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PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR+4 FLOORS +5TH FLOOR PART (HEIGHT-18.30M) RESIDENTIAL BUILDING WITH 68 DWELLING UNITS, AT PLOT NO: B , V.O.C. STREET VALASARAVAKKAM, CHENNAI- 600 087 COMPRISED IN SURVEY NO:143/ 3A1B1A1 OF VALASARAVAKKAM VILLAGE WITH IN THE LIMIT OF GREATER CHENNAI CORPORATION.

TYPICAL STRUCTURAL DESIGN CALCULATION

1 **General:**

Proposed building is S+ 5 upper floors for residential purpose. Stilt floor is used for car parking. The floor height is 3.05 m

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 as per soil report. Fe-500 steel is used as main steel and 8 mm bars for distributors.

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")

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	140	=	3.50 KN/sq.m
Live load		=	2.00 KN/sq.m
Finishes		=	1.25 KN/sq.m
			6.75 KN/sq.m

Say 6.75 KN/sq.m/floor for slab and beam design
Applying live load reduction of = 0.25 ,
For column and foundation design, 6.25 Kn/sqm is taken.

This value is also taken for frame analysis

Brick work 230 thick for exterior walls

	0.23	x	2.4	x	20		=	11 KN/m/floor
Beams	0.23	x	0.60	x	25		.=	3.45 KN/m/floor
Columns	0.45	x	0.60	x	2.55	x 25	.=	17.21 KN/floor

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

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6 **SLAB DESIGN:**

Thickness	=	140 mm	Concrete mix	Fck	= M	25	N/sq.mm
Cover	=	20 mm	Steel Grade	Fy	=Fe	500	N/sq.mm
Eff.Depth	=	115 mm					

Panel (5 x 6.5) m

Twoway slab Ly / Lx = 6.5 / 5.0 .= 1.3

Support condition - Two adjacent edges discontinuous,

short span=	α x	= 0.065	(- BM at continuous edge)	Table:26
		= 0.049	(+ BM at midspan)	in IS-456-2000
long span=	α y	= 0.047	(+ BM at continuous edge)	
		= 0.035	(+ BM at midspan)	

Designed for 0.065 co.efficient

Mu .= 0.065 x 6.8 x 1.5 x 5.0 x 5 = 16.45 knm/m

$$\text{Mu / b.d.d} = \frac{16.45 \times 1000 \times 1000}{1000 \times 115 \times 115} = 1.24 \text{ N/sq.mm}$$

From Table-3 of SP-16, Pt .= 0.306 %

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

At = 0.306 x 1000 x 115 ./ 100 = **352** sq.mm/m

Provide 10 dia @ 130 c/c = **604** sq.mm/m Short span

Provide 10 dia @ 180 c/c = **436** sq.mm/m Long span

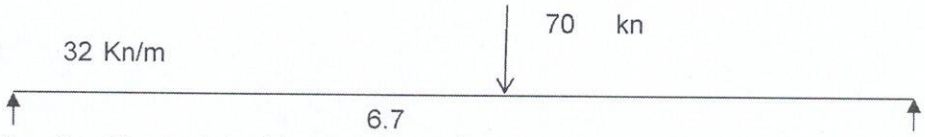
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7 **Beam design:**

Effective span = 6.7 m Beam size 230 x 600

Fck = M 25 d = 560 mm

udl= 32 Kn/m 70 kn



Max. Bending Moment at mid span udl = w.l.l / 12 + pl/8

$= \frac{32 \times 6.70 \times 6.70}{12} + \frac{70 \times 6.7}{8} =$ 178 Knm

Mu = 178 x 1.5 x 10-e6 = 267.5 x 10-e6 Nmm

$Mu/b.d.d = \frac{267 \times 10\text{-e6}}{230 \times 560 \times 560} =$ 3.71 N/sq.mm

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

Pt = **1.050** % for Pc = **0.110** %

At = 1.050 x 230 x 560 / 100 = **1352** sq.mm (bot)

Ac = 0.110 x 230 x 560 / 100 = **142** sq.mm (top)

provided 2 No 25 = **982** sq.mm

\+ 2 No 20 = 628 sq.mm

1610 sqmm bot

provided 2 No 20 = 628 sq.mm

\+ 2 No 25 = 982 sq.mm

1610 sqmm top of support

Shear Design:

$\text{Shear force} = \frac{32 \times 6.7}{2} + \frac{70}{2} =$ 142 KN

Factored shear force = 1.5 x 142.2 = 213 KN

for 1.05 % steel Shear resisted by concrete section

from table-61 0.65 x 230 x 560 / 1000 = 84 KN

Balance shear (Vus) = 213.3 - 84 = 130 KN

Vus/d = 130 / 41 = 3.2 KN/cm

from table 62 of SP-16

Required 2 legged 10 stirrups @ 170 mm c/c

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

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8 **COLUMN DESIGN:** **COL SIZE 450 X 600**

Maximum load on column in basement P = 200 t

Pu = 1.5 x 200 x10 = 3000 KN

Max.Bending Moment = 7 t.m Mu = 1.5 x 7.0 x10= 105 Kn.m

d'/d = 0.07 Cover = 40 mm

Fck = M35 = 35 N/sq.mm

Provide bars equaly all sides

Refer chart 48 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{3000 \times 1000}{35 \times 450 \times 600} = 0.32$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{105 \times 10^6}{35 \times 450 \times 600 \times 600} = 0.02$$

$$\frac{p}{Fck} = 0.03 \quad p\% = 0.03 \times 35 = 1.05\ \%$$

Minimum steel = 0.8 %

$$As = \frac{1.05 \times 450 \times 600}{100} = 2835\ \text{sq.mm}$$

Provided 12 Nos 25 dia = **5891 sq.mm**

Ties 8 @ 110c/c and 8 @ 190c/c

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9 **Pile cap and pile**

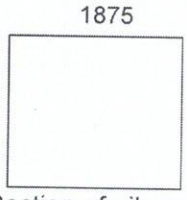
25 m bored cast-in-situ pile is adopted. as per soil report

450 dia pile safe capacity				=	790 KN
Col-A carries maximum load of				=	2000 Kn
So No of piles provided				=	3
Pile cap size	=	1875 X	1875 X	750	
M-30 grade	=	25	N/sq.mm		

2000 kn

1.13 m

Pile to pile distance



Section of pile cap

eff. Depth of pile cap= 0.67 m

Max. B.M of total UDL = $\frac{200}{9} \times \frac{1.13}{0.67}$ = 37.31 t

at reqd.= $\frac{37.3}{2}$ = 18.66 sqcm

Providing 16 dia bars, nos. reqd.= **9** bars

Provided bot 16 dia @ 100 c/c = **2513** sq.mm/m bothways

Provided top 10 dia @ 150 c/c = **655** sq.mm/m bothways

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