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STRUCTURAL STABILITY CERTIFICATE

Date : 13.12.2023

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 -24 OLD DOOR NOS: 26/1 TO 26/8 AND NEW DOOR NOS :51/1 TO 51/8, 4TH TRUST CROSS STREET, MANDAVELIPAKKAM, CHENNAI-600 028. COMPRISED IN R.S.NO: 4311/22, BLOCK NO.97, OF MYLAPORE VILLAGE, GREATER CHENNAI CORPORATION. DIVISION 126, ZONE -9.

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. The proposed structure is structurally safe and sound.

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TYPICAL STRUCTURAL DESIGN CALCULATION

1 **General:**

Proposed building is a Stilt + 5 upper floors for residential use. Stilt floor is used for car parking.

2 **Design Basis:**

Latest Design codes of BIS-456, 875 and 1893 are followed with SP-16 Design Aid book. A typical 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. Live load reduction factor is applied in design. Isolated foundation is proposed as per soil report. Fe- 500 steel is used as main steel and M25 grade concrete.

3 **Earthquake consideration:**

For better stability during earhquake, 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(12")

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			

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5 **Design Loads:**

Slab thk	130	=	3.25 KN/sq.m
Live load		=	2.00 KN/sq.m
Finishes		=	1.25 KN/sq.m
			6.50 KN/sq.m

Say 6.50 KN/sq.m/floor for slab and beam design
Applying live load reduction of = 0.1 ,
For column and foundation design, 6.30 Kn/sqm is taken.

This value is also taken for frame analysis

Clay bricks 230 thick for exterior walls

	0.23	x	2.6	x	20			=	12 KN/m/floor
Beams	0.23	x	0.45	x	25			.=	2.59 KN/m/floor
Columns	0.23	x	0.45	x	3.00	x	25	.=	7.76 KN/floor

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

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

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

Panel (4.4 x 4.6) m
=

Twoway slab Ly / Lx 4.6 / 4.4 .= 1.05

Support condition - ONE LONG EDGE CONTINUOUS

short span=	α x	=	0.045	(- BM at continuous edge)	Table:26
		=	0.060	(+ BM at midspan)	in IS-456-2000
long span=	α y	=	0.043	(- BM at continuous edge)	
		=	0.000	(+ BM at midspan)	

Designed for 0.060 co.efficient

Mu .= 0.060 x 6.5 x 1.5 x 4.4 x 4.4 = 11.33 knm/m

$$\text{Mu / b.d.d} = \frac{11.33 \times 1000 \times 1000}{1000 \times 110 \times 110} = 0.94 \text{ N/sq.mm}$$

From Table-3 of SP-16, Pt .= 0.280 %
Minimum Pt = 0.12 % as per code, fo 3

At = 0.280 x 1000 x 110 ./ 100 = **308** sq.mm/m

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

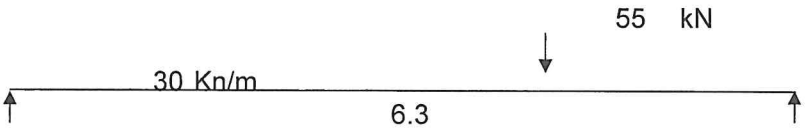
Provide 8 dia @ 150 c/c = **335.1** sq.mm/m Long span

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7 **Beam design:** B1 Refer sheet - 1 of drawing

Effective span = 4.4 m Beam size 230 x 600

Fck = M 25 d = 560 mm



Max. Bending Moment at support =

$$= \frac{30 \times 6.25 \times 6.25}{12} + 55.0 = 153 \text{ Knm}$$

Mu = 152.7 x 1.5 x 10-e6 = 229.0 x 10-e6 Nmm

$$Mu/b.d.d = \frac{229 \times 10\text{-e6}}{230 \times 560 \times 560} = 3.17 \text{ N/sq.mm}$$

From table-55 SP-16 for d'/d = 40 / 560 = 0.07

Pt = **0.900** % Pc = **0.250** %

At = 0.900 x 230 x 560 / 100 = **1159** sq.mm (bot)

Ac = 0.250 x 230 x 560 / 100 = **322** sq.mm (top)

provided 2 No 16 = 402 sq.mm

\+ 3 No 20 = 942 sq.mm

1345 sqmm Top support

Shear Design:

$$\text{Shear force} = \frac{30 \times 6.25}{2} + 40 = 134 \text{ KN}$$

Factored shear force = 1.5 x 134 = 200.6 KN

for 0.90 % steel Shear resisted by concrete section

from table-61 0.6 x 230 x 560 / 1000 = 77 KN

Balance shear (Vus) = 200.63 - 77 = 123 KN

Vus/d = 123 / 56 = 2.2 KN/cm

from table 62 of SP-16

Required 2 legged 8 stirrups @ 150 mm c/c

Provided 2 legged **8** stirrups @ **125** mm c/c

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8 **COLUMN DESIGN:** **C1** **COL SIZE** **1100** **X** **450**

Maximum load on column in basement P = 270 t

Pu = 1.5 x 270 x10 = 4050 KN

Max.Bending Moment = 60 t.m Mu = 1.5 x 60.0 x10= 900 Kn.m

Cover = 40 mm

d'/d = 0.09

Fck = 35 N/sq.mm

Provide bars equaly all sides

Refer chart 48 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{4050 \times 1000}{35 \times 1100 \times 450} = 0.23377$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{900 \times 10^6}{35 \times 1100 \times 410 \times 410} = 0.14$$

$$\frac{p}{Fck} = 0.075 \quad p\% = 0.08 \times 35 = 2.625\ \%$$

Minimum steel = 0.8 %

$$As = \frac{2.625 \times 1100 \times 450}{100} = 12994 \text{ sq.mm}$$

Provided 28 Nos 25 dia = **13745 sq.mm**

Ties 10 @ 100 C/C AND 175 C/C

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9 **FOOTING DESIGN** F1 for **C1** Refer sheet - 1 of drawing

Maximum load on column type " A P = 270 t Fck = 25

Max.Bending Moment = 2 t.m

S.B.C of Soil at 14 t/sqm at depth = 2.5 m
Assume footing base of 4.5 X 4.5 m and depth = 950 mm
So pressure on soil is Eff. Depth = 900 mm

$$\frac{270}{4.5 \times 4.5} = 13.3 \text{ t/sqm} < 14 \text{ t/sqm}$$

Cantilever projection of footing = $\frac{4.5 - 0.45}{2} = 2.03$ m

B.M on footing at face of column pedestal

BM = $13.33 \times 2.03 \times \frac{2.03}{2} = 27.34$ tm

Mu = 27.34 x 1.5= 41.01 tm

Mu/b.d.d = $\frac{41.01 \times 1000 \times 10000}{1000 \times 900 \times 900} = 0.51$ N/sqm

Fck = 25 n/sqmm

From Table-3 of SP-16, Pt 0.123 % min pt% .= 0.120 %

At = $\frac{0.123 \times 1000 \times 900}{100}$ = **1107** sq.mm

Provide 12 dia @ 100 c/c = **2319** sq.mm

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