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STRUCTURAL STABILITY CERTIFICATE

Date :19.02.2024

It is certified that the
PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR (PARKING) + 1st FLOOR RESIDENTIAL with 1DU + 2nd TO 4th FLOOR OFFICE BUILDING AT OLD DOOR NO.23, NEW DOOR NO.9, PLOT NO. 4363, X BLOCK, 5th STREET, ANNA NAGAR WEST, CHENNAI 600 040, COMPRISED IN OLD S.No.92pt, RS.No.92/2pt, TS NO.584, BLOCK NO.2, WARD No.1, MULLAM VILLAGE, AMINJAKARAI TALUK WITH IN THE LIMIT OF GREATER CHENNAI CORPORATION.

is designed to resist for earthquake. Check has been made 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.

N. Chandru

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TYPICAL STRUCTURAL DESIGN CALCULATION

1 **General:**

Proposed building is S+4 upper floors for office cum residential purpose 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 5 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	150	=	3.75 KN/sq.m	
Live load		=	4.00 KN/sq.m	(Office Floors)
Finishes		=	2.00 KN/sq.m	
			9.75 KN/sq.m	

Say 9.75 KN/sq.m/floor for slab and beam design
Applying live load reduction of = 0 ,
For column and foundation design, 9.75 Kn/sqm is taken.

This value is also taken for frame analysis

Clay bricks 230 thick for exterior walls

	0.23	x	3.2	x	20			=	15 KN/m/floor
Beams	0.23	x	0.45	x	25			.=	2.59 KN/m/floor
Columns	0.38	x	0.53	x	3.20	x	25	.=	15.75 KN/floor

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

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6 **SLAB DESIGN:**

Thickness	=	175	mm	Concrete mix	Fck	= M 25	N/sq.mm
Cover	=	25	mm	Steel Grade	Fy	=Fe 500	N/sq.mm
Eff.Depth	=	145	mm				

Panel (5.2 x 8.4) m

=

Twoway slab Ly / Lx 8.4 / 5.2 .= 1.6

Support condition - TWO SHORT EDGE DISCONTINUOUS

short span=	α x	=	0.047	(- BM at continuous edge)	Table 26
		=	0.062	(+ BM at midspan)	in IS-456-2000
long span=	α y	=	0.032	(- BM at continuous edge)	
		=	0.000	(+ BM at midspan)	

Designed for 0.062 co.efficient

Mu .= 0.062 x 9.8 x 1.5 x 5.2 x 5.2 = 24.52 knm/m

$$\text{Mu / b.d.d} = \frac{24.52 \times 1000 \times 1000}{1000 \times 145 \times 145} = 1.17 \text{ N/sq.mm}$$

From Table-3 of SP-16, Pt .= 0.293 %

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

At = 0.293 x 1000 x 145 ./ 100 = **424.85** sq.mm/m

Provide 10 dia @ 125 c/c = **628.3** 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:**

Effective span = 7.6 m Beam size 450 x 525

Fck = M 25 d = 485 mm



Max. Bending Moment at support = (w.l.l / 12)

$$= \frac{52 \times 7.6 \times 7.6}{12} + \frac{0.0}{8} = 250 \text{ Knm}$$

Mu = 250.3 x 1.5 x 10-e6 = 375.4 x 10-e6 Nmm

$$Mu/b.d.d = \frac{375 \times 10\text{-e6}}{450 \times 485 \times 485} = 3.55 \text{ N/sq.mm}$$

From table-55 SP-16 for d'/d = 40 / 485 = 0.08

Pt = **0.986** % Pc = **0.040** %

At = 0.986 x 450 x 485 / 100 = **2152** sq.mm (bot)

Ac = 0.040 x 450 x 485 / 100 = **87.3** sq.mm (top)

provided 4 No 20 = 1257 sq.mm

\+ 4 No 20 = 1257 sq.mm

2513 sqmm Top support

Shear Design:

$$\text{Shear force} = \frac{52 \times 7.6}{2} + 0 = 198 \text{ KN}$$

Factored shear force = 1.5 x 198 = 296.4 KN

for 0.99 % steel Shear resisted by concrete section

from table-61 0.63 x 450 x 485 / 1000 = 137 KN

Balance shear (Vus) = 296.4 - 137 = 159 KN

Vus/d = 159 / 56 = 2.8 KN/cm

from table 62 of SP-16

Required 4 legged	8 stirrups	@	200	mm	c/c
Provided 4 legged	**8** stirrups	@	**125**	mm	c/c

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8 **COLUMN DESIGN:** COL C1 IN Drawing **COL SIZE** **375** **X** **525**

Maximum load on column in basement P = 160 t

Pu = 1.5 x 160 x10 = 2400 KN

Max.Bending Moment = 20 t.m Mu = 1.5 x 20.0 x10= 300 Kn.m

Cover = 40 mm

d'/d = 0.08

Fck = 35 N/sq.mm

Provide bars equaly all sides

Refer chart 48 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{2400 \times 1000}{35 \times 375 \times 525} = 0.3483$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{300 \times 10^6}{35 \times 375 \times 525 \times 525} = 0.08$$

$$\frac{p}{Fck} = 0.04 \quad p\% = 0.04 \times 35 = 1.4\ \%$$

Minimum steel = 0.8 %

$$As = \frac{1.4 \times 375 \times 525}{100} = 2756 \text{ sq.mm}$$

Provided 12 Nos 20 dia = **3770 sq.mm**

Ties 8 @ 100 C/C AND 170 C/C

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9 **FOOTING DESIGN** for **COL-C1** refer sheet - 1 of drawing

Maximum load on column type " A P = 155 t Fck = 25
Add 10% footing load = 170.5 t
Max.Bending Moment = 0.5 t.m

S.B.C of Soil at 12 t/sqm at depth = 1.8 m
Assume footing base of 3.8 x 3.8 m and depth = 750 mm
So pressure on soil is Eff. Depth = 700 mm

$$\frac{171}{3.8 \times 3.8} = 11.8 \text{ t/sqm} < 15 \text{ t/sqm}$$

Cantilever projection of footing = $\frac{3.8 - 1.7 - 0.38}{2}$ = 1.70 m

B.M on footing at face of column pedestal

BM = $\frac{11.81 \times 1.70 \times 1.70}{2}$ = 17.06 tm

Mu = 17.06 x 1.5= 25.59 tm

Mu/b.d.d = $\frac{25.59 \times 1000 \times 10000}{1000 \times 700 \times 700}$ = 0.52 N/sqm

Fck = 25 n/sqmm
From Table-3 of SP-16, Pt 0.12 % min pt% .= 0.120 %

At = $\frac{0.120 \times 1000 \times 700}{100}$ = **840** sq.mm

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

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