

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 3 FLOORS (HEIGHT 12.30M) RESIDENTIAL BUILDING WITH 15 DWELLING UNITS AVAILING PREMIUM FSI AT NEW DOOR NO.28, DR.SOUNDARAMMAL STREET, LAKSHMIPURAM, CHROMPET, CHENNAI- 44, COMPRISED IN S.NO.314/17B OF THIRUNEERMALAI VILLAGE WITHIN THE LIMIT OF TAMBARAM MUNICIPAL CORPORATION

TYPICAL STRUCTURAL DESIGN CALCULATION

1 General:

Proposed building is S+ 3 upper floors for residential purpose. Stilt floor is used for car parking. The floor height is 3.0 m 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 4 stories, wind force is taken into account. Live load reduction factor is applied in design. isolated foundation is proposed. Fe-500 steel is used as main steel and M25 grade concrete.

3 Earthquake consideration:

For better stability during earthquake, 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

$$\begin{aligned}
 V_z &= V_b \times K_1 \times K_2 \times K_3 \\
 V_b &= 50 \text{ m/sec in Chennai} \\
 K_1 &= \text{Probability Factor} = 1 \\
 K_2 &= \text{Terrain, Height Factor} = 1 \\
 K_3 &= \text{Topography Factor} = 1 \\
 p &= 0.6 \times V_z \times V_z \\
 &= 0.6 \times 50 \times 50 \\
 &= 1500 \text{ N/Sq.m}
 \end{aligned}$$

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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
			<u>6.50 KN/sq.m</u>

Say 6.50 KN/sq.m/floor for slab and beam design
 Applying live load reduction of = 0.25 ,
 For column and foundation design, 6.00 Kn/sqm is taken.

This value is also taken for frame analysis

Brick work 230 thick for exterior walls

$$0.23 \times 2.4 \times 20 = 11 \text{ KN/m/floor}$$

$$\text{Beams } 0.23 \times 0.60 \times 25 = 3.5 \text{ KN/m/floor}$$

$$\text{Columns } 0.3 \times 0.60 \times 2.40 \times 25 = 10.8 \text{ KN/floor}$$

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

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6 **SLAB DESIGN:**

Thickness = 130 mm Concrete mix Fck = M 25 N/sq.mm
 Cover = 20 mm Steel Grade Fy = Fe 500 N/sq.mm
 Eff.Depth = 105 mm

Panel (3.35 x 6.9) m
 =

One way slab Ly / Lx 6.9 / 3.4 = 2.1

Support condition - One long edge discontinuous

short span= α_x = 0.000 (- BM at continuous edge) Table:26
 = 0.120 (+ BM at midspan) in IS-456-2000
 long span= α_y = 0.000 (+ BM at continuous edge)
 = 0.025 (+ BM at midspan)

Designed for 0.120 co. efficient

Mu = 0.120 x 6.5 x 1.5 x 3.4 x 3.35 = 13.13 knm/m

Mu / b.d.d = $\frac{13.13 \times 1000 \times 1000}{1000 \times 105 \times 105} = 1.19$ N/sq.mm

From Table-3 of SP-16, Pt = 0.290 %

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

At = 0.290 x 1000 x 105 / 100 = 305 sq.mm/m

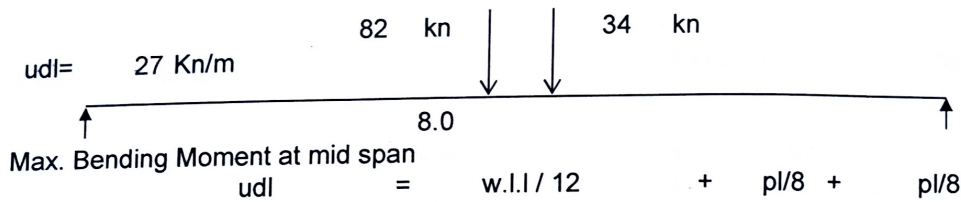
Provide 8 dia @ 130 c/c = 387 sq.mm/m Short span

Provide 8 dia @ 230 c/c = 219 sq.mm/m Long span

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7 **Beam design:**

Effective span = 8.0 m Beam size 230 x 600
 $F_{ck} = M 25$ $d = 560$ mm



$$= \frac{26 \times 8.00 \times 8.00}{12} + \frac{82 \times 8.0}{8} + \frac{34 \times 8.0}{8}$$

$$= 255 \text{ Knm}$$

$$M_u = 255 \times 1.5 \times 10^{-6} = 382.0 \times 10^{-6} \text{ Nmm}$$

$$M_u/b.d.d = \frac{382 \times 10^{-6}}{230 \times 560 \times 560} = 5.30 \text{ N/sq.mm}$$

From table-55 SP-16 $d'/d = \frac{40}{560} = 0.07$

$$P_t = 1.449 \% \text{ for } P_c = 0.548 \%$$

$$A_t = 1.449 \times 230 \times \frac{560}{100} = 1866 \text{ sq.mm (bot)}$$

$$A_c = 0.548 \times 230 \times \frac{560}{100} = 706 \text{ sq.mm (top)}$$

provided 3 No 25 = 1473 sq.mm

+ 2 No 25 = 982 sq.mm

2454 sqmm bot

provided 2 No 25 = 982 sq.mm

+ 3 No 25 = 1473 sq.mm

2454 sqmm top of support

Shear Design:

$$\text{Shear force} = \frac{26 \times 8}{2} + \frac{82}{2} + \frac{34}{2} = 162 \text{ KN}$$

$$\text{Factored shear force} = 1.5 \times 162 = 243 \text{ KN}$$

for 1.45 % steel

Shear resisted by concrete section

$$\text{from table-61 } 0.73 \times \frac{230 \times 560}{1000} = 94 \text{ KN}$$

$$\text{Balance shear (Vus)} = 243 - 94 = 149 \text{ KN}$$

$$V_{us}/d = \frac{149}{41} = 3.6 \text{ KN/cm}$$

from table 62 of SP-16

Required 2 legged

10 stirrups

@

155 mm c/c

Provided 2 legged

10 stirrups

@

130 mm c/c

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COLUMN DESIGN:**COL SIZE****300 X 600**

Maximum load on column in basement

$$P = 140 \text{ t}$$

Max. Bending Moment = 8 t.m

$$P_u = 1.5 \times 140 \times 10 = 2100 \text{ KN}$$

$$M_u = 1.5 \times 8.0 \times 10 = 120 \text{ Kn.m}$$

$$\text{Cover} = 40 \text{ mm}$$

$$d'/d = 0.07$$

Fck = M 35 =
Provide bars equally all sides
Refer chart 48 of SP-16

$$35 \text{ N/sq.mm} \quad F_y = \text{Fe500}$$

$$\frac{P_u}{F_{ck} b d} = \frac{2100 \times 1000}{35 \times 300 \times 600} = 0.33$$

$$\frac{M_u}{F_{ck} b d^2} = \frac{120 \times 10^6}{35 \times 300 \times 600 \times 600} = 0.03$$

$$\frac{p}{F_{ck}} = 0.03 \text{ p\%} = 0.03 \times 35 = 1.05 \%$$

Minimum steel = 0.8 %

$$A_s = \frac{1.05}{100} \times 300 \times 600 = 1890 \text{ sq.mm}$$

Provided	4	Nos	25 dia =	1964 sq.mm
+	4	Nos	20 dia =	1257 sq.mm
				<u>3220 sq.mm</u>

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

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9 FOOTING DESIGN

Maximum load on column $P = 140 \text{ t}$ $F_{ck} = \text{M25}$
 Add 10% footing load $= 154 \text{ t}$
 Max. Bending Moment $= 8 \text{ t.m}$
 S.B.C of Soil at 24 t/sqm at depth $= 2 \text{ m}$
 Assume footing base of $2.8 \times 2.8 \text{ m}$ and depth $= 750 \text{ mm}$
 So pressure on soil is Eff. Depth $= 700 \text{ mm}$

$$\frac{154}{2.65 \times 2.65} = 21.93 \text{ t/sqm} < 24 \text{ t/sqm}$$

$$\text{Cantilever projection of footing} = \frac{2.65 - 0.90}{2} = 0.88 \text{ m}$$

B.M on footing at face of column pedestal

$$\text{BM} = \frac{21.93 \times 0.88 \times 0.88}{2} = 8.39 \text{ tm}$$

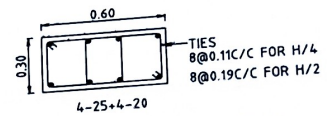
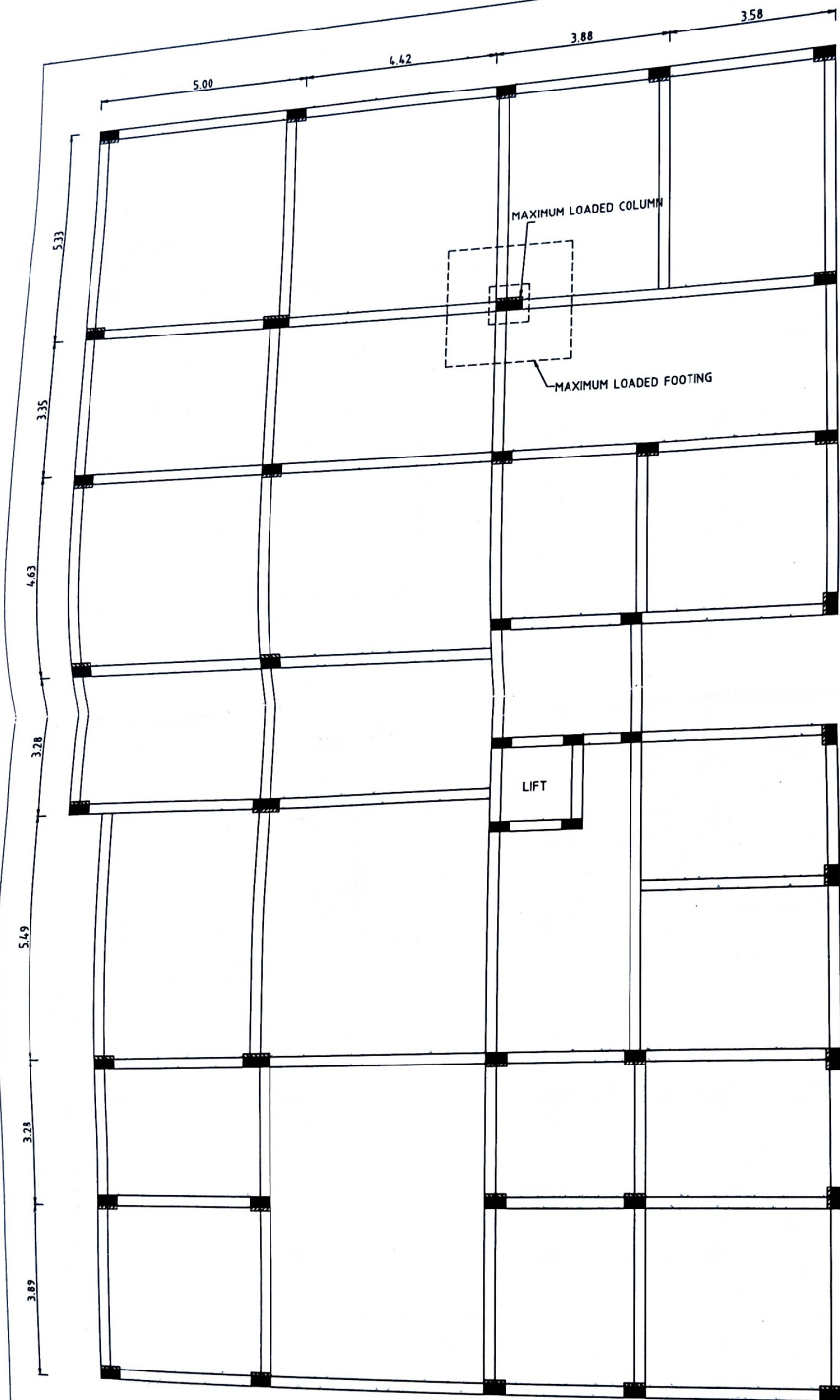
$$\begin{aligned} \mu &= \frac{8.39 \times 1.5}{12.59} = 1.5 \\ \mu/b.d.d &= \frac{12.59}{1000} \times \frac{1000}{700} \times \frac{10000}{700} = 0.26 \text{ N/sqm} \end{aligned}$$

$$\begin{aligned} F_{ck} &= 25 \text{ n/sqmm} \\ \text{From Table-3 of SP-16, } P_t &= 0.07 \% \text{ min } p_t \% = 0.120 \% \end{aligned}$$

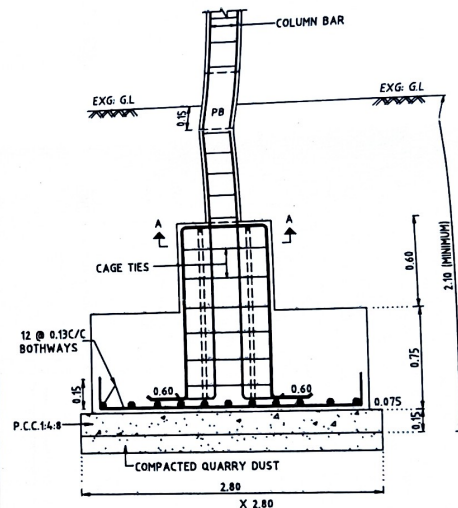
$$A_t = \frac{0.120 \times 1000 \times 700}{100} = 840 \text{ sq.mm}$$

$$\text{Provide } 12 \text{ dia } @ 130 \text{ c/c} = 2366 \text{ sq.mm}$$

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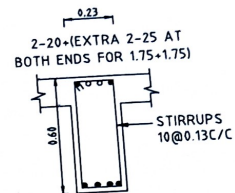
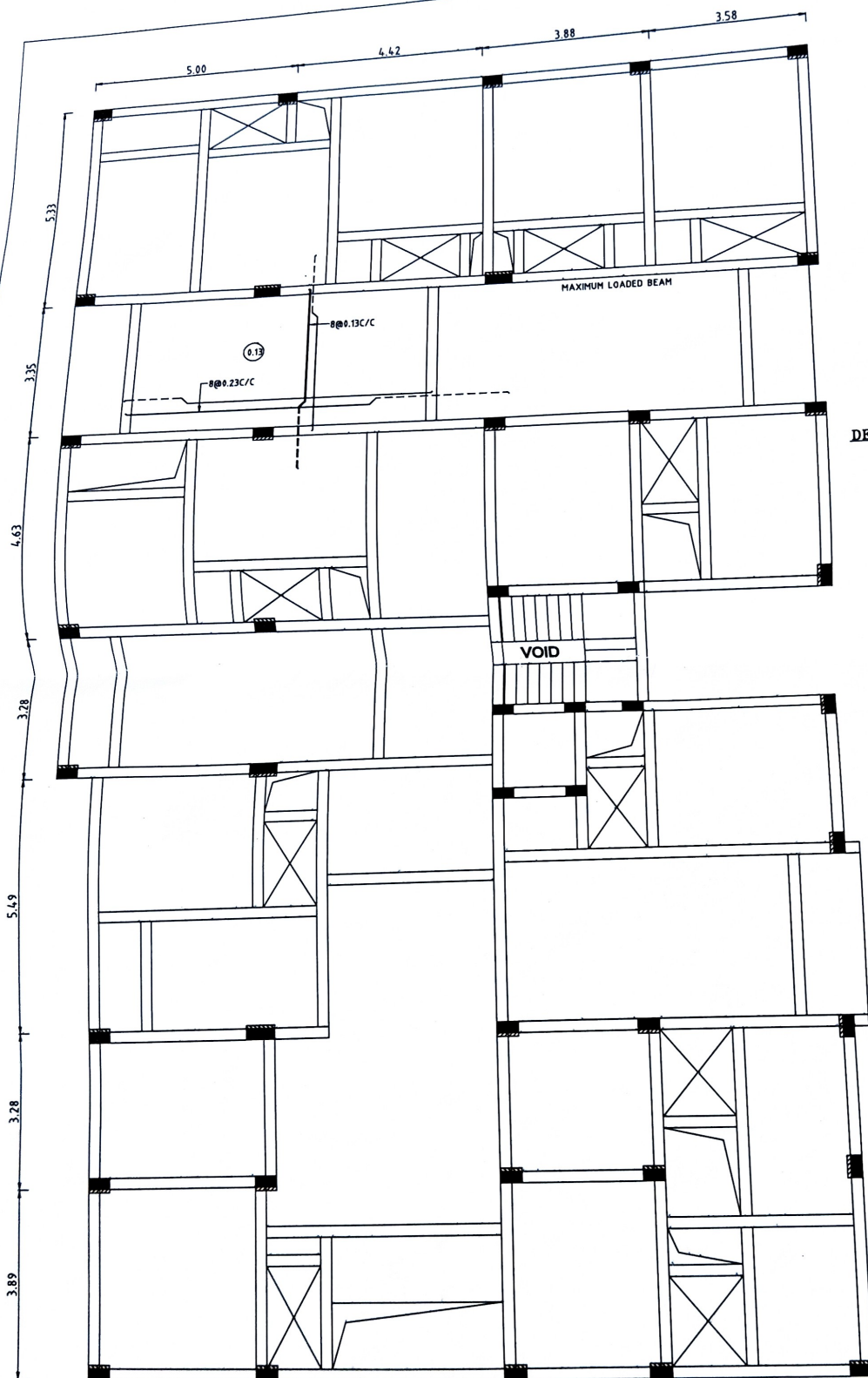


DETAIL OF MAXIMUM LOADED COLUMN
M-35



DETAIL OF MAXIMUM LOADED FOOTING
M-25

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2-25ST+2-20CT AT 1.10

DETAIL OF MAXIMUM LOADED BEAM

M-25

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