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CIN : U45201TN2005PTC055334

STRUCTURAL STABILITY CERTIFICATE

The detailed engineering and structure design of the proposed building **"THE PRESIDENT"** comprising of 3 Basement (Car parking, STP & UG Sump) and Ground floor part (Entrance Lobby, Indoor Activity Room, Party Hall, Electrical Room) + 1st floor to 21st floors (Residential Units) + 22nd Floor as Amenity floor including swimming pools and gym at R.S. No. 1738/2, 1738/92, 1738/94, 1738/95, 1738/96, 1738/97, Block No. 37, Dr. Radhakrishnan Salai, Mylapore Village, Mylapore Taluk, Chennai-600004 of **M/s. SAPTHRISHI BUILDCON Pvt. Ltd.** having office at No.2, Radisson Blu Hotel, Ethiraj Salai, Egmore, Chennai-600008 within the limits of Greater Chennai Corporation has been done by us based on the report of the geotechnical investigation (soil test) done by Dr. B. Ram Prasad, Report No. 029/BRP/24-25 dated March 19th 2025 and considering the functional requirements of the building.

It is certified that among other factors, the proposed building has been designed to resist earthquake. We have checked various parameters and found that the proposed building would be safe.

We further certify that:

i. The minimum grade of concrete is M30

ii. The design and analysis has been done using the code of practice for plain and reinforced concrete as per IS 456, design loads as per IS Code 875 and the design of earthquake resistant structure as per IS Code 1893:2016

The building will be safe and sound when used for the purpose for which it is designed.

Encl.: Structural Design Calculations

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PROPOSED RESIDENTIAL DEVELOPMENT
THE PRESIDENT AT MYLAPORE, CHENNAI

DESIGN BRIEF REPORT FOR STRUCTURAL SERVICES

Client:	ASTA	**M/s. ASTA PROPERTIES**
Structural Consultant:		**BURO ENGINEERS (I) PVT LTD** Civil & Structural Consultants New No.31, (old No. 14), Besant Avenue, Adyar, Chennai 600 020.

DOCUMENT NO : STR - DBR/Rev-R0

DATE	ISSUE	PREPARED	CHECKED	REVISION
23-07-2025	Primary Report	S.M	P.J	R0

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1.0 PROJECT INFORMATION

1.1 Introduction:

This Design Brief Report (DBR) is for the Proposed Residential Development **The President** at Mylapore, Chennai, for **M/s. ASTA Properties.**

The proposed **Residential Building** having 3 Basement + Ground floor + 22 Upper floors. The 20th, 21st and 22nd housing penthouse, amenities and swimming pools.

This report provides the information on Codes of Practice, Design loading, Material Strength considered for the Design and Analysis of the building. In addition this report includes Structural system, Foundation system, Method statement of structural analysis which will be adopted for design and analysis for the building.

1.2 Facilities:

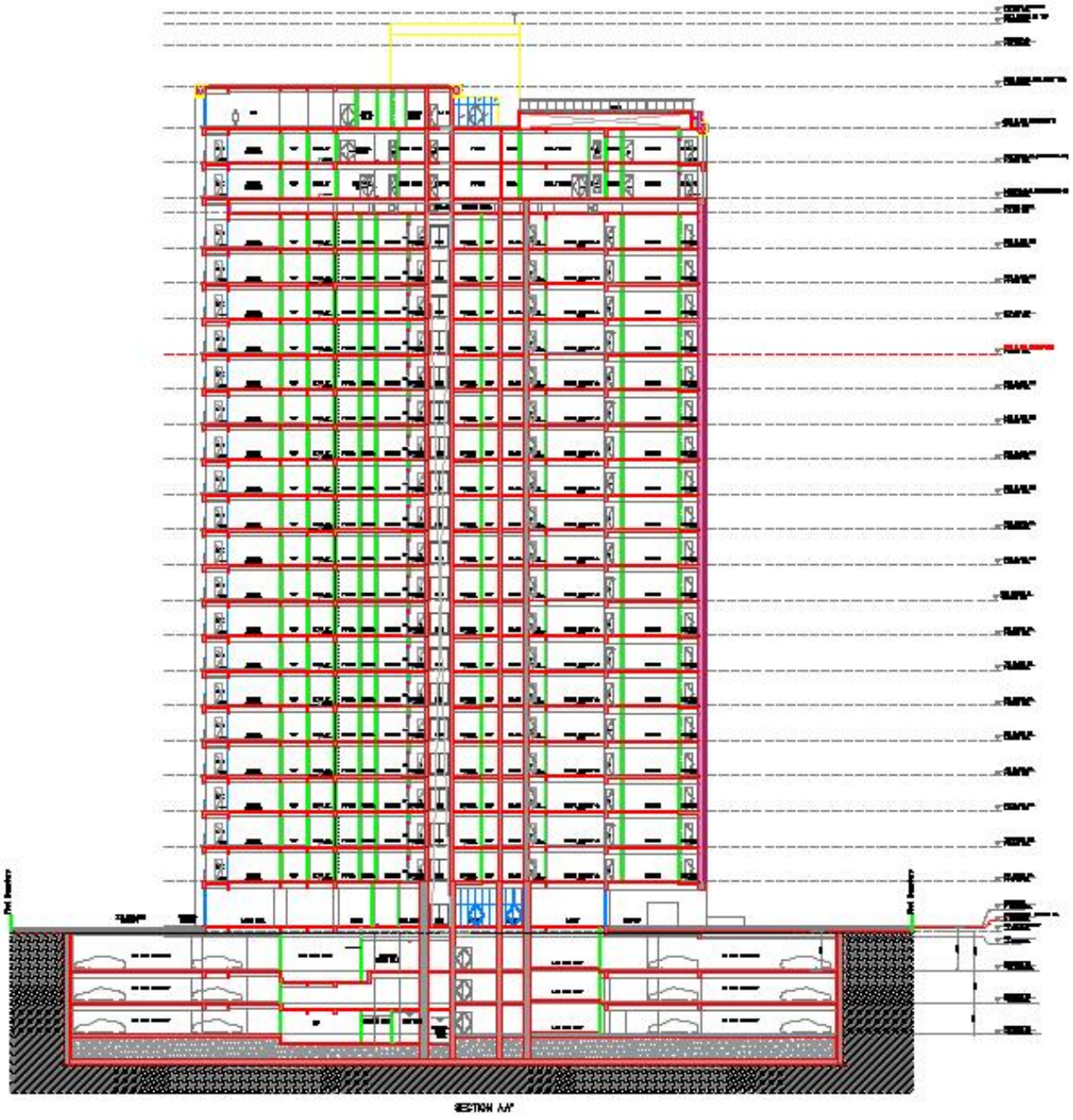
The proposed building, The President, is primarily a residential building housing apartments, amenities such as swimming pools, gym, party hall and car parking facilities at the substructure (Basement 1 to Basement 3).

2.0 STORY INFORMATION

Story	Facilities
Basement-3, Basement-2 & Basement-1	Car parking, STP (B3) & UG Sump (B1)
Ground Floor	Entrance lobby, party hall, electrical room & drop off.
Extended Podium	Landscape & Fire drive way.
Ground Floor to 22th Floor (TOWER)	Each floor consists of four flats, with the 16th and 25th floors designated as refuge floors. Above the 25th floor, there is a service floor that supports two upper levels of penthouses, each featuring swimming pools.
Terrace	Gym, sky lounge, swimming pool OHT & LMR

2.1 Floor to Floor Height:

Basement 3 & 2	3.2m
Basement 1	3.9m
Ground Floor	4.5m
1st to Terrace	3.5m

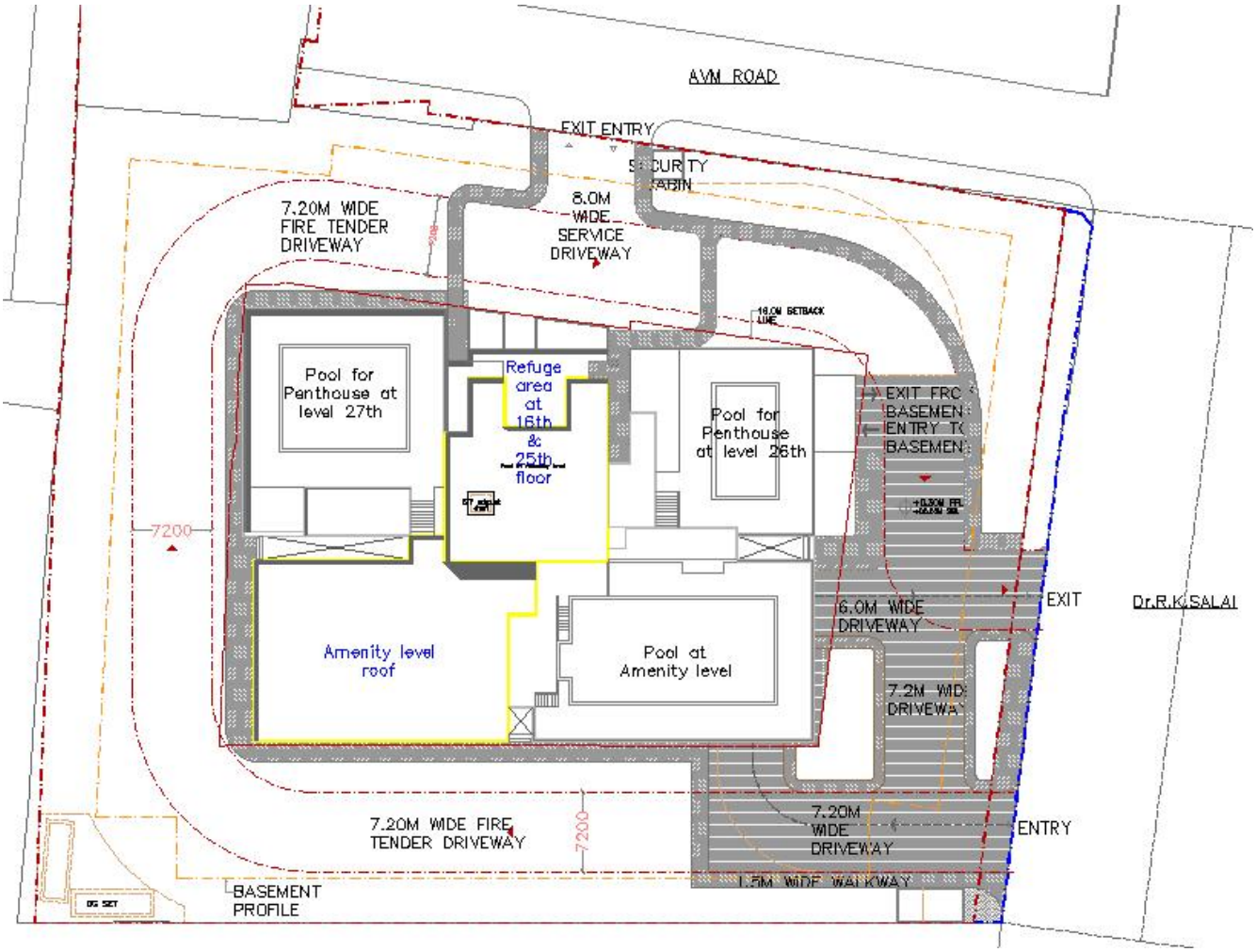


SECTIONAL VIEW

3.0 SITE DISCRIPTION

The site can be accessed from **R.K Salai Road** from the North and from the **AVM Avenue** along the western boundary.

The site previously housed a hotel building of approximately G+6 story, which was demolished to make way for the proposed structure.



SITE PLAN

3.1 Ground Condition:

We have reviewed the following reports to understand the stratigraphy and ground conditions at the site.
Dr. B. Ram Prasad Consultants (P) Limited, , Group Housing Development at R.K.Salai Main Road, Mylapore, Chennai, Geo-technical Investigation Report_2025.

The general geological sequence identified by the record of the borehole is as follows:

Stratum	**(Depth in m : from - to -) from existing ground level**
Fill Layer - Likely to be compressible and unsuitable for bearing	0-2m
Brown grey stiff clay - moderate strength but may pose settlement concerns under loads	2m to 4m
Brown fine to medium sand with stilt - potential for moderate to high permeability, impacts dewatering.	4.5m to 20m
Brown blue weathered rock and Jointed granite - good bearing stratum, used as founding strata.	20.5 to 28.5+

The geotechnical implications indicates the soil profile contains heterogeneous conditions **requiring deep foundation.**

4.0 CODES OF PRACTICE

The relevant Indian Standard codes below are followed.

4.1 Code, Standards and References:

All design of structures shall comply with the requirements specified in the following.

a. Relevant Indian Standard Codes of Practice
b. National Building Code.
c. Local Building regulations.
d. Other relevant International codes where required.

All applicable latest edition of codes and standards will be referred and adopted in the analysis of structures and the design and detailing of structural members. All structural elements design shall be carried out primarily based on. Indian Standards and Codes with latest revision, with amendments if any, as on date.In addition, other international codes and standards shall also be referred when required and relevant.

In the analysis, design and detailing of the building, the following Indian Standard codes of latest amendment will be used.

CODE	DESCRIPTION
IS 875(Part 1) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Unit weights of buildings materials and stored material
IS 875 (Part 2) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Imposed Loads
IS 875 (Part 3) 2015	Code of practice for Design Loads (other than earthquake) for buildings and structures – Wind Loads
IS 875 (Part 5) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Special Loads and load combinations
IS 456 – 2000	Code of Practice for Plain and Reinforced Concrete
IS 16700 – 2023	Criteria for Structural Safety of Tall Concrete Buildings
IS 1343 – 2012	Code of Practice for Prestressed Concrete
IS 1893 – 2016	Criteria for earthquake resistant design of structures
IS 4326 –1993	Code of practice for Earthquake Resistant Design and Construction of Buildings
IS 3370 – 2009	Code of Practice for Concrete structures for the storage of liquids
IS 1904-1995	Code of Practice for design and construction of Foundation
IS 1080 – 1997	Code of Practice for design and construction of shallow Foundation
IS 2950 - 1998	Code of Practice for design and construction of Raft Foundation
IS 800 – 2007	Code of practice for General Construction in steel

BS 8110 : 1997	Plain and reinforced concrete-code of practice(British standard)
ACI 318	Plain and reinforced concrete-code of practice (American standard)
IS 13920: 2016	Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces
SP24	Explanatory Hand book on Indian standard code of practice
SP34	Handbook on concrete reinforcement and detailing

5.0 COVER AND FIRE RATING

Cover to reinforcement considered for various elements

Structural element	Exposure condition	Fire rating in hours	Cover	
Pile Cap	Severe		50 (Bottom)	50 (Top)
Basement- 3 Floor slab	Severe		50 (Bottom)	25 (Top)
Basement wall	Severe		45 (Soil side)	30 (Building side)
Column		2	40	
Shear wall		2	30	
Beam (Simply supported)		2	40	
Beam (Continuous)		2	30	
Slab (Simply supported)		2	35	
Slab (Continuous)		2	25	

6.0 STRUCTURAL SYSTEM

Floor system: The structural Floor system for the super structure is R.C.C Beam with R.C.C and PT slab. The slab thicknesses are to be 125mm/150mm/200mm/225/250mm. And for the Sub structure floor system is RCC Beam and RCC and PT slab system.

Lateral load resisting system:

Ductile RC structural wall with Gravity columns.

7.0 FOUNDATION SYSTEM

The following are inferred from the Geo-technical investigation report.

A total of 6 boreholes were terminated after drilling approximately 28m depth in refusal/rock strata. Refusal strata encountered is in the form of **Weathered strong/jointed granite**. The N value recorded at this depth is more than 100.

The report has also stated the **ground water table is encountered at 0.8m from road level.** We have considered design water head from the ground level for the pile-cap and stitch-slab design. For stitch slab **anchors** are used to counter the uplift force due to water pressure.

Heavy Duty Hydraulic Rotary Rig Bored Cast In-Situ Pile

Pile Dia. M	Compressive Capacity		Uplift Capacity		Lateral Capacity @ 5 mm Defl.
	Ultimate Tons	Allowable Tons	Ultimate Tons	Allowable Tons	Allowable Tons
0.75	397.58	159	73.84	25	6.99
0.90	556.65	233	90.47	30	9.92
1.00	677.43	271	101.89	34	12.10
1.20	954.35	382	125.57	42	16.97
1.35	1192.97	477	144.05	48	21.06

Hence Foundation system adopted is **Combined Pile-cap for Tower and Isolated & combined Pile-cap with Stitch slab for extended basement.** The Pile capacity considered for the design is **400T for 1000mm diameter Pile (As per the results inferred from the Pile Load Test)** with reference to the soil investigation report. And basement stitch slabs are designed for water **uplift pressure of 106.5kN/m2.**

8.0 MATERIAL GRADES

Materials specified will confirm to the latest edition of the relevant Indian Standards. Specifications for materials will include for sampling and testing as stipulated in the design standards. Detailed material specifications will be included in the Technical specifications.

8.1 Concrete

Durability provisions for concrete structures shall be as per **'Extreme'** conditions of environment in accordance with IS 456:2000.

Keeping the durability and structural requirements, the proposed Compressive Strength of structural concrete at 28 days, for various structural elements/members are as indicated in the below table

Structural Elements		Compressive Strength at 28 days	Concrete grade
Minimum grade of concrete for any structural member is considered as		30 N/Sq.mm	M30
All Structural concrete for :			
Columns, Shear walls & Core walls	Foundation to 8th Floor level	50 N/Sq.mm	M50
	8th Floor level to 13th Floor level	40 N/Sq.mm	M40
	13th Floor level to Terrace and above floor	30 N/Sq.mm	M30
Pile		30 N/Sq.mm	M30
Pilecap		30 N/Sq.mm	M30
Beams and slabs	Basement to 8th Floor level	35 N/Sq.mm	M35
	8th Floor level to Terrace	30 N/Sq.mm	M30
Overhead Water Tank, UG Water Tank, STP & Pump room		30 N/Sq.mm	M30

8.2 Reinforcement

All reinforcement shall confirm to IS: 1786-2008 having minimum yield strength of 550 N/sq mm (Fe 550D).

Youngs' Modulus (Es)	200,000N/Sq.mm
Yield Stress (fy)	550 N/Sq.mm
Diameters {in mm} (d)	8, 10, 12, 16, 20, 25 & 32
Density (ϒ)	78.5 kN/cum

9.0 DESIGN OF LOADINGS

9.1 Material Density

Unit weight of materials are as per IS: 875 (Part-I) 1987.

Unit weight of concrete	-	25 KN / Cum.
Unit weight of steel	-	78.5 KN / Cum.
Screed concrete	-	24 KN / Cum.
Unit weight of dry soil	-	18 KN / Cum.
Unit weight of saturated soil	-	20 KN / Cum.
Unit weight of Glass	-	27.2 KN / Cum.
Unit weight of water	-	9.81 KN / Cum.
Aerated block masonry	-	8.65 KN / Cum.
Light weight concrete filling	-	16.0 KN / Cum (Supplier - Nuvoco)

9.2 Superimposed Dead Loads and Live Loads

The following are the imposed loads such as SDL and LL to be considered for the design of floor system depending usage floor. In addition to these loads, self-weight of structural elements will be considered depending member sizes shown in the floor plans.

Usage	SDL (kN/m2)				LL (kN/m2)
	Partition Wall	Services	Finishes	Total	
Parking - Cars	0.00	0.50	2.40	2.90	3.00
Staircase	0.00	0.00	3.00	3.00	3.00
Toilet	0.00	0.50	1.80	2.30	2.00
Bed, Living, Dinning & Kitchen	0.00	0.00	1.20	1.20	2.00
Balcony	0.00	0.50	1.80	2.30	3.00

Lobby & Corridor	0.00	0.00	2.40	2.40	3.00
Refuge	0.00	0.00	2.40	2.40	5.00
Reception & Lounge (GF)	0.00	0.00	1.80	1.80	4.00
Gym	0.00	0.00	1.80	1.80	4.00
Multipurpose Hall, Pre-Function	0.00	0.00	1.80	1.80	5.00
Terrace	0.00	0.00	3.60	3.60	5.00
LMR	0.00	0.00	3.60	3.60	10.00
OHT	0.00	10xWater Height	1.80	0.00	0.00
Swimming Pool	0.00	7.50	2.40	9.90	12.00
Swimming Pool Deck	0.00	7.50	2.40	9.90	5.00
Podium & Landscape	0.00	12.60(0.15x24+0.45 x20)		12.60	5.00
Fire Driveway	0.00	12.60(0.15x24+0.45 x20)		12.60	20.00

* (GF) - Ground floor

Permissible reduction in imposed load on each floor is considered for design of columns and footings as per IS 875 Part (2).

a) **SUPER IMPOSED DEAD LOADS (kN/m^2)**

Floor Finishes of 50 mm thickness have been considered on all the typical floors, Basement floors 100mm, toilet-50mm, balcony-75mm,

TERRACES (Load in kN/m2)

Waterproofing + Screed 3.60 (0.15(average floor finish.) x 24=3.60)

b) **SELF-WEIGHT OF LIGHT WEIGHT WALLS (kN/m^2)**

Infill walls (15mm plastering on either side)

(i) 200mm thick light weight block wall	- 2.72kN/m^2
(ii) 100mm thick light weight block wall	- 1.72kN/m^2

RCC walls

(i) 200mm thick RCC wall	- 5.00kN/m^2
(ii) 100mm thick RCC wall	- 2.50kN/m^2
Water Tank	Water height x 10

9.3 Seismic Design Parameters:

Design of lateral force under seismic condition shall be as per IS1893 – 2016. Total lateral force (base shear) of the building shall be estimated at ground floor level as per clause 7.2.1 of IS1893 – 2016 which provides by

Base shear Vb = Ah W

Ah is horizontal seismic coefficient and W is seismic weight of the building, Horizontal seismic coefficient depends on location of the building (Zone factor Z), usage of the building (Importance factor, I), building lateral resisting system (Response reduction factor, R) and design acceleration coefficient (Sa /g) which is based on subsoil condition and fundamental natural period (Ta).

For the proposed development is for residential use. Considering it, the seismic weight is summation of total dead load and 25% of live load where live load is equal and less than 3 kN/sq.m and 50% of live load greater that 5 kN/sq.m

1) The lateral load resisting system of the buildings is **ductile shear wall.**
2) As per IS 1893:2016 code, Chennai lies in Zone III with Zone factor Z = 0.16
3) The Design Base Shear is given by V_b = Ah x W, Where Ah = Z / 2 x I/R x S_a /g

   I = Importance Factor = 1.2

   Soil Type 1 (Rock or Dense soil)
4) Seismic Force-Resisting System:

   The building employs **ductile RC structural walls** as the primary lateral load-resisting system. Accordingly, the **Response Reduction Factor (R) = 4.0** is adopted, based on **IS 1893 (Part 1): 2016,** Table 9, Sl. No. (iii)(c). As

per **Note 3** of the same table, the moment-resisting frames do not fulfill the requirements of a "dual system".

- **All RC structural walls** are designed to resist **100% of the design lateral seismic forces.**
- However, in accordance with **Clause 7.11.2 of IS 1893 (Part 1): 2016,** all gravity-only columns have been checked for **deformation compatibility** under **R times the storey displacement,** to ensure they do not lose vertical load-carrying capacity under induced moments.
- Frames have been **independently designed to resist lateral forces** based on their **individual lateral stiffness.** This ensures that, in addition to deformation compatibility checks, the gravity frames also contribute to seismic load resistance proportionate to their stiffness.
- **RC columns** are detailed for ductile behavior as per **Clause 11 of IS 13920:2016.**

Sa/g = Average Response acceleration coefficient

For the building height with reference to IS: 1893-2016, since the buildings are well connected with basement walls so for the time period calculation the heights are considered ground floor to roof that is 105.05m.

The fundamental natural period (Ta) for building is calculated based on the empirical formula,

$\mathbf{T_a = 0.0672\ H^{0.75}}$ (As per IS 16700:2023 Cl.6.3.4)

Where,

Base Dimension along X Direction, dx = 51.05m

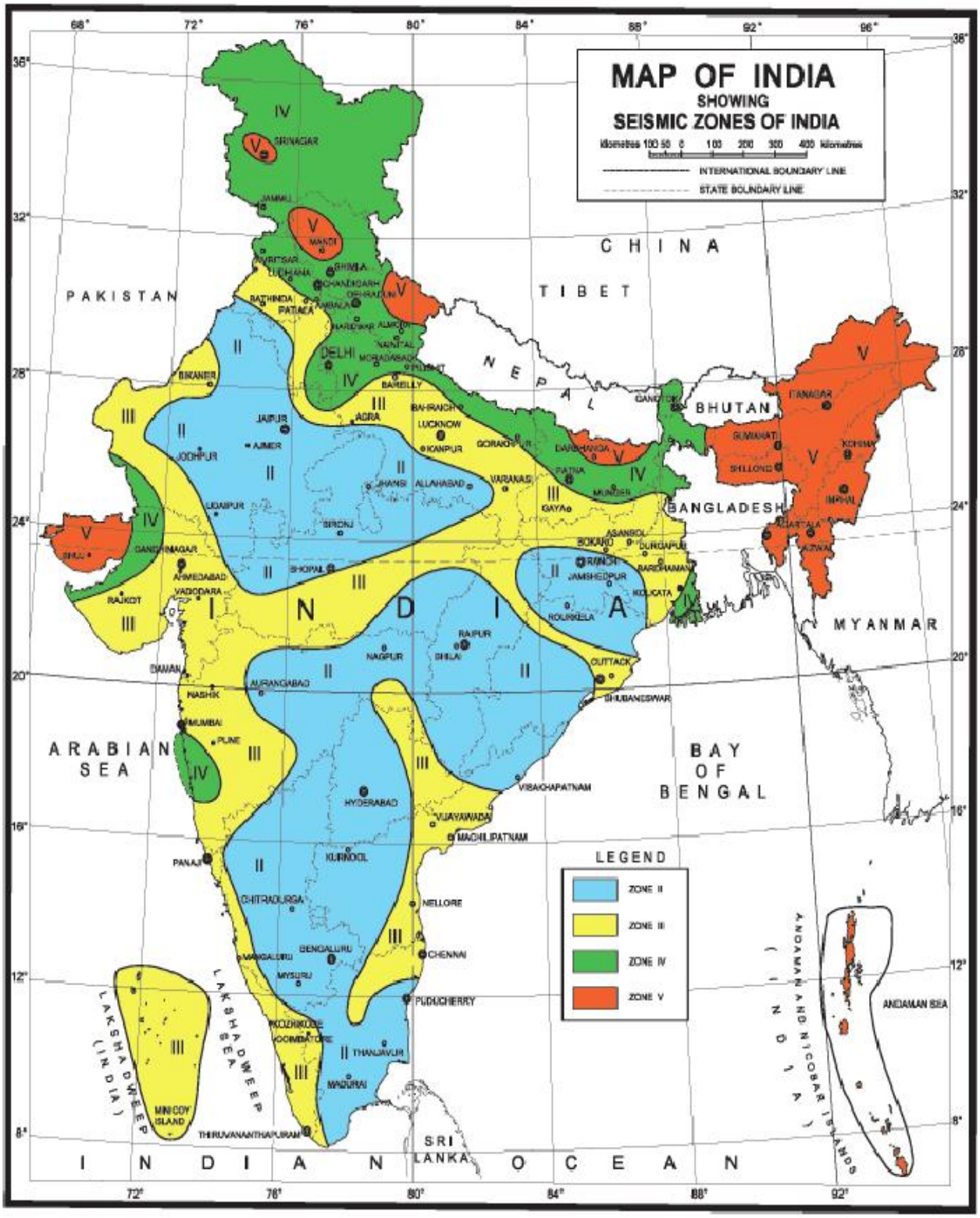
Base Dimension along Y Direction, dy = 39.65m

H = 84.075m

Min Ah = 1.1 (As per Table 7 of IS 1893(Part 1:2016)

T_a = 1.87 (along X direction)

T_a = 1.87 (along Y direction)



SEISMIC ZONE CLASSIFICATION FROM IS 1893 : 2016

Dynamic Analysis

Response spectrum method of Dynamic Analysis carried out with following parameters pertaining to dynamic analysis.

Number of modes Considered : 10 Numbers (Min)
Modal Combination Method Used : Complete Quadratic combination (CQC).
Directional Combination Method used : Square root of the sum of Square (SRSS).
Modal case type : Ritz vector Method
Cut off frequency in case response spectrum method of analysis - 33 Hz.
Mass participation is 90% as per our analysis
Damping 5%is used for seismic analysis
Dynamic analysis of building is carried out. The members are designed accordingly.

9.4 Deformation Compatibility Procedure:

Clause 7.11.2 of IS:1893 (Part 1) states that it should be ensured that the structural elements which are **not part of seismic load resisting system**, should not lose their vertical load carrying capacity under induced moments resulting from **'R' times storey displacement.** To calculate displacement it is permissible to use seismic forces calculated from computed fundamental time period of structure.
Procedure that we have adopted in ETABS for calculating induced moments and design of members not part of lateral load resisting system is as follows.

1) Define new load case **'EQX_Displacement'** with parameters
R = 1
I = 1
Time period shall be 'Program Calculated'
Other parameters to be same as considered for EQX

2) Define new non-linear static load case **'DL+LL+EQX_Displacement'** with following parameters

Initial Condition	- zero initial condition
Loads applied	- DL+LL+EQX_Displacement
Geometric Non-linearity Option	- P-Delta
Load Application	- full load
Results saved	- finial state only

3) Define new non-linear load case **P-delta-DL+LL+EQX** with following parameters

Initial Condition	- start at the end of non-linear load case 'DL+LL+EQX_Displacement'
Loads Applied	- DL+LL+EQX_Displacement
Geometric Non-linearity Option	- None
Load Application	- Full load
Results saved	- final state only

Analysis results for the load case **'P-delta-DL+LL+EQX_Displacement'** will give induced moments due to 'R' time's displacement EQX multiplied by axial forces due to DL+LL.

Design of members to be checked for load combination **1.2DL + 1.2LL +/- 1.2('Pdelta-DL+LL+EQX'), 0.9DL+/-1.5('Pdelta DL+LL+EQX)**

Steps 1 to 3 should be repeated for each lateral load case for loads applied in positive as well as negative direction.

9.5 Wind Loads

The wind pressure shall be calculated based on the basic wind speed and other provisions laid in IS 875 Part (3) - 2015

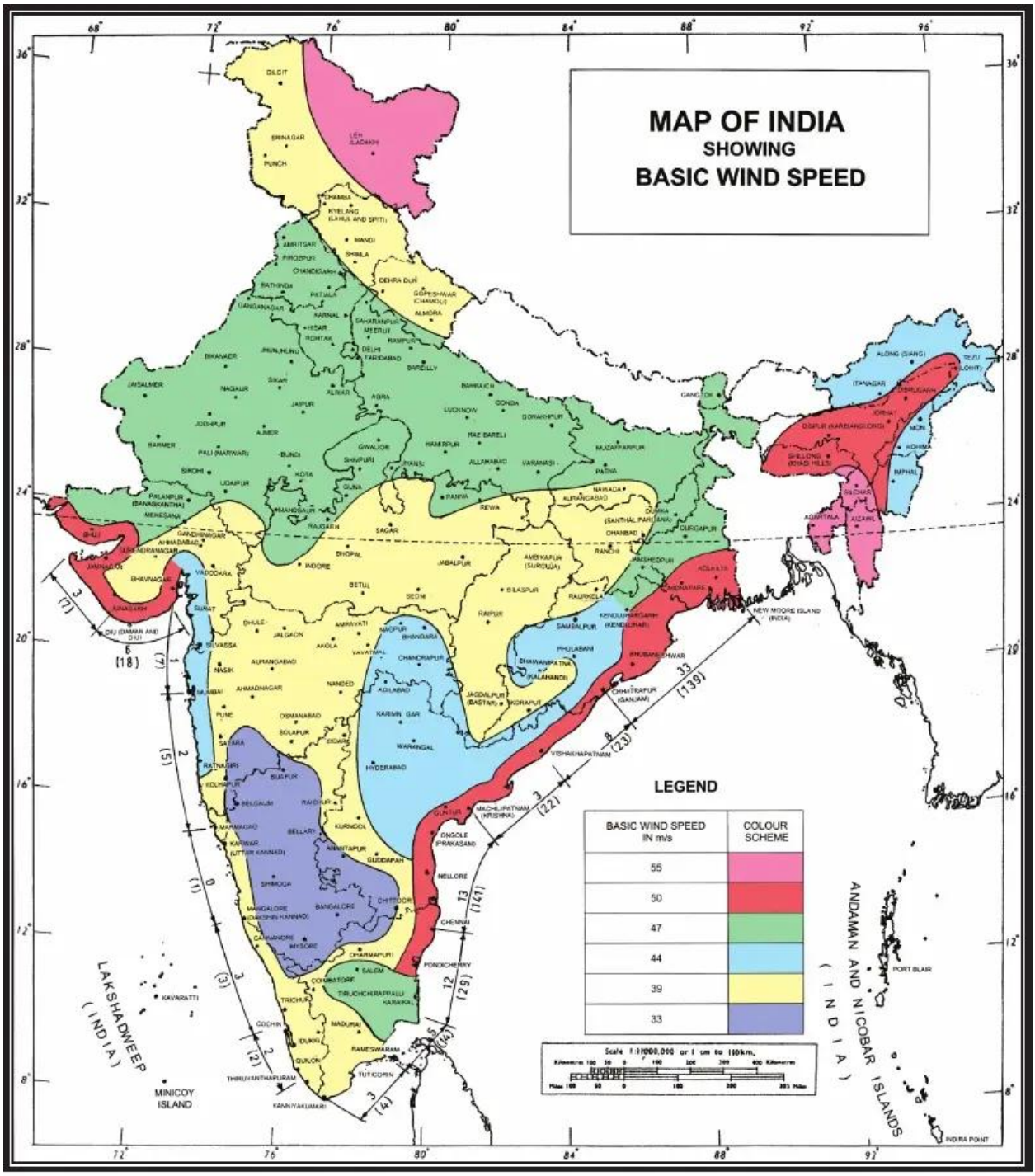
Design Wind Speed, VZ		= Vbxk1x k2x k3x k4
Vb	→ Basic Wind velocity for Chennai	= 50m/s
K1	→ Risk coefficient for all general buildings	= 1.00
k2	→ Terrain category 2	= To suit the height of the structure for terrain
k2 (H=84.075m -GF to Roof including parapet wall)		= 1.24
k3	→ Topography factor	= 1.00
k4	→ Importance Factor for cyclonic Region	= 1.00

Based on the above,

Max. design wind speed (VZ) (Vbxk1x k2x k3x k4) = 62 m/s

Max. design wind pressure (Pz)	= 0.6 x Vz2	= 2306.4 N/m2
Design wind pressure: pd	= Pz x Kax Kd x Kc	= 1681.36 N/m2

Kd	→ Wind directionality factor	= 0.90
ka	→ Area averaging factor	= 0.90
Kc	→ Combination factor	= 0.90



Based upon Survey of India Outline Map printed in 1993.

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The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.
Responsibility for correctness of internal details shown on the map rests with the publisher.
The state boundaries between Uttaranchal & Uttar Pradesh, Bihar & Jharkhand and Chhatisgarh & Madhya Pradesh have not been verified by Governments concerned.

FIG. 1 BASIC WIND SPEED IN m/s (BASED ON 50-YEARS RETURN PERIOD)

INDIAN WIND SPEED CLASSIFICATION FROM IS 875 PART (III)

9.6 Temperature Loads:

The building is completely covered with block work on the sides. So there will be no appreciable differential temperature during the service life of building. The roof slab and the podium of building is to be analyzed for ± 15°C difference in temperature is applied to ETABS model and necessary load combinations are considered in analysis & Design of the building. The roof slab is assign as semi rigid diaphragm for ultimate load combination.

10.0 LOAD COMBINATION

The various loads combinations used for design in accordance with IS 1893-2016 are as follows:

1. 1.5 (DL + LL)
2. 1.2 (DL + LL ± SPECX ± 30%SPECY ± 30%SPECZ)
3. 1.2 (DL + LL ± SPECY ± 30%SPECX ± 30%SPECZ)
4. 1.2 (DL + LL ± SPECZ ± 30%SPECX ± 30%SPECY)
5. 1.2 (DL + LL ± WindX)
6. 1.2 (DL + LL ± WindY)
7. 1.5 (DL ± SPECX ± 30%SPECY ± 30%SPECZ)
8. 1.5 (DL ± SPECY ± 30%SPECX ± 30%SPECZ)
9. 1.5 (DL ± SPECZ ± 30%SPECX ± 30%SPECY)
10. 1.5 (DL ± WindX)
11. 1.5 (DL ± WindY)
12. 0.9DL ± 1.5(SPECX ± 30%SPECY ± 30%SPECZ)
13. 0.9DL ± 1.5(SPECY ± 30%SPECX ± 30%SPECZ)
14. 0.9DL ± 1.5(SPECZ ± 30%SPECX ± 30%SPECY)
15. 0.9DL ± 1.5WindX
16. 0.9DL ± 1.5WindY

For gravity columns deformation compatibility load combinations are considered along with wind load combinations.

17. 1.2DL + 1.2LL ± 1.2('Pdelta-DL+LL±EQX')
18. 1.2DL + 1.2LL ± 1.2('Pdelta-DL+LL±EQY')
19. 0.9DL 1.5('Pdelta DL+LL±EQX)
20. 0.9DL 1.5('Pdelta DL+LL±EQY)
21. 1.5 (DL + 'Pdelta DL+LL±EQX)
22. 1.5 (DL + 'Pdelta DL+LL±EQY)

Where accidental / fire tender load case is applicable, the following load combination is considered

23. 1.5 DL + 1.05 AL + 1.50 LL

The various service loads combinations of structure as per IS 456 are as follows

24. 1.0DL +1.0 LL
25. 1.0DL ± 1.0SPECX

26. 1.0DL ± 1.0SPECY
27. 1.0DL ± 1.0WindX
28. 1.0DL ± 1.0WindY
29. 1.0DL ± 1.0TEMP
30. 1.0DL + 0.8LL ± 0.8SPECX
31. 1.0DL + 0.8LL ± 0.8SPECY
32. 1.0DL + 0.8LL ± 0.8WindX
33. 1.0DL + 0.8LL ± 0.8WindY
34. 1.0DL + 0.75LL ± 0.75TEMP
35. 1.0DL + 0.5LL ± 0.75TEMP ± 0.75SPECX
36. 1.0DL + 0.5LL ± 0.75TEMP ± 0.75SPECY
37. 1.0DL + 0.5LL ± 0.75TEMP ± 0.75WindX
38. 1.0DL + 0.5LL ± 0.75TEMP ± 0.75WindY

Where,	DL	- Dead load,
	LL	- Live load (Live>3kN/m2, Live<=3kN/m2)
	Wind X	- Wind load in X - direction
	Wind Y	- Wind load in Y - direction
	SPECX	- Earthquake load in X - direction
	SPECY	- Earthquake load in Y - direction
	TEMP	- Temperature load
	AL	- Accidental Load (such as fire tender load)

11.0 SERVICIBILITY LIMITS

11.1 Lateral Deflection (Wind)

Overall Deflection	<	Height/500
Storey Deflection	<	Storey height/500

11.2 Lateral Deflection (Seismic)

Overall Drift	<	H / 250
Storey Drift	<	0.004 times storey height

11.3 Vertical Deflection of Beams and Slabs due to Gravity Loads

Total Deflection (DL + LL) < Span/250

Deflection including the effects of Temperature, Creep and Shrinkage Occurring after erection of partitions and the application of finishes < Span/350 or 20mm whichever is less.

12.0 STRUCTURAL ANALYSIS AND DESIGN APPROACH

Computer-aided analysis using finite element method (FEM) shall be carried out for the design of structural elements. For 3D or 2D structural frame analysis latest version of software ETABS or SAFE shall be used, Prokon, RCDC and verified in-house spreadsheets will be used for the design of reinforced concrete (RC) and steel elements in consideration of flexure, shear and axial forces.

Assumptions for 3D model analysis using ETABS

Column : Frame Element
RC Wall : Wall (Shell) Element
Beam Element : Frame Element
Slab : Shell Element
The following are general parameters adopted in the analysis and design,
Modulus of Elasticity of Concrete -5000√fck
Consideration of Diaphragm - Semi Rigid Diaphragm.
Slab/Wall element considered as Shell element

Stiffness modification factors are adopted in the analysis as per IS -16700-2017, Table.6.

Table 6 Cracked RC Section Properties
(*Clause* 7.2)

Sl No.	Structural Element	Un-factored Loads		Factored Loads	
		Area	Moment of Inertia	Area	Moment of Inertia
(1)	(2)	(3)	(4)	(5)	(6)
i)	Slabs	1.0 A_g	0.35 I_g	1.00 A_g	0.25 I_g
ii)	Beams	1.0 A_g	0.7 I_g	1.00 A_g	0.35 I_g
iii)	Columns	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g
iv)	Walls	1.0 A_g	0.9 I_g	1.00 A_g	0.70 I_g

The following parameters and methods are adopted in creating ETABS 3D model for the buildings and design of structural elements.

- ✓ The 3D ETABS model generated based on the preliminary floor plans (shuttering drawings) prepared using preliminary sizes.
- ✓ Sectional properties are assigned to all the structural elements as per the preliminary floor plans (shuttering drawings).
- ✓ External & Internal infill wall loads are assigned as uniformly distributed line load on beams and as area load if the wall is intending to distribute on slab directly.
- ✓ Slabs are modeled as shell element if floor system and slabs are assigned with horizontal diaphragms.
- ✓ Live Load reduction is considered in the design of Foundation and Column as per the Code: IS 875-1987 (Part-II), clause.3.2.1.

- ✓ Area design load i.e. Live load/SDL or any other load is applied at floor relevant to its usage.
- ✓ All lateral loads & parameters are assigned as per Codes IS 1893-2016 & IS 875-Part-3, 2015.
- ✓ Temperature loads are applied on to the terraces and to areas directly exposed to atmosphere.
- ✓ Beams under Torsion is required to maintain Equilibrium will be designed for Torsion in accordance with IS 456-2000, clause 41.1 to 41.4 and for all other beams torsional stiffness is neglected in the analysis by applying stiffness modifier as 0.000001 to torsional constant "J". Hence no specific design for Torsion is required for these beams.
- ✓ Concrete cover to reinforcement complied accordance with IS 456-2000, Table.16 & 16A.
- ✓ All vertical wall elements are assigned with auto meshing/manual messing appropriately in order to achieve accuracy in results.

Design approach of structural elements

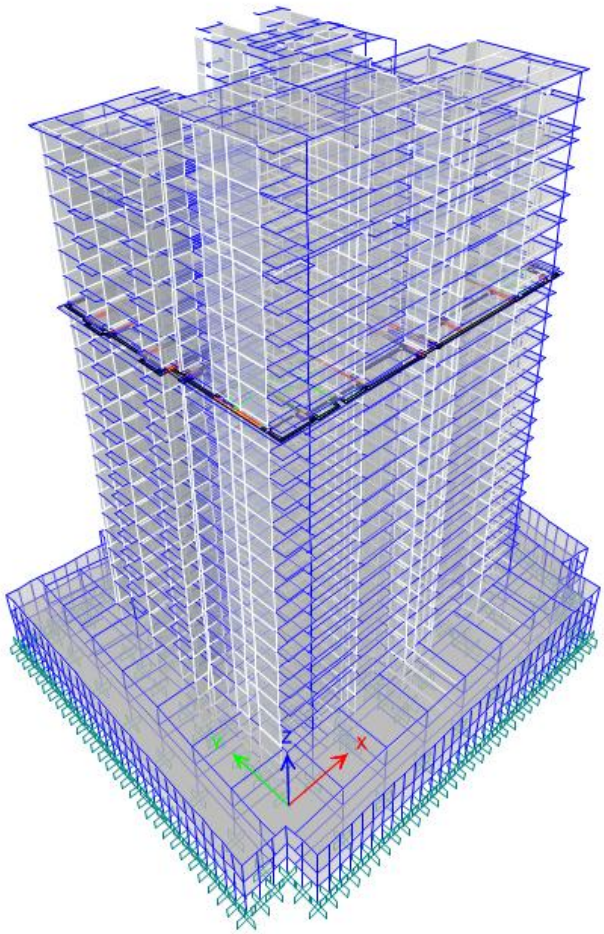
Shear wall/Column:
RC Structural Walls & Columns which are supporting both vertical loads and lateral forces are designed for the most adverse load conditions and envelope of the forces which will be the maximum for that structural element from the load combinations considered in the 3D ETABS Model.
RCDC a design software will be used to design the element for the maximum forces obtained from the ETABS model analysis results.
Beams: Each Beam will be designed for maximum forces from the 3D analysis using ETABS and RCDC Software.
Area Load & Application: Applied as uniformly distributed area load with intensity proportionate to its usage as mentioned in the Loading items in the DBR.
Line (Wall) Load & Application: Non load bearing or infill wall loads are calculated appropriately and Applied as uniformly distributed line load.

13.0 COMPUTER PROGRAMS

The following Software / spreadsheet to be used to carry out Structural analysis and design.

1.	PROKON Ver 2.3	- Wall & Beam design
2.	ETABS Ver 21.0.1	- Three Dimensional Program
3.	SAFE Ver 20.0	- Raft Analysis / Strip Analysis
4.	In-House Spreadsheet	- One way / two way slab design
5.	Rapt-6	- Post Tension Analysis & Design
6.	RCDC	- Beam Design, Isolated footing design, Column design and Wall design
STAAD PRO & ETABS		- Structural Steel Design.

ETABS®



THE PRESIDENT

Model File: THE PRESIENT [ASTA], Revision 0
24-07-2025

1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

1.1 Story Data

Table 1.1 - Story Definitions

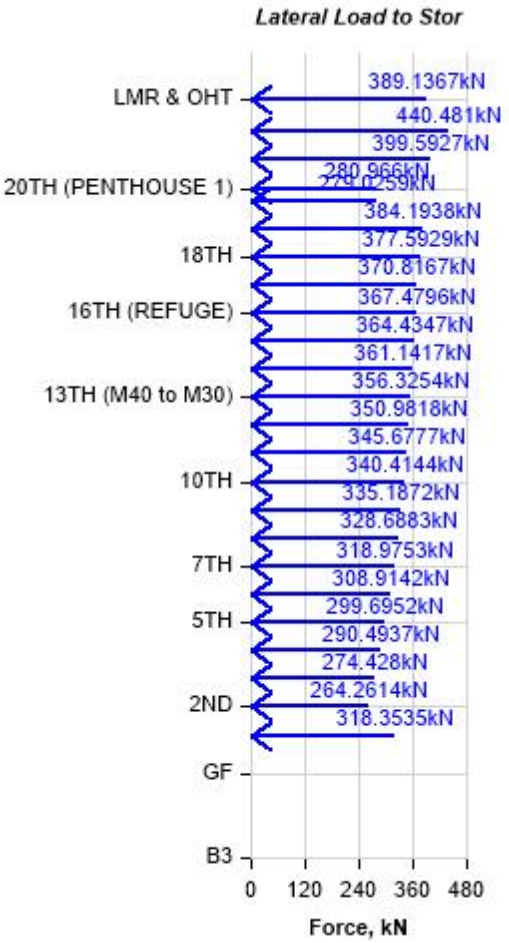
Tower	Name	Height m	Master Story	Similar To	Splice Story	Color
T1	LMR & OHT	4.1	No	20TH (PENTHOUSE 1)	No	Green
T1	22TH & TERRACE	3.5	No	20TH (PENTHOUSE 1)	No	Red
T1	21TH (PENTHOUSE 2)	3.5	No	20TH (PENTHOUSE 1)	No	Yellow
T1	20TH (PENTHOUSE 1)	1.5	Yes	None	No	Blue
T1	SERVICE	3.5	No	None	No	Cyan
T1	19TH	3.5	No	1ST	No	Cyan
T1	18TH	3.5	No	1ST	No	Magenta
T1	17TH	3.5	No	1ST	No	Gray8Dark
T1	16TH (REFUGE)	3.5	No	1ST	No	Green
T1	15TH	3.5	No	1ST	No	Red
T1	14TH	3.5	No	1ST	No	Yellow
T1	13TH (M40 to M30)	3.5	No	1ST	No	Blue
T1	12TH	3.5	No	1ST	No	Cyan
T1	11TH (V Size Reduction)	3.5	No	1ST	No	Magenta
T1	10TH	3.5	No	1ST	No	Gray8Dark
T1	9TH	3.5	No	1ST	No	Green
T1	8TH (M50 TO M40)	3.5	No	1ST	No	Red
T1	7TH	3.5	No	1ST	No	Yellow
T1	6TH	3.5	No	1ST	No	Blue
T1	5TH	3.5	No	1ST	No	Cyan
T1	4TH	3.5	No	1ST	No	Magenta
T1	3RD	3.5	No	1ST	No	Gray8Dark
T1	2ND	3.5	No	1ST	No	Green
T1	1ST	4.95	Yes	None	No	Red
T1	GF	3.9	No	None	No	Yellow
T1	B1	3.2	No	B2	No	Blue
T1	B2	3.2	Yes	None	No	Cyan

User Loads Auto Wind Load Calculation

This calculation presents the user defined lateral wind loads for load pattern W X.

Lateral Forces

Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
LMR & OHT	94.35	389.1367	0
22TH & TERRACE	90.25	440.481	0
21TH (PENTHOUSE 2)	86.75	399.5927	0
20TH (PENTHOUSE 1)	83.25	280.966	0
SERVICE	81.75	279.0259	0
19TH	78.25	384.1938	0
18TH	74.75	377.5929	0
17TH	71.25	370.8167	0
16TH (REFUGE)	67.75	367.4796	0
15TH	64.25	364.4347	0
14TH	60.75	361.1417	0
13TH (M40 to M30)	57.25	356.3254	0
12TH	53.75	350.9818	0
11TH (V Size Reduction)	50.25	345.6777	0
10TH	46.75	340.4144	0
9TH	43.25	335.1872	0
8TH (M50 TO M40)	39.75	328.6883	0
7TH	36.25	318.9753	0
6TH	32.75	308.9142	0
5TH	29.25	299.6952	0
4TH	25.75	290.4937	0
3RD	22.25	274.428	0
2ND	18.75	264.2614	0
1ST	15.25	318.3535	0
GF	10.3	0	0
B1	6.4	0	0
B2	3.2	0	0
B3	0	0	0

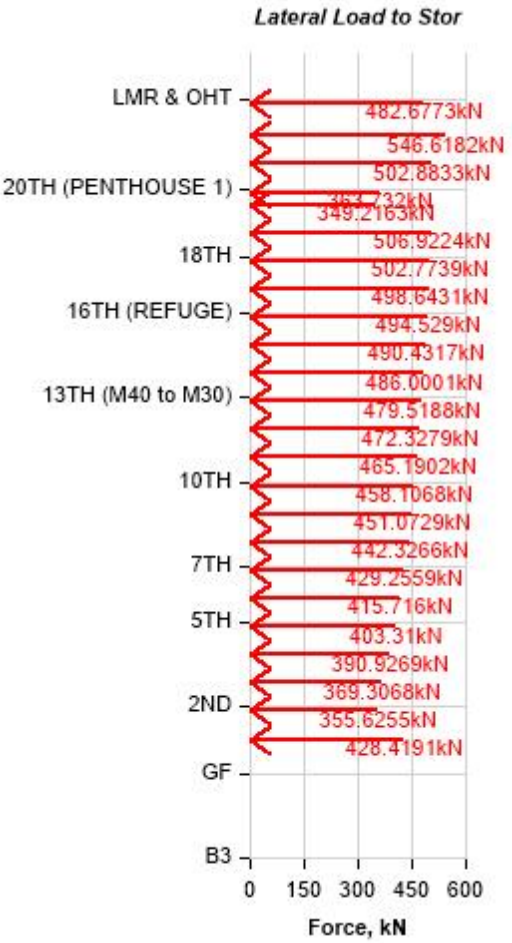


User Loads Auto Wind Load Calculation

This calculation presents the user defined lateral wind loads for load pattern W Y.

Lateral Forces

Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
LMR & OHT	94.35	0	482.6773
22TH & TERRACE	90.25	0	546.6182
21TH (PENTHOUSE 2)	86.75	0	502.8833
20TH (PENTHOUSE 1)	83.25	0	363.732
SERVICE	81.75	0	349.2163
19TH	78.25	0	506.9224
18TH	74.75	0	502.7739
17TH	71.25	0	498.6431
16TH (REFUGE)	67.75	0	494.529
15TH	64.25	0	490.4317
14TH	60.75	0	486.0001
13TH (M40 to M30)	57.25	0	479.5188
12TH	53.75	0	472.3279
11TH (V Size Reduction)	50.25	0	465.1902
10TH	46.75	0	458.1068
9TH	43.25	0	451.0729
8TH (M50 TO M40)	39.75	0	442.3266
7TH	36.25	0	429.2559
6TH	32.75	0	415.716
5TH	29.25	0	403.31
4TH	25.75	0	390.9269
3RD	22.25	0	369.3068
2ND	18.75	0	355.6255
1ST	15.25	0	428.4191
GF	10.3	0	0
B1	6.4	0	0
B2	3.2	0	0
B3	0	0	0



2.2 Auto Seismic Loading

IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern EQ X according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = X

Structural Period

Period Calculation Method = User Specified

User Period T = 1.87sec

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3] Z = 0.16

Response Reduction Factor, R [IS Table 9] R = 4

Importance Factor, I [IS Table 8] I = 1.2

Site Type [IS Table 1] = I

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2] $\frac{S_a}{g} = \frac{1}{T}$ $\frac{S_a}{g} = 0.534759$

Equivalent Lateral Forces

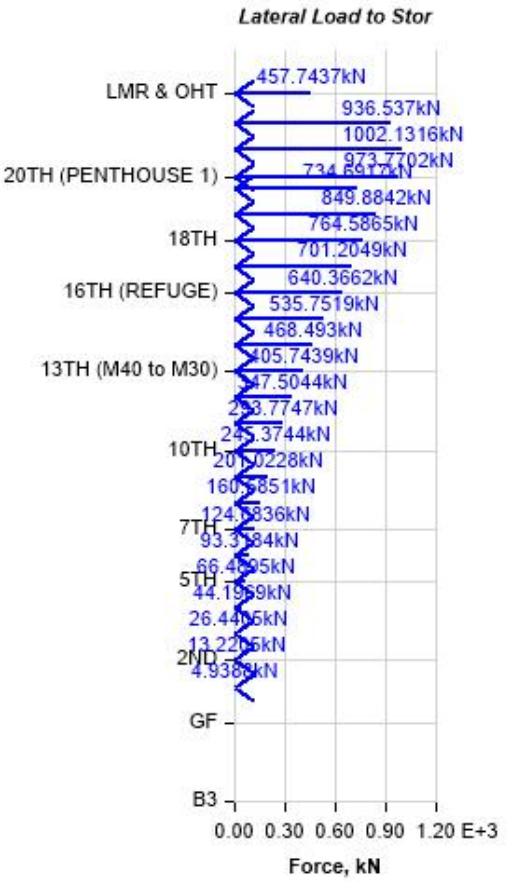
Seismic Coefficient, A_h [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
X	1.87	786370.4249	10092.4547

Applied Story Forces

Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
LMR & OHT	94.35	457.7437	0
22TH & TERRACE	90.25	936.537	0
21TH (PENTHOUSE 2)	86.75	1002.1316	0
20TH (PENTHOUSE 1)	83.25	973.7702	0
SERVICE	81.75	734.6917	0
19TH	78.25	849.8842	0
18TH	74.75	764.5865	0
17TH	71.25	701.2049	0
16TH (REFUGE)	67.75	640.3662	0
15TH	64.25	535.7519	0
14TH	60.75	468.493	0
13TH (M40 to M30)	57.25	405.7439	0
12TH	53.75	347.5044	0
11TH (V Size Reduction)	50.25	293.7747	0
10TH	46.75	245.3744	0
9TH	43.25	201.0228	0
8TH (M50 TO M40)	39.75	160.5851	0
7TH	36.25	124.6836	0
6TH	32.75	93.3184	0
5TH	29.25	66.4895	0
4TH	25.75	44.1969	0
3RD	22.25	26.4405	0
2ND	18.75	13.2205	0
1ST	15.25	4.9388	0
GF	10.3	0	0
B1	6.4	0	0
B2	3.2	0	0
B3	0	0	0



IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern EQ Y according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = Y

Structural Period

Period Calculation Method = User Specified

User Period — T = 1.87sec

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3] — Z = 0.16

Response Reduction Factor, R [IS Table 9] — R = 4

Importance Factor, I [IS Table 8] — I = 1.2

Site Type [IS Table 1] = I

Seismic Response

Spectral Acceleration Coefficient, S_a/g [IS 6.4.2] $\frac{S_a}{g} = \frac{1}{T}$ — $\frac{S_a}{g} = 0.534759$

Equivalent Lateral Forces

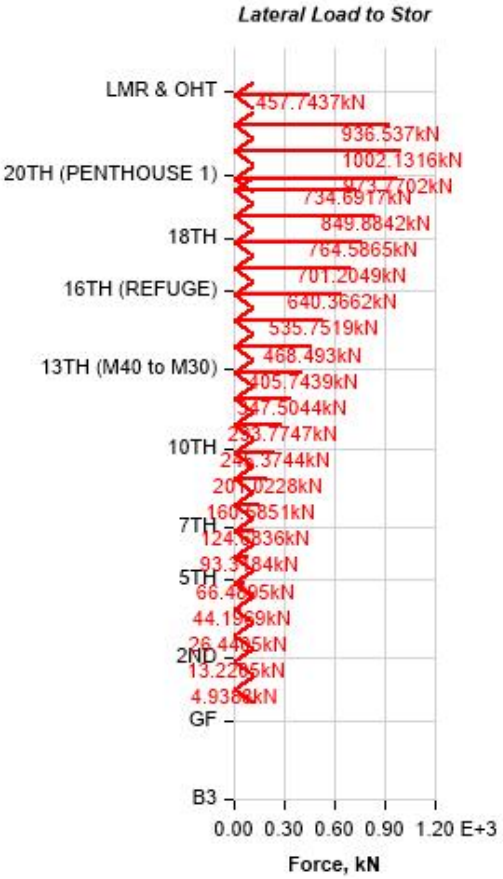
Seismic Coefficient, A_h [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
Y	1.87	786370.4249	10092.4547

Applied Story Forces

Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
LMR & OHT	94.35	0	457.7437
22TH & TERRACE	90.25	0	936.537
21TH (PENTHOUSE 2)	86.75	0	1002.1316
20TH (PENTHOUSE 1)	83.25	0	973.7702
SERVICE	81.75	0	734.6917
19TH	78.25	0	849.8842
18TH	74.75	0	764.5865
17TH	71.25	0	701.2049
16TH (REFUGE)	67.75	0	640.3662
15TH	64.25	0	535.7519
14TH	60.75	0	468.493
13TH (M40 to M30)	57.25	0	405.7439
12TH	53.75	0	347.5044
11TH (V Size Reduction)	50.25	0	293.7747
10TH	46.75	0	245.3744
9TH	43.25	0	201.0228
8TH (M50 TO M40)	39.75	0	160.5851
7TH	36.25	0	124.6836
6TH	32.75	0	93.3184
5TH	29.25	0	66.4895
4TH	25.75	0	44.1969
3RD	22.25	0	26.4405
2ND	18.75	0	13.2205
1ST	15.25	0	4.9388
GF	10.3	0	0
B1	6.4	0	0
B2	3.2	0	0
B3	0	0	0



2.3 Load Combinations

Table 2.5 - Load Combination Definitions (Part 1 of 2)

Name	Type	Is Auto	Load Name
0.9 D -1.5 EQX - 0.45EQY Displacement	Linear Add	No	Dead
0.9 D -1.5 EQX - 0.45EQY Displacement			Wall
0.9 D -1.5 EQX - 0.45EQY Displacement			SDL
0.9 D -1.5 EQX - 0.45EQY Displacement			Temp
0.9 D -1.5 EQX - 0.45EQY Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D -1.5 EQX - 0.45EQY Displacement			P-Delta-(DL+LL+EQY-Displacement)
0.9 D -1.5 EQX + 0.45EQY Displacement	Linear Add	No	Dead
0.9 D -1.5 EQX + 0.45EQY Displacement			Wall
0.9 D -1.5 EQX + 0.45EQY Displacement			SDL
0.9 D -1.5 EQX + 0.45EQY Displacement			Temp
0.9 D -1.5 EQX + 0.45EQY Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D -1.5 EQX + 0.45EQY Displacement			P-Delta-(DL+LL+EQY-Displacement)
0.9 D -1.5 EQY - 0.45EQX Displacement	Linear Add	No	Dead
0.9 D -1.5 EQY - 0.45EQX Displacement			Wall
0.9 D -1.5 EQY - 0.45EQX Displacement			SDL
0.9 D -1.5 EQY - 0.45EQX Displacement			Temp
0.9 D -1.5 EQY - 0.45EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D -1.5 EQY - 0.45EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)
0.9 D -1.5 EQY + 0.45EQX Displacement	Linear Add	No	Dead
0.9 D -1.5 EQY + 0.45EQX Displacement			Wall
0.9 D -1.5 EQY + 0.45EQX Displacement			SDL
0.9 D -1.5 EQY + 0.45EQX Displacement			Temp
0.9 D -1.5 EQY + 0.45EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)
0.9 D -1.5 EQY + 0.45EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D - 1.5 WX	Linear Add	No	Dead
0.9 D - 1.5 WX			Wall
0.9 D - 1.5 WX			SDL
0.9 D - 1.5 WX			W X
0.9 D - 1.5 WX			Temp
0.9 D - 1.5 WY	Linear Add	No	Dead
0.9 D - 1.5 WY			Wall
0.9 D - 1.5 WY			SDL
0.9 D - 1.5 WY			W Y
0.9 D - 1.5 WY			Temp
0.9 D +1.5 EQX - 0.45EQY Displacement	Linear Add	No	Dead
0.9 D +1.5 EQX - 0.45EQY Displacement			Wall
0.9 D +1.5 EQX - 0.45EQY Displacement			SDL
0.9 D +1.5 EQX - 0.45EQY Displacement			Temp
0.9 D +1.5 EQX - 0.45EQY Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D +1.5 EQX - 0.45EQY Displacement			P-Delta-(DL+LL+EQY-Displacement)
0.9 D +1.5 EQX + 0.45EQY Displacement	Linear Add	No	Dead
0.9 D +1.5 EQX + 0.45EQY Displacement			Wall
0.9 D +1.5 EQX + 0.45EQY Displacement			SDL
0.9 D +1.5 EQX + 0.45EQY Displacement			Temp
0.9 D +1.5 EQX + 0.45EQY Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D +1.5 EQX + 0.45EQY Displacement			P-Delta-(DL+LL+EQY-Displacement)
0.9 D +1.5 EQY - 0.45 EQX Displacement	Linear Add	No	Dead
0.9 D +1.5 EQY - 0.45 EQX Displacement			Wall
0.9 D +1.5 EQY - 0.45 EQX Displacement			SDL
0.9 D +1.5 EQY - 0.45 EQX Displacement			Temp
0.9 D +1.5 EQY - 0.45 EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D +1.5 EQY - 0.45 EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)
0.9 D +1.5 EQY + 0.45 EQX Displacement	Linear Add	No	Dead
0.9 D +1.5 EQY + 0.45 EQX Displacement			Wall
0.9 D +1.5 EQY + 0.45 EQX Displacement			SDL
0.9 D +1.5 EQY + 0.45 EQX Displacement			Temp
0.9 D +1.5 EQY + 0.45 EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
0.9 D +1.5 EQY + 0.45 EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)

Name	Type	Is Auto	Load Name
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	Linear Add	No	Dead
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)			Wall
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)			SDL
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)			Spec X
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)			Temp
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)			Spec Y
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)			Spec Z
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	Linear Add	No	Dead
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)			Wall
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)			SDL
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)			Spec X W
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)			Spec Y W
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)			Temp
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)			Spec Z W
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	Linear Add	No	Dead
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)			Wall
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)			SDL
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)			Spec Y
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)			Temp
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)			Spec X
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)			Spec Z
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	Linear Add	No	Dead
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)			Wall
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)			SDL
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)			Spec Y W
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)			Spec X W
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)			Temp
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)			Spec Z W
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	Linear Add	No	Dead
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)			Wall
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)			SDL
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)			Spec Z
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)			Temp
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)			Spec Y
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)			Spec X
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	Linear Add	No	Dead
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)			Wall
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)			SDL
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)			Spec Z W
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)			Spec X W
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)			Temp
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)			Spec Y W
0.9 D + 1.5 WX	Linear Add	No	Dead
0.9 D + 1.5 WX			Wall
0.9 D + 1.5 WX			SDL
0.9 D + 1.5 WX			W X
0.9 D + 1.5 WX			Temp
0.9 D + 1.5 WY	Linear Add	No	Dead
0.9 D + 1.5 WY			Wall
0.9 D + 1.5 WY			SDL
0.9 D + 1.5 WY			W Y
0.9 D + 1.5 WY			Temp
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	Linear Add	No	Dead
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			Live>3
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			Wall
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			SDL
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			Spec X
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			Live<3
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			Temp
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			Spec Y
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))			Spec Z

Name	Type	Is Auto	Load Name
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	Linear Add	No	Dead
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			Live>3
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			Wall
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			SDL
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			Spec X W
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			Spec Y W
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			Live<3
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			Temp
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))			Spec Z W
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	Linear Add	No	Dead
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			Live>3
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			Wall
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			SDL
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			Spec Y
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			Live<3
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			Temp
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			Spec X
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))			Spec Z
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	Linear Add	No	Dead
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			Live>3
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			Wall
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			SDL
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			Spec Y W
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			Spec X W
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			Live<3
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			Temp
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)			Spec Z W
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	Linear Add	No	Dead
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			Live>3
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			Wall
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			SDL
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			Spec Z
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			Live<3
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			Temp
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			Spec X
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))			Spec Y
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	Linear Add	No	Dead
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			Live>3
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			Wall
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			SDL
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			Spec Z W
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			Spec X W
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			Live<3
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			Temp
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)			Spec Y W
1.2 (D+L+WX)	Linear Add	No	Dead
1.2 (D+L+WX)			Live>3
1.2 (D+L+WX)			Wall
1.2 (D+L+WX)			SDL
1.2 (D+L+WX)			W X
1.2 (D+L+WX)			Live<3
1.2 (D+L+WX)			Temp
1.2(D+L+WY)	Linear Add	No	Dead
1.2(D+L+WY)			Live>3
1.2(D+L+WY)			Wall
1.2(D+L+WY)			SDL
1.2(D+L+WY)			W Y
1.2(D+L+WY)			Live<3
1.2(D+L+WY)			Temp
1.2(D+L-WX)	Linear Add	No	Dead
1.2(D+L-WX)			Live>3

Name	Type	Is Auto	Load Name
1.2(D+L-WX)			Wall
1.2(D+L-WX)			SDL
1.2(D+L-WX)			W X
1.2(D+L-WX)			Live<3
1.2(D+L-WX)			Temp
1.2 (D+L-WY)	Linear Add	No	Dead
1.2 (D+L-WY)			Live>3
1.2 (D+L-WY)			Wall
1.2 (D+L-WY)			SDL
1.2 (D+L-WY)			W Y
1.2 (D+L-WY)			Live<3
1.2 (D+L-WY)			Temp
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	Linear Add	No	Dead
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			Wall
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			SDL
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			Live>3
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			Live<3
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			Roof Live
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			Fire Tendor
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			Temp
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			P-Delta-(DL+LL+EQX-Displacement)
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	Linear Add	No	Dead
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			Wall
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			SDL
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			Live>3
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			Live<3
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			Roof Live
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			Fire Tendor
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			Temp
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			P-Delta-(DL+LL+EQX-Displacement)
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	Linear Add	No	Dead
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			Wall
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			SDL
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			Live>3
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			Live<3
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			Roof Live
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			Fire Tendor
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			Temp
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	Linear Add	No	Dead
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			Wall
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			SDL
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			Live>3
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			Live<3
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			Roof Live
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			Fire Tendor
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			Temp
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	Linear Add	No	Dead
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			Wall
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			SDL
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			Live>3
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			Live<3
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			Roof Live
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			Fire Tendor
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			Temp
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			P-Delta-(DL+LL+EQX-Displacement)

Name	Type	Is Auto	Load Name
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	Linear Add	No	Dead
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			Wall
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			SDL
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			Live>3
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			Live<3
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			Roof Live
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			Fire Tendor
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			Temp
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			P-Delta-(DL+LL+EQX-Displacement)
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	Linear Add	No	Dead
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			Wall
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			SDL
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			Live>3
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			Live<3
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			Roof Live
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			Fire Tendor
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			Temp
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	Linear Add	No	Dead
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			Wall
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			SDL
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			Live>3
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			Live<3
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			Roof Live
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			Fire Tendor
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			Temp
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			P-Delta-(DL+LL+EQX-Displacement)
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D+EQX-0.3EQY Displacement)	Linear Add	No	Dead
1.5 (D+EQX-0.3EQY Displacement)			Wall
1.5 (D+EQX-0.3EQY Displacement)			SDL
1.5 (D+EQX-0.3EQY Displacement)			Temp
1.5 (D+EQX-0.3EQY Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D+EQX-0.3EQY Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D+EQX+0.3EQY Displacement)	Linear Add	No	Dead
1.5 (D+EQX+0.3EQY Displacement)			Wall
1.5 (D+EQX+0.3EQY Displacement)			SDL
1.5 (D+EQX+0.3EQY Displacement)			Temp
1.5 (D+EQX+0.3EQY Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D+EQX+0.3EQY Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D+EQY-0.3EQX Displacement)	Linear Add	No	Dead
1.5 (D+EQY-0.3EQX Displacement)			Wall
1.5 (D+EQY-0.3EQX Displacement)			SDL
1.5 (D+EQY-0.3EQX Displacement)			Temp
1.5 (D+EQY-0.3EQX Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D+EQY-0.3EQX Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D+EQY+0.3EQX Displacement)	Linear Add	No	Dead
1.5 (D+EQY+0.3EQX Displacement)			Wall
1.5 (D+EQY+0.3EQX Displacement)			SDL
1.5 (D+EQY+0.3EQX Displacement)			Temp
1.5 (D+EQY+0.3EQX Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D+EQY+0.3EQX Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D+L)	Linear Add	No	Dead
1.5 (D+L)			Live>3
1.5 (D+L)			Wall
1.5 (D+L)			SDL
1.5 (D+L)			Live<3
1.5 (D+L)			Temp

Name	Type	Is Auto	Load Name
1.5 (D+L) - Fire Tendor	Linear Add	No	Dead
1.5 (D+L) - Fire Tendor			Live>3
1.5 (D+L) - Fire Tendor			Wall
1.5 (D+L) - Fire Tendor			SDL
1.5 (D+L) - Fire Tendor			Live<3
1.5 (D+L) - Fire Tendor			Temp
1.5 (D+L) - Fire Tendor			Fire Tendor
1.5 (D+L) - Fire Tendor - Seq	Linear Add	No	Seq
1.5 (D+L) - Fire Tendor - Seq			Live>3
1.5 (D+L) - Fire Tendor - Seq			Wall
1.5 (D+L) - Fire Tendor - Seq			SDL
1.5 (D+L) - Fire Tendor - Seq			Live<3
1.5 (D+L) - Fire Tendor - Seq			Temp
1.5 (D+L) - Fire Tendor - Seq			Fire Tendor
1.5 (D+L)-Seq	Linear Add	No	Seq
1.5 (D+L)-Seq			Live>3
1.5 (D+L)-Seq			Wall
1.5 (D+L)-Seq			SDL
1.5 (D+L)-Seq			Live<3
1.5 (D+L)-Seq			Temp
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	Linear Add	No	Dead
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)			Wall
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)			SDL
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)			Spec X
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)			Temp
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)			Spec Y
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)			Spec Z
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	Linear Add	No	Dead
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)			Wall
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)			SDL
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)			Spec X W
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)			Spec Y W
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)			Temp
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)			Spec Z W
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	Linear Add	No	Dead
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)			Wall
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)			SDL
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)			Spec Y
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)			Temp
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)			Spec X
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)			Spec Z
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	Linear Add	No	Dead
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)			Wall
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)			SDL
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)			Spec Y W
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)			Spec X W
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)			Temp
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)			Spec Z W
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	Linear Add	No	Dead
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)			Wall
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)			SDL
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)			Spec Z
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)			Temp
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)			Spec X
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)			Spec Y
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	Linear Add	No	Dead
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)			Wall
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)			SDL
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)			Spec Z W
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)			Spec X W
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)			Temp

Name	Type	Is Auto	Load Name
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)			Spec Y W
1.5 (D+WX)	Linear Add	No	Dead
1.5 (D+WX)			Wall
1.5 (D+WX)			SDL
1.5 (D+WX)			W X
1.5 (D+WX)			Temp
1.5 (D+WY)	Linear Add	No	Dead
1.5 (D+WY)			Wall
1.5 (D+WY)			SDL
1.5 (D+WY)			W Y
1.5 (D+WY)			Temp
1.5 (D-EQX-0.3EQY Displacement)	Linear Add	No	Dead
1.5 (D-EQX-0.3EQY Displacement)			Wall
1.5 (D-EQX-0.3EQY Displacement)			SDL
1.5 (D-EQX-0.3EQY Displacement)			Temp
1.5 (D-EQX-0.3EQY Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D-EQX-0.3EQY Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D-EQX+0.3EQY Displacement)	Linear Add	No	Dead
1.5 (D-EQX+0.3EQY Displacement)			Wall
1.5 (D-EQX+0.3EQY Displacement)			SDL
1.5 (D-EQX+0.3EQY Displacement)			Temp
1.5 (D-EQX+0.3EQY Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D-EQX+0.3EQY Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D-EQY-0.3EQX Displacement)	Linear Add	No	Dead
1.5 (D-EQY-0.3EQX Displacement)			Wall
1.5 (D-EQY-0.3EQX Displacement)			SDL
1.5 (D-EQY-0.3EQX Displacement)			Temp
1.5 (D-EQY-0.3EQX Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D-EQY-0.3EQX Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D-EQY+0.3EQX Displacement)	Linear Add	No	Dead
1.5 (D-EQY+0.3EQX Displacement)			Wall
1.5 (D-EQY+0.3EQX Displacement)			SDL
1.5 (D-EQY+0.3EQX Displacement)			Temp
1.5 (D-EQY+0.3EQX Displacement)			P-Delta-(DL+LL+EQX-Displacement)
1.5 (D-EQY+0.3EQX Displacement)			P-Delta-(DL+LL+EQY-Displacement)
1.5 (D-WX)	Linear Add	No	Dead
1.5 (D-WX)			Wall
1.5 (D-WX)			SDL
1.5 (D-WX)			W X
1.5 (D-WX)			Temp
1.5 (D-WY)	Linear Add	No	Dead
1.5 (D-WY)			Wall
1.5 (D-WY)			SDL
1.5 (D-WY)			W Y
1.5 (D-WY)			Temp
1.5 D	Linear Add	No	Dead
1.5 D			Wall
1.5 D			SDL
1.5 D			Temp
D+L	Linear Add	No	Dead
D+L			Live>3
D+L			Live<3
D+L			Wall
D+L			SDL
D+L			Roof Live
D+L			Fire Tendor
Envelope - Beam Design	Envelope	No	1.5 D
Envelope - Beam Design			1.5 (D+L) - Fire Tendor
Envelope - Beam Design			1.2 (D+L+WX)
Envelope - Beam Design			1.2(D+L-WX)
Envelope - Beam Design			1.2(D+L+WY)

Name	Type	Is Auto	Load Name
Envelope - Beam Design			1.2 (D+L-WY)
Envelope - Beam Design			1.5 (D+WX)
Envelope - Beam Design			1.5 (D-WX)
Envelope - Beam Design			1.5 (D+WY)
Envelope - Beam Design			1.5 (D-WY)
Envelope - Beam Design			0.9 D + 1.5 WX
Envelope - Beam Design			0.9 D - 1.5 WX
Envelope - Beam Design			0.9 D + 1.5 WY
Envelope - Beam Design			0.9 D - 1.5 WY
Envelope - Beam Design			1.2 (D+L+SPECX+0.3(SPECY+SPECZ))
Envelope - Beam Design			1.2 (D+L+SPECY+0.3(SPECX+SPECZ))
Envelope - Beam Design			1.2 (D+L+SPECZ+0.3(SPECX+SPECY))
Envelope - Beam Design			1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)
Envelope - Beam Design			1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)
Envelope - Beam Design			1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)
Envelope - Beam Design			0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)
Envelope - Beam Design			0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)
Envelope - Beam Design			0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)
Envelope - Beam Design			0.9 D -1.5 EQX - 0.45EQY Displacement
Envelope - Beam Design			0.9 D -1.5 EQY - 0.45EQX Displacement
Envelope - Beam Design			0.9 D +1.5 EQX + 0.45EQY Displacement
Envelope - Beam Design			1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement
Envelope - Beam Design			1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement
Envelope - Beam Design			1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement
Envelope - Beam Design			1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement
Envelope - Beam Design			1.5 (D+EQX+0.3EQY Displacement)
Envelope - Beam Design			1.5 (D+EQY-0.3EQX Displacement)
Envelope - Beam Design			1.5 (D-EQX+0.3EQY Displacement)
Envelope - Beam Design			1.5 (D-EQY+0.3EQX Displacement)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL + 1.5 EQ-X)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL + 1.5 EQ-Y)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL - 1.5 EQ-X)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL - 1.5 EQ-Y)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL + 1.5 W-X)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL - 1.5 W-X)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL + 1.5 W-Y)
Envelope - Beam Design			P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)
Envelope - Beam Design			1.5 (D+L)-Seq
Envelope - Beam Design			1.5 (D+L) - Fire Tendor - Seq
ENVELOPE - Deformation Compatibility Beam	Envelope	No	1.5 (D+L) - Fire Tendor
ENVELOPE - Deformation Compatibility Beam			1.2 (D+L+WX)
ENVELOPE - Deformation Compatibility Beam			1.2(D+L-WX)
ENVELOPE - Deformation Compatibility Beam			1.2(D+L+WY)
ENVELOPE - Deformation Compatibility Beam			1.2 (D+L-WY)
ENVELOPE - Deformation Compatibility Beam			1.5 (D+WX)
ENVELOPE - Deformation Compatibility Beam			1.5 (D-WX)
ENVELOPE - Deformation Compatibility Beam			1.5 (D+WY)
ENVELOPE - Deformation Compatibility Beam			1.5 (D-WY)
ENVELOPE - Deformation Compatibility Beam			0.9 D + 1.5 WX
ENVELOPE - Deformation Compatibility Beam			0.9 D - 1.5 WX
ENVELOPE - Deformation Compatibility Beam			0.9 D + 1.5 WY
ENVELOPE - Deformation Compatibility Beam			0.9 D - 1.5 WY
ENVELOPE - Deformation Compatibility Beam			0.9 D -1.5 EQX - 0.45EQY Displacement
ENVELOPE - Deformation Compatibility Beam			0.9 D -1.5 EQY - 0.45EQX Displacement
ENVELOPE - Deformation Compatibility Beam			0.9 D +1.5 EQX + 0.45EQY Displacement
ENVELOPE - Deformation Compatibility Beam			0.9 D +1.5 EQY + 0.45 EQX Displacement
ENVELOPE - Deformation Compatibility Beam			0.9 D -1.5 EQX + 0.45EQY Displacement
ENVELOPE - Deformation Compatibility Beam			0.9 D -1.5 EQY + 0.45EQX Displacement
ENVELOPE - Deformation Compatibility Beam			0.9 D +1.5 EQX - 0.45EQY Displacement
ENVELOPE - Deformation Compatibility Beam			0.9 D +1.5 EQY - 0.45 EQX Displacement

Name	Type	Is Auto	Load Name
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement
ENVELOPE - Deformation Compatibility Beam			1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement
ENVELOPE - Deformation Compatibility Beam			1.5 (D+EQX+0.3EQY Displacement)
ENVELOPE - Deformation Compatibility Beam			1.5 (D+EQY+0.3EQX Displacement)
ENVELOPE - Deformation Compatibility Beam			1.5 (D-EQX-0.3EQY Displacement)
ENVELOPE - Deformation Compatibility Beam			1.5 (D-EQY-0.3EQX Displacement)
ENVELOPE - Deformation Compatibility Beam			1.5 (D+EQX-0.3EQY Displacement)
ENVELOPE - Deformation Compatibility Beam			1.5 (D+EQY-0.3EQX Displacement)
ENVELOPE - Deformation Compatibility Beam			1.5 (D-EQX+0.3EQY Displacement)
ENVELOPE - Deformation Compatibility Beam			1.5 (D-EQY+0.3EQX Displacement)
P-Delta (1.2DL + 0.5 LL - 1.5 EQ-X)	Linear Add	No	P-Delta (1.2DL + 0.5 LL - 1.5 EQX)
P-Delta (1.2DL + 0.5 LL - 1.5 EQ-Y)	Linear Add	No	P-Delta (1.2DL + 0.5 LL - 1.5 EQY)
P-Delta (1.2DL + 0.5 LL - 1.5 W-X)	Linear Add	No	P-Delta (1.2DL + 0.5 LL - 1.5 WX)
P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	Linear Add	No	P-Delta (1.2DL + 0.5 LL - 1.5 WY)
P-Delta (1.2DL + 0.5 LL)	Linear Add	No	P-Delta (1.2DL + 0.5 LL)
P-Delta (1.2DL + 0.5 LL + 1.5 EQ-X)	Linear Add	No	P-Delta (1.2DL + 0.5 LL + 1.5 EQX)
P-Delta (1.2DL + 0.5 LL + 1.5 EQ-Y)	Linear Add	No	P-Delta (1.2DL + 0.5 LL + 1.5 EQX)
P-Delta (1.2DL + 0.5 LL + 1.5 W-X)	Linear Add	No	P-Delta (1.2DL + 0.5 LL + 1.5 WX)
P-Delta (1.2DL + 0.5 LL + 1.5 W-Y)	Linear Add	No	P-Delta (1.2DL + 0.5 LL + 1.5 WY)
SEISMIC WEIGHT	Linear Add	No	Dead
SEISMIC WEIGHT			Wall
SEISMIC WEIGHT			SDL
SEISMIC WEIGHT			Live>3
SEISMIC WEIGHT			Live<3

Table 2.5 - Load Combination Definitions (Part 2 of 2)

Name	SF	Notes
0.9 D -1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX - 0.45EQY Displacement	-1.5	
0.9 D -1.5 EQX - 0.45EQY Displacement	-0.45	
0.9 D -1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D -1.5 EQX + 0.45EQY Displacement	-1.5	
0.9 D -1.5 EQX + 0.45EQY Displacement	0.45	
0.9 D -1.5 EQY - 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY - 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY - 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY - 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY - 0.45EQX Displacement	-0.45	
0.9 D -1.5 EQY - 0.45EQX Displacement	-1.5	
0.9 D -1.5 EQY + 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY + 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY + 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY + 0.45EQX Displacement	0.9	
0.9 D -1.5 EQY + 0.45EQX Displacement	-1.5	
0.9 D -1.5 EQY + 0.45EQX Displacement	0.45	
0.9 D - 1.5 WX	0.9	Dead (min) - Wind [Strength]
0.9 D - 1.5 WX	0.9	
0.9 D - 1.5 WX	0.9	
0.9 D - 1.5 WX	-1.5	

Name	SF	Notes
0.9 D - 1.5 WX	0.9	
0.9 D - 1.5 WY	0.9	Dead (min) - Wind [Strength]
0.9 D - 1.5 WY	0.9	
0.9 D - 1.5 WY	0.9	
0.9 D - 1.5 WY	-1.5	
0.9 D - 1.5 WY	0.9	
0.9 D +1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX - 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX - 0.45EQY Displacement	1.5	
0.9 D +1.5 EQX - 0.45EQY Displacement	-0.45	
0.9 D +1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX + 0.45EQY Displacement	0.9	
0.9 D +1.5 EQX + 0.45EQY Displacement	1.5	
0.9 D +1.5 EQX + 0.45EQY Displacement	0.45	
0.9 D +1.5 EQY - 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY - 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY - 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY - 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY - 0.45 EQX Displacement	-0.45	
0.9 D +1.5 EQY - 0.45 EQX Displacement	1.5	
0.9 D +1.5 EQY + 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY + 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY + 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY + 0.45 EQX Displacement	0.9	
0.9 D +1.5 EQY + 0.45 EQX Displacement	0.45	
0.9 D +1.5 EQY + 0.45 EQX Displacement	1.5	
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	0.9	Dead (min) + Response Spectrum [Strength]
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	0.9	
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	0.9	
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	1.5	
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	0.9	
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	0.45	
0.9 D + 1.5 SPECX + 0.45 (SPECY+SPECZ)	0.45	
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	0.9	Dead (min) + Response Spectrum [Strength]
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	0.9	
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	0.9	
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	1.5	
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	0.45	
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	0.9	
0.9 D + 1.5 SPECX W + 0.45(SPECY W + SPECZ W)	0.45	
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	0.9	Dead (min) + Response Spectrum [Strength]
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	0.9	
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	0.9	
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	1.5	
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	0.9	
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	0.45	
0.9 D + 1.5 SPECY + 0.45 (SPECX+SPECZ)	0.45	
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	0.9	Dead (min) + Response Spectrum [Strength]
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	0.9	
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	0.9	
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	1.5	
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	0.45	
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	0.9	
0.9 D + 1.5 SPECY W + 0.45(SPECX W + SPECZ W)	0.45	
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	0.9	Dead (min) + Response Spectrum [Strength]
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	0.9	
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	0.9	

Name	SF	Notes
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	1.5	
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	0.9	
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	0.45	
0.9 D + 1.5 SPECZ + 0.45 (SPECY+SPECX)	0.45	
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	0.9	Dead (min) + Response Spectrum [Strength]
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	0.9	
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	0.9	
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	1.5	
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	0.45	
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	0.9	
0.9 D + 1.5 SPECZ W + 0.45(SPECX W + SPECY W)	0.45	
0.9 D + 1.5 WX	0.9	Dead (min) + Wind [Strength]
0.9 D + 1.5 WX	0.9	
0.9 D + 1.5 WX	0.9	
0.9 D + 1.5 WX	1.5	
0.9 D + 1.5 WX	0.9	
0.9 D + 1.5 WY	0.9	Dead (min) + Wind [Strength]
0.9 D + 1.5 WY	0.9	
0.9 D + 1.5 WY	0.9	
0.9 D + 1.5 WY	1.5	
0.9 D + 1.5 WY	0.9	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	1.2	Dead + Live + Response Spectrum [Strength]
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	1.2	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	1.2	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	1.2	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	1.2	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	1.2	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	1.2	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	0.36	
1.2 (D+L+SPECX+0.3(SPECY+SPECZ))	0.36	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	1.2	Dead + Live + Response Spectrum [Strength]
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	1.2	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	1.2	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	1.2	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	1.2	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	0.36	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	1.2	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	1.2	
1.2 (D+L+SPECX W) + 0.36(SPECY W+SPECZW))	0.36	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	1.2	Dead + Live + Response Spectrum [Strength]
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	1.2	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	1.2	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	1.2	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	1.2	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	1.2	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	1.2	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	0.36	
1.2 (D+L+SPECY+0.3(SPECX+SPECZ))	0.36	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	1.2	Dead + Live + Response Spectrum [Strength]
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	1.2	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	1.2	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	1.2	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	1.2	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	0.36	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	1.2	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	1.2	
1.2 (D+L+SPECY W) + 0.36(SPECX W+SPECZW)	0.36	
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	1.2	Dead + Live + Response Spectrum [Strength]
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	1.2	
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	1.2	
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	1.2	

Name	SF	Notes
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	1.2	
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	1.2	
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	1.2	
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	0.36	
1.2 (D+L+SPECZ+0.3(SPECX+SPECY))	0.36	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	1.2	Dead + Live + Response Spectrum [Strength]
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	1.2	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	1.2	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	1.2	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	1.2	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	0.36	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	1.2	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	1.2	
1.2 (D+L+SPECZ W) + 0.36(SPECX W+SPECYW)	0.36	
1.2 (D+L+WX)	1.2	Dead + Live + Wind + [Strength]
1.2 (D+L+WX)	1.2	
1.2 (D+L+WX)	1.2	
1.2 (D+L+WX)	1.2	
1.2 (D+L+WX)	1.2	
1.2 (D+L+WX)	1.2	
1.2 (D+L+WX)	1.2	
1.2(D+L+WY)	1.2	Dead + Live + Wind + [Strength]
1.2(D+L+WY)	1.2	
1.2(D+L+WY)	1.2	
1.2(D+L+WY)	1.2	
1.2(D+L+WY)	1.2	
1.2(D+L+WY)	1.2	
1.2(D+L+WY)	1.2	
1.2(D+L-WX)	1.2	Dead + Live - Wind + [Strength]
1.2(D+L-WX)	1.2	
1.2(D+L-WX)	1.2	
1.2(D+L-WX)	1.2	
1.2(D+L-WX)	-1.2	
1.2(D+L-WX)	1.2	
1.2(D+L-WX)	1.2	
1.2 (D+L-WY)	1.2	Dead + Live - Wind + [Strength]
1.2 (D+L-WY)	1.2	
1.2 (D+L-WY)	1.2	
1.2 (D+L-WY)	1.2	
1.2 (D+L-WY)	-1.2	
1.2 (D+L-WY)	1.2	
1.2 (D+L-WY)	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	-1.2	
1.2DL+1.2LL-1.2 EQX-0.36 EQ Y Displacement	-0.36	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	1.2	
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	-1.2	

Name	SF	Notes
1.2DL+1.2LL-1.2 EQX+0.36 EQ Y Displacement	0.36	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	-0.36	
1.2DL+1.2LL-1.2 EQY-0.36EQX Displacement	-1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	0.36	
1.2DL+1.2LL-1.2 EQY+0.36EQX Displacement	-1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX-0.36EQY Displacement	-0.36	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	1.2	
1.2DL+1.2LL+1.2 EQX+0.36EQY Displacement	0.36	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	-0.36	
1.2DL+1.2LL+1.2 EQY-0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	0.36	
1.2DL+1.2LL+1.2 EQY+0.36EQX Displacement	1.2	

Name	SF	Notes
1.5 (D+EQX-0.3EQY Displacement)	1.5	
1.5 (D+EQX-0.3EQY Displacement)	1.5	
1.5 (D+EQX-0.3EQY Displacement)	1.5	
1.5 (D+EQX-0.3EQY Displacement)	1.5	
1.5 (D+EQX-0.3EQY Displacement)	1.5	
1.5 (D+EQX-0.3EQY Displacement)	-0.45	
1.5 (D+EQX+0.3EQY Displacement)	1.5	
1.5 (D+EQX+0.3EQY Displacement)	1.5	
1.5 (D+EQX+0.3EQY Displacement)	1.5	
1.5 (D+EQX+0.3EQY Displacement)	1.5	
1.5 (D+EQX+0.3EQY Displacement)	1.5	
1.5 (D+EQX+0.3EQY Displacement)	0.45	
1.5 (D+EQY-0.3EQX Displacement)	1.5	
1.5 (D+EQY-0.3EQX Displacement)	1.5	
1.5 (D+EQY-0.3EQX Displacement)	1.5	
1.5 (D+EQY-0.3EQX Displacement)	1.5	
1.5 (D+EQY-0.3EQX Displacement)	-0.45	
1.5 (D+EQY-0.3EQX Displacement)	1.5	
1.5 (D+EQY+0.3EQX Displacement)	1.5	
1.5 (D+EQY+0.3EQX Displacement)	1.5	
1.5 (D+EQY+0.3EQX Displacement)	1.5	
1.5 (D+EQY+0.3EQX Displacement)	1.5	
1.5 (D+EQY+0.3EQX Displacement)	0.45	
1.5 (D+EQY+0.3EQX Displacement)	1.5	
1.5 (D+L)	1.5	Dead + Live [Strength]
1.5 (D+L)	1.5	
1.5 (D+L)	1.5	
1.5 (D+L)	1.5	
1.5 (D+L)	1.5	
1.5 (D+L)	1.5	
1.5 (D+L) - Fire Tendor	1.5	Dead + Live [Strength]
1.5 (D+L) - Fire Tendor	1.5	
1.5 (D+L) - Fire Tendor	1.5	
1.5 (D+L) - Fire Tendor	1.5	
1.5 (D+L) - Fire Tendor	1.5	
1.5 (D+L) - Fire Tendor	1.5	
1.5 (D+L) - Fire Tendor	1.05	
1.5 (D+L) - Fire Tendor - Seq	1.5	Dead + Live [Strength]
1.5 (D+L) - Fire Tendor - Seq	1.5	
1.5 (D+L) - Fire Tendor - Seq	1.5	
1.5 (D+L) - Fire Tendor - Seq	1.5	
1.5 (D+L) - Fire Tendor - Seq	1.5	
1.5 (D+L) - Fire Tendor - Seq	1.5	
1.5 (D+L) - Fire Tendor - Seq	1.05	
1.5 (D+L)-Seq	1.5	Dead + Live [Strength]
1.5 (D+L)-Seq	1.5	
1.5 (D+L)-Seq	1.5	
1.5 (D+L)-Seq	1.5	
1.5 (D+L)-Seq	1.5	
1.5 (D+L)-Seq	1.5	
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	1.5	Dead + Response Spectrum [Strength]
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	1.5	
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	1.5	
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	1.5	
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	1.5	
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	0.45	
1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	0.45	
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	1.5	Dead + Response Spectrum [Strength]
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	1.5	
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	1.5	
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	1.5	

Name	SF	Notes
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	0.45	
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	1.5	
1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	0.45	
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	1.5	Dead + Response Spectrum [Strength]
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	1.5	
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	1.5	
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	1.5	
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	1.5	
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	0.45	
1.5 (D+SPECY) + 0.45 (SPECX+SPECZ)	0.45	
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	1.5	Dead + Response Spectrum [Strength]
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	1.5	
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	1.5	
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	1.5	
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	0.45	
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	1.5	
1.5 (D+SPECY W) + 0.45(SPECX W+SPECZW)	0.45	
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	1.5	Dead + Response Spectrum [Strength]
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	1.5	
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	1.5	
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	1.5	
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	1.5	
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	0.45	
1.5 (D+SPECZ) + 0.45 (SPECX+SPECY)	0.45	
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	1.5	Dead + Response Spectrum [Strength]
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	1.5	
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	1.5	
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	1.5	
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	0.45	
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	1.5	
1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	0.45	
1.5 (D+WX)	1.5	Dead + Wind [Strength]
1.5 (D+WX)	1.5	
1.5 (D+WX)	1.5	
1.5 (D+WX)	1.5	
1.5 (D+WX)	1.5	
1.5 (D+WY)	1.5	Dead + Wind [Strength]
1.5 (D+WY)	1.5	
1.5 (D+WY)	1.5	
1.5 (D+WY)	1.5	
1.5 (D+WY)	1.5	
1.5 (D-EQX-0.3EQY Displacement)	1.5	
1.5 (D-EQX-0.3EQY Displacement)	1.5	
1.5 (D-EQX-0.3EQY Displacement)	1.5	
1.5 (D-EQX-0.3EQY Displacement)	1.5	
1.5 (D-EQX-0.3EQY Displacement)	-1.5	
1.5 (D-EQX-0.3EQY Displacement)	-0.45	
1.5 (D-EQX+0.3EQY Displacement)	1.5	
1.5 (D-EQX+0.3EQY Displacement)	1.5	
1.5 (D-EQX+0.3EQY Displacement)	1.5	
1.5 (D-EQX+0.3EQY Displacement)	1.5	
1.5 (D-EQX+0.3EQY Displacement)	-1.5	
1.5 (D-EQX+0.3EQY Displacement)	0.45	
1.5 (D-EQY-0.3EQX Displacement)	1.5	
1.5 (D-EQY-0.3EQX Displacement)	1.5	
1.5 (D-EQY-0.3EQX Displacement)	1.5	
1.5 (D-EQY-0.3EQX Displacement)	1.5	
1.5 (D-EQY-0.3EQX Displacement)	-0.45	
1.5 (D-EQY-0.3EQX Displacement)	-1.5	
1.5 (D-EQY+0.3EQX Displacement)	1.5	
1.5 (D-EQY+0.3EQX Displacement)	1.5	

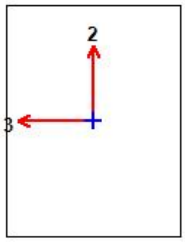
Name	SF	Notes
1.5 (D-EQY+0.3EQX Displacement)	1.5	
1.5 (D-EQY+0.3EQX Displacement)	1.5	
1.5 (D-EQY+0.3EQX Displacement)	0.45	
1.5 (D-EQY+0.3EQX Displacement)	-1.5	
1.5 (D-WX)	1.5	Dead - Wind [Strength]
1.5 (D-WX)	1.5	
1.5 (D-WX)	1.5	
1.5 (D-WX)	-1.5	
1.5 (D-WX)	1.5	
1.5 (D-WY)	1.5	Dead - Wind [Strength]
1.5 (D-WY)	1.5	
1.5 (D-WY)	1.5	
1.5 (D-WY)	-1.5	
1.5 (D-WY)	1.5	
1.5 D	1.5	Dead [Strength]
1.5 D	1.5	
1.5 D	1.5	
1.5 D	1.5	
D+L	1	
D+L	1	
D+L	1	
D+L	1	
D+L	1	
D+L	1	
D+L	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design

Name	SF	Notes
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
Envelope - Beam Design	1	
ENVELOPE - Deformation Compatibility Beam	1	
ENVELOPE - Deformation Compatibility Beam	1	
ENVELOPE - Deformation Compatibility Beam	1	
ENVELOPE - Deformation Compatibility Beam	1	
ENVELOPE - Deformation Compatibility Beam	1	
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ENVELOPE - Deformation Compatibility Beam	1	
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ENVELOPE - Deformation Compatibility Beam	1	
ENVELOPE - Deformation Compatibility Beam	1	
P-Delta (1.2DL + 0.5 LL - 1.5 EQ-X)	1	
P-Delta (1.2DL + 0.5 LL - 1.5 EQ-Y)	1	
P-Delta (1.2DL + 0.5 LL - 1.5 W-X)	1	
P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	1	
P-Delta (1.2DL + 0.5 LL)	1	
P-Delta (1.2DL + 0.5 LL + 1.5 EQ-X)	1	
P-Delta (1.2DL + 0.5 LL + 1.5 EQ-Y)	1	
P-Delta (1.2DL + 0.5 LL + 1.5 W-X)	1	
P-Delta (1.2DL + 0.5 LL + 1.5 W-Y)	1	
SEISMIC WEIGHT	1	
SEISMIC WEIGHT	1	
SEISMIC WEIGHT	1	
SEISMIC WEIGHT	0.5	
SEISMIC WEIGHT	0.25	

COLUMN DESIGN

ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
B2	C28	732	C 1200X900 M50	1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	0

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
3200	0.5	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
900	1200	53.9	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

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 kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm²	Rebar % %
17802.9816	587.3857	801.1342	623.1044	801.1342	8640	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	0.69195	2500	124.5563	0	801.1342
Minor Bend(M2)	0.685713	2500	299.0696	0	623.1044

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

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
Major, V_{u2}	108.366	723.7701	412.5974	0	997.59
Minor, V_{u3}	186.9676	717.7067	406.1299	0	1330.12

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	Shear Ratio Unitless

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	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 cm²	A_{sc} cm²	P_{uz} kN	P_b kN	P_u kN	k Unitless
10800	86.4	27864	11110.6003	17802.9816	0.600536

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 (kN-m)
Major Bending (M_3)	Yes	0.781	1200	1.442	12	No	0
Minor Bending (M_2)	Yes	0.781	900	1.905	12	No	0

Notes:

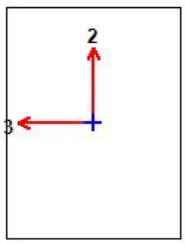
N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
B1	C28	729	C 1200X900 M50	1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	2500

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
3200	0.5	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
900	1200	53.9	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

Design Code Parameters

ɣc	ɣs
1.5	1.15

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

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm²	Rebar % %
17362.7504	-607.6963	27.0641	607.6963	781.3238	8640	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	0.990052	2500	-93.1401	0	781.3238
Minor Bend(M2)	1	2500	209.9222	0	607.6963

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

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
Major, V_{u2}	75.1213	723.7701	412.5974	0	997.59
Minor, V_{u3}	197.9779	717.7067	406.1299	0	1330.12

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	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 cm²	A_{sc} cm²	P_{uz} kN	P_b kN	P_u kN	k Unitless
10800	86.4	27864	11110.6003	17362.7504	0.626813

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 (kN-m)
Major Bending (M_3)	Yes	0.781	1200	2.063	12	No	0
Minor Bending (M_2)	Yes	0.781	900	2.778	12	No	0

Notes:

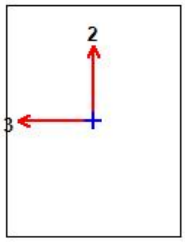
N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
GF	C28	717	C 1200X900 M50	1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	0

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
3900	0.5	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
900	1200	53.9	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

Design Code Parameters

ɣc	ɣs
1.5	1.15

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

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm²	Rebar % %
17145.3648	620.6622	-125.5917	620.6622	792.1159	8640	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	0.983727	3100	-57.8819	0	792.1159
Minor Bend(M2)	1	3100	233.3267	0	620.6622

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

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
Major, V_{u2}	66.4088	723.7701	412.5974	0	997.59
Minor, V_{u3}	88.2507	717.7067	406.1299	0	1330.12

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	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 cm²	A_{sc} cm²	P_{uz} kN	P_b kN	P_u kN	k Unitless
10800	86.4	27864	11110.6003	17145.3648	0.639789

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 (kN-m)
Major Bending (M_3)	Yes	0.795	1200	2.541	12	No	0
Minor Bending (M_2)	Yes	0.795	900	3.444	12	No	0

Notes:

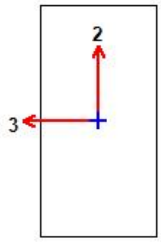
N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
1ST	C28	694	C 600X1200 M50	1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	2075

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
4950	0.5	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
600	1200	53.9	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

Design Code Parameters

γc	γs
1.5	1.15

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

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm²	Rebar % %
16751.2232	474.0596	-37.0375	474.0596	809.0841	8904	1.24

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	1	4150	89.8624	0	809.0841
Minor Bend(M2)	1	4150	-47.4957	0	474.0596

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

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
Major, V_{u2}	57.9686	580.8005	275.0649	0	665.06
Minor, V_{u3}	70.3596	564.7934	262.1299	0	1330.12

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	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 cm²	A_{sc} cm²	P_{uz} kN	P_b kN	P_u kN	k Unitless
7200	89	19872.8949	7415.9784	16751.2232	0.250597

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 (kN-m)
Major Bending (M_3)	Yes	0.838	1200	3.458	12	No	0
Minor Bending (M_2)	Yes	0.838	600	6.917	12	No	0

Notes:

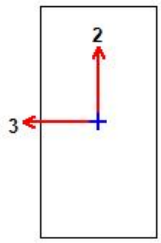
N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



Column Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc
2ND	C28	109	C 600X1200 M50	1.5 (D+SPECX)+ 0.45 (SPECY+SPECZ)	0

Column Element Details (Part 2 of 2)

Length (mm)	LLRF	Type
3500	0.5	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
600	1200	53.9	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

Design Code Parameters

ɣc	ɣs
1.5	1.15

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

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm²	Rebar % %
16221.8357	508.2981	-736.4713	412.0346	736.4713	7635	1.06

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	1	2700	-99.5845	0	736.4713
Minor Bend(M2)	1	2700	240.7925	0	412.0346

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

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
Major, V_{u2}	114.2406	546.5509	275.0649	0	665.06
Minor, V_{u3}	219.066	530.5438	262.1299	0	1330.12

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	Shear Ratio Unitless

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm²	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 cm²	A_{sc} cm²	P_{uz} kN	P_b kN	P_u kN	k Unitless
7200	76.4	19349.6371	7360.0112	16221.8357	0.260876

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 (kN-m)
Major Bending (M_3)	Yes	0.771	1200	2.25	12	No	0
Minor Bending (M_2)	Yes	0.771	600	4.5	12	No	0

Notes:

N/A: Not Applicable

N/C: Not Calculated

N/N: Not Needed

SHEARWALL DESIGN

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)	LLRF
B2	C14	12628	22923	3500	600	0.5

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

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	10878	22923	14378	22923	3500	600
Bottom	Leg 1	10878	22923	14378	22923	3500	600

Flexural Design for P_u, M_{u2} and M_{u3} (Part 1 of 2)

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN	M_{u2} kN-m
Top	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	25164.8564	-664.3522
Bottom	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	25366.4013	-669.673

Flexural Design for P_u, M_{u2} and M_{u3} (Part 2 of 2)

M_{u3} kN-m	Pier A_g mm²
-1379.3058	2100000
-469.4424	2100000

Shear Design (Part 1 of 2)

Station Location	ID	Rebar mm²/m	Shear Combo	P_u kN	M_u kN-m	V_u kN	V_c kN
Top	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	26694.0326	3662.2668	1743.2795	756
Bottom	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	26944.6836	7796.5184	1743.2795	756

Shear Design (Part 2 of 2)

$V_c + V_s$ kN
2271.6522
2271.6522

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_u kN	M_u kN-m
Top–Left	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	30461.2626	-3929.6727
Top–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	30461.2626	349.7938
Bottom–Left	Leg 1	1200	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	30033.3617	-9487.4974
Botttom–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	30716.8997	3046.6631

Boundary Element Check (Part 2 of 2)

Stress Comp MPa	Stress Limit MPa
17.71	10
14.79	10
22.05	10
17.11	10

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)	LLRF
B1	C19	12628	22923	3500	600	0.5

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

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	10878	22923	14378	22923	3500	600
Bottom	Leg 1	10878	22923	14378	22923	3500	600

Flexural Design for P_u, M_{u2} and M_{u3} (Part 1 of 2)

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN	M_{u2} kN-m
Top	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	24268.3815	-640.6853
Bottom	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	24469.9231	-646.006

Flexural Design for P_u, M_{u2} and M_{u3} (Part 2 of 2)

M_{u3} kN-m	Pier A_g mm²
-1316.228	2100000
-785.3243	2100000

Shear Design (Part 1 of 2)

Station Location	ID	Rebar mm²/m	Shear Combo	P_u kN	M_u kN-m	V_u kN	V_c kN
Top	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	25754.7242	2850.5827	1154.6596	756
Bottom	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	26006.1732	4558.4341	1154.6596	756

Shear Design (Part 2 of 2)

$V_c + V_s$ kN
2271.6522
2271.6522

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_u kN	M_u kN-m
Top–Left	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	29469.8372	-3452.8219
Top–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	29469.8372	107.728
Bottom–Left	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	29723.577	-3396.5139
Botttom–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	29723.577	1070.4974

Boundary Element Check (Part 2 of 2)

Stress Comp MPa	Stress Limit MPa
16.85	10
14.12	10
16.93	10
15.03	10

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)	LLRF
GF	C19	12628	22923	3500	600	0.5

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

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	10878	22923	14378	22923	3500	600
Bottom	Leg 1	10878	22923	14378	22923	3500	600

Flexural Design for P_u, M_{u2} and M_{u3} (Part 1 of 2)

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN	M_{u2} kN-m
Top	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	23303.3211	-647.8323
Bottom	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	23548.9491	-654.6608

Flexural Design for P_u, M_{u2} and M_{u3} (Part 2 of 2)

M_{u3} kN-m	Pier A_g mm²
-1209.0766	2100000
-848.2554	2100000

Shear Design (Part 1 of 2)

Station Location	ID	Rebar mm²/m	Shear Combo	P_u kN	M_u kN-m	V_u kN	V_c kN
Top	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	24740.0719	2678.9529	664.8344	756
Bottom	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	25047.2552	3719.6994	664.8344	756

Shear Design (Part 2 of 2)

$V_c + V_s$ kN
2271.6522
2271.6522

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_u kN	M_u kN-m
Top–Left	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	28403.1307	-3304.6406
Top–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	28403.1307	278.7478
Bottom–Left	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	28710.6622	-3033.7871
Botttom–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	28710.6622	703.2646

Boundary Element Check (Part 2 of 2)

Stress Comp MPa	Stress Limit MPa
16.22	10
13.75	10
16.15	10
14.25	10

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)	LLRF
1ST	C19	12628	22923	3500	600	0.5

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

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	10878	22923	14378	22923	3500	600
Bottom	Leg 1	10878	22923	14378	22923	3500	600

Flexural Design for P_u, M_{u2} and M_{u3} (Part 1 of 2)

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN	M_{u2} kN-m
Top	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	22242.8022	665.0598
Bottom	5250	0.0025	0.003	P-Delta (1.2DL + 0.5 LL - 1.5 W-Y)	22554.5566	-674.3812

Flexural Design for P_u, M_{u2} and M_{u3} (Part 2 of 2)

M_{u3} kN-m	Pier A_g mm²
-1025.1376	2100000
-972.4937	2100000

Shear Design (Part 1 of 2)

Station Location	ID	Rebar mm²/m	Shear Combo	P_u kN	M_u kN-m	V_u kN	V_c kN
Top	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	23641.9597	1877.3538	566.1252	756
Bottom	Leg 1	1500	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	24032.4793	3609.0344	566.1252	756

Shear Design (Part 2 of 2)

$V_c + V_s$ kN
2271.6522
2271.6522

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_u kN	M_u kN-m
Top–Left	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	27247.2206	-2724.2599
Top–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	27247.2206	74.3232
Bottom–Left	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	27636.193	-3202.7938
Botttom–Right	Leg 1	900	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	27636.193	756.5415

Boundary Element Check (Part 2 of 2)

Stress Comp MPa	Stress Limit MPa
15.2	10
13.04	10
15.77	10
13.78	10

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)	LLRF
2ND	C19	12628	22923	3500	400	0.5

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
35355.34	50	1	550	415

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	10878	22923	14378	22923	3500	400
Bottom	Leg 1	10878	22923	14378	22923	3500	400

Flexural Design for P_u, M_{u2} and M_{u3} (Part 1 of 2)

Station Location	Required Rebar Area (mm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN
Top	3916	0.0028	0.0025	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	26039.4826
Bottom	4588	0.0033	0.0025	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	26222.7446

Flexural Design for P_u, M_{u2} and M_{u3} (Part 2 of 2)

M_{u2} kN-m	M_{u3} kN-m	Pier A_g mm²
529.4695	-2016.1168	1400000
-533.1958	-2260.2453	1400000

Shear Design (Part 1 of 2)

Station Location	ID	Rebar mm²/m	Shear Combo	P_u kN	M_u kN-m	V_u kN	V_c kN
Top	Leg 1	1000	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	22484.0623	1691.8813	513.9991	504
Bottom	Leg 1	1000	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	22668.1761	2907.8229	513.9991	522.6104

Shear Design (Part 2 of 2)

$V_c + V_s$ kN
1514.4348
1533.0452

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_u kN	M_u kN-m
Top–Left	Leg 1	1200	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	26039.4826	-2016.1168
Top–Right	Leg 1	1000	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	26039.4826	258.6819
Bottom–Left	Leg 1	1200	1.5 (D+SPECZ W) + 0.45(SPECX W+SPECY W)	26222.7446	-2260.2453
Botttom–Right	Leg 1	1200	1.5 (D+SPECX W) + 0.45)SPECY W+ SPECZW)	25548.6422	2907.8229

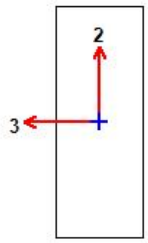
Boundary Element Check (Part 2 of 2)

Stress Comp MPa	Stress Limit MPa
21.07	10
18.92	10
21.5	10
21.81	10

BEAM DESIGN

ETABS Concrete Frame Design

IS 456:2000 Beam Section Design (Summary)



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF
4TH	B383	9473	B 300X800 M35	Envelope - Beam Design	7579.7	7583	1

Beam Element Details (Part 2 of 2)

Type
Ordinary Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
300	800	300	0	35	35

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

γc	γs
1.5	1.15

Factored Forces and Moments

Factored M_{u3} kN-m	Factored T_u kN-m	Factored V_{u2} kN	Factored P_u kN
-726.6656	11.9963	45.2301	-165.7946

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M_t kN-m	Positive Moment kN-m	Negative Moment kN-m
-726.6656	25.8743	0	-752.5399

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

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-752.5399		2441	173	2441	355
Bottom (-2 Axis)		0	355	173	0	355

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

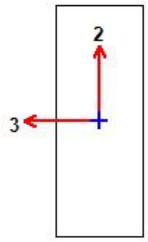
Shear V_e kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
45.2301	157.2761	91.8	137.6463	332.53

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

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{svt} /s mm²/m
12.551	45.2301	230	730	0

ETABS Concrete Frame Design

IS 456:2000 Beam Section Design (Summary)



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF
3RD	B383	9475	B 300X800 M35	Envelope - Beam Design	7579.7	7583	1

Beam Element Details (Part 2 of 2)

Type
Ordinary Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
300	800	300	0	35	35

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

ɣc	ɣs
1.5	1.15

Factored Forces and Moments

Factored M_{u3} kN-m	Factored T_u kN-m	Factored V_{u2} kN	Factored P_u kN
-703.6349	10.9087	44.6747	-167.5093

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M_t kN-m	Positive Moment kN-m	Negative Moment kN-m
-703.6349	23.5286	0	-727.1634

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

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-727.1634		2357	175	2357	355
Bottom (-2 Axis)		0	355	175	0	355

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

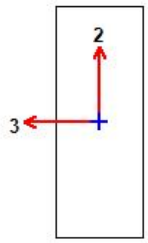
Shear V_e kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
44.6747	155.2565	91.8	133.7953	332.53

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

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{svt} /s mm²/m
11.3073	44.6747	230	730	0

ETABS Concrete Frame Design

IS 456:2000 Beam Section Design (Summary)



Beam Element Details (Part 1 of 2)

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF
2ND	B383	9441	B 300X800 M35	Envelope - Beam Design	7579.7	7583	1

Beam Element Details (Part 2 of 2)

Type
Ordinary Frame

Section Properties

b (mm)	h (mm)	b_f (mm)	d_s (mm)	d_{ct} (mm)	d_{cb} (mm)
300	800	300	0	35	35

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

γ_c	γ_s
1.5	1.15

Factored Forces and Moments

Factored M_{u3} kN-m	Factored T_u kN-m	Factored V_{u2} kN	Factored P_u kN
-679.4682	10.0708	44.0967	-165.624

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M_t kN-m	Positive Moment kN-m	Negative Moment kN-m
-679.4682	21.7213	0	-701.1896

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

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm²	+Moment Rebar mm²	Minimum Rebar mm²	Required Rebar mm²
Top (+2 Axis)	-701.1896		2269	173	2269	355
Bottom (-2 Axis)		0	355	173	0	355

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

Shear V_e kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm²/m
44.0967	152.9241	91.8	131.6031	332.53

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

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{svt} /s mm²/m
9.6867	44.0967	230	730	0

SLAB DESIGN

DESIGN OF SLAB :

Panel Name : Two adjacent edges discontinuous Code : 8

Clear Longer span, ly = 5350 mm

Clear Shorter span, lx = 5225 mm

ly / lx = 1.02 < 2, Hence, Twoway slab.

Effective Longer span = 5471.00 mm

Effective Shorter span = 5346.00 mm

Assume thickness of slab = 150.00 mm

Effective depth available = 121.00 mm

Loads :

Dead Load and Imposed Load (fixed) :

Floor finish = 1.200 kN/m^2

Self weight = 3.750 kN/m^2

w_{DL} = 4.950 kN/m^2

Imposed Load (Not fixed) :

Occupancy classification as per IS: 875(Part 2) - 1987 :

Live load = 2.000 kN/m^2

w_{LL} = 2.000 kN/m^2

Total load, $w = w_{DL} + w_{LL}$ = 6.950 kN/m^2

Span Moments:

Along Shorter span: $BM = \alpha_x w l_x^2$ = 0.036 x 6.95 x 5.346^2 = 7.15 kNm M_{ux1} = 10.73 kNm

Along Longer span: $BM = \alpha_y w l_x^2$ = 0.035 x 6.95 x 5.346^2 = 6.95 kNm M_{uy1} = 10.43 kNm

Support Moments:

Along Shorter span: $BM = \alpha_x w l_x^2$ = 0.048 x 6.95 x 5.346^2 = 9.57 kNm M_{ux2} = 14.36 kNm

Along Longer span: $BM = \alpha_y w l_x^2$ = 0.047 x 6.95 x 5.346^2 = 9.34 kNm M_{uy2} = 14.00 kNm

Check for section :

Factored Max. BM, Mu = 14.36 kNm / m

For M30 grade concrete & Fe500 grade steel , $Mu,lim / bd^2$ = 4.139

Effective depth required = 58.91 mm < Effective depth available, OK

Along the Shorter span

A_{st} reqd at midspan :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{ux1} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 209.95 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

A_{st} reqd at support :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{\ 1 - \sqrt{(\ 1 - [4.6\ M_{ux2} / (f_{ck}\ bd^2)])}\}\ b\ d =$ 284.09 mm^2 / m

Provide 8 mm dia bars @ 150 mm c/c As = 335.10 mm^2 / m OK

Along the Longer span

A_{st} reqd at midspan :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{uy1} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 203.95 mm^2 / m

Provide 8 mm dia bars @ 200 mm As = 251.33 mm^2 / m OK

A_{st} reqd at support :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{\ 1 - \sqrt{(\ 1 - [4.6\ M_{uy2} / (f_{ck}\ bd^2)])}\}\ b\ d =$ 276.73 mm^2 / m

Provide 8 mm dia bars @ 150 mm c/c As = 335.10 mm^2 / m OK

Min Ast = 0.12% Gross section area = 180 mm^2 / m

Distribution steel = 0.5 x (0.12/100) x 1000 x 150 = 90.00 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

Max Spacing = 3d or 300 mm whichever is less = 363 mm or 300 mm

Check for deflection:

fs = 0.58 x fy x (Ast req/Ast pro) = 242.26 MPa

MF = 1/(0.225+0.00322 fs – 0.625 log 10 (1/pt)) ≤ 2 = 1.729

Type of Slab = Continuous

Effective Shorter span = 5346.00 mm

Basic Value = 26

Allowable l/d = 44.94

Actual l/d = 44.18 Hence OK

DESIGN OF SLAB :

Panel Name : Two adjacent edges discontinuous Code : 8

Clear Longer span, ly = 6150 mm

Clear Shorter span, lx = 4575 mm

ly / lx = 1.34 < 2, Hence, Twoway slab.

Effective Longer span = 6271.00 mm

Effective Shorter span = 4696.00 mm

Assume thickness of slab = 150.00 mm

Effective depth available = 121.00 mm

Loads :

Dead Load and Imposed Load (fixed) :

Floor finish = 1.200 kN/m^2

Self weight = 3.750 kN/m^2

w_{DL} = 4.950 kN/m^2

Imposed Load (Not fixed) :

Occupancy classification as per IS: 875(Part 2) - 1987 :

Live load = 2.000 kN/m^2

w_{LL} = 2.000 kN/m^2

Total load, $w = w_{DL} + w_{LL}$ = 6.950 kN/m^2

Span Moments:

Along Shorter span: $BM = \alpha_x w l_x^2$ = 0.051 x 6.95 x 4.696^2 = 7.76 kNm M_{ux1} = 11.63 kNm

Along Longer span: $BM = \alpha_y w l_x^2$ = 0.035 x 6.95 x 4.696^2 = 5.36 kNm M_{uy1} = 8.05 kNm

Support Moments:

Along Shorter span: $BM = \alpha_x w l_x^2$ = 0.067 x 6.95 x 4.696^2 = 10.33 kNm M_{ux2} = 15.50 kNm

Along Longer span: $BM = \alpha_y w l_x^2$ = 0.047 x 6.95 x 4.696^2 = 7.20 kNm M_{uy2} = 10.81 kNm

Check for section :

Factored Max. BM, Mu = 15.50 kNm / m

For M30 grade concrete & Fe500 grade steel , $Mu,lim / bd^2$ = 4.139

Effective depth required = 61.19 mm < Effective depth available, OK

Along the Shorter span

A_{st} reqd at midspan :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{ux1} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 228.30 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

A_{st} reqd at support :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{\ 1 - \sqrt{(\ 1 - [4.6\ M_{ux2} / (f_{ck}\ bd^2)])}\}\ b\ d =$ 307.56 mm^2 / m

Provide 8 mm dia bars @ 150 mm c/c As = 335.10 mm^2 / m OK

Along the Longer span

A_{st} reqd at midspan :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{1 - \sqrt{(\ 1 - [4.6\ M_{uy1} / (f_{ck}\ bd^2)]\ )}\}\ b\ d =$ 156.31 mm^2 / m

Provide 8 mm dia bars @ 200 mm As = 251.33 mm^2 / m OK

A_{st} reqd at support :

$A_{st} = [\ 0.5 f_{ck} / f_y\ ] \{\ 1 - \sqrt{(\ 1 - [4.6\ M_{uy2} / (f_{ck}\ bd^2)])}\}\ b\ d =$ 211.55 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

Min Ast = 0.12% Gross section area = 180 mm^2 / m

Distribution steel = 0.5 x (0.12/100) x 1000 x 150 = 90.00 mm^2 / m

Provide 8 mm dia bars @ 200 mm c/c As = 251.33 mm^2 / m OK

Max Spacing = 3d or 300 mm whichever is less = 363 mm or 300 mm

Check for deflection:

fs = 0.58 x fy x (Ast req/Ast pro) = 263.43 MPa

MF = 1/(0.225+0.00322 fs – 0.625 log 10 (1/pt)) ≤ 2 = 1.546

Type of Slab = Continuous

Effective Shorter span = 4696.00 mm

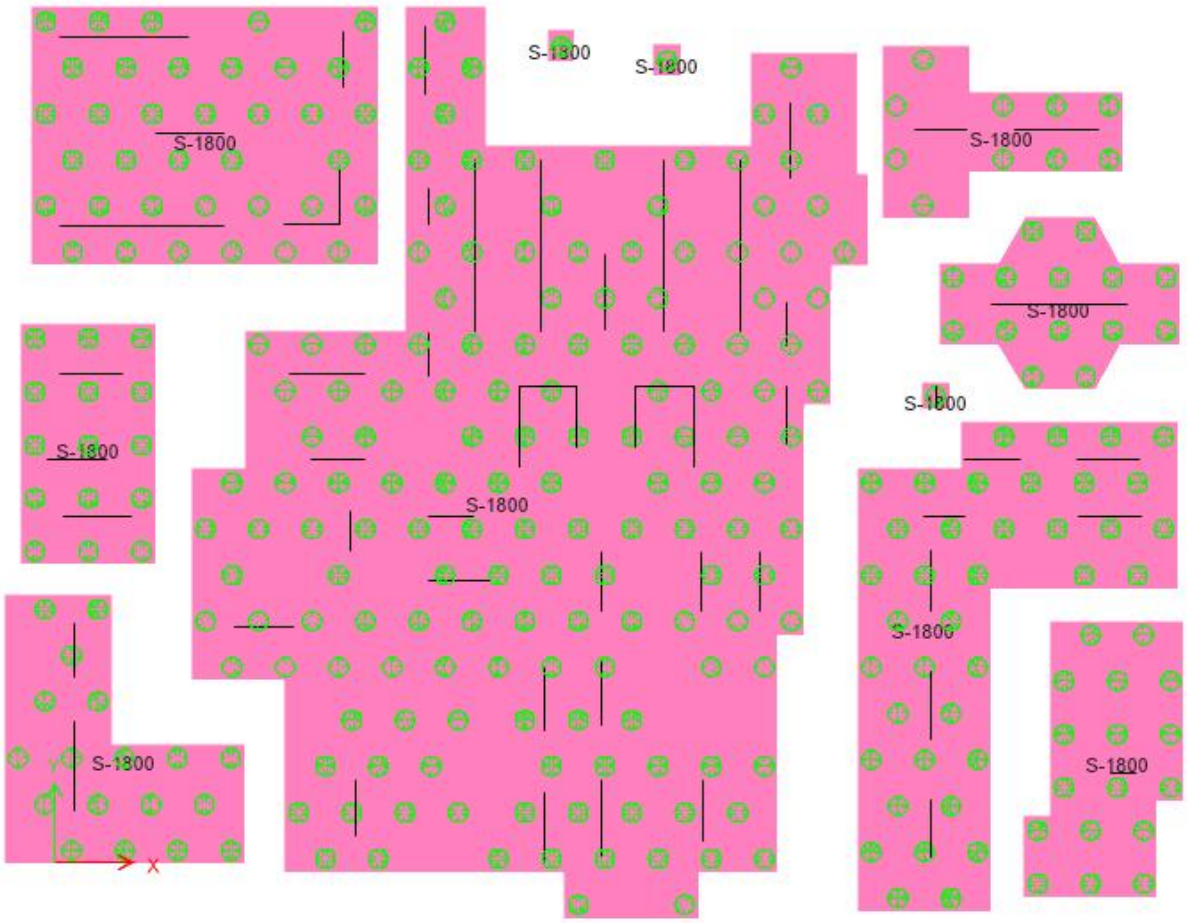
Basic Value = 26

Allowable l/d = 40.21

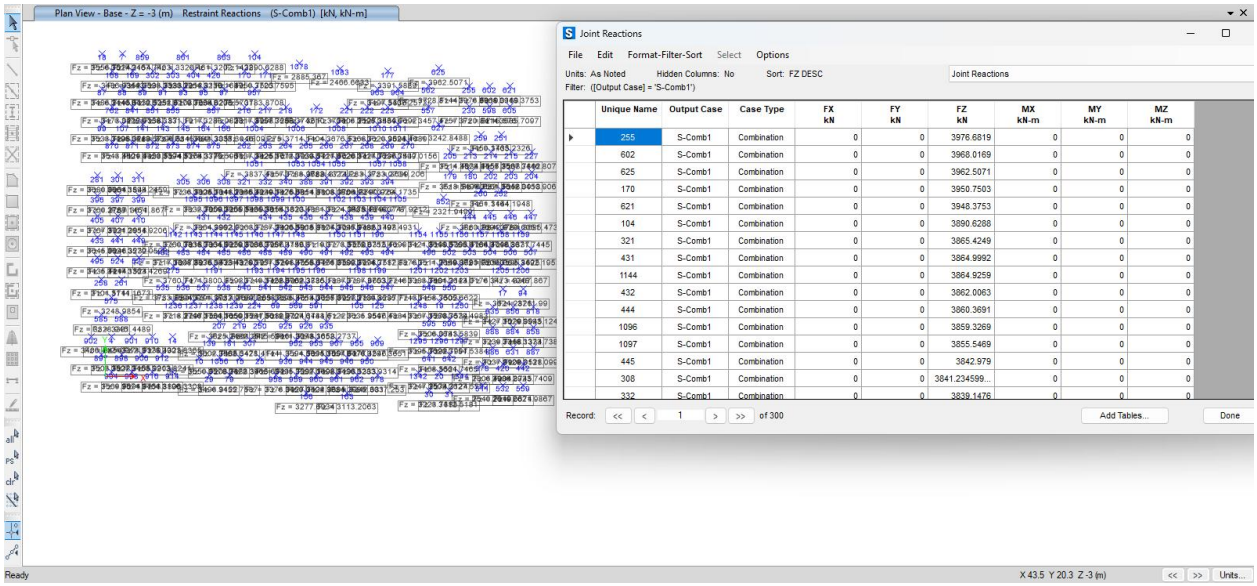
Actual l/d = 38.81 Hence OK

FOUNDATION DESIGN

SECTION IN SAFE MODEL



PILE REACTION



THE LANDLENS SUITE

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

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

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

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

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

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

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

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

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

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

FREE TOOLS · NO ACCOUNT NEEDED

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

Records and verification

The registers themselves, read for you.

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

Value and duty

What it is worth and what it costs to register.

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

Zoning and land use

What the plan says can happen on this land.

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

Registers and directories

Who holds it, and which office keeps the record.

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

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

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

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

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