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Verified RealEstate™
3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai 600 097, India

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

DIGITALLY VERIFIED RECORD

HOSUR (ICON-2)

Date : 17.03.2025

# DESIGN BASIS REPORT

## THE PROPOSED CONSTRUCTION OF STILT FLOOR + 3 FLOORS RESIDENTIAL BUILDING (APPARTMENT) FOR M/S G SQUARE PRISTINE , AT PLOT NO : 61 & 62,, SY NO : 309, NEAR TITAN TOWNSHIP ,NEXT TO SOPPATI VILLAGE ,MATHIGIRI POST, HOSUR, KRISHNAGIRI (ICON-2)

This is to Certify that the Proposed Building (RCC Roof) consists of stilt +3 Floor only.

This Proposed building site has been inspected on by me and the required details such as soil Report & other details etc. have been collected and foundation details are enclosed here with.

The Proposed Building which has been designed as per IS code IS 875 and structures of stilt +3 floor only. So, I here by certify that the Building will be structurally safe. No more future Vertical expansion will be allowed except stair head room etc, if necessary.

G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / SE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

**SUBMITTED BY**

**GCON ENGINEERS**

**G1 , Ekambaram street,**
**Pammal, Chennai-75.**

| | | | | |
|---|---|---|---|---|
| DBR –R0<br>DATE : 17-03-2025 | | | | |
| **DESCRIPTION** | **COMMENTS** | **GCON (STRUCTURAL CONSULTANT) SIGN & STAMP** | **ARCHITECT SIGN & STAMP** | **CLIENT SIGN & STAMP** |

## STRUCTURAL DESIGN BASIS REPORT
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## 1) GENERAL PROJECT DETAILS

### Structural Design Introduction

The proposed structure is STILT+3Storey residential apartment building situated at achettipalli village, hosur taluk, krishnagiri district ,India. In this brief report we are presenting the data and assumptions related to the project, which has lead to the conceptual design at this preliminary stage. The document attempts to record all inputs assumed in design and will form the basis for all future detailed structural work.

The report most importantly clarifies the load criteria assumed in the design and it is therefore expected that all related consultants, including the architects, would go through the document and refer to it at every stage of detailed design. Recommendations or revisions on assumed parameters are requested at this stage.

Besides this the report will also form the outline of the design criteria and methods of both analysis and design to be adopted in this project with the aim of achieving a design that satisfies all sorts of seismic, and serviceability requirements.

### 2. List of References:

| | |
|---|---|
| IS 456-2000 | Plain and reinforced concrete-code of practice |
| IS 875 | Code Of practice for design loads for buildings and structures |
| Part 1: 1987 | dead loads- unit weights of building material and stored material |
| Part 2: 1987 | Imposed loads |
| Part 3: 1987 | Wind loads |
| IS 1893: 2016 | Criteria for earthquake resistant design of structures |
| IS1904-1986 (Reaffirmed 2006) | Code of practice for design & construction of foundation in soils |
| IS 4326:1993 | Code of practice for earthquake resistant design and construction of buildings |
| IS 13920: 1993 | Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces |
| BS 8110 : 1997 | Plain and reinforced concrete-code of practice(British standard) |
| ACI 318 | Plain and reinforced concrete-code of practice (American standard) |
| CP65 | Plain and reinforced concrete-code of practice (Singapore standard) |
| IS 800:1984 & 2007 | Code of practice for general construction in steel |
| IS 1343:2012 | Code of practice for pre-stressed concrete (First Revision) |
| Reynolds Handbook | |
| IS 3414 | Code of practice for joints in the buildings |
| IS 3370 Part 1 TO 4 | Code of practice for liquid retaining structures |
| BS-8007 | Code of practice for liquid retaining structures for crack width calculation |
| Soil Report | |

## 3. Material, Workmanship, Inspection and Testing:

The proposed RCC structure will consists of concrete and steel reinforcement as the two main materials used for construction of the structure. The specifications for these materials are discussed in this chapter

### 3.1 Concrete:

The concrete shall be in grades designated as per Table 2 IS 456-2000.
Recommended grades for the different members is as follows:

| | |
|---|---|
| Footing/column | M25 |
| Shear wall/lift | M25 |
| Beams/Slabs | M25 |

Any other structural member will be in general designed in M25.

### 3.2 Durability of concrete

The structure is located in Coimbatore, where the climatic conditions are considered as moderate. Concrete grade of submerged structural elements will be a minimum of M25. Nominal covers shall not be less than 30 mm from a durability point of view.

The cover to the various structural elements is to be as follows,

| Structural Element | Clear Cover in mm |
|---|---|
| Slabs | 25 |
| Beams | 30 |
| Shear walls/Shear wall | 40 |
| Footings | 50 |
| Structural elements under ground | 50 |

### 3.3 Reinforcement:

The reinforcement shall be high strength deformed steel bars with yield strength of 550 $N/mm^2$ confirming to IS: 1786.

### 3.4 Structural Steel

The structural steel to be used shall confirm to IS 800

## 4) Foundation system:

**SHALLOW FOUNDATION:** Isolated Footing at 2.550 m from the natural ground level with 317.59 KN safe bearing capacity.

## 5) General design considerations:

### 5.1 Method of Design

The aim of design is the achievement of an acceptable probability that structures being designed will perform satisfactorily during their intended life. With an appropriate degree of safety, they should sustain all the loads and deformations of normal construction and use and have adequate durability and adequate resistance to the effects of earthquake, wind and fire.

Structures and structural elements will be designed by Limit State Method. Due consideration will give to the accepted theories, experience and modern philosophy of design.

### 5.2 Loads and Forces

In structural design, account is taken of the dead, imposed and wind loads and forces such as those caused by earthquake etc., where applicable.

### 5.2(a) Dead Loads

The dead loads are calculated on the basis of unit weights of materials given in IS 875 (Part 1) the data provided by consultant and other service consultants will be used for the specific materials/equipment.

Unless otherwise specified the unit weight of materials will be used as follows.

| | |
|---|---|
| Reinforced Concrete | 25 kN/cum |
| Plain concrete | 24 kN/cum |
| Brickwork | 20 kN/cum |
| Soil dry | 16 kN/cum |
| Floor finishes | 20 kN/cum |
| Structural steel | 78.5 kN/cum |
| Water | 9.81 kN/cum |

### 5.2 b Load Combinations considered:

1. 1.5D+1.5L
2. 1.2D+1.2L+1.2WX
3. 1.2D+1.2L-1.2WX
4. 1.2D+1.2L+1.2WZ
5. 1.2D+1.2L-1.2WZ
6. 0.9D+1.5WX
7. 0.9D-1.5WX
8. 0.9D+1.5WZ
9. 0.9D-1.5WZ
10. 1.5D+1.5WX
11. 1.5D-1.5WX
12. 1.5D+1.5WZ
13. 1.5D-1.5WZ
14. 1.2D+1.2L+1.2SX
15. 1.2D+1.2L-1.2SX
16. 1.2D+1.2L+1.2SZ
17. 1.2D+1.2L-1.2SZ

18. 0.9D+1.5SX
19. 0.9D-1.5SX
20. 0.9D+1.5SZ
21. 0.9D-1.5SZ
22. 1.5D+1.5SX
23. 1.5D-1.5SX
24. 1.5D+1.5SZ
25. 1.5D-1.5SZ
26. 1.2DL+1.2TL
27. 1.2DL+1.2LL+1.2TL
28. 1.2DL+1.2LL+1.2WX+1.2TL
29. 1.2DL+1.2LL +1.2WY+1.2TL
30. 1.2DL+1.2LL +1.2SX+1.2TL
31. 1.2DL+1.2LL +1.2SY+1.2TL

Following **Service load** combinations will be considered for the analysis of the structure.

1. DL+ LL
2. DL + 0.8 LL ± 0.8WX
3. DL + 0.8 LL ± 0.8WY
4. DL ± WX
5. DL ± WY
6. DL + 0.8 LL ± 0.8SX
7. DL + 0.8 LL ± 0.8SY
8. DL± SX
9. DL± SY

**Software's for the analysis & design:**

a. ETABS
b. Adapt / Safe
c. Excel program sheet
d. RCDC

# 6.0 Residential building

## 6.1 Residential building:

The special features for this building are listed as below.

The proposed building is residential building. Stilt floor is intended for parking, and toilets, drive ways. Above stilt floor typical floors are intended for Residential purpose which includes 1st to 3rd floors and terrace , LMR & head room floor above it.

## 6.1a Imposed Loads:

Imposed loads are assumed in accordance with IS 875 part 2, as follows. The table listed below is a summary of these loads.

| Sr.No. | Area Description | Floor Finish kN/sq.m | Live load kN/sq.m | Super imposed dead load | Remark / comment |
|---|---|---|---|---|---|
| 1 | Room | 1.5 | 2 | - | |
| 2 | Staircase | 1.5 | 3 | 3 | - |
| 3 | Lobby/corridor/passage | 1.5 | 3 | - | - |
| 4 | Living room | 1.5 | 2 | - | - |
| 5 | Balcony | 1.5 | 3 | 3 | - |
| 7 | Kitchen | 1.5 | 2 | - | - |
| 8 | Toilet | 1.5 | 2 | 0 | - |
| 9 | Dining | 1.5 | 2 | 0 | - |
| 10 | Utility | 1.5 | 3 | 0 | |
| 11 | Store room | 1.5 | 5 | 0 | |
| 12 | Terrace | 3 | 2 | 0 | 150 mm water proofing considered. |
| 13 | Water Tank | 1.5 | 12 | - | 1.5 m depth of tank is considered. |

## 6.1b Analysis Approach

Structural Geometry:

The structure consists of 4 slabs. The slabs with their description, levels, heights and approximate areas are given in table below:

| Floor | Height |
|---|---|
| Head room | 3 |
| Terrace | 3 |
| 3rd | 3 |
| 2nd | 3 |
| 1st | 3 |
| **Total** | 15 |

## Structural Frames

The proposed building is RCC frame structure, with Column & RCC beam framing is proposed for the typical floor system. After taking into considerations the feasibility of particular system, clear height available for particular floor, mobility of the services below slab, cost estimation, provision of openings in the slab, approval of architects, other consultants and client, the final framing system has been arrived.

## 6.1c Seismic Analysis:

### 6.1c (i) General Principles and design criteria

The structure is located in the seismic zone II. The design lateral force will calculated as per the method described in the following paragraphs. The structure is primarily shear wall and beam framing system although due considerations will be given to the major suggestions/clauses from IS:13920, the basic frame is assumed to be as column structure, as per Table 7.

### 6.1c (ii) Design Spectrum

Seismic Analysis (Initial analysis for preliminary shear wall sizing) The design Horizontal seismic coefficient for a structure

$$Ah = \frac{Z\ I\ Sa}{2\ R\ g}$$ IS:1893-2016 Clause 6.4.2

Where,

Z = Zone factor 0.16 for Zone II — Table 2

I = Importance Factor (1.5) — Table 6

R =Response reduction factor 5 — For Shear wall building from Table 7

Sa/g =Average Response acceleration coefficient

$T = 0.075\ h^{0.75}$ For RC frame building Clause 7.6

Where,

T is Fundamental natural period h = Height of the structure

$T = 0.075 \times 12^{0.75}$

=0.48

Sa/g = 2.45

Design Seismic Base shear $V_b$

$=A_h\ W$

Where,

W = seismic weight Ah = 0.06

## 6.1(d) Wind Loads

Wind load for design of structures shall be based on the design wind speed arrived from IS: 875 (Part3)-1987.

The parameters for calculation of design wind speed as per IS: 875 (Part 3)-1987.

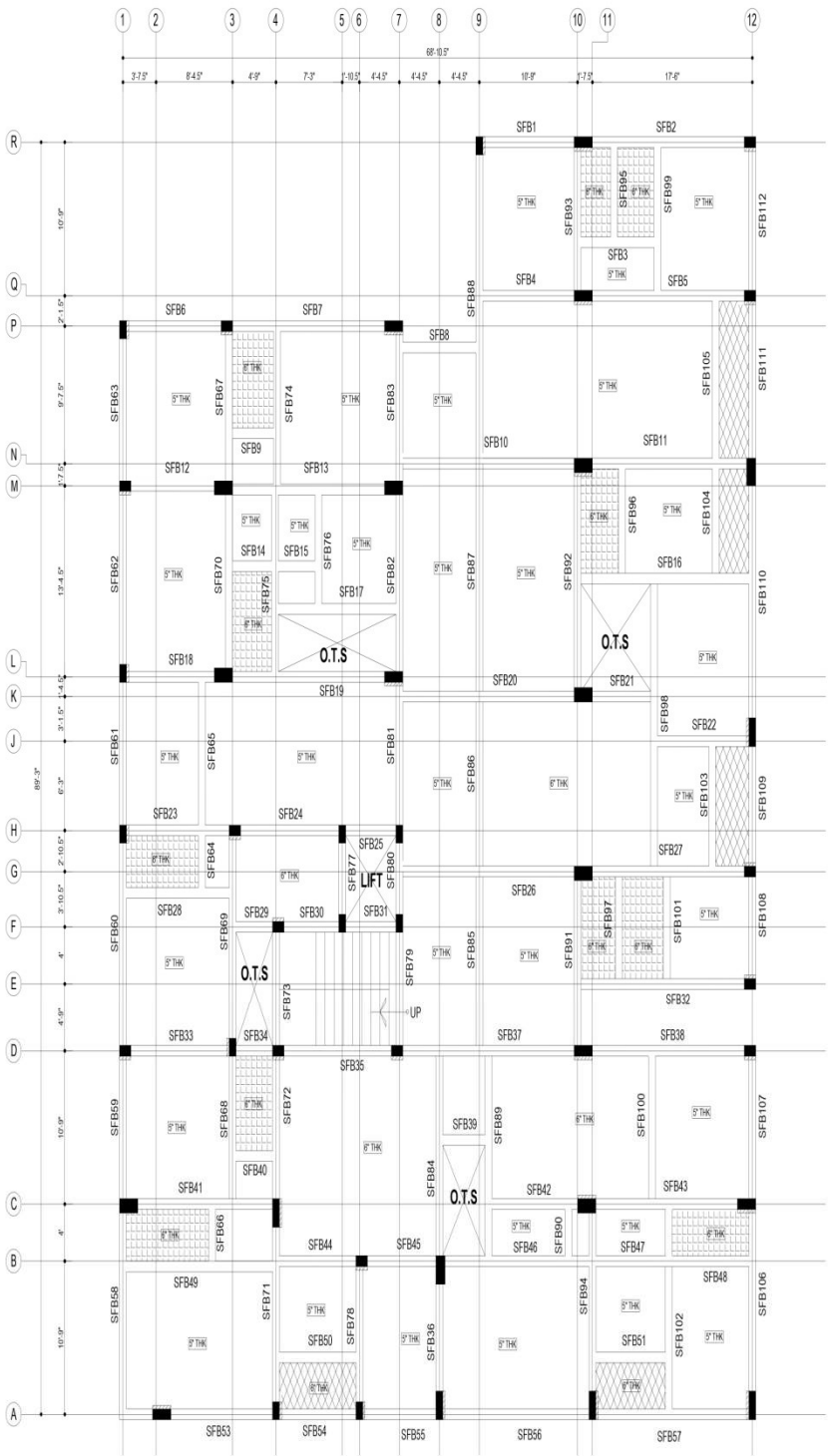
Basic wind speed, $V_b$ : 33 m/ sec.
Risk Coefficient, K1 : 1
(If design life of structure taken as 50 yrs.)
Terrain, Height, Structure size factor, K2 : To suit the height of the structure for Terrain category-2 & class c is 1.11
Topography factor, K3. : 1.0.
K4 factor value : 1.0
Design Wind Speed Vz : 36.6 m/s.
Design Wind Pressure Pz : 0.6x (36.6) $^2$= 803.7 N/m$^2$

## 7 Conclusions.

**7.1 Other loads:** Any other loads like those of services; storage etc. will be obtained from time to time from the relevant consultants and incorporated. The top slab of the lift shaft will be designed for lift loads as obtained from the manufacturer.

G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / RSE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

## 8 Layout.




STILT FLOOR ROOF BEAM LAYOUT

NOTES:

1. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE THE EXECUTION OF WORK.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE KEY PLAN AND ALL OTHER RELEVANT DRAWINGS.
3. ALL DIMENSIONS ARE IN FEET AND INCHES UNLESS OTHERWISE SPECIFIED.
4. USE CONCRETE - M25.
5. ALL REINFORCEMENTS SHALL BE OF GRADE Fe550 CONFIRMING IS-1786
6. FOOTING DESIGNED FOR S+3 ONLY.
7. NO ADMITURES SHALL BE ADDED WITHOUT PERMISSION OF CONSULTANT
8. CLEAR COVER TO REINFORCEMENT FOR
   a) FOUNDATION - 2" c) COLUMN - 1½"
   b) BEAM -1" d) SLAB - ½"
9. SBC OF SOIL CONSIDERED AS 299.26Kn/sqm AS PER SOIL REPORT
10. LAPPING SHALL BE 50 TIMES DIA. OF THE BAR.
11. STRUCTURAL DETAILED DRAWINGS ARE ISSUED FOR S+3 ONLY.
12. DE-SHUTTERING PERIOD AS PER IS 456
13. ALL SORTS OF PRECAUTIONARY MEASURES WILL BE TAKEN AT THE TIME OF CONSTRUCTION.
14. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.

| Rev | Description | DATE |
|---|---|---|
| R0 | ISSUE FOR APPROVAL | 09-11-2024 |

CLIENT:

ARCHITECT:

G SQUARE PRISTINE

CONSULTANT:

GCON ENGINEERS

email: gconchennai@gmail.com

PROJECT TITLE:
PROPOSED RESIDENTIAL BUILDING AT ACHETTIPALLI VILLAGE,HOSUR TALUK,KRISHNAGIRI DISTRICT. GS PRISTINE PLOT NO-61,62 (ICON-2)

DRAWING TITLE:
STILT FLOOR ROOF BEAM LAYOUT

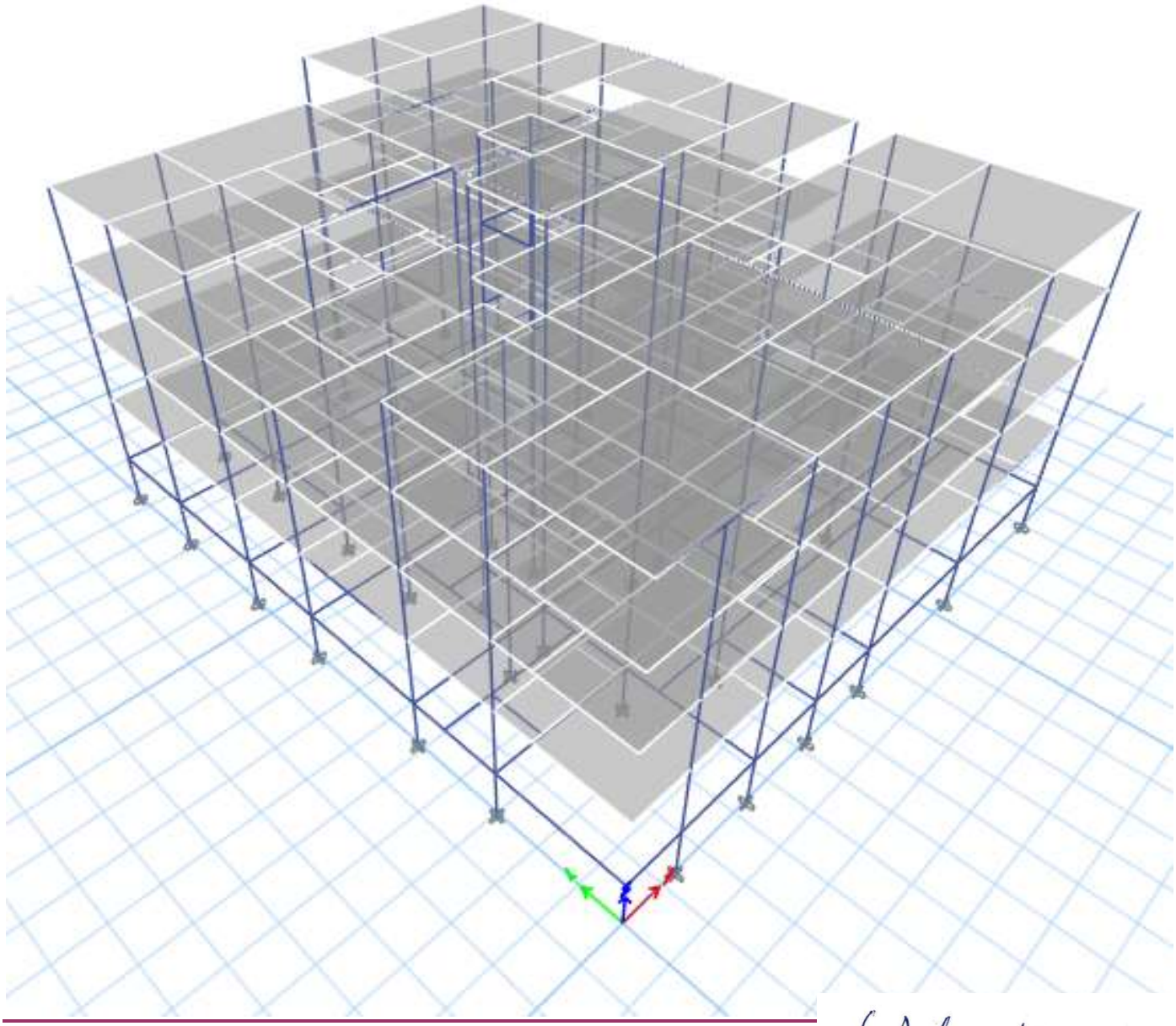
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## 9 Etab model.



G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / SE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

## 10 DESIGN.

### 10.1 FOOTING DESIGN:

| | | |
|---|---|---|
| Design Code | : IS 456 : 2000 + IS 13920 : 2016 | |
| Footing No | : FC1 | |
| Column No | : C27,C6,C29,C30,C25,C24,C32,C33 ( 300 mm X 375 mm) | |
| Analysis No | : C27,C6,C29,C30,C25,C24,C32,C33 | |
| | | |
| Concrete Grade | : M25 | N/sqmm |
| Steel Grade | : Fe550 | N/sqmm |
| Clear Cover | : 40 | mm |
| Df | : 3.5 M | |
| Dw | : 1 M | |
| | | |
| Density of Soil | = 18 | kN/cum |
| Soil Bearing Capacity | = 299 | kN/sqm |
| Gross Bearing Capacity | = 362 | kN/sqm |
| Permissible SBC Increase for EQ | = 25 | % |
| Permissible SBC Increase for Wind | = 25 | % |
| Live Load Reduction | = 50 | % |
| Permissible area of loss of contact | = 0 | % |
| | | |
| Cross Section designed by | : Maximum pressure | |
| Consider overburden pressure | | |

G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / RSE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

## HOSUR (ICON-2)

| | | | |
|---|---|---|---|
| Footing Type | : | Pad | |
| Footing Size (L x B x D) | : | 1300mm X 1200mm X 375mm | |
| **Without considering Effect of Water Table** | | | |
| Footing Self Wt., F1 | = | 14.62 | kN |
| Soil Weight, S1 | = | 81.42 | kN |
| Total Weight, W1 | = | F1 + S1 | |
| | = | 96.05 | kN |
| **Considering Effect of Water Table** | | | |
| Footing Self Wt., F2 | = | 8.77 | kN |
| Soil Weight, S2 | = | 50.66 | kN |
| Weight of Water (Submerged column), Wc | = | 2.39 | kN |
| Total Weight, W2 | = | F2 + S2 - Wc | |
| | = | 57.05 | kN |
| Offset Along L (Loff) | = | 462.5 | mm |
| Offset Along B (Boff) | = | 450 | mm |

**Check For Maximum Soil Pressure:**

| | | | |
|---|---|---|---|
| Critical Column No | = | C27 | |
| Critical Analysis Load Combination | = | FOOT | |
| Critical Load Combination | = | [15] : (Dead) +(SDL) +(Live) +(RLL) | |
| Pcomb | = | 415.22 | kN |
| P | = | Pcomb + W1 | |
| P | = | 511.27 | kN |
| Mx | = | 8.86 | kNm |
| My | = | -1.74 | kNm |
| P/A | = | 327.74 | kN/sqm |
| Mx/Zx | = | 26.2 | kN/sqm |
| My/Zy | = | -5.57 | kN/sqm |
| Maximum Soil Pressure | = | 359.51 | kN/sqm |
| Allowable Soil Pressure | = | (1 X 299) + 63 | kN/sqm |
| | = | 362 | kN/sqm |

**Check For Minimum Soil Pressure:**

| | | | |
|---|---|---|---|
| Critical Column No | = | C29 | |
| Critical Analysis Load Combination | = | FOOT | |
| Critical Load Combination | = | [15] : (Dead) +(SDL) +(Live) +(RLL) | |
| Pcomb | = | 280.67 | kN |
| P | = | Pcomb + W2 | |
| P | = | 337.72 | kN |
| Mx | = | 0.63 | kNm |
| My | = | -1.62 | kNm |

| | | | |
|---|---|---|---|
| P/A | = | 216.49 | kN/sqm |
| Mx/Zx | = | 1.86 | kN/sqm |
| My/Zy | = | -5.18 | kN/sqm |
| Minimum Soil Pressure | = | 209.45 | kN/sqm |
| | > | 0 | |

**Design For Bending:**

**Bottom Reinforcement Along L:**

| | | | |
|---|---|---|---|
| Critical Column No | = | C32 | |
| Critical Analysis Load Combination | = | DConS10 | |
| Critical Load Combination | = | [25] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+Y) | |
| Pu | = | 688.21 | kN |
| Mux | = | -44.29 | kNm |
| Muy | = | 0.32 | kNm |
| P/A | = | 441.16 | kN/sqm |
| Mx/Zx | = | -131.02 | kN/sqm |
| My/Zy | = | 1.04 | kN/sqm |
| | | | |
| Deff | = | 327 | mm |
| Beff | = | 1200 | mm |
| SPu | = | 573.22 | kN/sqm |
| Mu | = | SPu X B X Loff X Loff / 2 | |
| | = | 73.57 | kNm |
| Pt | = | 0.138 | % |
| Ast Rqd (BM) | = | 540 | sqmm |
| Ast Prv (Distributed Across Total Width) | = | 7 - T10 @ 200 | |
| | = | 550 | sqmm |

**Bottom Reinforcement Along B:**

| | | | |
|---|---|---|---|
| Critical Column No | = | C32 | |
| Critical Analysis Load Combination | = | DConS10 | |
| Critical Load Combination | = | [25] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+Y) | |
| Pu | = | 688.21 | kN |
| Mux | = | -44.29 | kNm |
| Muy | = | 0.32 | kNm |
| P/A | = | 441.16 | kN/sqm |
| Mx/Zx | = | -131.02 | kN/sqm |
| My/Zy | = | 1.04 | kN/sqm |
| | | | |
| Deff | = | 311 | mm |
| Leff | = | 1300 | mm |
| SPu | = | 573.22 | kN/sqm |
| Mu | = | SPu X L X Boff X Boff / 2 | |

| | | | |
|---|---|---|---|
| | = | 75.45 | kNm |
| Pt | = | 0.145 | % |
| Ast Rqd (BM) | = | 585 | sqmm |
| Ast Prv (Distributed Across Total Length) | = | 8 - T10 @ 200 | |
| | = | 628 | sqmm |

**Design For Shear:**

**One Way Shear Along L:**

Critical Section @ d from Column Face

| | | | |
|---|---|---|---|
| | = | 327 | mm |
| Critical Column No | = | C32 | |
| Critical Analysis Load Combination | = | DConS10 | |
| Critical Load Combination | = | [25] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+Y) | |
| Pu | = | 688.21 | kN |
| Mux | = | -44.29 | kNm |
| Muy | = | 0.32 | kNm |
| P/A | = | 441.16 | kN/sqm |
| Mx/Zx | = | -131.02 | kN/sqm |
| My/Zy | = | 1.04 | kN/sqm |
| | | | |
| Deff | = | 327 | mm |
| Beff | = | 1200 | mm |
| SPu | = | 573.22 | kN/sqm |
| Vu | = | SPu X (Loff - d) X B | |
| | = | 93.21 | kN |
| Tv | = | Vu / (Beff X Deff) | |
| | = | 0.24 | N/sqmm |
| Tc | = | 0.28 | N/sqmm |
| Tv | < | Tc | |

**One Way Shear Along B:**

Critical Section @ d from Column Face

| | | | |
|---|---|---|---|
| | = | 311 | mm |
| Critical Column No | = | C32 | |
| Critical Analysis Load Combination | = | DConS10 | |
| Critical Load Combination | = | [25] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+Y) | |
| Pu | = | 688.21 | kN |
| Mux | = | -44.29 | kNm |
| Muy | = | 0.32 | kNm |
| P/A | = | 441.16 | kN/sqm |

| | | | |
|---|---|---|---|
| Mx/Zx | = | -131.02 | kN/sqm |
| My/Zy | = | 1.04 | kN/sqm |
| | | | |
| Deff | = | 311 | mm |
| Leff | = | 1300 | mm |
| SPu | = | 573.22 | kN/sqm |
| Vu | = | SPu X (Boff - d) X L | |
| | = | 103.58 | kN |
| Tv | = | Vu / (Leff X Deff) | |
| | = | 0.26 | N/sqmm |
| Tc | = | 0.29 | N/sqmm |
| Tv | < | Tc | |

**Design For Punching Shear:**

Critical Section @ d/2 from Column Face

| | | | |
|---|---|---|---|
| | = | 160 | mm |
| | | | |
| Critical Column No | = | C30 | |
| Critical Analysis Load Combination | = | DConS8 | |
| Critical Load Combination | = | [23] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+X) | |
| Pu | = | 695.22 | kN |
| Mux | = | 0.65 | kNm |
| Muy | = | -29.31 | kNm |
| P/A | = | 445.65 | kN/sqm |
| Mx/Zx | = | 1.93 | kN/sqm |
| My/Zy | = | -93.94 | kN/sqm |
| | | | |
| Deff | = | 319 | mm |
| Leff | = | 694 | mm |
| Beff | = | 619 | mm |
| Punching Perimeter | = | 2626 | mm |
| Punching Area | = | 837694 | sqmm |
| SPu | = | Max Pressure | |
| | = | 541.53 | kN/sqm |
| Vu | = | SPu X ((L X B)-(Leff X Beff)) | |
| | = | 612.15 | kN |
| Tv | = | Vu / Punching Area | |
| | = | 0.731 | N/sqmm |
| Tc | = | 1.25 | N/sqmm |
| Tv | < | Tc | |

**Load Transfer Check For Load Transfer From Column To Footing**

| | | | |
|---|---|---|---|
| Critical Column No | = | C30 | |

| | | | |
|---|---|---|---|
| Critical Analysis Load Combination | = | DConS8 | |
| Critical Load Combination | = | [23] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+X) | |
| Pu | = | 695.22 | kN |
| A2 | = | 0.11 | sqm |
| A1 | = | 3.38 | sqm |
| Base Area | = | 1.56 | sqm |
| A1 | > | Base Area | |
| Thus, A1 | = | 1.56 | |
| Modification Factor | = | SquareRoot(A1/A2) < = 2 | |
| SquareRoot(A1/A2) | = | 3.7659 | |
| Thus, Modification Factor | = | 2 | |
| Concrete Bearing Capacity | = | 0.45 X Fck X Modification Factor X Column Area | |
| | = | 2531.25 | kN |
| Concrete Bearing Capacity | > | Pu, Hence Safe. | |

G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / RSE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

**10.2 COLUMN DESIGN**

**General Data**

| | | | |
|---|---|---|---|
| Column No. | : | C27 | |
| Level | : | Base To GROUND FLOOR ROOF | |
| Frame Type | = | Non-Ductile | |
| Response Reduction Factor | = | 3 | |
| Design Code | = | IS 456 : 2000 + IS 13920 : 2016 | |
| Grade Of Concrete | = | M25 | N/sqmm |
| Grade Of Steel (Main) | = | Fe550 | N/sqmm |
| Grade Of Steel (Shear) | = | Fe550 | N/sqmm |
| Grade Of Steel - Flexural Design | = | Fe550 | N/sqmm |
| Grade Of Steel - Shear Design | = | Fe415 | N/sqmm |
| Column B | = | 300 | mm |
| Column D | = | 375 | mm |
| Clear Cover | = | 40 | mm |
| Clear Floor Height @ B | = | 2700 | mm |
| Clear Floor Height @ D | = | 2625 | mm |
| No Of Floors | = | 2 | |
| No Of Columns In Group | = | 1 | |
| Column Type | : | UnBraced | |
| Minimum eccentricity check | : | One Axis at a Time | |
| Code defined D/B ratio | : | 4 | |
| D/B Ratio | : | 1.25 <= 4 Hence, Design as Column | |

**Flexural Design (Analysis Forces)**

| | | | |
|---|---|---|---|
| Analysis Reference No. | = | C27 | |
| Critical Analysis Load Combination | : | DConS8 | |
| Load Combination | = | [8] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+X) | |
| Critical Location | = | Top Joint | |
| Pu | = | 599.75 | kN |
| Mux | = | -36.11 | kNm |
| Muy | = | 20.7 | kNm |
| Vux | = | -19.63 | kN |
| Vuy | = | 20.05 | kN |

**Effective Length Calculation**

**Calculation Along Major Axis Of Column**

| Joint | Column Stiffness | Beam Sizes | | Beam Stiffness | | Beta |
|---|---|---|---|---|---|---|
| | | Beam 1 (Length x Width x Depth) | Beam 2 (Length x Width x Depth) | Beam 1 | Beam 2 | |
| | N-m x 10^6 | mm | mm | N-m x 10^6 | N-m x 10^6 | |
| Bottom | 43.945 | No Beam | No Beam | - | - | 0.928 |
| Top | 43.945 | No Beam | 11825 x 230 x 375 | - | 8.548 | 0.901 |

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Major Axis = 3.72

**Calculation Along Minor Axis Of Column**

| Joint | Column Stiffness | Beam Sizes | | Beam Stiffness | | Beta |
|---|---|---|---|---|---|---|
| | | Beam 1 (Length x Width x Depth) | Beam 2 (Length x Width x Depth) | Beam 1 | Beam 2 | |
| | N-m x 10^6 | mm | mm | N-m x 10^6 | N-m x 10^6 | |
| Bottom | 28.125 | No Beam | No Beam | - | - | 0.695 |
| Top | 28.125 | 3275 x 230 x 300 | No Beam | 15.802 | - | 0.721 |

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Minor axis = 1.98

**Minimum Eccentricity Check**

Since Axial Force is compressive, Min. Eccentricity check to be performed

Most critical case is with Min. Eccentricity check in X-direction

Minimum Eccentricity Along D:

Minimum Eccentricity = Unsupported Length / 500 + D / 30

= 17.75 mm

| | | | |
|---|---|---|---|
| Mminx | = | Pu x Minimum Eccentricity | |
| | = | 11.99 | kNm |

**Slenderness Check**

| | | | |
|---|---|---|---|
| Max Slenderness Ratio(L/B) | = | 9 | |
| | < | 60 | (Hence Ok) |
| Column Is Unbraced Along D | | | |
| Slenderness Check Along D: | | | |
| Effective Length Factor | = | 3.72 | |
| Slenderness Ratio | = | Effective Length / D | |
| | = | 26.04, Column Slender Along D | |
| Slenderness moment along D | = | (Pu D/ 2000) (Lex/D)^2 | |
| | = | 76.25 kNm | |
| Column Is Unbraced Along B | | | |
| Slenderness Check Along B: | | | |
| Effective Length Factor | = | 1.98 | |
| Slenderness Ratio | = | Effective Length / B | |
| | = | 17.82, Column Slender Along B | |
| Slenderness moment along B | = | (Pu B/ 2000) (Ley/B)^2 | |
| | = | 28.57 | kNm |
| Design slenderness moment along D | | | |
| Puz | = | 2253.9 | kN |
| Pd | = | 639.33 | kN |
| Reduction factor 'k' for slenderness moment | = | (Puz - Pu) / (Puz - Pd) < = 1 | |
| | = | 1.02 > = 1, Hence k=1 | |
| Mslndx | = | k x 76.25 | |
| | = | 76.25 | kNm |
| Design slenderness moment along B | | | |
| Puz | = | 2253.9 | kN |
| Pb | = | 578.66 | kN |
| Reduction factor 'k' for slenderness moment | = | (Puz - Pu) / (Puz - Pb) < = 1 | |
| | = | 0.99 < = 1, Hence k=0.99 | |
| Mslndy | = | k x 28.57 | |
| | = | 28.21 | kNm |

**Calculation of Design Moment**

| Direction | Manalysis | Mmin (Abs) | Mdesign | Mslndx (Abs) | Mdesign-final |
|---|---|---|---|---|---|
| | A | B | C | E | F |
| Major Axis - Mux | -36.11 | 11.99 | -36.11 | 76.25 | -112.36 |
| Minor Axis - Muy | 20.7 | --- | 20.7 | 28.21 | 48.91 |

**Where**

A = Moments directly from analysis

B = Moments due to minimum eccentricity

C = Maximum of analysis moment and min. eccentricity = Max (A,B)

E = Moment due to slenderness effect

F = Final design Moment = Max(C- Top Bottom , D- Top Bottom) + E

**Final Critical Design Forces**

| | | | |
|---|---|---|---|
| Pu | = | 599.75 | kN |
| Mux | = | -112.36 | kNm |
| Muy | = | 48.91 | kNm |

**Resultant Moment (Combined Action)**

**Moment Capacity Check**

| | | | |
|---|---|---|---|
| Pt Calculated | = | 2.19 | |
| Reinforcement Provided | = | 4-T20 + 6-T16 | |
| Load Angle | = | $Tan^{-1}$(Muy/Mux) | |
| | = | 23.52 | deg |
| MRes | = | 122.55 | kNm |
| MCap | = | 133.82 | kNm |
| Capacity Ratio | = | MRes/ MCap | |
| | = | 0.92 <= 1 | |

| **Shear Calculation** | **Along D** | **Along B** |
|---|---|---|
| **Critical Analysis Load Combination** | DConS13 | DConS11 |
| Critical Load Combination | [13] : 0.9 (Dead) +0.9 (SDL) +1.5 (EQ+Y) | [11] : 0.9 (Dead) +0.9 (SDL) +1.5 (EQ+X) |
| Design shear force, Vu (kN) | 22.968 | 14.7361 |
| Pu (kN) | 341.96 | 248.7 |
| Deff , Beff (mm) | 325 | 250 |
| Aeff (sqmm) | 97500 | 93750 |
| Design shear stress, Tv | Vu / (B x Deff) | Vu / (D x Beff) |
| Tv (N/sqmm) | 0.2356 | 0.1572 |
| Pt (%) | 1.095 | 1.095 |
| Design shear strength, Tc (N/sqmm) | 0.6633 | 0.6633 |
| Shear Strength Enhancement Factor (Compressive Force) | 1 + 3 x Pu / ( B x D x Fck) | |
| | 1.4209 | 1.3183 |
| Shear Strength Enhancement Factor (Tensile Force) | - | - |
| Shear Strength Enhancement Factor (max) | 1.5 | 1.5 |
| Shear Strength Enhancement Factor | 1.4209 | 1.3183 |

| | | |
|---|---|---|
| Enhanced shear strength, Tc-e (N/sqmm) | 0.9424 | 0.8744 |
| Design shear check | Tv < Tc x Enhancement factor | Tv < Tc x Enhancement factor |
| **Shear Links Design** | **Shear Links Not Required** | **Shear Links Not Required** |

**Design Of Links**

Links in the zone where special confining links are not required

Normal Links

| | | |
|---|---|---|
| Diameter of link | = 8 | mm |
| | > Max. longitudinal bar dia / 4 | |
| | = 5 | mm |

Criterion for spacing of normal links

| | | |
|---|---|---|
| Min. Longitudinal Bar dia X 16 | = 256 | mm |
| Min. dimension of column | = 300 | mm |
| Max. 300 mm | = 300 | mm |
| Provided spacing | = 200 | mm |

**Table For Links**

| | Required | | | Provided | |
|---|---|---|---|---|---|
| | **Normal Design** | **Shear Design** | **Ductile Design** | **Normal Zone** | **Ductile Zone** |
| Link Dia. | 8 | --- | --- | 8 | --- |
| Spacing | 200 | --- | --- | 200 | --- |

---

**General Data**

| | | | |
|---|---|---|---|
| Column No. | : | C27 | |
| Level | : | GROUND FLOOR ROOF To TERRACE FLOOR | |
| Frame Type | = | Non-Ductile | |
| Response Reduction Factor | = | 3 | |
| Design Code | = | IS 456 : 2000 + IS 13920 : 2016 | |
| Grade Of Concrete | = | M25 | N/sqmm |
| Grade Of Steel (Main) | = | Fe550 | N/sqmm |
| Grade Of Steel (Shear) | = | Fe550 | N/sqmm |
| Grade Of Steel - Flexural Design | = | Fe550 | N/sqmm |
| Grade Of Steel - Shear Design | = | Fe415 | N/sqmm |
| Column B | = | 230 | mm |
| Column D | = | 375 | mm |
| Clear Cover | = | 40 | mm |
| Clear Floor Height @ B | = | 2700 | mm |

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| | | | |
|---|---|---|---|
| Clear Floor Height @ D | = | 2625 | mm |
| No Of Floors | = | 3 | |
| No Of Columns In Group | = | 1 | |
| Column Type | : | UnBraced | |
| Minimum eccentricity check | : | One Axis at a Time | |
| Code defined D/B ratio | : | 4 | |
| D/B Ratio | : | 1.63 <= 4 Hence, Design as Column | |

**Flexural Design (Analysis Forces)**

| | | | |
|---|---|---|---|
| Analysis Reference No. | = | C27 | |
| Critical Analysis Load Combination | : | DConS8 | |
| Load Combination | = | [8] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+X) | |
| Critical Location | = | Bottom Joint | |
| Pu | = | 437.37 | kN |
| Mux | = | 53.34 | kNm |
| Muy | = | -19.73 | kNm |
| Vux | = | -14.01 | kN |
| Vuy | = | 34.88 | kN |

**Effective Length Calculation**

**Calculation Along Major Axis Of Column**

| Joint | Column Stiffness | Beam Sizes | | Beam Stiffness | | Beta |
|---|---|---|---|---|---|---|
| | | Beam 1 (Length x Width x Depth) | Beam 2 (Length x Width x Depth) | Beam 1 | Beam 2 | |
| | N-m x 10^6 | mm | mm | N-m x 10^6 | N-m x 10^6 | |
| Bottom | 33.691 | No Beam | 11825 x 230 x 375 | - | 8.548 | 0.901 |
| Top | 33.691 | No Beam | 11825 x 230 x 375 | - | 8.548 | 0.887 |

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Major Axis = 3.34

**Calculation Along Minor Axis Of Column**

| Joint | Column Stiffness | Beam Sizes | | Beam Stiffness | | Beta |
|---|---|---|---|---|---|---|
| | | Beam 1 (Length x Width x Depth) | Beam 2 (Length x Width x Depth) | Beam 1 | Beam 2 | |
| | N-m x 10^6 | mm | mm | N-m x 10^6 | N-m x 10^6 | |
| Bottom | 12.674 | 3275 x 230 x 300 | No Beam | 15.802 | - | 0.721 |
| Top | 12.674 | 3275 x 230 x 300 | No Beam | 15.802 | - | 0.616 |

| | | | |
|---|---|---|---|
| Sway Condition (as per Stability Index) | = | Sway | |
| Effective Length Factor along Minor axis | = | 1.86 | |

**Minimum Eccentricity Check**

Since Axial Force is compressive, Min. Eccentricity check to be performed

Most critical case is with Min. Eccentricity check in X-direction

Minimum Eccentricity Along D:

| | | | |
|---|---|---|---|
| Minimum Eccentricity | = | Unsupported Length / 500 + D / 30 | |
| | = | 17.75 | mm |
| Mminx | = | Pu x Minimum Eccentricity | |
| | = | 8.75 | kNm |

**Slenderness Check**

| | | | |
|---|---|---|---|
| Max Slenderness Ratio(L/B) | = | 11.74 | |
| | < | 60 | (Hence Ok) |

Column Is Unbraced Along D

Slenderness Check Along D:

| | | | |
|---|---|---|---|
| Effective Length Factor | = | 3.34 | |
| Slenderness Ratio | = | Effective Length / D | |
| | = | 23.38, Column Slender Along D | |
| Slenderness moment along D | = | (Pu D/ 2000) (Lex/D)^2 | |
| | = | 44.83 kNm | |

Column Is Unbraced Along B

Slenderness Check Along B:

| | | | |
|---|---|---|---|
| Effective Length Factor | = | 1.86 | |
| Slenderness Ratio | = | Effective Length / B | |
| | = | 21.83, Column Slender Along B | |
| Slenderness moment along B | = | (Pu B/ 2000) (Ley/B)^2 | |
| | = | 23.98 | kNm |

Design slenderness moment along D

| | | | |
|---|---|---|---|
| Puz | = | 1978.77 | kN |
| Pd | = | 529.18 | kN |
| Reduction factor 'k' for slenderness moment | = | (Puz - Pu) / (Puz - Pd) < = 1 | |
| | = | 1.06 > = 1, Hence k=1 | |
| Mslndx | = | k x 44.83 | |
| | = | 44.83 | kNm |

Design slenderness moment along B

| | | | |
|---|---|---|---|
| Puz | = | 1978.77 | kN |
| Pb | = | 370.17 | kN |
| Reduction factor 'k' for slenderness moment | = | (Puz - Pu) / (Puz - Pb) < = 1 | |
| | = | 0.96 < = 1, Hence k=0.96 | |
| Mslndy | = | k x 23.98 | |

| | | | |
|---|---|---|---|
| | = | 22.98 | kNm |

**Calculation of Design Moment**

| Direction | Manalysis | Mmin (Abs) | Mdesign | Mslndx (Abs) | Mdesign-final |
|---|---|---|---|---|---|
| | A | B | C | E | F |
| Major Axis - Mux | 53.34 | 8.75 | 53.34 | 44.83 | 98.17 |
| Minor Axis - Muy | -19.73 | --- | -19.73 | 22.98 | -42.71 |

**Where**

A = Moments directly from analysis

B = Moments due to minimum eccentricity

C = Maximum of analysis moment and min. eccentricity = Max (A,B)

E = Moment due to slenderness effect

F = Final design Moment = Max(C- Top Bottom , D- Top Bottom) + E

**Final Critical Design Forces**

| | | | |
|---|---|---|---|
| Pu | = | 437.37 | kN |
| Mux | = | 98.17 | kNm |
| Muy | = | -42.71 | kNm |

**Resultant Moment (Combined Action)**

**Moment Capacity Check**

| | | | |
|---|---|---|---|
| Pt Calculated | = | 2.91 | |
| Reinforcement Provided | = | 8-T20 | |
| Load Angle | = | $Tan^{-1}$(Muy/Mux) | |
| | = | 23.51 | deg |
| MRes | = | 107.06 | kNm |
| MCap | = | 107.42 | kNm |
| Capacity Ratio | = | MRes/ MCap | |
| | = | 1 <= 1 | |

| Shear Calculation | Along D | Along B |
|---|---|---|
| **Critical Analysis Load Combination** | DConS9 | DConS8 |
| Critical Load Combination | [9] : 1.5 (Dead) +1.5 (SDL) +1.5 (EQ+Y) | [8] : 1.5 (Dead) +1.5 (SDL) -1.5 (EQ+X) |
| Design shear force, Vu (kN) | 40.1608 | -11.8497 |
| Pu (kN) | 90.08 | 95.57 |
| Deff , Beff (mm) | 325 | 180 |
| Aeff (sqmm) | 74750 | 67500 |
| Design shear stress, Tv | Vu / (B x Deff) | Vu / (D x Beff) |

HOSUR (ICON-2)

| | | |
|---|---|---|
| Tv (N/sqmm) | 0.5373 | 0.1756 |
| Pt (%) | 1.457 | 1.457 |
| Design shear strength, Tc (N/sqmm) | 0.7348 | 0.7348 |
| Shear Strength Enhancement Factor (Compressive Force) | 1 + 3 x Pu / ( B x D x Fck) | |
| | 1.1446 | 1.1699 |
| Shear Strength Enhancement Factor (Tensile Force) | - | - |
| Shear Strength Enhancement Factor (max) | 1.5 | 1.5 |
| Shear Strength Enhancement Factor | 1.1446 | 1.1699 |
| Enhanced shear strength, Tc-e (N/sqmm) | 0.8411 | 0.8597 |
| Design shear check | Tv < Tc x Enhancement factor | Tv < Tc x Enhancement factor |
| **Shear Links Design** | **Shear Links Not Required** | **Shear Links Not Required** |

G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / RSE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

**Design Of Links**

Links in the zone where special confining links are not required

Normal Links

Diameter of link = 8 mm

> Max. longitudinal bar dia / 4

= 5 mm

Criterion for spacing of normal links

Min. Longitudinal Bar dia X 16 = 320 mm

Min. dimension of column = 230 mm

Max. 300 mm = 300 mm

Provided spacing = 200 mm

**Table For Links**

| | Required | | | Provided | |
|---|---|---|---|---|---|
| | **Normal Design** | **Shear Design** | **Ductile Design** | **Normal Zone** | **Ductile Zone** |
| Link Dia. | 8 | --- | --- | 8 | --- |
| Spacing | 200 | --- | --- | 200 | |

**10.3 BEAM DESIGN:**

| | | | |
|---|---|---|---|
| Group | : | **G1** | |
| Beam No | : | **B1** | |
| Analysis Reference (Member) | : | B62 (FIRST FLOOR ROOF) | |
| Beam Length | : | 2860 | mm |
| Breadth (B) | : | 230 | mm |
| Depth (D) | : | 300 | mm |
| Effective Depth (d) | : | 265 | mm |
| Design Code | : | IS 456 | |
| Beam Type | : | Regular Beam | |
| Grade Of Concrete (Fck) | : | M25 | N/sqmm |
| Grade Of Steel (Main) | : | Fe550 | N/sqmm |
| Grade Of Steel (Shear) | : | Fe550 | N/sqmm |
| Top/Bottom Clear Cover (Cmin) | : | 25 | mm |
| Side Clear Cover | : | 25 | mm |
| Es | : | 2x10^5 | N/sqmm |
| Ptnominal (%) (Bn) | : | 0.2 | % |

G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / RSE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

**Flexure Design**

| | Beam Bottom | | | Beam Top | | |
|---|---|---|---|---|---|---|
| | **Left** | **Mid** | **Right** | **Left** | **Mid** | **Right** |
| Critical L/C - Analysis | DConS11 | DConS7 | DConS12 | DConS8 | DConS12 | DConS7 |
| Critical L/C - RCDC | 11 | 7 | 12 | 8 | 12 | 7 |
| Mu (kNm) | 11.96 | 10.91 | 12.7 | 25.56 | 9.61 | 22.75 |
| Tu (kNm) | 0 | 0 | 0 | 0.17 | 0.12 | 0 |
| $M_{Tu}$ (kNm) | 0 | 0 | 0 | 0.23 | 0.16 | 0 |
| Mud (kNm) | 11.96 | 10.91 | 12.7 | 25.79 | 9.77 | 22.75 |
| MuLim (kNm) | 53 | 53 | 53 | 53 | 53 | 53 |
| R | 0.74 | 0.676 | 0.786 | 1.597 | 0.605 | 1.408 |
| Ptmin (%) (A) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Ptclc (%) (B') | 0.2 | 0.2 | 0.2 | 0.363 | 0.2 | 0.316 |
| Pcclc (%) (C) | 0 | 0 | 0 | 0 | 0 | 0 |
| PtPrv (%) | 0.387 | 0.387 | 0.387 | 0.66 | 0.66 | 1.611 |
| AstCalc (sqmm) | 121.9 | 121.9 | 121.9 | 221.12 | 121.9 | 192.9 |
| AstPrv (sqmm) | 235.62 | 235.62 | 235.62 | 402.12 | 402.12 | 981.74 |
| Reinforcement Provided | 3-T10 | 3-T10 | 3-T10 | 2-T16 | 2-T16 | 2-T25 |

**Note: Calculation of Ast**

AstCalc = Max {B',C} x B X d (for Mu > 0 )
AstCalc = Bn x B X d (for Mu = 0)
Where,

| | | | | |
|---|---|---|---|---|
| A | = | Ptmin | = | Min % area of flexural reinforcement |
| B' | = | Ptclc | = | Maximum of % reinforcement required for Bending Moment and Min % area of flexural reinforcement (A) |
| Bn | = | Ptnominal | = | Nominal % area of reinforcement |
| C | = | Pcclc | = | % area of compression reinforcement required |
| D | = | AstCrack | = | Area of reinforcement required for Crackwidth |

| **Shear Design** | | | |
|---|---|---|---|
| | **Left** | **Mid** | **Right** |
| Critical L/C - Analysis | DConS8 | DConS7 | DConS7 |
| Critical L/C - RCDC | 8 | 7 | 7 |
| PtPrv (%) | 0.66 | 0.66 | 1.611 |
| Vu (kN) | 39.02 | 22.78 | 33.58 |
| Tu (kNm) | 0.17 | 0 | 0 |
| $V_{Tu}$ (kN) | 1.17 | 0 | 0 |
| Vut (kN) | 40.19 | 22.78 | 33.58 |
| Tv (N/sqmm) | 0.66 | 0.37 | 0.55 |
| Tc (N/sqmm) | 0.55 | 0.55 | 0.76 |
| Vc (kN) | 33.31 | 33.31 | 46.37 |
| Vus=Vut-Vc (kN) | 6.88 | 0 | 0 |
| Legs | 2 | 2 | 2 |
| Stirrup Rebar | 8 | 8 | 8 |
| Asv Torsion (sqmm) | 196.845 | - | - |
| Asv Torsion Prv (sqmm) | 1005.4 | - | - |
| Asv Reqd (sqmm/m) | 254.81 | 254.81 | 254.81 |
| SvCalc (mm) | 100 | 175 | 175 |
| SvPrv (mm) | 100 | 175 | 175 |
| Asv Total Prv (sqmm) | 1005.4 | 574.51 | 574.51 |

**Maximum Spacing Criteria**

Basic

| | | |
|---|---|---|
| Spc1 =0.75d | = 199 | mm |
| Spc2 | = 300 | mm |

For Torsion

(X1 = 190, Y1 = 260)

| | | |
|---|---|---|
| Spc3 = X1 | = 190 | mm |
| Spc4=(X1+Y1)/4 | = 100 | mm |

**SFR Design**

| | | |
|---|---|---|
| Beam Width | = 230 | mm |
| Beam Depth | = 300 | mm |
| Web Depth | = 300 <= 750 | mm |
| Side Face Reinforcement not required. | | |

---

| | | | |
|---|---|---|---|
| Group | : | **G1** | |
| Beam No | : | **B2** | |
| Analysis Reference (Member) | : | B63 (FIRST FLOOR ROOF) | |
| Beam Length | : | 5362 | mm |
| Breadth (B) | : | 230 | mm |
| Depth (D) | : | 450 | mm |
| Effective Depth (d) | : | 415 | mm |
| Design Code | : | IS 456 | |
| Beam Type | : | Regular Beam | |
| Grade Of Concrete (Fck) | : | M25 | N/sqmm |
| Grade Of Steel (Main) | : | Fe550 | N/sqmm |
| Grade Of Steel (Shear) | : | Fe550 | N/sqmm |
| Top/Bottom Clear Cover (Cmin) | : | 25 | mm |
| Side Clear Cover | : | 25 | mm |
| Es | : | 2x10^5 | N/sqmm |
| Ptnominal (%) (Bn) | : | 0.2 | % |

| Flexure Design | | | | | | |
|---|---|---|---|---|---|---|
| | Beam Bottom | | | Beam Top | | |
| | Left | Mid | Right | Left | Mid | Right |
| Critical L/C - Analysis | DConS7 | DConS2 | DConS8 | DConS8 | DConS12 | DConS7 |
| Critical L/C - RCDC | 7 | 2 | 8 | 8 | 12 | 7 |
| Mu (kNm) | 21.04 | 58.92 | 25.83 | 118.47 | 4.75 | 101.5 |
| Tu (kNm) | 0.15 | 0 | 0.11 | 0.14 | 0.17 | 0.21 |
| $M_{Tu}$ (kNm) | 0.26 | 0 | 0.19 | 0.24 | 0.3 | 0.37 |
| Mud (kNm) | 21.3 | 58.92 | 26.02 | 118.71 | 5.05 | 101.87 |
| MuLim (kNm) | 129 | 129 | 129 | 129 | 129 | 129 |
| R | 0.538 | 1.487 | 0.657 | 2.997 | 0.128 | 2.572 |
| Ptmin (%) (A) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Ptclc (%) (B') | 0.2 | 0.336 | 0.2 | 0.751 | 0.2 | 0.623 |
| Pcclc (%) (C) | 0 | 0 | 0 | 0 | 0 | 0 |
| PtPrv (%) | 0.355 | 0.355 | 0.355 | 1.029 | 0.421 | 0.658 |
| AstCalc (sqmm) | 190.9 | 320.5 | 190.9 | 716.86 | 190.9 | 594.98 |
| AstPrv (sqmm) | 339.3 | 339.3 | 339.3 | 981.74 | 402.12 | 628.32 |
| Reinforcement Provided | 3-T12 | 3-T12 | 3-T12 | 2-T25 | 2-T16 | 2-T20 |

**Note: Calculation of Ast**

AstCalc = Max {B',C} x B X d (for Mu > 0 )
AstCalc = Bn x B X d (for Mu = 0)
Where,

| | | | | |
|---|---|---|---|---|
| A | = | Ptmin | = | Min % area of flexural reinforcement |
| B' | = | Ptclc | = | Maximum of % reinforcement required for Bending Moment and Min % area of flexural reinforcement (A) |
| Bn | = | Ptnominal | = | Nominal % area of reinforcement |
| C | = | Pcclc | = | % area of compression reinforcement required |
| D | = | AstCrack | = | Area of reinforcement required for Crackwidth |

| **Shear Design** | | | |
|---|---|---|---|
| | **Left** | **Mid** | **Right** |
| Critical L/C - Analysis | DConS8 | DConS7 | DConS7 |
| Critical L/C - RCDC | 8 | 7 | 7 |
| PtPrv (%) | 1.029 | 0.355 | 0.658 |
| Vu (kN) | 122.16 | 44.69 | 104.69 |
| Tu (kNm) | 0.14 | 0.19 | 0.21 |
| $V_{Tu}$ (kN) | 0.97 | 1.32 | 1.46 |
| Vut (kN) | 123.13 | 46.01 | 106.16 |
| Tv (N/sqmm) | 1.29 | 0.48 | 1.11 |
| Tc (N/sqmm) | 0.65 | 0.42 | 0.55 |
| Vc (kN) | 61.87 | 40.49 | 52.12 |
| Vus=Vut-Vc (kN) | 61.26 | 5.52 | 54.04 |
| Legs | 2 | 2 | 2 |
| Stirrup Rebar | 8 | 8 | 8 |
| Asv Torsion (sqmm) | 367.533 | 137.297 | 314.821 |
| Asv Torsion Prv (sqmm) | 670.27 | 670.27 | 670.27 |
| Asv Reqd (sqmm/m) | 408.83 | 254.81 | 360.62 |
| SvCalc (mm) | 150 | 150 | 150 |
| SvPrv (mm) | 150 | 150 | 150 |
| Asv Total Prv (sqmm) | 670.27 | 670.27 | 670.27 |

**Maximum Spacing Criteria**

Basic

| | | |
|---|---|---|
| Spc1 =0.75d | = 311 | mm |
| Spc2 | = 300 | mm |

For Torsion

(X1 = 190, Y1 = 410)

| | | |
|---|---|---|
| Spc3 = X1 | = 190 | mm |
| Spc4=(X1+Y1)/4 | = 150 | mm |

**SFR Design**

| | | |
|---|---|---|
| Beam Width | = 230 | mm |
| Beam Depth | = 450 | mm |
| Web Depth | = 450 <= 750 | mm |

Side Face Reinforcement not required.

G.GUNA M.Tech ( Structures).,AIV
Structural Engineer Grade-II(SE)
CMDA : SE / II / 2024 / 7 / 0275
DTCP : TVR / RSE-II / 2024 / 029
No.9/5, Sri Ragavendra Enclave
Mathavan Street, Pammal - 600 075.
Email: gconchennai@gmail.com
Ph: 09566 163232

THE LANDLENS SUITE

# Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

### LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
**/landlens/one**

### Verify My Land
Every record check run on one property and returned as a single report.
**/landlens/verify-my-land**

### Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
**/landlens**

### One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
**/landlens/one/map**

### PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
**/landlens/pricemap**

### Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
**/landlens/build-scope**

### Property Tracker
Watch a property and hear about it when something new is registered against it.
**/landlens/property-tracker**

### Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
**/landlens/deal-room**

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# Twenty-four checks you can run yourself, at no cost.

## Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

## Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

## Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

## Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

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/services

**The LandLens suite**
/landlens/one

Verified RealEstate™

# Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

**Verified RealEstate**
3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai 600 097, India
**hello@verified.realestate**
+91 9996 12 9996

Prepared from the registers named on the page each finding sits on. Where a register could not be read, this document says so in its place rather than leaving the gap to be read as a clean result.