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27.02.2023

STRUCTURAL STABILITY CERTIFICATE

It is certified that the
PLAN SHOWING THE PROPOSED CONSTRUCTION OF BF (PARKING) +GF+3F OFFICE BUILDING AT PLOT NO.2, 3, 4 & 5, 200 FEET MMRD ROAD (PALLAVARAM - THORAIPAKKAM ROAD), COMPRISED IN S.NOS.42/1B(PT), 45/2A2, 45/2A3, 45/5A1, 45/5A2, 45/5A3, 45/5A4, 45/5B, 45/6B1(PT), 45/7(PT) AND 46/1(PT) OF KOVILAMBAKKAM VILLAGE, TAMBARAMTALUK, CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF ST.THOMAS PANCHAYAT UNION.
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 is **B+ GF + 3** upper floors for office purpose.

Basement is used for car parking, and Upper floors are for office purpose

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 not taken into account. Live load reduction factor is applied in design. Footing with raft foundation as per soil report. Fe-500 steel is used as main steel and 8 mm bars for distributors. Minimum grade of concrete is M25

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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")

EARTHQUAKE LOAD

Design horizontal Seismic coeff. Ag = $\frac{Z}{2} \times \frac{I}{R} \times \frac{Sa}{g}$

Z = Zone Factor = 0.16 for Chennai

I = Importance Factor = 1.0

R = Response reduction Factor = 5

$\frac{Sa}{g}$ = Avg. response acc.coeff. Depends on Ta

Ta = Fundamental natural period

= $\frac{0.09\ h}{\sqrt{d}}$ for infill walls
h = height of the building
d = Width of the building

= 0.09x30/ sqrt 20

= 0.60

= $0.075\ h^{0.75}$ for office building

W = seismic weight of building

= 100% D.L + 25% L.L for residential <=300

= 100% D.L + 50% L.L for residential >300

Base Seismic Shear Vb = Ag x W

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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 = 1.02

K3 = Topography Factor = 1

p = 0.6 x Vz x Vz

= 0.6 x 51 x 51

= 1560.6 N/Sq.m

156 Kg/Sq.m

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5 **Design Loads:**

Slab 250 mm thk	=	6.3	KN/sq.m
Live load avg	=	2.5	KN/sq.m
Finishes	=	1.3	KN/sq.m
		10.0	KN/sq.m

Say 8.5 KN/sq.m/floor for slab and beam design

Applying live load reduction of = 0.5 ,

For column and foundation design, 8.75 Kn/sqm is taken.

This value is also taken for frame analysis

200 thick AAC blocks for exterior walls

0.2 x 2.55 x 10 = 5 KN/m/floor

100 thk AAC blocks for interior panels

0.100 X 2.55 x 10 = 2.55 KN/m/floor

Beams 0.2 x 0.90 x 25 .= 4.50 KN/m/floor

Columns 0.75 x 0.75 x 3.00 x 25 .= 42.2 KN/floor

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

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6 **SLAB DESIGN:** S1

Thickness = 250 mm Fck = M 30 N/sq.mm
Cover = 20 mm Fy =Fe 500 N/sq.mm
Eff.Depth = 225 mm

Panel (7.2 x 13) m

Twoway slab Ly / Lx = 13 / 7.2 .= 1.8
Support condition - 2 adjacent side discontionous

short span= α x = 0.087 (- BM at continuous edge) Table:26
= 0.066 (+ BM at midspan) in IS-456-2000
Longrt span= α y = 0.047 (+ BM at midspan)
0.035 (-) at support
Designed for 0.087 co.efficient

Mu .= 0.087 x 10.0 1.5 x 7.2 x 7.2 = 67.65 KNm/m

$$\text{Mu / b.d.d} = \frac{67.65 \times 1000 \times 1000}{1000 \times 225 \times 225} = 1.34 \text{ N/sq.mm}$$

From Table-2 of SP-16, Pt 0.390 %
Minimum Pt = 0.12 % as per code, for Fe-415

At = 0.390 x 1000 225 ./ 100 = **878** sq.mm/m

Provide 12 dia @ 125 = **905** sq.mm/m Short span

Provide 10 dia @ 125 = **628** sq.mm/m Long span

J. Prabakaran

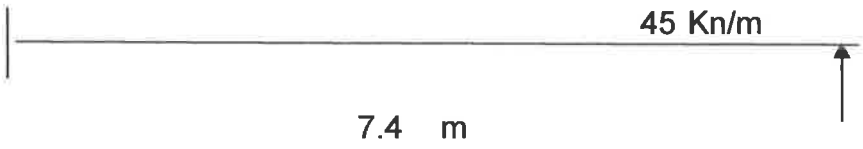
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7 **Beam design:** Beam-1

span = 7.4 m Beam size 200 x 900

d = 860 mm

Fck = M 30



Bending moment at support= **247** knm

Mu = 247 x 1.5 x 10-e6

370.5 x **10-e6** Nmm

Mu/b.d.d = **370.5** x 10-e6 / (200 x 860 x 860) = 2.50 N/sq.mm

Pt = **0.663** % Pc = **0.20** %

At = 0.663 x 200 x 900 / 100 = **1193** sq.mm (top)

Ac = 0.200 x 200 x 900 / 100 = **360** sq.mm (bot)

provided 3 No 20 = **942** sq.mm +

3 No 20 = **942**

1885 **sq.mm** at support top

Shear Design:

Shear force 244 KN

Factored shear force = 1.5 x 244 = 366 KN

for 0.66 % steel Shear resisted by concrete section

from table-61 0.74 x 200 x 860 / 1000 = 127 KN

Balance shear (Vus) = 366 - 127 = 239 KN

Vus/d = 239 / 86 = 2.78 KN/cm

from table 62 of SP-16

Required 2 legged 8 stirrups @ 130 mm c/c

Provided 2 legged **10** stirrups @ **130** mm c/c

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8 **COLUMN DESIGN:** **COL-1** **COL SIZE** **750 X 750**

Maximum load is P = 930 t

Pu = 1.5 x 930 x10 = **13950** KN

Max.Bending Moment = 30 t.m Mu = 1.5 x 30.0 x10= 450 Kn.m

Cover = 25 mm

d'/d = 0.05

Fck = 50 N/sq.mm

Provide bars equaly all sides

Refer chart 44 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{13950 \times 1000}{50 \times 750 \times 750} = 0.50$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{450 \times 10^6}{50 \times 750 \times 750 \times 750} = 0.02$$

$$\frac{p}{Fck} = 0.06 \qquad p\% = 0.06 \times 50 \times 750 = 3\ \%$$

Minimum %age of steel is 0.8 %

As = $\frac{3 \times 750 \times 750}{100}$ = **16875** sq.mm

Provided 16 Nos 32 dia + = **12868** sq.mm

16 Nos 25 dia = **7854** sq.mm

= 20722

Ties 8 @ 100 & 8@ 175

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

Maximum load on column type " A P = 930 t

Add 10% footing load = 1023 t

S.B.C of Soil at 1 m depth = 20 t/sqm

Assume base of 6.7 x 6.7 m Depth = 1400 mm

So pressure on soil is Eff. Depth = 1345 mm

Cantilever projection of footing = $\frac{6.7 - 0.345 - 0.345}{2}$ = 3.03 m

B.M on footing at face of column pedestal

BM = 20.0 X 3.03 X $\frac{3.03}{2}$ = 92.0 tm

Mu = 92.0 x 1.5= 138.0 tm

Mu/b.d.d = $\frac{138 \times 10000 \times 1000}{1000 \times 1345 \times 1345}$ = 0.7630 N/mm^2

Fck = 30 n/sqmm

From Table-4 of SP-16, pt% .= 0.191 %

At = 0.191 x 1345 1000 /100 = **2569** sq.mm

Provide 25 @ 150 C/C = **3272** sq.mm

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10 RAFT SLAB DESIGN:

Thickness	=	550 mm		Fck	= M 30	N/sq.mm
Cover	=	50 mm		Fy	=Fe 500	N/sq.mm
Eff.Depth	=	495 mm				

Net upward thrust on raft= 19 kn/sqm

As per analysis the moment = 122 Knm

Factored moment = 183 Knm

$$\text{Mu / b.d.d} = \frac{183.00 \times 1000 \times 1000}{1000 \times 495 \times 495} = 0.75 \text{ N/sq.mm}$$

From Table-4 of SP-16, Pt **0.179** %

Minimum Pt = 0.13 % as per code, for Fe-415

At = 0.179 x 1000 495 ./ 100 = **886** sq.mm/m

Provide 12 dia @ 125 = **905** sq.mm/m Short span

Provide 12 dia @ 125 = **905** sq.mm/m Long span

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