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DATE : 12-04-2023

STRUCTURAL STABILITY CERTIFICATE

It is certified that the

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT + 5 FLOORS (18.25M HEIGHT) RESIDENTIAL BUILDING WITH 40 DWELLING UNITS AT PLOT B, NEW GIRI ROAD, COMPRISED IN T.S.NO.4790/1PART, 4790/2, 4790/3 AND 4790/4, BLOCK NO.109 OF T.NAGAR VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION ZONE : 9, DIVISION: 117.

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 building consists of Stilt +5. Stilt floor used for parking, Upper floors for residencial purpose. The floor height is 3.05m in upper floors.

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. Pile foundation is proposed. 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	125	=	3.13 KN/sq.m
Live load		=	2.00 KN/sq.m
Finishes		=	1.25 KN/sq.m
			6.38 KN/sq.m

Say 6.38 KN/sq.m/floor for slab and beam design

Applying live load reduction of = 0.1 ,

For column and foundation design, 6.18 Kn/sqm is taken.

This value is also taken for frame analysis

200mm	thick block work								
	0.2	x	2.55	x	21		=	11	KN/m/floor
Beams	0.2	x	0.45	x	25		.=	2.25	KN/m/floor
Columns	0.3	x	0.60	x	2.55	x 25	.=	11.48	KN/floor

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

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6 **SLAB DESIGN:** **S1**

Thickness	=	175	mm	Concrete mix	Fck	= M 25	N/sq.mm
Cover	=	20	mm	Steel Grade	Fy	= Fe 500	N/sq.mm
Eff.Depth	=	150	mm				

Panel (7.35 x 7.35) m

Two way slab Ly / Lx = 7.35 / 7.4 .= 1.0
Support condition - Two short edges discontinuous

short span=	α x	=	0.032	(- BM at continuous edge)	Table:26
		=	0.024	(+ BM at midspan)	in IS-456-2000
long span=	α y	=	0.032	(- BM at continuous edge)	
		=	0.024	(+ BM at midspan)	

Designed for 0.032 co.efficient

Mu .= 0.032 x 6.4 x 1.5 x 7.4 x 7.35 = 16.53 knm/m

$$\text{Mu / b.d.d} = \frac{16.53 \times 1000 \times 1000}{1000 \times 150 \times 150} = 0.73 \text{ N/sq.mm}$$

From Table-3 of SP-16, Pt .= 0.179 %
Minimum Pt = 0.12 % as per code, for Fe-415

At = 0.179 x 1000 x 175 ./ 100 = **313.25** sq.mm/m

Provide 10 dia @ 125 c/c = **628.3** sq.mm/m Short span

Provide 10 dia @ 125 c/c = **628.3** sq.mm/m Long span

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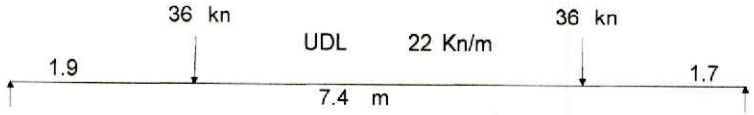
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7 **Beam design:**

BEAM B-A

Effective span = 7.4 m Beam size 200 x 600

Fck = M 25 d = 550 mm



Max. Bending Moment at column support = W*L*L / 10 + P1*a*b*b / l*l + P2*a1*b1*b1 / l*l

= 119 + 37.6 + 36.2

= 193 Kn-m

Mu = 193 x 1.5 x 10-e6 = 289 x 10-e6 Nmm

Mu/b.d.d = 289 x 10-e6 / 200 x 550 x 550 = 4.78 N/sq.mm

From table-53 SP-16 for d'/d = 40 / 550 = 0.07

Pt = **1.321** % Pc = **0.409** %

At = 1.321 x 200 x 550 / 100 = **1453** sq.mm (bot)

Ac = 0.409 x 200 x 550 / 100 = **449.9** sq.mm (top)

provided 3 No 20 = 942 sq.mm

\+ 2 No 20 = 628 sq.mm

= **1571** sqmm top of support

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Shear Design:

Shear force = 136.2 Kn

Factored shear force = 1.5 x 136.2 = 204.3 KN

for 1.32 % steel — Shear resisted by concrete section

from table-61		0.72	x	200	x	550 /	1000 =		79 KN
Balance shear		(Vus)	=	204	-	79 =	125 KN		
Vus/d	=	125	/	56	=	2.2 KN/cm			

from table 62 of SP-16

Required 2 legged	10 stirrups	@	175	mm	c/c
Provided 2 legged	**10** stirrups	@	**150**	mm	c/c

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8 **COLUMN DESIGN:** Column - A **COL SIZE** **300 X 600**

Maximum load on column in basement P = 243 t

Pu = 1.5 x 243 x 10 = 3645 KN

Max.Bending Moment = 6 t.m Mu = 1.5 x 6.0 x 10 = 90 Kn.m

Cover = 40 mm

d'/d = 0.07

Fck = 35 N/sq.mm

Provide bars equaly all sides

Refer chart 44 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{3645 \times 1000}{35 \times 300 \times 600} = 0.58$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{90 \times 10^6}{35 \times 300 \times 600 \times 600} = 0.02$$

$$\frac{p}{Fck} = 0.05 \quad p\% = 0.05 \times 35 = 1.75\ \%$$

Minimum steel = 0.8 %

As = $\frac{1.75 \times 300 \times 600}{100}$ = 3150 sq.mm

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

Col. Ties 8 @ 100 C/C and 8@ 170 c/c

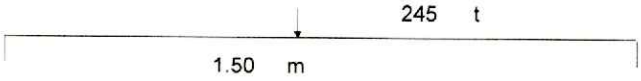
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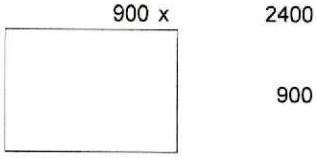
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9 **Pile cap and pile**

As per soil report, 20 m Bored pile can be adopted.
M30 concrete

600 Dia. Bored pile of safe capacity				=	130	t	Rebar 6 nos 16	
Col-A carries maximum load of				=	245	t		
So No of piles provided				=	2	Nos		
Pile cap size	=	900	x	x	2400			
M-30 grade	=	30		N/sq.mm				





Section of pile cap

Pile to pile distance = 1.50 m

Max. Bending Moment at column support = W*L / 6

= 613 Kn-m

Mu = 613 x 1.5 x 10-e6 = 919 x 10-e6 Nmm

Mu/b.d.d = $\frac{919 \times 10\text{-e6}}{900 \times 825 \times 825}$ = 1.50 N/sq.mm

From table-53 SP-16 for d'/d = 60 / 825 = 0.07

Pt = **0.387** % Pc = **0.000** %

At = 0.387 x 900 x 900 / 100 = **3135** sq.mm (bot)

Ac = 0.000 x 900 x 900 / 100 = **0** sq.mm (top)

Provided 10 No 20 = 3142 sq.mm

Shear Design:

Shear force = 1225 Kn

Factored shear force = 1.5 x 1225 = 1838 KN

for 0.39 % steel Shear resisted by concrete section

from table-61 0.45 x 900 x 750 / 1000 = 304 KN

Balance shear (Vus) = 1838 - 304 = 1534 KN

Vus/d = 1534 / 83 = 18.6 KN/cm

from table 62 of SP-16

Required 6 legged 12 stirrups @ 130 mm c/c

Provided 6 legged **12** stirrups @ **100** mm c/c

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