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DIGITALLY VERIFIED RECORD

STRUCTURAL ANALYSIS & DESIGN
FOR
PROPOSED G+4 & S+5 STORIED RESIDENTIAL BUILDING& CARE HOME (G+4) PROJECT
AT ASHIANA NEMILI, CHENNAI.

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KOLKATA – 700 029

DESIGN BASIS REPORT

OF

STRUCTURAL ANALYSIS & DESIGN

FOR

PROPOSED G+4, S+5 STORIED (TOWER – 1,2 & 11) & CARE HOME (G+4) RESIDENTIAL BUILDING PROJECT AT ASHIANA NEMILI, CHENNAI.

A. FOREWORD:

This report contains the Design parameters involved in Structural Analysis and Design for TOWER –1,2 & 11 of the proposed G+4 & S+5 storied residential building project at Ashiana Nemili, Chennai.

The intent of this document is to identify and record all the pertinent input requirements, analysis & design criteria for structural design of the building. It is aimed at formulating the basis of the structural analysis, design & detailing work that the Structural Engineer is planning for delivering the structural scheme of the building. The scheme will be compatible with the architectural theme, satisfy the functional needs, at the same time confirming to the Indian Standards and other applicable building norms to achieve safe, stable, strong and yet optimally economic structure.

The parameters adopted in this report are going to be the basis of the structural design calculations.

This report covers the minimum design requirement to establish the unified design basis that will form the overall design philosophy to be adopted in the structural design of the proposed building.

The design will aim to achieve

a) Structural and functional integrity of the building.

b) Desirable Structural performance under characteristic service design loads.

c) Resistance to loads due to natural phenomena i.e. earthquakes, winds.

d) Structural durability & maintainability of the building.

B. PROJECT DESCRIPTION

Project: Analysis & Design of Residential Complex.

Location: Ashiana Nemili, Chennai.

1. Description of the Site

The general topography of site is plain.

2. Detail Description of Buildings:

The proposed G+4 and S+5 storied residential buildings are located at Ashiana Nemili ,Chennai.

The height of different floors is as follows:

- FOR BLOCK - 2 & 11.

  Stilt floor - 3.4 m.

  1st floor - 2.95 m

  2nd Floor to roof - 2.95 m.

- FOR BLOCK-1.

  Stilt floor - 3.4 m.

  1st floor - 2.95 m

  2nd Floor to roof - 2.95 m.

- Care home:

  Stilt floor - 3.6 m.

  1st floor - 3.050 m

  2nd Floor to roof - 3.050 m.

C. MATERIALS OF CONSTRUCTION:

The buildings are predominantly RCC framed structures.

Concrete of Grade M25 for RCC structure of Building will be used.

High yield strength deformed bars conforming to IS 1786 of grade Fe 500 will be used.

D. LOADS

Loading and Other Design Considerations

Loading for the design of building will be as per IS: 875 - 1987.

1.Dead Loads:

Self-weight of the structural members will be considered on the basis of the following properties--:

1.	Density of reinforced concrete	2.50	T/m3
2.	Density of plain concrete	2.40	T/m3
3.	Density of steel	7.85	T/m3
4.	Density of floor plasters	2.10	T/m3
5.	Density of floor finishes	2.40	T/m3
6.	Density of soil	1.80	T/m3
7.	Density of Clay Brick	2.00	T/m3

Self-weight of RCC elements will be as per the sizes mentioned in the respective drawings.

The structural loading shall be in accordance with IS 875 Part 1.

It will be derived by the software based on density and size assigned to respective member.

The super imposed dead load due to floor finish, services; filling etc. is applied as uniformly distributed load over the slab.

Wall Loads shall be applied on beams as line loads. In case, walls are directly supported by slabs, then the slabs will be designed for equivalent UDL.

2. Imposed Loads:

The structural loading shall be in accordance with IS 875 Part 2.

All areas except corridor, stair, etc.	:	0.2 T/m2
Corridor, stair, lobby balconies etc.	:	0.3 T/m2
Lift Machine Room	:	0.5 T/m2
Roof (accessible)	:	0.15 T/m2
Roof (inaccessible)	:	0.075 T/m2

3. Wind Load:

The wind loads will be taken as per IS:875-2015 Part 3. Wind loads and seismic forces are not considered to act simultaneously. The value of wind load is worked out based upon IS:875 (Part 3) – 2015, which is as follows:

Wind velocity at any height, $V_z = V_b K_1 K_2 K_3 K_4$

Where,

V_b = Basic wind velocity (from Fig.1 of the code for the project site)

Vb = 50 m/s

K_1 = 1 (Table 1 of the code, design life = 50 years)

K_2 = From Table 2 of the code, for terrain category-3, assuming Class B structure
1.0

K_3 = 1.0 (Clause 6.3.3 of the code)

K_4 = 1.0 (Clause 6.34 of the code)

FOR BLOCK-1.

Width of the building = 18.7 m
Length of the building = 26.80 m
Height of Building up to roof = 18.15 m

H/W =18.15/18.7=0.971 &
L/W = 26.80/18.7 =1.40

θ = 0° Windward = 0.7
Leeward = 0.25

θ = 90° Windward = 0.7
Leeward = 0.25

- **FOR BLOCK-2.**

Width of the building = 22.45 m
Length of the building = 36.32 m
Height of Building up to roof = 18.15 m

H/W =18.15/22.45=0.81 &
L/W = 36.32/22.45 = 1.62

θ = 0° Windward = 0.7
Leeward = 0.3

θ = 90° Windward = 0.7
Leeward = 0.1

- **FOR BLOCK-11.**

Width of the building = 22.45 m
Length of the building = 36.32 m
Height of Building up to roof = 18.15 m

H/W =18.15/22.45=0.81 &
L/W = 36.32/22.45 = 1.62

θ = 0° Windward = 0.7
Leeward = 0.3

θ = 90° Windward = 0.7
Leeward = 0.1

- **FOR CARE HOMES:**

Width of the building = 11.92 m
Length of the building = 31.90m
Height of Building up to roof = 16.25 m

H/W =16.15/11.92=1.354 &
L/W = 31.90/11.92 = 2.676

θ = 0° Windward = 0.7
Leeward = 0.3

θ = 90° Windward = 0.7
Leeward = 0.1

Wind pressure, $P_z = 0.6\ V_z^2$.

Off shore wind velocity factor will be considered as per the codal provision. The buildings will be designed for appropriate force co-efficient as per IS: 875 (Part-3):2015.

4. Seismic Load:

As per Cl.19.4 of IS 456: 2000, the earthquake forces shall be calculated in accordance with IS 1893 – 2016 (Part I).

The proposed Hospital is located in Zone III with Z = 0.16.

The seismic load calculations will be carried out in accordance with IS: 1893:2016.

RCC Detailing shall be carried out as per IS 13920: 2016.

The design horizontal seismic co-efficient (Ah) shall be determined by the following method

$$A_h = \frac{Z\ I\ Sa}{2\ R\ g}$$

Where,

Z	Zone Factor For (Zone III)	0.16
I	Importance Factor	1
R	Response Reduction Factor (SMRF)	5.0

Medium stiff soil will be considered as per soil report and Damping 5%.

Sa/g = 2.5 for 0<T<0.55

=1.36/ T for 0.55< T <4.00

=0.34 T> 4.00

- **FOR BLOCK-12,&11**

Height of Building up to roof = 18.15 m

WITHOUT BRICK INFILL:

TIME PERIOD: (As per clause 7.6.2 of IS 1893 (Part 1):2016)

$Tx = Ty = 0.075\ H^{0.75}$

$= 0.075 \times 1815^{0.75}$ Sec

=0.66 Sec

Design seismic base shear V_B = Ah * W

W = Seismic weight of building from Analysis (Live load used in calculations of Seismic Weights will be 50% for live load greater than 3 kN/m^2 and 25% for live load less than & equal to 3 kN/m^2.)

E. PROPOSED APPROACH TO STRUCTURAL ANALYSIS:

The buildings are predominantly R.C.C framed structures. The lateral force resisting system shall be RCC special moment resisting frames. After preliminary sizing of various structural members, a computer model of the structural frame of each of the buildings will be generated for carrying out analysis for the effects of vertical and lateral load that are likely to be imposed on the structure.

The building structure will be analyzed using the ETABS and SAFE software for the following computer models of the building.

Space frame analysis (Static) of the entire structure - for dead, live, seismic and wind loads

ETABS has been thoroughly tested, validated and recognized internationally by several organizations and is well suited for the analysis of building systems.

Geometrical dimensions, member properties and member-node connectivity, including eccentricities will be modelled in the analysis problem. Variation in material grades, if present, will also be considered. The seismic loads will be derived from the results of Equivalent Static analysis and Dynamic analysis of the structure in accordance with the code IS 1893 – 2016 and relevant code of practice. The permissible values of the load factors and stresses will be utilized within the purview of the Indian Standards.

F. ANALYSIS METHOD ADOPTED FOR MODELLING USING ETABS:

- Geometry shall be developed for building as per final and approved GA drawings.
- Vertical members will be connected from floor to floor to assemble space frame.
- Preliminary sectional properties will be assigned to all the structural elements.
- All columns and shear-walls will be treated as fixed at the foundation level.
- The floor slabs will be modelled as shell.

- Appropriate torsion / moment releases will be given wherever required.
- Appropriate grades of concrete as mentioned earlier will be assigned.
- Gravity loads (Dead load and Live load) will be applied to all the respective areas as per the location and occupancy.
- Allowances in terms of Live-Load reductions as per number of floors shall be duly considered strictly in accordance with the codes.
- Seismic analysis will be carried out procedures mentioned in IS -1893(Part-1):2016
- Wind load analysis will be carried out using procedures mentioned in IS: 875 (Part-3):2015.
- The computer analysis will evaluate individual internal member forces, reactions at foundation level and deflection pattern of the entire structure and in the individual members.
- This data will then be used to verify adequacy of the member sizes and after further iterations arrive at the appropriate reinforcement design of the structural members.

G. LOAD COMBINATIONS:

The results obtained from the computer analysis in the form of member forces and reactions will be used for design the structural members. Following load combinations of the member forces will be considered for arriving at the design forces.

While making load combinations, some points are followed such as:

a) The wind and seismic loads are considered to act on the structure separately and not simultaneously.
b) Whenever Live load is combined with seismic load, appropriate part of live load is considered as per IS:1893 (Part-1):2016 for evaluating earthquake effect and combined load effect used in such combination.

The following load cases shall be considered as per IS.

Type	Load Case	Combinations
Primary	1	Dead Load (DL)
Primary	2	Live Load 1 (LL)
Primary	3	Wind Load X(+)
Primary	4	Wind Load X(-)
Primary	5	Wind Load Y (+)

Primary	6	Wind Load Y (-)
Primary	7	Seismic load along X - EL (X)
Primary	8	Seismic load along Y - EL (Y)
Primary	9	Spec X
Primary	10	Spec Y

The following load combinations shall be considered as per IS.

Load Combination	**Limit State of Collapse**		
	DL	LL	WL/EL
DL + LL	1.5	1.5	—
DL + WL	1.5 or 0.9*	—	±1.5
DL+LL+WL	1.2	1.2	±1.2
DL + EL	1.5 or 0.9*	—	±1.5
DL+LL+EL	1.2	1.2	±1.2

(where, DL - Dead Load, LL-Live Load, WL - Wind Load, EL - Earthquake Load).

1. General Design Procedure

For the design of R.C.C. elements, the Limit State Method will be used as per IS 456-2000. Materials of construction will be predominantly concrete with consideration for strength and durability. The grade of concrete for Foundation is taken as M25.The grade of concrete for Columns is M25 up to roof. All beams and slabs are of M25.

High Yield Strength Deformed bars conforming to IS: 1786 of grade Fe 500 will be used.

Ductile detailing norms will be adopted in accordance with IS: 13920:2016.

2. Nominal Cover to Reinforcement:

Covers to reinforcement will be in accordance with IS 456:2000 corresponding to moderate exposure and to satisfy fire rating of 2 hours accordance with National Building Code of India – SP –7 (part IV). Only fire escape staircase area is required to have a fire rating of 4 hours as per.

Element	COVER
Foundation	75 mm
Columns	40 mm
Beams	30 mm
SLABS	30 mm

3. Design of Structural Elements

4.1 Design Of Slabs:

Slabs will be designed using Tailor made excel sheets.

4.2 Design Of Beams:

Beams will be designed for the results of critical load combination. The condensed results will be obtained in a particular format using the established excel sheets. The design procedure will take into account all the member forces like axial, shear, torsion and bending.

4.3 Design Of Walls/Columns:

Column will be designed for bi-axial bending for the forces of critical load combination. The designs will be made using computer software as per the guide lines of IS: 456-2000 and IS-13920 adopting limit state method.

3.4 Design Of Foundation:

As per soil investigation report, ISOLATED FOOTING is adopted.

Design of foundation will be done using Tailor made excel sheets as attached in Annexure-1.

H. LIST OF DESIGN CODES :

1. For Loads Other Than Earthquake Loads:

IS Code	Description
IS 875(Part 1): 1987	Dead Loads - Unit Weight of Building Material and Stored Material.
IS 875(Part 2): 1987	Imposed Loads.
IS 875(Part 3): 2015	Wind Loads.
IS 875(Part 5): 1987	Special Loads and Combinations.

2. For Earthquake Loads:

IS Code	Description
IS 1893 (Part 1): 2016	Criteria for earthquake resistance design of structures.
IS 13920: 2016	Ductile Detailing of Reinforced Concrete Structures.

3. For Design Of Concrete Elements:

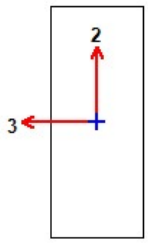
IS Code	Description
IS 456: 2000	Code of practice For Plain and Reinforced Concrete.
SP 16 : 1980	Structural Design Charts For Reinforced Concrete Elements.
SP 7(Part IV)	National Building Code of India
IS 1786 : 2008	Specification for high strength deformed bars and wires.

4. For Fire Safety Designs:

IS Code	Description
IS 1642 : 1989	Fire Safety Building Materials
SP 7 (Part II)	National Building Code of India

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
2ND FL	B159	248	B200X500M25	1.5DL-1.5SLY	0	5385	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-9995.92	0.89	9.3726	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-9995.92	1.83	0	-9997.75

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-9997.75		576	0	576	216
Bottom (-2 Axis)		0	288	0	0	288

Shear Force and Reinforcement for Shear, V_{u2} & T_u

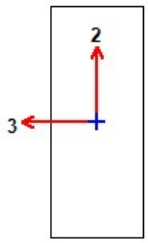
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
12.1836	0	12.1907	3.8887	0.74

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
0.89	9.3726	120	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
2ND FL	B73	210	B200X500M25	1.5DL-1.5SPECY	0	5650	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-10681.82	5.3	9.6768	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-10681.82	10.91	0	-10692.73

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-10692.73		624	0	624	216
Bottom (-2 Axis)		0	312	0	0	312

Shear Force and Reinforcement for Shear, V_{u2} & T_u

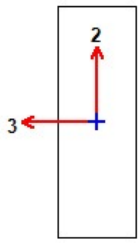
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
12.5705	0	12.6129	3.9856	0.76

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
2.4	9.6768	120	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
3RD FL	B18	926	B200X600M25	1.5DL+1.5LL	3650	3650	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	600	200	0	30	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-2721.32	21.67	5.3842	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-2721.32	50.99	0	-2772.31

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-2772.31		274	0	112	274
Bottom (-2 Axis)		0	68	0	0	68

Shear Force and Reinforcement for Shear, V_{u2} & T_u

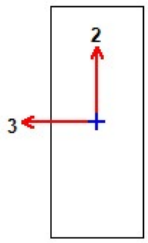
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
5.3842	4.1035	4.6499	5.1319	0.22

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
21.67	5.3842	160	560	0.11

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
4TH FL	B1	880	B200X500M25	1.5DL+1.5SLY	5700	5700	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-9900.42	156.64	10.0098	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-9900.42	322.49	0	-10222.91

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-10222.91		591	0	591	216
Bottom (-2 Axis)		0	296	0	0	296

Shear Force and Reinforcement for Shear, V_{u2} & T_u

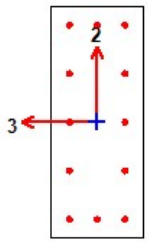
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
10.2532	0	11.5063	3.1675	0.69

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
156.64	10.0098	120	420	0.34

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design (Summary)



Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	C8	1132	CLM300X750M25	1.5DL-1.5SPECX	0	3400	0.52	Ductile Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	750	60	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u tonf	Design M_{u2} tonf-mm	Design M_{u3} tonf-mm	Minimum M_2 tonf-mm	Minimum M_3 tonf-mm	Rebar Area mm²	Rebar % %
162.3823	7818.99	-5194.83	3247.65	5001.37	1800	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment tonf-mm	Additional Moment tonf-mm	Minimum Moment tonf-mm
Major Bend(M3)	1	2900	7322.76	0	5001.37
Minor Bend(M2)	0.759264	2900	1102.45	0	3247.65

Axial Compression Check for Seismic Design per IS 13920:2016 Section 7.1

Limit Compression Factor Unitless	Limit Compression Strength tonf	Compression D/C Ratio Unitless	Status
0.4	229.4362	0.707745	OK

Shear Design for V_{u2} , V_{u3}

	Shear V_u tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s mm²/mm
Major, V_{u2}	6.7942	14.4407	8.4433	2.385	0.33
Minor, V_{u3}	4.7051	13.4909	7.342	4.7051	0.83

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area mm²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g mm²	A_{sc} mm²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
225000	1800	326.9466	113.8494	162.3823	0.77225

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-mm)
Major Bending (M_3)	No	0.853	750	3.867	12	No	0
Minor Bending (M_2)	No	0.853	300	7.34	12	No	0

Notes:

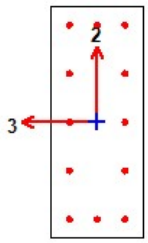
N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design (Summary)



Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	C4	1130	CLM300X750M25	1.5DL-1.5SPECX	0	3400	0.518	Ductile Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	750	60	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u tonf	Design M_{u2} tonf-mm	Design M_{u3} tonf-mm	Minimum M_2 tonf-mm	Minimum M_3 tonf-mm	Rebar Area mm²	Rebar % %
161.051	8130.46	5665	3221.02	4960.37	1800	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment tonf-mm	Additional Moment tonf-mm	Minimum Moment tonf-mm
Major Bend(M3)	1	2900	-6987.82	0	4960.37
Minor Bend(M2)	0.759264	2900	1210.72	0	3221.02

Axial Compression Check for Seismic Design per IS 13920:2016 Section 7.1

Limit Compression Factor Unitless	Limit Compression Strength tonf	Compression D/C Ratio Unitless	Status
0.4	229.4362	0.701942	OK

Shear Design for V_{u2} , V_{u3}

	Shear V_u tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s mm²/mm
Major, V_{u2}	6.8366	14.4407	8.4433	2.4426	0.33
Minor, V_{u3}	4.8273	13.4909	7.342	4.8273	0.83

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area mm²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g mm²	A_{sc} mm²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
225000	1800	326.9466	113.8494	161.051	0.778497

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-mm)
Major Bending (M_3)	No	0.853	750	3.867	12	No	0
Minor Bending (M_2)	No	0.853	300	7.34	12	No	0

Notes:

N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
1ST FL	P104	26600	650	800	200	Special Wall	0.745

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	26600	250	26600	1050	800	200
Bottom	Leg 1	26600	250	26600	1050	800	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	2707	0.0169	0.0025	1.5DL-1.5SPECX	121.3479	7894.51	8112.75	160000
Bottom	2706	0.0169	0.0025	1.5DL-1.5SPECX	123.4275	7954.62	-7366.91	160000

Shear Design

Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL-1.5SPECY	97.0927	11424.03	-5.717	9.7893	21.5648
Bottom	Leg 1	0.5	1.5DL-1.5SPECY	99.1723	-976.81	-5.717	9.7893	21.5648

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	200	1.5DL+1.5SPECY	108.6346	-1348.52	0.0007	0.0005
Top–Right	Leg 1	200	1.5DL+1.5SLX	127.0568	3494.31	0.001	0.0005
Bottom–Left	Leg 1	200	1.5DL+1.5SLX	129.1364	-3325.28	0.001	0.0005
Botttom–Right	Leg 1	0	1.2DL+1.2LL+1.2SLX	0	0	0	0

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
1ST FL	P106	26600	11900	800	200	Special Wall	0.824

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	26600	11500	26600	12300	800	200
Bottom	Leg 1	26600	11500	26600	12300	800	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	1742	0.0109	0.0025	1.5DL-1.5SPECX	105.7894	6093.72	8670.89	160000
Bottom	1856	0.0116	0.0025	1.5DL-1.5SPECX	107.869	6153.82	-9490.18	160000

Shear Design

Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL-1.5SPECY	87.2911	12961.89	-7.4039	9.7893	21.5648
Bottom	Leg 1	0.5	1.5DL-1.5SPECY	89.3707	-279.96	-7.4039	9.7893	21.5648

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	200	1.5DL+1.5SPECY	104.4374	-1003.41	0.0007	0.0005
Top–Right	Leg 1	200	1.5DL+1.5SLX	108.5387	5307.99	0.0009	0.0005
Bottom–Left	Leg 1	200	1.5DL+1.5SLX	110.6183	-5376.34	0.0009	0.0005
Botttom–Right	Leg 1	0	1.2DL+1.2LL+1.2SLX	0	0	0	0

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
2ND FL	P21	11500	7200	1000	250	Special Wall	0.603

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	11500	6700	11500	7700	1000	250
Bottom	Leg 1	11500	6700	11500	7700	1000	250

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	1862	0.0074	0.0031	1.5DL+1.5SLX	167.4349	11716.26	6569.03	250000
Bottom	2076	0.0083	0.0031	1.5DL+1.5SLX	170.2542	-12324.23	-6679.64	250000

Shear Design

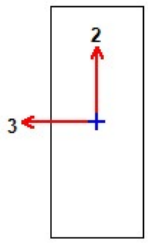
Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.63	1.5DL-1.5SLY	154.8254	20326.3	-13.7785	12.9596	31.3589
Bottom	Leg 1	0.63	1.5DL-1.5SLY	157.6447	-20939.63	-13.7785	13.6402	32.0394

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	250	1.5DL+1.5SPECY	156.1032	-12035.68	0.0009	0.0005
Top–Right	Leg 1	250	1.5DL+1.5SLX	167.4349	4569.71	0.0008	0.0005
Bottom–Left	Leg 1	250	1.5DL+1.5SLX	170.2542	-5766.85	0.0008	0.0005
Botttom–Right	Leg 1	250	1.5DL+1.5SPECY	158.9226	8021.62	0.0008	0.0005

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	B323	29	B200X500M25	1.5DL-1.5SPECY	5385	5385	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-11695.08	5.61	10	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-11695.08	11.55	0	-11706.63

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-11706.63		696	0	696	216
Bottom (-2 Axis)		0	348	0	0	348

Shear Force and Reinforcement for Shear, V_{u2} & T_u

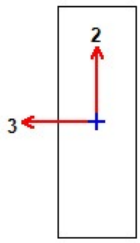
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
13	0	13	5	0.78

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
0.79	10	120	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	B140	4	B200X600M25	1.5DL-1.5SLX	0	3250	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	600	200	0	30	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-13000.27	0.23	9	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-13000.27	0.54	0	-13000.82

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-13000.82		573	0	573	274
Bottom (-2 Axis)		0	286	0	0	286

Shear Force and Reinforcement for Shear, V_{u2} & T_u

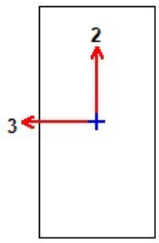
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
13	0	13	9	0.61

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
0.23	9	160	560	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
3RD FL	B28	469	B 250 X500 M25	1.5DL+1.5LL	0	7850	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
250	500	250	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-15956.21	15.81	14	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-15956.21	27.89	0	-15984.1

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-15984.1		971	0	971	270
Bottom (-2 Axis)		0	486	0	0	486

Shear Force and Reinforcement for Shear, V_{u2} & T_u

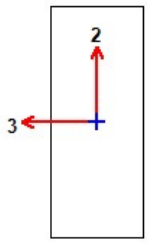
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
14	7	7	4	0.44

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
15.81	14	170	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	B1	43	B200X500M25	1.5DL-1.5SPECY	0	5650	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-12433.01	5.88	10	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-12433.01	12.1	0	-12445.11

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-12445.11		751	0	751	216
Bottom (-2 Axis)		0	375	0	0	375

Shear Force and Reinforcement for Shear, V_{u2} & T_u

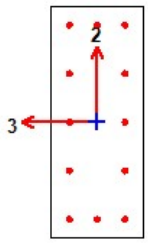
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
13	0	13	5	0.81

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
5.88	10	120	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design (Summary)



Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	C13	1418	CLM300X750M25	1.5DL+1.5SLY	0	3400	0.481	Ductile Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	750	60	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u tonf	Design M_{u2} tonf-mm	Design M_{u3} tonf-mm	Minimum M_2 tonf-mm	Minimum M_3 tonf-mm	Rebar Area mm²	Rebar % %
186	12940.12	6581.56	3725.74	5737.64	2698	1.2

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment tonf-mm	Additional Moment tonf-mm	Minimum Moment tonf-mm
Major Bend(M3)	0.918194	2900	2632.62	0	5737.64
Minor Bend(M2)	4.427848	2900	1958.3	0	3725.74

Axial Compression Check for Seismic Design per IS 13920:2016 Section 7.1

Limit Compression Factor Unitless	Limit Compression Strength tonf	Compression D/C Ratio Unitless	Status
0.4	229	0.811933	OK

Shear Design for V_{u2} , V_{u3}

	Shear V_u tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s mm²/mm
Major, V_{u2}	5	17	8	5	0.33
Minor, V_{u3}	4	16	7	4	0.83

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area mm²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g mm²	A_{sc} mm²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
225000	2698	361	117	186	0.716107

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-mm)
Major Bending (M_3)	No	0.853	750	3.55	12	No	0
Minor Bending (M_2)	No	0.853	300	42.803	12	Yes	0

Notes:

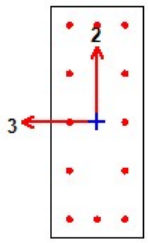
N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design (Summary)



Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	C8	1419	CLM300X750M25	1.5DL-1.5SLX	2900	3400	0.5	Ductile Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	750	60	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u tonf	Design M_{u2} tonf-mm	Design M_{u3} tonf-mm	Minimum M_2 tonf-mm	Minimum M_3 tonf-mm	Rebar Area mm²	Rebar % %
152	-8169.35	-7297.44	3039.59	4680.97	1800	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment tonf-mm	Additional Moment tonf-mm	Minimum Moment tonf-mm
Major Bend(M3)	0.923318	2900	-1759.36	0	4680.97
Minor Bend(M2)	1.2	2900	-3267.74	0	3039.59

Axial Compression Check for Seismic Design per IS 13920:2016 Section 7.1

Limit Compression Factor Unitless	Limit Compression Strength tonf	Compression D/C Ratio Unitless	Status
0.4	229	0.662404	OK

Shear Design for V_{u2} , V_{u3}

	Shear V_u tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s mm²/mm
Major, V_{u2}	5	14	8	5	0.33
Minor, V_{u3}	4	13	7	3	0.83

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area mm²	Shear Ratio Unitless
Major Shear, V_{u2}	0	5	30	115	225000	0.263
Minor Shear, V_{u3}	0	3	21	54	105000	0.39

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
0.199	0.361

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g mm²	A_{sc} mm²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
225000	1800	327	114	152	0.821067

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-mm)
Major Bending (M_3)	No	0.853	750	3.57	12	No	0
Minor Bending (M_2)	No	0.853	300	11.6	12	No	0

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
1ST FL	P121	38100	18000	1000	200	Special Wall	0.69

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	38100	17500	38100	18500	1000	200
Bottom	Leg 1	38100	17500	38100	18500	1000	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	2369	0.0118	0.0025	1.5DL-1.5SPECX	124	9394.59	-4994.88	200000
Bottom	2436	0.0122	0.0025	1.5DL-1.5SPECX	127	9469.71	5099.21	200000

Shear Design

Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL+1.5SLY	159	-16410.1	7	12	27
Bottom	Leg 1	0.5	1.5DL+1.5SLY	162	8128.56	7	12	27

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	300	1.5DL+1.5SLY	159	-16410.1	0.0013	0.0005
Top–Right	Leg 1	200	1.5DL+1.5SPECY	153	10927	0.0011	0.0005
Bottom–Left	Leg 1	200	1.5DL+1.5SPECY	156	-3321.9	0.0009	0.0005
Botttom–Right	Leg 1	200	1.5DL+1.5SLY	162	8128.56	0.0011	0.0005

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
2ND FL	P37	3650	12165	800	200	Special Wall	0.804

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	3650	11765	3650	12565	800	200
Bottom	Leg 1	3650	11765	3650	12565	800	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	1259	0.0079	0.0025	1.5DL-1.5SPECX	95	6240.25	3093.23	160000
Bottom	1294	0.0081	0.0025	1.5DL-1.5SPECX	97	6279.5	-3151.99	160000

Shear Design

Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL-1.5SPECY	86	7487.68	-4	9	20
Bottom	Leg 1	0.5	1.5DL-1.5SPECY	88	79.1	-4	9	20

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	200	1.5DL+1.5SPECY	94	-3407.46	0.0007	0.0005
Top–Right	Leg 1	200	1.5DL-1.5SLX	96	1498.61	0.0007	0.0005
Bottom–Left	Leg 1	200	1.5DL-1.5SLX	98	-1939.77	0.0007	0.0005
Botttom–Right	Leg 1	200	1.5DL+1.5SPECY	95	79.1	0.0006	0.0005

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
1ST FL	P34	5250	12165	800	200	Special Wall	0.702

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	5250	11765	5250	12565	800	200
Bottom	Leg 1	5250	11765	5250	12565	800	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	3662	0.0229	0.0025	1.5DL-1.5SPECX	123	10751.75	-4118.7	160000
Bottom	3722	0.0233	0.0025	1.5DL-1.5SPECX	125	10811.85	-4188.3	160000

Shear Design

Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL-1.5SPECY	110	11860.68	6	10	22
Bottom	Leg 1	0.5	1.5DL-1.5SPECY	112	7874.32	6	10	22

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	200	1.5DL-1.5SLX	125	-1848.18	0.0009	0.0005
Top–Right	Leg 1	200	1.5DL+1.5SPECX	123	998.75	0.0008	0.0005
Bottom–Left	Leg 1	200	1.5DL-1.5SLX	127	-190.18	0.0008	0.0005
Botttom–Right	Leg 1	200	1.5DL+1.5SPECX	125	668.03	0.0008	0.0005

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
1ST FL	P108	30250	18900	800	200	Special Wall	0.766

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	30250	18500	30250	19300	800	200
Bottom	Leg 1	30250	18500	30250	19300	800	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	1071	0.0067	0.0025	1.5DL-1.5SPECX	78	6229.3	2616.42	160000
Bottom	1119	0.007	0.0025	1.5DL-1.5SPECX	80	6289.4	2686.02	160000

Shear Design

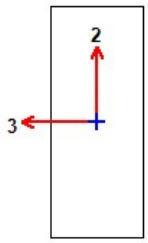
Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL-1.5SLY	50	9237.7	-4	7	19
Bottom	Leg 1	0.5	1.5DL-1.5SLY	52	-5139.61	-4	7	19

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	200	1.5DL+1.5SLY	104	-7358.56	0.001	0.0005
Top–Right	Leg 1	200	1.5DL+1.5SPECY	100	9270.19	0.0011	0.0005
Bottom–Left	Leg 1	200	1.5DL+1.5SPECY	102	-4694.55	0.0009	0.0005
Botttom–Right	Leg 1	200	1.5DL+1.5SLY	106	4926.42	0.0009	0.0005

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	B323	29	B200X500M25	1.5DL-1.5SPECY	5385	5385	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-11695.08	5.61	10	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-11695.08	11.55	0	-11706.63

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-11706.63		696	0	696	216
Bottom (-2 Axis)		0	348	0	0	348

Shear Force and Reinforcement for Shear, V_{u2} & T_u

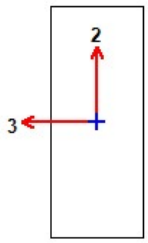
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
13	0	13	5	0.78

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
0.79	10	120	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
2ND FL	B98	327	B200X500M25	1.5DL-1.5SLY	0	5650	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-10505.46	1.68	9	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-10505.46	3.45	0	-10508.91

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-10508.91		611	0	611	216
Bottom (-2 Axis)		0	305	0	0	305

Shear Force and Reinforcement for Shear, V_{u2} & T_u

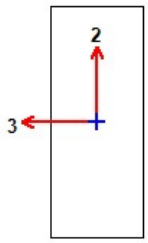
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
12	0	12	4	0.73

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
1.68	9	120	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
3RD FL	B77	1092	B200X500M25	1.5DL+1.5SLY	5185	5185	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	500	200	0	50	50

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-6874.94	2.08	8	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-6874.94	4.28	0	-6879.22

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-6879.22		377	0	377	216
Bottom (-2 Axis)		0	188	0	0	188

Shear Force and Reinforcement for Shear, V_{u2} & T_u

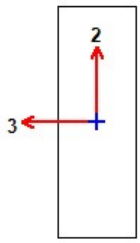
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
8	0	8	2	0.5

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
2.08	8	120	420	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
4TH FL	B399	539	B200X600M25	1.5DL+1.5LL	3650	3650	1	Ductile Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
200	600	200	0	30	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-mm	Factored T_u tonf-mm	Factored V_{u2} tonf	Factored P_u tonf
-1803.81	0.88	4	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-mm	Factored M_t tonf-mm	Positive Moment tonf-mm	Negative Moment tonf-mm
-1803.81	2.08	0	-1805.88

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-mm	Design +Moment tonf-mm	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-1805.88		274	0	72	274
Bottom (-2 Axis)		0	68	0	0	68

Shear Force and Reinforcement for Shear, V_{u2} & T_u

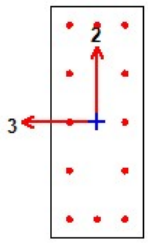
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
4	4	5	5	0.22

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-mm	V_u tonf	Core b_1 mm	Core d_1 mm	Rebar A_{svt}/s mm²/mm
0.88	4	160	560	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design (Summary)



Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	C24	8	CLM300X750M25	1.5DL-1.5SPECX	2900	3400	0.491	Ductile Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	750	60	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_C	γ_S
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u tonf	Design M_{u2} tonf-mm	Design M_{u3} tonf-mm	Minimum M_2 tonf-mm	Minimum M_3 tonf-mm	Rebar Area mm²	Rebar % %
177	3548.74	21267.69	3548.74	5465.06	1800	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment tonf-mm	Additional Moment tonf-mm	Minimum Moment tonf-mm
Major Bend(M3)	4.716262	2900	11134.44	0	5465.06
Minor Bend(M2)	0.755843	2900	528.67	0	3548.74

Axial Compression Check for Seismic Design per IS 13920:2016 Section 7.1

Limit Compression Factor Unitless	Limit Compression Strength tonf	Compression D/C Ratio Unitless	Status
0.4	229	0.773361	OK

Shear Design for V_{u2} , V_{u3}

	Shear V_u tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s mm²/mm
Major, V_{u2}	9	14	8	3	0.33
Minor, V_{u3}	5	13	7	5	0.83

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area mm²	Shear Ratio Unitless
Major Shear, V_{u2}	0	3	19	115	225000	0.162
Minor Shear, V_{u3}	0	5	32	54	105000	0.601

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
0.13	0.599

Additional Moment Reduction Factor k (IS 39.7.1.1)

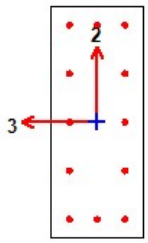
A_g mm²	A_{sc} mm²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
225000	1800	327	114	177	0.701603

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-mm)
Major Bending (M_3)	No	0.853	750	18.236	12	Yes	0
Minor Bending (M_2)	No	0.853	300	7.306	12	No	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Column Section Design (Summary)



Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
1ST FL	C14	34	CLM300X750M25	1.5DL-1.5SPECX	2900	3400	0.498	Ductile Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
300	750	60	30

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u tonf	Design M_{u2} tonf-mm	Design M_{u3} tonf-mm	Minimum M_2 tonf-mm	Minimum M_3 tonf-mm	Rebar Area mm²	Rebar % %
179	3584.3	-21199.57	3584.3	5519.83	1800	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment tonf-mm	Additional Moment tonf-mm	Minimum Moment tonf-mm
Major Bend(M3)	5.276973	2900	-10707.12	0	5519.83
Minor Bend(M2)	0.752936	2900	384.97	0	3584.3

Axial Compression Check for Seismic Design per IS 13920:2016 Section 7.1

Limit Compression Factor Unitless	Limit Compression Strength tonf	Compression D/C Ratio Unitless	Status
0.4	229	0.781111	OK

Shear Design for V_{u2} , V_{u3}

	Shear V_u tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s mm²/mm
Major, V_{u2}	9	14	8	3	0.33
Minor, V_{u3}	5	13	7	5	0.83

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area mm²	Shear Ratio Unitless
Major Shear, V_{u2}	0	3	19	115	225000	0.162
Minor Shear, V_{u3}	0	5	35	54	105000	0.656

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
0.13	0.651

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g mm²	A_{sc} mm²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
225000	1800	327	114	179	0.693258

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-mm)
Major Bending (M_3)	No	0.853	750	20.404	12	Yes	0
Minor Bending (M_2)	No	0.853	300	7.278	12	No	0

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
1ST FL	P106	26600	12715	800	200	Special Wall	0.654

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	26600	12315	26600	13115	800	200
Bottom	Leg 1	26600	12315	26600	13115	800	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	2658	0.0166	0.0025	1.5DL-1.5SPECX	116	8415.15	5389.12	160000
Bottom	2611	0.0163	0.0025	1.5DL-1.5SPECX	118	8475.25	-3961.31	160000

Shear Design

Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL-1.5SLY	125	10480.86	-6	10	22
Bottom	Leg 1	0.5	1.5DL-1.5SLY	128	-8343.23	-6	10	22

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	200	1.5DL+1.5SPECY	124	-529.36	0.0008	0.0005
Top–Right	Leg 1	200	1.5DL-1.5SLY	125	10480.86	0.0013	0.0005
Bottom–Left	Leg 1	200	1.5DL-1.5SLY	128	-8343.23	0.0012	0.0005
Botttom–Right	Leg 1	200	1.5DL+1.5SPECY	126	546.4	0.0008	0.0005

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
2ND FL	P104	26600	1200	800	200	Special Wall	0.721

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	26600	800	26600	1600	800	200
Bottom	Leg 1	26600	800	26600	1600	800	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	2300	0.0144	0.0025	1.5DL-1.5SPECX	102	8178.55	4779.99	160000
Bottom	2415	0.0151	0.0025	1.5DL-1.5SPECX	104	8217.81	-5632.71	160000

Shear Design

Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL-1.5SLY	105	7728.67	-5	10	22
Bottom	Leg 1	0.5	1.5DL-1.5SLY	107	-6433.19	-5	10	22

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	0	1.2DL+1.2LL+1.2SLX	0	0	0	0
Top–Right	Leg 1	200	1.5DL-1.5SLY	105	7728.67	0.001	0.0005
Bottom–Left	Leg 1	200	1.5DL-1.5SLY	107	-6433.19	0.001	0.0005
Botttom–Right	Leg 1	0	1.2DL+1.2LL+1.2SLX	0	0	0	0

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	Pier Ductility	LLRF
2ND FL	P111	34000	18850	900	200	Special Wall	0.741

Material Properties

E_c (tonf/mm²)	f_{ck} (tonf/mm²)	Lt.Wt Factor (Unitless)	f_y (tonf/mm²)	f_{ys} (tonf/mm²)
2.5493	0.0025	1	0.051	0.0423

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	34000	18400	34000	19300	900	200
Bottom	Leg 1	34000	18400	34000	19300	900	200

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-mm	M_{u3} tonf-mm	Pier A_g mm²
Top	1532	0.0085	0.0028	1.5DL-1.5SPECX	89	6461.36	-11328.86	180000
Bottom	1633	0.0091	0.0028	1.5DL-1.5SPECX	91	6505.52	12374.62	180000

Shear Design

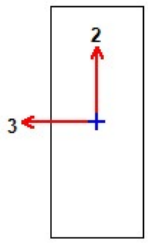
Station Location	ID	Rebar mm²/mm	Shear Combo	P_u tonf	M_u tonf-mm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.5	1.5DL+1.5SLY	98	-14548.3	9	10	23
Bottom	Leg 1	0.5	1.5DL+1.5SLY	100	13036.99	9	10	24

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u tonf	M_u tonf-mm	Stress Comp tonf/mm²	Stress Limit tonf/mm²
Top–Left	Leg 1	200	1.5DL+1.5SLY	98	-14548.3	0.0011	0.0005
Top–Right	Leg 1	0	1.2DL+1.2LL+1.2SLX	0	0	0	0
Bottom–Left	Leg 1	0	1.2DL+1.2LL+1.2SLX	0	0	0	0
Botttom–Right	Leg 1	200	1.5DL+1.5SLY	100	13036.99	0.001	0.0005

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (cm)	LLRF	Type
3rd Floor	B9	400	B200X500M25	1.5DL-1.5SLY	533	533	1	Ductile Frame

Section Properties

b (cm)	h (cm)	b_f (cm)	d_s (cm)	d_{ct} (cm)	d_{cb} (cm)
20	50	20	0	3	3

Material Properties

E_c (tonf/cm²)	f_{ck} (tonf/cm²)	Lt.Wt Factor (Unitless)	f_y (tonf/cm²)	f_{ys} (tonf/cm²)
254.929	0.255	1	5.099	4.232

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-cm	Factored T_u tonf-cm	Factored V_{u2} tonf	Factored P_u tonf
-592.396	0.01	0.3511	-0.0173

Design Moments, M_{u3} & M_t

Factored Moment tonf-cm	Factored M_t tonf-cm	Positive Moment tonf-cm	Negative Moment tonf-cm
-592.396	0.021	0	-592.417

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-cm	Design +Moment tonf-cm	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-592.417		2.97	0	2.97	2.26
Bottom (-2 Axis)		0	1.49	0	0	1.49

Shear Force and Reinforcement for Shear, V_{u2} & T_u

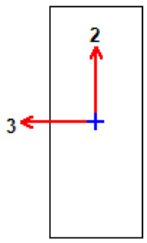
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s cm²/cm
2.3677	0	3.8341	2.0958	0.0222

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-cm	V_u tonf	Core b_1 cm	Core d_1 cm	Rebar A_{svt}/s cm²/cm
0.009	0.3511	16	46	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (cm)	LLRF	Type
3rd Floor	B107	495	B200X500M25	1.5DL-1.5SLY	0	397	1	Ductile Frame

Section Properties

b (cm)	h (cm)	b_f (cm)	d_s (cm)	d_{ct} (cm)	d_{cb} (cm)
20	50	20	0	3	3

Material Properties

E_c (tonf/cm²)	f_{ck} (tonf/cm²)	Lt.Wt Factor (Unitless)	f_y (tonf/cm²)	f_{ys} (tonf/cm²)
254.929	0.255	1	5.099	4.232

Design Code Parameters

ɣc	ɣs
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-cm	Factored T_u tonf-cm	Factored V_{u2} tonf	Factored P_u tonf
-775.648	0.041	4.4278	0.0234

Design Moments, M_{u3} & M_t

Factored Moment tonf-cm	Factored M_t tonf-cm	Positive Moment tonf-cm	Negative Moment tonf-cm
-775.648	0.084	0	-821.85

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-cm	Design +Moment tonf-cm	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-821.85		4.2	0	4.2	2.26
Bottom (-2 Axis)		0	2.1	0	0	2.1

Shear Force and Reinforcement for Shear, V_{u2} & T_u

Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s cm²/cm

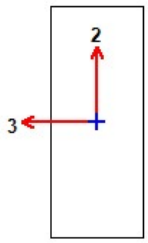
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv} /s cm²/cm
7.2933	0	7.2966	4.1655	0.0422

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-cm	V_u tonf	Core b_1 cm	Core d_1 cm	Rebar A_{svt} /s cm²/cm
0.041	4.4278	16	46	0

ETABS Concrete Frame Design

IS 456:2000 + IS 13920:2016 Beam Section Design (Summary)



Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (cm)	LLRF	Type
3rd Floor	B134	750	B200X500M25	1.5DL-1.5SLX	0	318	1	Ductile Frame

Section Properties

b (cm)	h (cm)	b_f (cm)	d_s (cm)	d_{ct} (cm)	d_{cb} (cm)
20	50	20	0	3	3

Material Properties

E_c (tonf/cm²)	f_{ck} (tonf/cm²)	Lt.Wt Factor (Unitless)	f_y (tonf/cm²)	f_{ys} (tonf/cm²)
254.929	0.255	1	5.099	4.232

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-cm	Factored T_u tonf-cm	Factored V_{u2} tonf	Factored P_u tonf
-736.837	0.033	5.9457	0.0354

Design Moments, M_{u3} & M_t

Factored Moment tonf-cm	Factored M_t tonf-cm	Positive Moment tonf-cm	Negative Moment tonf-cm
-736.837	0.068	0	-736.905

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment tonf-cm	Design +Moment tonf-cm	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-736.905		3.73	0	3.73	2.26
Bottom (-2 Axis)		0	1.87	0	0	1.87

Shear Force and Reinforcement for Shear, V_{u2} & T_u

Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s cm²/cm
8.834	0	8.8367	5.2436	0.0511

Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u tonf-cm	V_u tonf	Core b_1 cm	Core d_1 cm	Rebar A_{svt}/s cm²/cm
0.033	5.9457	16	46	0

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (cm)	Centroid Y (cm)	Length (cm)	Thickness (cm)	Pier Ductility	LLRF
1st Floor	P36	1626.5	426.5	100	20	Special Wall	0.582

Material Properties

E_c (tonf/cm²)	f_{ck} (tonf/cm²)	Lt.Wt Factor (Unitless)	f_y (tonf/cm²)	f_{ys} (tonf/cm²)
254.929	0.255	1	5.099	4.232

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 cm	Left Y_1 cm	Right X_2 cm	Right Y_2 cm	Length cm	Thickness cm
Top	Leg 1	1626.5	376.5	1626.5	476.5	100	20
Bottom	Leg 1	1626.5	376.5	1626.5	476.5	100	20

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (cm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-cm	M_{u3} tonf-cm	Pier A_g cm²
Top	40.19	0.0201	0.0025	1.5DL-1.5SPECY	216.7777	714.789	2224.586	2000
Bottom	44	0.022	0.0025	1.5DL-1.5SPECY	219.3772	722.301	-2664.053	2000

Shear Design

Station Location	ID	Rebar cm²/cm	Shear Combo	P_u tonf	M_u tonf-cm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.05	1.5DL-1.5SPECY	157.109	2224.586	-14.0634	12.2366	26.956
Bottom	Leg 1	0.05	1.5DL-1.5SPECY	159.7085	2373.054	-14.0634	12.2366	26.956

Boundary Element Check

Station Location	ID	Edge Length (cm)	Governing Combo	P_u tonf	M_u tonf-cm	Stress Comp tonf/cm²	Stress Limit tonf/cm²
Top–Left	Leg 1	30	1.5DL+1.5SLY	221.5275	-1595.248	0.159	0.051
Top–Right	Leg 1	30	1.5DL+1.5SPECY	216.7777	2224.586	0.175	0.051
Bottom–Left	Leg 1	40	1.5DL+1.5SPECY	219.3772	-2664.053	0.19	0.051
Botttom–Right	Leg 1	40	1.5DL+1.5SLY	224.127	2428.843	0.185	0.051

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (cm)	Centroid Y (cm)	Length (cm)	Thickness (cm)	Pier Ductility	LLRF
1st Floor	P15	1437.5	915.25	80.5	20	Special Wall	0.558

Material Properties

E_c (tonf/cm²)	f_{ck} (tonf/cm²)	Lt.Wt Factor (Unitless)	f_y (tonf/cm²)	f_{ys} (tonf/cm²)
254.929	0.255	1	5.099	4.232

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 cm	Left Y_1 cm	Right X_2 cm	Right Y_2 cm	Length cm	Thickness cm
Top	Leg 1	1437.5	875	1437.5	955.5	80.5	20
Bottom	Leg 1	1437.5	875	1437.5	955.5	80.5	20

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (cm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-cm	M_{u3} tonf-cm	Pier A_g cm²
Top	28.15	0.0175	0.0025	1.5DL+1.5LL	192.5228	-531.101	647.518	1610
Bottom	28.86	0.0179	0.0025	1.5DL+1.5LL	194.6154	537.149	-654.556	1610

Shear Design

Station Location	ID	Rebar cm²/cm	Shear Combo	P_u tonf	M_u tonf-cm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.05	1.5DL-1.5SLY	137.4087	893.931	-6.254	9.8505	21.6996
Bottom	Leg 1	0.05	1.5DL-1.5SLY	139.5013	-1301.402	-6.254	9.8505	21.6996

Boundary Element Check

Station Location	ID	Edge Length (cm)	Governing Combo	P_u tonf	M_u tonf-cm	Stress Comp tonf/cm²	Stress Limit tonf/cm²
Top–Left	Leg 1	20	1.2DL+1.2LL+1.2SPECY	156.3076	-387.561	0.115	0.051
Top–Right	Leg 1	20	1.2DL+1.2LL+1.2SLX	160.736	246.94	0.111	0.051
Bottom–Left	Leg 1	30	1.2DL+1.2LL+1.2SPECY	157.9817	-1033.103	0.146	0.051
Botttom–Right	Leg 1	20	1.2DL+1.2LL+1.2SPECX	161.4893	182.696	0.109	0.051

ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (cm)	Centroid Y (cm)	Length (cm)	Thickness (cm)	Pier Ductility	LLRF
1st Floor	P8	1840.5	1415.5	80	20	Special Wall	0.729

Material Properties

E_c (tonf/cm²)	f_{ck} (tonf/cm²)	Lt.Wt Factor (Unitless)	f_y (tonf/cm²)	f_{ys} (tonf/cm²)
254.929	0.255	1	5.099	4.232

Design Code Parameters

Γ_S	Γ_C	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 cm	Left Y_1 cm	Right X_2 cm	Right Y_2 cm	Length cm	Thickness cm
Top	Leg 1	1840.5	1375.5	1840.5	1455.5	80	20
Bottom	Leg 1	1840.5	1375.5	1840.5	1455.5	80	20

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (cm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u tonf	M_{u2} tonf-cm	M_{u3} tonf-cm	Pier A_g cm²
Top	11.96	0.0075	0.0025	1.5DL-1.5SPECY	103.6692	392.244	1501.877	1600
Bottom	14.63	0.0091	0.0025	1.5DL-1.5SPECY	105.7488	398.254	-1763.518	1600

Shear Design

Station Location	ID	Rebar cm²/cm	Shear Combo	P_u tonf	M_u tonf-cm	V_u tonf	V_c tonf	$V_c + V_s$ tonf
Top	Leg 1	0.05	1.5DL-1.5SPECY	66.8174	1501.877	-9.4547	8.2597	20.0352
Bottom	Leg 1	0.05	1.5DL-1.5SPECY	68.897	1723.214	-9.4547	9.1588	20.9343

Boundary Element Check

Station Location	ID	Edge Length (cm)	Governing Combo	P_u tonf	M_u tonf-cm	Stress Comp tonf/cm²	Stress Limit tonf/cm²
Top–Left	Leg 1	20	1.5DL+1.5SLY	106.7598	-1358.299	0.13	0.051
Top–Right	Leg 1	20	1.5DL+1.5SPECY	103.6692	1501.877	0.135	0.051
Bottom–Left	Leg 1	20	1.5DL+1.5SPECY	105.7488	-1763.518	0.149	0.051
Botttom–Right	Leg 1	20	1.5DL+1.5SLY	108.8394	1725.175	0.149	0.051

SLAB MARKING	S2	
CONCRETE (Fck)=	25	Mpa
STEEL (fy)	500	Mpa
xumax/d=	0.4560	
Mulim/bd^2=	3.3256	
50XFck/fy=	2.5	
SLAB DEPTH=	**135**	**mm**
CLEAR COVER=	**20**	**mm**

REQUIRED DEPTH=	**68.796**	**mm**
EFFECTIVE DEPTH (d)=	115	mm
DEAD LOAD (DL)=	0.338	T/m^2
LIVE LOAD (L)=	0.200	T/m^2
FLOOR FINISH and FILLING LOAD=	0.125	T/m^2
Total LOAD=	0.663	T/m^2

S1 Step 1 Slab dimensions

Clear LENGTH (Ly)=	4.3	m
Clear WIDTH(Lx)=	3.45	m
EFFECTIVE LENGTH=	4.435	m
EFFECTIVE WIDTH=	3.585	m
SPAN TO DEPTH RATIO=	26.556	

Step 2 $\left(\frac{l_y}{l_x}\right)$ 1.24

Step 3 Edge condition

	Type	4	**TWO ADJACENT EDGE DISCONTINOUS**

Step 5 Reinforcement

	Coefficients	Ultimate moments	4.6Mu/fckbd^2	p_t (%)	A_{st} (mm^2)	Spacing Provided	BAR DIA(mm)
	0.062	0.792	0.110	0.14	163.0	125	8
MIDSPAN	0.047	0.595	0.083	0.12	138.0	125	8
Long span							
SUPPORT	0.047	0.600	0.084	0.12	138.0	175	8
MIDSPAN	0.035	0.447	0.062	0.12	138.0	175	8

CHECK FOR SERVICABILITY

SHORT SPAN

	pt Provided	f_s	Modification factor	depth required	
SUPPORT	0.298	117.5	2.00	91.70	OKAY
MIDSPAN	0.298	99.5	2.00	91.70	OKAY
LONG SPAN					
SUPPORT	0.213	139.3	2.00	108.70	OKAY
MIDSPAN	0.213	139.3	2.00	108.70	OKAY

DESIGN OF ISOLATED FOOTING (F-1)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2700 2100 0500 / 250

Foundation under column :

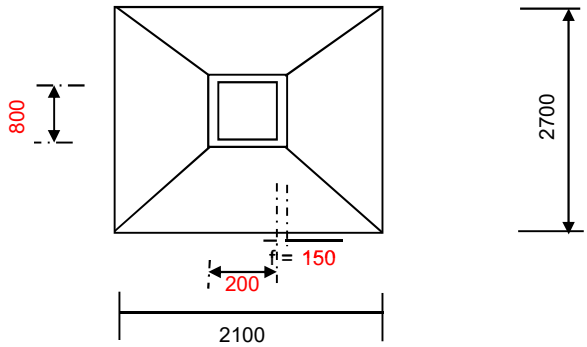
Column load on Foundation = 84 T

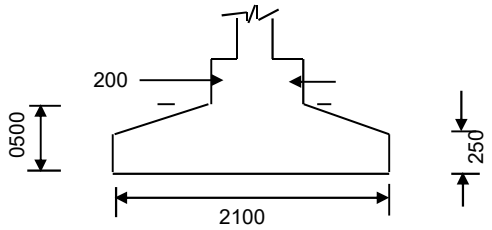
s/w of footing = 0

Total = 84 T SBC of Soil= 15.0 T/m2

Area Reqd = 5.600 5.60 m^2

Provided Area = 5.67 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.800 m

Moment at the face of column = (15 X 0.8^2)/2 4.80 T-m/m run

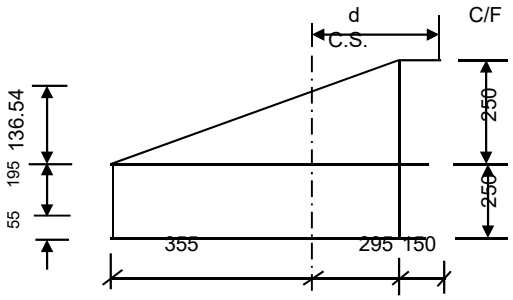
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.36 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 305.94 mm 389.0625

Shear at critical section = 5.33 T/m run

Shear stress at critical sectic τ_v = 0.26 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.25

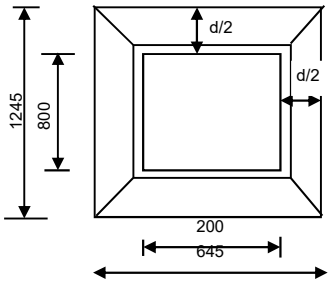
*(From Table 61, SP-16:1980)

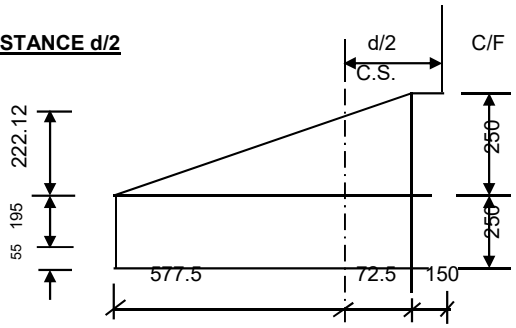
For pt = 0.25 τ_c = 0.36 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3780 mm

Critical Depth = 416.12 mm

Shear at critical section = 84.00 T/m run

Shear stress at critical section τ_v = 0.80 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress K_s τ = 0.9375

Where, Ks=(0.5+ β) $\not<$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-2)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2900 3400 0700 / 350

Foundation under column :

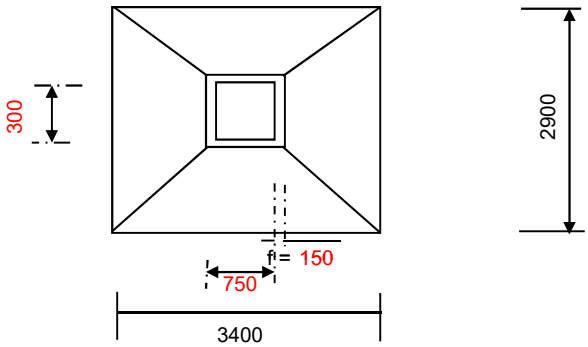
Column load on Foundation = 140 T

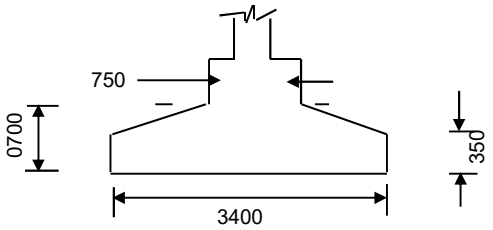
s/w of footing = 0

Total = 140 T SBC of Soil= 15.0 T/m2

Area Reqd = 9.333 9.33 m^2

Provided Area = 9.86 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.175 m

Moment at the face of column = (15 X 1.175^2)/2 10.35 T-m/m run

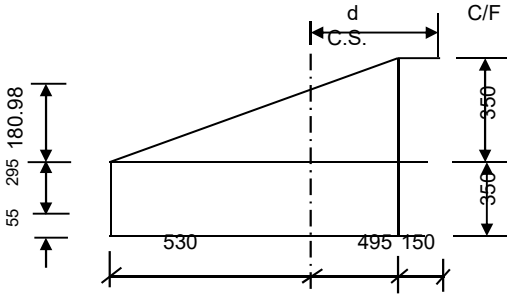
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/bd^2 = 0.37 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 452.87 mm 542.1276596

Shear at critical section = 7.95 T/m run

Shear stress at critical secti τ_v = 0.26 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

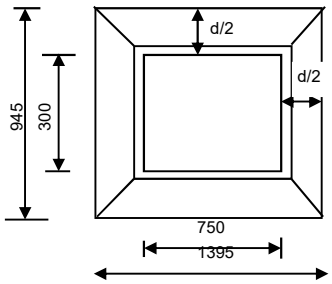
*(From Table 61, SP-16:1980)

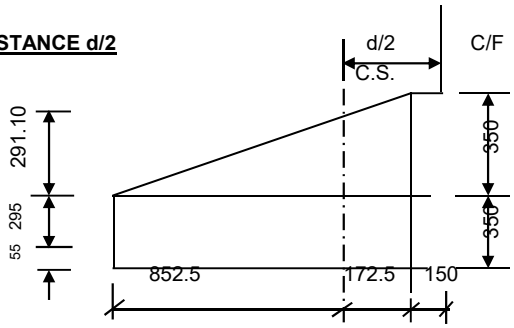
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ **[Hence OK]**

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4680 mm

Critical Depth = 585.10 mm

Shear at critical section = 140.00 T/m run

Shear stress at critical section τ_v = 0.77 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.125

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.4 } **Ks** = 0.9

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ **[Hence OK]**

DESIGN OF ISOLATED FOOTING (F-3)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3000 2300 0500 / 250

Foundation under column :

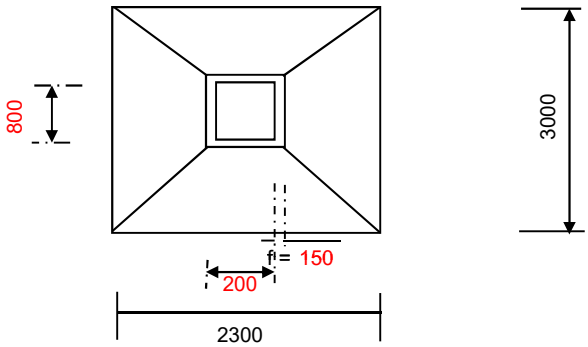
Column load on Foundation = 98 T

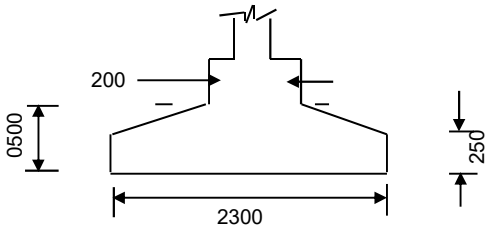
s/w of footing = 0

Total = 98 T SBC of Soil= 15.0 T/m2

Area Reqd = 6.533 6.53 m^2

Provided Area = 6.9 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.900 m

Moment at the face of column = (15 X 0.9^2)/2 6.08 T-m/m run

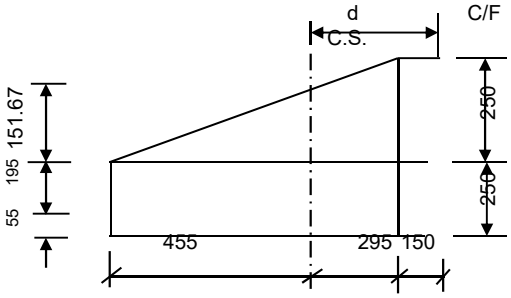
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.46 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 321.39 mm 373.6111111

Shear at critical section = 6.83 T/m run

Shear stress at critical secti τ_v = 0.32 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.23

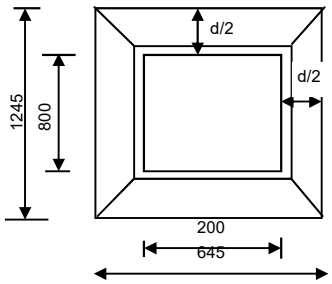
*(From Table 61, SP-16:1980)

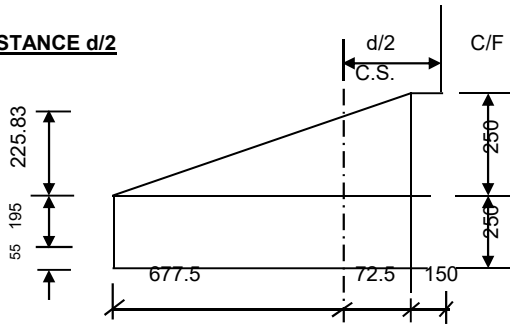
For pt = 0.23 τ_c = 0.35 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3780 mm

Critical Depth = 419.83 mm

Shear at critical section = 98.00 T/m run

Shear stress at critical section τ_v = 0.93 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-4)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2600 2000 0500 / 250

Foundation under column :

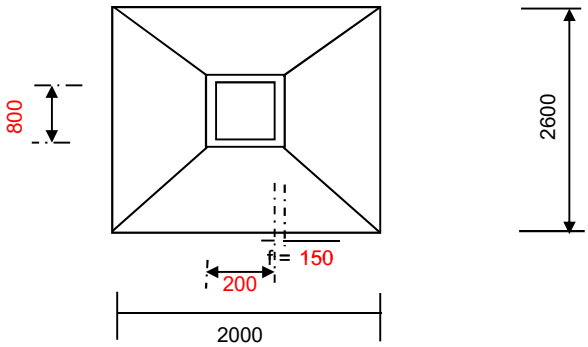
Column load on Foundation = 78 T

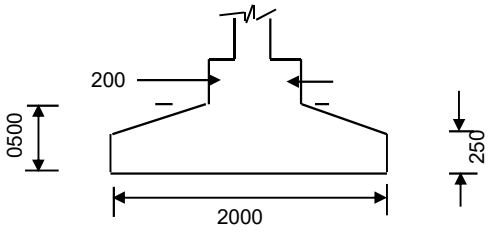
s/w of footing = 0

Total = 78 T SBC of Soil= 15.0 T/m2

Area Reqd = 5.200 5.20 m^2

Provided Area = 5.2 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.750 m

Moment at the face of column = (15 X 0.75^2)/2 4.22 T-m/m run

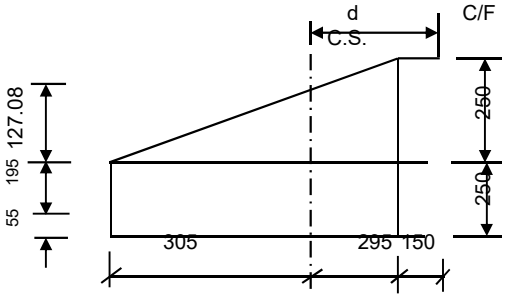
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.32 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 296.67 mm 398.3333333

Shear at critical section = 4.58 T/m run

Shear stress at critical secti τ_v = 0.23 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.25

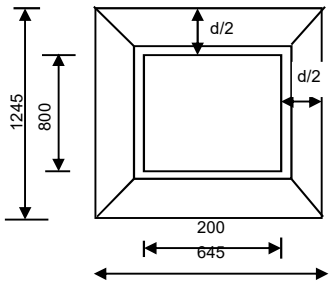
*(From Table 61, SP-16:1980)

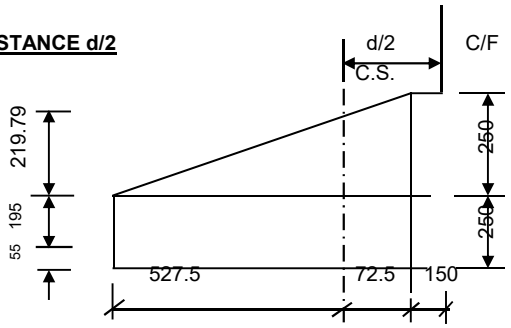
For pt = 0.25 τ_c = 0.36 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3780 mm

Critical Depth = 413.79 mm

Shear at critical section = 78.00 T/m run

Shear stress at critical section τ_v = 0.75 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β) $\neq$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-5)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2700 2000 0500 / 250

Foundation under column :

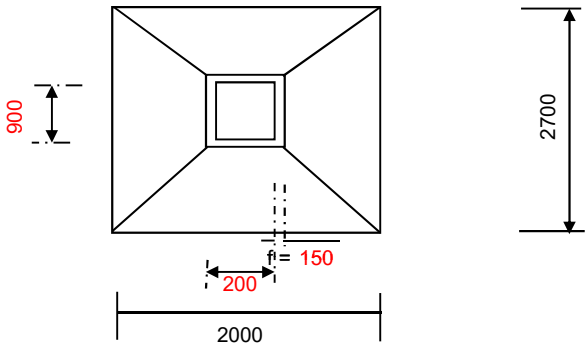
Column load on Foundation = 80 T

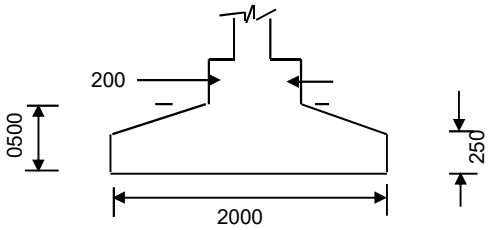
s/w of footing = 0

Total = 80 T SBC of Soil= 15.0 T/m2

Area Reqd = 5.333 5.33 m^2

Provided Area = 5.4 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.750 m

Moment at the face of column = (15 X 0.75^2)/2 4.22 T-m/m run

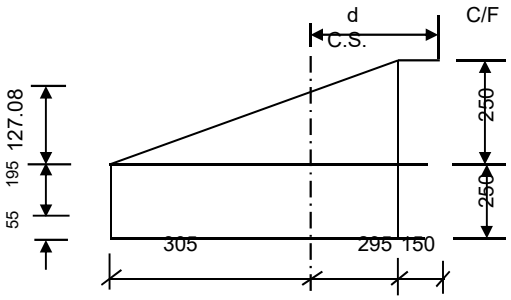
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.32 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 296.67 mm 398.3333333

Shear at critical section = 4.58 T/m run

Shear stress at critical secti τ_v = 0.23 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.25

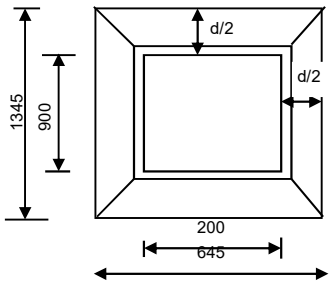
*(From Table 61, SP-16:1980)

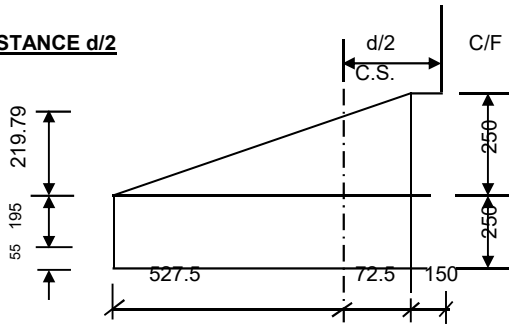
For pt = 0.25 τ_c = 0.36 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3980 mm

Critical Depth = 413.79 mm

Shear at critical section = 80.00 T/m run

Shear stress at critical section τ_v = 0.73 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.902778

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.22222 **Ks** = 0.722222222

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-6)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2600 1900 0500 / 250

Foundation under column :

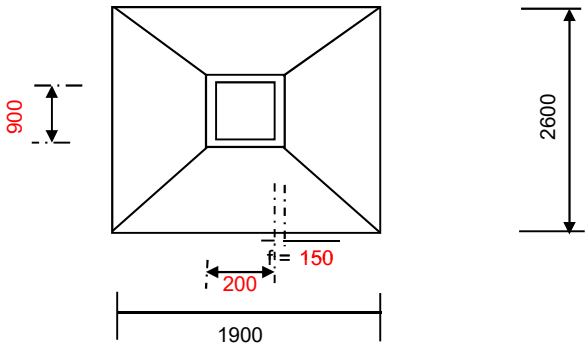
Column load on Foundation = 72 T

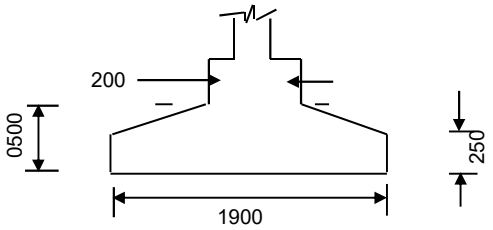
s/w of footing = 0

Total = 72 T SBC of Soil= 15.0 T/m2

Area Reqd = 4.800 4.80 m^2

Provided Area = 4.94 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.700 m

Moment at the face of column = (15 X 0.7^2)/2 3.68 T-m/m run

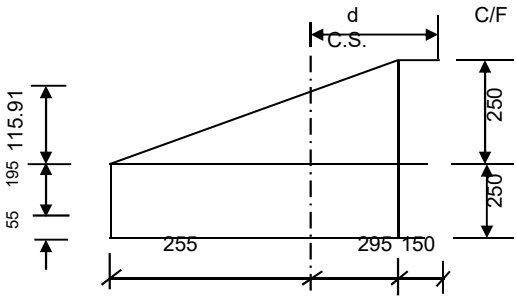
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.28 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 286.07 mm 408.9285714

Shear at critical section = 3.83 T/m run

Shear stress at critical secti τ_v = 0.20 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.26

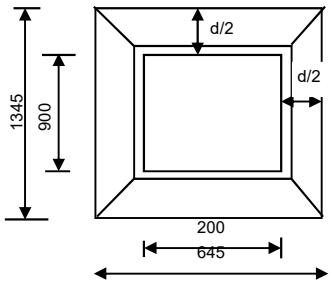
*(From Table 61, SP-16:1980)

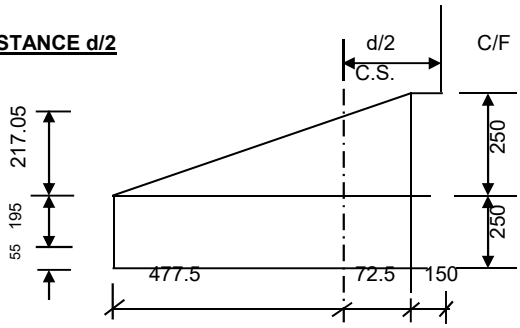
For pt = 0.26 τ_c = 0.37 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3980 mm

Critical Depth = 411.05 mm

Shear at critical section = 72.00 T/m run

Shear stress at critical section τ_v = 0.66 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.902778

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.22222 } **Ks** = 0.722222222

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-7)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3300 2800 0700 / 350

Foundation under column :

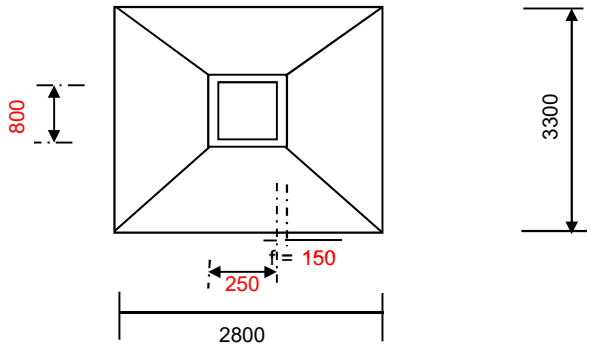
Column load on Foundation = 136 T

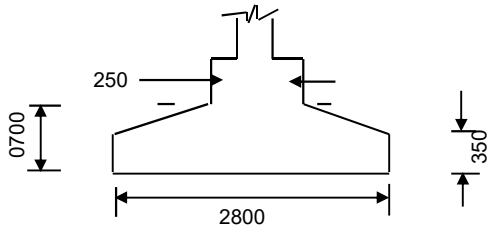
s/w of footing = 0

Total = 136 T SBC of Soil= 15.0 T/m2

Area Reqd = 9.067 9.07 m^2

Provided Area = 9.24 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.125 m

Moment at the face of column = (15 X 1.125^2)/2 9.49 T-m/m run

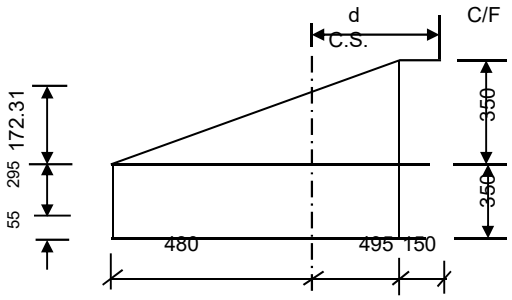
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/ bd^2 = 0.34 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 444.33 mm 550.6666667

Shear at critical section = 7.20 T/m run

Shear stress at critical secti τ_v = 0.24 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

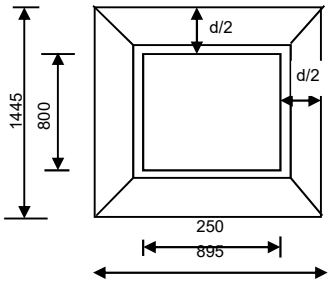
*(From Table 61, SP-16:1980)

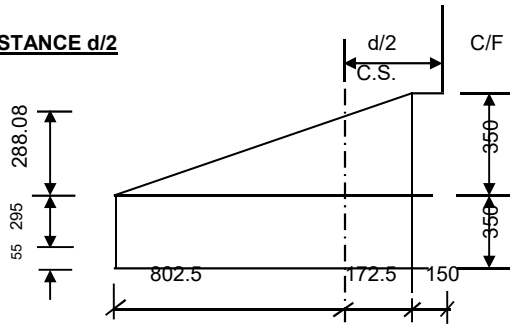
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4680 mm

Critical Depth = 582.08 mm

Shear at critical section = 136.00 T/m run

Shear stress at critical section τ_v = 0.75 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.015625

Where, Ks=(0.5+ β_c) $\not<$ 1

β_c = short side of the col / long side of the col = 0.3125 } **Ks** = 0.8125

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-8)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3000 2500 0600 / 300

Foundation under column :

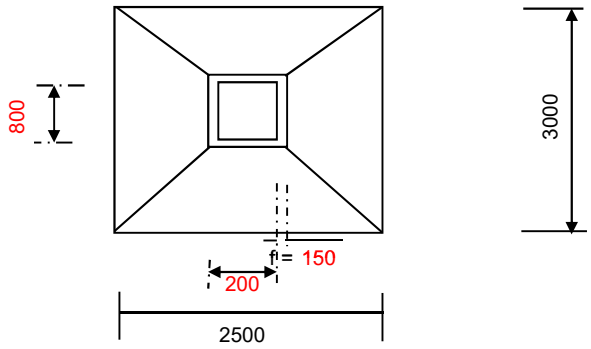
Column load on Foundation = 110 T

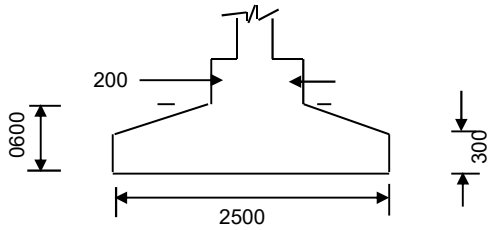
s/w of footing = 0

Total = 110 T SBC of Soil= 15.0 T/m2

Area Reqd = 7.333 7.33 m^2

Provided Area = 7.5 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.000 m

Moment at the face of column = (15 X 1^2)/2 7.50 T-m/m run

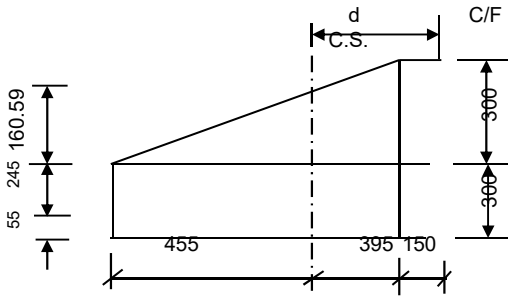
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/ bd^2 = 0.38 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150.c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 381.50 mm 463.5

Shear at critical section = 6.83 T/m run

Shear stress at critical secti τ_v = 0.27 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

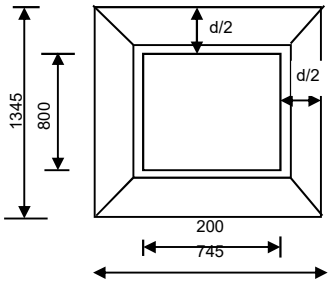
*(From Table 61, SP-16:1980)

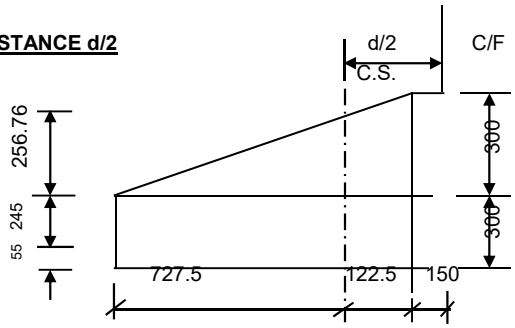
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4180 mm

Critical Depth = 500.76 mm

Shear at critical section = 110.00 T/m run

Shear stress at critical section τ_v = 0.79 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β_c) $\not>$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-9)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3200 2600 0600 / 300

Foundation under column :

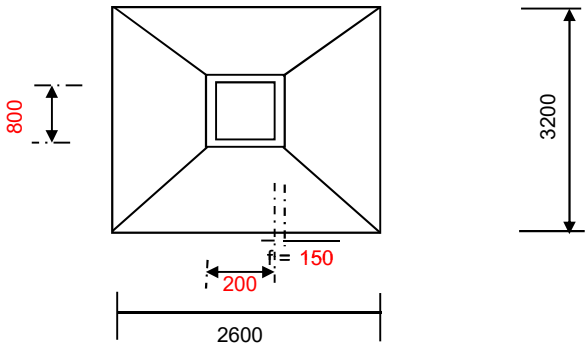
Column load on Foundation = 123 T

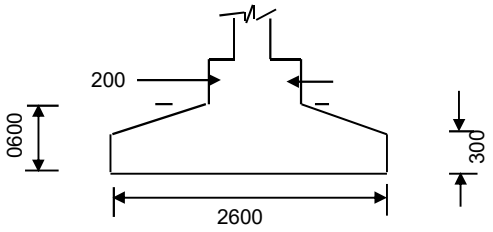
s/w of footing = 0

Total = 123 T SBC of Soil= 15.0 T/m2

Area Reqd = 8.200 8.20 m^2

Provided Area = 8.32 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.050 m

Moment at the face of column = (15 X 1.05^2)/2 8.27 T-m/m run

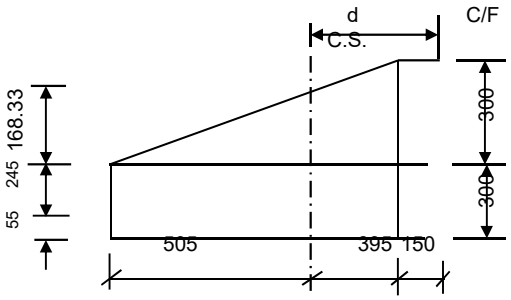
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/ bd^2 = 0.42 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 389.29 mm 455.7142857

Shear at critical section = 7.58 T/m run

Shear stress at critical secti τ_v = 0.29 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.19

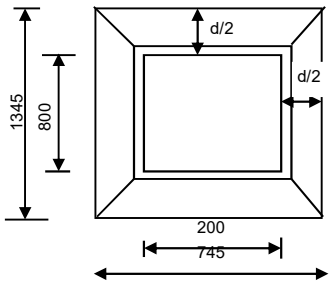
*(From Table 61, SP-16:1980)

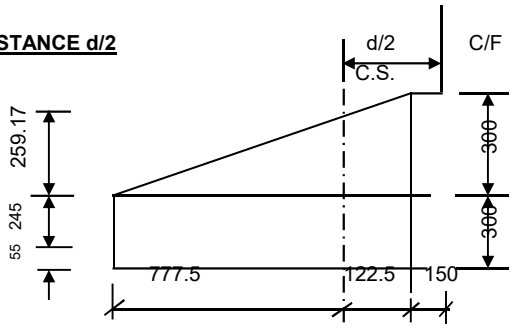
For pt = 0.19 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4180 mm

Critical Depth = 503.17 mm

Shear at critical section = 123.00 T/m run

Shear stress at critical section τ_v = 0.88 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-10)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2900 2400 0600 / 300

Foundation under column :

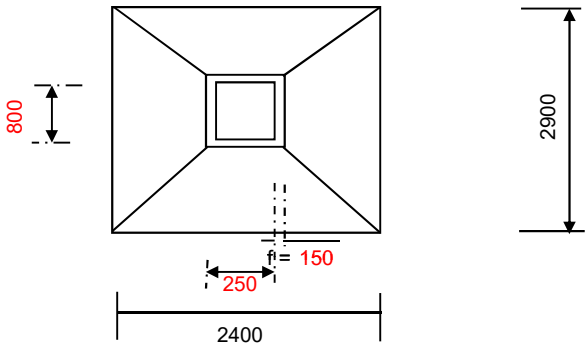
Column load on Foundation = 102 T

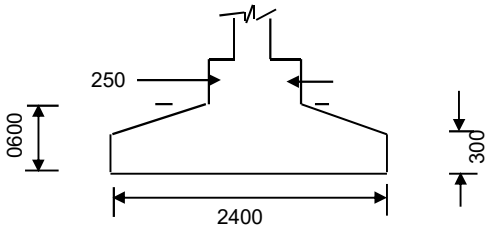
s/w of footing = 0

Total = 102 T SBC of Soil= 15.0 T/m2

Area Reqd = 6.800 6.80 m^2

Provided Area = 6.96 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.925 m

Moment at the face of column = (15 X 0.925^2)/2 6.42 T-m/m run

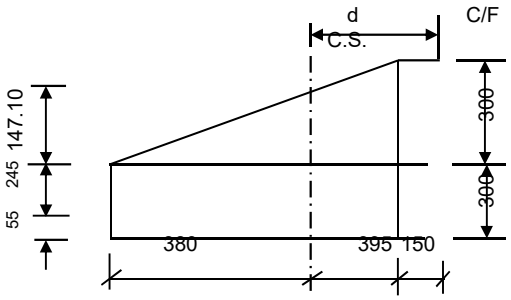
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/ bd^2 = 0.32 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 368.24 mm 476.7567568

Shear at critical section = 5.70 T/m run

Shear stress at critical secti τ_v = 0.23 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

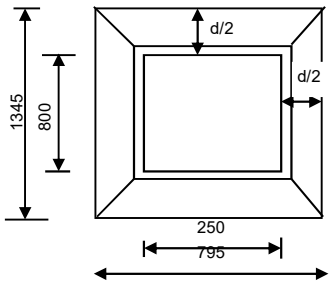
*(From Table 61, SP-16:1980)

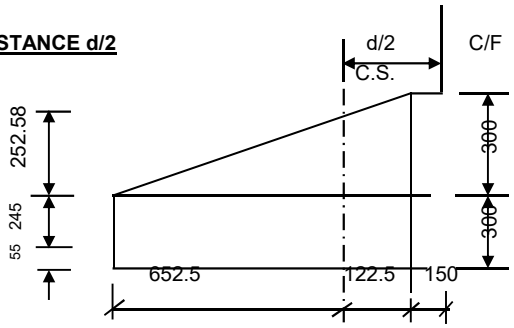
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4280 mm

Critical Depth = 496.58 mm

Shear at critical section = 102.00 T/m run

Shear stress at critical section τ_v = 0.72 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.015625

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.3125 } **Ks** = 0.8125

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

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DESIGN OF ISOLATED FOOTING (F-11)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2800 2200 0500 / 250

Foundation under column :

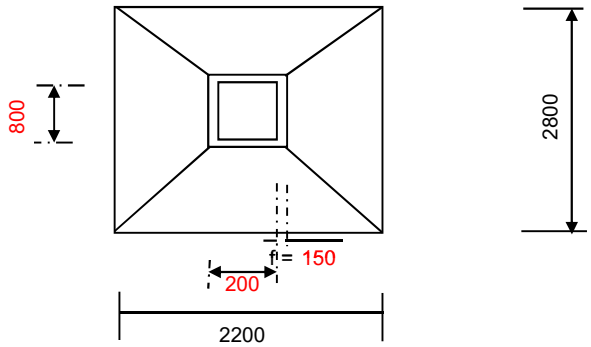
Column load on Foundation = 89 T

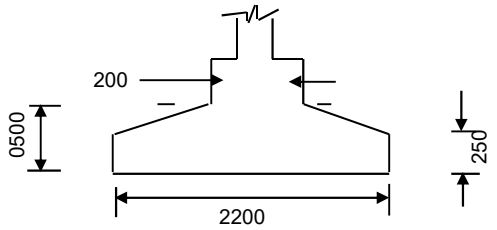
s/w of footing = 0

Total = 89 T SBC of Soil= 15.0 T/m2

Area Reqd = 5.933 5.93 m^2

Provided Area = 6.16 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.850 m

Moment at the face of column = (15 X 0.85^2)/2 5.42 T-m/m run

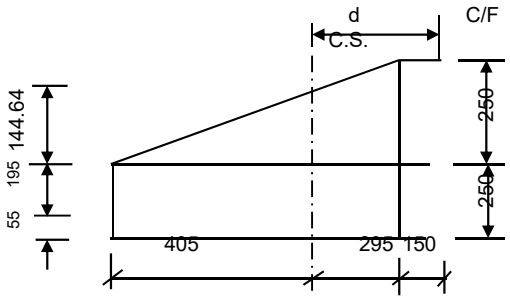
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.41 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 314.12 mm 380.8823529

Shear at critical section = 6.08 T/m run

Shear stress at critical secti τ_v = 0.29 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.24

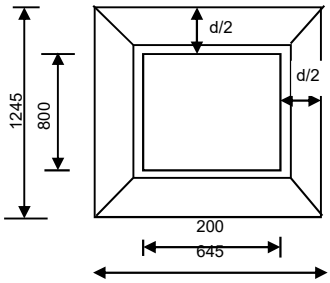
*(From Table 61, SP-16:1980)

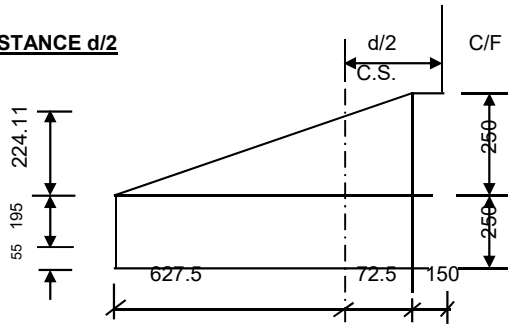
For pt = 0.24 τ_c = 0.35 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3780 mm

Critical Depth = 418.11 mm

Shear at critical section = 89.00 T/m run

Shear stress at critical section τ_v = 0.84 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β_c) $\not<$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-12)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3500 2800 0700 / 350

Foundation under column :

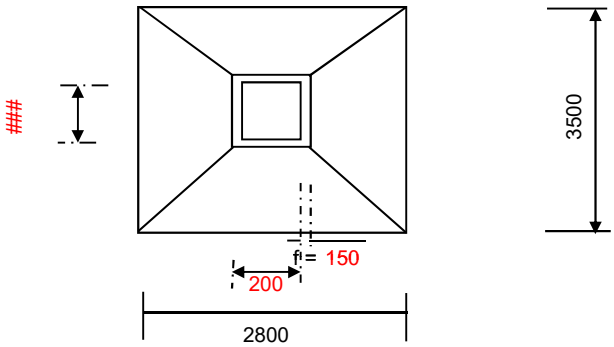
Column load on Foundation = 136 T

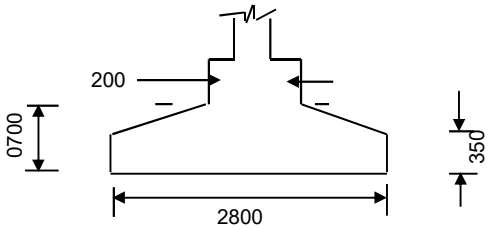
s/w of footing = 0

Total = 136 T SBC of Soil= 15.0 T/m2

Area Reqd = 9.067 9.07 m^2

Provided Area = 9.8 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.150 m

Moment at the face of column = (15 X 1.15^2)/2 9.92 T-m/m run

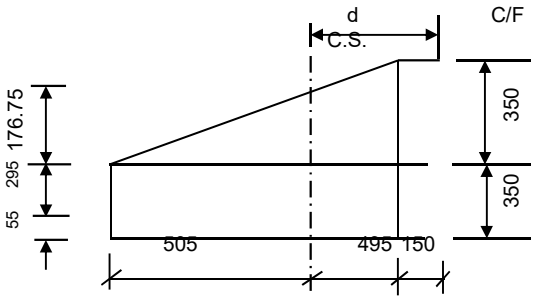
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/ bd^2 = 0.36 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 448.70 mm 546.3043478

Shear at critical section = 7.58 T/m run

Shear stress at critical secti τ_v = 0.25 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

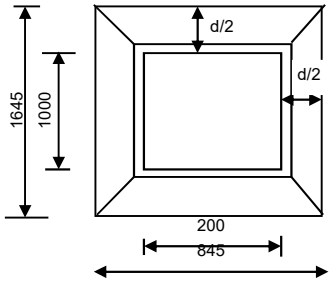
*(From Table 61, SP-16:1980)

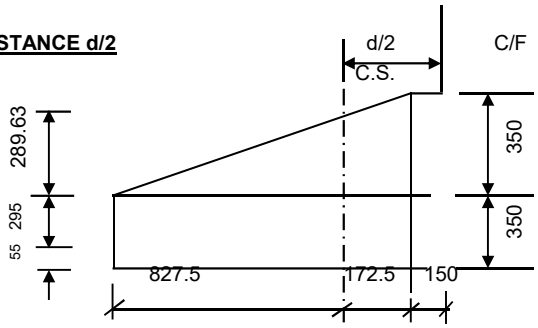
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4980 mm

Critical Depth = 583.63 mm

Shear at critical section = 136.00 T/m run

Shear stress at critical section τ_v = 0.70 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.875

Where, Ks=(0.5+ β) $\neq$ 1

β_c = short side of the col / long side of the col = 0.2 } **Ks** = 0.7

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-13)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3100 2600 0600 / 300

Foundation under column :

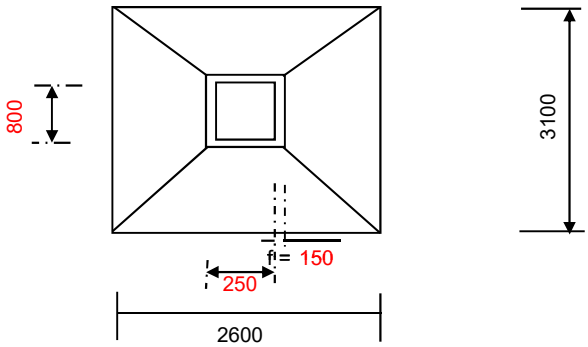
Column load on Foundation = 112 T

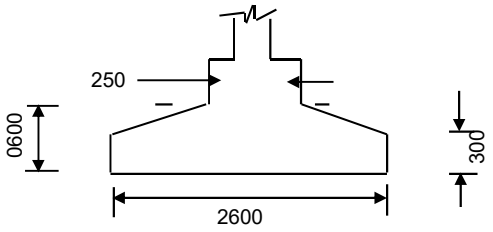
s/w of footing = 0

Total = 112 T SBC of Soil= 15.0 T/m2

Area Reqd = 7.467 7.47 m^2

Provided Area = 8.06 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.025 m

Moment at the face of column = (15 X 1.025^2)/2 7.88 T-m/m run

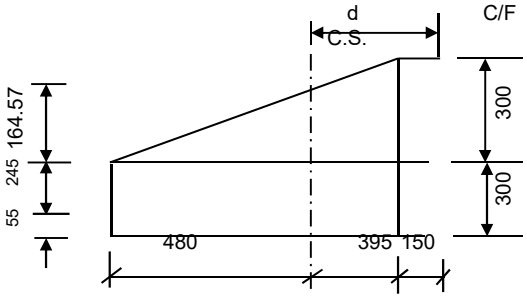
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/ bd^2 = 0.40 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 385.49 mm 459.5121951

Shear at critical section = 7.20 T/m run

Shear stress at critical secti τ_v = 0.28 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

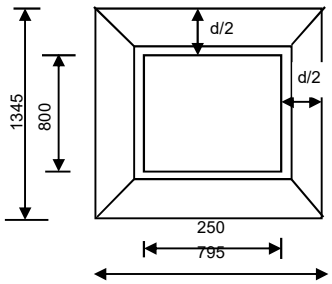
*(From Table 61, SP-16:1980)

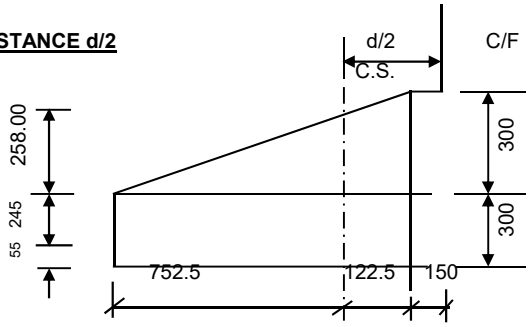
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4280 mm

Critical Depth = 502.00 mm

Shear at critical section = 112.00 T/m run

Shear stress at critical section τ_v = 0.78 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.015625

Where, Ks=(0.5+ β) $\neq$ 1

β_c = short side of the col / long side of the col = 0.3125 } **Ks** = 0.8125

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-14)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3200 2400 0600 / 300

Foundation under column :

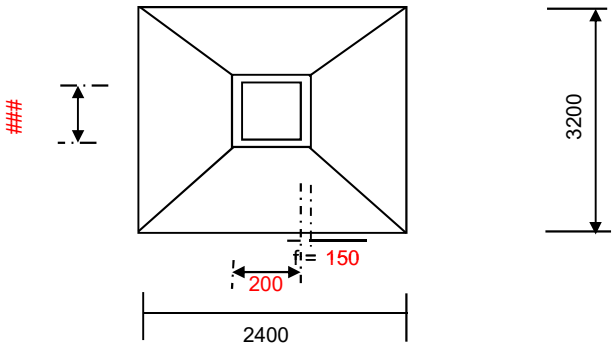
Column load on Foundation = 114 T

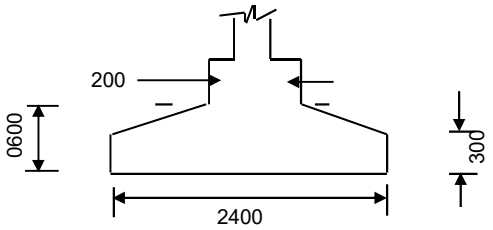
s/w of footing = 0

Total = 114 T SBC of Soil= 15.0 T/m2

Area Reqd = 7.600 7.60 m^2

Provided Area = 7.68 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.950 m

Moment at the face of column = (15 X 0.95^2)/2 6.77 T-m/m run

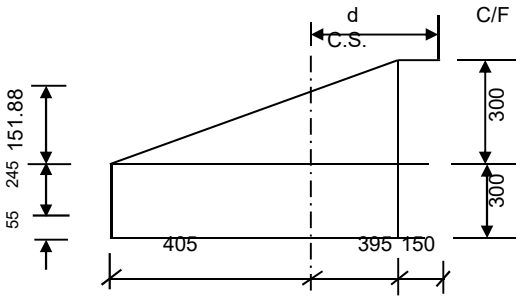
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/bd^2 = 0.34 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 372.89 mm 472.1052632

Shear at critical section = 6.08 T/m run

Shear stress at critical secti τ_v = 0.24 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

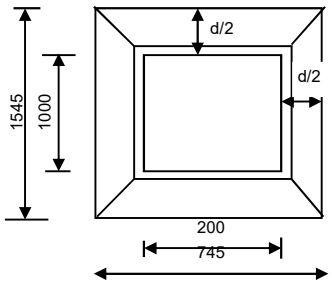
*(From Table 61, SP-16:1980)

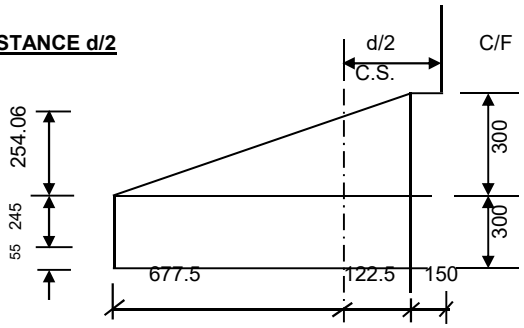
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4580 mm

Critical Depth = 498.06 mm

Shear at critical section = 114.00 T/m run

Shear stress at critical section τ_v = 0.75 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.875

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.2 } **Ks** = 0.7

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-15)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3600 2900 0700 / 350

Foundation under column :

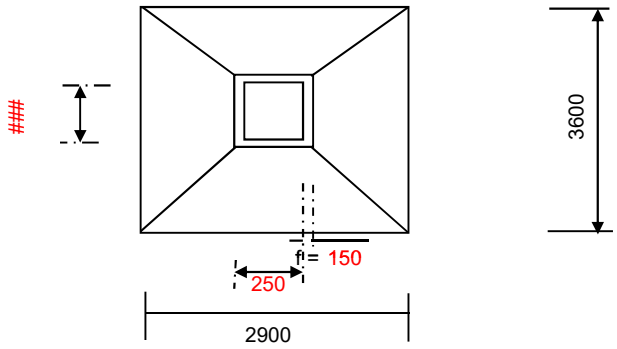
Column load on Foundation = 145 T

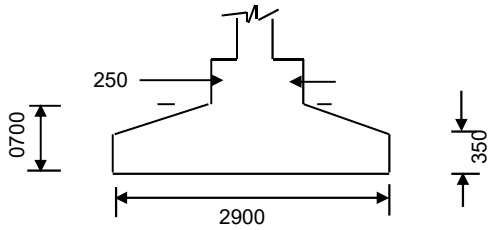
s/w of footing = 0

Total = 145 T SBC of Soil= 15.0 T/m2

Area Reqd = 9.667 9.67 m^2

Provided Area = 10.44 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.175 m

Moment at the face of column = (15 X 1.175^2)/2 10.35 T-m/m run

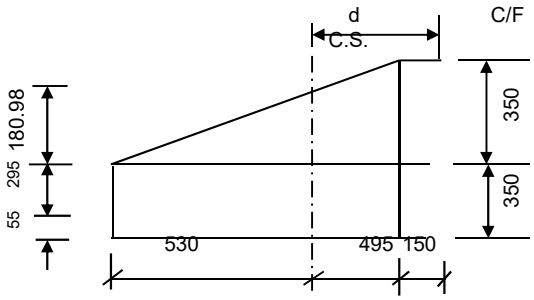
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/ bd^2 = 0.37 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 452.87 mm 542.1276596

Shear at critical section = 7.95 T/m run

Shear stress at critical secti τ_v = 0.26 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

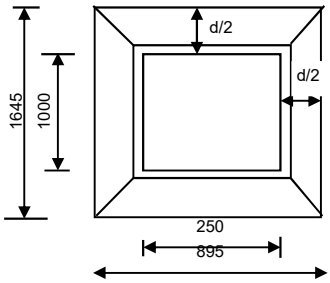
*(From Table 61, SP-16:1980)

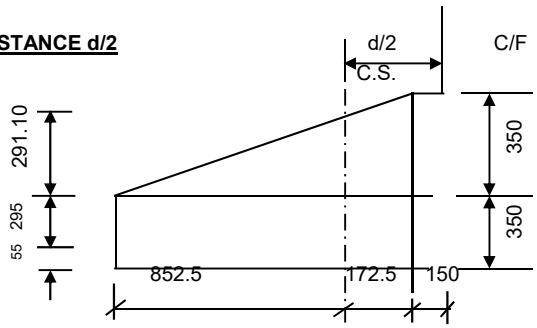
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 5080 mm

Critical Depth = 585.10 mm

Shear at critical section = 145.00 T/m run

Shear stress at critical section τ_v = 0.73 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β_c) $\not<$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-16)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2700 3200 0600 / 300

Foundation under column :

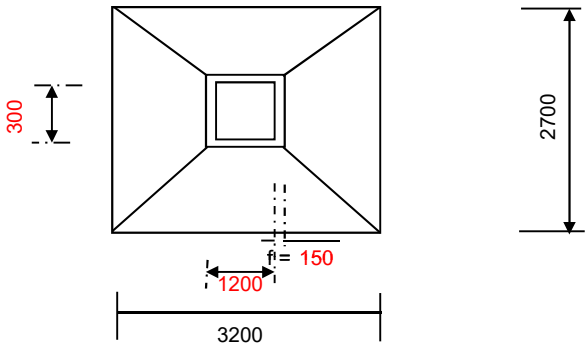
Column load on Foundation = 130 T

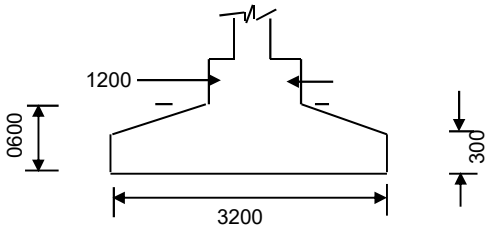
s/w of footing = 0

Total = 130 T SBC of Soil= 15.0 T/m2

Area Reqd = 8.667 8.67 m^2

Provided Area = 8.640 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.05 T/m^2

O.K.

Max Cantilever length = 0.850 m

Moment at the face of column = 462962962963 X 0.8 5.44 T-m/m run

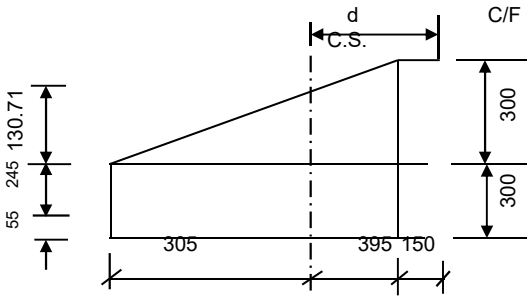
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/bd^2 = 0.27 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 352.65 mm 492.3529412

Shear at critical section = 4.59 T/m run

Shear stress at critical secti τ_v = 0.20 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.21

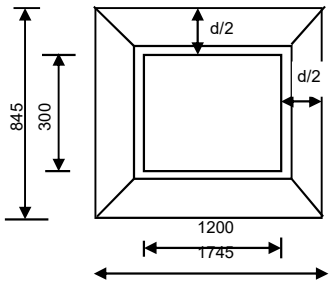
*(From Table 61, SP-16:1980)

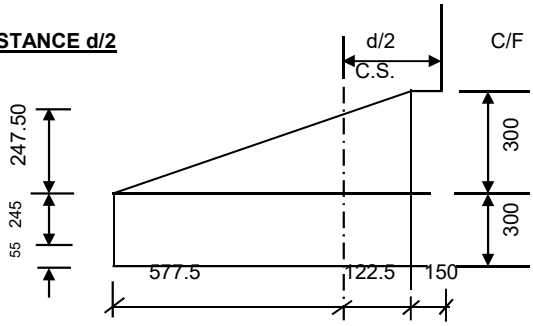
For pt = 0.21 τ_c = 0.34 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 5180 mm

Critical Depth = 491.50 mm

Shear at critical section = 130.00 T/m run

Shear stress at critical section τ_v = 0.77 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-17)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3400 2800 0700 / 350

Foundation under column :

Column load on Foundation = 134 T

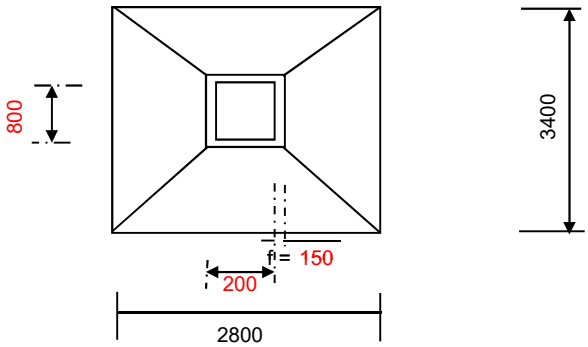
s/w of footing = 0

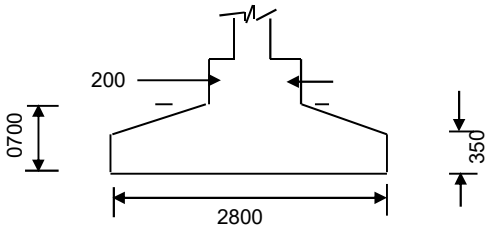
Total = 134 T

SBC of Soil= 15.0 T/m2

Area Reqd = 8.933 8.93 m^2

Provided Area = 9.52 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.150 m

Moment at the face of column = (15 X 1.15^2)/2 9.92 T-m/m run

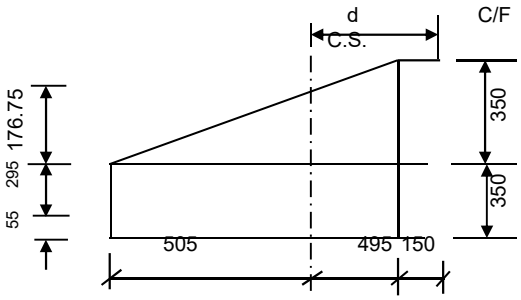
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/ bd^2 = 0.36 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 448.70 mm 546.3043478

Shear at critical section = 7.58 T/m run

Shear stress at critical secti τ_v = 0.25 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

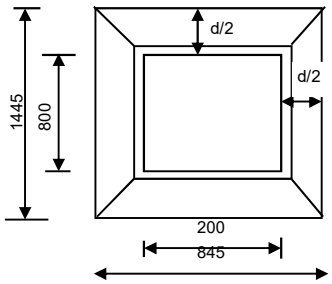
*(From Table 61, SP-16:1980)

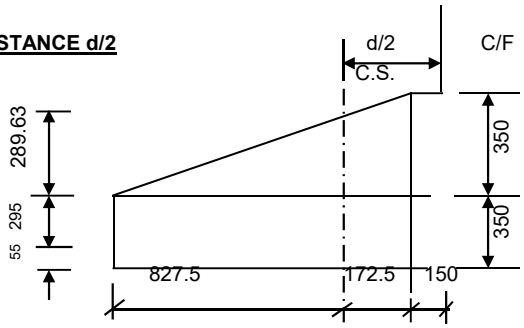
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4580 mm

Critical Depth = 583.63 mm

Shear at critical section = 134.00 T/m run

Shear stress at critical section τ_v = 0.75 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β) $\neq$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-18)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3200 3700 0700 / 350

Foundation under column :

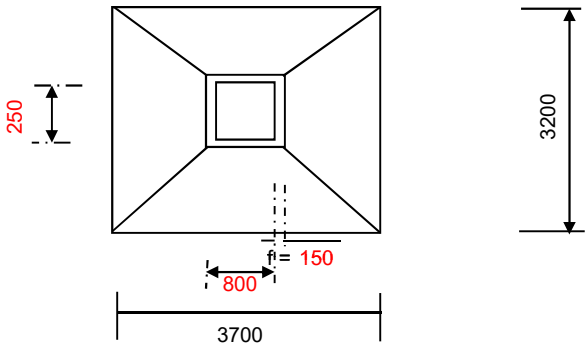
Column load on Foundation = 165 T

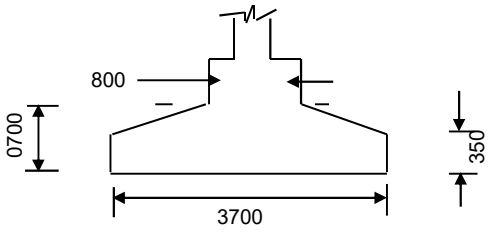
s/w of footing = 0

Total = 165 T SBC of Soil= 15.0 T/m2

Area Reqd = 11.000 11.00 m^2

Provided Area = 11.84 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.300 m

Moment at the face of column = (15 X 1.3^2)/2 12.68 T-m/m run

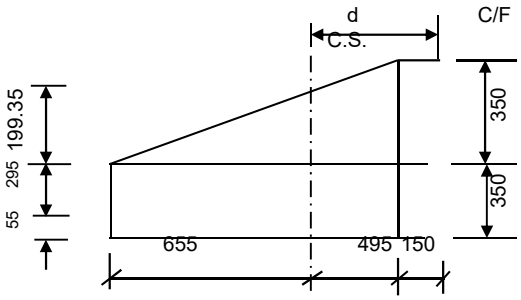
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/ bd^2 = 0.46 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 471.35 mm 523.6538462

Shear at critical section = 9.83 T/m run

Shear stress at critical secti τ_v = 0.31 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.19

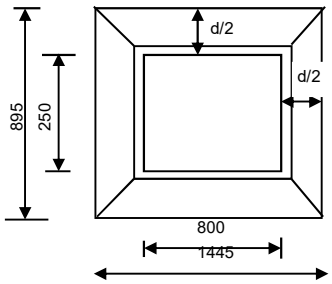
*(From Table 61, SP-16:1980)

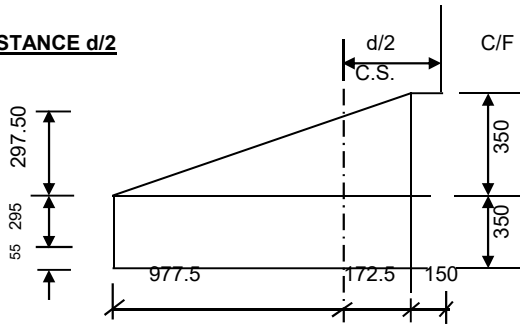
For pt = 0.19 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4680 mm

Critical Depth = 591.50 mm

Shear at critical section = 165.00 T/m run

Shear stress at critical section τ_v = 0.89 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.015625

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.3125 } **Ks** = 0.8125

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-19)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3800 3100 0700 / 350

Foundation under column :

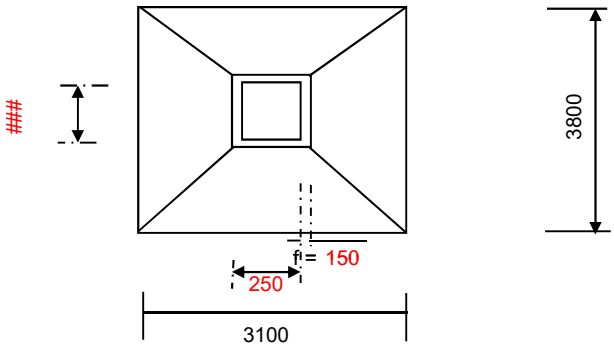
Column load on Foundation = 166 T

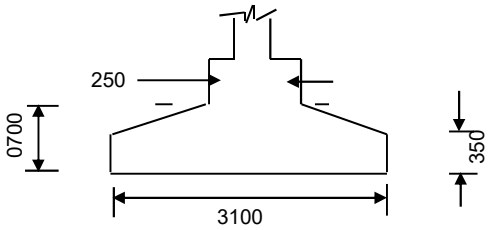
s/w of footing = 0

Total = 166 T SBC of Soil= 15.0 T/m2

Area Reqd = 11.067 11.07 m^2

Provided Area = 11.78 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.275 m

Moment at the face of column = (15 X 1.275^2)/2 12.19 T-m/m run

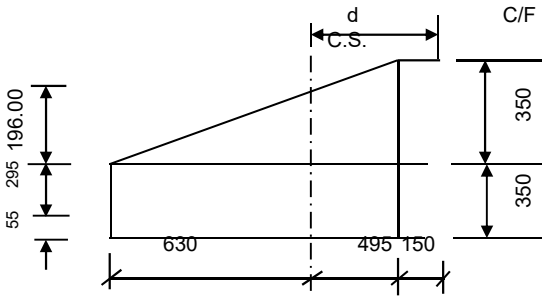
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/bd^2 = 0.44 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 467.94 mm 527.0588235

Shear at critical section = 9.45 T/m run

Shear stress at critical secti τ_v = 0.30 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.19

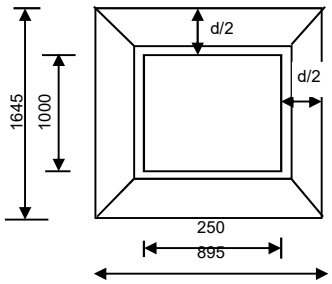
*(From Table 61, SP-16:1980)

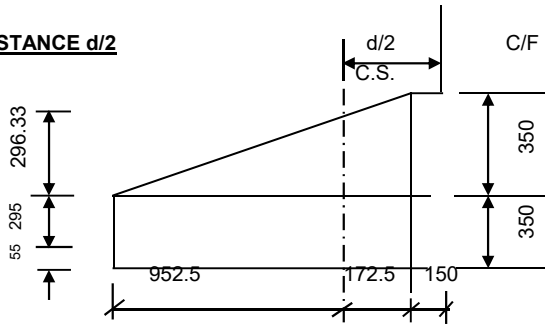
For pt = 0.19 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ **[Hence OK]**

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 5080 mm

Critical Depth = 590.33 mm

Shear at critical section = 166.00 T/m run

Shear stress at critical section τ_v = 0.83 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ **[Hence OK]**

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DESIGN OF ISOLATED FOOTING (F-20)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3500 3000 0700 / 350

Foundation under column :

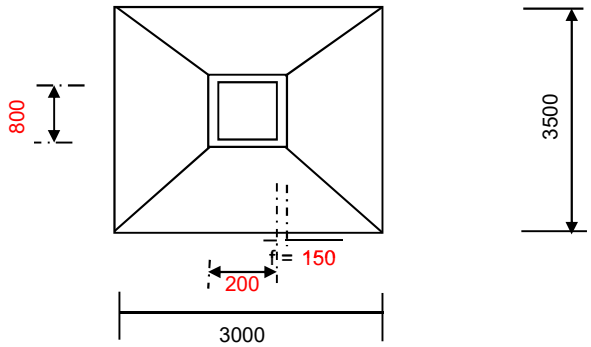
Column load on Foundation = 151 T

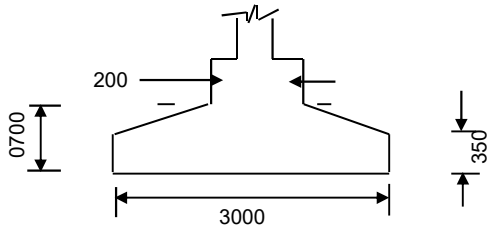
s/w of footing = 0

Total = 151 T SBC of Soil= 15.0 T/m2

Area Reqd = 10.067 10.07 m^2

Provided Area = 10.5 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.250 m

Moment at the face of column = (15 X 1.25^2)/2 11.72 T-m/m run

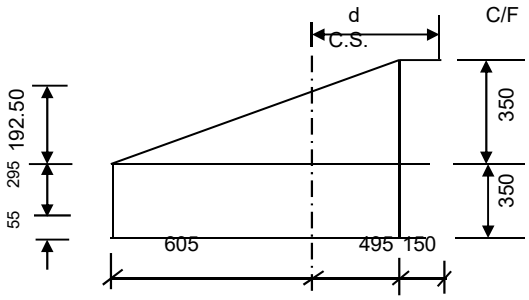
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/ bd^2 = 0.42 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 464.40 mm 530.6

Shear at critical section = 9.08 T/m run

Shear stress at critical secti τ_v = 0.29 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.19

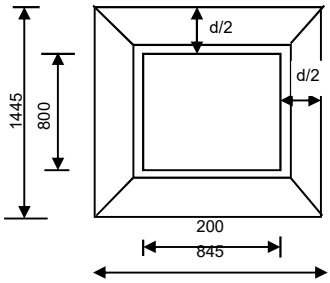
*(From Table 61, SP-16:1980)

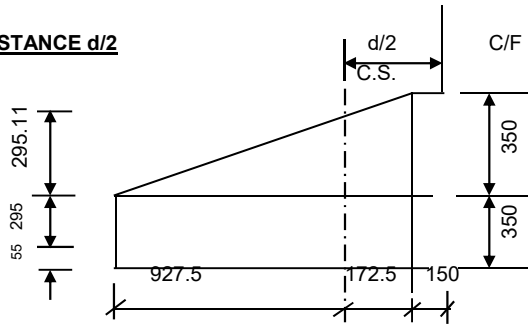
For pt = 0.19 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ **[Hence OK]**

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4580 mm

Critical Depth = 589.11 mm

Shear at critical section = 151.00 T/m run

Shear stress at critical section τ_v = 0.84 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β) $\not<$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ **[Hence OK]**

DESIGN OF ISOLATED FOOTING (F-21)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3200 2700 0700 / 350

Foundation under column :

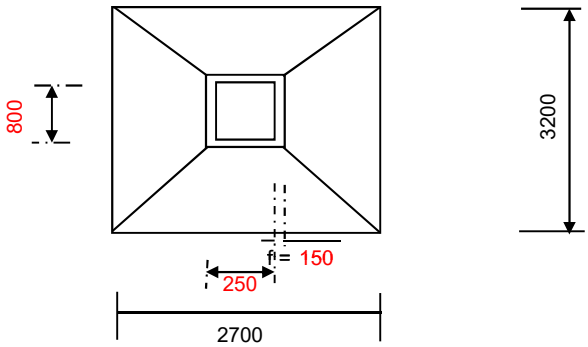
Column load on Foundation = 122 T

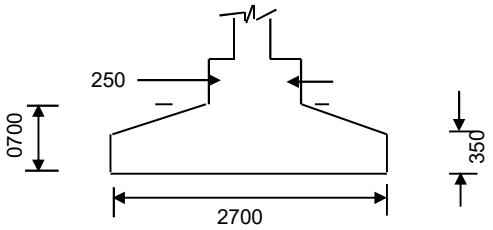
s/w of footing = 0

Total = 122 T SBC of Soil= 15.0 T/m2

Area Reqd = 8.133 8.13 m^2

Provided Area = 8.64 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.075 m

Moment at the face of column = (15 X 1.075^2)/2 8.67 T-m/m run

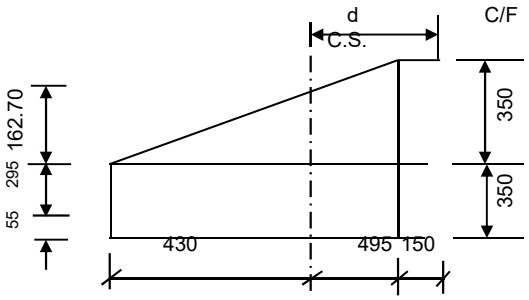
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/ bd^2 = 0.31 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 435.00 mm 560

Shear at critical section = 6.45 T/m run

Shear stress at critical secti τ_v = 0.22 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.21

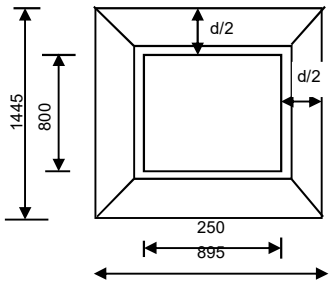
*(From Table 61, SP-16:1980)

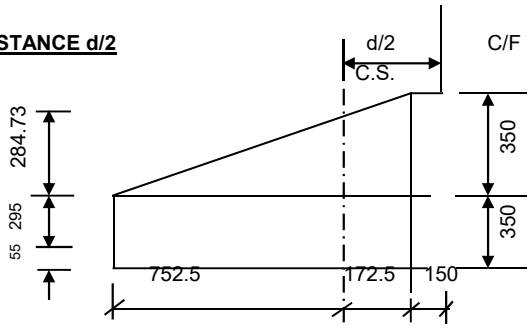
For pt = 0.21 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4680 mm

Critical Depth = 578.73 mm

Shear at critical section = 122.00 T/m run

Shear stress at critical section τ_v = 0.68 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.015625

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.3125 } **Ks** = 0.8125

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-22)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2000 2500 0500 / 250

Foundation under column :

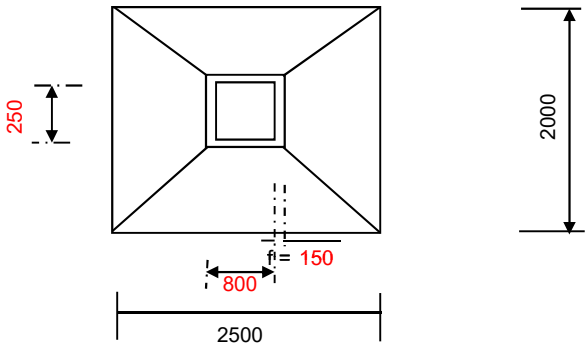
Column load on Foundation = 72 T

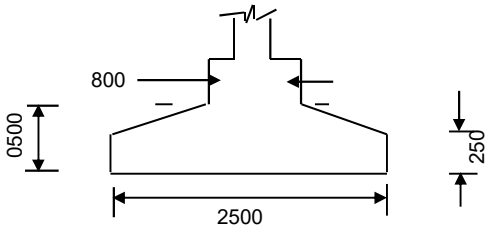
s/w of footing = 0

Total = 72 T SBC of Soil= 15.0 T/m2

Area Reqd = 4.800 4.80 m^2

Provided Area = 5 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.700 m

Moment at the face of column = (15 X 0.7^2)/2 3.68 T-m/m run

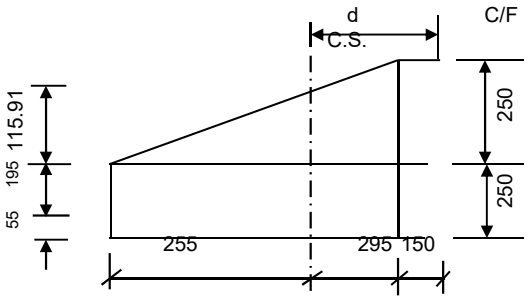
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.28 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 286.07 mm 408.9285714

Shear at critical section = 3.83 T/m run

Shear stress at critical secti τ_v = 0.20 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.26

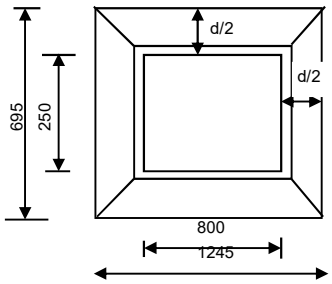
*(From Table 61, SP-16:1980)

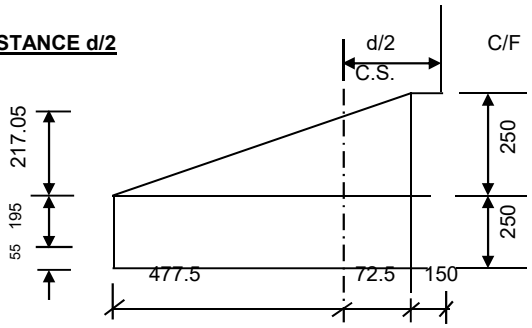
For pt = 0.26 τ_c = 0.37 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3880 mm

Critical Depth = 411.05 mm

Shear at critical section = 72.00 T/m run

Shear stress at critical section τ_v = 0.68 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.015625

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.3125 } **Ks** = 0.8125

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-23)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2800 2300 0500 / 250

Foundation under column :

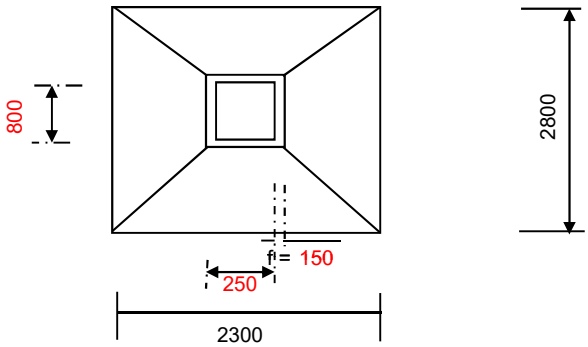
Column load on Foundation = 93 T

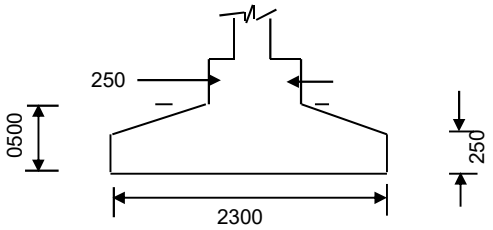
s/w of footing = 0

Total = 93 T SBC of Soil= 15.0 T/m2

Area Reqd = 6.200 6.20 m^2

Provided Area = 6.44 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.875 m

Moment at the face of column = (15 X 0.875^2)/2 5.74 T-m/m run

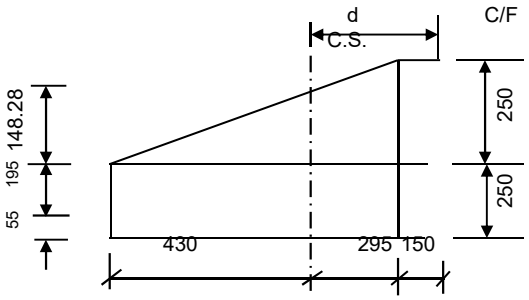
Effective depth of footing = 0500 - 50 - 5 = 445 mm.

Mu/ bd^2 = 0.43 $N/mm.^2$

Required area of steel = 5.34 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 445 mm

Depth of critical section = 317.86 mm 377.1428571

Shear at critical section = 6.45 T/m run

Shear stress at critical secti τ_v = 0.30 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.24

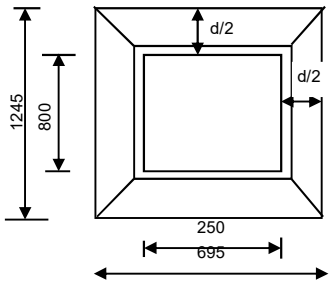
*(From Table 61, SP-16:1980)

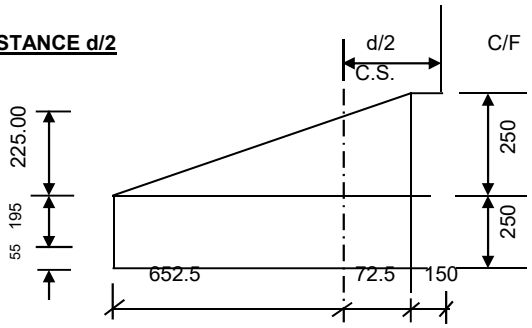
For pt = 0.24 τ_c = 0.35 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 3880 mm

Critical Depth = 419.00 mm

Shear at critical section = 93.00 T/m run

Shear stress at critical section τ_v = 0.86 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.015625

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.3125 } **Ks** = 0.8125

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-24)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 4300 3600 0900 / 450

Foundation under column :

Column load on Foundation = 228 T

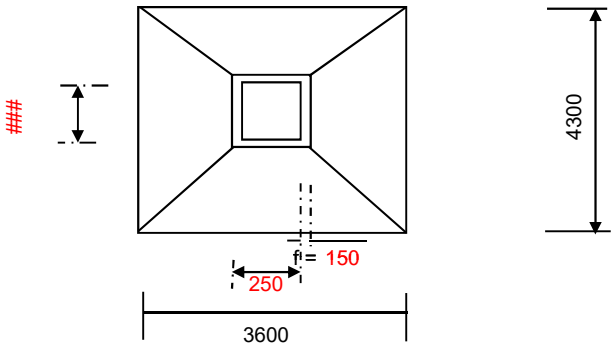
s/w of footing = 0

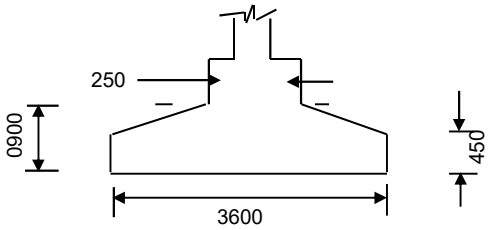
Total = 228 T

SBC of Soil= 15.0 T/m2

Area Reqd = 15.200 15.20 m^2

Provided Area = 15.48 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.525 m

Moment at the face of column = (15 X 1.525^2)/2 17.44 T-m/m run

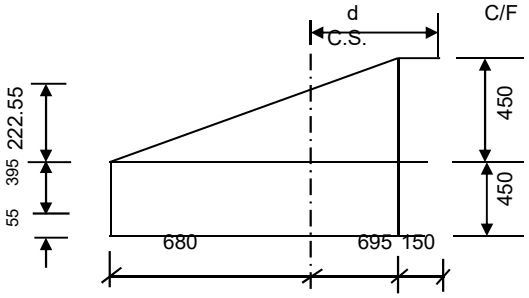
Effective depth of footing = 0900 - 50 - 5 = 845 mm.

Mu/ bd^2 = 0.37 $N/mm.^2$

Required area of steel = 10.14 cm^2

Provide 12 Tor @ 100c/c = **11.31 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 845 mm

Depth of critical section = 595.66 mm 699.3442623

Shear at critical section = 10.20 T/m run

Shear stress at critical secti τ_v = 0.26 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.19

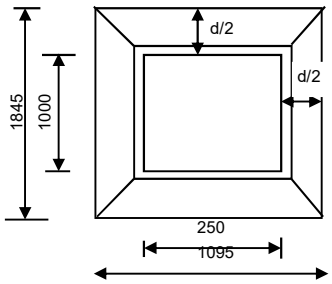
*(From Table 61, SP-16:1980)

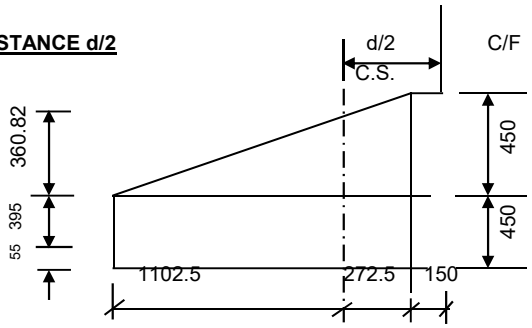
For pt = 0.19 τ_c = 0.32 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 5880 mm

Critical Depth = 754.82 mm

Shear at critical section = 228.00 T/m run

Shear stress at critical section τ_v = 0.77 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.9375

Where, Ks=(0.5+ β) $\neq$ 1

β_c = short side of the col / long side of the col = 0.25 } **Ks** = 0.75

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-25)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2500 3300 0600 / 300

Foundation under column :

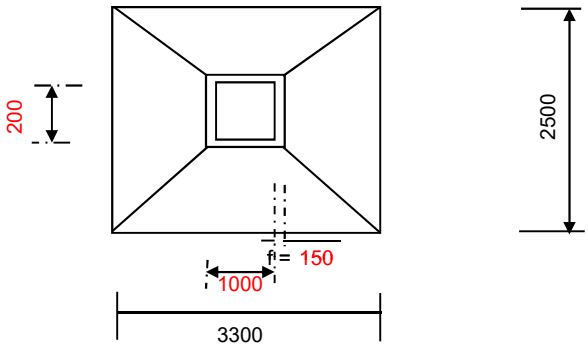
Column load on Foundation = 122 T

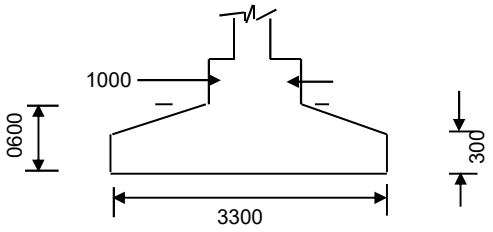
s/w of footing = 0

Total = 122 T SBC of Soil= 15.0 T/m2

Area Reqd = 8.133 8.13 m^2

Provided Area = 8.25 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 1.000 m

Moment at the face of column = (15 X 1^2)/2 7.50 T-m/m run

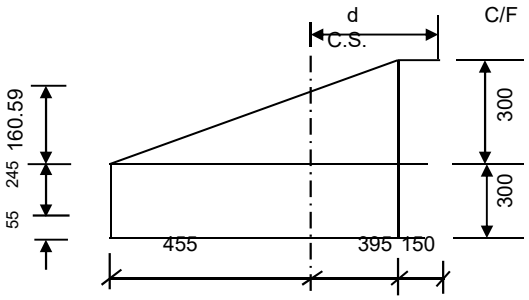
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/bd^2 = 0.38 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 381.50 mm 463.5

Shear at critical section = 6.83 T/m run

Shear stress at critical secti τ_v = 0.27 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

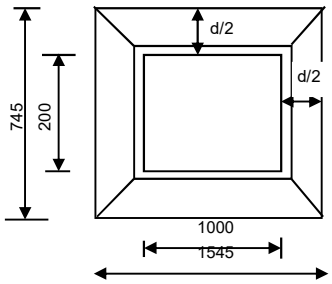
*(From Table 61, SP-16:1980)

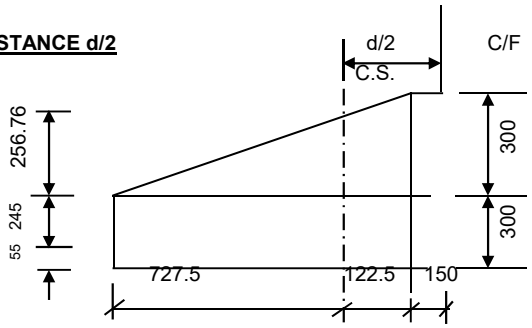
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4580 mm

Critical Depth = 500.76 mm

Shear at critical section = 122.00 T/m run

Shear stress at critical section τ_v = 0.80 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.875

Where, Ks=(0.5+ β) $\neq$ 1

β_c = short side of the col / long side of the col = 0.2 } **Ks** = 0.7

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-26)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3200 3800 0700 / 350

Foundation under column :

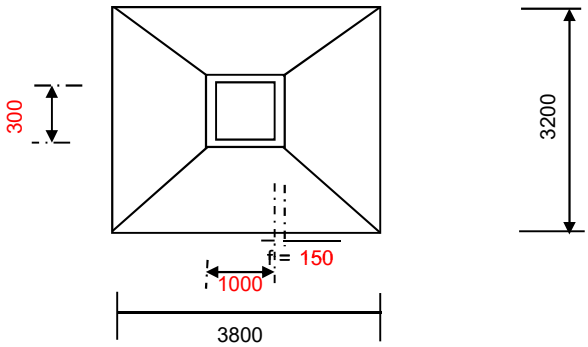
Column load on Foundation = 178 T

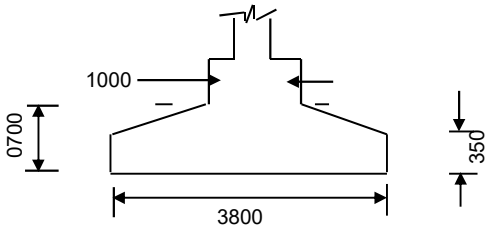
s/w of footing = 0

Total = 178 T SBC of Soil= 15.0 T/m2

Area Reqd = 11.867 11.87 m^2

Provided Area = 12.16 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2 **O.K.**

Max Cantilever length = 1.250 m

Moment at the face of column = (15 X 1.25^2)/2 11.72 T-m/m run

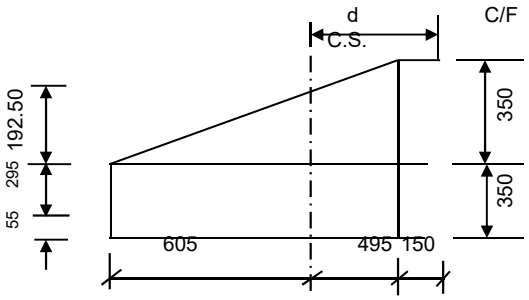
Effective depth of footing = 0700 - 50 - 5 = 645 mm.

Mu/bd^2 = 0.42 $N/mm.^2$

Required area of steel = 7.74 cm^2

Provide 12 Tor @ 125c/c = **9.05 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 645 mm

Depth of critical section = 464.40 mm 530.6

Shear at critical section = 9.08 T/m run

Shear stress at critical secti τ_v = 0.29 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.19

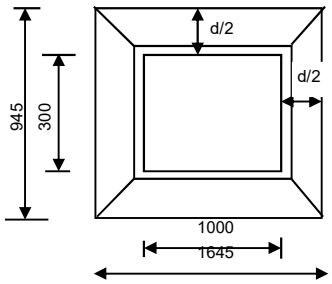
*(From Table 61, SP-16:1980)

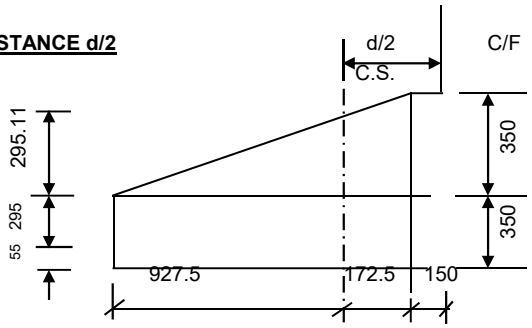
For pt = 0.19 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 5180 mm

Critical Depth = 589.11 mm

Shear at critical section = 178.00 T/m run

Shear stress at critical section τ_v = 0.87 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1

Where, Ks=(0.5+ β) $\neq$ 1

β_c = short side of the col / long side of the col = 0.3 } **Ks** = 0.8

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-27)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 2500 3000 0600 / 300

Foundation under column :

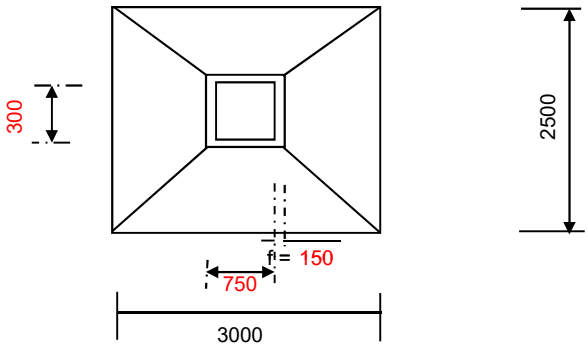
Column load on Foundation = 106 T

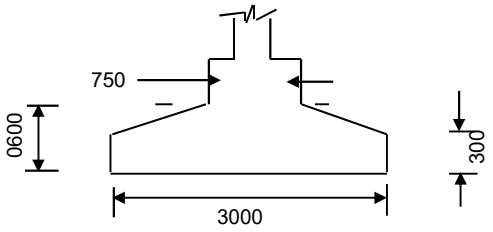
s/w of footing = 0

Total = 106 T SBC of Soil= 15.0 T/m2

Area Reqd = 7.067 7.07 m^2

Provided Area = 7.5 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.975 m

Moment at the face of column = (15 X 0.975^2)/2 7.13 T-m/m run

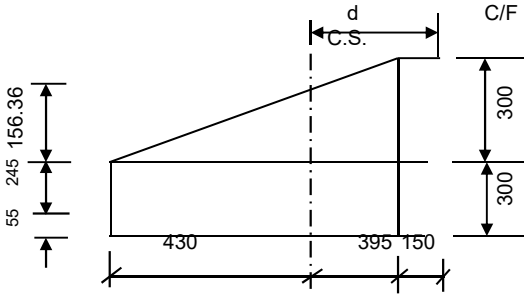
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/ bd^2 = 0.36 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 377.31 mm 467.6923077

Shear at critical section = 6.45 T/m run

Shear stress at critical secti τ_v = 0.26 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.20

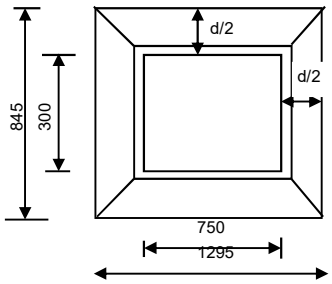
*(From Table 61, SP-16:1980)

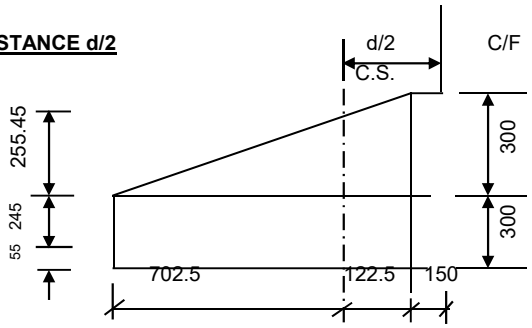
For pt = 0.20 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4280 mm

Critical Depth = 499.45 mm

Shear at critical section = 106.00 T/m run

Shear stress at critical section τ_v = 0.74 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 1.125

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.4 } **Ks** = 0.9

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

DESIGN OF ISOLATED FOOTING (F-28)

Foundation Marked :

Grade of Conc = M 25
Grade of Steel = Fe 500

Foundation Size : 3000 2300 0600 / 300

Foundation under column :

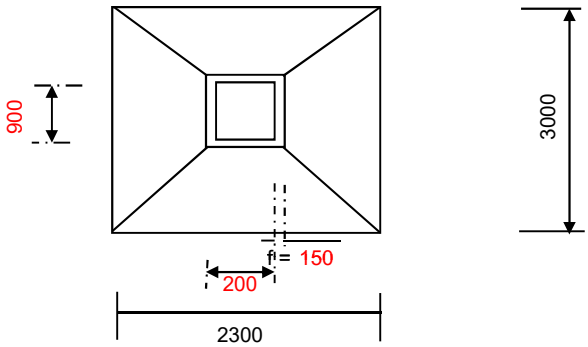
Column load on Foundation = 97 T

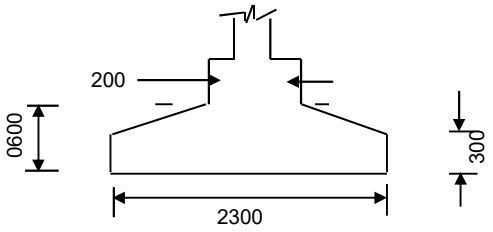
s/w of footing = 0

Total = 97 T SBC of Soil= 15.0 T/m2

Area Reqd = 6.467 6.47 m^2

Provided Area = 6.9 m^2





CHECK AGAINST MOMENT

Net Bearing Pressure = 15.00 T/m^2

O.K.

Max Cantilever length = 0.900 m

Moment at the face of column = (15 X 0.9^2)/2 6.08 T-m/m run

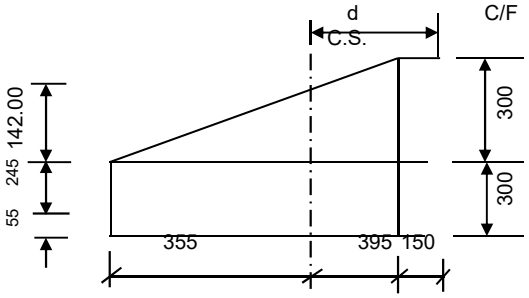
Effective depth of footing = 0600 - 50 - 5 = 545 mm.

Mu/ bd^2 = 0.31 $N/mm.^2$

Required area of steel = 6.54 cm^2

Provide 12 Tor @ 150c/c = **7.54 cm2** (BOTHWAYS)

CHECK FOR ONEWAY SHEAR AT A DISTANCE d



Distance of critical section from face of the Col. = 545 mm

Depth of critical section = 363.33 mm 481.6666667

Shear at critical section = 5.33 T/m run

Shear stress at critical secti τ_v = 0.22 N/mm^2/m width

Percentage of steel provided, pt_{prov} = 0.21

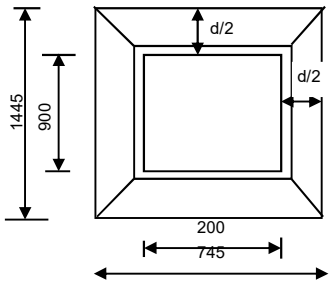
*(From Table 61, SP-16:1980)

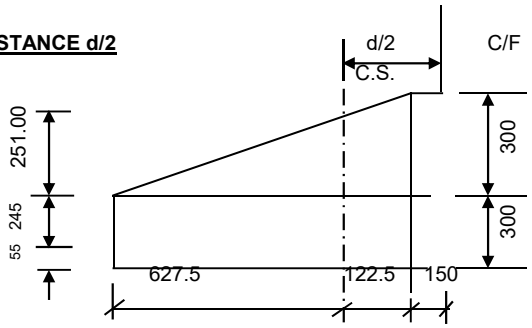
For pt = 0.21 τ_c = 0.33 N/mm^2/m width

$\tau_v < \tau_c$ [Hence OK]

CHECK FOR TWOWAY SHEAR OR PUNCHING AT A DISTANCE d/2

Punching Shear cross-section area : Plan View





Critical Perimeter = 4380 mm

Critical Depth = 495.00 mm

Shear at critical section = 97.00 T/m run

Shear stress at critical section τ_v = 0.67 N/mm^2/m width

(Ref Clause 31.6.3.1 IS456:200)

Permissible Shear Stress $K_s \tau_c$ = 0.902778

Where, Ks=(0.5+ β_c) $\neq$ 1

β_c = short side of the col / long side of the col = 0.22222 } **Ks** = 0.722222222

τ_c = $0.25\sqrt{f_{ck}}$ = 1.25 } τ_c = 1.25

$\tau_v < K_s \tau_c$ [Hence OK]

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

Verified RealEstate
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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.