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KSB Consultants & Engineers

P.R.Jeyaprakash B.E, M.I.E
BBCL Ashraya Block-C, Flat-2C,
Pillayar koil street,
Thuraipakkam, Chennai-600 097.

Mobile: 98409 22092

E-mail: s_balas_bala@yahoo.co.in

May 15,'24

Stability Certificate

It is certified that plan showing the proposed construction of stilt floor + 5 floors (height - 18.30m) residential building at plot no.11 , old door no. 11, new door no: 28, lotus ramasamy street, royapuram, chennai - 600 013, comprised in s.no: 3057 / 14, block no: 46 of tondiarpet village, within the limits of greater chennai corporation. is designed to resist for earthquake. This design is made structurally safe and sound and I hereby certify that

1. The minimum grade of concrete is M25
2. The Minimum column size is 300 mm in stilt areas,
3. 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.


P.R. Jeyaprakash, B.E., M.I.E
Structural Engineer
Reg. No. SE/GR-II/19/04/042
BBCL Ashraya Block-C, Flat-2C,
Pillayar Koil Street, Thuraipakkam,
Chennai - 600 097.

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOORS
(HEIGHT - 18.30M) RESIDENTIAL BUILDING AT PLOT NO.11 , OLD DOOR NO.
11, NEW DOOR No: 28, LOTUS RAMASAMY STREET, ROYAPURAM, CHENNAI -
600 013, COMPRISED IN S.No: 3057 / 14, BLOCK No: 46 OF TONDIARPET
VILLAGE, WITHIN THE LIMITS 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 earthquake, 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

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

P.R. Jeyaraj
P.R. JEPAPRAKASH, B.E., M.I.E
Structural Engineer
Reg. No. SE/GR-II/19/04/042
BBCL Ashraya Block-C, Flat-2C,
Pillayar Koil Street, Thuraipakkam,
Chennai - 600 097.

5 **Design Loads:**

Slab thk	140	=	3.50 KN/sq.m
Live load		=	2.00 KN/sq.m
Finishes		=	1.25 KN/sq.m
			<u>6.75 KN/sq.m</u>

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

$$0.23 \times 2.55 \times 20 = 12 \text{ KN/m/floor}$$

$$\text{Beams } 0.23 \times 0.75 \times 25 = 4.31 \text{ KN/m/floor}$$

$$\text{Columns } 0.3 \times 0.60 \times 2.55 \times 25 = 11.48 \text{ KN/floor}$$

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

P.R. Jayal
P.R. EYAPRAKASH, B.E., M.I.E
 Structural Engineer
 Reg. No. SE/GR-II/19/04/042
 BBCL Ashraya Block-C, Flat-2C,
 Pillayar Koil Street, Thuraipakkam,
 Chennai - 600 097.

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 (4.4 x 5.6) m

Twoway slab Ly / Lx = 5.6 / 4.4 = 1.3

Support condition - 1 long edge discontinuous,

short span= αx = 0.057 (- BM at continuous edge) Table:26
 = 0.044 (+ BM at midspan) in IS-456-2000
 long span= αy = 0.037 (+ BM at continuous edge)
 = 0.028 (+ BM at midspan)

Designed for 0.057 co.efficient

Mu = 0.057 x 6.8 x 1.5 x 4.4 x 4.4 = 11.17 knm/m

Mu / b.d.d = $\frac{11.17 \times 1000}{1000 \times 115} \times \frac{1000}{115} = 0.84$ N/sq.mm

From Table-3 of SP-16, Pt = 0.204 %

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

At = 0.204 x 1000 x 115 / 100 = 235 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

P. R. Jeyaraj
P. R. J EYARAJ, B.E., M.I.E
 Structural Engineer
 Reg. No. SE/GR-II/19/04/042
 BBCL Ashraya Block-C, Flat-2C,
 Pillayar Koil Street, Thuraipakkam,
 Chennai - 600 097.

7 **Beam design:**

Effective span = 8.4 m Beam size 230 x 750
 $F_{ck} = M 25$ $d = 710$ mm

udl = 32 Kn/m

120 kn

8.4

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

= $\frac{32 \times 8.4 \times 8.4}{12} + \frac{120 \times 8.4}{8} = 314$ Knm

$M_u = 314 \times 1.5 \times 10^{-6} = 471.2 \times 10^{-6}$ Nmm

$M_u / b.d.d = \frac{471 \times 10^{-6}}{230 \times 710 \times 710} = 4.06$ N/sq.mm

From table-55 SP-16 $d'/d = \frac{40}{710} = 0.06$

$P_t = 1.142\%$ for $P_c = 0.215\%$

$A_t = 1.142 \times 230 \times 710 / 100 = 1865$ sq.mm (bot)

$A_c = 0.215 \times 230 \times 710 / 100 = 351$ sq.mm (top)

provided 2 No 25 = 982 sq.mm

+ 2 No 25 = 982 sq.mm

1964 sqmm bot

provided 2 No 25 = 982 sq.mm

+ 2 No 25 = 982 sq.mm

1964 sqmm top of support

Shear Design:

Shear force = $\frac{32 \times 8.4}{2} + \frac{120}{2} = 194$ KN

Factored shear force = $1.5 \times 194.4 = 292$ KN
 for 1.14 % steel Shear resisted by concrete section

from table-61 $0.69 \times \frac{230 \times 710}{1000} = 113$ KN

Balance shear (V_{us}) = $291.6 - 113 = 179$ KN

$V_{us}/d = \frac{179}{41} = 4.4$ KN/cm

from table 62 of SP-16

Required 2 legged 12 stirrups @ 180 mm c/c

Provided 2 legged 12 stirrups @ 150 mm c/c

P.R. Jeyapraakash
P.R. JEYAPRAKASH, B.E., M.I.E
 Structural Engineer
 Reg. No. SE/GR-II/19/04/042
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 Chennai - 600 097.

8 COLUMN DESIGN:

COL SIZE

300 X 600

Maximum load on column in basement

$$P = 150 \text{ t}$$

Max. Bending Moment = 7 t.m
d'/d = 0.07

$$\begin{aligned} P_u &= 1.5 \times 150 \times 10 = 2250 \text{ KN} \\ M_u &= 1.5 \times 7.0 \times 10 = 105 \text{ Kn.m} \\ \text{Cover} &= 40 \text{ mm} \end{aligned}$$

$$F_{ck} = M35 = 35 \text{ N/sq.mm}$$

Provide bars equally all sides
Refer chart 48 of SP-16

$$\frac{P_u}{F_{ck} b d} = \frac{2250 \times 1000}{35 \times 300 \times 600} = 0.36$$

$$\frac{M_u}{F_{ck} b d^2} = \frac{105 \times 10^6}{35 \times 300 \times 600^2} = 0.03$$

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

Minimum steel = 0.8 %

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

Provided 8 Nos 25 dia = 3927 sq.mm

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

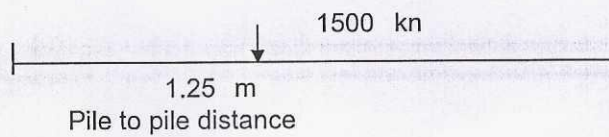
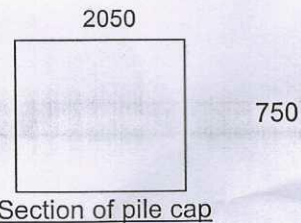
P. R. Jay. L
P. R. VEYAPRAKASH B.E., M.I.E.
Structural Engineer
Reg. No. SE/GR-II/19/04/042
BBCL Ashraya Block-C, Flat-2C,
Pillayar Koil Street, Thuraipakkam,
Chennai - 600 097.

9 Pile cap and pile

12 m bored cast-in-situ pile is adopted.

as per soil report

500 dia pile safe capacity = 500 KN
 Col-A carries maximum load of = 1500 KN
 So No of piles provided = 3
 Pile cap size = 2050 X 2050 X 750
 M-30 grade = 25 N/sq.mm



eff. Depth of pile cap = 0.67 m

$$\text{Max. B.M of total UDL} = \frac{150}{9} \times \frac{1.25}{0.67} = 31.09 \text{ t}$$

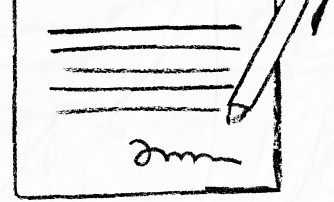
$$\text{at reqd.} = \frac{31.1}{2} = 15.55 \text{ sqcm}$$

Providing 16 dia bars, nos. reqd. = 8 bars

Provided bot 16 dia @ 130 c/c = 1933 sq.mm/m bothways

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

P. R. Jeyaprakash
P.R. Jeyaprakash, B.E., M.I.E
 Structural Engineer
 Reg. No. SE/GR-II/19/04/042
 BBCL Ashraya Block-C, Flat-2C,
 Pillayar Koil Street, Thuraiyapakkam,
 Chennai - 600 097.



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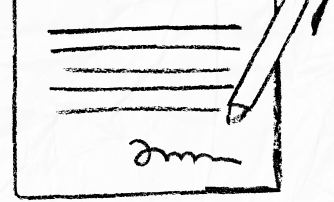
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3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai, India

hello@verified.realestate
[+91 9996 12 9996](tel:+919996129996)
www.verified.realestate