$$M_u / b.d.d = \frac{8.21 \times 1000 \times 1000}{1000 \times 105 \times 105} = 0.74 \text{ N/sq.mm}$$

From Table-3 of SP-16, Pt 0.350 %

Minimum Pt = 0.12 % as per code,

$$A_t = 0.350 \times 1000 \times 105 / 100 = 368 \text{ sq.mm/m}$$

Provide 10 dia @ 125 = 628 sq.mm/m Short span

Provide 10 dia @ 175 = 449 sq.mm/m Long span

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Beam size 200 x 600

d = 560 mm

F_{ck} = M 25

Max. Bending Moment at support top = $\frac{WL^2}{12} + p_1 \cdot ab^2/l^2 + P_2 \cdot ab^2/l^2$

= 6.2 Kn.m

$$M_u = 6 \times 1.5 \times 10^{-6} \text{ Nmm}$$

$$M_u/b.d.d = \frac{9 \times 10^{-6}}{200 \times 560 \times 560} = 0.15 \text{ N/sq.mm}$$

From table 55 SP-16 for $d'/d = 40 / 600 = 0.07$

$$P_t = 0.695 \% \quad P_c = 0.40 \%$$

$$A_t = 0.695 \times 200 \times 600 / 100 = 834 \text{ sq.mm (top)}$$

$$A_c = 0.400 \times 200 \times 600 / 100 = 480 \text{ sq.mm (bot)}$$

provided 2 No 16 = 402 sq.mm

+ 1 No 20 = 314

+ 2 nos 20 = 628

1345 sq.mm at top of support

Shear Design:

Shear force 90 KN

$$\text{Factored shear force} = 1.5 \times 90 = 135 \text{ KN}$$

for 0.70 % steel Shear resisted by concrete section

from table-61 $0.7 \times 200 \times 560 / 1000 = 78 \text{ KN}$

Balance shear (V_{us}) = 135 - 78 = 57 KN

$$V_{us}/d = 57 / 56 = 1.0 \text{ KN/cm}$$

from table 62 of SP-16

Required 2 legged 8 stirrups @ 170 mm c/c

Provided 2 legged 10 stirrups @ 125 mm c/c

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8 **COLUMN DESIGN:** **COL-A** **COL SIZE** **450 X 600**

Maximum load

$$P = 260 \text{ t}$$

$$P_u = 1.5 \times 260 \times 10 = 3900 \text{ KN}$$

Max.Bending Moment =

5 t.m

$$M_u = 1.5 \times 5.0 \times 10 = 75 \text{ Kn.m}$$

$$\text{Cover} = 40 \text{ mm}$$

$$d'/d = 0.07$$

$$F_{ck} = 40 \text{ N/sq.mm}$$

Provide bars equaly all sides

Refer chart 48 of SP-16

$$\frac{P_u}{F_{ck} \cdot b \cdot d} = \frac{3900 \times 1000}{40 \times 450 \times 600} = 0.36$$

$$\frac{M_u}{F_{ck} \cdot b \cdot d^2} = \frac{75 \times 10^6}{40 \times 450 \times 600^2} = 0.01$$

$$\frac{p}{F_{ck}} = 0.03 \quad p\% = 0.03 \times 40 = 1.2 \%$$

Minimum steel 0.8%

$$A_s = \frac{1.2 \times 450 \times 600}{100} = 3240 \text{ sq.mm}$$

$$\text{Provided } 16 \text{ Nos } 25 \text{ dia} = 7854 \text{ sq.mm}$$

Ties 8 @ 100 c/c and 8 @ 175 c/c

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9 **FOOTING DESIGN** for **COL-A** refer sheet - 1 of drawing

Maximum load on column type " A P = 320 t
 Add 10% footing load = 352 t
 S.B.C of Soil at 2.5 m depth = 25 t/sqm
 Assume square base of 4.5 m x 3.2 m. footing
 So pressure on soil is and depth = 1000 mm
 Eff. Depth = 950 mm

$$\frac{352}{4.5 \times 3.2} = 24 \text{ t/sqm} < 25 \text{ t/sqm}$$

Pedestal size = 0.9 m

$$\text{Cantilever projection of footing} = \frac{3.3 - 0.15 - 0.90}{2} = 1.13 \text{ m}$$

B.M on footing at face of column

$$\text{BM} = 24.4 \times 1.13 \times \frac{1.13}{2} = 15.47 \text{ tm}$$

$$\text{Mu} = 15.47 \times 1.5 = 23.20 \text{ tm}$$

$$\text{Mu/b.d.d} = \frac{23.20 \times 1000 \times 10000}{900 \times 950 \times 950} = 0.29 \text{ N/sqm}$$

$$\text{Fck} = 30 \text{ n/sqmm}$$

From Table-4 of SP-16,

$$\text{pt\%} = 0.200 \%$$

$$\text{At} = 0.200 \times 950 \times \frac{4350}{100} = 1710 \text{ sq.mm}$$

$$\text{Provide } 16 \text{ dia @ } 150 \text{ c/c} = 4088 \text{ sq.mm}$$

bothways

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