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INFINUSTECH

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STABILITY CERTIFICATE

It is certified that the plan showing the proposed construction of residential building stilt +5 floors with 39 units inS.F.No : 368/2, at Sasi Avenue , Kalapatti Village, Coimbatore District & 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 M20
2. The minimum column size is 200mm in stilt areas,
3. The design analysis using the code of practice for loading standards as per BIS-875 and Sesmic forces as per the latest code BIS-1893 & BIS-456

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REGISTERED STRUCTURAL ENGINEER GRADE-1
13A, SM Towers, 1st Floor, Jawahar Nagar,
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PLAN SHOWING THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING STILT +5 FLOORS WITH 39 UNITS IN S.F.NO : 368/2, AT SASI AVENUE KALAPATTI VILLAGE, COIMBATORE DISTRICT & CORPORATION.

TYPICAL STRUCTURAL DESIGN CALCULATION

1. **General:**

Proposed building is Stilt +5 upper floors for residential purpose. Stilt floor is used for car parking. The floor height is 3.05m 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 6stories. Windforce is taken into account. Live load reduction factor applied in design. Isolated foundation is proposed. Fe-500 steel is used as main steel and M20 grade concrete.

3. **Earthquake consideration:**

For better stability during earthquake, Thecolumns 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 200mm(8")

4. **WIND LOAD:**

$Vz = Vb \times K1 \times K2 \times K3$

Vb= 39 m/sec in Coimbatore

K1 = Probability Factor = 1

K2 = Terrin, Height Factor = 1

$p = 0.6 \times 39 \times 39$

$= 912.6$ N/sq.m

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5. **Design Loads :**

Slab Thick 130 (5"Tk) = 3.175 KN/sq.m

Live Load = 2 KN/sq.m

Finishes = 1 KN/sq.m

= 7.175

(Say 6.50 KN/sq.m/ floor for slab and beam design

Applying live load reduction of = 0.3,

For column and foundation design , 6.00 KN/sqm is taken)

This value is also taken for analysis

Block work 200 thick for exterior walls

0.2 x 2.74 x 18 = 9.86 KN/m/floor

Beam 0.2 x 0.60 x 25 = 3.0 KN/m/floor

Column 0.2 x 0.60 x 2.74 x 25 = 8.22 KN/floor

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

6. **SLAB DESIGN:**

Thickness = 127 mm (5"Tk) Concerte Mix Fck = M 20 N/sq.mm

Cover =20 mm Steel Grade Fy= Fe 500 N/sq.mm

Eff.Depth =99 mm

Panel = (5.2 x 3.66) m

Two Way Slab = Ly/Lx = 5.2 / 3.66 = 1.42

Support Condition - Two Adjacent Edges Discontinuous

Short Span = ax = 0.071 (-BM at continuous edge) Table: 91

=0.053 (+BM at midspan) in IS-456-2000

Long Span= ay = 0.099 (+BM at continuous edge)

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=0.051 (+BM at midspan)

Designed for 0.071 coefficient

Mu = 0.071 x 3.66 x 3.66x1.5 x 5.2 =7.42kNm/m

$$Mu = \frac{7.42 \times 1000 \times 1000}{1000 \times 99 \times 99} = 0.75 N/sq.m$$

From Table – 3 of SP – 16, Pt = 0.179 %

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

At = 0.179 x 1000 x 99 x 100 =177.21 sq.mm/m

Provide 8 dia @ 152 c/c = 330 sq.mm/m Short span

Provide 8 dia @152 c/c = 330 sq.mm/m Long Span

7. BEAM DESIGN

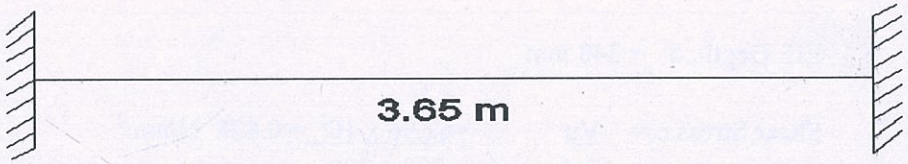
Effective Span = 3.65 m

Beam Size = 200 x 380 mm

D = 348mm

F_{ck}= M_{20}

Udl = 23 KN/m



Max. Bending Moment at Mid Span for Udl $= \frac{Wl^2}{12}$

$= \frac{23 \times 3.65 \times 3.65}{12}$

= 25.53kNm

Mu = 25.53 x 1.5 x 10^{-6}

= 38.3 x 10^{-6}Nmm

$\frac{Mu}{bd^2} = \frac{38.3 \times 10^{-6}}{200 \times 348 \times 348}$

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$= 1.58 \text{ N/sq.mm}^2$

From Table 48 of SP 16, $d' / d = 33 / 348 = 0.095$

$P_t = 0.697\%$ $P_c = 0.000\%$

$A_t = (0.697 \times 200 \times 348) / 100 = 485.11 \text{ sq.mm}^2$ (bottom)

$A_c = (0.000 \times 200 \times 348) / 100 = 0 \text{ mm}^2$ (top)

Provided 2 Nos. 12 = 226.19 sq.mm

1 Nos. 16 = 201.06 sq.mm

+ 2 Nos. 12= 226.19 sq.mm

= 653.44 sq.mm (bottom of support)

Provided 2 Nos. 12= 226.19 sq.mm

+ 2 Nos. 12 = 226.19 sq.mm

1 Nos. 16 = 201.06 sq.mm

= 6153.44 sq.mm (top of support)

SHEAR DESIGN

Shear Force $= 23 \times \frac{365}{2} = 41.98$ KN

Factored Shear Force = $1.5 \times 41.98 = 62.96$ KN

Eff. Depth, d = 348 mm

Shear Stress $\tau_v = \frac{Vu}{bd} = \frac{62.96 \times 10^3}{200 \times 380} = 0.828 \text{ N/mm}^2$

Table 20 of IS 456 : 2000, For M20, pg no. 73

$\tau_{c,max} = 2.8 \text{ N/mm}^2$

Shear to be carried out by stirrups $V_u - \tau_c bd$

From Table 61, $P_t = 0.6$ $\tau_c = 0.51 \text{ N/mm}^2$

$V_{us} = V_u - \tau_c bd$

$= (62.96 \times 10^3) - (0.51 \times 200 \times 348)$

$= 27464$kN

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$\frac{V_{us}}{d} = \frac{27.46}{34.8}$ = 0.789kN/cm

Sp 16, pg no. 179, from table 62, Fy = 500 N/mm^2

Provide 8mm dia two legged vertical stirrups at 152 mm c/c

8mm dia two legged vertical stirrups at 200 mm c/c

8. COLUMN DESIGN:

Column size = 200x380

Maximum load on column in basement P = 708kN

PU=1.5x 708 = 1062 kN

Maximum Bending moment = 46.2kNm MU=1.5x 46.2 = 69.3 kNm

Cover =40mm

d'/d=0.126

Fck= M25= 25N/sq.mm fy= Fe500

Provide bars equally all sides

Refer chart 48 of SP-16

$\frac{pu}{Fckxbxd} = \frac{1062\ x10}{25\ x200\ x380} = 0.559$

$$\frac{Mu}{Fckxbd^2} = \frac{69.3\ x10^6}{25\ x200\ x380\ x380} = 0.096$$

$\frac{p}{Fck}$ = 0.11 p% = 0.11 x 25 = 2.75%

Minimum steel = 2.75%

As = $\frac{2.75x200\ x\ 380}{100} = 2090\ sq.mm$

Provide 10Nos 16dia = $2010.62 sq.mm$

2 Ties 8@203c/c and 1 link 8 @ 203c/c.

9. FOOTING DESIGN:

Maximum load on column P = 708kN Fck = M20

Add 5% Footing load = 743.4kN

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S.B.C of Soil at 260kN/m^2 at depth = 3 m

Assume footing base of 2.29 X 1.98 m and depth = 457 mm

Eff. Depth =424 mm

$$\text{Area} = \frac{743.4}{260}$$

$$= 2.86 \text{sq.m}$$

So, Pressure on soil is

$$\frac{708}{2.29\ X\ 1.98} = 156.15 \text{kN/m}^2 < 260 \text{kN/m}^2$$

$$M = \frac{156.15x\left(\frac{2.29}{2} - \frac{1.98}{2}\right)^2}{2}$$

$$= 1.875 \text{KNm}$$

Mu =2.813KNm

$$\frac{Mu}{bd^2} = \frac{2.813\ x(10)^6}{1000x(424)^2}$$

$$= 0.015 \text{N/sq.m}$$

Fck= 20 N/sq.mm

From Table-3 of SP – 16, min pt% = 0.16%

$$At = \frac{0.16\ X\ 1000\ X\ 424}{100} = 678.4 \text{ sq.mm}$$

Provide 10 dia @ 101.6 c/c

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