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07-03-2025

STRUCTURAL STABILITY CERTIFICATE

The detailed engineering and structure design of The Proposed Construction Of Group Housing Development Consisting Of 2 Blocks , Block -1: Stilt Floor (Parking) + 5 Floors (18.30m- Height) With 30 Dwelling Units , Block -2, Stilt Floor(Parking) + 5 Floors (18.30m - Height)With 20 Dwelling Units, Totally 50 Dwelling Units Availing Premium Fsi At Plot No: 46,47,58,59 & 60 ,Door No: 1,Shanmugapuram 7 Th Street, And T. S. Gopal Nagar 1st Street , Thiruvottiyur, Chennai.600019, Comprised In Old S.No: 548/Part 1a1a1a1a1b1a, T.S. No. 66, Block No:3 , Ward -G Of Thiruvottiyur Village , Within The Limit Of Greater Chennai Corporation.has been done by me based on the report of geotechnical investigation (soil test) done by Geo Mines Engineers Pvt. Ltd. (GMEPL/HANSA ESTATES PVT. LTD./415/2023-24) Dated 02/12/2023 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.

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ENCL: Structural Design Calculations

PLAN SHOWING THE PROPOSED CONSTRUCTION OF GROUP HOUSING DEVELOPMENT CONSISTING OF 2 BLOCKS , BLOCK -1: STILT FLOOR (PARKING) + 5 FLOORS (18.30M- HEIGHT) WITH 30 DWELLING UNITS , BLOCK -2, STILT FLOOR(PARKING) + 5 FLOORS (18.30M - HEIGHT)WITH 20 DWELLING UNITS, TOTALLY 50 DWELLING UNITS AVAILING PREMIUM FSI AT PLOT NO: 46,47,58,59 & 60 ,DOOR NO: 1,SHANMUGAPURAM 7 TH STREET, AND T. S. GOPAL NAGAR 1ST STREET , THIRUVOTTIYUR, CHENNAI.600019, COMPRISED IN OLD S.NO: 548/PART 1A1A1A1A1B1A, T.S. NO. 66, BLOCK NO:3 , WARD -G OF THIRUVOTTIYUR VILLAGE , WITHIN THE LIMIT OF GREATER CHENNAI CORPORATION.

TYPICAL STRUCTURAL DESIGN CALCULATION

1 General:

Proposed residential buildings are S + 5 FLOORS. Stilt floor is used as car park. Upper floors are used for Residential purpose. Typical floor height 3.05m. Typical one design calculation is given.

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. Also a live load reduction factor of 0.25 is taken for foundation and column design.

foundation is proposed pile foundation as per soil report.

Fe- 500 steel is used as main steel and minimum M25 concrete is provided

3 Earthquake consideration:

For better stability during earhquake, the columns are braced in both direction with beams. Continuous lintels are specified for outer walls and column ties are closely spaced for better ductility. For building on stilt, minimum size is taken as 300 mm(12")

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4 EARTHQUAKE LOAD

Design horizontal Seismic coeff. Ag = $\frac{Z}{2} \times \frac{I}{R} \times \frac{Sa}{g}$

Z = Zone Factor = 0.16 for Chennai

I = Importance Factor = 1.0

R = Response reduction Factor = 5

$\frac{Sa}{g}$ = Avg. response acc.coeff. Depends on Ta

Ta = Fundamental natural period

= $\frac{0.09\ h}{\sqrt{d}}$ for infill walls

h = height of the building

d = Width of the building

= 0.075 h [0.75] for residential building

W = seismic weight of building

= 100% D.L + 25% L.L for residential <=300

= 100% D.L + 50% L.L for residential >300

Base Seismic Shear Vb = Ag x W

5 WIND LOAD

Vz = Vb x K1 x K2 x k3

Vb = 50 m/sec in Chennai

K1 = Probability Factor = 1

K2 = Terrain, Height Factor = 1

K3 = Topography Factor = 1

p = 0.6 x Vz x Vz

= 0.6 x 50 x 50

= 1500 N/Sq.m

150 Kg/Sq.m

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6 **Design Loads:**

Slab130 mm thk avg	=	3.3	KN/sq.m
Live load	=	2.0	KN/sq.m
Finishes	=	1.5	KN/sq.m
		6.8	KN/sq.m

Say 7 KN/sq.m/floor for slab and beam design

Applying live load reduction of = 0.25 ,

For column and foundation design, 5.1 Kn/sqm is taken.

This value is also taken for frame analysis

230 thick brick exterior walls

0.23 x 2.55 x 20 = 12 KN/m/floor

B.W. 115 thk for interior panels

0.100 X 2.55 x 20 = 5.1 KN/m/floor

Beams 0.23 x 0.45 x 25 .= 2.59 KN/m/floor

Columns 0.3 x 0.60 x 3.00 x 25 .= 13.5 KN/floor

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

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7 **SLAB DESIGN:**

Thickness	=	130 mm		Fck	= M 30	N/sq.mm
Cover	=	25 mm		Fy	=Fe 500	N/sq.mm
Eff.Depth	=	100 mm				

Panel (3.1 x 3.9) m

Twoway slab Ly / Lx = 3.9 / 3.1 .= 1.3

Support condition - 1 short edges continuous

short span=	α x	=	0.061	(- BM at continuous edge)	Table:26
		=	0.046	(+ BM at midspan)	in IS-456-2000
Long span	α y	=	-	(- BM at support)	
			0.04	+BM AT MIDSPAN	

Designed for 0.061 co.efficient

Mu .= 0.061 x 7.0 1.5 x 3.1 x 3.1 = 6.16 KNm/m

$$\text{Mu / b.d.d} = \frac{6.16 \times 1000 \times 1000}{1000 \times 100 \times 100} = 0.62 \text{ N/sq.mm}$$

From Table-3of SP-16, Pt 0.210 %

Minimum Pt = 0.12 % as per code, for Fe-500

At = 0.210 x 1000 100 ./ 100 = **210** sq.mm/m

Provide 8 dia @ 150 = **335.1** sq.mm/m Short span

Provide 8 dia @ 175 = **287.2** sq.mm/m Long span

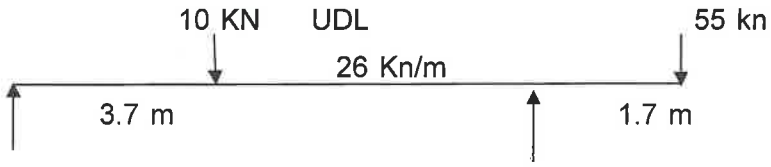
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8 **Beam design:**

span = 3.7 m **Beam size 200 x 600**

d = 545 mm

Fck = M 30



Bending moment for UDL 189.00 Kn.m

Max. B.M = 189.00 (top of support) This is taken for design

Mu = 189 x 1.5 x 10-e6 = **283.5** x **10-e6** Nmm

$$Mu/b.d.d = \frac{283.5 \times 10\text{-e6}}{200 \times 545 \times 545} = 4.77 \text{ N/sq.mm}$$

From table-53 SP-16 for d'/d = 80 / 670 = 0.12

Pt = **1.423** % Pc = **0.52** %

At = 1.423 x 200 x 545 / 100 = **1551** sq.mm (top)

Ac = 0.520 x 200 x 545 / 100 = **566.8** sq.mm (bot)

provided 3 No 20 = **942** sq.mm +

3 No 20 = **942**

1885 sq.mm at support top

Shear Design:

Shear force p/2 = 189 KN

Factored shear force = 1.5 x 189 = 284 KN

for 1.42 % steel Shear resisted by concrete section

from table-61 0.78 x 200 x 545 / 1000 = 85 KN

Balance shear (Vus) = 284 - 85 = 198 KN

Vus/d = 198 / 54.5 = 3.64 KN/cm

from table 62 of SP-16

Required 2 legged 8 stirrups @ 100 mm c/c

Provided 2 legged **10** stirrups @ **110** mm c/c

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9 **COLUMN DESIGN:** COL-1 COL SIZE 300 X 600

Maximum load is with wind force P = 170 t

Pu = 1.5 x 170 x10 = 2550 KN

Max.Bending Moment = 8 t.m Mu = 1.5 x 8.0 x10= 120 Kn.m

Cover = 40 mm

d'/d = 0.07

Fck = 30 N/sq.mm

Provide bars equaly all sides

Refer chart 44 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{2550 \times 1000}{30 \times 300 \times 600} = 0.47$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{120 \times 10^6}{30 \times 300 \times 600} = 0.04$$

$$\frac{p}{Fck} = \frac{p\%}{100 \times 600} = \frac{0.03 \times 30}{600} = 0.9\ \%$$

Minimum %age of steel is 0.8 %

$$As = \frac{0.9 \times 300 \times 600}{100} = 1620 \text{ sq.mm}$$

Provided 6 Nos 20 dia = 1885 sq.mm

\+ 4 Nos 20 dia = 1257 sq.mm

3142 SQ MM

Ties 8 @ 110 & 170 c/c

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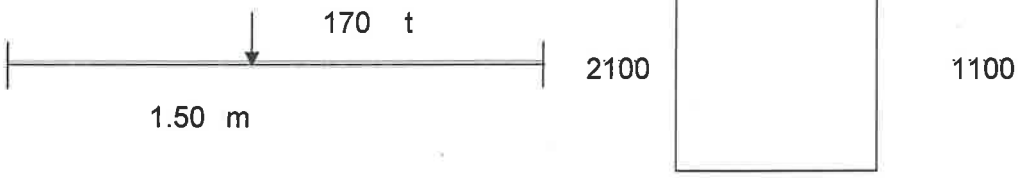
10 **Pile cap and pile**

As per soil report, **25.0** m bored cast-in-situ pile can be adopted.

600 dia pile safe capacity	=	140	t
Col-A carries maximum load of	=	170	t
So No of piles provided	=	2	Nos

Pile cap size = 900 X 2400 X 1100 mm

M-30 grade = 30 N/sq.mm



Section of pile cap

Pile to pile distance = 1.50 m

axial force = 170 x 1.50 / / 1.03

= 61.9 tonnes

At reqd = 61.893 /2.5 '= 21 sqcm

Provided bttom bothways = **8 nos** 20

= 25.13 sqcm

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CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
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PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru J.PRABAKARAN** 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 **6 years**.

He has been given the Registration No.**SE/GR-I/2020/03/263** on **12.03.2020.** 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 **11.03.2025.**



12.03.2020
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