STRUCTURAL ANALYSIS & DESIGN FOR

PROPOSED BASEMENT+G+5 STORIED RESIDENTIAL CUM COMMERCIAL BUILDING OF SAMRIDDHI VENTURES REPRESENTED BY SMT. ANKITA GOYAL AT MOUZA: SILIGURI PURBA,J.L. NO.:92 PLOT NO.: 10575 (R.S.),3148,3149 (L.R.) KHATIAN NO.: 5030 (R.S.), 13732(L.R.) SHEET NO.19 (R.S.), 8(L.R.) WARD.: 16 (S.M.C.), P.S. : SILIGURI, PARGANA: BAIKUNTHAPUR,DIST.: DARJEELING,HOLDING N0. : 76/209/287, L.U.C.C. MEMO NO. - 12613/SJDA, DATED: 14.03.2024.

DESIGN BASIS REPORT

OF

STRUCTURAL ANALYSIS & DESIGN

FOR

PROPOSED BASEMENT+G+5 STORIED RESIDENTIAL CUM COMMERCIAL BUILDING OF SAMRIDDHI VENTURES REPRESENTED BY SMT. ANKITA GOYAL AT MOUZA: SILIGURI PURBA,J.L. NO.:92 PLOT NO.: 10575 (R.S.),3148,3149 (L.R.) KHATIAN NO.: 5030 (R.S.), 13732(L.R.) SHEET NO.19 (R.S.), 8(L.R.) WARD.: 16 (S.M.C.), P.S. : SILIGURI, PARGANA: BAIKUNTHAPUR, DIST.: DARJEELING,HOLDING N0. : 76/209/287, L.U.C.C. MEMO NO. - 12613/SJDA, DATED: 14.03.2024.

A. FOREWORD:

This report contains the Design parameters involved in Structural Analysis and Design for the Proposed building at mouza: Siliguri Purba, J.L. No.:92 Plot No.: 10575 (R.S.),3148,3149 (L.R.) Khatian No.: 5030 (R.S.), 13732(L.R.) Sheet No.19 (R.S.), 8(L.R.) Ward.: 16 (S.M.C.), P.S. : Siliguri, Pargana: Baikunthapur, Dist.:- Darjeeling, Holding N0. : 76/209/287, L.U.C.C. Memo No. - 12613/SJDA, Dated: 14.03.2024.

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: Proposed building at mouza: Siliguri Purba, J.L. No.:92 Plot No.: 10575 (R.S.),3148,3149 (L.R.) Khatian No.: 5030 (R.S.), 13732(L.R.) Ward.: 16 (S.M.C.), P.S. : Siliguri, Pargana: Baikunthapur, Dist.:

Location: mouza: Siliguri Purba, P.S. : Siliguri, Pargana: Baiku

1. Description of the Site

The general topography of the plot is a little bit slope.

2. Detail Description of Buildings:

The height of different floors is as follows:

BASEMENT: - 3.3

GROUND FLOOR - 3.6 m

TYPICAL FLOOR - 3.15 m.

C. MATERIALS OF CONSTRUCTION:

The buildings are predominantly RCC framed structures.

Concrete of Grade M25 & M30 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 AAC Block	1.00	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; filli rmly distributed load over the slab.

Wall Loads shall be applied on beams as line loads. In case, v d 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 stair, balcony corridor	:	0.2 T/m^2
Stair, Balcony, corridor	:	0.3 T/m^2
Lift Machine Room	:	0.5 T/m^2
Roof (accessible)	:	0.15 T/m^2
Roof (inaccessible)	:	0.075 T/m^2
Commercial floor	:	0.4 T/m^2

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, $V_z = V_b K_1 K_2 K_3$
Were,

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

V_b = 47 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,

K_3 = 1.0 (Clause 6.3.3 of the code)

K_4 = 1.0 (Clause 6.34 of the code)

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

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

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 IV with Z = 0.24.

The seismic load calculations will be carried out in accordance

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 IV)**	0.24
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

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 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 recogniz veral organizations and is well suited for the analysis of building syste Geometrical dimensions, member properties and member ding eccentricities will be modelled in the analysis problem. Variatior sent,

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 -1893:2016
- Wind load analysis will be carried out using procedures mentioned in IS: 875 (Part-3).
- 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 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 Z - EL (Y)
Primary	9	Spec X
Primary	10	Spec Y
Primary	11	Spec Z

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

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

1. DESIGN OF STRUCTURAL ELEMENTS:

2. General Design Procedure

For the design of R.C.C. elements, the Limit State Method will b[illegible].

Materials of construction will be predominantly concrete with consideration for strength and durability.The grade of concrete for Foundation, Plinth Beams, Slabs M25 & and Column M30. 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.

3. Nominal Cover to Reinforcement:

Covers to reinforcement will be in accordance with IS 456:2000 corresponding to mild exposure and to satisfy fire rating of 2 hours accordance with National Building Code of India – SP –7 (part IV).

Element	CLEAR COVER
Foundation	50mm
Columns	40mm
Continuous Beams	30mm

4. Design of Structural Elements

4.1 Design of Slabs:

Minimum thickness of slabs will be 125 mm for 2hrs. 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.

4.4 Design of Foundation:

As per soil investigation report, **RAFT FOUNDATION** is adopte

Design of foundation will be done using CSI SAFE SOFTWAR

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
IS 875(Part 2): 1987	Imposed Loads.
IS 875(Part 3): 1987	Wind Loads.
IS 875(Part 5): 1987	Special Loads and Combinations.

2. For Earthquake Loads:

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

3. For Design Of Concrete Elements:

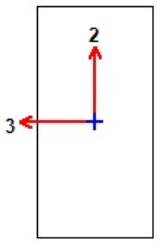
IS Code	Description
IS 456: 2000	Code of practice For Plain and Reinforced Concrete.
SP 16 : 1980	Structural Design Charts For Reinforced Concrete Elements.
SP 7(Part IV)	National Building Code of India
IS 1786 : 2008	Specification for high strength deformed bars and wires.

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
GR FL	B339	281	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	4.8	5.425

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
2.4532	0.0057	6	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
2.4532	0.0101	2.4633	-7.2946

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-7.2946		4	0	3	4
Bottom (-2 Axis)		2.4633	4	1	0	4

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

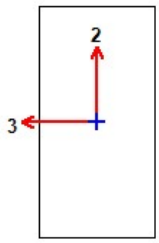
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
10	0	10	6	0.5

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0004	6	0.24	0.54	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 (m)	LLRF	Type
GR FL	B60	225	B300X600M25	1.5(DL+LL)	3.8	7.525	1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
24.7105	0.0001	10	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
24.7105	0.0002	24.7107	0

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Mini Rel cr
Top (+2 Axis)	0		2	0	0
Bottom (-2 Axis)		24.7107	12	12	0

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

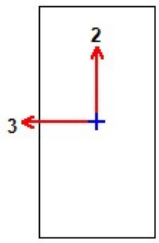
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
10	9	7	6	0.3

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0001	10	0.24	0.54	0

ETABS Concrete Frame Design

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



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
1ST FL	B274	597	B300X600M25	1.5(DL+SPECPX+0.3SPECY+0.3SPECZ)	4.85	5.2

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
8.2835	0.0159	23	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
8.2835	0.0281	8.3116	-25.1155

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-25.1155		12	0	12	4
Bottom (-2 Axis)		8.3116	6	3	0	6

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

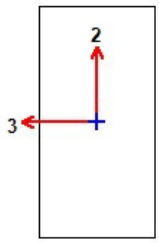
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
24	0	24	13	1.2

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0159	23	0.24	0.54	0

ETABS Concrete Frame Design

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



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
1ST FL	B192	503	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	7.125	7.125

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
0	0.0395	4	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
0	0.0697	0.0697	-0.0697

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-0.0697		4	0	2.81E-02	4
Bottom (-2 Axis)		0.0697	4	2.81E-02	0	4

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

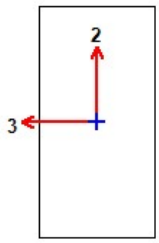
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
7	0	7	4	0.3

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0245	4	0.24	0.54	0

ETABS Concrete Frame Design

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



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
1ST FL	B38	441	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	7.825	8.025

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
0.4163	0.1606	16	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
0.4163	0.2835	0.6998	-28.6426

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-28.6426		14	0	14	4
Bottom (-2 Axis)		0.6998	7	2.828E-01	0	7

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

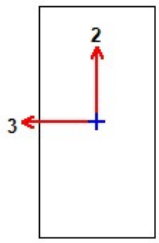
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
20	0	20	8	1

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.1606	16	0.24	0.54	0.5

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 (m)	LLRF	Type
2ND FL	B302	789	B300X600M25	1.5(DL+SLYTP+0.3SLXTN)	6.9	7.225	1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
-19.771	0.0031	10	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
-19.771	0.0055	0	-19.7766

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Mini Rel cr
Top (+2 Axis)	-19.7766		9	0	9
Bottom (-2 Axis)		0	4	0	0

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	6	0.6

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0031	10	0.24	0.54	0

ETABS Concrete Frame Design

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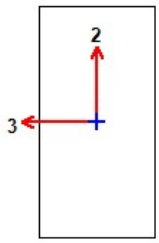


Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
3RD FL	B327	669	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	5.225	5.425

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
15.0393	0.0114	13	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
15.0393	0.02	15.0593	-21.8994

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-21.8994		10	0	10	4
Bottom (-2 Axis)		15.0593	7	7	0	5

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

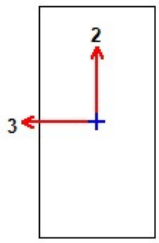
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
16	0	16	11	0.8

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0114	13	0.24	0.54	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 (m)	LLRF	Type
3RD FL	B255	719	B300X600M25	1.5(DL+SLXTN-0.3SLYTN)	3.725	3.725	1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
-21.2072	0.019	7	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
-21.2072	0.0336	0	-21.2407

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Mini Rel cr
Top (+2 Axis)	-21.2407		10	0	1
Bottom (-2 Axis)		0	5	0	0

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

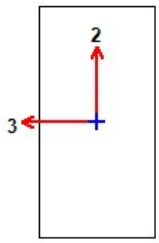
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
16	0	16	12	0.8

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.019	7	0.24	0.54	0

ETABS Concrete Frame Design

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



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
3RD FL	B19	641	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	0.35	3.8

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
-30.3937	0.0075	21	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
-30.3937	0.0133	26.8363	-30.407

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-30.407		15	0	15	4
Bottom (-2 Axis)		26.8363	13	13	0	7

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

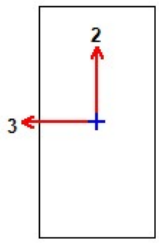
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
32	0	32	29	1.6

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0069	21	0.24	0.54	0

ETABS Concrete Frame Design

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



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
4TH FL	B343	917	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	3.975	5.425

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
6.9507	0.0138	10	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
6.9507	0.0243	6.975	-12.8503

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-12.8503		6	0	6	4
Bottom (-2 Axis)		6.975	4	3	0	4

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	0	10	5	0.5

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0044	4	0.24	0.54	0

ETABS Concrete Frame Design

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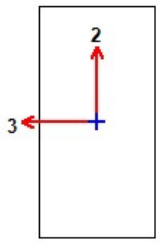

Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)	LLRF	Type
4TH FL	B1	846	B300X600M25	1.5(DL-SLXTP+0.3SLYTP)	0.2	4.225	1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
-21.789	0.0009	14	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
-21.789	0.0015	0	-21.7905

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Mini Rel cr
Top (+2 Axis)	-21.7905		10	0	1
Bottom (-2 Axis)		0	5	0	0

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
19	0	19	15	0.9

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0009	14	0.24	0.54	0

ETABS Concrete Frame Design

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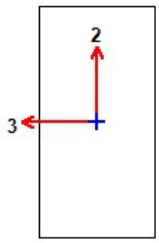


Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)	LLRF	Type
5TH	B163	1211	B300X600M25	1.5(DL+SLXTN-0.3SLYTN)	4.725	4.725	1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
-16.0856	0.0205	9	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
-16.0856	0.0362	0	-16.1219

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Mini Rel cr
Top (+2 Axis)	-16.1219		7	0	7
Bottom (-2 Axis)		0	4	0	0

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

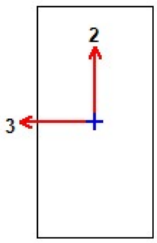
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
10	0	10	7	0.5

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0205	9	0.24	0.54	0.3

ETABS Concrete Frame Design

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



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
5TH	B317	1090	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	2.75	4.2

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
13.1579	0.04	9	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
13.1579	0.0706	13.2285	0

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	0		1	0	0	1
Bottom (-2 Axis)		13.2285	6	6	0	4

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

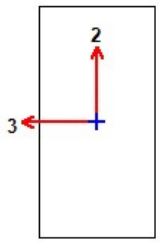
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
13	0	14	6	0.7

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.04	9	0.24	0.54	0.3

ETABS Concrete Frame Design

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



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (m)
5TH	B282	1377	B300X600M25	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	2.4	2.725

Beam Element Details (Part 2 of 2)

LLRF	Type
1	Ductile Frame

Section Properties

b (m)	h (m)	b_f (m)	d_s (m)	d_{ct} (m)	d_{cb} (m)
0.3	0.6	0.3	0	0.04	0.04

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} tonf-m	Factored T_u tonf-m	Factored V_{u2} tonf	Factored P_u tonf
15.2892	0.0097	20	0

Design Moments, M_{u3} & M_t

Factored Moment tonf-m	Factored M_t tonf-m	Positive Moment tonf-m	Negative Moment tonf-m
15.2892	0.0171	15.3063	-19.9961

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

	Design -Moment tonf-m	Design +Moment tonf-m	-Moment Rebar cm²	+Moment Rebar cm²	Minimum Rebar cm²	Required Rebar cm²
Top (+2 Axis)	-19.9961		9	0	9	4
Bottom (-2 Axis)		15.3063	7	7	0	5

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

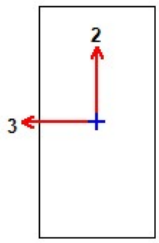
Shear V_e tonf	Shear V_c tonf	Shear V_s tonf	Shear V_p tonf	Rebar A_{sv}/s mm²/mm
29	0	29	26	1.4

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

T_u tonf-m	V_u tonf	Core b_1 m	Core d_1 m	Rebar A_{svt}/s mm²/mm
0.0063	20	0.24	0.54	0

ETABS Concrete Frame Design

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



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
2ND FL	C1	2	CLM350X700M30	0.9DL+1.5(SPECPX+0.3SPECY+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.6	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.35	0.7	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
1	14.764	-20.3664	0.0265	0.0377	36	1.48

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.950238	2.55	-5.8392	0	
Minor Bend(M2)	0.805721	2.55	5.9056	0	

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}	17	14	9	17	0.4
Minor, V_{u3}	10	13	8	10	0.8

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.245	0.0036	476	154	1	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.7	3.462	12	No	0
Minor Bending (M_2)	Yes	0.81	0.35	5.87	12	No	0

Notes:

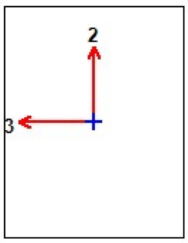
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
4TH FL	C24	1048	CLM500X650M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.8	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.5	0.65	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
4	4.4215	42.7014	0.0951	0.117	43	1.33

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.891197	2.55	16.7518	0	
Minor Bend(M2)	1	2.55	1.7686	0	

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}	29	18	12	22	0.6
Minor, V_{u3}	4	17	12	4	0.7

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.325	0.0043	612	210	4	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.65	3.496	12	No	0
Minor Bending (M_2)	Yes	0.81	0.5	5.1	12	No	0

Notes:

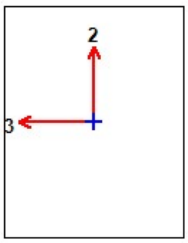
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
5TH	C12	1164	CLM500X650M30	0.9DL+1.5(SPECPX+0.3SPECY+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.9	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.5	0.65	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
1	16.0679	-9.3451	0.0214	0.0263	26	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.942467	2.55	5.165	0	
Minor Bend(M2)	0.938188	2.55	-2.6231	0	

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}	8	14	12	8	0.6
Minor, V_{u3}	9	14	12	9	0.7

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.325	0.0026	547	202	1	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.65	3.697	12	No	0
Minor Bending (M_2)	Yes	0.81	0.5	4.785	12	No	0

Notes:

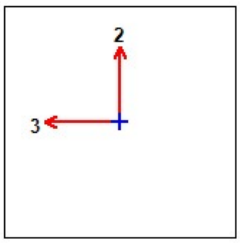
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
1ST FL	C5	571	CLM500X500M30	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.6	0.6	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.5	0.5	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
238	-27.2419	-22.7477	5.3929	5.3929	46	1.82

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.824882	3	-9.8029	0	
Minor Bend(M2)	0.897628	3	-13.6381	0	

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}	14	22	9	14	0.6
Minor, V_{u3}	11	22	9	11	0.6

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.25	0.0046	518	159	238	0.780546

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.833	0.5	4.949	12	No	0
Minor Bending (M_2)	Yes	0.833	0.5	5.386	12	No	0

Notes:

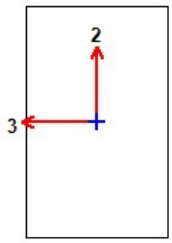
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
4TH FL	C51	815	CLM400X650M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.8	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.4	0.65	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
26	25.8505	-27.2551	0.5247	0.7022	51	1.95

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.921374	2.55	-10.902	0	
Minor Bend(M2)	0.793137	2.55	8.7442	0	

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}	18	18	10	13	0.4
Minor, V_{u3}	15	17	9	14	0.7

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.26	0.0051	552	169	26	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.65	3.615	12	No	0
Minor Bending (M_2)	Yes	0.81	0.4	5.056	12	No	0

Notes:

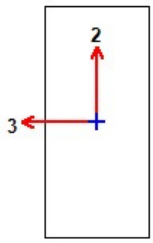
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
3RD FL	C13	617	CLM400X900M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.7	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.4	0.9	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
-4	16.5566	-33.1756	0.0832	0.146	32	0.9

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.97131	2.55	-11.8153	0	
Minor Bend(M2)	1	2.55	6.6226	0	

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}	21	17	14	21	0.4
Minor, V_{u3}	11	16	12	10	1

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.36	0.0032	619	230	-4	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.9	2.752	12	No	0
Minor Bending (M_2)	Yes	0.81	0.4	6.375	12	No	0

Notes:

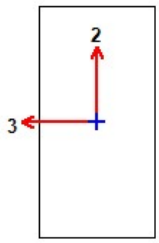
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
2ND FL	C53	201	CLM350X700M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.6	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.35	0.7	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
54	12.025	-45.5041	1.0816	1.5377	45	1.82

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.870225	2.55	-18.2016	0	
Minor Bend(M2)	1	2.55	4.81	0	

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}	27	18	9	17	0.4
Minor, V_{u3}	7	17	8	7	0.8

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.245	0.0045	508	157	54	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.7	3.17	12	No	0
Minor Bending (M_2)	Yes	0.81	0.35	7.286	12	No	0

Notes:

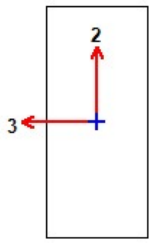
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
2ND FL	C35	23	CLM350X800M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.6	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.35	0.8	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
52	-8.4686	-54.8708	1.0311	1.6378	42	1.5

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.875959	2.55	-21.9483	0	
Minor Bend(M2)	0.825659	2.55	-3.3875	0	

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}	32	19	13	18	0.5
Minor, V_{u3}	11	18	9	11	0.9

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.28	0.0042	546	181	52	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.8	2.792	12	No	0
Minor Bending (M_2)	Yes	0.81	0.35	6.016	12	No	0

Notes:

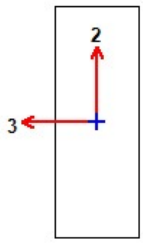
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
5TH	C52	1170	CLM450X1250M30	0.9DL+1.5(SPECPX+0.3SPECY+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.9	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.45	1.25	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
29	21.6031	20.3852	0.5925	1.3786	45	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.985528	2.55	-6.9927	0	
Minor Bend(M2)	0.926167	2.55	8.6412	0	

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}	12	26	22	12	0.5
Minor, V_{u3}	15	25	20	10	1.4

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.5625	0.0045	946	371	29	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	1.25	2.01	12	No	0
Minor Bending (M_2)	Yes	0.81	0.45	5.248	12	No	0

Notes:

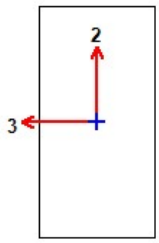
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
5TH	C16	1169	CLM400X800M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.8	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.4	0.8	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
28	21.6181	20.1704	0.5568	0.8844	32	0.99

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.946717	2.55	-8.8192	0	
Minor Bend(M2)	0.921992	2.55	4.721	0	

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}	16	17	12	10	0.4
Minor, V_{u3}	12	16	11	12	0.9

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.32	0.0032	561	202	28	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.8	3.018	12	No	0
Minor Bending (M_2)	Yes	0.81	0.4	5.878	12	No	0

Notes:

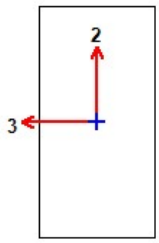
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
2ND FL	C38	8	CLM350X700M30	1.5(DL+SPECPY+0.3SPECX+0.3SPECZ)	2.55

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.6	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.35	0.7	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
226	-10.0649	35.319	4.5153	6.4192	32	1.31

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.898627	2.55	-8.1544	0	
Minor Bend(M2)	1	2.55	4.4369	0	

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}	22	20	9	22	0.4
Minor, V_{u3}	8	19	8	0	0.8

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	Shear Ratio Unitless
Major Shear, V_{u2}	0	16	84	164	0.245	0.514
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
0.679	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.245	0.0032	460	153	226	0.762422

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.7	3.274	12	No	0
Minor Bending (M_2)	Yes	0.81	0.35	7.286	12	No	0

Notes:

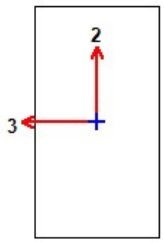
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
3RD FL	C49	634	CLM350X650M30	1.5(DL+SPECPX+0.3SPECY+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.7	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.35	0.65	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2549291	2549.29	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
173	-21.3858	21.4182	3.4566	4.6261	56	2.44

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	1	2.55	5.4222	0	
Minor Bend(M2)	0.792417	2.55	-8.5543	0	

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}	13	23	8	13	0.4
Minor, V_{u3}	13	21	8	6	0.7

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.2275	0.0056	473	127	173	0.868266

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.65	3.923	12	No	0
Minor Bending (M_2)	Yes	0.81	0.35	5.773	12	No	0

Notes:

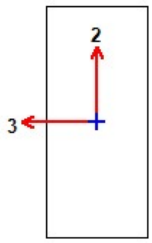
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
2ND FL	C36	41	CLM350X800M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	2.55

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.6	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.35	0.8	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
45	-31.9576	-8.2191	0.8977	1.4259	58	2.07

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.963001	2.55	7.7872	0	
Minor Bend(M2)	0.893969	2.55	5.784	0	

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}	11	21	11	11	0.4
Minor, V_{u3}	20	19	9	20	0.9

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	Shear Ratio Unitless
Major Shear, V_{u2}	0	8	40	156	0.28	0.256
Minor Shear, V_{u3}	0	14	75	93	0.1663	0.806

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
0.201	0.895

Additional Moment Reduction Factor k (IS 39.7.1.1)

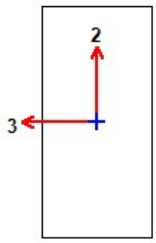
A_g m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.28	0.0058	607	187	45	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.8	3.07	12	No	0
Minor Bending (M_2)	Yes	0.81	0.35	6.513	12	No	0

ETABS Concrete Frame Design

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



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
5TH	C26	1175	CLM450X950M30	0.9DL+1.5(SPECPX+0.3SPECY+0.3SPECZ)	0

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.9	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.45	0.95	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
50	29.3618	-20.5745	1.0114	1.85	36	0.84

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.980822	2.55	9.6871	0	
Minor Bend(M2)	0.935236	2.55	6.5413	0	

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}	16	22	16	7	0.5
Minor, V_{u3}	16	21	15	16	1.1

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	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 m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.4275	0.0036	725	276	50	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.95	2.633	12	No	0
Minor Bending (M_2)	Yes	0.81	0.45	5.3	12	No	0

Notes:

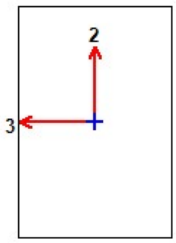
N/A: Not Applicable

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 (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
ROOF	C18	1404	CLM600X900M30	0.9DL+1.5(SPECPY+0.3SPECX+0.3SPECZ)	2.55

Column Element Details (Part 2 of 2)

Length (m)	LLRF	Type
3.15	0.9	Ductile Frame

Section Properties

b (m)	h (m)	dc (m)	Cover (Torsion) (m)
0.6	0.9	0.06	0.03

Material Properties

E_c (tonf/m²)	f_{ck} (tonf/m²)	Lt.Wt Factor (Unitless)	f_y (tonf/m²)	f_{ys} (tonf/m²)
2792608	3059.15	1	50985.81	42318.22

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-m	Design M_{u3} tonf-m	Minimum M_2 tonf-m	Minimum M_3 tonf-m	Rebar Area cm²	Rebar % %
29	13.013	41.0649	0.7358	1.0289	43	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length m	Initial Moment tonf-m	Additional Moment tonf-m	Minimum Moment
Major Bend(M3)	0.973618	2.55	16.426	0	
Minor Bend(M2)	0.963863	2.55	5.2052	0	

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}	24	25	21	17	0.7
Minor, V_{u3}	9	25	20	6	1

Joint Shear Check/Design

	Joint Shear Force tonf	Shear V_{Top} tonf	Shear $V_{u,Tot}$ tonf	Shear V_c tonf	Joint Area m²	Shear Ratio Unitless
Major Shear, V_{u2}	0	12	53	302	0.54	0.175
Minor Shear, V_{u3}	0	5	20	201	0.36	0.098

(1.4) Beam/Column Capacity Ratio

Major Ratio	Minor Ratio
0.301	0.175

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g m²	A_{sc} m²	P_{uz} tonf	P_b tonf	P_u tonf	k Unitless
0.54	0.0043	909	353	29	1

Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (m)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (tonf-m)
Major Bending (M_3)	Yes	0.81	0.9	2.759	12	No	0
Minor Bending (M_2)	Yes	0.81	0.6	4.096	12	No	0

SLAB MARKING	S1	
CONCRETE (Fck)=	25	Mpa
STEEL (fy)	500	Mpa
xumax/d=	0.4560	
Mulim/bd^2=	3.3256	
50XFck/fy=	2.5	
SLAB DEPTH=	**150**	**mm**
CLEAR COVER=	**20**	**mm**

REQUIRED DEPTH=	**72.928**	**mm**
EFFECTIVE DEPTH (d)=	130	mm
DEAD LOAD (DL)=	0.375	T/m^2
LIVE LOAD (L)=	0.400	T/m^2
FLOOR FINISH and FILLING LOAD=	0.125	T/m^2
Total LOAD=	0.900	T/m^2

S1 Step 1 Slab dimensions

Clear LENGTH (Ly)=	3.7754	m
Clear WIDTH(Lx)=	3.5	m
EFFECTIVE LENGTH=	3.925	m
EFFECTIVE WIDTH=	3.650	m
SPAN TO DEPTH RATIO=	24.333	

Step 2 $\left(\frac{l_y}{l_x}\right)$ 1.08

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)
Short span							
SUPPORT	0.052	0.932	0.101	0.13	169.2	150	10
MIDSPAN	0.039	0.701	0.076	0.12	156.0	150	10
Long span							
SUPPORT	0.047	0.845	0.092	0.12	156.0	150	10
MIDSPAN	0.035	0.629	0.069	0.12	156.0	150	10

CHECK FOR SERVICABILITY

SHORT SPAN

	pt Provided	f_s	Modification factor	depth required	
SUPPORT	0.349	93.7	2.00	93.00	OKAY
MIDSPAN	0.349	86.4	2.00	93.00	OKAY
LONG SPAN					
SUPPORT	0.349	86.4	2.00	98.51	OKAY
MIDSPAN	0.349	86.4	2.00	98.51	OKAY

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=	**125**	**mm**
CLEAR COVER=	**20**	**mm**

REQUIRED DEPTH=	**63.204**	**mm**
EFFECTIVE DEPTH (d)=	105	mm
DEAD LOAD (DL)=	0.313	T/m^2
LIVE LOAD (L)=	0.200	T/m^2
FLOOR FINISH and FILLING LOAD=	0.125	T/m^2
Total LOAD=	0.638	T/m^2

S1 Step 1 Slab dimensions

Clear LENGTH (Ly)=	3.65	m
Clear WIDTH(Lx)=	3.5	m
EFFECTIVE LENGTH=	3.775	m
EFFECTIVE WIDTH=	3.625	m
SPAN TO DEPTH RATIO=	29.000	

Step 2 $\left(\frac{l_y}{l_x}\right)$ 1.04

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)
Short span							
SUPPORT	0.049	0.621	0.104	0.13	139.7	150	8
MIDSPAN	0.037	0.465	0.078	0.12	126.0	150	8
Long span							
SUPPORT	0.047	0.591	0.099	0.13	132.7	150	8
MIDSPAN	0.035	0.440	0.073	0.12	126.0	150	8

CHECK FOR SERVICABILITY

SHORT SPAN

	pt Provided	f_s	Modification factor	depth required	
SUPPORT	0.268	120.9	2.00	92.50	OKAY
MIDSPAN	0.268	109.0	2.00	92.50	OKAY
LONG SPAN					
SUPPORT	0.268	114.9	2.00	95.50	OKAY
MIDSPAN	0.268	109.0	2.00	95.50	OKAY