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S.NAGESH, M.A.Sc., F.I.E.,
Consulting Engineer & Regd. Valuer,
New no. 15, 3rd cross street,
Karpagam Gardens, Adyar,
Chennai- 600 020

Telefax: 24464410

E-mail-nagesh.somadev@gmail.com
www.somadevnagesh.in

15.04.2025

STRUCTURAL STABILITY CERTIFICATE

The detailed engineering and structure design of the proposed building comprising of Basement+Stilt+13 floors at Katpadi Village, Katpadi Taluk, Vellore District and Survey Nos. 612/2A1B, 612/2A2A, 612/2A2B & 612/8 has been done by me/us based on the report of geotechnical investigation (TJE/002071/2021) done by T.J.ENGINEERS, Dated 01.11.2021 and considering the functional requirement of the building.

2. It is certified that among other factors, the proposed building has been designed to resist earthquake. I/We have checked various parameters and found that the proposed building would be safe.

3. I/We further certify that:

(i) The minimum grade of concrete is M25

(ii) The design and analysis has been done using the code of practice for plain and reinforced concrete as per IS 456, design loads as per IS875 and design of earthquake resistant structure as per IS 1893.

4. The building will be safe and sound when used for the purpose for which it is designed.

Encl.: Structural Design Calculation

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (HR)
DTCP REG No. CC/ARCHITECT/I/2019/0304 (VELLORE)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 020.
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

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THE PROPOSED BUILDING COMPRISING OF BASEMENT+STILT+13 FLOORS AT KATPADI VILLAGE, KATPADI TALUK, VELLORE DISTRICT AND SURVEY NOS. 612/2A1B, 612/2A2A, 612/2A2B & 612/8

TYPICAL STRUCTURAL DESIGN CALCULATION

1 **General:**

Proposed building is for Residentail use. Basement floor is for car park and upper floors used for Residential Purpose

2 **Design Basis:**

Latest Design codes of BIS-456, 875 and 1893 are followed with SP-16 Design Aid book. Since the building is 15 stories, wind force is not taken into account. Also a live load reduction factor of 0.1 is taken for foundation and column design.

Pile foundation is proposed as per as per soil report.

Fe- 500 steel is used as main steel and minimum M25 concrete is provided

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

= $0.075\ h^{\frac{3}{4}}$ 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

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/05/004 (MLPA)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 020.
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

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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

K3 = Topography Factor = 1

p = 0.6 x Vz x Vz

= 0.6 x 50 x 50

= 1500 N/Sq.m

150 Kg/Sq.m

5 **Design Loads:**

Slab	140 mm thk	=	3.4 KN/sq.m
Live load avg		=	2.00 KN/sq.m
Finishes		=	1.50 KN/sq.m
			6.86 KN/sq.m

Applying live load reduction of = 0.1 ,

For column and foundation design, 6.66 Kn/sqm is taken.

This value is also taken for frame analysis

b.w. 200 thick for exterior walls

0.2 x 2.95 x 20 = 12 KN/m/floor

B.W. 115 thk for interior panels

0.100 X 2.95 x 20 = 5.9 KN/m/floor

Beams 0.2 x 0.60 x 25 .= 3.0 KN/m/floor

Columns 0.35 x 0.85 x 2.95 x 25 .= 21.9 KN/floor

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

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/05/004 (MLPA)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 020.
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

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6 **SLAB DESIGN:** Refer drawing sheet

Thickness	=	140 mm	Fck	= M 30	N/sq.mm
Cover	=	20 mm	Fy	=Fe 500	N/sq.mm
Eff.Depth	=	115 mm			

Effective slab (3.5 x 6.9) m

One way slab Ly / Lx = 6.9 / 3.5 .= 2.0

Support condition - One way slab, simply supported

Simply suppo α x = W*L*L /8 (Discontinuous edge) Table:26 in IS-456-2000

Mu .= 6.9 x 1.5 x 3.5 x 3.5 = 16 KNm/m

$$\text{Mu / b.d.d} = \frac{16.00 \times 1000 \times 1000}{1000 \times 115 \times 115} = 1.2 \text{ N/sq.mm}$$

From Table-3of SP-16, Pt 0.250 %

Minimum Pt = 0.12 % as per code,

At = 0.250 x 1000 115 ./ 100 = **288** sq.mm/m

Provide 10 dia @ 150 = **523.6** sq.mm/m Short span

Provide 8 dia @ 150 = **335.1** sq.mm/m Long span

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/05/004 (MLPA)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 020.
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

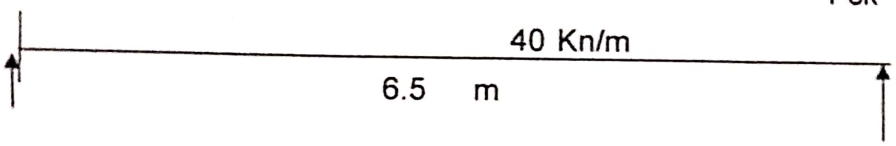
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7 **Beam design:** Beam-1

span = 6.5 m Beam size 200 x 600

d = 560 mm

Fck = M 30



Bending moment for UDL load = **W x l x l / 12** = 140.83 Kn.m

Max. B.M = 140.8 Knm (top of support)

This is taken for design

Mu = 141 x 1.5 x 10-e6

211 x **10-e6** Nmm

$$Mu/b.d.d = \frac{211 \times 10\text{-}e6}{200 \times 560 \times 560} = 3.37 \text{ N/sq.mm}$$

From table-3 SP-16 for d'/d = 40 / 600 = 0.07

Pt = **0.820** % Pc = **0.00** %

At = 0.820 x 200 x 560 / 100 = **918** sq.mm (top)

Ac = 0.000 x 200 x 560 / 100 = **0** sq.mm (bot)

provided 3 No 16 = **603** sq.mm +

2 No 16 = **402**

1005 sq.mm at support top

Shear Design:

Shear force wl/2 = 130

Factored shear force = 1.5 x 130 = 195 KN

for 0.82 % steel Shear resisted by concrete section

from table-61 0.65 x 200 x 560 / 1000 = 73 KN

Balance shear (Vus) = 195 - 73 = 122 KN

Vus/d = 122 / 56 = 2.18 KN/cm

from table 62 of SP-16

Required 2 legged 8 stirrups @ 175 mm c/c

Provided 2 legged **8** stirrups @ **110** mm c/c

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/03/004 (MLP1)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 020.
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

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8 **COLUMN DESIGN:** **COL-A** **COL SIZE** 350 X 850

Maximum load is with wind force P = 315 t

Pu = 1.5 x 315 x10 = 4725 KN

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

Cover = 35 mm

d'/d = 0.05

Fck = 40 N/sq.mm

Provide bars equaly all sides

Refer chart 47 of SP-16

$$\frac{Pu}{Fck\ b\ d} = \frac{5E+03 \times 1000}{40 \times 350 \times 850} = 0.40$$

$$\frac{Mu}{Fck\ b\ d^2} = \frac{300 \times 10^6}{40 \times 350 \times 850} = 0.030$$

$$\frac{p}{Fck} = 0.045 \qquad p\% = \frac{0.05}{850} \times 40 = 2\ \%$$

Minimum %age of steel is 0.8 %

$$As = \frac{2 \times 350 \times 850}{100} = 5950 \text{ sq.mm}$$

Provided 6 Nos 32 dia = **4825** sq.mm

Provided 8 Nos 25 dia = **3927** sq.mm

= **8752**

Ties 8 @ 110 c/c & 170 mm c/c

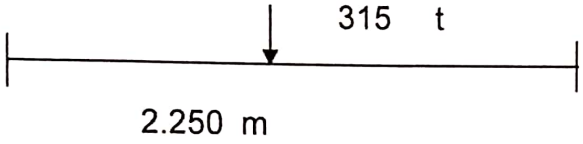
S. NAGESH, B.E. (CIVIL). M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/05/004 (MLPA)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 020
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

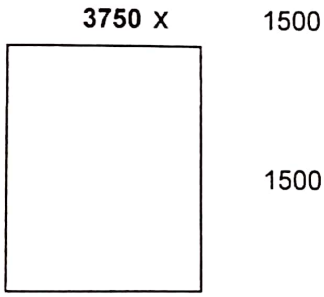
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9 **Pile cap and pile**

As per soil report, 9 m bored cast-in-situ pile can be adopted.
M3 0 concrete

900 dia pile safe capacity	=	163	t	Rebar 18 nos 20	
Col-A carries maximum load of	=	315	t		
So No of piles provided	=	2	Nos		
Pile cap size	=	3750	x	1500	
M-30 grade	=	30	N/sq.mm		





Section of pile cap

Pile to pile distance = 2.25 m

axial force = 315 x 2.25 / 8 x 1.42
= 62.4 tonnes

At reqd = 62.39 /2.3 '= 27 sqcm

Provided bttom bothways = **8 nos** 25
= 39.3 sqcm

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/05/004 (MLPA)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600
Email : nagesh.somadev@gmail
Mobile : 98402 316

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10 RAFT SLAB DESIGN:

Thickness	=	500 mm	Fck	= M 30	N/sq.mm
Cover	=	50 mm	Fy	=Fe 500	N/sq.mm
Eff.Depth	=	445 mm			

Upward thrust on raft= 20 kn/sqm

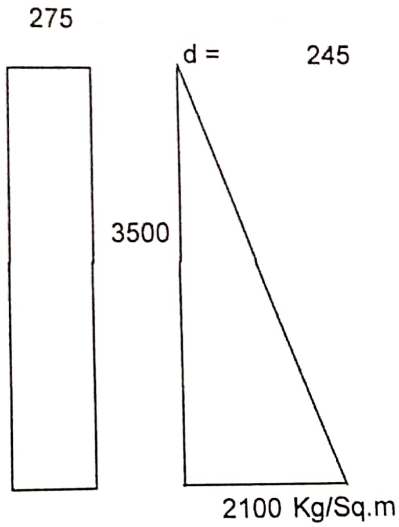
Since the upward thrust is nominal, and downaward load of raft is high, nominal rebars have been provided.

Provided 12 @ 125mm c/c top and bottom , bothways

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/05/004 (MLPA)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 020.
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

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11 Design of R.C.Wall



Pressure at the base = Kr x r x h

Kr = 0.3

= 0.3 x 2000 x 3.5

= 2100 Kg/Sq.m

Bending Moment = 1/2 x 2100 x 2.52 x 2.52 / 3

= 4287.5 Kg.m

= 42.875 Kn.m

$$\frac{Mu}{b \times d \times d} = \frac{1.5 \times 42.88 \times 1000000}{1000 \times 245 \times 245}$$

= 1.07 N/Sq.mm

From table-4 SP-16 for d'/d = 30 / 275 = 0.11

Pt = **0.210** % Pc = 0.0 %

At = 0.210 x 1000 x 245 / 100 = **515** sq.mm

Ac = 0.000 x 1000 x 245 / 100 = **0** sq.mm

Provided 10 dia @ 150 c/c for earth side = **524** sq.mm/m

S. NAGESH, B.E. (CIVIL), M.A.Sc., F.I.E.
STRUCTURAL ENGINEER GRADE I (SE)
DTCP REG No. CGLDIST/SE/GR-I/2019/05/004 (MLPA)
New No. 15, 3rd Cross Street,
Karpagam Gardens, Adyar, Chennai - 600 02(
Email : nagesh.somadev@gmail.com
Mobile : 98402 31666

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Chennai, India

hello@verified.realestate
+91 9996 12 9996
www.verified.realestate