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Date : 02.05.2024

STRUCTURAL STABILITY CERTIFICATE

It is certified that the
PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOORS (HEIGHT 18.30 M) RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AVAILING PREMIUM FSI AT PLOT NO. 5 & 6, OLD DOOR NO. 17, 18/1, 18/2, 18/3 AND 18/4, NEW DOOR NO. 42, 44/1, 44/2, 44/3 AND 44/4, VENKATARAMAN STREET, T.NAGAR, CHENNAI – 600 017, COMPRISED IN OLD S.NO. 68, PAIMASH NO. 627 A & 647 A, T.S. NO: 4871/2, 4871/3, 4871/4, BLOCK NO. 113 OF T.NAGAR VILLAGE WITHINTHE LIMITS OF GREATER CHENNAI CORPORATION'. DIVISION - 136, ZONE -10.

is designed to resist for earthquake. Check has been made and found safe and I hereby certify that

1. The minimum grade of concrete is M25
2. The design analysis using the code of practice for loading . standards as per BIS-875 and Seismic forces as per the latest code BIS-1893 & BIS-456
3. Least dimension of column is 300mm in stilt floor.
4. Proposed structure will be structurally safe and sound.

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TYPICAL STRUCTURAL DESIGN CALCULATION

1 **General:**

Proposed buildings are **S+5** floors. Stilt floor is used for car parking. Upper floors are for residential purpose.

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 0.5 is taken for foundation and column design.

Pile foundation is proposed as per as per soil report.

Fe-500 steel is used as main steel

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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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

= 0.09x18/ sqrt 23.7

= 0.33

= $0.075\ h^{0.75}$ for office 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

4

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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5 **Design Loads:**

Slab 130mm thk	=	3.25	KN/sq.m
Live load	=	2.00	KN/sq.m
Finishes	=	1.50	KN/sq.m
		6.75	KN/sq.m

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

Applying live load reduction of = 0.5 ,

For column and foundation design, 5.75 Kn/sqm is taken.

This value is also taken for frame analysis

Block Work 200 thick for exterior walls

0.2 x 2.4 x 10 = 5 KN/m/floor

Blockk Work 100 thick for interior walls

0.100 X 2.4 x 10 = 2.4 KN/m/floor

Beam 0.23 x 0.60 x 25 .= 3.45 KN/m/floor

Columns 0.6 x 0.60 x 3.00 x 25 .= 27.0 KN/floor

for 6 upper 6 X 27.0 KN/floo .= 162 KN

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

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6 **SLAB DESIGN:** Refer sheet-1 SLAB - S1

Thickness	=	140 mm		Fck	= M 25	N/sq.mm
Cover	=	25 mm		Fy	=Fe 500	N/sq.mm
Eff.Depth	=	110 mm				

Panel (4.6 X 5.1) m

Twoway slab Ly / Lx = 5.1 / 4.6 .= 1.11

Support condition - Two short edges discontinous

short span= α x = 0.054 (- BM at continuous edge) Table:26

= 0.047 (+ BM at midspan) in IS-456-2000

short span= α y = 0.040 (+ BM at midspan)

= 0.035 (- BM at continuous edge)

Designed for 0.054 co.efficient

Mu .= 0.054 x 8.0 1.5 x 4.6 x 4.6 = 13.71 KNm/m

$$\text{Mu / b.d.d} = \frac{13.71 \times 1000 \times 1000}{1000 \times 110 \times 110} = 1.13 \text{ N/sq.mm}$$

From Table-2 of SP-16, Pt 0.273 %

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

At = 0.273 x 1000 110 ./ 100 = **300** sq.mm/m

Provide 8 dia @ 125 = **402** sq.mm/m Short span

Provide 8 dia @ 150 = **335** sq.mm/m Long span

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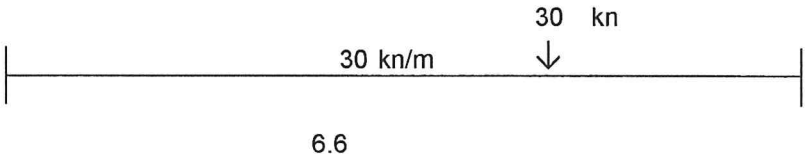
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7 **Beam design:** Beam-1 (Refer sheet -01)

span = 5.8 m Beam size 200 x 600

d = 560 mm

Fck = M 25



Bending moment = 150.00 Kn.m

Max. B.M = 150.0 Knm (top of support)

This is taken for design

Mu = 150.0 x 1.5 x 10-e6

225.0 x **10-e6** Nmm

Mu/b.d.d = $\frac{225.0 \times 10\text{-e6}}{200 \times 560 \times 560}$ = 3.59 N/sq.mm

From table-2 SP-16 for d'/d = 40 / 600 = 0.07

Pt = **1.350** % Pc = **0.450** %

At = 1.350 x 200 x 560 / 100 = **1512** sq.mm (Bot)

Ac = 0.450 x 200 x 560 / 100 = **504** sq.mm (Top)

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

3 No 20 = **942**

1885 sq.mm

No of bars at top of support = **3 Nos** **20** dia + **3 Nos** **20** dia

%age of steel at top of support = 1.7 %

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Shear Design:

Shear force 172 KN

Factored shear force = 1.5 x 172 = 258 KN

for	1.68	%	steel		Shear resisted by concrete section				
from table-61		0.74	x	200	x	560 /	1000 =	83	KN
Balance shear	(Vus)	=		258	-	83	=	175	KN

Vus/d = 175 / 56 = 3.13 KN/cm

from table 62 of SP-16

Required 2 legged	10 stirrups	@	200 mm	c/c
Provided 2 legged	**10** stirrups	@	**130** mm	c/c

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8 **COLUMN DESIGN:** **COL-C1** **COL SIZE** **600 X 600**

Maximum load is with wind force — P = 100 t

Pu = 1.5 x 100 x10 = 1500 KN

Max.Bending Moment = 5 t.m — Mu = 1.5 x 5.0 x10= 75 Kn.m

Cover = 40 mm

d'/d = 0.07

Fck = **M30** = 30 N/sq.mm

Provide bars equaly all sides

Refer chart 44 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{1500 \times 1000}{30 \times 600 \times 560} = 0.14$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{75 \times 10^6}{30 \times 600 \times 560} = 0.01$$

$$\frac{p}{Fck} = \frac{0.04}{p\% = 0.04 \times 30} \quad p\% = 1.2\ \%$$

Minimum %age of steel is 0.8 %

$$As = \frac{1.2 \times 600 \times 600}{100} = 4320\ sq.mm$$

Provided 8 Nos 20 dia + = 2513 sq.mr +

8 Nos 20 dia = 2513 sq.mm

TOTAL PROVIDED = 5027 sq.mm

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

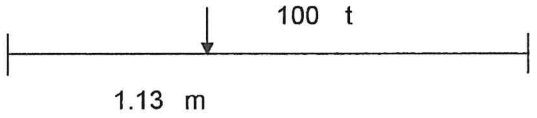
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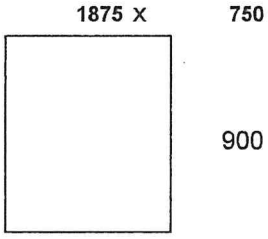
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9 **Pile cap and pile**

As per soil report, 13 m bored cast-in-situ pile can be adopted.

450 dia pile safe capacity	=	100	t	
Col-A carries maximum load of	=	160	t	
So No of piles provided	=	2	Nos	
Pile cap size =	1875	x 750	X	900 mm
M-30 grade =	30	N/sq.mm		





Section of pile cap

Pile to pile distance = 1.13 m

axial force = 100 x 1.13 / / 0.82

= 101 tonnes

At reqd = 100.5 /2.5 '= 23.1 sqcm

Provided bottom = **8 Nos 20**

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