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DIGITALLY VERIFIED RECORD

# DESIGN CALCULATION

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS (HEIGHT – 16.00M) RESIDENTIAL BUILDING WITH 12 DWELLING UNITS AVAILING PREMIUM FSI AT PLOT NO.31 IN VANCHINATHAN STREET,MADIPAKKAM, CHENNAI 600091, COMPRISED IN OLD S.NO.220/1 AND 220/28 AS PER PATTA NEW S.NO. 220/139 OF MADIPAKKAM-1 VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

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## 1.0 DESIGN BRIEF:

THIS DOCUMENT PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS (HEIGHT – 16.00M) RESIDENTIAL BUILDING WITH 12 DWELLING UNITS AVAILING PREMIUM FSI AT PLOT NO.31 IN VANCHINATHAN STREET,MADIPAKKAM, CHENNAI 600091, COMPRISED IN OLD S.NO.220/1 AND 220/28 AS PER PATTA NEW S.NO. 220/139 OF MADIPAKKAM-1 VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

## 2.0 GENERAL DESIGN CRITERIA

### 2.1. Description of the structure

The Residential Building consists of Stilt Floor + 4 Upper floors and the structure is designed as a RCC framed structure.

1. Size of the building : 28.04 X 10.28M
2. Height of the building : 16.00M
3. Number of storeys above GL : Stilt Floor +4 upper floors
4. Floor to floor height of this building : Stilt and First floors - 3.20m
   : Typical floor – 3.20m
5. Type of foundation : Isolated foundation as per geotechnical report

### 2.2. Materials Used

Following materials are generally used in the design of the various components of the structure.
For Concrete Structure

- M25 grade concrete for all reinforced concrete parts of the structure
- Fe500 grade Structural reinforcement steel
- Masonry for all walls : Brick / Block

### 2.3. Design Codes & Standards

Following codes and specifications have been generally used in the design of the members of the structure.

- IS 456 : 2000 Code of practice for Plain and Reinforced concrete
- SP: 16 Design Aids for Reinforced concrete
- IS 875 : 1987 Design Loads for building and structures
- IS 1893 : 2002 Criteria for Earthquake Resistant design of structures
- IS 13920: 1993 Ductile Detailing of R.C structures subjected to Seismic forces
- SP: 34 Handbook on Concrete Reinforcement & Detailing
- IS 800 : 1984 Code of practice for general construction in steel
- IS 2062 : 1999 Steel for general structural purposes specification
- IS 1786: 1985 Specification for high strength deformed bars and wires for concrete reinforcement

## 3.0 LOADING

### Primary Load:

- Dead Load (DL)
- Live Load (LL)

### 3.1. Dead load (DL)

### Material weight

- Density of Concrete =25 kN/$m^3$

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- D.L. due to partitions
  (Light Partition as per IS 875) =1.50 kN/$m^2$
- D.L due to floor finish 50mm thick = 0.05x25 = 1.25 kN/$m^2$

### 3.2. Live load (LL)

Minimum Uniformly Distributed Live Loads:

| Occupancy or use | Live Load (kn/$m^2$) |
|---|---|
| All rooms and kitchens | 2.00 |
| Toilet and bath rooms | 3.00 |
| Corridors, passages, staircases | 3.00 |
| Balconies | 3.00 |
| Terrace Floor | 1.50 |
| Basic wind speed | =50 m/sec |
| Seismic Zone | =Zone III |

### 3.5 Loading Combinations

The following combinations of Loads as per IS 1893 is considered in the STAAD Analysis

- 1.5(DL +LL)
- 1.2(DL + LL )

The below load combinations are used to check the structure in serviceability condition.

- 1.0(DL +LL)

## 4.0 STRUCTURAL MATERIAL:

### 4.1 Concrete Material Specifications:

| | |
|---|---|
| Concrete compressive cube strength | - 25 N/$mm^2$ |
| Minimum cement content | - Refer standard drawings for general & Legends |
| Cement type | - OPC |
| Free water cement ratio | - 0.5 (Maximum) |
| Nominal maximum size of aggregate | - 20mm UNO |

### 4.2 Reinforcement:

Steel reinforcement shall be deformed bars, the characteristic of reinforcement bars shall conform to the following specification:

| Grade of Steel | Actual Yield Strength (MPa) |
|---|---|
| Grade Fe500 | Minimum 500 MPa, |

### 4.4 Concrete cover:

Cover for Reinforcement is considered as per Table 16A of NBC, for a Fire resistance of 2 hrs.

- Raft Slab = 50mm
- Footing = 50mm
- RC Wall = 30mm
- Columns = 40mm

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- Beams = 30mm
- Slabs = 25mm

## 5.0 Structural Description

### 5.1. Method of analysis

Structure analysis & design:

The structure is analyzed as a Space frame structure in STADD Pro Vi8. Columns, Footing, Basement walls, slabs, Beams and Staircases are designed as reinforced concrete members.

### 5.2. Framing System, Analysis and Design

Limit State concept of design will be used as per IS: 456-2000 & SP - 16. The detailing of reinforcement shall be done satisfying the requirements of IS: 456-2000, SP-16, IS: 13920, IS: 4326-1993 and SP-34.

The Slabs and beams are checked for deflection as per IS 456:2000. Cover for Reinforcement is considered as per Table 16A of NBC, for a Fire resistance of 2 hrs.

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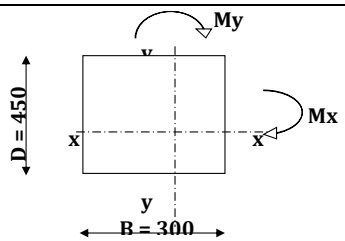
# APPENDIX I

## Design Calculations

## Column Design

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| | | | | | |
|---|---|---|---|---|---|
| PROJECT | RESIDENTIAL BUILDING(S+4) AT PLOT NO.31 IN VANCHINATHAN STREET, MADIPAKKAM. | DOCUMENT. NO. | DATE | DESIGNED | DATE |
| TITLE | Design for a Short Column with Biaxial Bending | REVISION | DATE | CHECKED | DATE |

| CL. NO. | DESIGN CALCULATIONS | REFERENCES |
|---|---|---|
| | **Column No:**   **CRITICAL LOAD CASE:** | |
| 1.0 | **Basic Data** | |
| 1.1 | **Material Data** | |
| | Grade of Concrete: M 25 | |
| | Grade of Steel: Fe 500 | |
| 1.2 | **Codal Data** | |
| | Nominal Cover = 40 mm | Cl 26.4.2.1,IS456:2000 |
| | Diameter of the Bar = 25 mm ≥ 12 mm | |
| | d' = 52.5 mm | |
| 1.3 | **Basic Dimensions** | |
| | Unsupported Length of the Column $L_{ox}$ = 3000 mm | |
| | $L_{oy}$ = 3000 mm | |
| | $L_{ex}$ = 3000 mm | Table 28 , |
| | $L_{ey}$ = 3000 mm | IS456:2000 |
| | Size of the Column B X D = 300 x 450 mm | |
| 1.4 | **Analysis Results** | |
| | Factored Axial Load $P_u$ = 780.0 kN | STAAD |
| | Factored Moment $M_{ux}$ = 22.00 kNm | OUTPUT |
| | Factored Moment $M_{uy}$ = 71.00 kNm | |
| 2.0 | **Check for Slenderness** | |
| | Slenderness Ratio about Major Axis $L_{ex}$ / D = 6.667 | |
| | Slenderness Ratio about Minor Axis $L_{ey}$ / B = 10.000 | |
| | **Since Leff / LLD <12 Designed as Short Column** | Cl 25.1.2, IS456:2000 |
| 3.0 | **Check for Eccentricity** | |
| | Minimum Eccentricit $e_x$ = $L_{ox}$ / 500 + D / 30 = 21.0 mm >20 | Cl 25.4 |
| | $e_y$ = $L_{oy}$ / 500 + B / 30 = 16.0 mm <20 | IS456:2000 |
| 3.1 | **Moments Due to Minimum Eccentricity** | |
| | $Me_x$ = 16.38 kN.m | |
| | $Me_y$ = 15.60 kN.m | |
| 4.0 | **Design Moment** | |
| | Design Moment about X axis $M_{ux}$ = 22.00 kN.m | |
| | Design Moment about Y axis $M_{uy}$ = 71.00 kN.m | |

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| CL. NO. | DESIGN CALCULATIONS | REFERENCES |
|---|---|---|
| **5.0** | **Uniaxial Moment Carrying capacity of the Section about X & Y- axis** | |
| | d' / D = 0.117 | |
| | d' / B = 0.175 | |
| | Assume the Reinforcement Percentage p = **2.00** | |
| | $p / f_{ck}$ = 0.080 | |
| | $p_u / f_{ck}BD$ = 0.231 | |
| | Reinforcement distributed equally on four sides **4** | |
| | $M_{ux1} / f_{ck}BD^2$ = | Chart 43 - 46 |
| | $M_{uy1} / f_{ck}DB^2$ = | SP 16 : 1980 |
| | Moment carrying capacity about X axis $M_{ux1}$ = kN.m | |
| | Moment carrying capacity about Y axis $M_{uy1}$ = kN.m | |
| | **Pu < Axial Load Carrying capacity ; Hence O.K** | |
| **6.0** | **Calculation of $P_{uz}$** | |
| | $P_{uz} = 0.45 f_{ck} A_c + 0.75 f_y A_{sc}$ = 2500.88 kN | Cl 39.6 , IS456:2000 |
| | $P_u/P_{uz}$ = 0.312 | |
| | $a_n$ = 1.186 | Cl 39.6 , IS456:2000 |
| **7.0** | **Criteria for Biaxial Bending (Bresler's Formulation)** | |
| | $(M_{ux}/M_{ux1})^{an} + (M_{uy}/M_{uy1})^{an}$ = 1 | Cl 39.6 , IS456:2000 |
| **8.0** | **Longitudinal Reinforcement** | |
| | Area of compression Steel $A_{sc,reqd}$ = **2700** $mm^2$ | |
| | **10** No Y20 + No Y20 $A_{sc,pro}$ = **3142** $mm^2$ | |
| **8.1** | **Check for Minimum & Maximum Area of Steel** | |
| | Minimum Area of ste ( 0.8 % of $A_g$ dir ) = **441** $mm^2$ | Cl 26.5.3.1 a & b , |
| | (Based on the area of concrete reqd to resist direct stress) | IS 456 : 2000 |
| | Maximum Area of ste ( 4 % of $A_g$ ) = **5400** $mm^2$ | |
| | **441** < **3142** < **5400** $mm^2$ | |
| | **Area of Steel is with in the permissible limit ; Hence O.K** | |
| **9.0** | **Transverse Reinforcement** | |
| **9.1** | Diameter of Transverse Reinforcement = **8** mm ≥ 6 mm | Cl 26.5.3.2 c 2) , |
| **9.2** | **Spacing of Lateral Ties :** | |
| | i) Least Lateral Dimension of the column = 300 mm | Cl 26.5.3.2 c 1) , |
| | ii) 16 times the Smallest dia of Longitudinal Steel = 320 mm | IS 456 : 2000 |
| | iii) = 300 mm | |
| | Reqd. Spacing of Ties (Minimum of the above) = 300 mm | |
| | Provide 8 mm dia Lateral Ties @ **300** mm Spacing | |
| | Provide closer spacing on either side of the column above and below beam / slab. | |

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# Footing Design

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**A RESIDENTIAL BUILDING(S+4) AT PLOT NO.31 IN VANCHINATHAN STREET, MADIPAKKAM.**

**Design of Isolated Footing** **F2** **Node :** **38**

**Basic Data:**

| | | |
|---|---|---|
| Net Safe Bearing Capacity | 150 | kN/m$^2$ |
| Unit wieght of Soil | 18 | kN/m$^3$ |
| Unit wieght of Concrete | 25 | kN/m$^3$ |
| Grade of Concrete | 25 | N/mm$^2$ |
| Grade of Steel | 500 | N/mm$^2$ |
| Clear Cover to Reinforceme | 50 | mm |
| Earth Fill above FGL | 0 | mm |
| Base Area of Footing | 3.78 | m$^2$ |
| Ixx | 1.02 | m$^4$ |
| Izz | 1.39 | m$^4$ |
| Weight of Footing | 47.25 | kN |
| Weight of soil | 85.29 | kN |

**Gross Bearing Pressure Calculatio** (kN/m$^2$)

| Critical Load Combinations | Pmax | Pmin |
|---|---|---|
| 200 | 154.11 | 154.111905 |
| 0 | 35.06 | 35.06 |

Gross SB( ( w/o increase ) 182.4 kN/m$^2$

Hence **OK**

**Factored Net Upward Pressure Calculation**

Load Factor for Design 1.5

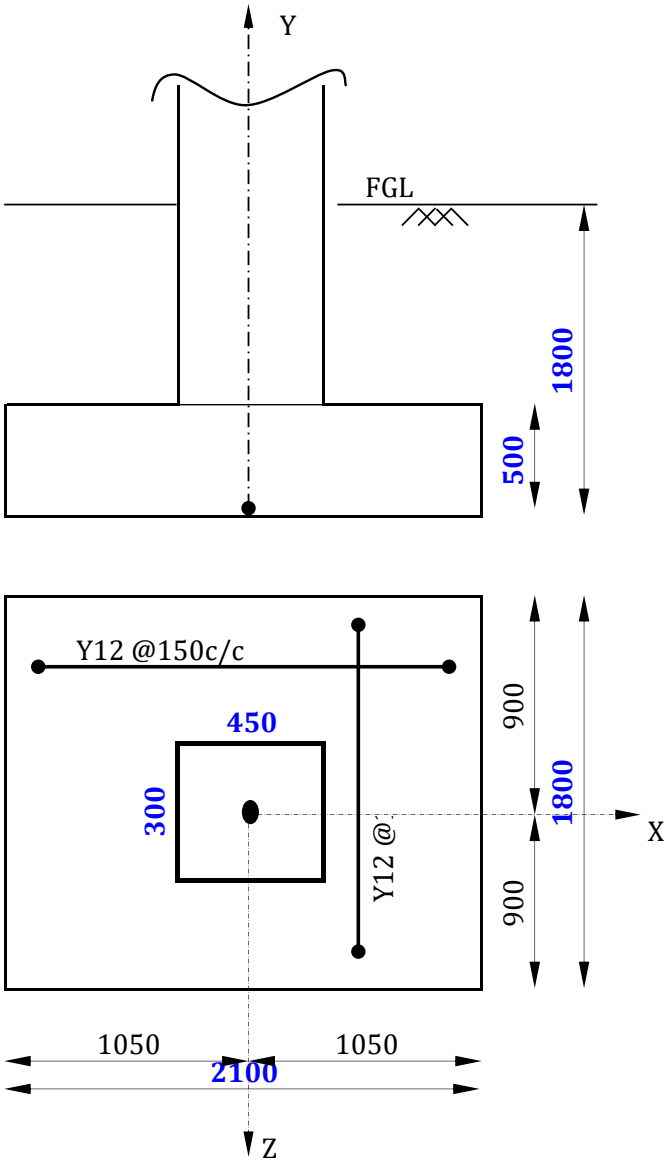
| Critical Load Combinations | Pmax | Pmin |
|---|---|---|
| 200 | 178.57 | 178.571429 |
| 0 | 0.00 | 0.0 |

| | | |
|---|---|---|
| Dsgn.(+ve) BM abt. X-axis M | 50.22 | kN.m |
| Dsgn.(+ve) BM abt. Z-axis M | 60.77 | kN.m |
| Dsgn.(-ve) BM abt. X-axis M | 0.00 | kN.m |
| Dsgn.(-ve) BM abt. Z-axis M | 0.00 | kN.m |
| Provided Eff. depth for Mux | 432.00 | mm |
| Provided Eff. depth for Muz | 444.00 | mm |
| Mu,lim | ##### | kN.m |

Depth provided is #####

**Bottom Reinforcement**

| | | |
|---|---|---|
| Ast Required for Mux | ##### | mm$^2$ |
| Ast Required for Muz | ##### | mm$^2$ |
| Min. Ast Reqd. | 600 | mm$^2$ |




**Bottom Reinforcement**

| | | | | | | Ast Provided | Ast Required | | |
|---|---|---|---|---|---|---|---|---|---|
| Provide | 12 | @ | 150 | C/C | along Z | 754 | #NAME? | mm$^2$ | Hence |
| Provide | 12 | @ | 150 | C/C | along X | 754 | #NAME? | mm$^2$ | ##### |


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**A RESIDENTIAL BUILDING(S+4) AT PLOT NO.31 IN VANCHINATHAN STREET, MADIPAKKAM.**

**Design of Isolated Footing** F2 **Node :** 38

**Top Reinforcement**

| | | |
|---|---|---|
| Ast Required for Mux | 0.00 | $mm^2$ |
| Ast Required for Muz | 0.00 | $mm^2$ |
| Min. Ast Reqd. | Not Req | $mm^2$ |

**Check For Flexural / Oneway Shear**

| | Actual | Allowable | | Hence |
|---|---|---|---|---|
| Shear Stress (Plane ll to X) | 0.131 | #NAME? | $N/mm^2$ | #NAME? |
| Shear Stress (Plane ll to Z) | 0.153 | #NAME? | $N/mm^2$ | #NAME? |

**Check For Punching / Twoway Shear**

| | | | | |
|---|---|---|---|---|
| Allowable Shear Stress | | 1.25 | $N/mm^2$ | |
| Actual Shear Stress | | 0.46 | $N/mm^2$ | Hence **OK** |

**Check For Overturning**

| | | | | | | |
|---|---|---|---|---|---|---|
| Co-efficient of friction | = | 0.57 | | | | |
| Factor of safety for overturning, slidi | = | 1.4 | | | | |
| Net Moments acting at Pad Level, $M_{xx}$ | = | 0.00 | kNm | | | |
| Net Moments acting at Pad Level, $M_{zz}$ | = | 0.00 | kNm | | | |
| Weight of pad | = | 47.25 | kN | | | |
| Weight of Over burden Earth | = | 85.29 | kN | | | |
| Total downward Load | = | 582.54 | kN | | | |
| Stabilizing moment along X-Dir | = | 582.54 | x | 1.05 | | |
| | = | 611.67 | kNm | | | |
| Actuating moment, $M_{zz}$ | = | 0.00 | kNm | | | |
| **Factor of Safety (Along X-Dir)** | = | 611.67 | / | 0.0 | | |
| | | - | > | 1.40 | Hence | **OK** |

**Check For Sliding**

| | | | | | | |
|---|---|---|---|---|---|---|
| Resistance against Sliding | = | 332.05 | kN | | | |
| Max. Shear Load @ Pad level in X-Dir | = | 2.5 | kN | | | |
| Max. Shear Load @ Pad level in Z-Dir | = | 5.3 | kN | | | |
| **Factor of Safety (Along X-Dir)** | = | 332.0 | / | 2.5 | | |
| | | 130.73 | > | 1.40 | Hence | **OK** |
| **Factor of Safety (Along Z-Dir)** | = | 332.0 | / | 5.3 | | |
| | | 62.65 | > | 1.4 | Hence | **OK** |



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# Plinth Beam Design

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| **TITLE** | | **REVISION** | **DATE** | **CHECKED** RMK | **DATE** |
| **CL. NO.** | **BEAM DESIGN CALCULATIONS** | | | | **REFERENCES** |

1.1 **Geomentry Data**

| | | | | | |
|---|---|---|---|---|---|
| Beam Number | | = | **PB2** | | |
| Type of Beam | | = | Rectangular Beam | | |
| Support Condition | | = | Continuous Beam | | |
| Width of beam | b | = | 200 | mm | |
| Overall Depth of Beam | D | = | 380 | mm | |
| Dia of bar | Φ | = | 25 | mm | |
| Nominal Cover | cc | = | 30 | mm | IS 456:2000 Table 19 |
| Effective Depth | d | = | 337.5 | mm | IS 456:2000 |
| Effective Cover | | = | 42.5 | mm | Cl 23.0 |
| Effective Span of beam | $l_{eff}$ | = | 4500 | mm | |
| Concrete grade | | = | M 25 | | |
| Steel Grade | | = | Fe 500 | | |
| $p_{t,lim}$ | | = | 0.944 % | | |
| $p_{t,min}$ | | = | 0.170 % | | IS 456:2000 |
| $p_t$ & $p_{cmax}$ | | = | 4.00 % | | Cl 26.5.1.1 |

1.2 **Force Input**

| | | | | |
|---|---|---|---|---|
| Left negative moment | (Support 1) | = | 84 | kNm |
| Mid span positive moment | | = | 84 | kNm |
| Right negative moment | (Support 2) | = | 84 | kNm |
| Shear @ (Support 1) | | = | 149 | kN |
| Shear @ (Span) | | = | 149 | kN |
| Shear @ (Support 2) | | = | 149 | kN |

1.3 **Limiting Moment**

$M_{ulim}$ = 0.133 $f_{ck}$ b $d^2$ = 75.75 kNm

1.4 **Area of Steel**

Minimum Area of Steel = 0.17% b d = 114.75 $mm^2$

**Support 1**

| | | | | |
|---|---|---|---|---|
| Negative moment | (Support 1) | = | 84 | kNm |

Hence the Section is designed as Doubly Reinforced Section

| | | | | |
|---|---|---|---|---|
| | $M_u/bd^2$ | = | 3.687 | |
| Percentage of tension steel reqd | $p_t$ | = | 1.039 | % |
| Percentage of compression steel reqd | $p_c$ | = | 0.106 | % |
| Required Area of tension steel | $A_{st\ reqd}$ | = | 701.33 | $mm^2$ |
| Required Area of compression steel | $A_{sc\ reqd}$ | = | 71.55 | $mm^2$ |

**Detail of bars**

| | I st Layer | | II nd Layer | |
|---|---|---|---|---|
| | Nos | Dia | Nos | Dia |
| Tension Reinforcement | **3** | **16** | | |

$A_{st}$ provided = 603.19 $mm^2$



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| | | | | | | |
|---|---|---|---|---|---|---|
| | Nos | Dia | Nos | Dia | | |
| Compression Reinforcemer | 3 | 16 | 0 | | | |
| | $A_{sc}$ provided | = | 603.19 | $mm^2$ | | |
| Percentage of tension steel provided | $p_t$ | = | 0.894 | % | **Not safe** | |
| Percentage of compression steel provid | $p_c$ | = | 0.894 | % | **Hence O.K** | |

**Check for Shear**

| | | | | | |
|---|---|---|---|---|---|
| Shear | | = | 149 | kN | |
| Nominal Shear Stress | tv | = | 2.21 | $N/mm^2$ | Cl 40.1, IS456:2000 |
| Permissible Shear Stress | tc | = | 0.92 | $N/mm^2$ | β = 1.000 |
| Maximum Shear Stress | tc,max | = | 2.5 | $N/mm^2$ | Table 19, IS456:2000 |
| Diameter of the Stirrup bar | | = | 8 | mm | Table 20, IS456:2000 |
| Number of Legs | | = | 2 | | |
| Spacing of Shear reinforcement Required | | = | 160.0 | | Cl 40.4, IS456:2000 |
| Maximum Spacing of Shear Reinforcement | | = | 250 | | Cl 26.5.1.5,IS456:2000 |

Provide 8 mm dia 2 legged stirrups @ 160mm c/c spacing

**Support 2**

| | | | | | |
|---|---|---|---|---|---|
| Negative moment | | = | 84 | kNm | |
| Hence the Section is designed as Doubly Reinforced Section | | | | | |
| | $M_u/bd^2$ | = | 3.687 | | |
| Percentage of tension steel reqd | $p_t$ | = | 1.039 | % | |
| Percentage of compression steel reqd | $p_c$ | = | 0.106 | % | |
| Required Area of tension steel | $A_{st\ reqd}$ | = | 701.33 | $mm^2$ | |
| Required Area of compression steel | $A_{sc\ reqd}$ | = | 71.55 | $mm^2$ | |

**Detail of bars**

| | I st Layer | | | II nd Layer | | |
|---|---|---|---|---|---|---|
| | Nos | Dia | | Nos | Dia | |
| Tension Reinforcement | 3 | 16 | | 0 | 0 | |
| | $A_{st}$ provided | = | 603.19 | mm | | |
| | Nos | Dia | | Nos | Dia | |
| Compression Reinforcemer | 3 | 16 | | 0 | 0 | |
| | $A_{sc}$ provided | = | 603.19 | mm | | |
| Percentage of tension steel provided | $p_t$ | = | 0.894 | % | **Not safe** | |
| Percentage of compression steel provid | $p_c$ | = | 0.894 | % | **Hence O.K** | |

**Check for Shear**

| | | | | | |
|---|---|---|---|---|---|
| Shear | | = | 149 | kN | |
| Nominal Shear Stress | tv | = | 2.21 | $N/mm^2$ | Cl 40.1, IS456:2000 |
| Permissible Shear Stress | tc | = | 0.92 | $N/mm^2$ | β = 1.000 |
| Maximum Shear Stress | tc,max | = | 2.5 | $N/mm^2$ | Table 19, IS456:2000 |
| Diameter of the Stirrup bar | | = | 8 | mm | Table 20, IS456:2000 |

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Number of Legs = 2

Spacing of Shear reinforcement Required = 160.0 — Cl 40.4, IS456:2000

Maximum Spacing of Shear Reinforcement = 250 — Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 160mm c/c spacing

**Span**

Positive moment (Span) = 84 kNm

Hence the Section is designed as Doubly Reinforced Section

$M_u/bd^2$ = 3.325

Percentage of tension steel reqd $p_t$ = 1.039 %

Percentage of compression steel reqd $p_c$ = 0.106 %

Required Area of tension steel $A_{st\ reqd}$ = 701.33 $mm^2$

Required Area of compression steel $A_{sc\ reqd}$ = 71.55 mm

**Detail of bars**

| | I st Layer | | II nd Layer | |
|---|---|---|---|---|
| | Nos | Dia | Nos | Dia |
| Tension Reinforcement | 3 | 16 | 0 | 0 |

$A_{st}$ provided = 603.19 $mm^2$

| | Nos | Dia | Nos | Dia |
|---|---|---|---|---|
| Compression Reinforcemer | 3 | 16 | 0 | 0 |

$A_{sc}$ provided = 603.19 $mm^2$

Percentage of tension steel provided $p_t$ = 0.894 % **Not safe**

Percentage of compression steel provid $p_c$ = 0.894 % **Hence O.K**

**Check for Shear**

Shear = 149 kN

Nominal Shear Stress tv = 2.21 $N/mm^2$

Permissible Shear Stress tc = 0.92 $N/mm^2$ — β = 1.000

Maximum Shear Stress tc,max = 2.5 $N/mm^2$ — Table 19, IS456:2000

Diameter of the Stirrup bar = 8 mm — Table 20, IS456:2000

Number of Legs = 2

Spacing of Shear reinforcement Required = 160.0 — Cl 40.4, IS456:2000

Maximum Spacing of Shear Reinforcement = 250 — Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 160mm c/c spacing

**Check For Deflection**

Basic Value = 26 — Cl.23.2, IS456:2000

Service Stress in Steel $f_s$ = **337.19** N/mm

Modification Factor(Tension Reinforcement) $F_1$ = 0.78

Allowable Span/Depth = 20.28

Actual Span/Depth = 13.33 **Hence Safe**

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# Floor Beam Design

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1.1 **Geomentry Data**

| | | | | | |
|---|---|---|---|---|---|
| Beam Number | | = | B3 | | |
| Type of Beam | | = | Rectangular Beam | | |
| Support Condition | | = | Continuous Beam | | |
| Width of beam | b | = | 200 | mm | |
| Overall Depth of Beam | D | = | 530 | mm | |
| Dia of bar | Φ | = | 25 | mm | |
| Nominal Cover | cc | = | 30 | mm | IS 456:2000 Table 19 |
| Effective Depth | d | = | 487.5 | mm | IS 456:2000 |
| Effective Cover | | = | 42.5 | mm | Cl 23.0 |
| Effective Span of beam | $l_{eff}$ | = | 3700 | mm | |
| Concrete grade | | = | M 25 | | |
| Steel Grade | | = | Fe 500 | | |
| $p_{t,lim}$ | | = | 0.944 % | | |
| $p_{t,min}$ | | = | 0.170 % | | IS 456:2000 |
| $p_t$ & $p_{cmax}$ | | = | 4.00 % | | Cl 26.5.1.1 |

1.2 **Force Input**

| | | | | |
|---|---|---|---|---|
| Left negative moment | (Support 1) | = | 254 | kNm |
| Mid span positive moment | | = | 254 | kNm |
| Right negative moment | (Support 2) | = | 254 | kNm |
| Shear @ (Support 1) | | = | 241 | kN |
| Shear @ (Span) | | = | 241 | kN |
| Shear @ (Support 2) | | = | 241 | kN |

1.3 **Limiting Moment**

$M_{ulim}$ = 0.133 $f_{ck}$ b $d^2$ = 181.75 kNm

1.4 **Area of Steel**

Minimum Area of Ste = 0.17% b d = 190.6125 $mm^2$

**Support 1**

Negative moment (Support 1) = 254 kNm

Hence the Section is designed as Doubly Reinforced Section

| | | | | |
|---|---|---|---|---|
| | $M_u/bd^2$ | = | 4.647 | |
| Percentage of tension steel reqd | $p_t$ | = | 1.277 | % |
| Percentage of compression steel reqd | $p_c$ | = | 0.359 | % |
| Required Area of tension steel | $A_{st\ reqd}$ | = | 1431.84 | $mm^2$ |
| Required Area of compression steel | $A_{sc\ reqd}$ | = | 402.53 | $mm^2$ |

**Detail of bars**

| | I st Layer | | II nd Layer | |
|---|---|---|---|---|
| | Nos | Dia | Nos | Dia |
| Tension Reinforcement | 3 | 20 | 3 | 20 |
| $A_{st}$ provided = 1884.96 $mm^2$ | | | | |
| | Nos | Dia | Nos | Dia |
| Compression Reinforceme | 3 | 20 | 3 | 20 |

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$A_{sc}$ provided = 1884.96 $mm^2$

Percentage of tension steel provided $p_t$ = 1.681 % **Hence O.K**

Percentage of compression steel provided $p_c$ = 1.681 % **Hence O.K**

**Check for Shear**

Shear = 241 kN

| | | | | | |
|---|---|---|---|---|---|
| Nominal Shear Stress | tv | = | 2.15 | $N/mm^2$ | Cl 40.1, IS456:2000 |
| Permissible Shear Stress | tc | = | 0.92 | $N/mm^2$ | β = 1.000 |
| Maximum Shear Stress | tc,max | = | 2.5 | $N/mm^2$ | Table 19, IS456:2000 |
| Diameter of the Stirrup bar | | = | 8 | mm | Table 20, IS456:2000 |
| Number of Legs | | = | 2 | | |
| Spacing of Shear reinforcement Required | | = | 150.0 | | Cl 40.4, IS456:2000 |
| Maximum Spacing of Shear Reinforcement | | = | 300 | | Cl 26.5.1.5,IS456:2000 |

Provide 8 mm dia 2 legged stirrups @ 150mm c/c spacing

**Support 2**

Negative moment = 254 kNm

Hence the Section is designed as Doubly Reinforced Section

| | | | | |
|---|---|---|---|---|
| | $M_u/bd^2$ | = | 4.647 | |
| Percentage of tension steel reqd | $p_t$ | = | 1.277 | % |
| Percentage of compression steel reqd | $p_c$ | = | 0.359 | % |
| Required Area of tension steel | $A_{st\ reqd}$ | = | 1431.84 | $mm^2$ |
| Required Area of compression steel | $A_{sc\ reqd}$ | = | 402.53 | $mm^2$ |

**Detail of bars**

| | I st Layer | | II nd Layer | |
|---|---|---|---|---|
| | Nos | Dia | Nos | Dia |
| Tension Reinforcement | 3 | 20 | 3 | 20 |

$A_{st}$ provided = 1884.956 $mm^2$

| | I st Layer | | II nd Layer | |
|---|---|---|---|---|
| | Nos | Dia | Nos | Dia |
| Compression Reinforceme | 3 | 20 | 3 | 20 |

$A_{sc}$ provided = 1884.96 $mm^2$

Percentage of tension steel provided $p_t$ = 1.681 % **Hence O.K**

Percentage of compression steel provided $p_c$ = 1.681 % **Hence O.K**

**Check for Shear**

Shear = 241 kN

| | | | | | |
|---|---|---|---|---|---|
| Nominal Shear Stress | tv | = | 2.15 | $N/mm^2$ | Cl 40.1, IS456:2000 |
| Permissible Shear Stress | tc | = | 0.92 | $N/mm^2$ | β = 1.000 |
| Maximum Shear Stress | tc,max | = | 2.5 | $N/mm^2$ | Table 19, IS456:2000 |
| Diameter of the Stirrup bar | | = | 8 | mm | Table 20, IS456:2000 |
| Number of Legs | | = | 2 | | |
| Spacing of Shear reinforcement Required | | = | 150.0 | | Cl 40.4, IS456:2000 |
| Maximum Spacing of Shear Reinforcement | | = | 300 | | Cl 26.5.1.5,IS456:2000 |

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Provide 8 mm dia 2 legged stirrups @ 150mm c/c spacing

**Span**

Positive moment (Span) = 254 kNm

Hence the Section is designed as Doubly Reinforced Section

$M_u/bd^2$ = 3.325

Percentage of tension steel reqd $p_t$ = 1.277 %

Percentage of compression steel reqd $p_c$ = 0.359 %

Required Area of tension steel $A_{st\ reqd}$ = 1431.84 $mm^2$

Required Area of compression steel $A_{sc\ reqd}$ = 402.53 $mm^2$

**Detail of bars**

| | I st Layer | | II nd Layer | |
|---|---|---|---|---|
| | Nos | Dia | Nos | Dia |
| Tension Reinforcement | 3 | 20 | 3 | 20 |

$A_{st}$ provided = 1884.96 $mm^2$

| | Nos | Dia | Nos | Dia |
|---|---|---|---|---|
| Compression Reinforceme | 3 | 20 | 3 | 20 |

$A_{sc}$ provided = 1884.96 $mm^2$

Percentage of tension steel provided $p_t$ = 1.681 % **Hence O.K**

Percentage of compression steel provided $p_c$ = 1.681 % **Hence O.K**

**Check for Shear**

Shear = 241 kN

| | | | | |
|---|---|---|---|---|
| Nominal Shear Stress | tv | = | 2.15 $N/mm^2$ | Cl 40.1, IS456:2000 |
| Permissible Shear Stress | tc | = | 0.92 $N/mm^2$ | β = 1.000 |
| Maximum Shear Stress | tc,max | = | 2.5 $N/mm^2$ | Table 19, IS456:2000 |
| Diameter of the Stirrup bar | | = | 8 mm | Table 20, IS456:2000 |
| Number of Legs | | = | 2 | |
| Spacing of Shear reinforcement Required | | = | 150.0 | Cl 40.4, IS456:2000 |
| Maximum Spacing of Shear Reinforcement | | = | 300 | Cl 26.5.1.5,IS456:2000 |

Provide 8 mm dia 2 legged stirrups @ 150mm c/c spacing

**Check For Deflection**

| | | | | |
|---|---|---|---|---|
| Basic Value | | = | 26 | Cl.23.2, IS456:2000 |
| Service Stress in Steel | $f_s$ | = | **220.29** $N/mm^2$ | |
| Modification Factor(Tension Reinforcement) | $F_1$ | = | 0.93 | |
| Allowable Span/Depth | | = | 24.18 | |
| Actual Span/Depth | | = | 7.59 | **Hence Safe** |

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# Floor Slab Design

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**1.0 Design of Two Way Slab S3**

**1.0.1 Basic Input Data**

| | | | | | |
|---|---|---|---|---|---|
| Grade of concrete | | = | M 25 | | |
| Grade of steel | | = | Fe 500 | | |
| Thickness of slab | D | = | 150 | mm | |
| Clear cover | cc | = | 25 | mm | Table 16 Cl.26.4.2 , |
| Effective thickness of slab ($d_{eff}$) | 150 - 25 - 5 | = | 120 | mm | IS 456 -2000 |
| Unit weight of concrete | | = | 25 | $KN/m^3$ | Cl 19.2.1, IS 456-2000 |
| Effective Shorter Span | $L_x$ | = | 5 | m | |
| Effective Longer Span | $L_y$ | = | 7.7 | m | |
| Aspect ratio | $L_y/L_x$ | = | 1.54 | < 2 | |
| Hence designed as Two way slab | | | | | Cl D-1.11, IS 456-2000 |
| Edge Conditio One Long edge Discontinuous | | | | | |

**1.0.2 Load Data**

| | | | | |
|---|---|---|---|---|
| Self Weight of Slab = 0.150 x 25 | = | 3.750 | $KN/m^2$ | |
| Floor finish | = | 1.500 | $KN/m^2$ | |
| Partition Load | = | 0.000 | $KN/m^2$ | |
| Sunken Filling | = | 0.000 | $KN/m^2$ | |
| Imposed Load | = | 3.000 | $KN/m^2$ | IS 875 (Part 2) -1987 |
| Extra Load, (if Any) | = | 0.000 | $KN/m^2$ | |
| Total load | = | 8.250 | $KN/m^2$ | |
| Design load ( Wu ) = 1.5 x 8.25 | = | **12.375** | $KN/m^2$ | Table 18 Cl 36.4.1 IS 456 -2000 |

**1.0.3 Moment and Shear Calculations**

**Short Span Direction**

| | | | | | |
|---|---|---|---|---|---|
| $a_x$ for positive moment | 1.5 | → | 0.051 | | Table 26 Cl D-1.1, |
| | 1.75 | → | 0.059 | | IS 456 -2000 |
| for 1.54 | $a_x$ | = | 0.052 | | |
| Positive moment 0.052 x 12.38 x 5 ^2 | | = | **16.17** | KN-m | |
| $a_x$ for negative moment | 1.5 | → | 0.067 | | Table 26 Cl D-1.1, |
| | 1.75 | → | 0.077 | | IS 456 -2000 |
| for 1.54 | $a_x$ | = | 0.069 | | |
| Negative momen 0.069 x 12.38 x 5 ^2 | | = | **21.22** | KN-m | |

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| | **Long Span Direction** | |
| | For positive moment $a_y$ = 0.028 | Table 26 Cl D-1.1, |
| | Positive moment 0.028 x 12.38 x 5 ^2 = **8.66** KN-m | IS 456 -2000 |
| | For negative moment $a_y$ = 0.037 | Table 26 Cl D-1.1, |
| | Negative momen 0.037 x 12.38 x 5 ^2 = **11.45** KN-m | IS 456 -2000 |
| | Shear force V = 12.38 x 5 x 1 = **30.94** KN | |
| **1.0.4** | **Check Effective Depth for Max.Bending Moment** | |
| | Depth require = $(M_j / (0.133x\ fck\ x\ b))^{1/2}$ = 79.89 mm | Table C,SP 16 :1980 |
| | Depth provide = 150 - 25 - 10 /2 = 120 mn > ### mn | Cl 2.3 |
| | **Hence the section is Safe against Bending** | |
| **1.0.5** | **Check Depth for Shear** | |
| | Nominal Shear Stress $t_v = V_u / b\ d$ = 0.26 $N/mm^2$ | Cl.40.1, IS 456:2000 |
| | Design shear stre ( $t_c$ ) = 0.46 $N/mm^2$ | Table 19 , IS 456:2000 |
| | k = 1.30 | Cl.40.2.1.1, |
| | k * $t_c$ = 0.60 $N/mm^2$ | IS 456:2000 |
| | $t_v$ < k * $t_c$ **Hence the section is Safe against Shear** | |
| **1.0.6** | **Check for Maximum Shear Stress:** | |
| | Nominal Shear Stress $t_v = V_u / b\ d$ = 0.26 $N/mm^2$ | Cl.40.1, IS 456:2000 |
| | Maximum Shear Stre ( $t_{c,max}$ ) = 3.1 $N/mm^2$ | Table 20 , IS 456:2000 |
| | # $t_{c,max}$ = 1.55 $N/mm^2$ | |
| | $t_v$ < 1 $t_{c,max}$ **Hence the section is Safe against Max.Shear Stres** | Cl.40.2.3.1, IS 456:200 |
| **1.0.7** | **Reinforcement calculations** | |
| | **Short Span Direction @ Support** | |
| | Mu/bd = $\frac{21.22 \times 10^6}{1000 \times \# \times 120}$ = **1.474** | |
| | Pt = **0.37** % | Table 2-4, SP16 :1980 |

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|---|---|---|
| | Area of steel = 0.0037 x 1000 x 120 = 439 $mm^2$ | |
| | Minimum area of 0.001 x 1000 x 150 = #### $mm^2$ | Cl:26.5.2.1 |
| | Spacing of # bar 78.54 x 1000 / 438.88 = 179 mm | IS 456 -2000 |
| | **Check for Spacing** | |
| | Minimum of 1) 3d = 360 mm | |
| | 2) = 300 mm | Cl:26.3.3.(b).1 |
| | 3) = 178.86 mm | IS 456 -2000 |
| | Therefore provid # @ **170** mm C/C | |
| | **Short Span Direction @ Mid Span** | |
| | Mu/bd = $\frac{16.17 \times 10 \wedge 6}{1000 \times \# \times 120}$ = 1.123 | |
| | Pt = 0.273 % | SP16 :1980 Table 2-4 |
| | Area of steel = 0.0027 x 1000 x 120 = 328 $mm^2$ | IS 456:2000 |
| | Minimum area of 0.001 x 1000 x 150 = #### $mm^2$ | Cl:26.5.2.1 |
| | Spacing of # bar 78.54 x 1000 / 327.93 = 239 mm | |
| | **Check for Spacing** | |
| | Minimum of 1) 3d = 360 mm | IS 456:2000 |
| | 2) = 300 mm | Cl:26.3.3.(b).1 |
| | 3) = 239.38 mm | |
| | Therefore provid # @ **150** mm C/C 150 | |
| | Provided % of Tension Reinforcement (pt) = **0.436** % | |
| | **Long Span Direction @ Support** | |
| | Mu/bd = $\frac{11.45 \times 10 \wedge 6}{1000 \times \# \times 120}$ = 0.795 | |
| | Pt = 0.190 % | SP16 :1980 Table 2-4 |
| | Area of steel = 0.0019 x 1000 x 120 = 228 $mm^2$ | IS 456:2000 |
| | Minimum area of 0.001 x 1000 x 150 = #### $mm^2$ | Cl:26.5.2.1 |
| | Spacing of # bar 78.54 x 1000 / 228.07 = 344 mm | |

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Ph: 044-48597100 Cell: 9790751378

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | RESIDENTIAL BUILDING(S+4) AT PLOT NO.31 IN VANCHINATHAN STREET, MADIPAKKAM. | DOCUMENT.N | DATE | DESIGNE | DATE |
| TITLE | TWO WAY SLAB DESIGN | REVISION | DATE | CHECKED | DATE |

| CL. NO. | DESIGN CALCULATIONS | REFERENCES |
|---|---|---|

**Check for Spacing**

Minimum of 1) 3d = 360 mm — IS 456:2000
2) = 300 mm — Cl:26.3.3.(b).1
3) = 344.20 mm
Therefore provid # @ **300** mm C/C

**Long Span Direction @ mid Span**

$Mu/bd = \frac{8.66 \times 10 \wedge 6}{1000 \times \# \times 120} = 0.602$

Pt = 0.142 % — SP16 :1980 Table 2-4

Area of steel = 0.0014 x 1000 x 120 = 171 $mm^2$ — IS 456:2000
Minimum area of 0.001 x 1000 x 150 = #### $mm^2$ — Cl:26.5.2.1
Spacing of # bar 78.54 x 1000 / 180.00 = 436 mm

**Check for Spacing**

Minimum of 1) 3d = 360 mm — IS 456:2000
2) = 300 mm — Cl:26.3.3.(b).1
3) = 436.11 mm
Therefore provid # @ **300** mm C/C

**1.0.8** **<u>Check for Deflection:</u> (Simplified Approach)**

Basic Span/depth Ratio = 26 — IS 456:2000 Cl:23.2.1
% of Tension Reinforcement provided ( $p_t$ ) = 0.436 %
Service stress of stee 0.58 fy (Ast_R/Ast_P) = 181.63 $N/mm^2$ — IS456:2000 Fig 4
Modification Factor for Tension Reinforcen = 1.71 — Page 38
Allowable Span / Effective Depth Ratio = 44.47 — IS 456:2000 Cl:23.2.1
Actual Span/Eff Dept = 5 x 1000 / 120 = 41.67

**Hence Safe against Deflection**

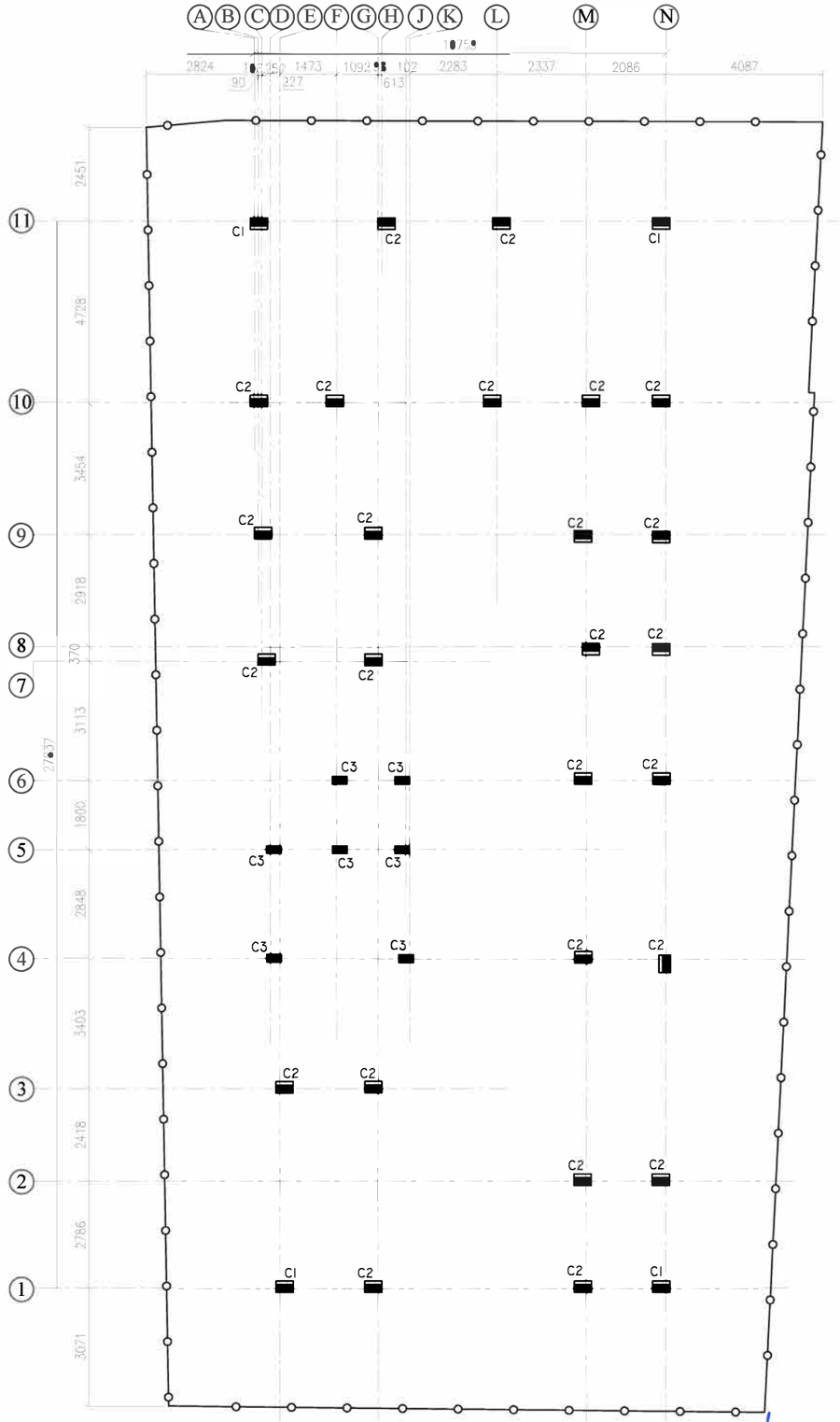
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# APPENDIX II

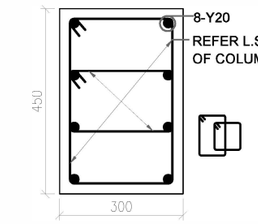
# GENERAL ARRANGEMENT DRAWINGS

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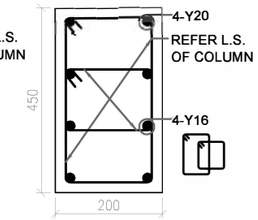
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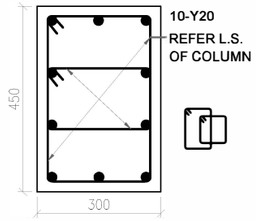

LAYOUT OF COLUMN



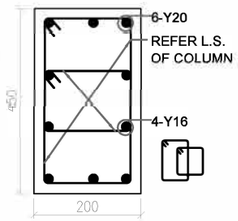

C.S. OF COLUMN "C1"
(300 x 450)
UP TO SFR



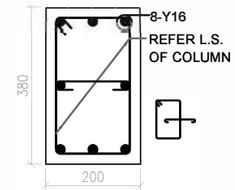

C.S. OF COLUMN "C1"
(200 x 450)
SFR TO TOP



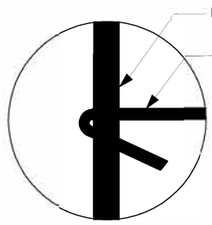

C.S. OF COLUMN "C2"
(300 x 450)
UP TO SFR




C.S. OF COLUMN "C2"
(200 x 450)
SFR TO TOP

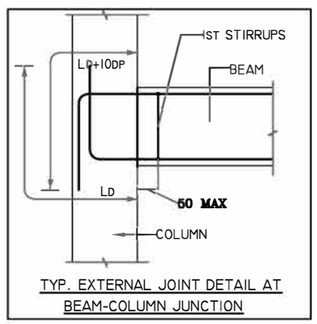



C.S. OF COLUMN "C3"
(200 x 380)
UP TO TOP

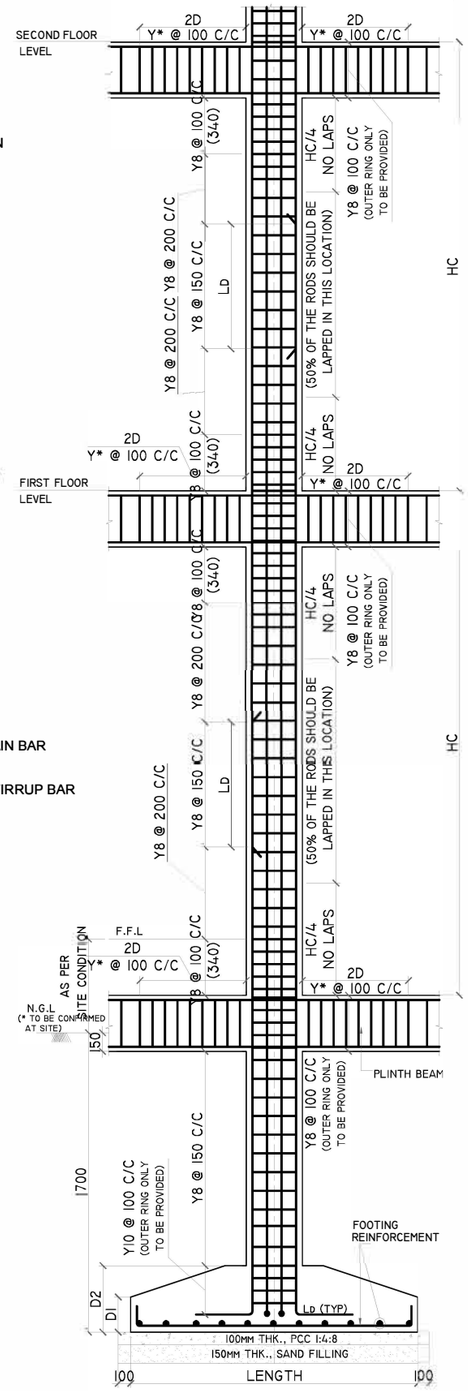



HOOK DETAIL

| COLUMN SCHEDULE | | | |
|---|---|---|---|
| S.NO. | NAME | SIZE | |
| | | UPTO STILT ROOF | STILT ROOF TO TOP |
| 1. | C1 | 300 X 450 | 200 X 450 |
| 2. | C2 | 300 X 450 | 200 X 450 |
| 3. | C3 | 200 X 380 | 200 X 380 |




TYP. EXTERNAL JOINT DETAIL AT
BEAM-COLUMN JUNCTION




COLUMN AND BEAM JUNCTION
REINFORCEMENT DETAILING COLUMN
(AS PER SEISMIC DETAILING CODE IS13920)
(ALTERNATE RODS TO BE LAPPED IN ALTERNATE FLOORS)
(Y* = DIA OF ROD REFER FLOOR BEAM DETAILS)

NOTE:

N.G.L - NATURAL GROUND LEVEL.

ALL HOOKS SHOULD BE BENT TO AN ANGLE OF 135° WITH A LENGTH NOT LESS THAN 75 MM

FOR APPROVAL ONLY

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## GENERAL NOTES:

### REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% THE SPECIFIED STRENGTH OF CONCRETE. HOWEVER THE FOLLOWING MINIMUM PERIOD (AFTER FINAL POUR ) SHALL BE ALLOWED BEFORE REMOVAL OF SHUTTERING AS PER CLAUSE 11.3.1, IS 456:2000

A) VERTICAL SIDE OF SHUTTERING OF COLUMNS,WALLS

### LAP JOINTS FOR REINFORCEMENT BARS :

I) AT ANY CROSS SECTION OF THE MEMBER,NOT MORE THAN 50% THE BARS SHALL BE LAPPED.

II) LAPS SHALL BE STAGGERED WITH A MINIMUM CENTRE TO CENTRE DISTANCE OF1.3 TIMES LAP LENGTH OF THE BAR FOR TENSION & COMPRESSION MEMBERS.

III) DEVELOPMENT LENGTH (LD) SHALL BE AS PER (SP:34-1999) TABLE BELOW:

A) DEVELOPMENT LENGTH FOR COLUMN BARS -40D
B) DEVELOPMENT LENGTH FOR BEAM BARS -50D

IV) LAPS IN COLUMNS SHALL BE PROVIDED AT MID HEIGHT OF FLOOR AND NOT AT SLAB LEVEL .

VII) DETAILING OF REBARS SHALL CONFIRM TO IBC

### EXCAVATION AND BACKFILL

I) BACKFILL FOR FOUNDATIONS AND PITS SHALL BE PLACED EVENLY LAYERS OF 300 MM THICKNESS AND SHALL BE WELL COMPACTED. THE FILL SHALL CONTAIN NO STONES WITH A DIAMETER GREATER THAN 100 MM. THE DEGREE OF COMPACTION OF BACKFILL SHALL BE 95% OF THE MAXIMUM DRY DENSITY AT OPTIMUM MOISTURE CONTENT OBTAINED BY THE MODIFIED PROCTOR COMPACTION TEST.

II) UNSUITABLE MATERIALS LIKE ROCKS/ EXISTING FOOTINGS ARE DETECTED BELOW FOUNDATION LEVEL IN AREAS OF CUT SHALL BE EXCAVATED TO FIRM GROUND. THE RESULTANT EXCAVATION SHALL BE FILLED TO THE REQUIRED LEVELS WITH MASS CONCRETE GRADE M10. ALSO WHEREVER EXCAVATION OCCURS BELOW THE FOUNDATION LEVEL STATED ON THE DESIGN DRAWING THE RESULTING VOID SHALL BE BACK FILLED WITH MASS CONCRETE GRADE-10.

III) BEFORE CASTING FOUNDATIONS, ANY IMMEDIATE OR ADJACENT AREAS OF DISTURBED OM.AOFT SOIL MUST BE REMOVED AND REPLACED WITH MASS CONCRETE OF GRADE 10

IV) A LAYER OF BLINDING CONCRETE 100 MM THICK SHALL BE PLACED UNDER ALL FOUNDATIONS. BLINDING CONCRETE SHALL HAVE A CHARACTERISTIC STRENGTH OF 10 N/MM AT 28 DAYS.

V) EXCAVATED FINE-GRAINED SOIL ENCOUNTERED AT SHALLOW DEPTHS SHALL BE IN NO CASE USED FOR BACK FILLING PURPOSES.

## GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   A) COLUMN = 40MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. COLUMNS AND FOOTINGS ARE DESIGNED FOR S+4 FLOOR LOADS AND SBC OF THE SOIL IS 150KN/ SQM. @ 1800 BELOW N.G.L.
7. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
8. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

| REV. | DESCRIPTIONS | DRN | CHK | DATE |
|---|---|---|---|---|
| 00 | ISSUE FOR APPROVAL | S.K | R.M | 18.02.26 |

**PROJECT :-**

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS (HEIGHT – 16.00M) RESIDENTIAL BUILDING WITH 12 DWELLING UNITS AVAILING PREMIUM FSI AT PLOT NO.31 IN VANCHINATHAN STREET,MADIPAKKAM, CHENNAI 600091, COMPRISED IN OLD S.NO.220/1 AND 220/28 AS PER PATTA NEW S.NO. 220/139 OF MADIPAKKAM-1 VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

**DRAWING TITLE :-**

LAYOUT & R.C DETAILS OF COLUMN

| DATE | SCALE | JOB.NO | DRG.NO |
|---|---|---|---|
| 18.02.26 | 1 : 120 | -------- | 001 |

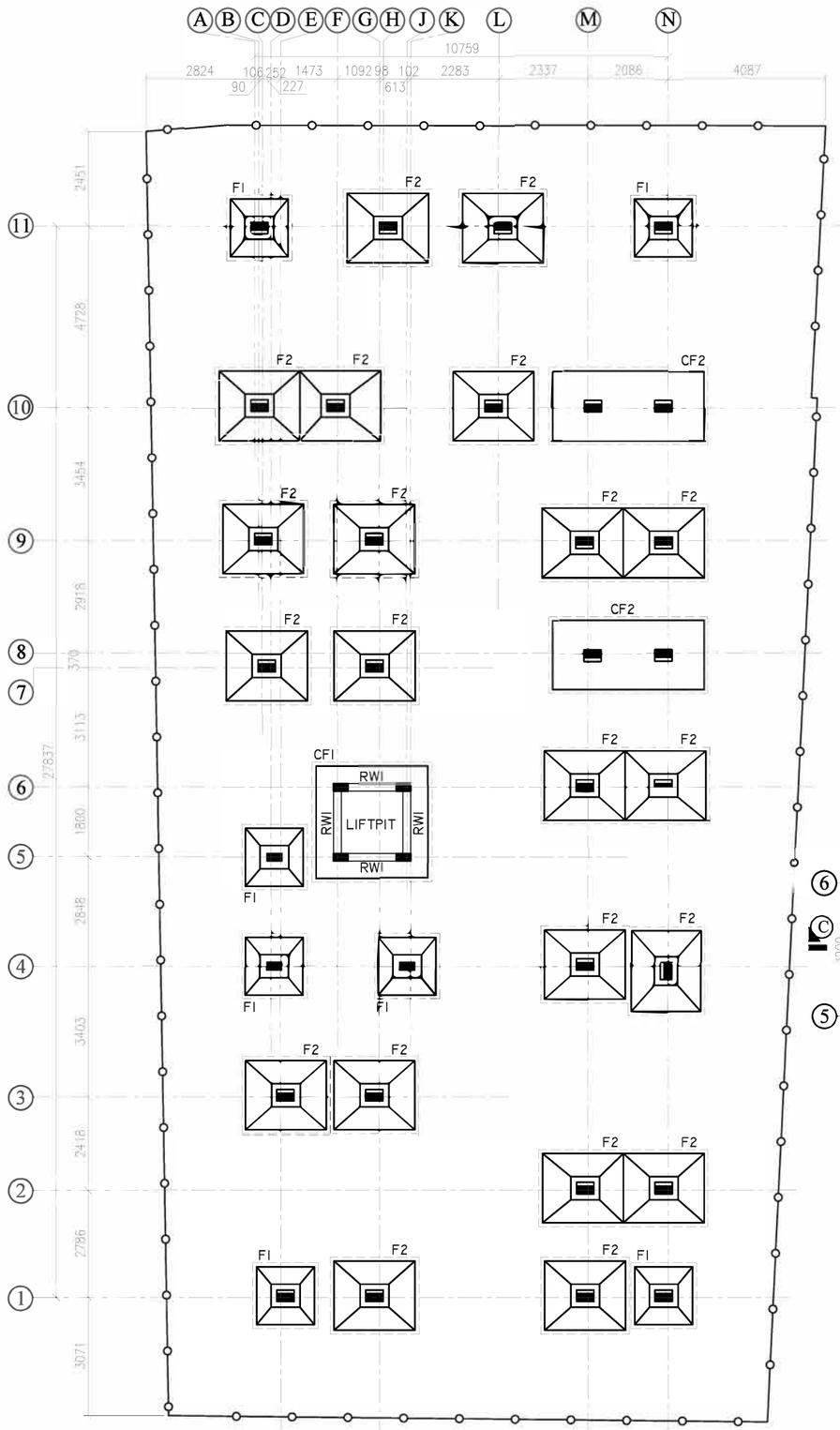
**ARCHITECT / CONSULTANTS :-**

**STRUCTURAL CONSULTANTS :-**

AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
ASHOK NAGAR, CHENNAI- 600 083.
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
aura Engineeering Consultants

A3

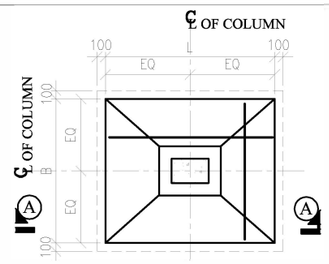
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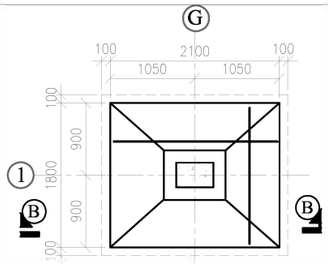

LAYOUT OF FOOTINGS

NOTE:

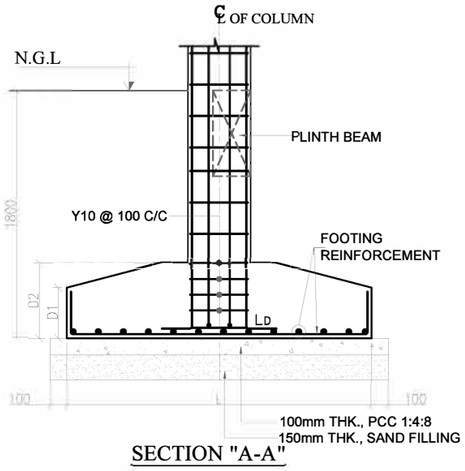
N.G.L - NATURAL GROUND LEVEL.



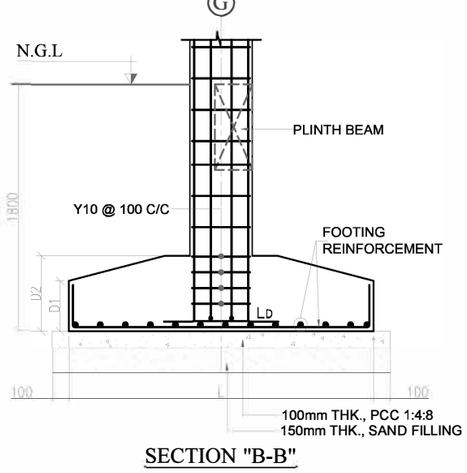

PLAN OF SLOPED FOOTING



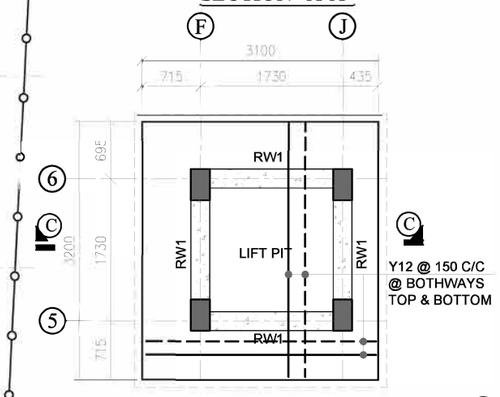

PLAN OF SLOPED FOOTING-F2




SECTION "A-A"




SECTION "B-B"



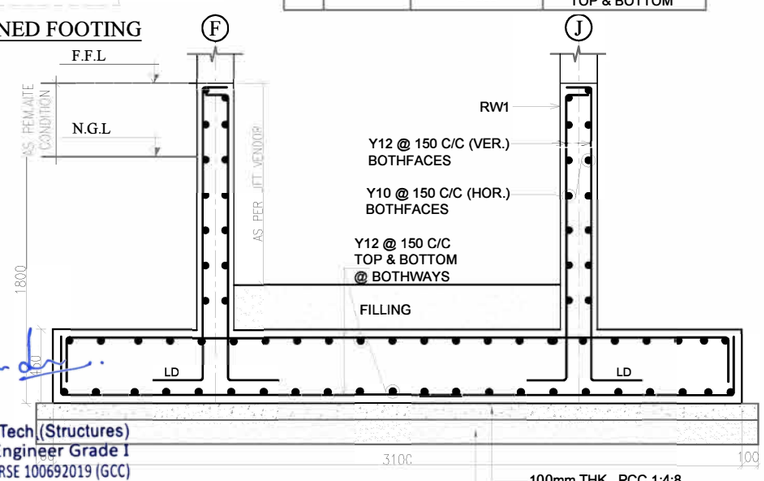

PLAN OF COMBINED FOOTING

FOOTINGS SCHEDULE:-

| SI. | FOOTING NAME | FOOTING SIZE | FOOTING REINFORCEMENT |
|---|---|---|---|
| 01 | F1 | 1500 X 1500 SLOPED FOOTING D1=250 , D2=450 | Y10 @ 150 C/C BOTHWAYS @ BOTTOM |
| 02 | F2 | 1800 X 2100 SLOPED FOOTING D1=300 , D2=550 | Y12 @ 150 C/C BOTHWAYS @ BOTTOM |

COMBINED FOOTINGS SCHEDULE:-

| SI. | FOOTING NAME | FOOTING SIZE | FOOTING REINFORCEMENT |
|---|---|---|---|
| 01 | CF1 | 2600 X 1500 D=380 | Y12 @ 150 C/C @ BOTHWAYS TOP & BOTTOM |




SECTION "C-C"

FOR APPROVAL ONLY

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Ph: 044-48597100 Cell: 9790751378

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% THE SPECIFIED STRENGTH OF CONCRETE. HOWEVER THE FOLLOWING MINIMUM PERIOD (AFTER FINAL POUR ) SHALL BE ALLOWED BEFORE REMOVAL OF SHUTTERING AS PER CLAUSE 11.3.1, IS 456:2000

A) VERTICAL SIDE OF SHUTTERING OF COLUMNS,WALLS

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A) DEVELOPMENT LENGTH FOR COLUMN BARS -40D
B) DEVELOPMENT LENGTH FOR BEAM BARS -50D

IV) LAPS IN COLUMNS SHALL BE PROVIDED AT MID HEIGHT OF FLOOR AND NOT AT SLAB LEVEL .

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EXCAVATION AND BACKFILL

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3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   A) FOOTING = 50MM B) R.C WALL = 25MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. COLUMNS AND FOOTINGS ARE DESIGNED FOR S+4 FLOOR LOADS AND SBC OF THE SOIL IS 150KN/ SQM. @ 1800 BELOW N.G.L.
7. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
8. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

| REV. | DESCRIPTIONS | DRN | CHK | DATE |
|---|---|---|---|---|
| 00 | ISSUE FOR APPROVAL | S.K | R.M | 18.02.26 |

PROJECT :-

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS (HEIGHT – 16.00M) RESIDENTIAL BUILDING WITH 12 DWELLING UNITS AVAILING PREMIUM FSI AT PLOT NO.31 IN VANCHINATHAN STREET,MADIPAKKAM, CHENNAI 600091, COMPRISED IN OLD S.NO.220/1 AND 220/28 AS PER PATTA NEW S.NO. 220/139 OF MADIPAKKAM-1 VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

DRAWING TITLE :-

LAYOUT & R.C DETAILS OF FOOTING

| DATE | SCALE | JOB.NO | DRG.NO |
|---|---|---|---|
| 18.02.26 | 1 : 120 | -------- | 002 |

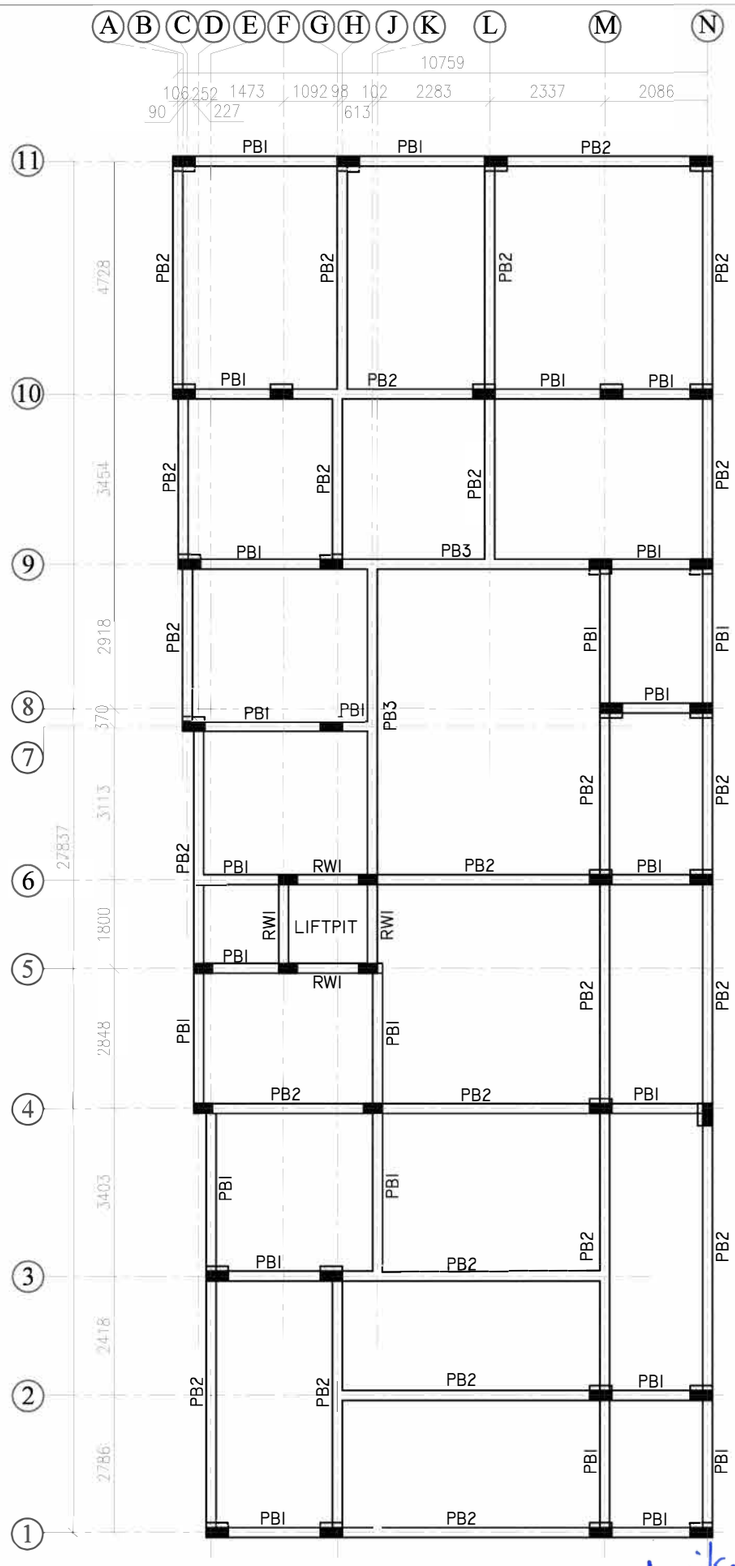
ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

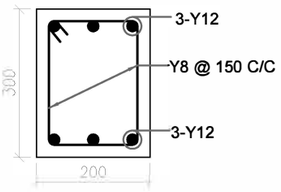
AURA ENGINEERING CONSULTANTS
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Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
Engineering Consultants

A3

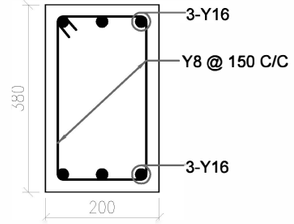
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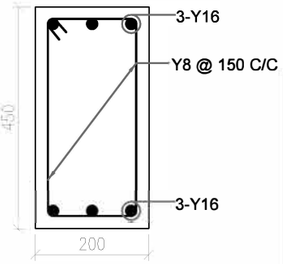

LAYOUT OF PLINTH BEAM




C.S. OF BEAM "PB1"
(200 x 300)

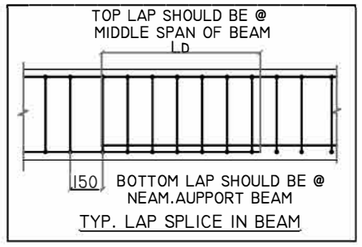



C.S. OF BEAM "PB2"
(200 x 380)

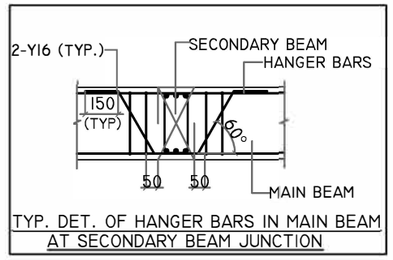



C.S. OF BEAM "PB3"
(200 x 450)

| BEAM SCHEDULE | | |
|---|---|---|
| SL.NO | NAME | SIZE |
| 01 | PB1 | 200 x 300 |
| 02 | PB2 | 200 x 380 |
| 03 | PB3 | 200 x 450 |




TYP. LAP SPLICE IN BEAM



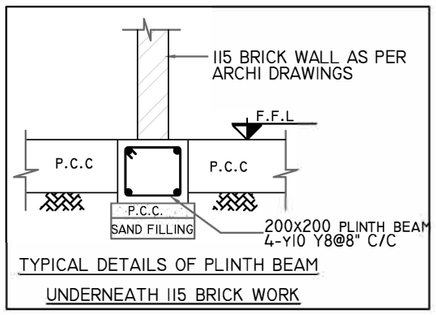

TYP. DET. OF HANGER BARS IN MAIN BEAM
AT SECONDARY BEAM JUNCTION

NOTE:

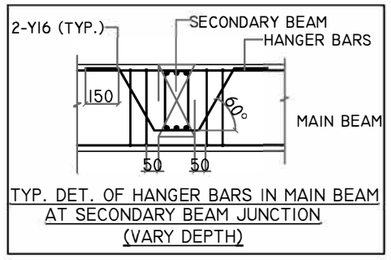
N.G.L - NATURAL GROUND LEVEL.

F.F.L - FLOOR FINISH LEVEL

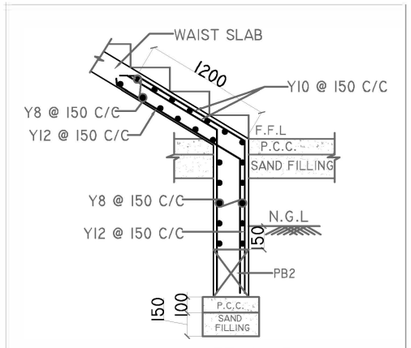
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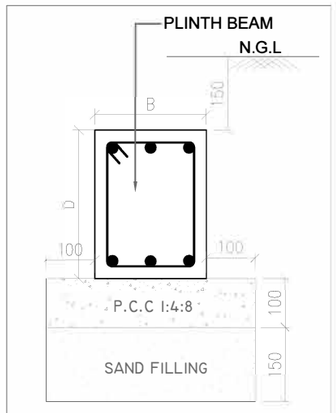

TYPICAL DETAILS OF PLINTH BEAM
UNDERNEATH 115 BRICK WORK




TYP. DET. OF HANGER BARS IN MAIN BEAM
AT SECONDARY BEAM JUNCTION
(VARY DEPTH)




TYP. DETAIL OF
STAIRCASE DOWELS




TYPICAL DETAIL OF PLINTH BEAM

GENERAL NOTES:

REMOVAL OF FORMWORK(SHUTTERING) :

SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE REMOVED UNTIL THE CONCRETE ATTAINS 70% THE SPECIFIED STRENGTH OF CONCRETE. HOWEVER THE FOLLOWING MINIMUM PERIOD (AFTER FINAL POUR ) SHALL BE ALLOWED BEFORE REMOVAL OF SHUTTERING AS PER CLAUSE 11.3.1, IS 456:2000

A) VERTICAL SIDE OF SHUTTERING OF COLUMNS,WALLS

LAP JOINTS FOR REINFORCEMENT BARS :

I) AT ANY CROSS SECTION OF THE MEMBER,NOT MORE THAN 50% THE BARS SHALL BE LAPPED.

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I) BACKFILL FOR FOUNDATIONS AND PITS SHALL BE PLACED EVENLY LAYERS OF 300 MM THICKNESS AND SHALL BE WELL COMPACTED. THE FILL SHALL CONTAIN NO STONES WITH A DIAMETER GREATER THAN 100 MM. THE DEGREE OF COMPACTION OF BACKFILL SHALL BE 95% OF THE MAXIMUM DRY DENSITY AT OPTIMUM MOISTURE CONTENT OBTAINED BY THE MODIFIED PROCTOR COMPACTION TEST.

II) UNSUITABLE MATERIALS LIKE ROCKS/ EXISTING FOOTINGS ARE DETECTED BELOW FOUNDATION LEVEL IN AREAS OF CUT SHALL BE EXCAVATED TO FIRM GROUND. THE RESULTANT EXCAVATION SHALL BE FILLED TO THE REQUIRED LEVELS WITH MASS CONCRETE GRADE M10. ALSO WHEREVER EXCAVATION OCCURS BELOW THE FOUNDATION LEVEL STATED ON THE DESIGN DRAWING THE RESULTING VOID SHALL BE BACK FILLED WITH MASS CONCRETE GRADE-10.

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V) EXCAVATED FINE-GRAINED SOIL ENCOUNTERED AT SHALLOW DEPTHS SHALL BE IN NO CASE USED FOR BACK FILLING PURPOSES.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   A) BEAM = 30MM B) R.C WALL = 25MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. COLUMNS AND FOOTINGS ARE DESIGNED FOR S+4 FLOOR LOADS AND SBC OF THE SOIL IS 150KN/ SQM. @ 1800 BELOW N.G.L.
7. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
8. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

| REV. | DESCRIPTIONS | DRN | CHK | DATE |
|---|---|---|---|---|
| 00 | ISSUE FOR APPROVAL | S.K | R.M | 18.02.26 |

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DRAWING TITLE :-

LAYOUT & R.C DETAILS OF PLINTH BEAM

| DATE | SCALE | JOB.NO | DRG.NO |
|---|---|---|---|
| 18.02.26 | 1 : 100 | -------- | 003 |

ARCHITECT / CONSULTANTS :-

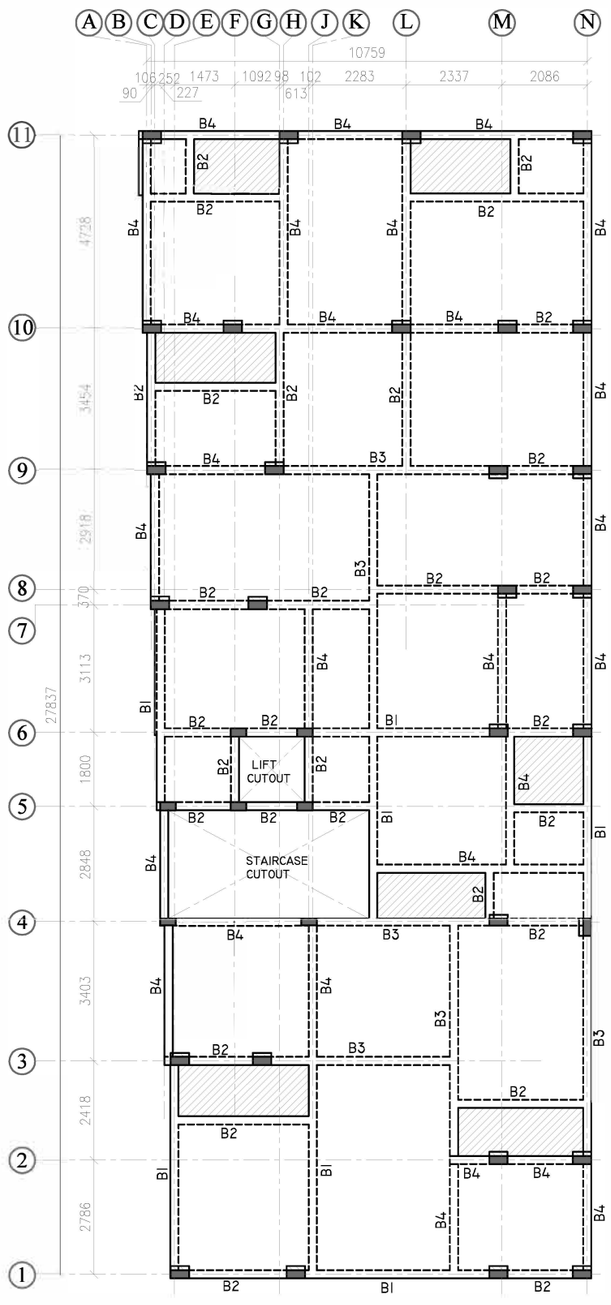
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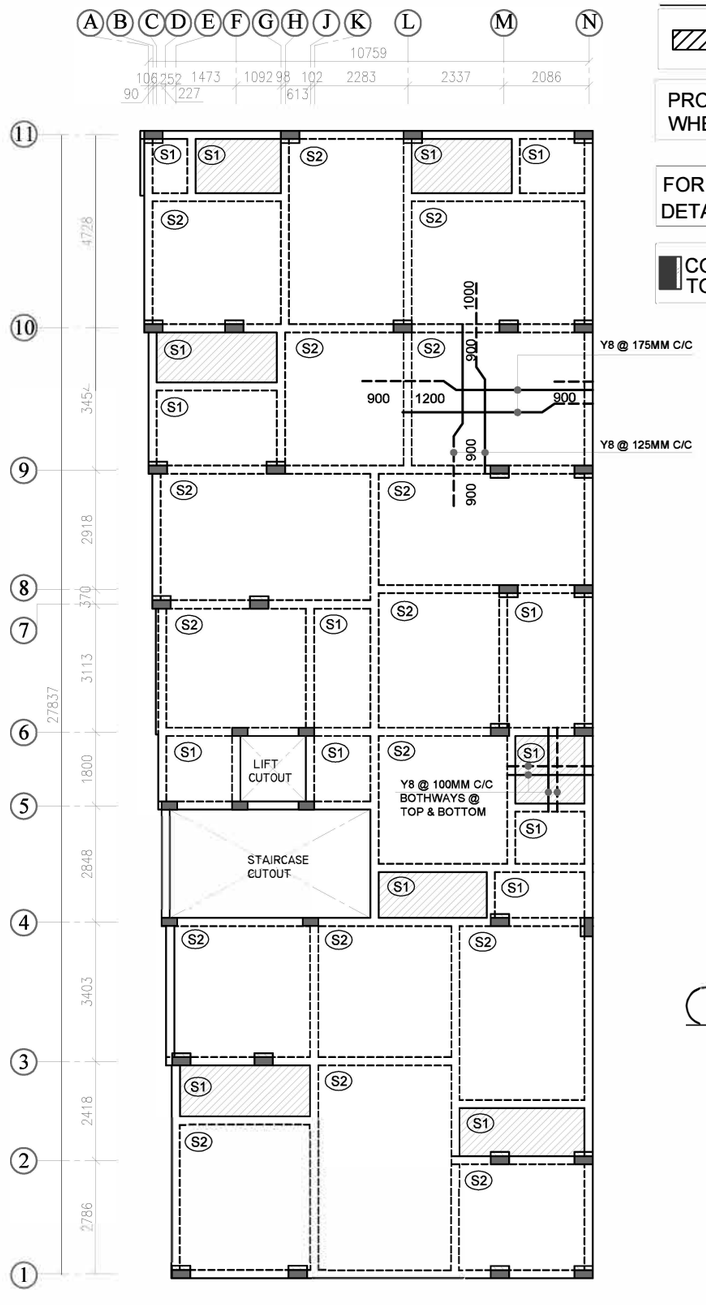
A3

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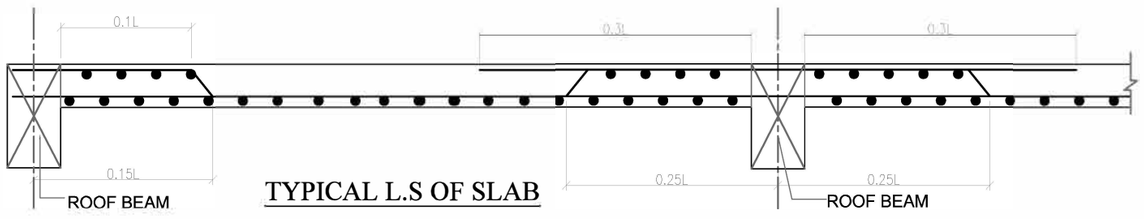
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NUMERATION LAYOUT OF STILT FLOOR
ROOF SLAB & BEAM




R.C LAYOUT OF STILT FLOOR
ROOF SLAB & BEAM




TYPICAL L.S OF SLAB

## NOTE:

SLAB SUNK BY 0'-10"

PROVIDE Y8 @ 8" C/C AS DISTRIBUTORS WHERE EVER REQUIRED

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

COLUMN CURTAILED TO BE BEND IN TO TOP OF THE SLAB

### SLAB SCHEDULE

| SL.NO | NAME | THICK |
|---|---|---|
| 01 | S1 | 150 THK. |
| 02 | S2 | 150 THK. |

### BEAM SCHEDULE

| SL.NO | NAME | SIZE |
|---|---|---|
| 01 | B1 | 200 x 450 |
| 02 | B2 | 200 x 450 |
| 03 | B3 | 200 x 530 |
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DRAWING TITLE :-

NUMERATION LAYOUT & R.C LAYOUT OF STILT FLOOR ROOF SLAB & BEAMS

| DATE | SCALE | JOB.NO | DRG.NO |
|---|---|---|---|
| 18.02.26 | 1 : 100 | ------- | 004 |

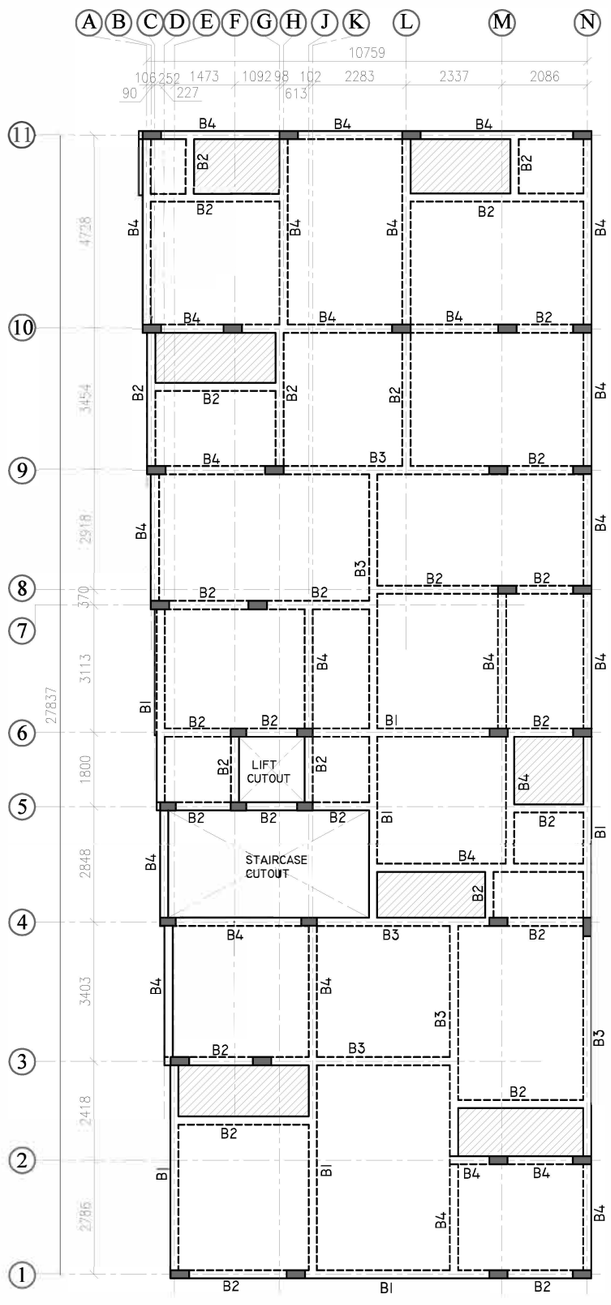
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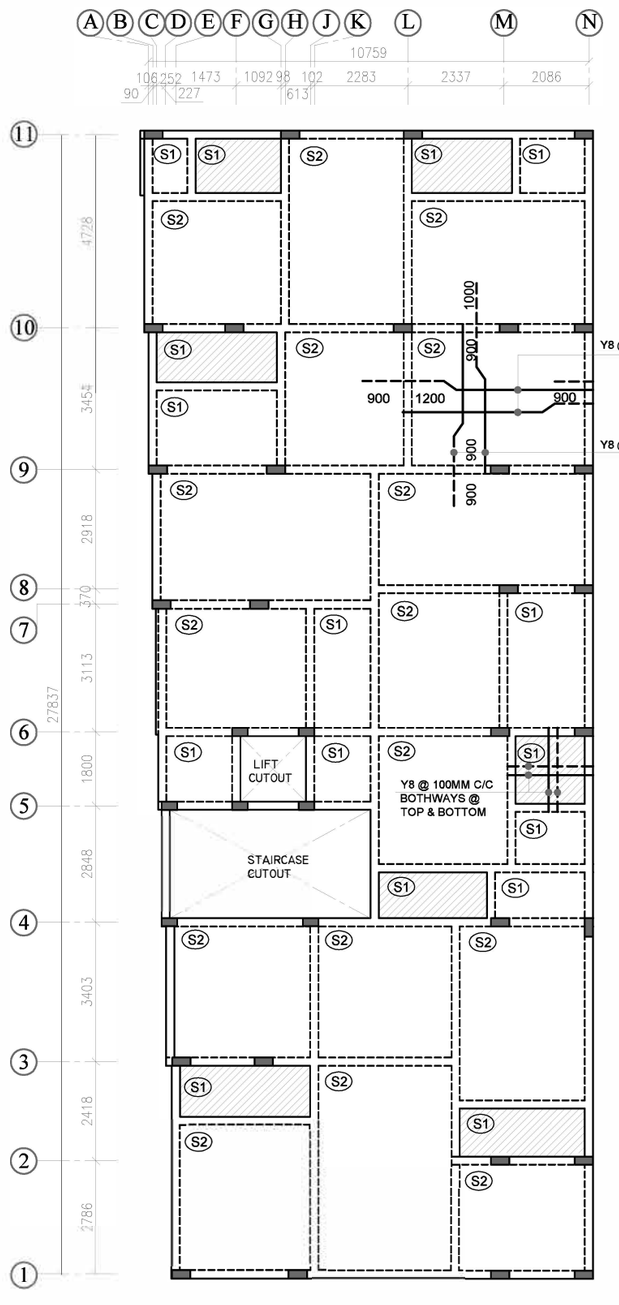
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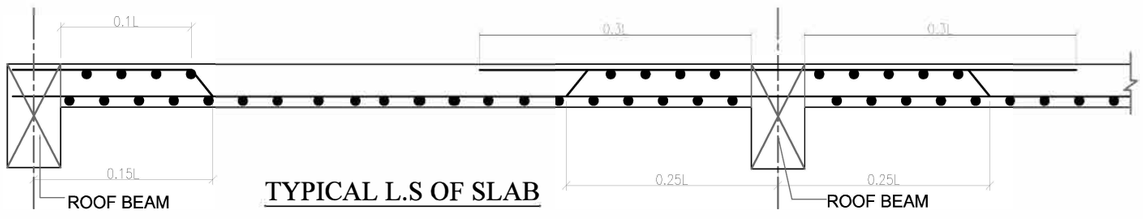
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NUMERATION LAYOUT OF TYPICAL FLOOR
ROOF SLAB & BEAM




R.C LAYOUT OF TYPICAL FLOOR
ROOF SLAB & BEAM




TYPICAL L.S OF SLAB

## NOTE:

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PROVIDE Y8 @ 8" C/C AS DISTRIBUTORS WHERE EVER REQUIRED

FOR BEAM REINFORCEMENT DETAILS REFER DWG.NO : 007

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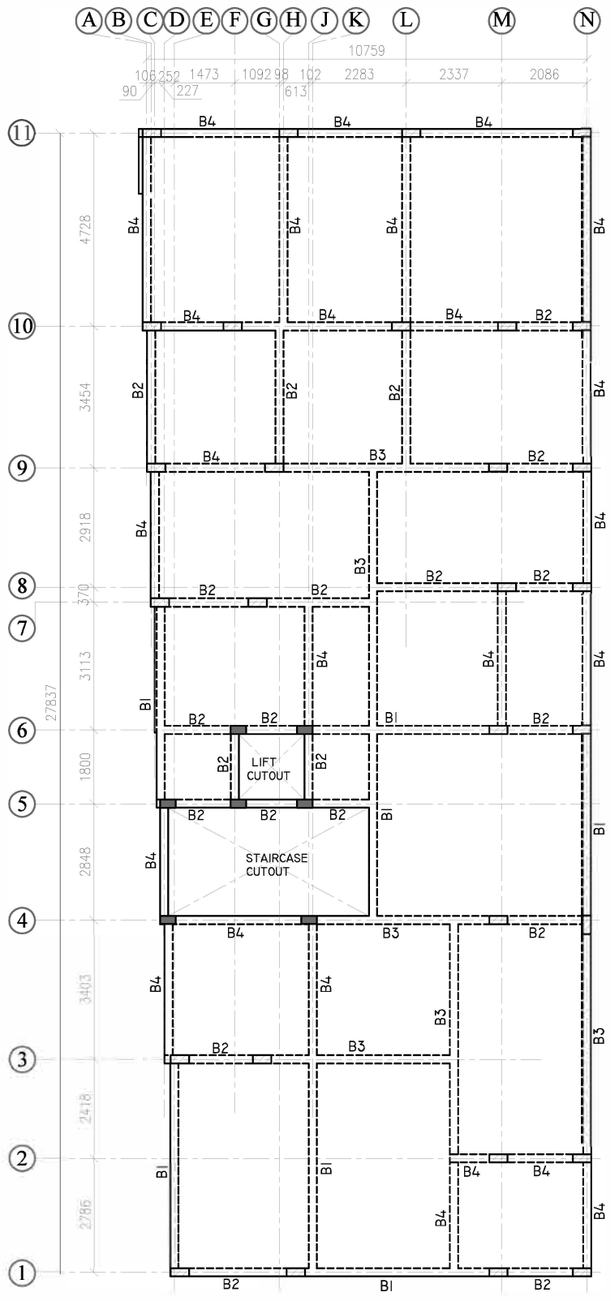
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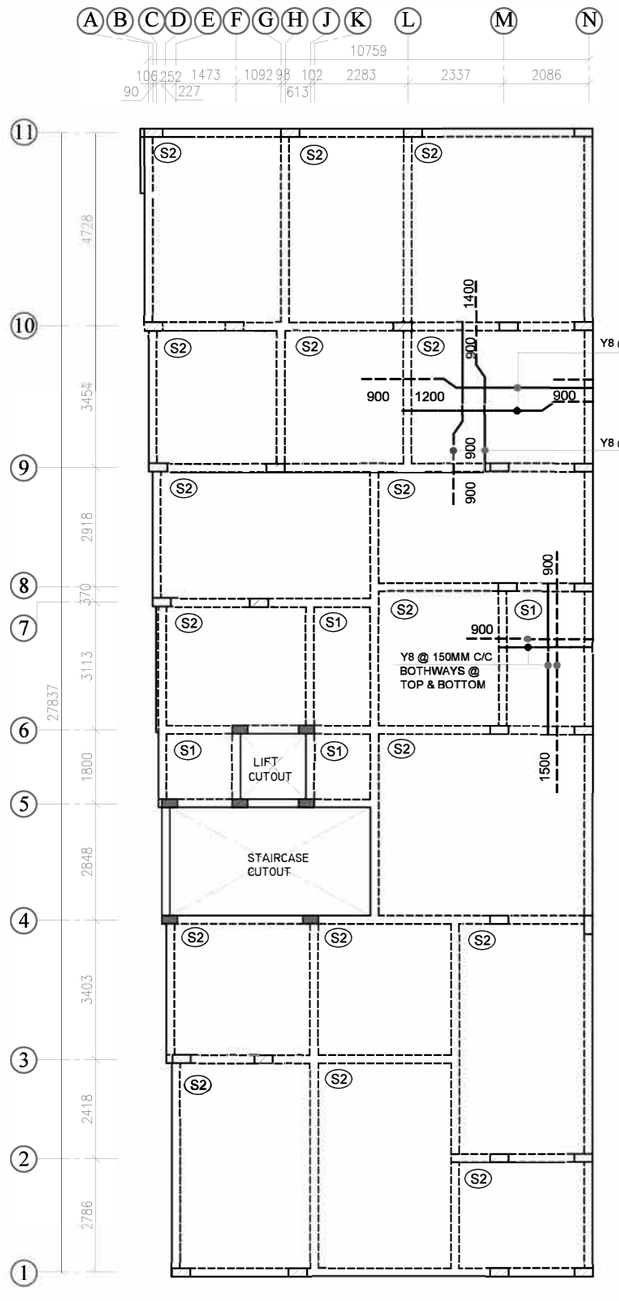
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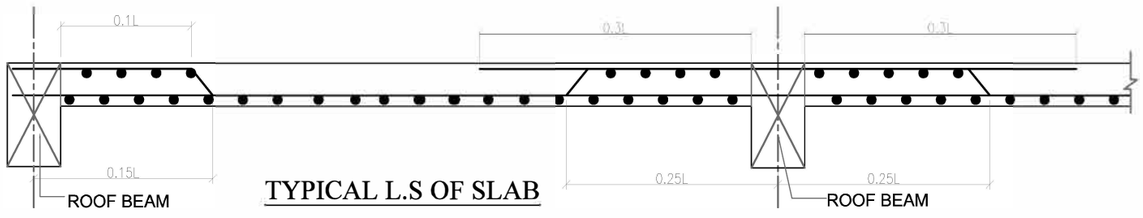
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NUMERATION LAYOUT OF TERRACE FLOOR SLAB & BEAM




R.C LAYOUT OF TERRACE FLOOR SLAB & BEAM




TYPICAL L.S OF SLAB

## NOTE:

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▯ COLUMN CURTAILED TO BE BEND IN TO TOP OF THE SLAB

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3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   A) BEAM = 30MM  B) SLAB = 20MM
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
7. ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

| REV. | DESCRIPTIONS | DRN | CHK | DATE |
|---|---|---|---|---|
| 00 | ISSUE FOR APPROVAL | S.K | R.M | 18.02.26 |

**PROJECT :-**

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS (HEIGHT – 16.00M) RESIDENTIAL BUILDING WITH 12 DWELLING UNITS AVAILING PREMIUM FSI AT PLOT NO.31 IN VANCHINATHAN STREET,MADIPAKKAM, CHENNAI 600091, COMPRISED IN OLD S.NO.220/1 AND 220/28 AS PER PATTA NEW S.NO. 220/139 OF MADIPAKKAM-1 VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

**DRAWING TITLE :-**

NUMERATION LAYOUT & R.C LAYOUT OF TERRACE FLOOR SLAB & BEAMS

| DATE | SCALE | JOB.NO | DRG.NO |
|---|---|---|---|
| 18.02.26 | 1 : 100 | ------- | 006 |

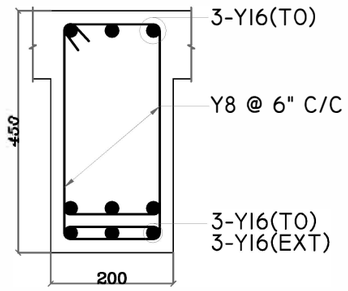
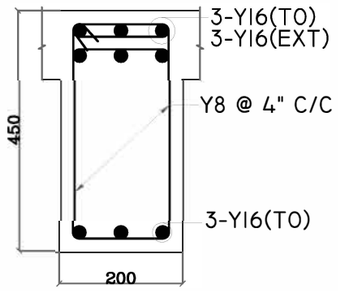
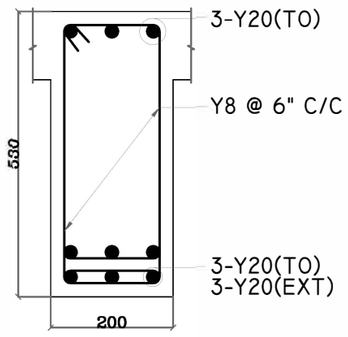
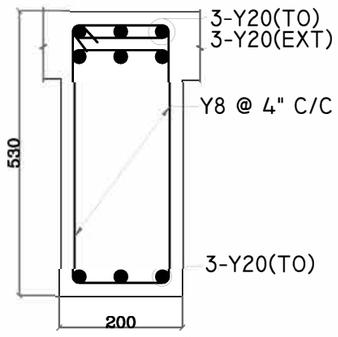
**ARCHITECT / CONSULTANTS :-**

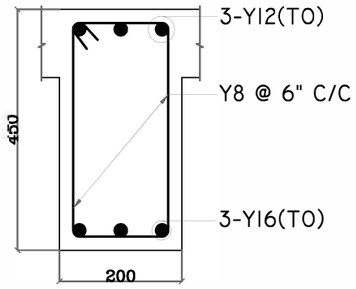
**STRUCTURAL CONSULTANTS :-**

AURA ENGINEERING CONSULTANTS
#8, 50th St, Sarvamangala Colony, 7th Avenue,
ASHOK NAGAR, CHENNAI- 600 083.
Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
http://auraengineers.co.in/
aura Engineeering Consultants

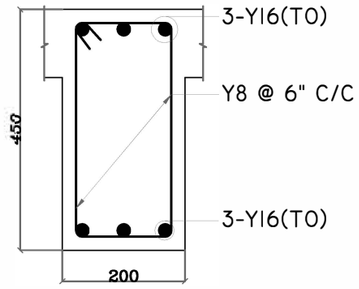
A3

THIS DRAWING IS THE PROPERTY OF M/s. AURA ENGINEERING CONSULTANTS. AND MUST NOT BE COPIED WITHOUT THEIR WRITTEN CONSENT, NOR MADE KNOWN TO THE THIRD PARTY

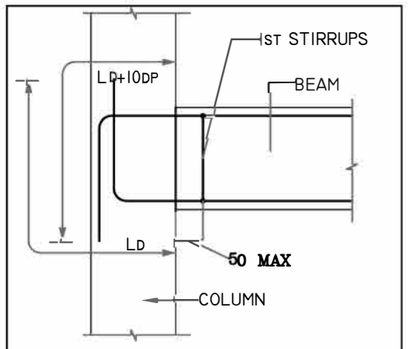
| NAME | MID SPAN | END SUPPORT |
|---|---|---|
| B1 (200 X 450) |   |   |
| B3 (200 X 530) |   |   |




C.S. OF BEAM "B2"
(200 X 450)




C.S. OF BEAM "B4"
(200 X 450)




TYP. EXTERNAL JOINT DETAIL AT BEAM-COLUMN JUNCTION

BEAM SCHEDULE

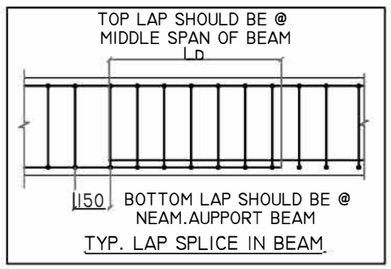
| SL.NO | NAME | SIZE |
|---|---|---|
| 01 | B1 | 200 x 450 |
| 02 | B2 | 200 x 450 |
| 03 | B3 | 200 x 530 |
| 04 | B4 | 200 x 450 |

GENERAL NOTES:

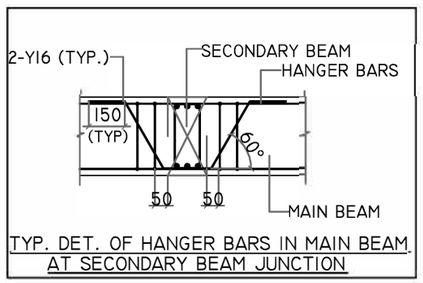
1. ALL DIMENSIONS ARE IN FOOT UNITS.
2. CONCRETE GRADE SHALL BE M25 CONFIRMING TO IS 456:2000
3. GRADE OF REINFORCEMENT MARKED THUS (Y) SHALL BE Fe 500 CONFIRMING TO IS 1786-2008
4. CLEAR COVER FOR REINFORCEMENT
   A) COLUMN = 1½" B) BEAM = 1"
   C) SLAB = ¾"
5. THIS DRG. READ IN CONJECTION WITH ARCH.DRGS.
6. STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY
7. DEVELOPMENT LENGTH (LD) SHALL BE AS PER (SP:34-1999) TABLE BELOW:

| | |
|---|---|
| DEVELOPMENT LENGTH FOR COLUMNS | = 40D |
| DEVELOPMENT LENGTH FOR BEAMS | = 50D |

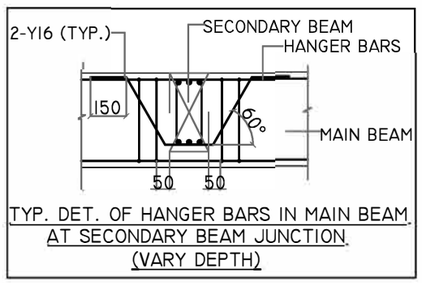
8. DETAILING OF REBARS SHALL CONFIRM TO SP-34 & IS 13920.



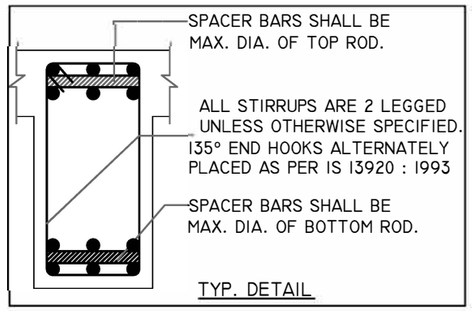

TYP. LAP SPLICE IN BEAM.



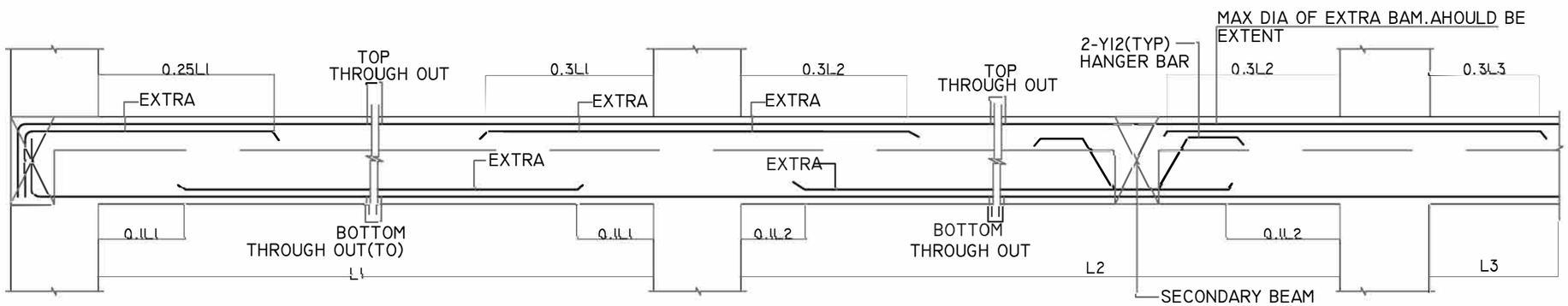

TYP. DET. OF HANGER BARS IN MAIN BEAM AT SECONDARY BEAM JUNCTION




TYP. DET. OF HANGER BARS IN MAIN BEAM AT SECONDARY BEAM JUNCTION (VARY DEPTH)




TYP. DETAIL




TYPICAL L.S OF ROOF BEAM

R. MANIKANDAN, M.Tech.,(Structures)
Registered Structural Engineer Grade I
SE/GR-I/19/06/154 (CMDA), RSE 100692019 (GCC)
AURA ENGINEERING CONSULTANTS
# 13/27, 67th Street, R.V. Nagar,
Ashok Nagar, Chennai-600 083.
Ph: 044-48597100 Cell: 9790751378

| REV | DESCRIPTIONS | DRN | CHK | DATE |
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DRAWING TITLE :-
R.C. DETAILS FOR ALL FLOOR BEAMS

| DATE | SCALE | JOB.NO | DRG.NO |
|---|---|---|---|
| 18.02.26 | 1 : 130 | -------- | 007 |

ARCHITECT / CONSULTANTS :-

STRUCTURAL CONSULTANTS :-

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Fixed Line :- 044 4859 7100
projects.auraengg@gmail.com
projects@auraengineers.co.in
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aura Engineeering Consultants

A3

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**

FREE TOOLS · NO ACCOUNT NEEDED

# 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

**Every free tool**
/tools

**Services we run for you**
/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

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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.