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**STRUCTURAL DESIGN BASIS REPORT**

Of

# PROJECT PALLAVARAM GARDENS AT PALLAVARAM

For

## PRESTIGE PALLAVARAM ESTATES PRIVATE LIMITED

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| R0 | 1.12.2023 | FOR APPROVAL | ANANYA | SUNIL | NNNK |
| **REV NO.** | **DATE** | **DESCRIPTION** | **PREPARED BY** | **REVIEWED BY** | **APPRVD. BY** |

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CIN: U28920MH1978PTC020333

Date: 07th May 2025.

# STABILITY CERTIFICATE

(To be furnished while filing application for registration of building)

The detailed engineering and structure design of the Proposed construction of Combined extended Doubled Basement floor for Block 1 to 14; **Block – 1** : Ground floor + 14 floors – Residential Building with 116 Dwelling Units; **Block – 2** : Ground floor + 14 floors – Residential Building with 58 Dwelling Units; **Block – 3** : Ground floor + 14 floors – Residential Building with 249 Dwelling Units; **Block – 4** : Ground floor + 14 floors Residential Building with 58 Dwelling Units; **Block – 5** : Ground floor + 14 floors –Residential Building with 88 Dwelling Units; **Block-6** : Ground floor + 14 floors – Residential Building with 88 Dwelling Units; **Block – 7** : Ground floor + 14 floors – Residential Building with 58 Dwelling Units; **Block – 8** : Ground floor + 14 floors – Residential Building with 88 Dwelling Units; **Block – 9** : Ground floor + 14 floors – Residential Building with 176 Dwelling Units; **Block – 10** : Ground floor + 14 floors – Residential Building with 352 Dwelling Units; **Block – 11** : Ground floor + 14 floors – Residential Building with 174 Dwelling Units; **Block – 12** : Ground floor + 14 floors – Residential Building with 264 Dwelling Units; **Block – 13** : Ground floor + 14 floors – Residential Building with 300 Dwelling Units (Totally 2069 Dwelling units); **Block – 14** : Ground floor + 5 floors – Club House with Gym, Yoga, Play area, Spa, Mini Theatre, Swimming Pool, Pharmacy, Badminton Court, Party Hall & Departmental Store & **Visitors Cabin Block** : Ground floor only situated at Pallavaram Radial Road and Comprised in T.S. No. 9/20A, 9/20B, 10/5, 10/6, 10/7-1, 10/7-2, 10/7-3, 11/4, 11/5, 11/6, 11/7A, 11/7B, 11/8, 11/10, 11/11, 12/9, 12/11, 12/12, 12/14, 13/1, 13/2A, 13/3A, 134A1, 13/4B1, 13/4C1, 13/5A, 15/1, 15/2A, 15/2B1, 15/4A, 15/4C, 15/5, 16/1, Block No. 25, Ward – C, Old Survey No. 136/1A, 1B, 1C, 137/4, 5, 6A, 6B1, 6B2, 8, 9, 138/1, 2A1, 2B, 2A3, 143/1, 6B1, 143/6B2, 7, 8, 201/8, 9A, 9B, 12, 202/12, 206/5, 6 ,7 of Zamin Pallavaram village, within the limits of Tambaram Corporation and T.S. No. 4/1, 4/3, 5/1, 5/2, 5/3, 5/4A1, 5/4A2, 5/4B, 5/5-2, 5/6, 5/7, 5/8, 5/9, 5/10-2, 6/1, 6/2, 6/3, 6/4-1, 6/11A1,6/12, Block No. 19, Ward – G, Old Survey No. 21/1,2, 22/1A, 1B, 2, 24/1B, 99/2, 102/1,1A, 103, 103/2, 104, 105, 106/1,2, 107/1,2, 108, of Nemilichery village within the limits of Tambaram Corporation has been done by us based on the report of geotechnical investigation (soil test) done by **M/s. Geo Marine Consultants Pvt. Ltd,** Chennai. Report No. **JC-GT-2112** Dated **16th Sept 2013**, and considering the functional requirement of the building.

2. 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.

3. We further certify that:

(i) The minimum grade of concrete is **M:30**

(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 Codes No. **IS 875-Part I, II & III** and design of earthquake resistant structure as per IS Code No. **IS 1893-Part1-2016**

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

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Encl.: Structural Design Calculation

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# 1. FOREWORD

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

The parameters adopted in this report are going to be the basis of the structural design calculations. Hence it is expected that the planning and design team members - architects, services consultants and project management team - give their feedback and approval to the parameters, suggestions, recommendations and queries mentioned in the report.

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

The design will aim to achieve

Structural & functional integrity.

Desirable Structural performance under characteristic service design loads.

Resistance to loads due to natural phenomena i.e. wind and earthquakes.

Structural durability & maintainability.

# 2. PROJECT DESCRIPTION

***Project:*** PRESTIGE PALLAVARAM GARDENS.

***Location*:** Pallavaram, Chennai.

## 2.1 Agencies

***Owner:*** PRESTIGE PALLAVARAM ESTATES PRIVATE LIMITED

***Architects:*** RSP Design Consultants (India) Pvt. Ltd., Chennai

***Structural Consultants:*** Sterling Engineering Consultancy Services (P) Ltd., Bangalore

***Services Consultants:*** Design Tree Services Consultants Pvt Ltd.

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## 2.2 The Building

The proposed residential development comprises of 13 towers + Club house and a podium extending upto the ground floor. The building will have a common basements and podium with landscape and drive ways for Fire engine movement.



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The building is essentially a R.C.C. framed structure with shear walls and columns. The columns and shear walls are connected to each other with a network of R.C.C. beams and slabs with the slabs acting as in-plane rigid diaphragms for each of the floors.

### 2.3 Detail Description of Building:

The proposed structure consists of 13 residential towers and a club house.
Each tower consists of 2 basements (Common for all towers) with ground + 14 upper floors + terrace. The typical floor height at each tower is 3.0m and a ground floor and upper basement height of 4.2m and 3.9m respectively.

Club House is proposed at the Ground Floor level.

Podium contains landscape area and common area connecting towers. The level difference between tower & non-tower portion is 1000mm. A 450mm maximum soil filling and 3.0KN/Sqm. Live load is taken considering this as an assembly area on the podium slab. Fire Engine movement is considered on the defined drive ways as per the loading specified.

## 3. LIST OF CODES

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

### 3.1 DESIGN LOADS (OTHER THAN EARTHQUAKE LOADS)

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

### 3.2 DESIGN FOR EARTHQUAKE RESISTANCE

| IS Code | Description |
|---|---|
| IS 1893(Part 1) : 2016 | Criteria for earthquake resistance design of structures. |
| IS 4326: 1993 | Earthquake Resistant Design and Construction of Buildings – Code of Practice |

### 3.3 DESIGN OF STEEL STRUCTURAL ELEMENTS

| IS Code | Description |
|---|---|
| IS 800: 2007 | Code of Practice for General Construction in Steel |
| IS 2062 | Steel for general structural purposes |

### 3.4 DESIGN OF CONCRETE ELEMENTS

| IS Code | Description |
|---|---|
| IS 456: 2000 | Plain and Reinforced Concrete - Code of practice |
| IS 1904 | Indian Standard Code of practice for design & construction foundations in Soil: General Requirements |
| IS 2950 | Indian Standard Code of Practice for Design and Construction of Raft Foundation (Part – 1) |
| IS 2974 | Code of practice for design & construction of machine foundation |
| SP 16 | Structural use of concrete. Design charts for singly reinforced beams, doubly reinforced beams and columns. |
| SP 34 | Handbook on Concrete Reinforcement & Detailing |
| SP 7:2016 | National Building code of India 2016 (Vol. 1 & 2) |
| IS 1786:2008 | Specification for high strength deformed bars and wires for concrete reinforcement. (Amendment No:1) |
| IS 3370 (part I) | Code of practice for concrete structure for the storage of liquids |

# 4. DESIGN PARAMETERS

### 4.1 Materials of Construction

The building is predominantly RCC frame structure with columns and shears walls; floor slabs being used as diaphragms in redistribution of lateral forces.

**Concrete**

Concrete of Grade ranging from M: 50 to M30 have been used in RCC structural members. Concrete Mix with 15% cementatious material like GGBS in structural concrete and 30% of GGBS in all other finishing works shall suffice LEED requirement.

Concrete Mix M15 shall be used in filling, plum concrete, leveling courses and other non-structural items.

Density of reinforced concrete is assumed as 25.00 KN/cu.m
Poisson's ratio: 0.2
Co-efficient of thermal expansion: $5.5 \times 10^{-6}$

Minimum cement content, water cement ratio etc. shall conform to IS 456:2000 code provisions for durability and strength criteria.

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***Cement:***

Ordinary Portland cement of grade 53 confirming to IS 8112 and IS 12269 is specified for concrete grades ranging from M30 to M50.

***Aggregates:***

The sizes of coarse aggregates confirm to IS 383.Nominal maximum size of coarse aggregate shall be 20 mm, suitably graded as per the requirement of mix design.

The fine aggregates confirm to the specifications of IS 383

***Water:***

Water used for construction shall comply with IS 456:2000.

***Reinforcement:***

Thermo-mechanically treated (TMT) bars conforming to IS 1786:2008 with $f_y$ = 500 N/ sq.mm and 550 N/sq.mm shall be used.
Poisson's ratio: 0.3
Co-efficient of thermal expansion: $12x10^{-6}$

***Structural Steel:***

Structural steel work, if any, shall conform to IS 226 and IS 2062 for Indian steel sections.

***Soil Parameters:***

Shall be followed as per soil report.

Analysis of Soil and Rock profile

A perusal of the data presented in the soil profile tables indicates that the substrata mainly Consists of the following five strata in the boreholes:
a) **Stratum - I**: Brownish grey moist poorly graded M.dense clayey silty sand, sand silt clay mixtures

b) **Stratum - II**: Dark brown moist V dense completely weathered rock, Descent from Charnockite

c) **Stratum - III**: Brownish grey V dense, completely weathered rock, Descent from Charnockite

d) **Stratum - IV**: grey completely weathered rock, Descent from Charnockite

e) **Stratum - V**: Grey Fresh rock, Charnockite

For the proposed configuration of the structures, it is considered that a minimum depth of excavation will be 4.0m for the basement floors and could be 5.0m to 6.0m for the foundations.

Hence, for the kind of proposed structure, open isolated column footing located a minimum depth of 5.5m below E.G.L can be adopted. The footing can be designed for an allowable bearing pressure of 1500kPa.



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Concrete Grades of Structural Elements,

| | | |
|---|---|---|
| i) Footings & Pedestals | - | M40 |
| ii) Raft & Retaining wall | - | M30 |
| iii) Columns | - | M50 to M30 |
| iv) Underground Tanks & OHT | - | M30 |
| v) Slab & beams | - | M30 |
| vi) Ramps & Staircases | - | M30 |

## 4.2 Loading Standards

**Dead Loads**

- **Self-weights**

Self-weight of the materials will be considered based on following criteria

| | |
|---|---|
| Unit weight of reinforced concrete | 25 kN/cum |
| Unit weight of reinforced steel/structural steel | 78.5 kN/cum |
| Unit weight of water | 10 kN/cum |
| Unit weight of glass | 28 kN/cum |
| Unit weight of stainless steel | 78.5 kN/cum |
| Unit weight of masonry including plastering | 21 kN/cum |
| Unit weight of cinder for filling | 08 kN/cum |
| Unit weight of granite | 28 kN/cum |
| Unit weight of plain concrete | 24 kN/cum |
| Unit weight of screed | 20 kN/cum |
| Unit weight of saturated soil | 21 kN/cum |
| Unit weight of floor finishes | 20 kN/cum |

- **Suspended services and other dead loads.**

| Load Component | Thickness (mm) | UDL (kN/m$^2$) |
|---|---|---|
| Insulation | | 0.10 |
| Fire sprinklers | | 0.1 |
| Mechanical ducting, Electrical/Lighting | | 0.1 |
| False ceiling | | 0.1 |
| Miscellaneous | | 0.1 |

Total suspended services and other dead loads = 0.5KN/ m$^2$

### 4.2.1 Imposed Loads on slabs

The following are the imposed loads in the structural slabs, in addition to the self-weight and the floor finishes.

*(Self-weight of slab will be as per the thickness mentioned in the respective drawings Floor finishes of 75 mm thickness have been considered on all floors.)*

**(i) Living, Dining, Bedrooms and Kitchens**

| Load Component | Thickness (mm) | UDL (kN/m$^2$) |
|---|---|---|

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| | | |
|---|---|---|
| Finishes | | 1.5 |
| Live Load | | 2.0 |

**(ii) Terraces**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Integrated Water-Proofing | | 3.00 |
| Live Load | | 1.50 |

**(iii) Toilets**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Finishes | | 1.50 |
| Sunk & Filled | 100 mm | 2.00 |
| Live Load | | 2.00 |
| *Filling material considered shall be screed density 2000kg/cu.m | | |

**(iv) Corridors, Passages, Lobbies and Balconies**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Finishes | | 1.50 |
| Sunk & Filled for balcony | 150mm | 3.00 |
| Live Load | | 3.00 |
| *Filling material considered shall be screed density 2000kg/cu.m | | |

**(v) Connecting bridges.**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Finishes | | 1.50 |
| Live Load | | 3.00 |
| *Filling material considered shall be screed density 2000kg/cu.m | | |

**(vi) Staircases**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Steps | 150 (Riser) Assuming 75mm Avg thickness | 1.875 |
| Finishes | | 1.50 |
| Live Load | | 3.00 |

**(vii) Lift Machine Rooms, Elec. Rooms and DG Area(basements)**

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| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Finishes | | 1.50 |
| Live Load | | 10.00 |

**(viii) Utilities**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Finishes | | 1.50 |
| Live Load | | 3.00 |
| Sunk & Filled | 150mm | 3.00 |

**(ix) Parking Space and Drive-way Ramps**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Finishes | 100mm | 2.4 |
| Live Load (LMV) | | 3.0 |

**(x) Podium Level**

| Load Component | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| Filling | (Depth x 21kN/m3) | Equivalent UDL + Landscape loads |
| Live Load (Fire Tender Movement) | | 16 to 20 |
| Live Load (LMV) | | 5.00 |

Landscape filling load of 450mm depth will be considered on podium as per clients requirement in general.

**(xi) Self - Weight of Different Walls**

| Wall Type | Thickness (mm) | UDL (kN/m²) |
|---|---|---|
| ***External Wall*** | | |
| Concrete Block-work | 200 | 4.20 |
| **Wall Type** | **Thickness (mm)** | **UDL (kN/m²)** |
| ***Internal Partition Wall*** | | |
| Block work (including plastering) | 100 | 2.1 |

**Fire tender where applicable Wheel /Axial load – IRC Class-A, 60 Tonnes of Design load above pavements will be considered.**

Fire tender movement along the periphery of the building on the podium slab with fire engine loading will be considered and the Uniformly Distributed load works out to be q = 16 to 20 kN/m².

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### 4.2.2 Wind loads

Wind loads will be calculated in accordance with IS 875: (Part 3) :2015

Design wind speed

$$V_z = V_b \times k_1 \times k_2 \times k_3$$

$V_b$ ⟶ Basic wind velocity for Bangalore. = 50 m/s

$k_1$ ⟶ Risk coefficient for all general buildings = 1.0
(For a design life of 50 years)

$k_2$ ⟶ Terrain category 3, class C, for Max height 50 m,
= 1.0

$k_3$ ⟶ Topography factor = 1.0

Based on the above,

Design wind speed ($V_z$) = 50 m/s

Design wind pressure

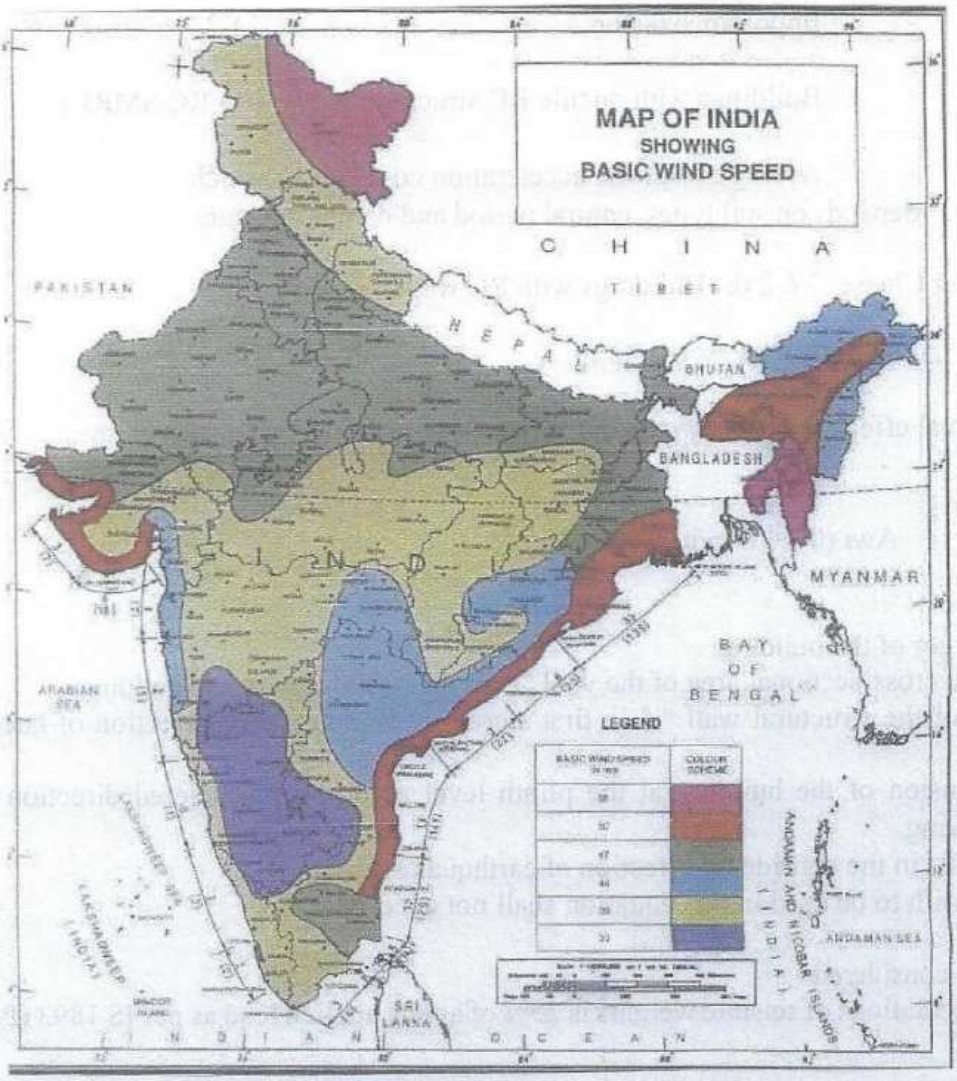
$$P_z = 0.6 \times V_z^2$$
$$= 1.5 \text{ kN/sq.m}$$

Further to Design Wind Pressure ($P_z$) appropriate pressure coefficient will be used as applicable.

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### 4.2.3 Seismic Loads

The seismic load calculations will be carried out in accordance with IS 1893 (Part 1): 2016. (IS 13920:2016 code of practice for ductile detailing of reinforced structure subjected to seismic forces specifies that all structures in these zone II requires no special design or ductile detailing other than following general principles of limit state design and detailing given in IS 456 are generally required for adequate safety against these low intensity earthquakes.)
As per this code, Chennai lies in Zone III with zone factor Z = 0.16

The design horizontal seismic co-efficient for a structure shall be determined by the following expression.

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

Z - Zone factor for Zone III Low Seismic Intensity 0.16

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I - Importance factor = 1.2

R - Buildings with ductile RC structural walls with RC SMRF's = 5.0

Sa / g - Average response acceleration co-efficient which depends on soil types, natural period and damping values.

As per Clause, 7.6.2 (b) Buildings with RC walls,

$Ta = 0.075h0.75/\sqrt{Aw} \geq 0.09h/\sqrt{d}$

Where Aw is total effective area of walls in the first storey of the building given by,

$$Aw = \sum_{i=1}^{Nw} \left[ Awi\ (0.2+(Lwi/h)2) \right]$$

Where, H = height of the building
Awi = Effective cross-sectional area of the wall "i" in the first storey of the building.
Lwi = Length of the structural wall "i" in first storey in the considered direction of lateral forces.
d = base dimension of the building at the plinth level along the considered direction of earthquake shaking.
Nw = no. of walls in the considered direction of earthquake shaking.
The value of Lwi/h to be used in this equation shall not exceed 0.9

A damping of 5% is considered.
Live load used in calculations of seismic weights is 25% of actual applied load as per IS 1893 (Part 1): 2016.

Design horizontal seismic coefficient and base shear
X- direction, Vbx = Ahx * W
Y- direction, Vby = Ahy * W

W = Seismic weight of the building

**4.2.3.1 Dynamic Analysis**

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

Number of modes Considered : 12 Numbers (Min)

Modal Combination Method Used : Complete Quadratic combination

(CQC).

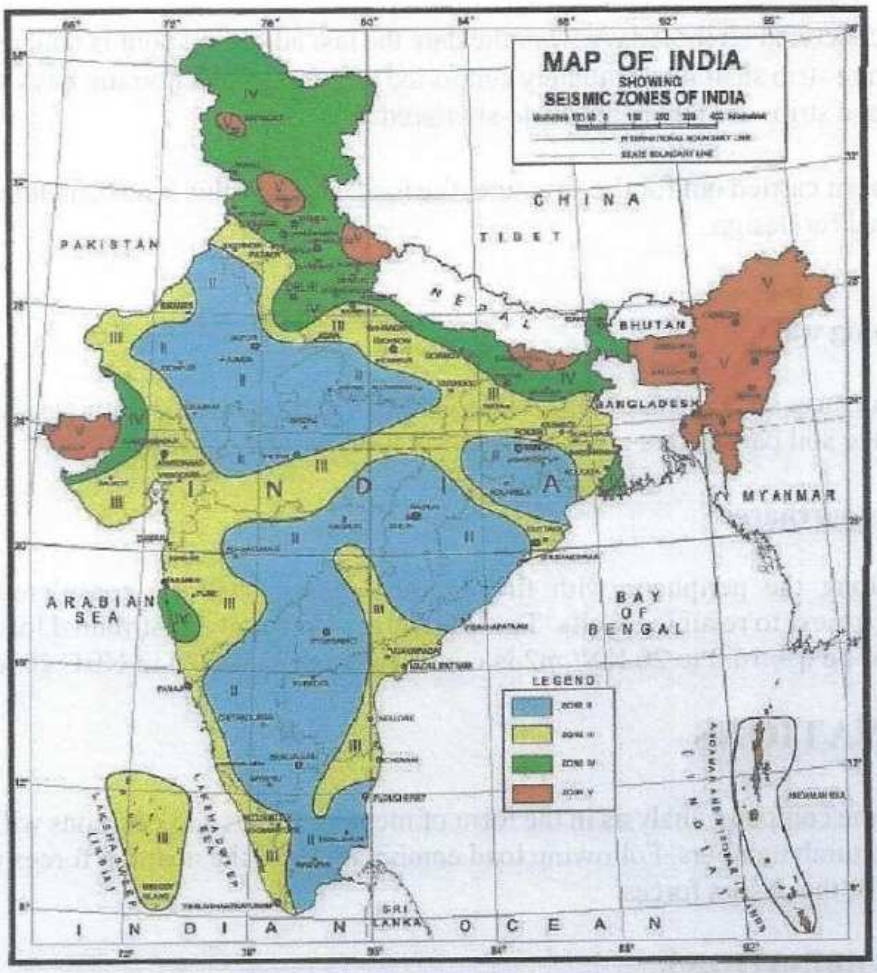
Spatial Combination Method used :Square root of the sum of Square

(SRSS).

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Modal case type : Ritz vector Method

Orthogonal directional seismic effect : Not applicable




### 4.2.4 Thermal Effects

Temperature variation produces stresses in the structure, as it tends to expand and contract. In the structures, with large geometrical dimensions, the effect of temperature is important in the behavior and final design. Due to deformation of expansion & contraction - between daytime and nights, and between winter and summer - the effect on the durability of structure and on the supported finishes is significant to produce considerable results.

The structure will be analyzed for the following temperature variation conditions, if required.

| | |
|---|---|
| Case 1 | |
| Overall temperature variation between day and nights and between summer and winter conditions. | 10 $^0$C |
| Case 2 | |
| Differential inside and outside temperature considering that the building is air-conditioned and thermally insulated. | 10 $^0$C |

#### 4.2.4.1 Shrinkage Effects

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Shrinkage strips shall be provided in the podium area to take care of temperature stresses. Since the overall length of the building exceeds more than 45m, expansion joint in the building is required. As the building functional requirement doesn't permit expansion joint, shrinkage strip is provided and the same will be indicated in the drawing at appropriate locations.

Shrinkage strips shall be concreted after 60 days from the date the last adjoining pour is concreted. For this period the shrinkage strip shall be adequately supported on props and adjoining bays shall be propped till the shrinkage strips are concreted & de-shuttered.

Also, thermal analysis is been carried out for the structure, the load cases for this kind is mentioned in the load cases considered for design.

### 4.2.5 Soil loads on retaining walls

For design of retaining structures such as basements, underground water tank, and retaining wall to sustain level differences, the soil parameters given in the soil report will be considered.

### 4.2.6 Load due to vehicle surcharge

Fire tender movement along the periphery with fire engine loading shall be considered as surcharge on the drive ways next to retaining walls. The Equivalent Uniformly Distributed load of the fire tender works out to be q = 16.0 to 20 KN/ m2 is considered as mentioned in NBC 2016.

## 5. LOAD COMBINATIONS

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

**FACTORED LOAD COMBINATIONS:**

| Load Combination | LOAD FACTORS | | | | | | |
|---|---|---|---|---|---|---|---|
| | D L | L L | Wind | Earthquake | Temperature | Spec x | Spec y |
| LC-1 | 1.5 | - | - | - | | | |
| LC-2 | 1.5 | 1.5 | - | - | | | |
| LC-3 | 1.2 | 1.2 | 1.2 (x) | - | | | |
| LC-4 | 1.2 | 1.2 | -1.2 (x) | - | | | |
| LC-5 | 1.2 | 1.2 | 1.2 (y) | - | | | |
| LC-6 | 1.2 | 1.2 | -1.2 (y) | - | | | |
| LC-7 | 1.2 | 1.2 | - | 1.2 (x) | | | |
| LC-8 | 1.2 | 1.2 | - | -1.2 (x) | | | |
| LC-9 | 1.2 | 1.2 | - | 1.2 (y) | | | |
| LC-10 | 1.2 | 1.2 | - | -1.2 (y) | | | |
| LC-11 | 1.5 | - | 1.5 (x) | - | | | |
| LC-12 | 1.5 | - | -1.5 (x) | - | | | |
| LC-13 | 1.5 | - | 1.5 (y) | - | | | |
| LC-14 | 1.5 | - | -1.5 (y) | - | | | |
| LC-15 | 1.5 | - | - | 1.5 (x) | | | |



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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LC-16 | 1.5 | - | - | -1.5 (x) | | | |
| LC-17 | 1.5 | - | - | 1.5 (y) | | | |
| LC-18 | 1.5 | - | - | -1.5 (y) | | | |
| LC-19 | 0.9 | - | 1.5 (x) | - | | | |
| LC-20 | 0.9 | - | -1.5 (x) | - | | | |
| LC-21 | 0.9 | - | 1.5 (y) | - | | | |
| LC-22 | 0.9 | - | -1.5 (y) | - | | | |
| LC-23 | 0.9 | - | - | 1.5 (x) | | | |
| LC-24 | 0.9 | - | - | -1.5 (x) | | | |
| LC-25 | 0.9 | - | - | 1.5 (y) | | | |
| LC-26 | 0.9 | - | - | -1.5 (y) | | | |
| LC-27 | 1.2 | 1.2 | - | - | 1.2 | | |
| LC-28 | 1.2 | 1.2 | | | | 1.2 | |
| LC-29 | 1.2 | 1.2 | | | | | 1.2 |
| LC-30 | 1.5 | | | | | 1.5 | |
| LC-31 | 1.5 | | | | | | 1.5 |
| LC-32 | 0.9 | | | | | 1.5 | |
| LC-33 | 0.9 | | | | | | 1.5 |
| LC-34 | 1.5 | | | | 1.5 | | |
| LC-35 | 1.5 | | | | -1.5 | | |

**SERVICIABILITY LOAD COMBINATIONS:**

| DL | LL | WL/EL/TL |
|---|---|---|
| 1 | 1 | — |
| 1 | — | 1 |
| 1 | — | 1 |
| 1 | — | 1 |
| 1 | 0.8 | 0.8 |
| 1 | 0.8 | 0.8 |
| 1 | 1 | 1 |
| 1 | — | 1 |
| 1 | — | 1 |
| 1 | 1 | 1 |

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Suffixes x and y in above table indicates the lateral direction in which the forces are applied.
All members will be designed for the largest value of the design forces obtained due to positive as well as negative values of reversible forces (Wind and Earthquake).

# 6. PROPOSED APPROACH OF STRUCTURAL ANALYSIS

This building is a R.C.C shear wall/columns and proposed beam slab system at all levels.
After preliminary sizing of various structural members, a computer model of the structural frame of the building will be generated for carrying out computer analysis for the effects of vertical and lateral load that are likely to be imposed on the structure.

The building structure will be analyzed using the ETABS -v17.0.1 software for the following computer models of the building.

i) Floor analysis of all floors - for vertical loads and thermal effects with the entire building space



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frame.

ii) Space frame analysis (Static) of the entire structure - for wind loads.

iii) Space frame analysis (Dynamic) of the entire structure - for seismic loads.

ETABS -v17.0.1 has been thoroughly tested, validated and recognized internationally by several organizations and is well suited for the analysis of building systems.
Geometrical dimensions, member properties and member-node connectivity, including eccentricities will be modeled in the analysis problem. Variation in material grades, if present, will be considered.
Wind load derivations will be carried out using coefficients / factors in accordance with the relevant Indian codes.

The seismic loads will be derived from the results of dynamic analysis of the structure in accordance with the relevant code of practice.

The permissible values of the load factors and stresses will be utilized within the purview of the Indian Standards.

The computer analysis will produce accurate individual member forces, reactions at foundation level and deflection pattern of the entire structure as well as individual members. This data will then be used to confirm / review the member sizes and arrive at the most appropriate design of the structural members. Some re-runs of the analysis program might be required for arriving at the optimum structural space frame characteristics that satisfy the strength and stability criteria in all respects.

Design of different structural elements will be carried out using In-house developed spreadsheets and packages, software's like STAAD-pro-v8i SS6, ETABS -v17.0.1, SAFE, RCDC etc,.

Beams/slabs will be assigned actual sectional properties as per the chosen cross-sections, with stiffness modifiers to simulate cracked sections for performance review.

Appropriate property modifiers for cracked analysis as per IS 16700:2017 shall be considered as mentioned below:

**For Factored Loads**

| Structural Element | Area | Moment of Inertia |
|---|---|---|
| Slabs | 1 | 0.25 |
| Beams | 1 | 0.35 |
| Columns | 1 | 0.70 |
| Walls | 1 | 0.70 |

**For Un-factored Loads**

| Structural Element | Area | Moment of |
|---|---|---|

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| | | Inertia |
|---|---|---|
| Slabs | 1 | 0.35 |
| Beams | 1 | 0.70 |
| Columns | 1 | 0.90 |
| Walls | 1 | 0.90 |

Dead and live loads will be applied as per the parameters defined in this report. This will help in obtaining reasonable column loads directly out of analysis for the column design.

Seismic and wind load calculations will be carried out using coefficients in accordance with the frame structure / soil interaction, nature of the building frame and exposure conditions in line with the parameters mentioned in this report. Dynamic analysis of the structure will be carried out arriving at nodal load distribution, as per recommendations of IS-1893.

### 6.1 ACCEPTANCE CRITERIA

Under Serviceability Limit State the limiting structural deflection shall be as follows.

Total deflection under all imposed loads including temperature, creep and shrinkage shall not exceed L/250.

In the above limiting value, the deflection contribution due to temperature, creep and shrinkage shall not be more than L/350.

Lateral deflection (sway) due to wind shall not exceed H/500 (.002 H) where H is the height of the building above ground.

#### 6.1.1 Crack width Limits

The Limiting values of crack width as per clause 35.3 of IS: 456-2000 is followed in the design

- In general, for slabs crack width is limited to 0.3mm.
- For water retaining structures, Slab crack width is limited to 0.2mm

## 7. DESIGN OF STRUCTURAL ELEMENTS

For the design of R.C.C. elements, the Limit State Method will be used as per IS 456-2000.

Materials of construction will be predominantly concrete with consideration for strength and durability. The grade of concrete is suggested as M:50 to M:30 for columns, shear walls and M 30 for other elements, in view of the level of stresses to be borne by the members both in compression as well as flexural.

High Yield Strength Deformed bars conforming to IS: 1786 with $F_y$ = 500/550 MPa will be used as reinforcement.
Structural steel with Fy = 250/350 Grade shall be used.

Ductile detailing norms will be adopted to make the building earthquake resistant in accordance with IS: 13920:2016

**Cover to Reinforcement:**

Covers to reinforcement shall be in accordance with NBC-2016 to satisfy fire rating of 2 hours,

| | |
|---|---|
| i) For continuous beams | - 30mm |
| ii) For simply supported beams | - 40mm |
| iii) For columns fully exposed | - 40mm |
| iv)For continuous slabs | - 25mm |
| v) Footing and Footing Beams and Plinth Beams | - 50 mm |
| a. Raft slab Bottom | - 75 mm |
| b. Top | - 50 mm |
| vi) Water tanks / Sump tank | |
| c. On earth face | - 50 mm |
| d. On water face | - 40 mm |
| e. On other face | - 25mm |

# 8. FOUNDATION SYSTEM

## 8.1 Foundations for the Building:

As per soil report,

For the proposed configuration of the structures, it is considered that a minimum depth of excavation will be 4.0m for the basement floors and could be 5.0m to 6.0m for the foundations.

Hence, for the kind of proposed structure, open isolated column footing located a minimum depth of 5.5m below E.G.L can be adopted. The footing can be designed for an allowable bearing pressure of 1500kPa.

The stitched raft is designed for a full water head of 7m with a counterfill of M-sand with good compaction is considered.

# 9. STABILITY OF STRUCTURES

9.1 For the purpose of stability of the structure as a whole against overturning, the restoring moment shall not be less than 1.2 times the maximum overturning moments due to dead load plus 1.4 times the maximum overturning moments due to imposed loads. In case where dead load provides the restoring moments only 0.9 times in dead load shall be considered. The restoring moments due to imposed loads shall be ignored.

9.2 The factor of safety against sliding shall not be less than 1.40.

9.3 Factor of safety against buoyancy shall be not less than 1.20 ignoring the superimposed loading.



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# 10. OTHER DATA

Specific requirements of floor and wall cutouts for services, sinking (extent & depth) of floors in services, kitchen, utility and toilet areas, external architectural features, and entrance canopies are provided as required by Architects and Service Consultants. The relevant information is obtained from them in the form of drawings.

Lift loads and lift machine room equipment and cutout layouts will be obtained from the lift manufacturers. An impact factor of 100% will be considered in the lift supporting structures.

# 11. VALUE ENGINEERING EXERCISES

In order to optimize the material consumption, sample analysis and design exercises have been undertaken with different combinations of member sizes and the required reinforcement and formwork will be estimated. Results of these exercises have been considered in arriving at the structural scheme of the building.

# 12. DESIGN DEVELOPMENT

1. A layout of columns / shear walls and beams has already been developed.
2. We have submitted the structural General Arrangement plans for perusal of the design team members, who will be expected to note the salient features of the structural system and examine the compatibility with various requirements of architecture and other engineering disciplines. The co-ordination among various design team members will be part of the design development process and we - as structural engineers - will be a part of the process.

# 13. ANALYSIS FOR THE LATERAL LOADS

Seismic analysis:

For the purpose of the lateral analysis, the entire structure is modeled as a 3D space frame with concrete shear walls, columns and beams at different floor levels. The slab floor is modeled as membrane with rigid diaphragm assigned to it.

After assigning required geometrical properties and gravity loads on structure it is then subjected to appropriate seismic forces.

**Wind load analysis**

Wind loads are evaluated manually and are applied as "Exposure from extents of rigid diaphragms" at various levels.
The modeling of the structure would be same as the one used for the seismic analysis as explained above.

The structures are analysed for the various load combinations as per IS: 456-2000. The condensed output containing only the result for the critical load combination is obtained by using few computer softwares developed in-house for the purpose, which use ETABS -v17.0.1, analysis output as their input.



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For designing the structural steel members, the guidelines of IS: 800-2007 is adopted.

For the design of the R.C.C structures the recommendations of IS: 456-2000 is followed. Limit State design would be adopted with appropriate load factors for the various load combinations.

**Design of suspended floor / roof slabs**

Slab elements are designed for the forces obtained from the coefficients given in Annex D in IS code 456:2000 and using the limit state design method. Wall load on slab is taken as uniformly distributed over entire area. Based on yield line theory, slab loads are transferred on to supporting beams.

**Design of beams**

Beams are designed by using E-TABS software for critical load combinations.

**Design of columns**

R.C Columns are designed for bi-axial bending for the forces of critical load combination. The designs are made using E-TABS software and In-house spread sheets as per the guide lines of IS:456-2000 adopting limit state method.

**Design of footings**

Isolated footings with connecting raft (at the bottom of footing) are designed for the forces of critical load combination. Limit state method of design is adopted. The designs are done using in-house developed excel sheets and computer softwares. For this purpose the condensed output of the ETABS -v17.0.1, is used as input for these programs.

The stitched raft is designed for a full water head of 7m with a counterfill of M-sand with good compaction is considered.

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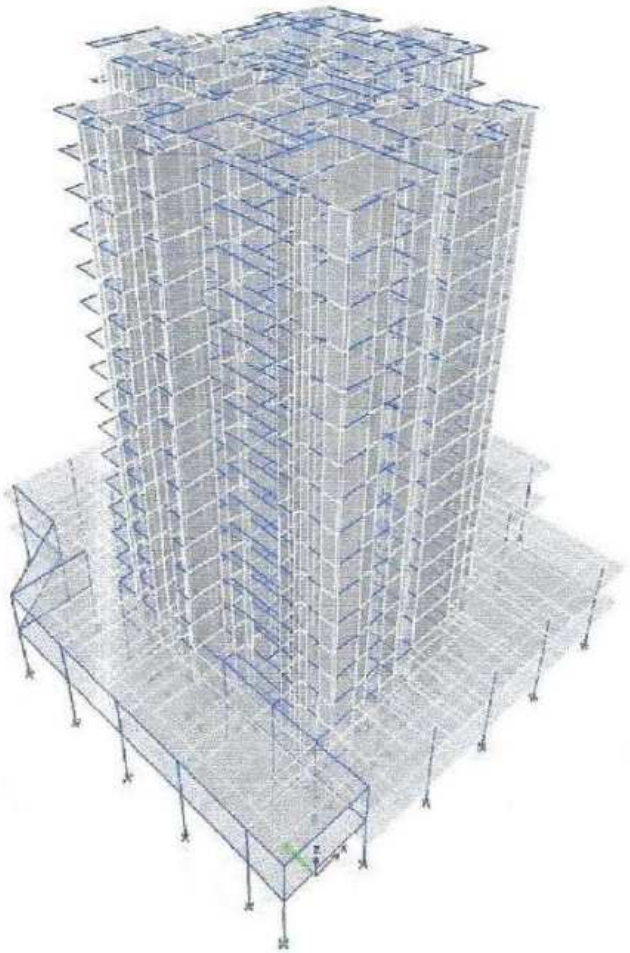
# *ANALYSIS SUMMARY REPORT*

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ETABS® version 17
Integrated Building Design Software



# Project Report for Block 10A-D, 12A-C, 3A

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WX | Diaphragms | From Diaphragms | 0 | 0.7 | 0.25 | TERR | GF | Yes | 1.2 | 50 | 3 | 1 |
| WY | Diaphragms | From Diaphragms | 90 | 0.7 | 0.25 | TERR | GF | Yes | 1.2 | 50 | 3 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQX | Seismic | X | | No | User Specified | 0.688 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQY | Seismic | Y | | No | User Specified | 0.668 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQXP | Seismic | X | | No | User Specified | 0.688 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.688 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.668 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQYN | Seismic | Y - Ecc. X | 5 | No | User Specified | 0.668 | TERR | GF | Per Code | 0.16 | II | 1.2 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.688 | 0.037959 | 185809.0535 | 7053.1269 |
| 5 | 0.668 | 0.039102 | 185809.0535 | 7265.4178 |
| 5 | 0.688 | 0.037959 | 185809.0535 | 7053.1269 |
| 5 | 0.688 | 0.037959 | 185809.0535 | 7053.1269 |
| 5 | 0.668 | 0.039102 | 185809.0535 | 7265.4178 |
| 5 | 0.668 | 0.039102 | 185809.0535 | 7265.4178 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.688$ sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] $Z = 0.16$
Response Reduction Factor, R [IS Table 9] $R = 5$
Importance Factor, I [IS Table 8] $I = 1.2$
Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 2.395964$

**Equivalent Lateral Forces**

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

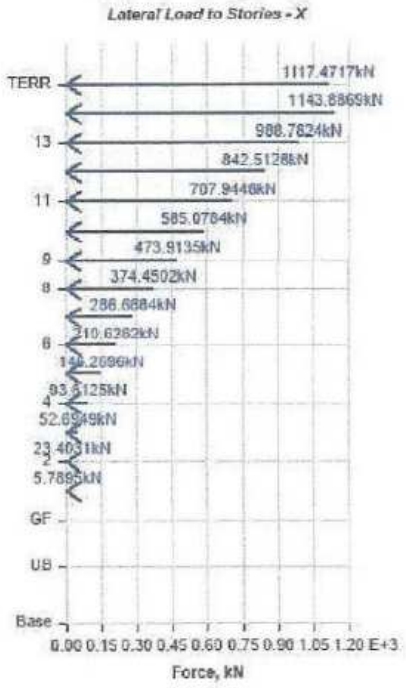
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X | 0.688 | 185809.0535 | 7053.1269 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 1117.4717 | 0 |
| 14 | 52.55 | 1143.8869 | 0 |
| 13 | 49.55 | 988.7824 | 0 |
| 12 | 46.55 | 842.5128 | 0 |
| 11 | 43.55 | 707.9448 | 0 |
| 10 | 40.55 | 585.0784 | 0 |
| 9 | 37.55 | 473.9135 | 0 |
| 8 | 34.55 | 374.4502 | 0 |
| 7 | 31.55 | 286.6884 | 0 |
| 6 | 28.55 | 210.6282 | 0 |
| 5 | 25.55 | 146.2696 | 0 |
| 4 | 22.55 | 93.6125 | 0 |
| 3 | 19.55 | 52.6949 | 0 |
| 2 | 16.55 | 23.4031 | 0 |
| 1 | 13.55 | 5.7895 | 0 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.668$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 2.395964$

**Equivalent Lateral Forces**

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

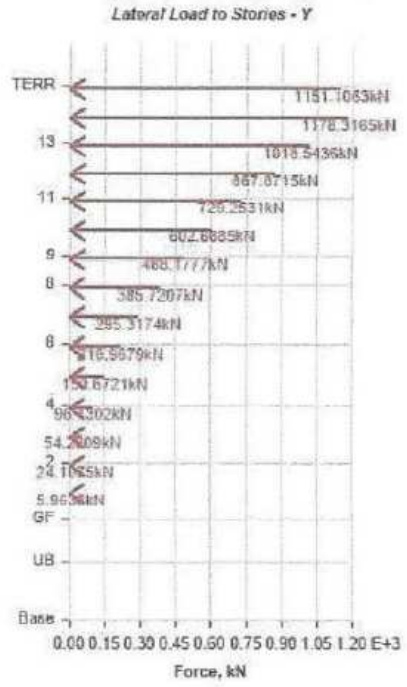
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y | 0.668 | 185809.0535 | 7265.4178 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 0 | 1151.1063 |
| 14 | 52.55 | 0 | 1178.3165 |
| 13 | 49.55 | 0 | 1018.5436 |
| 12 | 46.55 | 0 | 867.8715 |
| 11 | 43.55 | 0 | 729.2531 |
| 10 | 40.55 | 0 | 602.6885 |
| 9 | 37.55 | 0 | 488.1777 |
| 8 | 34.55 | 0 | 385.7207 |
| 7 | 31.55 | 0 | 295.3174 |
| 6 | 28.55 | 0 | 216.9679 |
| 5 | 25.55 | 0 | 150.6721 |
| 4 | 22.55 | 0 | 96.4302 |
| 3 | 19.55 | 0 | 54.2809 |
| 2 | 16.55 | 0 | 24.1075 |
| 1 | 13.55 | 0 | 5.9638 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.688$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

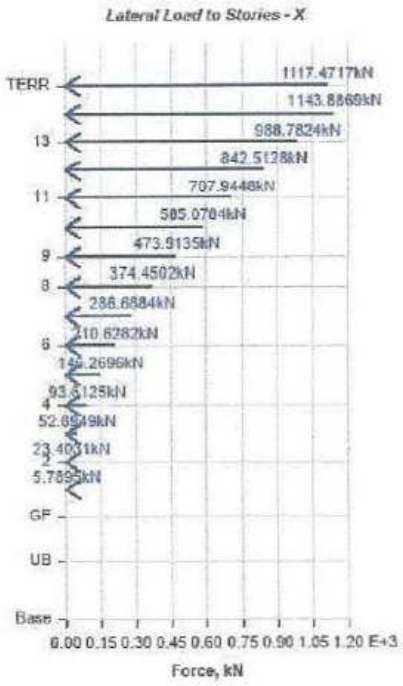
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X | 0.688 | 185809.0535 | 7053.1269 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 1117.4717 | 0 |
| 14 | 52.55 | 1143.8869 | 0 |
| 13 | 49.55 | 988.7824 | 0 |
| 12 | 46.55 | 842.5128 | 0 |
| 11 | 43.55 | 707.9448 | 0 |
| 10 | 40.55 | 585.0784 | 0 |
| 9 | 37.55 | 473.9135 | 0 |
| 8 | 34.55 | 374.4502 | 0 |
| 7 | 31.55 | 286.6884 | 0 |
| 6 | 28.55 | 210.6282 | 0 |
| 5 | 25.55 | 146.2696 | 0 |
| 4 | 22.55 | 93.6125 | 0 |
| 3 | 19.55 | 52.6949 | 0 |
| 2 | 16.55 | 23.4031 | 0 |
| 1 | 13.55 | 5.7895 | 0 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.688$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

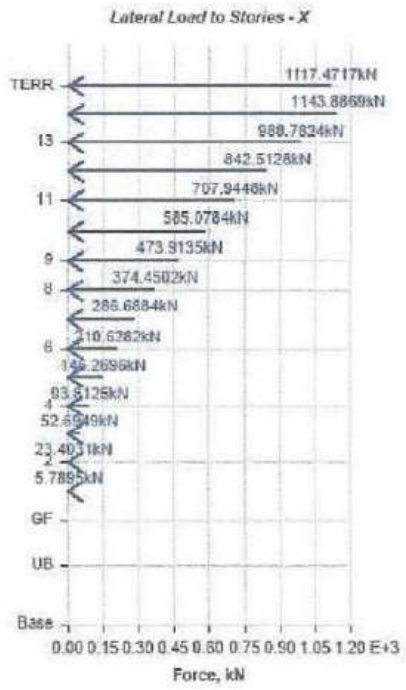
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X - Ecc. Y | 0.688 | 185809.0535 | 7053.1269 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 1117.4717 | 0 |
| 14 | 52.55 | 1143.8869 | 0 |
| 13 | 49.55 | 988.7824 | 0 |
| 12 | 46.55 | 842.5128 | 0 |
| 11 | 43.55 | 707.9448 | 0 |
| 10 | 40.55 | 585.0784 | 0 |
| 9 | 37.55 | 473.9135 | 0 |
| 8 | 34.55 | 374.4502 | 0 |
| 7 | 31.55 | 286.6884 | 0 |
| 6 | 28.55 | 210.6282 | 0 |
| 5 | 25.55 | 146.2696 | 0 |
| 4 | 22.55 | 93.6125 | 0 |
| 3 | 19.55 | 52.6949 | 0 |
| 2 | 16.55 | 23.4031 | 0 |
| 1 | 13.55 | 5.7895 | 0 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.668$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

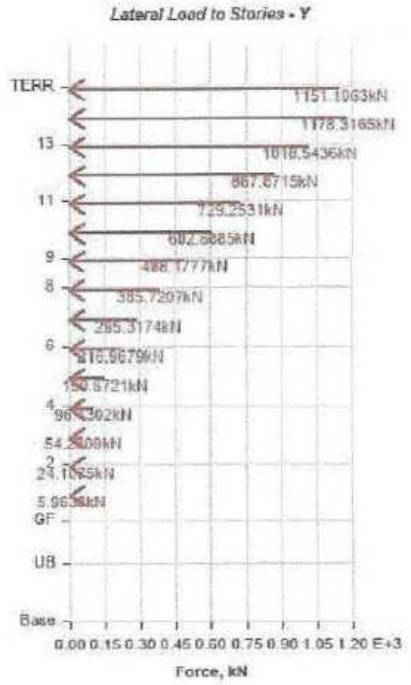
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.668 | 185809.0535 | 7265.4178 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 0 | 1151.1063 |
| 14 | 52.55 | 0 | 1178.3165 |
| 13 | 49.55 | 0 | 1018.5436 |
| 12 | 46.55 | 0 | 867.8715 |
| 11 | 43.55 | 0 | 729.2531 |
| 10 | 40.55 | 0 | 602.6885 |
| 9 | 37.55 | 0 | 488.1777 |
| 8 | 34.55 | 0 | 385.7207 |
| 7 | 31.55 | 0 | 295.3174 |
| 6 | 28.55 | 0 | 216.9679 |
| 5 | 25.55 | 0 | 150.6721 |
| 4 | 22.55 | 0 | 96.4302 |
| 3 | 19.55 | 0 | 54.2809 |
| 2 | 16.55 | 0 | 24.1075 |
| 1 | 13.55 | 0 | 5.9638 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y - Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.668$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

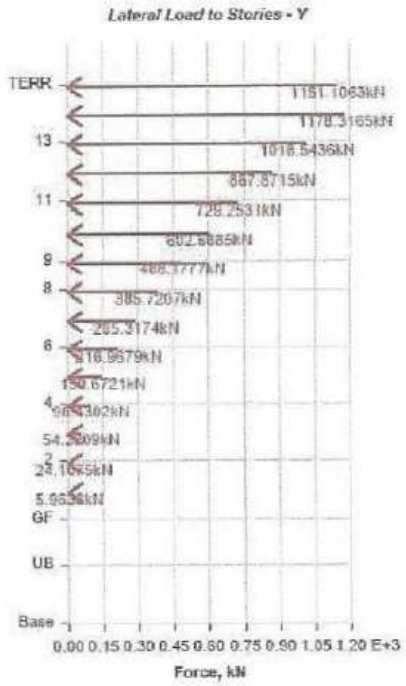
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y - Ecc. X | 0.668 | 185809.0535 | 7265.4178 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 0 | 1151.1063 |
| 14 | 52.55 | 0 | 1178.3165 |
| 13 | 49.55 | 0 | 1018.5436 |
| 12 | 46.55 | 0 | 867.8715 |
| 11 | 43.55 | 0 | 729.2531 |
| 10 | 40.55 | 0 | 602.6885 |
| 9 | 37.55 | 0 | 488.1777 |
| 8 | 34.55 | 0 | 385.7207 |
| 7 | 31.55 | 0 | 295.3174 |
| 6 | 28.55 | 0 | 216.9679 |
| 5 | 25.55 | 0 | 150.6721 |
| 4 | 22.55 | 0 | 96.4302 |
| 3 | 19.55 | 0 | 54.2809 |
| 2 | 16.55 | 0 | 24.1075 |
| 1 | 13.55 | 0 | 5.9638 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

**Table 1.9 - Response Spectrum Function - IS 1893:2016**

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 1.237 | 0.809 | 5.0805 | 25.8113 |
| Modal | 2 | 1.031 | 0.97 | 6.0948 | 37.1471 |
| Modal | 3 | 0.894 | 1.118 | 7.0243 | 49.3403 |
| Modal | 4 | 0.578 | 1.729 | 10.8668 | 118.0866 |
| Modal | 5 | 0.404 | 2.475 | 15.5498 | 241.7967 |
| Modal | 6 | 0.365 | 2.739 | 17.2124 | 296.2653 |
| Modal | 7 | 0.338 | 2.959 | 18.5944 | 345.7518 |
| Modal | 8 | 0.267 | 3.75 | 23.562 | 555.1656 |
| Modal | 9 | 0.187 | 5.342 | 33.5631 | 1126.4787 |
| Modal | 10 | 0.143 | 6.971 | 43.8003 | 1918.4705 |
| Modal | 11 | 0.104 | 9.576 | 60.1661 | 3619.9613 |
| Modal | 12 | 0.084 | 11.861 | 74.5273 | 5554.3167 |
| Modal-V | 1 | 1.237 | 0.809 | 5.0805 | 25.8113 |
| Modal-V | 2 | 1.031 | 0.97 | 6.0948 | 37.1471 |
| Modal-V | 3 | 0.894 | 1.118 | 7.0243 | 49.3403 |
| Modal-V | 4 | 0.578 | 1.729 | 10.8635 | 118.015 |
| Modal-V | 5 | 0.504 | 1.983 | 12.4628 | 155.3156 |
| Modal-V | 6 | 0.398 | 2.513 | 15.7916 | 249.374 |
| Modal-V | 7 | 0.359 | 2.784 | 17.4911 | 305.9373 |
| Modal-V | 8 | 0.322 | 3.104 | 19.5031 | 380.3696 |
| Modal-V | 9 | 0.245 | 4.083 | 25.6552 | 658.187 |
| Modal-V | 10 | 0.181 | 5.531 | 34.7504 | 1207.5889 |
| Modal-V | 11 | 0.134 | 7.459 | 46.8662 | 2196.4427 |
| Modal-V | 12 | 0.06 | 16.635 | 104.5226 | 10924.9644 |

**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.237 | 0.006 | 0.4895 | 0 | 0.006 | 0.4895 | 0 |
| Modal | 2 | 1.031 | 0.0006 | 0.1297 | 2.104E-05 | 0.0066 | 0.6192 | 2.104E-05 |
| Modal | 3 | 0.894 | 0.6026 | 0.0072 | 8.717E-06 | 0.6092 | 0.6264 | 2.976E-05 |
| Modal | 4 | 0.578 | 8.013E-07 | 4.046E-06 | 0.0017 | 0.6092 | 0.6264 | 0.0017 |
| Modal | 5 | 0.404 | 3.626E-06 | 0.0001 | 0.006 | 0.6092 | 0.6265 | 0.0077 |
| Modal | 6 | 0.365 | 0.0006 | 0.1279 | 4.023E-05 | 0.6097 | 0.7544 | 0.0077 |
| Modal | 7 | 0.338 | 0.0011 | 0.0753 | 0.0001 | 0.6108 | 0.8297 | 0.0078 |
| Modal | 8 | 0.267 | 0.2177 | 0.0015 | 0.0002 | 0.8286 | 0.8312 | 0.008 |
| Modal | 9 | 0.187 | 0.0012 | 0.0923 | 2.496E-05 | 0.8297 | 0.9234 | 0.008 |
| Modal | 10 | 0.143 | 0.0801 | 0.0031 | 0.0003 | 0.9099 | 0.9265 | 0.0083 |
| Modal | 11 | 0.104 | 0.0193 | 0.0408 | 4.177E-06 | 0.9291 | 0.9673 | 0.0083 |
| Modal | 12 | 0.084 | 0.0451 | 0.0113 | 0.0001 | 0.9742 | 0.9786 | 0.0084 |
| Modal-V | 1 | 1.237 | 0.006 | 0.4895 | 0 | 0.006 | 0.4895 | 0 |
| Modal-V | 2 | 1.031 | 0.0006 | 0.1297 | 2.104E-05 | 0.0066 | 0.6192 | 2.104E-05 |
| Modal-V | 3 | 0.894 | 0.6026 | 0.0072 | 8.717E-06 | 0.6092 | 0.6264 | 2.976E-05 |
| Modal-V | 4 | 0.578 | 7.917E-07 | 4.036E-06 | 0.0015 | 0.6092 | 0.6264 | 0.0016 |
| Modal-V | 5 | 0.504 | 0 | 0 | 0.0029 | 0.6092 | 0.6264 | 0.0044 |
| Modal-V | 6 | 0.398 | 6.013E-06 | 3.765E-05 | 0.0009 | 0.6092 | 0.6264 | 0.0053 |
| Modal-V | 7 | 0.359 | 2.755E-05 | 0.0001 | 0.0112 | 0.6092 | 0.6266 | 0.0165 |
| Modal-V | 8 | 0.322 | 0.0003 | 0.0013 | 0.0097 | 0.6095 | 0.6279 | 0.0261 |
| Modal-V | 9 | 0.245 | 0.002 | 0.0002 | 0.0318 | 0.6115 | 0.628 | 0.0579 |
| Modal-V | 10 | 0.181 | 0.0007 | 1.542E-05 | 0.0816 | 0.6122 | 0.628 | 0.1395 |
| Modal-V | 11 | 0.134 | 1.455E-05 | 3.26E-05 | 0.0244 | 0.6123 | 0.628 | 0.164 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal-V | 12 | 0.06 | 0.0002 | 1.698E-05 | 0.1661 | 0.6124 | 0.6281 | 0.9301 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.2334 | 0.0031 | 0.0958 | 0.2334 | 0.0031 | 0.0958 |
| Modal | 2 | 0.0549 | 0.0004 | 0.4173 | 0.2882 | 0.0035 | 0.5131 |
| Modal | 3 | 0.0027 | 0.3152 | 9.096E-07 | 0.291 | 0.3186 | 0.5131 |
| Modal | 4 | 0.0021 | 0.0004 | 0 | 0.2931 | 0.319 | 0.5131 |
| Modal | 5 | 0.0041 | 1.473E-05 | 0.0045 | 0.2971 | 0.319 | 0.5176 |
| Modal | 6 | 0.1306 | 0.0007 | 0.1187 | 0.4278 | 0.3197 | 0.6363 |
| Modal | 7 | 0.0965 | 0.0002 | 0.183 | 0.5243 | 0.32 | 0.8193 |
| Modal | 8 | 0.0012 | 0.2282 | 3.15E-05 | 0.5255 | 0.5482 | 0.8194 |
| Modal | 9 | 0.0831 | 0.0016 | 0.0025 | 0.6086 | 0.5498 | 0.8219 |
| Modal | 10 | 0.0071 | 0.0795 | 0.0001 | 0.6157 | 0.6293 | 0.822 |
| Modal | 11 | 0.0677 | 0.0177 | 0.0013 | 0.6834 | 0.647 | 0.8233 |
| Modal | 12 | 0.0115 | 0.0579 | 0.0029 | 0.6949 | 0.7049 | 0.8262 |
| Modal-V | 1 | 0.2334 | 0.0031 | 0.0958 | 0.2334 | 0.0031 | 0.0958 |
| Modal-V | 2 | 0.0549 | 0.0004 | 0.4173 | 0.2882 | 0.0035 | 0.5131 |
| Modal-V | 3 | 0.0027 | 0.3152 | 9.096E-07 | 0.291 | 0.3186 | 0.5131 |
| Modal-V | 4 | 0.0024 | 0.0003 | 0 | 0.2933 | 0.319 | 0.5131 |
| Modal-V | 5 | 0.0038 | 0.0011 | 2.548E-06 | 0.2972 | 0.3201 | 0.5131 |
| Modal-V | 6 | 0.0017 | 0.0004 | 0.0002 | 0.2988 | 0.3205 | 0.5132 |
| Modal-V | 7 | 0.0058 | 0.0048 | 0.0011 | 0.3046 | 0.3253 | 0.5143 |
| Modal-V | 8 | 0.0118 | 0.0088 | 0.0023 | 0.3165 | 0.3341 | 0.5166 |
| Modal-V | 9 | 0.0024 | 0.0015 | 0.0002 | 0.3189 | 0.3355 | 0.5169 |
| Modal-V | 10 | 0.0047 | 0.0003 | 0.0001 | 0.3236 | 0.3358 | 0.5169 |
| Modal-V | 11 | 0.0007 | 0.0004 | 0 | 0.3243 | 0.3362 | 0.5169 |
| Modal-V | 12 | 0.0006 | 0.003 | 6.499E-06 | 0.3249 | 0.3392 | 0.5169 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.237 | 1.3E-05 | 0.000116 | 9.837E-09 | -1.557995 | 0.177109 | -0.784718 | 1E-06 | 3E-05 |
| Modal | 2 | 1.031 | 4E-06 | 6E-05 | 1E-06 | -0.7553 | 0.066024 | 1.637805 | 1E-06 | 4E-05 |
| Modal | 3 | 0.894 | -0.000129 | 1.4E-05 | -4.902E-07 | -0.16828 | -1.7987 | -0.002418 | 1E-06 | 5E-05 |
| Modal | 4 | 0.578 | 1.486E-07 | -3.34E-07 | 7E-06 | 0.148575 | -0.063638 | 9.4E-05 | 1E-06 | 0.00012 |
| Modal | 5 | 0.404 | 3.161E-07 | 2E-06 | 1.3E-05 | -0.205518 | -0.012296 | -0.17047 | 1E-06 | 0.00024 |
| Modal | 6 | 0.365 | 4E-06 | 5.9E-05 | -1E-06 | 1.165484 | -0.083628 | -0.873684 | 1E-06 | 0.0003 |
| Modal | 7 | 0.338 | -6E-06 | -4.6E-05 | 1E-06 | -1.002052 | 0.049945 | -1.084568 | 1E-06 | 0.00035 |
| Modal | 8 | 0.267 | 7.7E-05 | -6E-06 | -2E-06 | -0.110426 | -1.5307 | 0.01423 | 1E-06 | 0.00056 |
| Modal | 9 | 0.187 | 6E-06 | 5E-05 | 1E-06 | 0.929817 | -0.129045 | -0.127577 | 1E-06 | 0.00113 |
| Modal | 10 | 0.143 | -4.7E-05 | 9E-06 | -3E-06 | 0.270902 | 0.903131 | -0.028003 | 1E-06 | 0.00192 |
| Modal | 11 | 0.104 | -2.3E-05 | -3.4E-05 | -3.393E-07 | -0.839412 | 0.426421 | -0.090382 | 1E-06 | 0.00362 |
| Modal | 12 | 0.084 | 3.5E-05 | -1.8E-05 | -2E-06 | -0.345772 | -0.770689 | -0.137183 | 1E-06 | 0.00555 |
| Modal-V | 1 | 1.237 | 1.3E-05 | 0.000116 | 9.837E-09 | -1.557995 | 0.177109 | -0.784718 | 1E-06 | 3E-05 |
| Modal-V | 2 | 1.031 | 4E-06 | 6E-05 | 1E-06 | -0.7553 | 0.066025 | 1.637805 | 1E-06 | 4E-05 |
| Modal-V | 3 | 0.894 | -0.000129 | 1.4E-05 | -4.902E-07 | -0.16828 | -1.7987 | -0.002418 | 1E-06 | 5E-05 |
| Modal-V | 4 | 0.578 | -1.477E-07 | 3.335E-07 | -6E-06 | -0.156346 | 0.058283 | 0.001646 | 1E-06 | 0.00012 |
| Modal-V | 5 | 0.504 | 4.715E-08 | 4.001E-08 | 9E-06 | -0.199972 | -0.106888 | -0.004047 | 1E-06 | 0.00016 |
| Modal-V | 6 | 0.398 | 4.365E-07 | -1E-06 | -5E-06 | -0.131741 | 0.065235 | -0.032484 | 1E-06 | 0.00025 |
| Modal-V | 7 | 0.359 | -1E-06 | 2E-06 | -1.8E-05 | 0.246033 | 0.222313 | 0.082963 | 1E-06 | 0.00031 |
| Modal-V | 8 | 0.322 | -3E-06 | -6E-06 | 1.6E-05 | -0.350466 | 0.299856 | -0.122469 | 1E-06 | 0.00038 |
| Modal-V | 9 | 0.245 | 7E-06 | -2E-06 | -3E-05 | -0.158278 | -0.122252 | -0.036537 | 1E-06 | 0.00066 |
| Modal-V | 10 | 0.181 | 4E-06 | -1E-06 | 4.7E-05 | -0.221116 | -0.057328 | 0.020878 | 1E-06 | 0.00121 |
| Modal-V | 11 | 0.134 | -1E-06 | 1E-06 | 0.000131 | 0.08826 | -0.064076 | -0.001734 | 1E-06 | 0.0022 |
| Modal-V | 12 | 0.06 | 2E-06 | 1E-06 | 6.8E-05 | -0.078416 | 0.174052 | -0.006464 | 1E-06 | 0.01092 |

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**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 97.42 |
| Modal | Acceleration | UY | 100 | 97.85 |
| Modal | Acceleration | UZ | 7.88 | 0.84 |
| Modal-V | Acceleration | UX | 96.52 | 61.24 |
| Modal-V | Acceleration | UY | 96.81 | 62.81 |
| Modal-V | Acceleration | UZ | 100 | 93.01 |

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Integrated Building Design Software



# Project Report for Block 1A,1B,2,11A,11B,11C

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WX | Diaphragms | From Diaphragms | 0 | 0.8 | 0.8 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |
| WY | Diaphragms | From Diaphragms | 90 | 0.8 | 0.8 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQXP | Seismic | X + Ecc. Y | 5 | No | User Specified | 0.846 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.846 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.792 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYN | Seismic | Y - Ecc. X | 5 | No | User Specified | 0.792 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.846 | 0.030854 | 151808.0193 | 4683.9312 |
| 5 | 0.846 | 0.030854 | 151808.0193 | 4683.9312 |
| 5 | 0.792 | 0.032974 | 151808.0193 | 5005.6964 |
| 5 | 0.792 | 0.032974 | 151808.0193 | 5005.6964 |

N. N. Nagarajan

## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.846$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

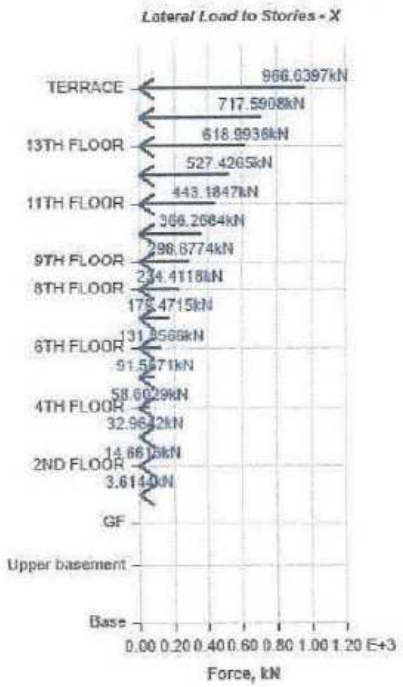
Seismic Coefficient, $A_h$ [IS 6.4.2] $A_h = \frac{ZI\frac{S_a}{g}}{2R}$

**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X + Ecc. Y | 0.846 | 151806.0193 | 4683.9312 |

**Applied Story Forces**

N. N. Nagendra




| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 966.6397 | 0 |
| 14TH FLOOR | 52.55 | 717.5908 | 0 |
| 13TH FLOOR | 49.55 | 618.9936 | 0 |
| 12TH FLOOR | 46.55 | 527.4265 | 0 |
| 11TH FLOOR | 43.55 | 443.1847 | 0 |
| 10TH FLOOR | 40.55 | 366.2684 | 0 |
| 9TH FLOOR | 37.55 | 296.6774 | 0 |
| 8TH FLOOR | 34.55 | 234.4118 | 0 |
| 7TH FLOOR | 31.55 | 179.4715 | 0 |
| 6TH FLOOR | 28.55 | 131.8566 | 0 |
| 5TH FLOOR | 25.55 | 91.5671 | 0 |
| 4TH FLOOR | 22.55 | 58.6029 | 0 |
| 3RD FLOOR | 19.55 | 32.9642 | 0 |
| 2ND FLOOR | 16.55 | 14.6616 | 0 |
| 1ST FLOOR | 13.55 | 3.6144 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.846$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

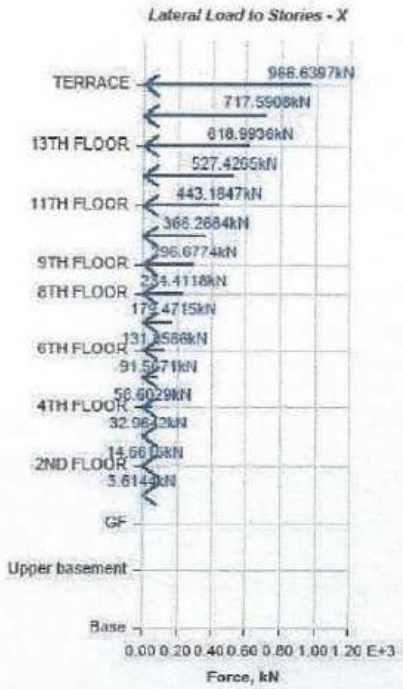
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_h$ (kN) |
|---|---|---|---|
| X - Ecc. Y | 0.846 | 151808.0193 | 4683.9312 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 966.6397 | 0 |
| 14TH FLOOR | 52.55 | 717.5908 | 0 |
| 13TH FLOOR | 49.55 | 618.9936 | 0 |
| 12TH FLOOR | 46.55 | 527.4265 | 0 |
| 11TH FLOOR | 43.55 | 443.1847 | 0 |
| 10TH FLOOR | 40.55 | 366.2684 | 0 |
| 9TH FLOOR | 37.55 | 296.6774 | 0 |
| 8TH FLOOR | 34.55 | 234.4118 | 0 |
| 7TH FLOOR | 31.55 | 179.4715 | 0 |
| 6TH FLOOR | 28.55 | 131.8566 | 0 |
| 5TH FLOOR | 25.55 | 91.5671 | 0 |
| 4TH FLOOR | 22.55 | 58.6029 | 0 |
| 3RD FLOOR | 19.55 | 32.9642 | 0 |
| 2ND FLOOR | 16.55 | 14.6616 | 0 |
| 1ST FLOOR | 13.55 | 3.6144 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| basement | | | |
|---|---|---|---|
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.792$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

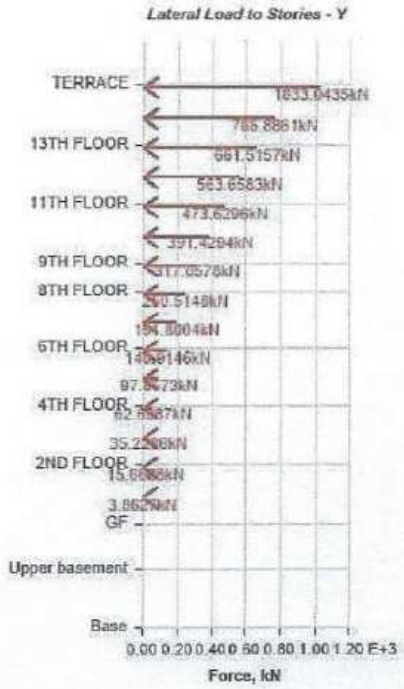
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.792 | 151808.0193 | 5005.6964 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 1033.0435 |
| 14TH FLOOR | 52.55 | 0 | 766.8861 |
| 13TH FLOOR | 49.55 | 0 | 661.5157 |
| 12TH FLOOR | 46.55 | 0 | 563.6583 |
| 11TH FLOOR | 43.55 | 0 | 473.6296 |
| 10TH FLOOR | 40.55 | 0 | 391.4294 |
| 9TH FLOOR | 37.55 | 0 | 317.0578 |
| 8TH FLOOR | 34.55 | 0 | 250.5148 |
| 7TH FLOOR | 31.55 | 0 | 191.8004 |
| 6TH FLOOR | 28.55 | 0 | 140.9146 |
| 5TH FLOOR | 25.55 | 0 | 97.8573 |
| 4TH FLOOR | 22.55 | 0 | 62.6287 |
| 3RD FLOOR | 19.55 | 0 | 35.2286 |
| 2ND FLOOR | 16.55 | 0 | 15.6688 |
| 1ST FLOOR | 13.55 | 0 | 3.8627 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| basement | | | |
|---|---|---|---|
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y - Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.792$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

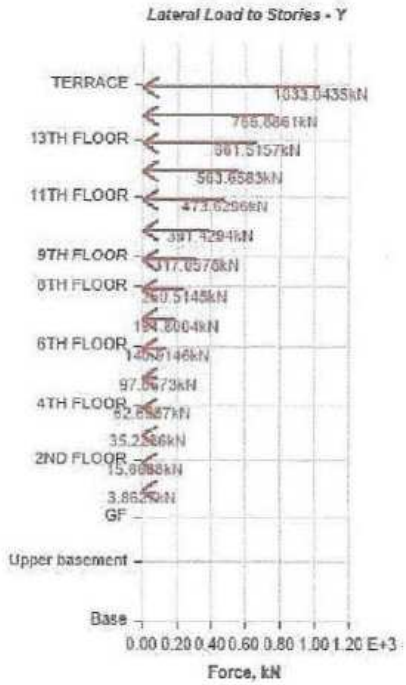
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y - Ecc. X | 0.792 | 151808.0193 | 5005.6964 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 1033.0435 |
| 14TH FLOOR | 52.55 | 0 | 766.8861 |
| 13TH FLOOR | 49.55 | 0 | 661.5157 |
| 12TH FLOOR | 46.55 | 0 | 563.6583 |
| 11TH FLOOR | 43.55 | 0 | 473.6296 |
| 10TH FLOOR | 40.55 | 0 | 391.4294 |
| 9TH FLOOR | 37.55 | 0 | 317.0578 |
| 8TH FLOOR | 34.55 | 0 | 250.5148 |
| 7TH FLOOR | 31.55 | 0 | 191.8004 |
| 6TH FLOOR | 28.55 | 0 | 140.9146 |
| 5TH FLOOR | 25.55 | 0 | 97.8573 |
| 4TH FLOOR | 22.55 | 0 | 62.6287 |
| 3RD FLOOR | 19.55 | 0 | 35.2286 |
| 2ND FLOOR | 16.55 | 0 | 15.6688 |
| 1ST FLOOR | 13.55 | 0 | 3.8627 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

Table 1.7 - Response Spectrum Function - IS 1893:2016

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 1.678 | 0.596 | 3.7451 | 14.0255 |
| Modal | 2 | 1.455 | 0.687 | 4.3191 | 18.655 |
| Modal | 3 | 1.058 | 0.945 | 5.938 | 35.2597 |
| Modal | 4 | 0.441 | 2.267 | 14.2421 | 202.8364 |
| Modal | 5 | 0.391 | 2.556 | 16.0602 | 257.9305 |
| Modal | 6 | 0.292 | 3.43 | 21.5497 | 464.3891 |
| Modal | 7 | 0.212 | 4.719 | 29.6485 | 879.0343 |
| Modal | 8 | 0.171 | 5.848 | 36.7464 | 1350.2986 |
| Modal | 9 | 0.14 | 7.144 | 44.8846 | 2014.6302 |
| Modal | 10 | 0.127 | 7.873 | 49.4645 | 2446.733 |
| Modal | 11 | 0.097 | 10.298 | 64.7071 | 4187.0146 |
| Modal | 12 | 0.063 | 15.766 | 99.062 | 9813.284 |
| Modal-V | 1 | 1.678 | 0.596 | 3.7451 | 14.0255 |
| Modal-V | 2 | 1.455 | 0.687 | 4.3191 | 18.655 |
| Modal-V | 3 | 1.058 | 0.945 | 5.938 | 35.2597 |
| Modal-V | 4 | 0.441 | 2.267 | 14.2421 | 202.8364 |
| Modal-V | 5 | 0.391 | 2.556 | 16.0595 | 257.9073 |
| Modal-V | 6 | 0.292 | 3.429 | 21.5452 | 464.1947 |
| Modal-V | 7 | 0.214 | 4.679 | 29.4006 | 864.3931 |
| Modal-V | 8 | 0.178 | 5.616 | 35.2869 | 1245.1655 |
| Modal-V | 9 | 0.155 | 6.471 | 40.6569 | 1652.986 |
| Modal-V | 10 | 0.125 | 8.013 | 50.3445 | 2534.5672 |
| Modal-V | 11 | 0.093 | 10.709 | 67.2847 | 4527.2285 |
| Modal-V | 12 | 0.043 | 23.234 | 145.9819 | 21310.712 |

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**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.678 | 0.5732 | 0.0188 | 1.28E-05 | 0.5732 | 0.0188 | 1.28E-05 |
| Modal | 2 | 1.455 | 0.0102 | 0.0085 | 1.264E-05 | 0.5834 | 0.0273 | 2.544E-05 |
| Modal | 3 | 1.058 | 0.0183 | 0.5744 | 9.508E-07 | 0.6017 | 0.6017 | 2.639E-05 |
| Modal | 4 | 0.441 | 0.1884 | 0.0054 | 0.0001 | 0.7901 | 0.6071 | 0.0001 |
| Modal | 5 | 0.391 | 0.0039 | 0.0088 | 2.381E-05 | 0.794 | 0.6159 | 0.0001 |
| Modal | 6 | 0.292 | 0.0029 | 0.1743 | 1.733E-06 | 0.7969 | 0.7903 | 0.0001 |
| Modal | 7 | 0.212 | 0.0981 | 0.0027 | 4.415E-05 | 0.895 | 0.793 | 0.0001 |
| Modal | 8 | 0.171 | 0.004 | 0.0422 | 0.0003 | 0.8991 | 0.8352 | 0.0004 |
| Modal | 9 | 0.14 | 0.0179 | 0.0051 | 0.0005 | 0.9169 | 0.8403 | 0.0009 |
| Modal | 10 | 0.127 | 0.022 | 0.0387 | 3.041E-06 | 0.939 | 0.879 | 0.0009 |
| Modal | 11 | 0.097 | 0.0155 | 0.0679 | 0.001 | 0.9545 | 0.9469 | 0.0019 |
| Modal | 12 | 0.063 | 0.0315 | 0.0118 | 7.466E-07 | 0.986 | 0.9587 | 0.0019 |
| Modal-V | 1 | 1.678 | 0.5732 | 0.0188 | 1.28E-05 | 0.5732 | 0.0188 | 1.28E-05 |
| Modal-V | 2 | 1.455 | 0.0102 | 0.0085 | 1.264E-05 | 0.5834 | 0.0273 | 2.544E-05 |
| Modal-V | 3 | 1.058 | 0.0183 | 0.5744 | 9.508E-07 | 0.6017 | 0.6017 | 2.639E-05 |
| Modal-V | 4 | 0.441 | 0.1884 | 0.0054 | 0.0001 | 0.7901 | 0.6071 | 0.0001 |
| Modal-V | 5 | 0.391 | 0.0039 | 0.0088 | 2.139E-05 | 0.794 | 0.6159 | 0.0001 |
| Modal-V | 6 | 0.292 | 0.003 | 0.1743 | 5.503E-06 | 0.7969 | 0.7903 | 0.0001 |
| Modal-V | 7 | 0.214 | 0.0009 | 0.0004 | 0.0095 | 0.7978 | 0.7906 | 0.0096 |
| Modal-V | 8 | 0.178 | 0.0003 | 0.0008 | 0.1895 | 0.7981 | 0.7914 | 0.1992 |
| Modal-V | 9 | 0.155 | 0.0003 | 0.0025 | 0.2162 | 0.7983 | 0.7939 | 0.4153 |
| Modal-V | 10 | 0.125 | 0.0001 | 0.001 | 0.2699 | 0.7984 | 0.7949 | 0.6852 |
| Modal-V | 11 | 0.093 | 0.0001 | 0.0008 | 0.1061 | 0.7985 | 0.7957 | 0.7913 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal-V | 12 | 0.043 | 1.61E-05 | 0.0001 | 0.1564 | 0.7985 | 0.7958 | 0.9477 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.0115 | 0.3122 | 0.0048 | 0.0115 | 0.3122 | 0.0048 |
| Modal | 2 | 0.0036 | 0.0038 | 0.4948 | 0.0151 | 0.316 | 0.4996 |
| Modal | 3 | 0.3165 | 0.0079 | 0.0088 | 0.3316 | 0.3238 | 0.5084 |
| Modal | 4 | 0.0032 | 0.1805 | 0.003 | 0.3348 | 0.5044 | 0.5115 |
| Modal | 5 | 0.0153 | 0.0052 | 0.2077 | 0.3501 | 0.5096 | 0.7192 |
| Modal | 6 | 0.1781 | 0.0037 | 0.0186 | 0.5281 | 0.5133 | 0.7378 |
| Modal | 7 | 0.0023 | 0.1053 | 0.002 | 0.5304 | 0.6187 | 0.7398 |
| Modal | 8 | 0.036 | 0.005 | 0.0536 | 0.5664 | 0.6236 | 0.7934 |
| Modal | 9 | 0.0006 | 0.0385 | 0.0007 | 0.567 | 0.6621 | 0.7941 |
| Modal | 10 | 0.0381 | 0.0323 | 0.01 | 0.6051 | 0.6944 | 0.804 |
| Modal | 11 | 0.1301 | 0.0189 | 0.0219 | 0.7352 | 0.7133 | 0.8259 |
| Modal | 12 | 0.0278 | 0.06 | 0.0004 | 0.763 | 0.7733 | 0.8263 |
| Modal-V | 1 | 0.0115 | 0.3122 | 0.0048 | 0.0115 | 0.3122 | 0.0048 |
| Modal-V | 2 | 0.0036 | 0.0038 | 0.4948 | 0.0151 | 0.316 | 0.4996 |
| Modal-V | 3 | 0.3165 | 0.0079 | 0.0088 | 0.3316 | 0.3238 | 0.5084 |
| Modal-V | 4 | 0.0032 | 0.1805 | 0.003 | 0.3348 | 0.5044 | 0.5115 |
| Modal-V | 5 | 0.0152 | 0.0052 | 0.2092 | 0.35 | 0.5096 | 0.7207 |
| Modal-V | 6 | 0.1788 | 0.0036 | 0.02 | 0.5288 | 0.5132 | 0.7407 |
| Modal-V | 7 | 0.0001 | 0.0002 | 0.0031 | 0.5289 | 0.5135 | 0.7437 |
| Modal-V | 8 | 0.0043 | 0.0108 | 1.641E-06 | 0.5332 | 0.5242 | 0.7437 |
| Modal-V | 9 | 0.004 | 0.0056 | 0.0014 | 0.5372 | 0.5299 | 0.7451 |
| Modal-V | 10 | 0.0003 | 0.0005 | 0.0024 | 0.5375 | 0.5304 | 0.7476 |
| Modal-V | 11 | 0.0028 | 0.0003 | 0.0041 | 0.5403 | 0.5306 | 0.7516 |
| Modal-V | 12 | 0.0013 | 0.0005 | 0.0014 | 0.5416 | 0.5311 | 0.7531 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.678 | 0.000111 | 2E-05 | -1E-06 | -0.294629 | 1.514478 | 0.12822 | 1E-06 | 1E-05 |
| Modal | 2 | 1.455 | -1.5E-05 | 1.3E-05 | -1E-06 | -0.16534 | -0.16607 | 1.299735 | 1E-06 | 2E-05 |
| Modal | 3 | 1.058 | 2E-05 | -0.000111 | 1.425E-07 | 1.547721 | 0.240165 | 0.17333 | 1E-06 | 4E-05 |
| Modal | 4 | 0.441 | 6.3E-05 | 1.1E-05 | 1E-06 | 0.155257 | -1.151591 | 0.10188 | 1E-06 | 0.0002 |
| Modal | 5 | 0.391 | -9E-06 | 1.4E-05 | 1E-06 | 0.340051 | 0.195798 | 0.842071 | 1E-06 | 0.00026 |
| Modal | 6 | 0.292 | 8E-06 | -6.1E-05 | -1.923E-07 | -1.160874 | -0.165493 | 0.25232 | 1E-06 | 0.00046 |
| Modal | 7 | 0.212 | 4.6E-05 | 8E-06 | -1E-06 | 0.131347 | -0.879623 | 0.082402 | 1E-06 | 0.00088 |
| Modal | 8 | 0.171 | -9E-06 | 3E-05 | -2E-06 | 0.521968 | 0.191031 | 0.427801 | 1E-06 | 0.00135 |
| Modal | 9 | 0.14 | -2E-05 | 1E-05 | -3E-06 | 0.067249 | 0.531847 | -0.04901 | 1E-06 | 0.00201 |
| Modal | 10 | 0.127 | -2.2E-05 | -2.9E-05 | -2.548E-07 | -0.537005 | 0.487068 | 0.184326 | 1E-06 | 0.00245 |
| Modal | 11 | 0.097 | 1.8E-05 | -3.8E-05 | -5E-06 | -0.992148 | -0.372743 | 0.273179 | 1E-06 | 0.00419 |
| Modal | 12 | 0.063 | 2.6E-05 | 1.6E-05 | -1.262E-07 | 0.458457 | -0.663643 | 0.037796 | 1E-06 | 0.00981 |
| Modal-V | 1 | 1.678 | -0.000111 | -2E-05 | 1E-06 | 0.294629 | -1.514478 | -0.12822 | 1E-06 | 1E-05 |
| Modal-V | 2 | 1.455 | -1.5E-05 | 1.3E-05 | -1E-06 | -0.16534 | -0.16607 | 1.299735 | 1E-06 | 2E-05 |
| Modal-V | 3 | 1.058 | 2E-05 | -0.000111 | 1.425E-07 | 1.547721 | 0.240165 | 0.17333 | 1E-06 | 4E-05 |
| Modal-V | 4 | 0.441 | -6.3E-05 | -1.1E-05 | -1E-06 | -0.155245 | 1.15158 | -0.101997 | 1E-06 | 0.0002 |
| Modal-V | 5 | 0.391 | -9E-06 | 1.4E-05 | 1E-06 | 0.339447 | 0.196044 | 0.845206 | 1E-06 | 0.00026 |
| Modal-V | 6 | 0.292 | -8E-06 | 6.1E-05 | 3.427E-07 | 1.163135 | 0.163396 | -0.2611 | 1E-06 | 0.00046 |
| Modal-V | 7 | 0.214 | -4E-06 | -3E-06 | 1.4E-05 | -0.030208 | 0.039575 | -0.10207 | 1E-06 | 0.00086 |
| Modal-V | 8 | 0.178 | -2E-06 | 4E-06 | -6.4E-05 | -0.180827 | 0.281425 | 0.002367 | 1E-06 | 0.00125 |
| Modal-V | 9 | 0.155 | 2E-06 | -7E-06 | -6.8E-05 | 0.173475 | -0.203403 | -0.068939 | 1E-06 | 0.00165 |
| Modal-V | 10 | 0.125 | -1E-06 | 5E-06 | -7.6E-05 | 0.046903 | -0.060045 | 0.091292 | 1E-06 | 0.00253 |
| Modal-V | 11 | 0.093 | -1E-06 | 4E-06 | 4.8E-05 | 0.146053 | -0.043212 | 0.117819 | 1E-06 | 0.00453 |
| Modal-V | 12 | 0.043 | -1E-06 | 2E-06 | -5.8E-05 | 0.099926 | -0.061265 | 0.070252 | 1E-06 | 0.02131 |

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**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 98.6 |
| Modal | Acceleration | UY | 100 | 95.87 |
| Modal | Acceleration | UZ | 0.63 | 0.19 |
| Modal-V | Acceleration | UX | 99.68 | 79.85 |
| Modal-V | Acceleration | UY | 99.64 | 79.58 |
| Modal-V | Acceleration | UZ | 100 | 94.77 |

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ETABS® version 17
Integrated Building Design Software



# Project Report for Block 5 and 6

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WX | Diaphragms | From Diaphragms | 0 | 0.7 | 0.25 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |
| WY | Diaphragms | From Diaphragms | 90 | 0.7 | 0.25 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQXP | Seismic | X + Ecc. Y | 5 | No | User Specified | 0.688 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.688 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.773 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYN | Seismic | Y - Ecc. X | 5 | No | User Specified | 0.773 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.688 | 0.037959 | 191619.0004 | 7273.6667 |
| 5 | 0.688 | 0.037959 | 191619.0004 | 7273.6667 |
| 5 | 0.773 | 0.033802 | 191619.0004 | 6477.0943 |
| 5 | 0.773 | 0.033802 | 191619.0004 | 6477.0943 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.688$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

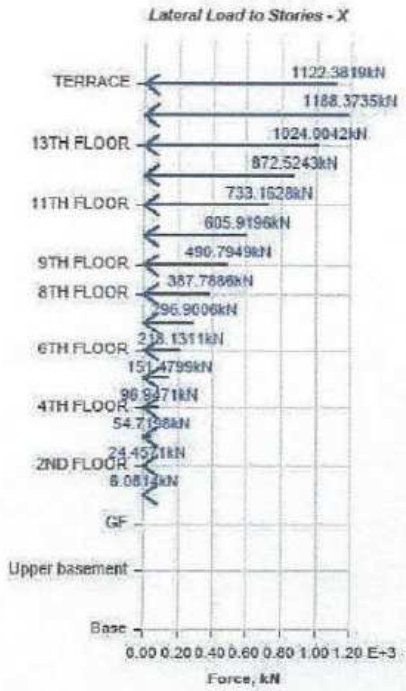
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X + Ecc. Y | 0.688 | 191619.0004 | 7273.6667 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 1122.3819 | 0 |
| 14TH FLOOR | 52.55 | 1188.3735 | 0 |
| 13TH FLOOR | 49.55 | 1024.0042 | 0 |
| 12TH FLOOR | 46.55 | 872.5243 | 0 |
| 11TH FLOOR | 43.55 | 733.1628 | 0 |
| 10TH FLOOR | 40.55 | 605.9196 | 0 |
| 9TH FLOOR | 37.55 | 490.7949 | 0 |
| 8TH FLOOR | 34.55 | 387.7886 | 0 |
| 7TH FLOOR | 31.55 | 296.9006 | 0 |
| 6TH FLOOR | 28.55 | 218.1311 | 0 |
| 5TH FLOOR | 25.55 | 151.4799 | 0 |
| 4TH FLOOR | 22.55 | 96.9471 | 0 |
| 3RD FLOOR | 19.55 | 54.7198 | 0 |
| 2ND FLOOR | 16.55 | 24.4571 | 0 |
| 1ST FLOOR | 13.55 | 6.0814 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.688$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

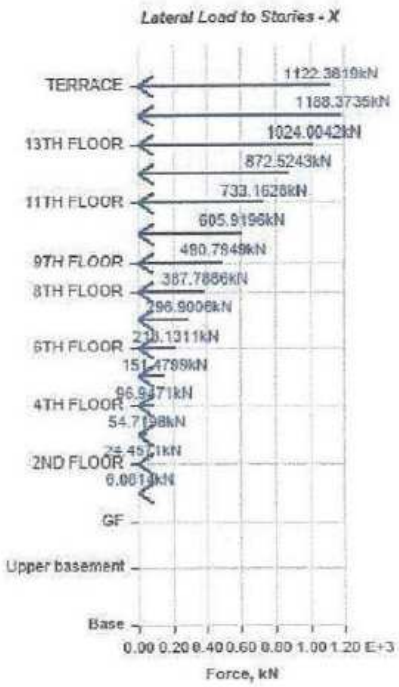
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X - Ecc. Y | 0.688 | 191619.0004 | 7273.6667 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 1122.3819 | 0 |
| 14TH FLOOR | 52.55 | 1188.3735 | 0 |
| 13TH FLOOR | 49.55 | 1024.0042 | 0 |
| 12TH FLOOR | 46.55 | 872.5243 | 0 |
| 11TH FLOOR | 43.55 | 733.1628 | 0 |
| 10TH FLOOR | 40.55 | 605.9196 | 0 |
| 9TH FLOOR | 37.55 | 490.7949 | 0 |
| 8TH FLOOR | 34.55 | 387.7886 | 0 |
| 7TH FLOOR | 31.55 | 296.9006 | 0 |
| 6TH FLOOR | 28.55 | 218.1311 | 0 |
| 5TH FLOOR | 25.55 | 151.4799 | 0 |
| 4TH FLOOR | 22.55 | 96.9471 | 0 |
| 3RD FLOOR | 19.55 | 54.7198 | 0 |
| 2ND FLOOR | 16.55 | 24.4571 | 0 |
| 1ST FLOOR | 13.55 | 6.0814 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.773$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

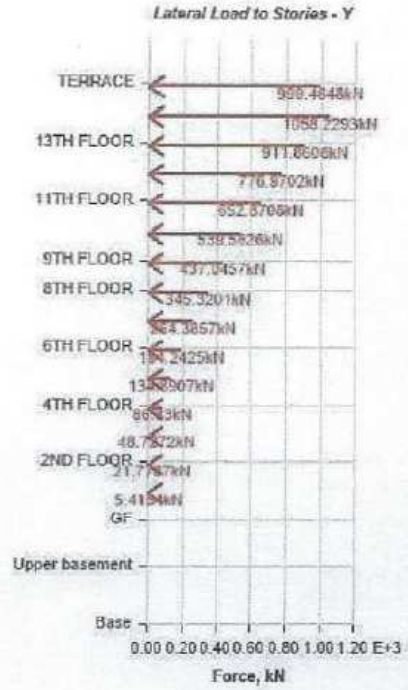
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.773 | 191619.0004 | 6477.0943 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 999.4648 |
| 14TH FLOOR | 52.55 | 0 | 1058.2293 |
| 13TH FLOOR | 49.55 | 0 | 911.8608 |
| 12TH FLOOR | 46.55 | 0 | 776.9702 |
| 11TH FLOOR | 43.55 | 0 | 652.8708 |
| 10TH FLOOR | 40.55 | 0 | 539.5626 |
| 9TH FLOOR | 37.55 | 0 | 437.0457 |
| 8TH FLOOR | 34.55 | 0 | 345.3201 |
| 7TH FLOOR | 31.55 | 0 | 264.3857 |
| 6TH FLOOR | 28.55 | 0 | 194.2425 |
| 5TH FLOOR | 25.55 | 0 | 134.8907 |
| 4TH FLOOR | 22.55 | 0 | 86.33 |
| 3RD FLOOR | 19.55 | 0 | 48.7272 |
| 2ND FLOOR | 16.55 | 0 | 21.7787 |
| 1ST FLOOR | 13.55 | 0 | 5.4154 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| basement | | | |
|---|---|---|---|
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y - Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.773$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

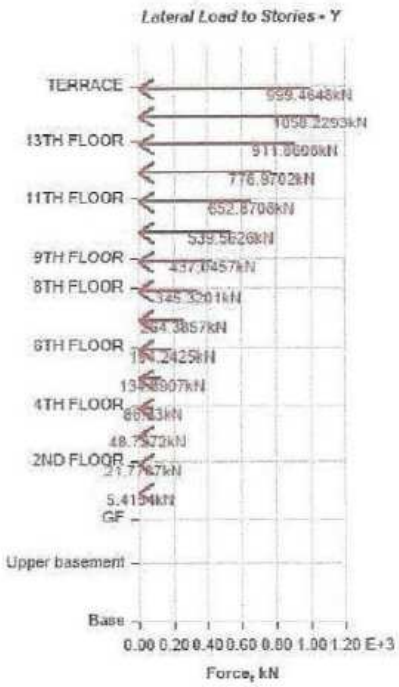
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y - Ecc. X | 0.773 | 191619.0004 | 6477.0943 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 999.4648 |
| 14TH FLOOR | 52.55 | 0 | 1058.2293 |
| 13TH FLOOR | 49.55 | 0 | 911.8608 |
| 12TH FLOOR | 46.55 | 0 | 776.9702 |
| 11TH FLOOR | 43.55 | 0 | 652.8708 |
| 10TH FLOOR | 40.55 | 0 | 539.5626 |
| 9TH FLOOR | 37.55 | 0 | 437.0457 |
| 8TH FLOOR | 34.55 | 0 | 345.3201 |
| 7TH FLOOR | 31.55 | 0 | 264.3857 |
| 6TH FLOOR | 28.55 | 0 | 194.2425 |
| 5TH FLOOR | 25.55 | 0 | 134.8907 |
| 4TH FLOOR | 22.55 | 0 | 86.33 |
| 3RD FLOOR | 19.55 | 0 | 48.7272 |
| 2ND FLOOR | 16.55 | 0 | 21.7787 |
| 1ST FLOOR | 13.55 | 0 | 5.4154 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

**Table 1.7 - Response Spectrum Function - IS 1893:2016**

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 2.057 | 0.486 | 3.054 | 9.3267 |
| Modal | 2 | 1.748 | 0.572 | 3.5935 | 12.9136 |
| Modal | 3 | 1.313 | 0.761 | 4.7844 | 22.8901 |
| Modal | 4 | 0.58 | 1.723 | 10.8243 | 117.1652 |
| Modal | 5 | 0.459 | 2.176 | 13.6743 | 186.9868 |
| Modal | 6 | 0.347 | 2.88 | 18.0855 | 327.4458 |
| Modal | 7 | 0.278 | 3.592 | 22.5663 | 509.2357 |
| Modal | 8 | 0.176 | 5.695 | 35.7832 | 1280.4404 |
| Modal | 9 | 0.167 | 6.004 | 37.7246 | 1423.1464 |
| Modal | 10 | 0.117 | 8.575 | 53.8753 | 2902.5463 |
| Modal | 11 | 0.1 | 10.047 | 63.1292 | 3985.2991 |
| Modal | 12 | 0.064 | 15.694 | 98.6079 | 9723.5136 |
| Modal-V | 1 | 2.057 | 0.486 | 3.054 | 9.3267 |
| Modal-V | 2 | 1.748 | 0.572 | 3.5935 | 12.9136 |
| Modal-V | 3 | 1.313 | 0.761 | 4.7844 | 22.8901 |
| Modal-V | 4 | 0.58 | 1.723 | 10.8243 | 117.1652 |
| Modal-V | 5 | 0.459 | 2.176 | 13.6742 | 186.9839 |
| Modal-V | 6 | 0.347 | 2.88 | 18.0948 | 327.4207 |
| Modal-V | 7 | 0.235 | 4.254 | 26.7277 | 714.3724 |
| Modal-V | 8 | 0.187 | 5.334 | 33.5116 | 1123.0283 |
| Modal-V | 9 | 0.172 | 5.812 | 36.5188 | 1333.6251 |
| Modal-V | 10 | 0.142 | 7.035 | 44.2007 | 1953.7045 |
| Modal-V | 11 | 0.101 | 9.867 | 61.9946 | 3843.3262 |
| Modal-V | 12 | 0.048 | 20.948 | 131.6217 | 17324.2699 |

**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 2.057 | 0.0135 | 0.661 | 9.32E-07 | 0.0135 | 0.661 | 9.32E-07 |
| Modal | 2 | 1.748 | 0.0449 | 0.0785 | 7.321E-06 | 0.0584 | 0.7394 | 8.253E-06 |
| Modal | 3 | 1.313 | 0.6429 | 0.0021 | 1.704E-05 | 0.7013 | 0.7415 | 2.53E-05 |
| Modal | 4 | 0.58 | 0.0015 | 0.1441 | 0 | 0.7028 | 0.8856 | 2.539E-05 |
| Modal | 5 | 0.459 | 0.0106 | 0.0037 | 3.7E-05 | 0.7134 | 0.8893 | 0.0001 |
| Modal | 6 | 0.347 | 0.168 | 0.0004 | 0.0002 | 0.8815 | 0.8897 | 0.0002 |
| Modal | 7 | 0.278 | 0.0004 | 0.0482 | 0 | 0.8819 | 0.9379 | 0.0002 |
| Modal | 8 | 0.176 | 0.0357 | 0.0039 | 0.0002 | 0.9176 | 0.9418 | 0.0005 |
| Modal | 9 | 0.167 | 0.0056 | 0.0183 | 0.0001 | 0.9232 | 0.96 | 0.0005 |
| Modal | 10 | 0.117 | 0.0167 | 0.0053 | 0.0003 | 0.9399 | 0.9653 | 0.0008 |
| Modal | 11 | 0.1 | 0.0305 | 0.0107 | 2.639E-05 | 0.9704 | 0.9761 | 0.0008 |
| Modal | 12 | 0.064 | 0.006 | 0.0171 | 0.0001 | 0.9763 | 0.9932 | 0.001 |
| Modal-V | 1 | 2.057 | 0.0135 | 0.661 | 9.32E-07 | 0.0135 | 0.661 | 9.32E-07 |
| Modal-V | 2 | 1.748 | 0.0449 | 0.0785 | 7.321E-06 | 0.0584 | 0.7394 | 8.253E-06 |
| Modal-V | 3 | 1.313 | 0.6429 | 0.0021 | 1.704E-05 | 0.7013 | 0.7415 | 2.53E-05 |
| Modal-V | 4 | 0.58 | 0.0015 | 0.1441 | 0 | 0.7028 | 0.8856 | 2.539E-05 |
| Modal-V | 5 | 0.459 | 0.0106 | 0.0037 | 3.722E-05 | 0.7134 | 0.8893 | 0.0001 |
| Modal-V | 6 | 0.347 | 0.168 | 0.0004 | 0.0002 | 0.8814 | 0.8897 | 0.0002 |
| Modal-V | 7 | 0.235 | 0.0006 | 0.0338 | 1.748E-05 | 0.882 | 0.9233 | 0.0002 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal-V | 8 | 0.187 | 3.303E-05 | 0.0013 | 0.1083 | 0.8821 | 0.9246 | 0.1085 |
| Modal-V | 9 | 0.172 | 0.0001 | 0.0015 | 0.2634 | 0.8821 | 0.9261 | 0.3719 |
| Modal-V | 10 | 0.142 | 0.0001 | 0.0005 | 0.4279 | 0.8823 | 0.9266 | 0.7998 |
| Modal-V | 11 | 0.101 | 0.0007 | 0.0027 | 0.0426 | 0.883 | 0.9293 | 0.8424 |
| Modal-V | 12 | 0.048 | 0.0001 | 0.0007 | 0.1255 | 0.8831 | 0.93 | 0.9679 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.1887 | 0.0046 | 0.0597 | 0.1887 | 0.0046 | 0.0597 |
| Modal | 2 | 0.0204 | 0.0158 | 0.5841 | 0.209 | 0.0204 | 0.6438 |
| Modal | 3 | 0.0005 | 0.2376 | 0.0563 | 0.2095 | 0.258 | 0.7001 |
| Modal | 4 | 0.2942 | 0.0015 | 0.0049 | 0.5037 | 0.2595 | 0.705 |
| Modal | 5 | 0.0086 | 0.0159 | 0.163 | 0.5123 | 0.2754 | 0.868 |
| Modal | 6 | 0.0005 | 0.268 | 0.0143 | 0.5128 | 0.5434 | 0.8823 |
| Modal | 7 | 0.0676 | 0.0008 | 0.0005 | 0.5804 | 0.5442 | 0.8827 |
| Modal | 8 | 0.0089 | 0.0507 | 0.01 | 0.5893 | 0.5948 | 0.8927 |
| Modal | 9 | 0.047 | 0.0068 | 0.0002 | 0.6364 | 0.6016 | 0.8929 |
| Modal | 10 | 0.0062 | 0.0461 | 0.0083 | 0.6425 | 0.6477 | 0.9012 |
| Modal | 11 | 0.0188 | 0.0632 | 0.0085 | 0.6614 | 0.711 | 0.9097 |
| Modal | 12 | 0.0469 | 0.0081 | 0.0008 | 0.7083 | 0.7191 | 0.9105 |
| Modal-V | 1 | 0.1887 | 0.0046 | 0.0597 | 0.1887 | 0.0046 | 0.0597 |
| Modal-V | 2 | 0.0204 | 0.0158 | 0.5841 | 0.209 | 0.0204 | 0.6438 |
| Modal-V | 3 | 0.0005 | 0.2376 | 0.0563 | 0.2095 | 0.258 | 0.7001 |
| Modal-V | 4 | 0.2942 | 0.0015 | 0.0049 | 0.5037 | 0.2595 | 0.705 |
| Modal-V | 5 | 0.0086 | 0.0159 | 0.1633 | 0.5123 | 0.2754 | 0.8683 |
| Modal-V | 6 | 0.0005 | 0.2679 | 0.0146 | 0.5128 | 0.5433 | 0.8829 |
| Modal-V | 7 | 0.0416 | 0.0013 | 0.015 | 0.5544 | 0.5446 | 0.8979 |
| Modal-V | 8 | 0.0291 | 0.0101 | 0.0031 | 0.5835 | 0.5548 | 0.9011 |
| Modal-V | 9 | 0.0114 | 0.0525 | 0.0036 | 0.5949 | 0.6073 | 0.9046 |
| Modal-V | 10 | 0.0001 | 0.0173 | 0.0008 | 0.5951 | 0.6246 | 0.9055 |
| Modal-V | 11 | 0.0035 | 0.0041 | 0.0025 | 0.5986 | 0.6287 | 0.908 |
| Modal-V | 12 | 0.0012 | 0.0002 | 0.0005 | 0.5998 | 0.6289 | 0.9085 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 2.057 | 1.8E-05 | 0.000123 | -1.455E-07 | -1.174401 | 0.177585 | -0.488656 | 1E-06 | 1E-05 |
| Modal | 2 | 1.748 | -3.2E-05 | 4.2E-05 | 4.079E-07 | -0.38582 | -0.330107 | 1.528812 | 1E-06 | 1E-05 |
| Modal | 3 | 1.313 | -0.000121 | 7E-06 | -1E-06 | -0.058059 | -1.278634 | -0.47472 | 1E-06 | 2E-05 |
| Modal | 4 | 0.58 | -6E-06 | -5.7E-05 | 4.622E-08 | -1.466676 | 0.1013 | 0.139926 | 1E-06 | 0.00012 |
| Modal | 5 | 0.459 | 1.6E-05 | -9E-06 | 1E-06 | -0.250943 | -0.331138 | -0.807568 | 1E-06 | 0.00019 |
| Modal | 6 | 0.347 | 6.2E-05 | -3E-06 | -2E-06 | -0.058367 | -1.358058 | 0.238932 | 1E-06 | 0.00033 |
| Modal | 7 | 0.278 | 3E-06 | 3.3E-05 | 3.921E-08 | 0.702937 | -0.073872 | -0.042478 | 1E-06 | 0.00051 |
| Modal | 8 | 0.176 | 2.8E-05 | -9E-06 | 2E-06 | -0.255254 | -0.590452 | -0.199719 | 1E-06 | 0.00128 |
| Modal | 9 | 0.167 | 1.1E-05 | 2E-05 | 1E-06 | 0.586409 | -0.216241 | -0.026314 | 1E-06 | 0.00142 |
| Modal | 10 | 0.117 | 1.9E-05 | 1.1E-05 | -2E-06 | 0.212759 | -0.563406 | 0.182436 | 1E-06 | 0.0029 |
| Modal | 11 | 0.1 | -2.6E-05 | 1.6E-05 | 1E-06 | 0.370938 | 0.659686 | -0.184201 | 1E-06 | 0.00399 |
| Modal | 12 | 0.064 | -1.2E-05 | -2E-05 | -2E-06 | -0.585749 | 0.23616 | 0.057567 | 1E-06 | 0.00972 |
| Modal-V | 1 | 2.057 | -1.8E-05 | -0.000123 | 1.455E-07 | 1.174401 | -0.177585 | 0.488656 | 1E-06 | 1E-05 |
| Modal-V | 2 | 1.748 | -3.2E-05 | 4.2E-05 | 4.079E-07 | -0.38582 | -0.330107 | 1.528812 | 1E-06 | 1E-05 |
| Modal-V | 3 | 1.313 | -0.000121 | 7E-06 | -1E-06 | -0.058059 | -1.278634 | -0.47472 | 1E-06 | 2E-05 |
| Modal-V | 4 | 0.58 | -6E-06 | -5.7E-05 | 4.617E-08 | -1.466675 | 0.101299 | 0.139938 | 1E-06 | 0.00012 |
| Modal-V | 5 | 0.459 | 1.6E-05 | -9E-06 | 1E-06 | -0.250947 | -0.331064 | -0.808366 | 1E-06 | 0.00019 |
| Modal-V | 6 | 0.347 | 6.2E-05 | -3E-06 | -2E-06 | -0.058878 | -1.35788 | 0.241654 | 1E-06 | 0.00033 |

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| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal-V | 7 | 0.235 | 4E-06 | -2.8E-05 | -1E-06 | -0.551414 | -0.095582 | -0.244882 | 1E-06 | 0.00071 |
| Modal-V | 8 | 0.187 | 1E-06 | -5E-06 | 5E-05 | -0.461536 | 0.263949 | 0.112225 | 1E-06 | 0.00112 |
| Modal-V | 9 | 0.172 | -1E-06 | -6E-06 | -7.7E-05 | -0.288519 | 0.601082 | 0.119222 | 1E-06 | 0.00133 |
| Modal-V | 10 | 0.142 | 2E-06 | 3E-06 | -9.9E-05 | 0.030008 | -0.345312 | -0.058037 | 1E-06 | 0.00195 |
| Modal-V | 11 | 0.101 | 4E-06 | 8E-06 | 3.1E-05 | 0.160639 | -0.168383 | -0.09975 | 1E-06 | 0.00384 |
| Modal-V | 12 | 0.048 | 2E-06 | 4E-06 | -5.3E-05 | 0.093286 | -0.040507 | -0.045122 | 1E-06 | 0.01732 |

**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 97.63 |
| Modal | Acceleration | UY | 100 | 99.32 |
| Modal | Acceleration | UZ | 0.46 | 0.1 |
| Modal-V | Acceleration | UX | 99.86 | 88.31 |
| Modal-V | Acceleration | UY | 99.92 | 93 |
| Modal-V | Acceleration | UZ | 100 | 96.79 |

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# ETABS®



## Report for Block 4 and 7

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Load Pattern Definitions - Auto Wind - Indian IS 875 2015 (Part 1 of 3)**

| Name | Exposure Set | Is Auto Load | Exposure Source | Top Story | Bottom Story | Include Parapet | Parapet Height m | Cp Windward | Cp Leeward | Wind Speed meter/sec |
|---|---|---|---|---|---|---|---|---|---|---|
| WX | 1 | No | Diaphragms | TERRACE | GF | Yes | 1.2 | 0.6 | 0.6 | 50 |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WX | 1 | No | | | | | | | | |
| WY | 1 | No | Diaphragms | TERRACE | Base | Yes | 1.2 | 0.6 | 0.6 | 50 |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |
| WY | 1 | No | | | | | | | | |

**Table 1.1 - Load Pattern Definitions - Auto Wind - Indian IS 875 2015 (Part 2 of 3)**

| Name | Exposure Set | Terrain Category | Importance Factor | Risk Coefficient | Topography | Width Type | Direction Angle deg | Story |
|---|---|---|---|---|---|---|---|---|
| WX | 1 | 3 | 1.00 | 1 | 1 | Auto | 0 | TERRACE |
| WX | 1 | | | | | | | 14TH FLOOR |
| WX | 1 | | | | | | | 13TH FLOOR |
| WX | 1 | | | | | | | 12TH FLOOR |
| WX | 1 | | | | | | | 11TH FLOOR |
| WX | 1 | | | | | | | 10TH FLOOR |
| WX | 1 | | | | | | | 9TH FLOOR |
| WX | 1 | | | | | | | 8TH FLOOR |
| WX | 1 | | | | | | | 7TH FLOOR |

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| Name | Exposure Set | Terrain Category | Importance Factor | Risk Coefficient | Topography | Width Type | Direction Angle deg | Story |
|---|---|---|---|---|---|---|---|---|
| WX | 1 | | | | | | | 6TH FLOOR |
| WX | 1 | | | | | | | 5TH FLOOR |
| WX | 1 | | | | | | | 4TH FLOOR |
| WX | 1 | | | | | | | 3RD FLOOR |
| WX | 1 | | | | | | | 2ND FLOOR |
| WX | 1 | | | | | | | 1ST FLOOR |
| WX | 1 | | | | | | | GF |
| WX | 1 | | | | | | | Upper Basement |
| WY | 1 | 3 | 1.00 | 1 | 1 | Auto | 90 | TERRACE |
| WY | 1 | | | | | | | 14TH FLOOR |
| WY | 1 | | | | | | | 13TH FLOOR |
| WY | 1 | | | | | | | 12TH FLOOR |
| WY | 1 | | | | | | | 11TH FLOOR |
| WY | 1 | | | | | | | 10TH FLOOR |
| WY | 1 | | | | | | | 9TH FLOOR |
| WY | 1 | | | | | | | 8TH FLOOR |
| WY | 1 | | | | | | | 7TH FLOOR |
| WY | 1 | | | | | | | 6TH FLOOR |
| WY | 1 | | | | | | | 5TH FLOOR |
| WY | 1 | | | | | | | 4TH FLOOR |
| WY | 1 | | | | | | | 3RD FLOOR |
| WY | 1 | | | | | | | 2ND FLOOR |
| WY | 1 | | | | | | | 1ST FLOOR |
| WY | 1 | | | | | | | GF |
| WY | 1 | | | | | | | Upper Basement |

**Table 1.1 - Load Pattern Definitions - Auto Wind - Indian IS 875 2015 (Part 3 of 3)**

| Name | Exposure Set | Diaphragm | Width m | Depth m | X m | Y m |
|---|---|---|---|---|---|---|
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 30.453 | 47.144 | 22.115 | 13.2515 |
| WX | 1 | D1 | 42.57 | 57.694 | 17.84 | 11.405 |
| WX | 1 | D1 | 42.57 | 57.694 | 17.84 | 11.405 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |

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| Name | Exposure Set | Diaphragm | Width m | Depth m | X m | Y m |
|---|---|---|---|---|---|---|
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 47.144 | 30.453 | 22.115 | 13.2515 |
| WY | 1 | D1 | 57.694 | 42.57 | 17.84 | 11.405 |
| WY | 1 | D1 | 57.694 | 42.57 | 17.84 | 11.405 |

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## 1.2 Auto Seismic Loading

**Table 1.2 - Load Pattern Definitions - Auto Seismic - IS 1893 2016 (Part 1 of 3)**

| Name | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN | Is Auto Load | X Dir? | X Dir Plus Ecc? | X Dir Minus Ecc? | Y Dir? | Y Dir Plus Ecc? | Y Dir Minus Ecc? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EQXN | 0.588 | 0.044408 | 205169.6342 | 9111.2066 | No | No | No | Yes | No | No | No |
| EQXP | 0.588 | 0.044408 | 205169.6342 | 9111.2066 | No | No | Yes | No | No | No | No |
| EQYN | 0.74 | 0.035301 | 205169.6342 | 7242.6517 | No | No | No | No | No | Yes | No |
| EQYP | 0.74 | 0.035301 | 205169.6342 | 7242.6517 | No | No | No | No | No | Yes | No |

**Table 1.2 - Load Pattern Definitions - Auto Seismic - IS 1893 2016 (Part 2 of 3)**

| Name | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN | Ecc Ratio | Top Story | Bottom Story | Period Type | User T sec | Z | Site Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EQXN | 0.588 | 0.044408 | 205169.6342 | 9111.2066 | 0.05 | TERRACE | GF | User Defined | 0.588 | 0.16 | II |
| EQXP | 0.588 | 0.044408 | 205169.6342 | 9111.2066 | 0.05 | TERRACE | GF | User Defined | 0.588 | 0.16 | II |
| EQYN | 0.74 | 0.035301 | 205169.6342 | 7242.6517 | 0.05 | TERRACE | GF | User Defined | 0.74 | 0.16 | II |
| EQYP | 0.74 | 0.035301 | 205169.6342 | 7242.6517 | 0.05 | TERRACE | GF | User Defined | 0.74 | 0.16 | II |

**Table 1.2 - Load Pattern Definitions - Auto Seismic - IS 1893 2016 (Part 3 of 3)**

| Name | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN | I | R |
|---|---|---|---|---|---|---|
| EQXN | 0.588 | 0.044408 | 205169.6342 | 9111.2066 | 1.2 | 5 |
| EQXP | 0.588 | 0.044408 | 205169.6342 | 9111.2066 | 1.2 | 5 |
| EQYN | 0.74 | 0.035301 | 205169.6342 | 7242.6517 | 1.2 | 5 |
| EQYP | 0.74 | 0.035301 | 205169.6342 | 7242.6517 | 1.2 | 5 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period — $T = 0.588$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] — $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ — $\frac{S_a}{g} = 2.312925$

**Equivalent Lateral Forces**

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

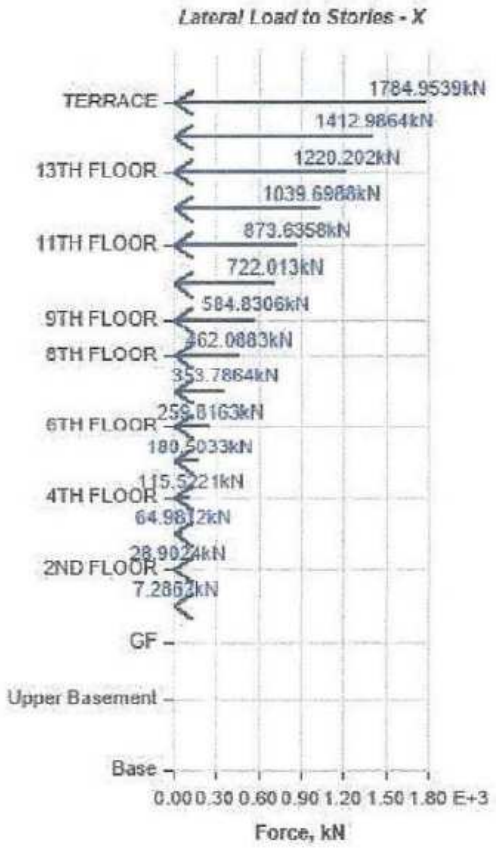
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X + Ecc. Y | 0.588 | 205169.6342 | 9111.2066 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 1784.9539 | 0 |
| 14TH FLOOR | 52.55 | 1412.9864 | 0 |
| 13TH FLOOR | 49.55 | 1220.202 | 0 |
| 12TH FLOOR | 46.55 | 1039.6988 | 0 |
| 11TH FLOOR | 43.55 | 873.6358 | 0 |
| 10TH FLOOR | 40.55 | 722.013 | 0 |
| 9TH FLOOR | 37.55 | 584.8306 | 0 |
| 8TH FLOOR | 34.55 | 462.0883 | 0 |
| 7TH FLOOR | 31.55 | 353.7864 | 0 |
| 6TH FLOOR | 28.55 | 259.8163 | 0 |
| 5TH FLOOR | 25.55 | 180.5033 | 0 |
| 4TH FLOOR | 22.55 | 115.5221 | 0 |
| 3RD FLOOR | 19.55 | 64.9812 | 0 |
| 2ND FLOOR | 16.55 | 28.9024 | 0 |
| 1ST FLOOR | 13.55 | 7.2862 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper Basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period — $T = 0.588$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] — $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ — $\frac{S_a}{g} = 2.312925$

**Equivalent Lateral Forces**

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

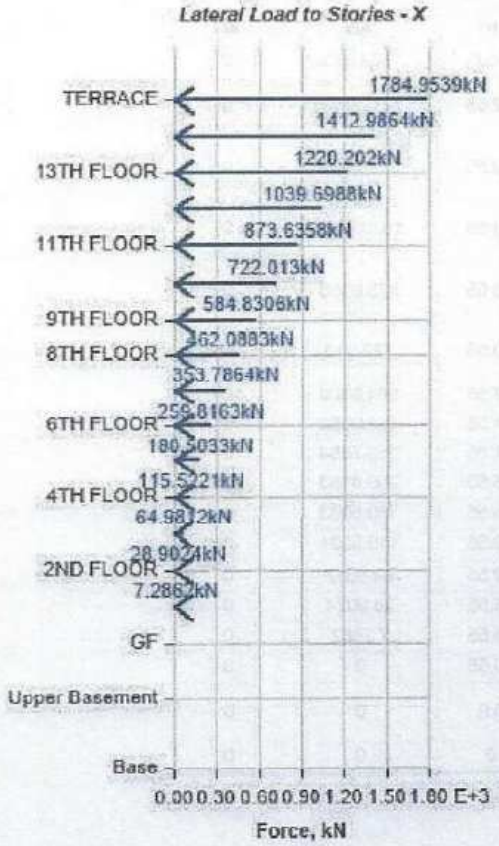
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X - Ecc. Y | 0.588 | 205169.6342 | 9111.2066 |

***Applied Story Forces***

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 1784.9539 | 0 |
| 14TH FLOOR | 52.55 | 1412.9864 | 0 |
| 13TH FLOOR | 49.55 | 1220.202 | 0 |
| 12TH FLOOR | 46.55 | 1039.6988 | 0 |
| 11TH FLOOR | 43.55 | 873.6358 | 0 |
| 10TH FLOOR | 40.55 | 722.013 | 0 |
| 9TH FLOOR | 37.55 | 584.8306 | 0 |
| 8TH FLOOR | 34.55 | 462.0883 | 0 |
| 7TH FLOOR | 31.55 | 353.7864 | 0 |
| 6TH FLOOR | 28.55 | 259.8163 | 0 |
| 5TH FLOOR | 25.55 | 180.5033 | 0 |
| 4TH FLOOR | 22.55 | 115.5221 | 0 |
| 3RD FLOOR | 19.55 | 64.9812 | 0 |
| 2ND FLOOR | 16.55 | 28.9024 | 0 |
| 1ST FLOOR | 13.55 | 7.2862 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper Basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period — $T = 0.74$ sec

**Factors and Coefficients**

| | |
|---|---|
| Seismic Zone Factor, Z [IS Table 3] | $Z = 0.16$ |
| Response Reduction Factor, R [IS Table 9] | $R = 5$ |
| Importance Factor, I [IS Table 8] | $I = 1.2$ |
| Site Type [IS Table 1] = II | |

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\quad \frac{S_a}{g} = \frac{1.36}{T}$ $\quad \frac{S_a}{g} = 1.838583$

**Equivalent Lateral Forces**

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

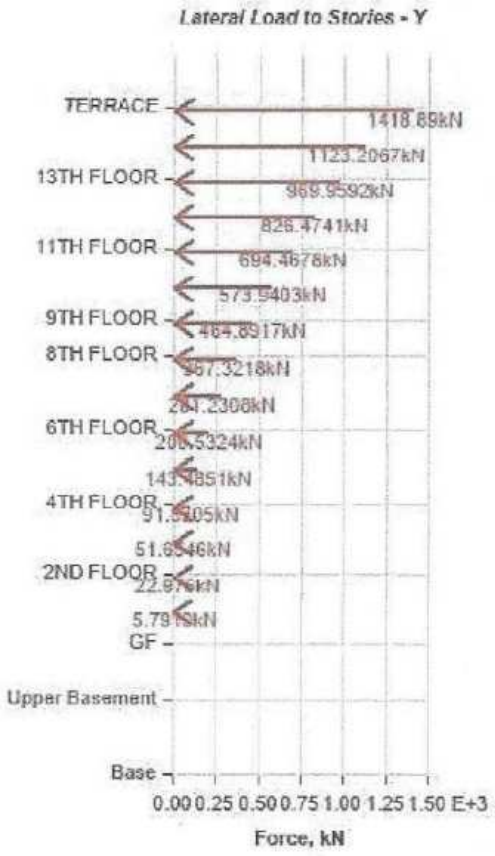
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.74 | 205169.6342 | 7242.6517 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 1418.89 |
| 14TH FLOOR | 52.55 | 0 | 1123.2067 |
| 13TH FLOOR | 49.55 | 0 | 969.9592 |
| 12TH FLOOR | 46.55 | 0 | 826.4741 |
| 11TH FLOOR | 43.55 | 0 | 694.4678 |
| 10TH FLOOR | 40.55 | 0 | 573.9403 |
| 9TH FLOOR | 37.55 | 0 | 464.8917 |
| 8TH FLOOR | 34.55 | 0 | 367.3218 |
| 7TH FLOOR | 31.55 | 0 | 281.2308 |
| 6TH FLOOR | 28.55 | 0 | 206.5324 |
| 5TH FLOOR | 25.55 | 0 | 143.4851 |
| 4TH FLOOR | 22.55 | 0 | 91.8305 |
| 3RD FLOOR | 19.55 | 0 | 51.6546 |
| 2ND FLOOR | 16.55 | 0 | 22.975 |
| 1ST FLOOR | 13.55 | 0 | 5.7919 |
| GF | 10.55 | 0 | 0 |
| Upper Basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period — $T = 0.74$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] — $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ — $\frac{S_a}{g} = 1.838583$

**Equivalent Lateral Forces**

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

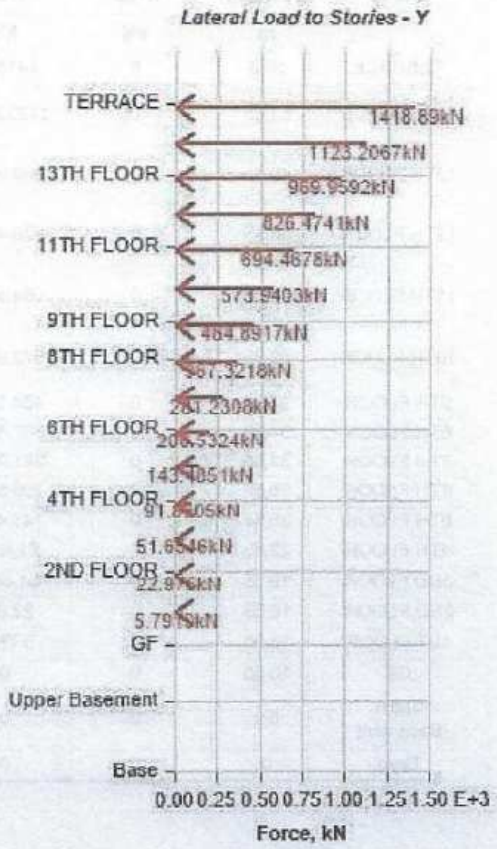
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.74 | 205169.6342 | 7242.6517 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 1418.89 |
| 14TH FLOOR | 52.55 | 0 | 1123.2067 |
| 13TH FLOOR | 49.55 | 0 | 969.9592 |
| 12TH FLOOR | 46.55 | 0 | 826.4741 |
| 11TH FLOOR | 43.55 | 0 | 694.4678 |
| 10TH FLOOR | 40.55 | 0 | 573.9403 |
| 9TH FLOOR | 37.55 | 0 | 464.8917 |
| 8TH FLOOR | 34.55 | 0 | 367.3218 |
| 7TH FLOOR | 31.55 | 0 | 281.2308 |
| 6TH FLOOR | 28.55 | 0 | 206.5324 |
| 5TH FLOOR | 25.55 | 0 | 143.4851 |
| 4TH FLOOR | 22.55 | 0 | 91.8305 |
| 3RD FLOOR | 19.55 | 0 | 51.6546 |
| 2ND FLOOR | 16.55 | 0 | 22.975 |
| 1ST FLOOR | 13.55 | 0 | 5.7919 |
| GF | 10.55 | 0 | 0 |
| Upper Basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

Table 1.7 - Functions - Response Spectrum - IS1893 2016

| Name | Period sec | Value | Seismic Zone | I | Soil Type | R | Damping Ratio |
|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | III | 1.2 | II | 5 | 0.05 |
| RSP | 0.1 | 0.048 | | | | | |
| RSP | 0.55 | 0.048 | | | | | |
| RSP | 0.8 | 0.03264 | | | | | |
| RSP | 1 | 0.026112 | | | | | |
| RSP | 1.2 | 0.02176 | | | | | |
| RSP | 1.4 | 0.018651 | | | | | |
| RSP | 1.6 | 0.01632 | | | | | |
| RSP | 1.8 | 0.014507 | | | | | |
| RSP | 2 | 0.013056 | | | | | |
| RSP | 2.5 | 0.010445 | | | | | |
| RSP | 3 | 0.008704 | | | | | |
| RSP | 3.5 | 0.007461 | | | | | |
| RSP | 4 | 0.006528 | | | | | |
| RSP | 4.5 | 0.006528 | | | | | |
| RSP | 5 | 0.006528 | | | | | |
| RSP | 5.5 | 0.006528 | | | | | |
| RSP | 6 | 0.006528 | | | | | |
| RSP | 6.5 | 0.006528 | | | | | |
| RSP | 7 | 0.006528 | | | | | |
| RSP | 7.5 | 0.006528 | | | | | |
| RSP | 8 | 0.006528 | | | | | |
| RSP | 8.5 | 0.006528 | | | | | |
| RSP | 9 | 0.006528 | | | | | |
| RSP | 9.5 | 0.006528 | | | | | |
| RSP | 10 | 0.006528 | | | | | |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods And Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | CircFreq rad/sec | Eigenvalue rad2/sec2 |
|---|---|---|---|---|---|
| Modal | 1 | 3.628 | 0.276 | 1.7318 | 2.9991 |
| Modal | 2 | 2.279 | 0.439 | 2.7567 | 7.5997 |
| Modal | 3 | 1.599 | 0.625 | 3.9292 | 15.4383 |
| Modal | 4 | 1.001 | 0.999 | 6.2788 | 39.4232 |
| Modal | 5 | 0.604 | 1.655 | 10.3999 | 108.1583 |
| Modal | 6 | 0.493 | 2.027 | 12.7366 | 162.221 |
| Modal | 7 | 0.437 | 2.288 | 14.3735 | 206.5988 |
| Modal | 8 | 0.302 | 3.308 | 20.7824 | 431.9065 |
| Modal | 9 | 0.232 | 4.317 | 27.1255 | 735.7929 |
| Modal | 10 | 0.203 | 4.922 | 30.9285 | 956.4461 |
| Modal | 11 | 0.142 | 7.05 | 44.294 | 1961.9598 |
| Modal | 12 | 0.114 | 8.782 | 55.1765 | 3044.4452 |
| Modal-V | 1 | 3.628 | 0.276 | 1.7318 | 2.9991 |
| Modal-V | 2 | 2.279 | 0.439 | 2.7567 | 7.5997 |
| Modal-V | 3 | 1.599 | 0.625 | 3.9292 | 15.4383 |
| Modal-V | 4 | 1.001 | 0.999 | 6.2788 | 39.4232 |
| Modal-V | 5 | 0.605 | 1.654 | 10.3932 | 108.0189 |
| Modal-V | 6 | 0.483 | 2.16 | 13.5738 | 184.2487 |
| Modal-V | 7 | 0.39 | 2.562 | 16.0978 | 259.1387 |
| Modal-V | 8 | 0.343 | 2.919 | 18.3413 | 336.4029 |
| Modal-V | 9 | 0.297 | 3.362 | 21.1228 | 446.1723 |
| Modal-V | 10 | 0.212 | 4.715 | 29.6266 | 877.7353 |
| Modal-V | 11 | 0.156 | 6.409 | 40.2712 | 1621.7714 |
| Modal-V | 12 | 0.079 | 12.707 | 79.8433 | 6374.9545 |

**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | SumUX | SumUY | SumUZ | RX | RY | RZ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 3.628 | 0.61 | 0.001 | 0 | 0.61 | 0.001 | 0 | 0.0005 | 0.2437 | 8.688E-06 |
| Modal | 2 | 2.279 | 0.0005 | 0.0098 | 0.0001 | 0.6105 | 0.0107 | 0.0001 | 0.0081 | 0.0001 | 0.5078 |
| Modal | 3 | 1.599 | 0.0017 | 0.5994 | 3.544E-06 | 0.6122 | 0.6101 | 0.0001 | 0.3127 | 0.0005 | 0.0026 |
| Modal | 4 | 1.001 | 0.1901 | 0.0005 | 9.001E-07 | 0.8022 | 0.6106 | 0.0001 | 0 | 0.1477 | 0.0001 |
| Modal | 5 | 0.604 | 1.057E-06 | 0.0003 | 2.747E-05 | 0.8022 | 0.6109 | 0.0001 | 0.0001 | 1.991E-06 | 0.2276 |
| Modal | 6 | 0.493 | 0.1091 | 3.018E-06 | 6.023E-07 | 0.9113 | 0.6109 | 0.0001 | 1.033E-05 | 0.0909 | 0.0009 |
| Modal | 7 | 0.437 | 6.55E-06 | 0.1996 | 2.634E-05 | 0.9113 | 0.8105 | 0.0001 | 0.2077 | 0.0001 | 0.0049 |
| Modal | 8 | 0.302 | 0.0446 | 8.368E-06 | 1.688E-05 | 0.9559 | 0.8105 | 0.0001 | 2.596E-05 | 0.0518 | 0.0028 |
| Modal | 9 | 0.232 | 0.0003 | 0.075 | 0.0003 | 0.9562 | 0.8854 | 0.0004 | 0.0614 | 0.0005 | 0.0071 |
| Modal | 10 | 0.203 | 0.0157 | 0.0022 | 0.0007 | 0.9719 | 0.8876 | 0.0012 | 0.003 | 0.0181 | 0.0114 |
| Modal | 11 | 0.142 | 0.0011 | 0.0807 | 4.089E-05 | 0.9729 | 0.9683 | 0.0012 | 0.1447 | 0.0014 | 0.0032 |
| Modal | 12 | 0.114 | 0.0246 | 0.0019 | 0.0005 | 0.9976 | 0.9702 | 0.0018 | 0.0029 | 0.0384 | 0.0094 |
| Modal-V | 1 | 3.628 | 0.61 | 0.001 | 0 | 0.61 | 0.001 | 0 | 0.0005 | 0.2437 | 8.688E-06 |
| Modal-V | 2 | 2.279 | 0.0005 | 0.0098 | 0.0001 | 0.6105 | 0.0107 | 0.0001 | 0.0081 | 0.0001 | 0.5078 |
| Modal-V | 3 | 1.599 | 0.0017 | 0.5994 | 3.544E-06 | 0.6122 | 0.6101 | 0.0001 | 0.3127 | 0.0005 | 0.0026 |
| Modal-V | 4 | 1.001 | 0.1901 | 0.0005 | 9.001E-07 | 0.8022 | 0.6106 | 0.0001 | 0 | 0.1477 | 0.0001 |
| Modal-V | 5 | 0.605 | 1.463E-06 | 0.0003 | 4.495E-05 | 0.8022 | 0.6109 | 0.0001 | 3.714E-05 | 0 | 0.2266 |
| Modal-V | 6 | 0.483 | 0.0939 | 0.0021 | 9.992E-06 | 0.8961 | 0.609 | 0.0001 | 0.0816 | 0.0005 | 0.0002 |
| Modal-V | 7 | 0.39 | 0.013 | 0.0551 | 0.0011 | 0.879 | 0.7481 | 0.0012 | 0.071 | 0.0209 | 0.0052 |
| Modal-V | 8 | 0.343 | 0.0099 | 0.0285 | 0.0136 | 0.8889 | 0.7766 | 0.0148 | 0.0193 | 0.0067 | 0.0051 |

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| Case | Mode | Period sec | UX | UY | UZ | SumUX | SumUY | SumUZ | RX | RY | RZ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Modal-V | 9 | 0.297 | 0.0023 | 0.0044 | 0.0824 | 0.8912 | 0.781 | 0.1072 | 0.0318 | 0.0016 | 0.0001 |
| Modal-V | 10 | 0.212 | 0.0012 | 0.0016 | 0.2923 | 0.8924 | 0.7826 | 0.3996 | 0.0008 | 0.0061 | 0.0003 |
| Modal-V | 11 | 0.156 | 0.0017 | 0.0014 | 0.3523 | 0.8941 | 0.784 | 0.7518 | 0.0007 | 0.0036 | 0.0001 |
| Modal-V | 12 | 0.079 | 0.0032 | 0.0036 | 0.1737 | 0.8973 | 0.7876 | 0.9255 | 0.0042 | 0.0003 | 2.729E-05 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | SumRX | SumRY | SumRZ |
|---|---|---|---|---|
| Modal | 1 | 0.0005 | 0.2437 | 8.688E-06 |
| Modal | 2 | 0.0087 | 0.2438 | 0.5078 |
| Modal | 3 | 0.3214 | 0.2443 | 0.5103 |
| Modal | 4 | 0.3214 | 0.392 | 0.5105 |
| Modal | 5 | 0.3214 | 0.392 | 0.738 |
| Modal | 6 | 0.3214 | 0.4829 | 0.7389 |
| Modal | 7 | 0.5291 | 0.483 | 0.7438 |
| Modal | 8 | 0.5291 | 0.5347 | 0.7466 |
| Modal | 9 | 0.5906 | 0.5353 | 0.7537 |
| Modal | 10 | 0.5935 | 0.5534 | 0.7651 |
| Modal | 11 | 0.7382 | 0.5547 | 0.7683 |
| Modal | 12 | 0.7411 | 0.5931 | 0.7777 |
| Modal-V | 1 | 0.0005 | 0.2437 | 8.688E-06 |
| Modal-V | 2 | 0.0087 | 0.2438 | 0.5078 |
| Modal-V | 3 | 0.3214 | 0.2443 | 0.5103 |
| Modal-V | 4 | 0.3214 | 0.392 | 0.5105 |
| Modal-V | 5 | 0.3214 | 0.392 | 0.7371 |
| Modal-V | 6 | 0.403 | 0.4525 | 0.7373 |
| Modal-V | 7 | 0.474 | 0.4734 | 0.7425 |
| Modal-V | 8 | 0.4933 | 0.4802 | 0.7476 |
| Modal-V | 9 | 0.5251 | 0.4817 | 0.7477 |
| Modal-V | 10 | 0.5259 | 0.4878 | 0.7479 |
| Modal-V | 11 | 0.5266 | 0.4914 | 0.748 |
| Modal-V | 12 | 0.5306 | 0.4917 | 0.748 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | ModalMass kN-m-s2 | ModalStiff kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 3.628 | 0.000132 | -5E-06 | -3.073E-08 | 0.071974 | 1.753606 | -0.008246 | 1E-06 | 2.999E-06 |
| Modal | 2 | 2.279 | -4E-06 | 1.7E-05 | -1E-06 | -0.288283 | -0.033777 | 1.99348 | 1E-06 | 1E-05 |
| Modal | 3 | 1.599 | -7E-06 | -0.000131 | 3.207E-07 | 1.786415 | -0.080378 | 0.1423 | 1E-06 | 2E-05 |
| Modal | 4 | 1.001 | 7.4E-05 | -4E-06 | -1.616E-07 | 0.001532 | -1.364906 | 0.033324 | 1E-06 | 4E-05 |
| Modal | 5 | 0.604 | 1.742E-07 | -3E-06 | -1E-06 | -0.0236 | -0.005012 | -1.334525 | 1E-06 | 0.00011 |
| Modal | 6 | 0.493 | 5.6E-05 | 2.944E-07 | -1.322E-07 | -0.010266 | -1.070707 | 0.083656 | 1E-06 | 0.00016 |
| Modal | 7 | 0.437 | -4.336E-07 | -7.6E-05 | 1E-06 | -1.455865 | 0.034562 | 0.195611 | 1E-06 | 0.00021 |
| Modal | 8 | 0.302 | 3.6E-05 | 4.901E-07 | -1E-06 | 0.016277 | -0.808074 | 0.148553 | 1E-06 | 0.00043 |
| Modal | 9 | 0.232 | 3E-06 | 4.6E-05 | 3E-06 | 0.791899 | -0.081671 | -0.235392 | 1E-06 | 0.00074 |
| Modal | 10 | 0.203 | -2.1E-05 | 8E-06 | -5E-06 | 0.173604 | 0.478031 | 0.298916 | 1E-06 | 0.00096 |
| Modal | 11 | 0.142 | -5E-06 | -4.8E-05 | 1E-06 | -1.215048 | 0.130889 | -0.157311 | 1E-06 | 0.00196 |
| Modal | 12 | 0.114 | 2.7E-05 | -7E-06 | -4E-06 | -0.170992 | -0.69594 | 0.271228 | 1E-06 | 0.00304 |
| Modal-V | 1 | 3.628 | -0.000132 | 5E-06 | 3.073E-08 | -0.071974 | -1.753606 | 0.008246 | 1E-06 | 2.999E-06 |
| Modal-V | 2 | 2.279 | -4E-06 | 1.7E-05 | -1E-06 | -0.288283 | -0.033777 | 1.99348 | 1E-06 | 1E-05 |
| Modal-V | 3 | 1.599 | -7E-06 | -0.000131 | 3.207E-07 | 1.786415 | -0.080378 | 0.1423 | 1E-06 | 2E-05 |
| Modal-V | 4 | 1.001 | 7.4E-05 | -4E-06 | -1.616E-07 | 0.001531 | -1.364906 | 0.033324 | 1E-06 | 4E-05 |
| Modal-V | 5 | 0.605 | -2.05E-07 | 3E-06 | 1E-06 | 0.019468 | 0.001998 | 1.331656 | 1E-06 | 0.00011 |
| Modal-V | 6 | 0.463 | 4.3E-05 | 4.9E-05 | -1E-06 | 0.912628 | -0.873928 | 0.040867 | 1E-06 | 0.00018 |
| Modal-V | 7 | 0.39 | -1.9E-05 | 4E-05 | -6E-06 | 0.85117 | 0.513389 | -0.201438 | 1E-06 | 0.00026 |
| Modal-V | 8 | 0.343 | 1.7E-05 | 2.9E-05 | 2E-05 | 0.443982 | 0.291244 | -0.200102 | 1E-06 | 0.00034 |

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| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | ModalMass kN-m-s2 | ModalStiff kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal-V | 9 | 0.297 | -8E-06 | 1.1E-05 | -5.2E-05 | 0.569988 | 0.141742 | -0.025911 | 1E-06 | 0.00045 |
| Modal-V | 10 | 0.212 | -6E-06 | 7E-06 | 9.2E-05 | 0.089296 | -0.276814 | 0.047257 | 1E-06 | 0.00088 |
| Modal-V | 11 | 0.156 | 7E-06 | -6E-06 | 0.000101 | 0.085799 | 0.213327 | -0.021251 | 1E-06 | 0.00162 |
| Modal-V | 12 | 0.079 | 1E-05 | -1E-05 | -7.1E-05 | -0.206583 | -0.058426 | -0.014614 | 1E-06 | 0.00637 |

**Table 2.4 - Modal Load Participation Ratios**

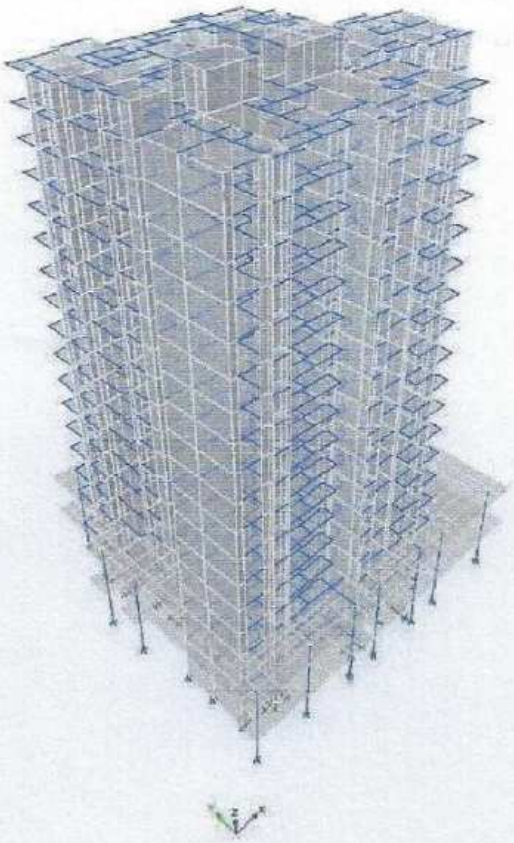
| Case | ItemType | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 99.76 |
| Modal | Acceleration | UY | 100 | 97.02 |
| Modal | Acceleration | UZ | 1.22 | 0.18 |
| Modal-V | Acceleration | UX | 99.82 | 89.73 |
| Modal-V | Acceleration | UY | 99.14 | 78.76 |
| Modal-V | Acceleration | UZ | 100 | 92.55 |

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# Report for Block 4 and 7

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WX | Diaphragms | From Diaphragms | 0 | 0.7 | 0.7 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |
| WY | Diaphragms | From Diaphragms | 90 | 0.7 | 0.7 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

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## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQXP | Seismic | X + Ecc. Y | 5 | No | User Specified | 0.79 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.79 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.739 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYN | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.739 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.79 | 0.033053 | 151887.1217 | 5020.35 |
| 5 | 0.79 | 0.033053 | 151887.1217 | 5020.35 |
| 5 | 0.739 | 0.035334 | 151887.1217 | 5366.8153 |
| 5 | 0.739 | 0.035334 | 151887.1217 | 5366.8153 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.79$ sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] $Z = 0.16$
Response Reduction Factor, R [IS Table 9] $R = 5$
Importance Factor, I [IS Table 8] $I = 1.2$
Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

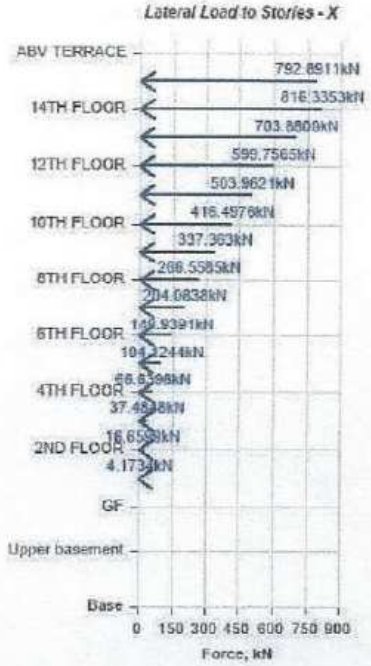
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X + Ecc. Y | 0.79 | 151887.1217 | 5020.35 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 792.8911 | 0 |
| 14TH FLOOR | 52.55 | 816.3353 | 0 |
| 13TH FLOOR | 49.55 | 703.8809 | 0 |
| 12TH FLOOR | 46.55 | 599.7565 | 0 |
| 11TH FLOOR | 43.55 | 503.9621 | 0 |
| 10TH FLOOR | 40.55 | 416.4976 | 0 |
| 9TH FLOOR | 37.55 | 337.363 | 0 |
| 8TH FLOOR | 34.55 | 266.5585 | 0 |
| 7TH FLOOR | 31.55 | 204.0838 | 0 |
| 6TH FLOOR | 28.55 | 149.9391 | 0 |
| 5TH FLOOR | 25.55 | 104.1244 | 0 |
| 4TH FLOOR | 22.55 | 66.6396 | 0 |

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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 37.4848 | 0 |
| 2ND FLOOR | 16.55 | 16.6599 | 0 |
| 1ST FLOOR | 13.55 | 4.1734 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.79$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

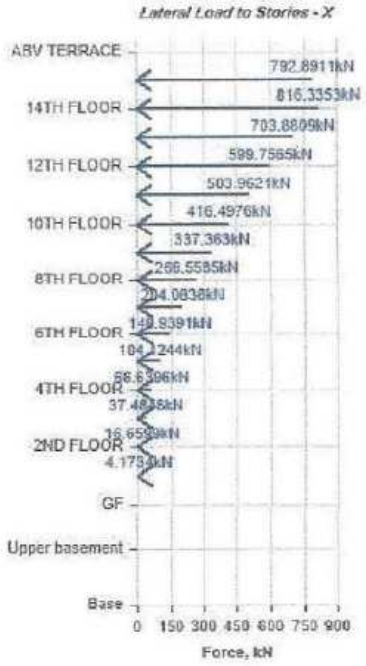
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X - Ecc. Y | 0.79 | 151887.1217 | 5020.35 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 792.8911 | 0 |
| 14TH FLOOR | 52.55 | 816.3353 | 0 |
| 13TH FLOOR | 49.55 | 703.8809 | 0 |
| 12TH FLOOR | 46.55 | 599.7565 | 0 |
| 11TH FLOOR | 43.55 | 503.9621 | 0 |
| 10TH FLOOR | 40.55 | 416.4976 | 0 |
| 9TH FLOOR | 37.55 | 337.363 | 0 |
| 8TH FLOOR | 34.55 | 266.5585 | 0 |
| 7TH FLOOR | 31.55 | 204.0838 | 0 |
| 6TH FLOOR | 28.55 | 149.9391 | 0 |
| 5TH FLOOR | 25.55 | 104.1244 | 0 |
| 4TH FLOOR | 22.55 | 66.6396 | 0 |

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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 37.4848 | 0 |
| 2ND FLOOR | 16.55 | 16.6599 | 0 |
| 1ST FLOOR | 13.55 | 4.1734 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.739$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

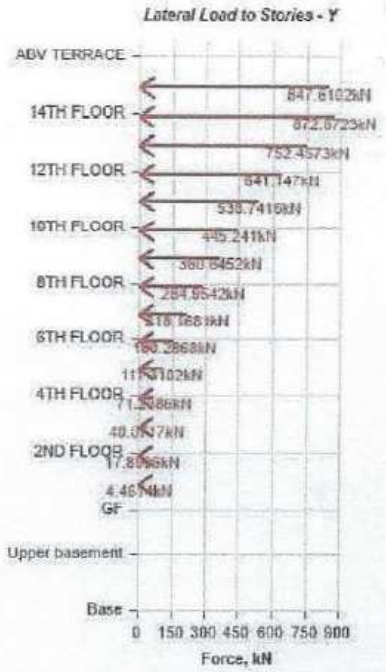
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.739 | 151887.1217 | 5366.8153 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 0 | 847.6102 |
| 14TH FLOOR | 52.55 | 0 | 872.6723 |
| 13TH FLOOR | 49.55 | 0 | 752.4573 |
| 12TH FLOOR | 46.55 | 0 | 641.147 |
| 11TH FLOOR | 43.55 | 0 | 538.7416 |
| 10TH FLOOR | 40.55 | 0 | 445.241 |
| 9TH FLOOR | 37.55 | 0 | 360.6452 |
| 8TH FLOOR | 34.55 | 0 | 284.9542 |
| 7TH FLOOR | 31.55 | 0 | 218.1681 |
| 6TH FLOOR | 28.55 | 0 | 160.2868 |
| 5TH FLOOR | 25.55 | 0 | 111.3102 |
| 4TH FLOOR | 22.55 | 0 | 71.2386 |

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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 0 | 40.0717 |
| 2ND FLOOR | 16.55 | 0 | 17.8096 |
| 1ST FLOOR | 13.55 | 0 | 4.4614 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.739$ sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] $Z = 0.16$
Response Reduction Factor, R [IS Table 9] $R = 5$
Importance Factor, I [IS Table 8] $I = 1.2$
Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

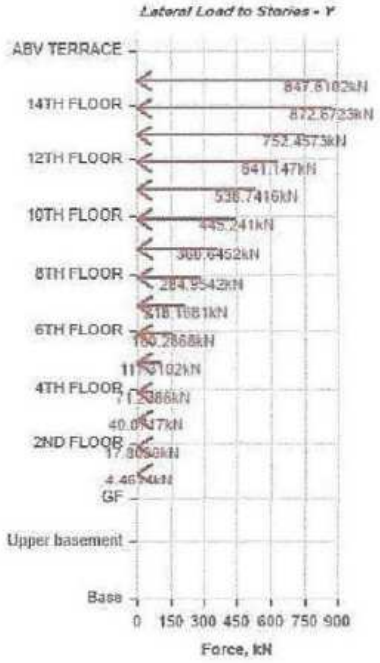
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.739 | 151887.1217 | 5366.8153 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 0 | 847.6102 |
| 14TH FLOOR | 52.55 | 0 | 872.6723 |
| 13TH FLOOR | 49.55 | 0 | 752.4573 |
| 12TH FLOOR | 46.55 | 0 | 641.147 |
| 11TH FLOOR | 43.55 | 0 | 538.7416 |
| 10TH FLOOR | 40.55 | 0 | 445.241 |
| 9TH FLOOR | 37.55 | 0 | 360.6452 |
| 8TH FLOOR | 34.55 | 0 | 284.9542 |
| 7TH FLOOR | 31.55 | 0 | 218.1681 |
| 6TH FLOOR | 28.55 | 0 | 160.2868 |
| 5TH FLOOR | 25.55 | 0 | 111.3102 |
| 4TH FLOOR | 22.55 | 0 | 71.2386 |

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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 0 | 40.0717 |
| 2ND FLOOR | 16.55 | 0 | 17.8096 |
| 1ST FLOOR | 13.55 | 0 | 4.4614 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

**Table 1.7 - Response Spectrum Function - IS 1893:2016**

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 1.508 | 0.663 | 4.1675 | 17.3683 |
| Modal | 2 | 1.433 | 0.698 | 4.3852 | 19.2297 |
| Modal | 3 | 1.2 | 0.833 | 5.2363 | 27.4194 |
| Modal | 4 | 0.614 | 1.627 | 10.2257 | 104.5645 |
| Modal | 5 | 0.545 | 1.836 | 11.5335 | 133.0221 |
| Modal | 6 | 0.445 | 2.247 | 14.1207 | 199.3931 |
| Modal | 7 | 0.422 | 2.369 | 14.8822 | 221.4787 |
| Modal | 8 | 0.353 | 2.836 | 17.8188 | 317.5111 |
| Modal | 9 | 0.315 | 3.179 | 19.9732 | 398.9288 |
| Modal | 10 | 0.226 | 4.418 | 27.7602 | 770.6262 |
| Modal | 11 | 0.15 | 6.673 | 41.9276 | 1757.9261 |
| Modal | 12 | 0.128 | 7.83 | 49.1994 | 2420.5847 |
| Modal-V | 1 | 1.508 | 0.663 | 4.1675 | 17.3683 |
| Modal-V | 2 | 1.433 | 0.698 | 4.3852 | 19.2297 |
| Modal-V | 3 | 1.2 | 0.833 | 5.2363 | 27.4194 |
| Modal-V | 4 | 0.619 | 1.615 | 10.1468 | 102.9569 |
| Modal-V | 5 | 0.611 | 1.636 | 10.2797 | 105.6731 |
| Modal-V | 6 | 0.592 | 1.689 | 10.6117 | 112.6074 |
| Modal-V | 7 | 0.462 | 2.164 | 13.5943 | 184.8059 |
| Modal-V | 8 | 0.399 | 2.505 | 15.741 | 247.7779 |
| Modal-V | 9 | 0.308 | 3.245 | 20.389 | 415.7107 |
| Modal-V | 10 | 0.189 | 5.281 | 33.182 | 1101.0429 |
| Modal-V | 11 | 0.149 | 6.693 | 42.0516 | 1768.3332 |
| Modal-V | 12 | 0.081 | 12.293 | 77.2378 | 5965.6822 |

**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.508 | 0.475 | 0.0001 | 1.37E-05 | 0.475 | 0.0001 | 1.37E-05 |
| Modal | 2 | 1.433 | 0.1893 | 0.0468 | 3.523E-06 | 0.6643 | 0.0469 | 1.722E-05 |
| Modal | 3 | 1.2 | 0.012 | 0.6011 | 4.361E-05 | 0.6763 | 0.648 | 0.0001 |
| Modal | 4 | 0.614 | 0.0001 | 0.0004 | 0.0081 | 0.6764 | 0.6484 | 0.0081 |
| Modal | 5 | 0.545 | 0.0011 | 2.646E-05 | 0.0001 | 0.6776 | 0.6484 | 0.0083 |
| Modal | 6 | 0.445 | 0.0879 | 0.0036 | 8.366E-06 | 0.7654 | 0.6521 | 0.0083 |
| Modal | 7 | 0.422 | 0.0784 | 0.0001 | 0.0002 | 0.8438 | 0.6522 | 0.0085 |
| Modal | 8 | 0.353 | 0.002 | 0.1075 | 0.0002 | 0.8458 | 0.7597 | 0.0087 |
| Modal | 9 | 0.315 | 0.0012 | 0.078 | 0.0003 | 0.847 | 0.8377 | 0.009 |
| Modal | 10 | 0.226 | 0.0737 | 0.0015 | 2.717E-05 | 0.9207 | 0.8392 | 0.009 |
| Modal | 11 | 0.15 | 0.0053 | 0.1085 | 7.129E-06 | 0.926 | 0.9477 | 0.009 |
| Modal | 12 | 0.128 | 0.0511 | 0.0062 | 1.995E-05 | 0.9771 | 0.9539 | 0.009 |
| Modal-V | 1 | 1.508 | 0.475 | 0.0001 | 1.37E-05 | 0.475 | 0.0001 | 1.37E-05 |
| Modal-V | 2 | 1.433 | 0.1893 | 0.0468 | 3.523E-06 | 0.6643 | 0.0469 | 1.722E-05 |
| Modal-V | 3 | 1.2 | 0.012 | 0.6011 | 4.361E-05 | 0.6763 | 0.648 | 0.0001 |
| Modal-V | 4 | 0.619 | 3.713E-05 | 0.0002 | 0.0023 | 0.6763 | 0.6481 | 0.0023 |
| Modal-V | 5 | 0.611 | 0.0001 | 0.0003 | 0.006 | 0.6765 | 0.6484 | 0.0083 |
| Modal-V | 6 | 0.592 | 0.0002 | 3.824E-06 | 0.0002 | 0.6766 | 0.6484 | 0.0086 |
| Modal-V | 7 | 0.462 | 0.0003 | 0 | 0.0048 | 0.6769 | 0.6484 | 0.0133 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal-V | 8 | 0.399 | 0.001 | 4.787E-05 | 0.0046 | 0.6779 | 0.6485 | 0.0179 |
| Modal-V | 9 | 0.308 | 0.0002 | 0.0002 | 0.0039 | 0.6781 | 0.6486 | 0.0219 |
| Modal-V | 10 | 0.189 | 6.76E-06 | 0.0005 | 0.1321 | 0.6781 | 0.6491 | 0.1539 |
| Modal-V | 11 | 0.149 | 8.083E-06 | 0.0001 | 0.5262 | 0.6781 | 0.6492 | 0.6801 |
| Modal-V | 12 | 0.061 | 1.36E-05 | 7.132E-07 | 0.2234 | 0.6781 | 0.6492 | 0.9035 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.0002 | 0.1824 | 0.1679 | 0.0002 | 0.1824 | 0.1679 |
| Modal | 2 | 0.0221 | 0.0662 | 0.3881 | 0.0223 | 0.2486 | 0.556 |
| Modal | 3 | 0.2711 | 0.004 | 0.0235 | 0.2934 | 0.2527 | 0.5795 |
| Modal | 4 | 0.0036 | 0.0002 | 0.0005 | 0.297 | 0.2528 | 0.58 |
| Modal | 5 | 0.0001 | 0.0004 | 0.0069 | 0.2971 | 0.2532 | 0.5869 |
| Modal | 6 | 0.0038 | 0.1399 | 0.0528 | 0.301 | 0.3931 | 0.6396 |
| Modal | 7 | 0.0004 | 0.1207 | 0.0769 | 0.3014 | 0.5138 | 0.7165 |
| Modal | 8 | 0.1613 | 0.0014 | 0.0203 | 0.4627 | 0.5152 | 0.7368 |
| Modal | 9 | 0.0939 | 0.003 | 0.0562 | 0.5567 | 0.5182 | 0.7929 |
| Modal | 10 | 0.0015 | 0.0958 | 0.0023 | 0.5582 | 0.614 | 0.7953 |
| Modal | 11 | 0.1517 | 0.0088 | 0.0001 | 0.7099 | 0.6228 | 0.7953 |
| Modal | 12 | 0.0104 | 0.1 | 0.0086 | 0.7203 | 0.7228 | 0.8039 |
| Modal-V | 1 | 0.0002 | 0.1824 | 0.1679 | 0.0002 | 0.1824 | 0.1679 |
| Modal-V | 2 | 0.0221 | 0.0662 | 0.3881 | 0.0223 | 0.2486 | 0.556 |
| Modal-V | 3 | 0.2711 | 0.004 | 0.0235 | 0.2934 | 0.2527 | 0.5795 |
| Modal-V | 4 | 0.0011 | 1.327E-05 | 4.53E-05 | 0.2945 | 0.2527 | 0.5795 |
| Modal-V | 5 | 0.0026 | 0.0002 | 0.0008 | 0.2971 | 0.2529 | 0.5803 |
| Modal-V | 6 | 0.0001 | 1.894E-05 | 0.0024 | 0.2972 | 0.2529 | 0.5828 |
| Modal-V | 7 | 0.0016 | 0.0086 | 4.979E-05 | 0.2988 | 0.2615 | 0.5828 |
| Modal-V | 8 | 0.0006 | 0.0084 | 0.0021 | 0.2994 | 0.2699 | 0.5849 |
| Modal-V | 9 | 0.0004 | 0.0019 | 0.0014 | 0.2998 | 0.2718 | 0.5864 |
| Modal-V | 10 | 0.0056 | 0.0045 | 0.0003 | 0.3053 | 0.2764 | 0.5866 |
| Modal-V | 11 | 3.095E-06 | 0.0006 | 0.0002 | 0.3053 | 0.277 | 0.5869 |
| Modal-V | 12 | 0.0102 | 0.0061 | 0.0006 | 0.3155 | 0.2831 | 0.5874 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.508 | 9.8E-05 | -2E-06 | -1E-06 | 0.03739 | 1.127483 | 0.73452 | 1E-06 | 2E-05 |
| Modal | 2 | 1.433 | 6.2E-05 | 3.1E-05 | 2.672E-07 | -0.385087 | 0.679417 | -1.116943 | 1E-06 | 2E-05 |
| Modal | 3 | 1.2 | -1.6E-05 | 0.00011 | -1E-06 | -1.348731 | -0.167789 | 0.274839 | 1E-06 | 3E-05 |
| Modal | 4 | 0.614 | 2E-06 | -3E-06 | -1.3E-05 | -0.156364 | 0.032539 | -0.040343 | 1E-06 | 0.0001 |
| Modal | 5 | 0.545 | 5E-06 | -1E-06 | 2E-06 | 0.020925 | -0.049735 | -0.148607 | 1E-06 | 0.00013 |
| Modal | 6 | 0.445 | -4.2E-05 | -9E-06 | 4.118E-07 | -0.160643 | 0.987509 | 0.411851 | 1E-06 | 0.0002 |
| Modal | 7 | 0.422 | -4E-05 | -1E-06 | -2E-06 | -0.054752 | 0.917039 | -0.497031 | 1E-06 | 0.00022 |
| Modal | 8 | 0.353 | -6E-06 | 4.7E-05 | 2E-06 | 1.040458 | 0.099477 | -0.255231 | 1E-06 | 0.00032 |
| Modal | 9 | 0.315 | 5E-06 | -4E-05 | 3E-06 | -0.793851 | -0.145172 | -0.424964 | 1E-06 | 0.0004 |
| Modal | 10 | 0.226 | 3.9E-05 | 6E-06 | -1E-06 | 0.101064 | -0.817255 | -0.085075 | 1E-06 | 0.00077 |
| Modal | 11 | 0.15 | -1E-05 | 4.7E-05 | 3.801E-07 | 1.008994 | 0.247017 | 0.016721 | 1E-06 | 0.00176 |
| Modal | 12 | 0.128 | -3.2E-05 | -1.1E-05 | -1E-06 | -0.264715 | 0.834959 | -0.16621 | 1E-06 | 0.00242 |
| Modal-V | 1 | 1.508 | -9.8E-05 | 2E-06 | 1E-06 | -0.03739 | -1.127483 | -0.73452 | 1E-06 | 2E-05 |
| Modal-V | 2 | 1.433 | -6.2E-05 | -3.1E-05 | -2.672E-07 | 0.385087 | -0.679417 | 1.116943 | 1E-06 | 2E-05 |
| Modal-V | 3 | 1.2 | -1.6E-05 | 0.00011 | -1E-06 | -1.348731 | -0.167789 | 0.274839 | 1E-06 | 3E-05 |
| Modal-V | 4 | 0.615 | -1E-05 | 2E-06 | 7E-06 | 0.006566 | 0.008615 | 0.012867 | 1E-06 | 0.0001 |
| Modal-V | 5 | 0.611 | 2E-06 | -2E-06 | -1.1E-05 | -0.131732 | 0.034973 | -0.05123 | 1E-06 | 0.00011 |
| Modal-V | 6 | 0.592 | 2E-06 | -2.784E-07 | 2E-06 | 0.028999 | -0.01149 | -0.088026 | 1E-06 | 0.00011 |

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIND X | Diaphragms | From Diaphragms | 0 | 0.8 | 0.5 | terr floor | GF | Yes | 1.2 | 50 | 3 | 1 |
| WIND Y | Diaphragms | From Diaphragms | 90 | 0.8 | 0.5 | terr floor | Base | Yes | 1.2 | 50 | 2 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

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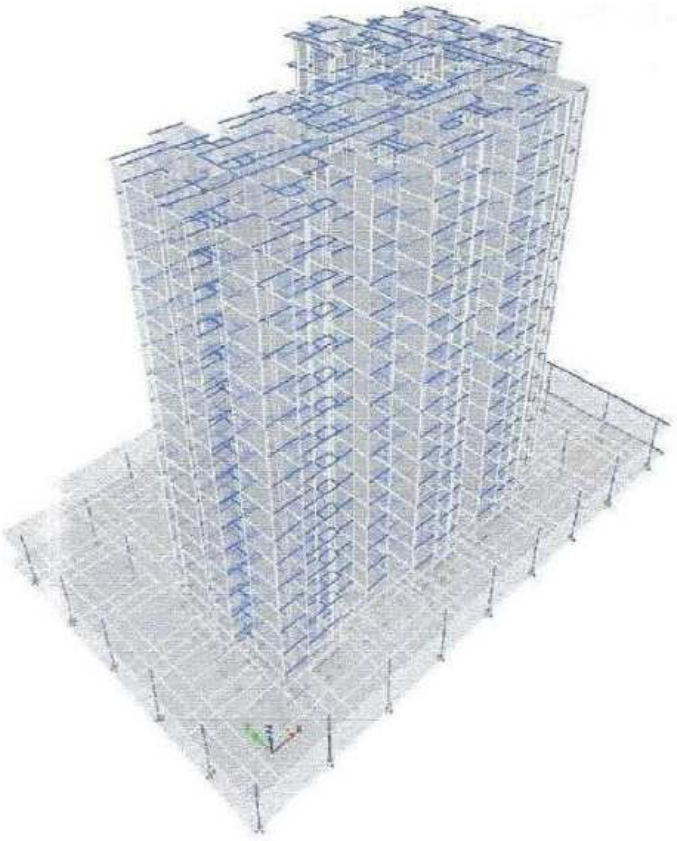

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        1.3.1 Response Spectrum Functions
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# Report for Block 13B

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| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal-v | 7 | 0.412 | -3.384E-07 | 4E-06 | -1E-06 | 0.036706 | -0.071708 | -0.130854 | 1E-06 | 0.00023 |
| Modal-v | 8 | 0.324 | -6E-06 | -2.2E-05 | 2E-06 | -0.349053 | 0.113114 | 1.549828 | 1E-06 | 0.00038 |
| Modal-v | 9 | 0.234 | 1E-06 | 4E-06 | 2.2E-05 | -0.204053 | -0.213862 | -0.042546 | 1E-06 | 0.00072 |
| Modal-v | 10 | 0.16 | 3.72E-07 | -8E-06 | 6.8E-05 | -0.374795 | 0.518985 | -0.039173 | 1E-06 | 0.00154 |
| Modal-v | 11 | 0.131 | 6.73E-08 | -5E-06 | -0.000141 | -0.280764 | 0.332773 | -0.017811 | 1E-06 | 0.00231 |
| Modal-v | 12 | 0.066 | 2.96E-07 | 6E-06 | -9E-05 | 0.166506 | -0.273885 | 0.015192 | 1E-06 | 0.00901 |

**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 99.21 |
| Modal | Acceleration | UY | 100 | 94.46 |
| Modal | Acceleration | UZ | 0.27 | 0.01 |
| Modal-v | Acceleration | UX | 99.55 | 82.31 |
| Modal-v | Acceleration | UY | 97.95 | 61.58 |
| Modal-v | Acceleration | UZ | 100 | 91.08 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal-v | 8 | 0.324 | 0.0009 | 0.0135 | 0.0001 | 0.8231 | 0.6122 | 0.0002 |
| Modal-v | 9 | 0.234 | 8.141E-06 | 0.0005 | 0.0128 | 0.8231 | 0.6127 | 0.013 |
| Modal-v | 10 | 0.16 | 3.822E-06 | 0.0016 | 0.1267 | 0.8231 | 0.6143 | 0.1397 |
| Modal-v | 11 | 0.131 | 0 | 0.0007 | 0.5463 | 0.8231 | 0.6149 | 0.686 |
| Modal-v | 12 | 0.066 | 2.42E-06 | 0.0008 | 0.2248 | 0.8231 | 0.6158 | 0.9108 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.0055 | 0.1335 | 0.0005 | 0.0055 | 0.1335 | 0.0005 |
| Modal | 2 | 0.0569 | 0.0005 | 0.4314 | 0.0624 | 0.134 | 0.4319 |
| Modal | 3 | 0.2959 | 0.001 | 0.1211 | 0.3583 | 0.135 | 0.553 |
| Modal | 4 | 0.0181 | 2.928E-05 | 0.0058 | 0.3764 | 0.1351 | 0.5588 |
| Modal | 5 | 0.0004 | 0.1075 | 3.825E-05 | 0.3768 | 0.2426 | 0.5589 |
| Modal | 6 | 2.523E-06 | 0.0001 | 4.396E-05 | 0.3768 | 0.2426 | 0.5589 |
| Modal | 7 | 0.0196 | 0.0004 | 0.0532 | 0.3964 | 0.2431 | 0.6121 |
| Modal | 8 | 0.0016 | 0.0376 | 0.0001 | 0.398 | 0.2807 | 0.6122 |
| Modal | 9 | 0.1737 | 1.268E-06 | 0.0045 | 0.5717 | 0.2807 | 0.6167 |
| Modal | 10 | 0.0002 | 0.0381 | 0.0049 | 0.5718 | 0.3188 | 0.6216 |
| Modal | 11 | 0.0198 | 0.0285 | 0.0086 | 0.5917 | 0.3473 | 0.6301 |
| Modal | 12 | 0.1621 | 0.0043 | 0.0033 | 0.7538 | 0.3515 | 0.6334 |
| Modal-v | 1 | 0.0055 | 0.1335 | 0.0005 | 0.0055 | 0.1335 | 0.0005 |
| Modal-v | 2 | 0.0569 | 0.0005 | 0.4314 | 0.0624 | 0.134 | 0.4319 |
| Modal-v | 3 | 0.2959 | 0.001 | 0.1211 | 0.3583 | 0.135 | 0.553 |
| Modal-v | 4 | 0.0181 | 2.927E-05 | 0.0058 | 0.3764 | 0.1351 | 0.5588 |
| Modal-v | 5 | 0.0004 | 0.1075 | 3.878E-05 | 0.3768 | 0.2425 | 0.5588 |
| Modal-v | 6 | 0.0004 | 0.0003 | 0.0001 | 0.3772 | 0.2428 | 0.559 |
| Modal-v | 7 | 0.0001 | 0.0002 | 0.0009 | 0.3773 | 0.243 | 0.5599 |
| Modal-v | 8 | 0.011 | 0.0005 | 0.1264 | 0.3882 | 0.2435 | 0.6883 |
| Modal-v | 9 | 0.0037 | 0.0017 | 0.0001 | 0.392 | 0.2452 | 0.6884 |
| Modal-v | 10 | 0.0126 | 0.0103 | 0.0001 | 0.4046 | 0.2555 | 0.6885 |
| Modal-v | 11 | 0.0071 | 0.0042 | 1.696E-05 | 0.4117 | 0.2597 | 0.6885 |
| Modal-v | 12 | 0.0025 | 0.0029 | 1.234E-05 | 0.4142 | 0.2626 | 0.6885 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.887 | 0.000153 | 1.8E-05 | -6.188E-08 | -0.246452 | 1.870763 | -0.097648 | 1E-06 | 1E-05 |
| Modal | 2 | 1.231 | -1.2E-05 | 5.7E-05 | 1E-06 | -0.795318 | -0.116106 | -2.840796 | 1E-06 | 3E-05 |
| Modal | 3 | 1.148 | 1.7E-05 | -0.00013 | -5.795E-08 | 1.813216 | 0.16435 | -1.505362 | 1E-06 | 3E-05 |
| Modal | 4 | 1.016 | 2E-06 | -3.4E-05 | 1E-06 | 0.448876 | 0.027706 | 0.328551 | 1E-06 | 4E-05 |
| Modal | 5 | 0.576 | 7.7E-05 | 8E-06 | 2.182E-07 | 0.067415 | -1.676905 | 0.026751 | 1E-06 | 0.00012 |
| Modal | 6 | 0.527 | -3E-06 | 1E-06 | -8.567E-08 | 0.005295 | 0.04128 | 0.028678 | 1E-06 | 0.00014 |
| Modal | 7 | 0.333 | -1E-06 | -3E-05 | 2E-06 | -0.466196 | 0.106908 | 0.997646 | 1E-06 | 0.00036 |
| Modal | 8 | 0.321 | 5.2E-05 | -8E-06 | -2.39E-07 | -0.134113 | -0.993381 | -0.032148 | 1E-06 | 0.00038 |
| Modal | 9 | 0.273 | -8.426E-08 | 8.2E-05 | 2.757E-07 | 1.389182 | 0.005766 | 0.29058 | 1E-06 | 0.00053 |
| Modal | 10 | 0.222 | -4.4E-05 | 2E-06 | -1E-06 | 0.042686 | 0.999313 | -0.302354 | 1E-06 | 0.0008 |
| Modal | 11 | 0.129 | -3.7E-05 | -2.3E-05 | 2.209E-07 | -0.469452 | 0.864014 | 0.400444 | 1E-06 | 0.00236 |
| Modal | 12 | 0.12 | 1.4E-05 | -6.6E-05 | 2.363E-07 | -1.342199 | -0.333962 | 0.246961 | 1E-06 | 0.00276 |
| Modal-v | 1 | 1.887 | -0.000153 | -1.8E-05 | 6.188E-08 | 0.246452 | -1.870763 | 0.097648 | 1E-06 | 1E-05 |
| Modal-v | 2 | 1.231 | 1.2E-05 | 5.7E-05 | -1E-06 | 0.795318 | 0.116106 | 2.840795 | 1E-06 | 3E-05 |
| Modal-v | 3 | 1.148 | -1.7E-05 | 0.00013 | 5.794E-08 | -1.813216 | -0.16435 | 1.505357 | 1E-06 | 3E-05 |
| Modal-v | 4 | 1.016 | 2E-06 | -3.4E-05 | 1E-06 | 0.448874 | 0.027705 | 0.328522 | 1E-06 | 4E-05 |
| Modal-v | 5 | 0.576 | -7.7E-05 | -8E-06 | -2.192E-07 | -0.066992 | 1.678626 | -0.026936 | 1E-06 | 0.00012 |
| Modal-v | 6 | 0.514 | -3E-06 | -3E-06 | -1.283E-08 | -0.063182 | 0.087341 | 0.046783 | 1E-06 | 0.00015 |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 1.887 | 0.53 | 3.3298 | 11.0873 |
| Modal | 2 | 1.231 | 0.812 | 5.1032 | 26.0431 |
| Modal | 3 | 1.148 | 0.871 | 5.4717 | 29.94 |
| Modal | 4 | 1.016 | 0.984 | 6.1856 | 38.262 |
| Modal | 5 | 0.576 | 1.735 | 10.8994 | 118.7969 |
| Modal | 6 | 0.527 | 1.898 | 11.9276 | 142.2675 |
| Modal | 7 | 0.333 | 3.003 | 18.8675 | 355.981 |
| Modal | 8 | 0.321 | 3.118 | 19.5881 | 383.695 |
| Modal | 9 | 0.273 | 3.663 | 23.0151 | 529.6943 |
| Modal | 10 | 0.222 | 4.503 | 28.2905 | 800.3512 |
| Modal | 11 | 0.129 | 7.738 | 48.6184 | 2363.7475 |
| Modal | 12 | 0.12 | 8.368 | 52.5766 | 2764.3008 |
| Modal-v | 1 | 1.887 | 0.53 | 3.3298 | 11.0873 |
| Modal-v | 2 | 1.231 | 0.812 | 5.1032 | 26.0431 |
| Modal-v | 3 | 1.148 | 0.871 | 5.4717 | 29.94 |
| Modal-v | 4 | 1.016 | 0.984 | 6.1856 | 38.262 |
| Modal-v | 5 | 0.576 | 1.735 | 10.8994 | 118.797 |
| Modal-v | 6 | 0.514 | 1.945 | 12.2208 | 149.3478 |
| Modal-v | 7 | 0.412 | 2.428 | 15.2577 | 232.7968 |
| Modal-v | 8 | 0.324 | 3.083 | 19.3708 | 375.2277 |
| Modal-v | 9 | 0.234 | 4.271 | 26.8327 | 719.9951 |
| Modal-v | 10 | 0.16 | 6.236 | 39.1838 | 1535.3663 |
| Modal-v | 11 | 0.131 | 7.654 | 48.0891 | 2312.5579 |
| Modal-v | 12 | 0.066 | 15.105 | 94.9071 | 9007.3519 |

**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.887 | 0.6463 | 0.0093 | 0 | 0.6463 | 0.0093 | 0 |
| Modal | 2 | 1.231 | 0.0042 | 0.0905 | 1.28E-05 | 0.6505 | 0.0998 | 1.291E-05 |
| Modal | 3 | 1.148 | 0.0079 | 0.4643 | 0 | 0.6584 | 0.5641 | 1.3E-05 |
| Modal | 4 | 1.016 | 0.0001 | 0.0319 | 8.451E-06 | 0.6585 | 0.596 | 2.145E-05 |
| Modal | 5 | 0.576 | 0.1635 | 0.0018 | 1.315E-06 | 0.8219 | 0.5978 | 2.277E-05 |
| Modal | 6 | 0.527 | 0.0002 | 1.23E-05 | 0 | 0.8221 | 0.5978 | 2.297E-05 |
| Modal | 7 | 0.333 | 4.644E-05 | 0.0249 | 0.0001 | 0.8221 | 0.6227 | 0.0001 |
| Modal | 8 | 0.321 | 0.0734 | 0.0018 | 1.577E-06 | 0.8956 | 0.6245 | 0.0001 |
| Modal | 9 | 0.273 | 0 | 0.1866 | 2.099E-06 | 0.8956 | 0.8111 | 0.0001 |
| Modal | 10 | 0.222 | 0.053 | 0.0001 | 8.964E-06 | 0.9485 | 0.8112 | 0.0001 |
| Modal | 11 | 0.129 | 0.0383 | 0.0149 | 1.348E-06 | 0.9869 | 0.8261 | 0.0001 |
| Modal | 12 | 0.12 | 0.0052 | 0.1185 | 1.542E-06 | 0.9921 | 0.9446 | 0.0001 |
| Modal-v | 1 | 1.887 | 0.6463 | 0.0093 | 0 | 0.6463 | 0.0093 | 0 |
| Modal-v | 2 | 1.231 | 0.0042 | 0.0905 | 1.28E-05 | 0.6505 | 0.0998 | 1.291E-05 |
| Modal-v | 3 | 1.148 | 0.0079 | 0.4643 | 0 | 0.6584 | 0.5641 | 1.3E-05 |
| Modal-v | 4 | 1.016 | 0.0001 | 0.0319 | 8.45E-06 | 0.6585 | 0.596 | 2.145E-05 |
| Modal-v | 5 | 0.576 | 0.1635 | 0.0018 | 1.327E-06 | 0.8219 | 0.5978 | 2.278E-05 |
| Modal-v | 6 | 0.514 | 0.0002 | 0.0003 | 0 | 0.8221 | 0.5982 | 2.278E-05 |
| Modal-v | 7 | 0.412 | 3.162E-06 | 0.0006 | 7.522E-06 | 0.8221 | 0.5987 | 3.031E-05 |

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## 1.3 Functions

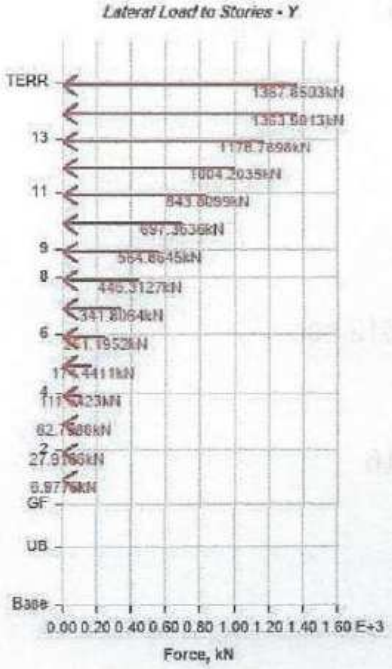
### 1.3.1 Response Spectrum Functions

Table 1.9 - Response Spectrum Function - IS 1893:2016

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 0 | 1367.6503 |
| 14 | 52.55 | 0 | 1363.9913 |
| 13 | 49.55 | 0 | 1178.7898 |
| 12 | 46.55 | 0 | 1004.2035 |
| 11 | 43.55 | 0 | 843.8099 |
| 10 | 40.55 | 0 | 697.3636 |
| 9 | 37.55 | 0 | 564.8645 |
| 8 | 34.55 | 0 | 446.3127 |
| 7 | 31.55 | 0 | 341.8064 |
| 6 | 28.55 | 0 | 251.1952 |
| 5 | 25.55 | 0 | 174.4411 |
| 4 | 22.55 | 0 | 111.6423 |
| 3 | 19.55 | 0 | 62.7988 |
| 2 | 16.55 | 0 | 27.9106 |
| 1 | 13.55 | 0 | 6.9776 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y - Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.812$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

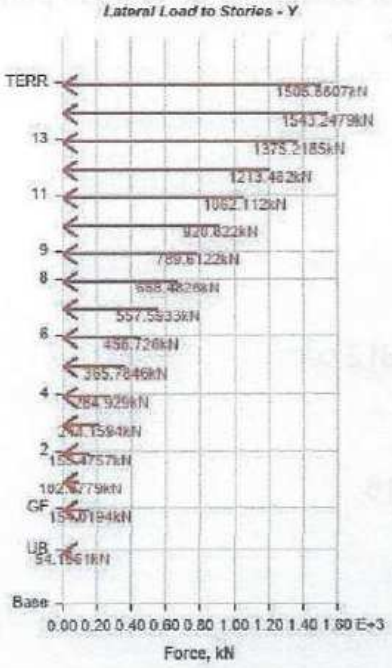
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y - Ecc. X | 0.812 | 262444.6114 | 8443.7576 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 0 | 1506.8807 |
| 14 | 52.55 | 0 | 1543.2479 |
| 13 | 49.55 | 0 | 1375.2185 |
| 12 | 46.55 | 0 | 1213.482 |
| 11 | 43.55 | 0 | 1062.112 |
| 10 | 40.55 | 0 | 920.822 |
| 9 | 37.55 | 0 | 789.6122 |
| 8 | 34.55 | 0 | 668.4826 |
| 7 | 31.55 | 0 | 557.5933 |
| 6 | 28.55 | 0 | 456.726 |
| 5 | 25.55 | 0 | 365.7846 |
| 4 | 22.55 | 0 | 284.929 |
| 3 | 19.55 | 0 | 214.1594 |
| 2 | 16.55 | 0 | 153.4757 |
| 1 | 13.55 | 0 | 102.8779 |
| GF | 10.55 | 0 | 154.0194 |
| UB | 5.9 | 0 | 54.1651 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.812$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

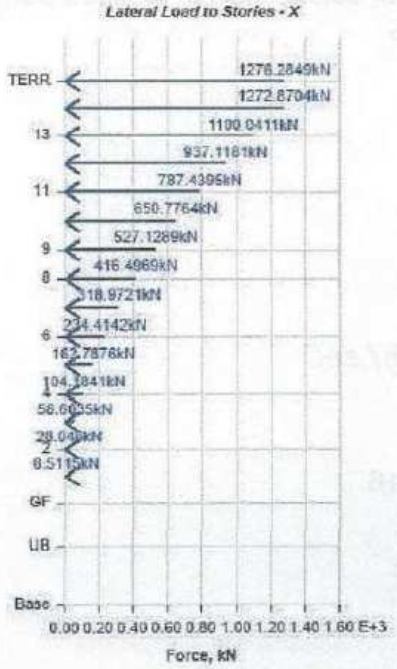
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.812 | 355062.2002 | 11423.5882 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 1276.2849 | 0 |
| 14 | 52.55 | 1272.8704 | 0 |
| 13 | 49.55 | 1100.0411 | 0 |
| 12 | 46.55 | 937.1181 | 0 |
| 11 | 43.55 | 787.4395 | 0 |
| 10 | 40.55 | 650.7764 | 0 |
| 9 | 37.55 | 527.1289 | 0 |
| 8 | 34.55 | 416.4969 | 0 |
| 7 | 31.55 | 318.9721 | 0 |
| 6 | 28.55 | 234.4142 | 0 |
| 5 | 25.55 | 162.7876 | 0 |
| 4 | 22.55 | 104.1841 | 0 |
| 3 | 19.55 | 58.6035 | 0 |
| 2 | 16.55 | 26.046 | 0 |
| 1 | 13.55 | 6.5115 | 0 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.87$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

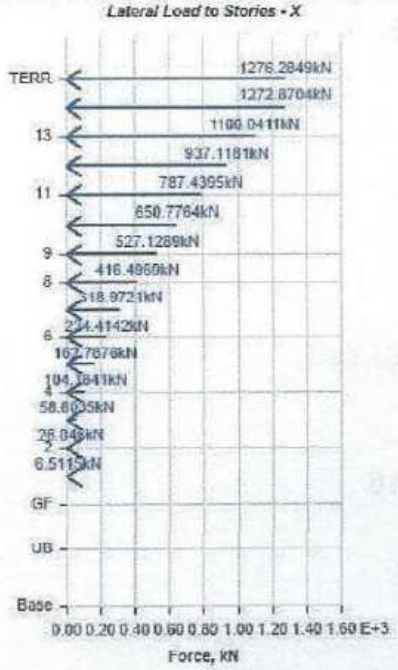
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X - Ecc. Y | 0.87 | 262444.6114 | 7879.6754 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 1276.2849 | 0 |
| 14 | 52.55 | 1272.8704 | 0 |
| 13 | 49.55 | 1100.0411 | 0 |
| 12 | 46.55 | 937.1181 | 0 |
| 11 | 43.55 | 787.4395 | 0 |
| 10 | 40.55 | 650.7764 | 0 |
| 9 | 37.55 | 527.1289 | 0 |
| 8 | 34.55 | 416.4969 | 0 |
| 7 | 31.55 | 318.9721 | 0 |
| 6 | 28.55 | 234.4142 | 0 |
| 5 | 25.55 | 162.7876 | 0 |
| 4 | 22.55 | 104.1841 | 0 |
| 3 | 19.55 | 58.6035 | 0 |
| 2 | 16.55 | 26.046 | 0 |
| 1 | 13.55 | 6.5115 | 0 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.87$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

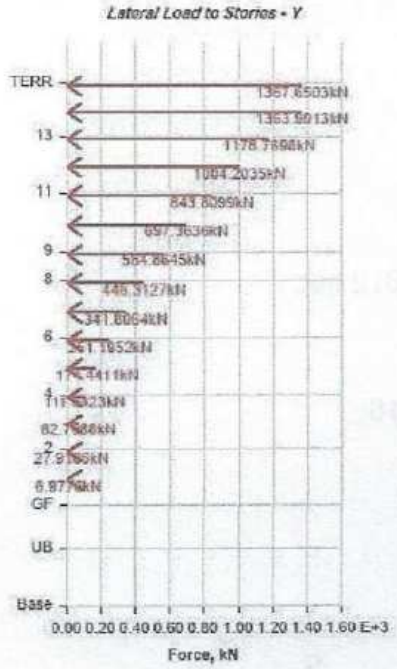
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X + Ecc. Y | 0.87 | 262444.6114 | 7879.6754 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 0 | 1367.6503 |
| 14 | 52.55 | 0 | 1363.9913 |
| 13 | 49.55 | 0 | 1178.7898 |
| 12 | 46.55 | 0 | 1004.2035 |
| 11 | 43.55 | 0 | 843.8099 |
| 10 | 40.55 | 0 | 697.3636 |
| 9 | 37.55 | 0 | 564.8645 |
| 8 | 34.55 | 0 | 446.3127 |
| 7 | 31.55 | 0 | 341.8064 |
| 6 | 28.55 | 0 | 251.1952 |
| 5 | 25.55 | 0 | 174.4411 |
| 4 | 22.55 | 0 | 111.6423 |
| 3 | 19.55 | 0 | 62.7988 |
| 2 | 16.55 | 0 | 27.9106 |
| 1 | 13.55 | 0 | 6.9776 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.812$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 1.512198$

**Equivalent Lateral Forces**

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

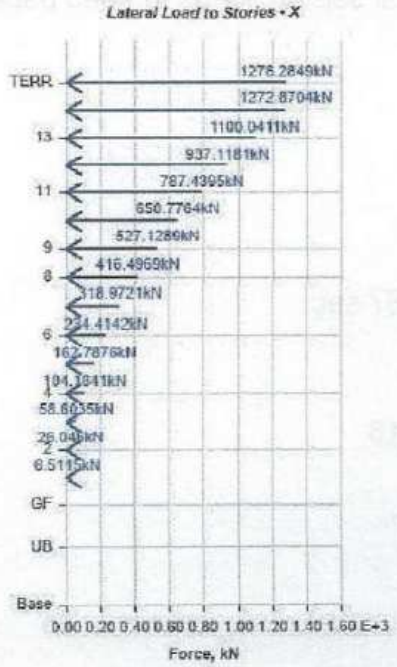
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y | 0.812 | 262444.6114 | 8443.7576 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERR | 55.5 | 1276.2849 | 0 |
| 14 | 52.55 | 1272.8704 | 0 |
| 13 | 49.55 | 1100.0411 | 0 |
| 12 | 46.55 | 937.1181 | 0 |
| 11 | 43.55 | 787.4395 | 0 |
| 10 | 40.55 | 650.7764 | 0 |
| 9 | 37.55 | 527.1289 | 0 |
| 8 | 34.55 | 416.4969 | 0 |
| 7 | 31.55 | 318.9721 | 0 |
| 6 | 28.55 | 234.4142 | 0 |
| 5 | 25.55 | 162.7876 | 0 |
| 4 | 22.55 | 104.1841 | 0 |
| 3 | 19.55 | 58.6035 | 0 |
| 2 | 16.55 | 26.046 | 0 |
| 1 | 13.55 | 6.5115 | 0 |
| GF | 10.55 | 0 | 0 |
| UB | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.87$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 0.938143$

**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 | 0.87 | 262444.6114 | 7879.6754 |

**Applied Story Forces**

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## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQX | Seismic | X | | No | User Specified | 0.87 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQY | Seismic | Y | | No | User Specified | 0.812 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQXP | Seismic | X + Ecc. Y | 5 | No | User Specified | 0.87 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.87 | TERR | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.812 | TERR | Base | Per Code | 0.16 | II | 1.2 |
| EQYN | Seismic | Y - Ecc. X | 5 | No | User Specified | 0.812 | TERR | GF | Per Code | 0.16 | II | 1.2 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.87 | 0.030024 | 262444.6114 | 7879.6754 |
| 5 | 0.812 | 0.032173 | 262444.6114 | 8443.7576 |
| 5 | 0.87 | 0.030024 | 262444.6114 | 7879.6754 |
| 5 | 0.87 | 0.030024 | 262444.6114 | 7879.6754 |
| 5 | 0.812 | 0.032173 | 355062.2002 | 11423.5882 |
| 5 | 0.812 | 0.032173 | 262444.6114 | 8443.7576 |

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WX | Diaphragms | From Diaphragms | 0 | 0.8 | 0.5 | TERR | GF | Yes | 1.2 | 50 | 2 | 1 |
| WY | Diaphragms | From Diaphragms | 90 | 0.8 | 0.5 | TERR | GF | Yes | 1.2 | 50 | 2 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

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Table 1.2 Auto Seismic - IS 1893:2016

Table 1.9 Response Spectrum Function - IS 1893:2016

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Table 2.2 Modal Participating Mass Ratios

Table 2.3 Modal Participation Factors

Table 2.4 Modal Load Participation Ratios

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ETABS® version 17

Integrated Building Design Software



# Report for Block-13A

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| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal-V | 7 | 0.462 | 2E-06 | 9.617E-08 | 1E-05 | 0.102058 | -0.244897 | -0.012651 | 1E-06 | 0.00018 |
| Modal-V | 8 | 0.399 | -5E-06 | -1E-06 | -1E-05 | 0.063076 | 0.242671 | -0.082671 | 1E-06 | 0.00025 |
| Modal-V | 9 | 0.308 | 2E-06 | -2E-06 | -9E-06 | -0.050009 | 0.114819 | 0.067545 | 1E-06 | 0.00042 |
| Modal-V | 10 | 0.189 | -3.701E-07 | 3E-06 | -5.2E-05 | -0.193648 | -0.177815 | -0.02945 | 1E-06 | 0.0011 |
| Modal-V | 11 | 0.149 | 4.048E-07 | -2E-06 | -0.000103 | 0.004557 | -0.065763 | 0.027283 | 1E-06 | 0.00177 |
| Modal-V | 12 | 0.081 | -1E-06 | -1.202E-07 | -8.7E-05 | 0.261252 | 0.206417 | -0.043005 | 1E-06 | 0.00597 |

**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 97.71 |
| Modal | Acceleration | UY | 100 | 95.39 |
| Modal | Acceleration | UZ | 14.05 | 0.9 |
| Modal-V | Acceleration | UX | 97.6 | 67.81 |
| Modal-V | Acceleration | UY | 97.53 | 84.92 |
| Modal-V | Acceleration | UZ | 100 | 90.35 |

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## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQX | Seismic | X | | No | User Specified | 0.687 | terr floor | GF | Per Code | 0.16 | II | 1.2 |
| EQY | Seismic | Y | | No | User Specified | 0.67 | terr floor | GF | Per Code | 0.16 | II | 1.2 |
| EQXP | Seismic | X + Ecc. Y | 5 | No | User Specified | 0.687 | terr floor | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.687 | terr floor | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.67 | terr floor | GF | Per Code | 0.36 | II | 1.2 |
| EQYN | Seismic | Y - Ecc. X | 5 | No | User Specified | 0.67 | terr floor | GF | Per Code | 0.16 | II | 1.2 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.687 | 0.037992 | 220169.7123 | 8364.7192 |
| 5 | 0.67 | 0.038956 | 220169.7123 | 8576.8634 |
| 5 | 0.687 | 0.037992 | 220169.7123 | 8364.7192 |
| 5 | 0.687 | 0.037992 | 220169.7123 | 8364.7192 |
| 5 | 0.67 | 0.08765 | 220169.7123 | 19297.9426 |
| 5 | 0.67 | 0.038956 | 220169.7123 | 8576.8634 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.687$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 0.724634$

**Equivalent Lateral Forces**

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

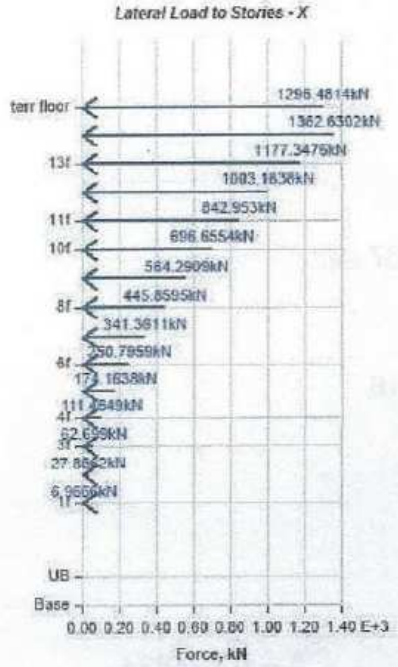
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X | 0.687 | 220169.7123 | 8364.7192 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| terr floor | 52.6 | 1296.4814 | 0 |
| 14f | 49.65 | 1362.6302 | 0 |
| 13f | 46.65 | 1177.3476 | 0 |
| 12f | 43.65 | 1003.1838 | 0 |
| 11f | 40.65 | 842.953 | 0 |
| 10f | 37.65 | 696.6554 | 0 |
| 9f | 34.65 | 564.2909 | 0 |
| 8f | 31.65 | 445.8595 | 0 |
| 7f | 28.65 | 341.3611 | 0 |
| 6f | 25.65 | 250.7959 | 0 |
| 5f | 22.65 | 174.1638 | 0 |
| 4f | 19.65 | 111.4649 | 0 |
| 3f | 16.65 | 62.699 | 0 |
| 2f | 13.65 | 27.8662 | 0 |
| 1f | 10.65 | 6.9666 | 0 |
| GF | 7.65 | 0 | 0 |
| UB | 3 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.67$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 0.724634$

**Equivalent Lateral Forces**

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

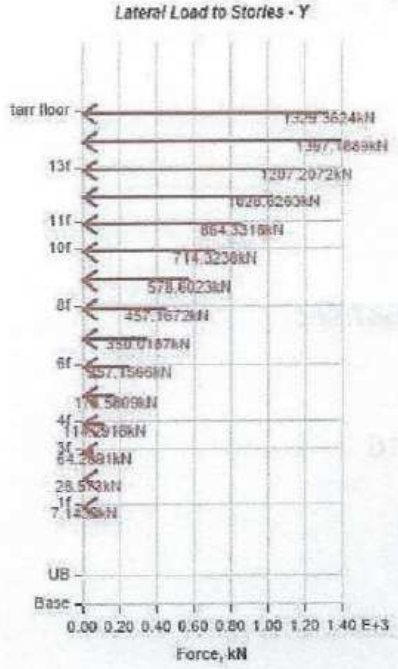
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y | 0.67 | 220169.7123 | 8576.8634 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| terr floor | 52.6 | 0 | 1329.3624 |
| 14f | 49.65 | 0 | 1397.1889 |
| 13f | 46.65 | 0 | 1207.2072 |
| 12f | 43.65 | 0 | 1028.6263 |
| 11f | 40.65 | 0 | 864.3318 |
| 10f | 37.65 | 0 | 714.3238 |
| 9f | 34.65 | 0 | 578.6023 |
| 8f | 31.65 | 0 | 457.1672 |
| 7f | 28.65 | 0 | 350.0187 |
| 6f | 25.65 | 0 | 257.1566 |
| 5f | 22.65 | 0 | 178.5809 |
| 4f | 19.65 | 0 | 114.2918 |
| 3f | 16.65 | 0 | 64.2891 |
| 2f | 13.65 | 0 | 28.573 |
| 1f | 10.65 | 0 | 7.1432 |
| GF | 7.65 | 0 | 0 |
| UB | 3 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.687$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

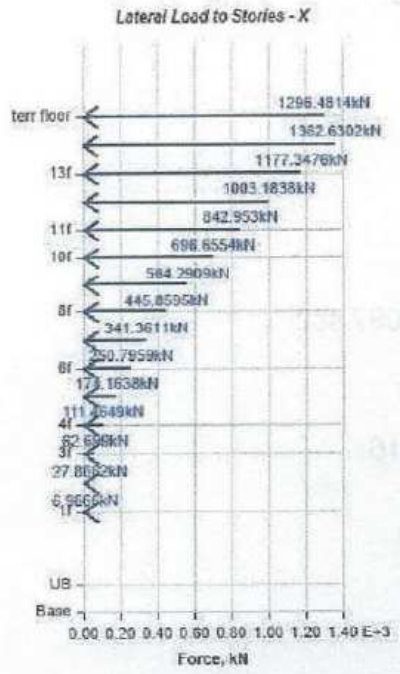
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X + Ecc. Y | 0.687 | 220169.7123 | 8364.7192 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| terr floor | 52.6 | 1296.4814 | 0 |
| 14f | 49.65 | 1362.6302 | 0 |
| 13f | 46.65 | 1177.3476 | 0 |
| 12f | 43.65 | 1003.1838 | 0 |
| 11f | 40.65 | 842.953 | 0 |
| 10f | 37.65 | 696.6554 | 0 |
| 9f | 34.65 | 564.2909 | 0 |
| 8f | 31.65 | 445.8595 | 0 |
| 7f | 28.65 | 341.3611 | 0 |
| 6f | 25.65 | 250.7959 | 0 |
| 5f | 22.65 | 174.1638 | 0 |
| 4f | 19.65 | 111.4649 | 0 |
| 3f | 16.65 | 62.699 | 0 |
| 2f | 13.65 | 27.8662 | 0 |
| 1f | 10.65 | 6.9666 | 0 |
| GF | 7.65 | 0 | 0 |
| UB | 3 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.687$ sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] $Z = 0.16$
Response Reduction Factor, R [IS Table 9] $R = 5$
Importance Factor, I [IS Table 8] $I = 1.2$
Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

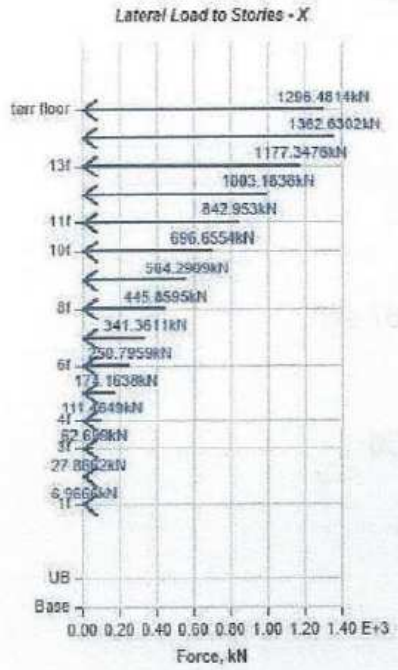
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X - Ecc. Y | 0.687 | 220169.7123 | 8364.7192 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| terr floor | 52.6 | 1296.4814 | 0 |
| 14f | 49.65 | 1362.6302 | 0 |
| 13f | 46.65 | 1177.3476 | 0 |
| 12f | 43.65 | 1003.1838 | 0 |
| 11f | 40.65 | 842.953 | 0 |
| 10f | 37.65 | 696.6554 | 0 |
| 9f | 34.65 | 564.2909 | 0 |
| 8f | 31.65 | 445.8595 | 0 |
| 7f | 28.65 | 341.3611 | 0 |
| 6f | 25.65 | 250.7959 | 0 |
| 5f | 22.65 | 174.1638 | 0 |
| 4f | 19.65 | 111.4649 | 0 |
| 3f | 16.65 | 62.699 | 0 |
| 2f | 13.65 | 27.8662 | 0 |
| 1f | 10.65 | 6.9666 | 0 |
| GF | 7.65 | 0 | 0 |
| UB | 3 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.67$ sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] $Z = 0.36$

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

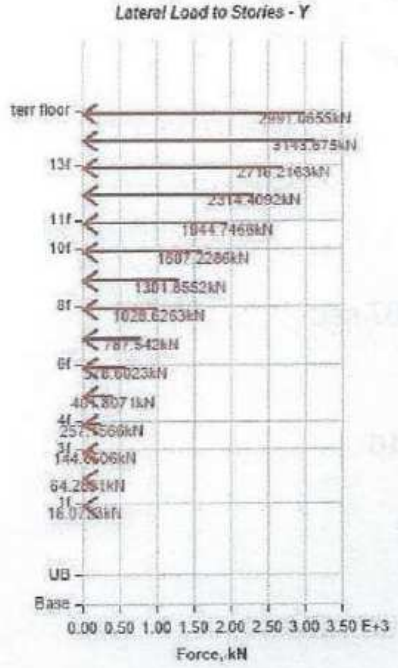
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y + Ecc. X | 0.67 | 220169.7123 | 19297.9426 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| terr floor | 52.6 | 0 | 2991.0655 |
| 14f | 49.65 | 0 | 3143.675 |
| 13f | 46.65 | 0 | 2716.2163 |
| 12f | 43.65 | 0 | 2314.4092 |
| 11f | 40.65 | 0 | 1944.7466 |
| 10f | 37.65 | 0 | 1607.2286 |
| 9f | 34.65 | 0 | 1301.8552 |
| 8f | 31.65 | 0 | 1028.6263 |
| 7f | 28.65 | 0 | 787.542 |
| 6f | 25.65 | 0 | 578.6023 |
| 5f | 22.65 | 0 | 401.8071 |
| 4f | 19.65 | 0 | 257.1566 |
| 3f | 16.65 | 0 | 144.6506 |
| 2f | 13.65 | 0 | 64.2891 |
| 1f | 10.65 | 0 | 16.0723 |
| GF | 7.65 | 0 | 0 |
| UB | 3 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y - Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period T = 0.67 sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] Z = 0.16
Response Reduction Factor, R [IS Table 9] R = 5
Importance Factor, I [IS Table 8] I = 1.2
Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

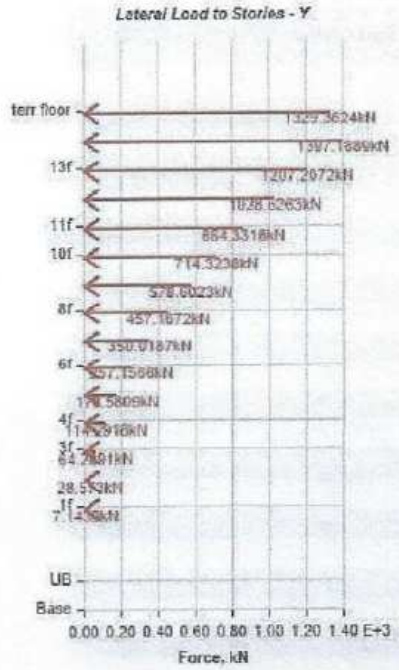
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| Y - Ecc. X | 0.67 | 220169.7123 | 8576.8634 |

**Applied Story Forces**

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N. N - Nagendra




| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| terr floor | 52.6 | 0 | 1329.3624 |
| 14f | 49.65 | 0 | 1397.1889 |
| 13f | 46.65 | 0 | 1207.2072 |
| 12f | 43.65 | 0 | 1028.6263 |
| 11f | 40.65 | 0 | 864.3318 |
| 10f | 37.65 | 0 | 714.3238 |
| 9f | 34.65 | 0 | 578.6023 |
| 8f | 31.65 | 0 | 457.1672 |
| 7f | 28.65 | 0 | 350.0187 |
| 6f | 25.65 | 0 | 257.1566 |
| 5f | 22.65 | 0 | 178.5809 |
| 4f | 19.65 | 0 | 114.2918 |
| 3f | 16.65 | 0 | 64.2691 |
| 2f | 13.65 | 0 | 28.573 |
| 1f | 10.65 | 0 | 7.1432 |
| GF | 7.65 | 0 | 0 |
| UB | 3 | 0 | 0 |
| Base | 0 | 0 | 0 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

Table 1.9 - Response Spectrum Function - IS 1893:2016

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 1.824 | 0.548 | 3.4439 | 11.8608 |
| Modal | 2 | 1.664 | 0.601 | 3.7756 | 14.255 |
| Modal | 3 | 1.185 | 0.844 | 5.3044 | 28.1371 |
| Modal | 4 | 0.494 | 2.026 | 12.7279 | 161.9997 |
| Modal | 5 | 0.436 | 2.293 | 14.4096 | 207.6378 |
| Modal | 6 | 0.424 | 2.361 | 14.8334 | 220.0312 |
| Modal | 7 | 0.303 | 3.303 | 20.7535 | 430.707 |
| Modal | 8 | 0.248 | 4.031 | 25.3288 | 641.5475 |
| Modal | 9 | 0.195 | 5.125 | 32.2016 | 1036.946 |
| Modal | 10 | 0.166 | 6.03 | 37.8905 | 1435.6925 |
| Modal | 11 | 0.112 | 8.949 | 56.2282 | 3161.6065 |
| Modal | 12 | 0.089 | 11.238 | 70.6089 | 4985.6171 |
| Modal V | 1 | 1.824 | 0.548 | 3.4439 | 11.8608 |
| Modal V | 2 | 1.664 | 0.601 | 3.7756 | 14.255 |
| Modal V | 3 | 1.185 | 0.844 | 5.3044 | 28.1371 |
| Modal V | 4 | 0.493 | 2.027 | 12.7346 | 162.1691 |
| Modal V | 5 | 0.461 | 2.17 | 13.6336 | 185.8754 |
| Modal V | 6 | 0.391 | 2.558 | 16.0751 | 258.4093 |
| Modal V | 7 | 0.337 | 2.964 | 18.6228 | 346.8081 |
| Modal V | 8 | 0.3 | 3.331 | 20.93 | 438.0657 |
| Modal V | 9 | 0.244 | 4.1 | 25.7635 | 663.7602 |
| Modal V | 10 | 0.175 | 5.718 | 35.9263 | 1290.6972 |
| Modal V | 11 | 0.14 | 7.163 | 45.0078 | 2025.7019 |
| Modal V | 12 | 0.064 | 15.747 | 98.9422 | 9789.5512 |

**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.824 | 0.4671 | 0.0355 | 2.374E-06 | 0.4671 | 0.0355 | 2.374E-06 |
| Modal | 2 | 1.664 | 0.0971 | 0.2171 | 6.205E-06 | 0.5642 | 0.2527 | 8.579E-06 |
| Modal | 3 | 1.185 | 0.0011 | 0.2857 | 1.56E-05 | 0.5653 | 0.5384 | 2.418E-05 |
| Modal | 4 | 0.494 | 0.1521 | 0.0039 | 3.508E-06 | 0.7174 | 0.5423 | 2.769E-05 |
| Modal | 5 | 0.436 | 1.095E-06 | 0.0001 | 0.0016 | 0.7174 | 0.5424 | 0.0016 |
| Modal | 6 | 0.424 | 0.0144 | 0.0589 | 4.841E-06 | 0.7318 | 0.6013 | 0.0016 |
| Modal | 7 | 0.303 | 0 | 0.1204 | 0.0001 | 0.7318 | 0.7217 | 0.0017 |
| Modal | 8 | 0.248 | 0.0969 | 0.0017 | 1.552E-05 | 0.8287 | 0.7234 | 0.0017 |
| Modal | 9 | 0.195 | 0.0075 | 0.0478 | 0.0003 | 0.8363 | 0.7712 | 0.002 |
| Modal | 10 | 0.166 | 0.0594 | 0.0022 | 0.0001 | 0.8957 | 0.7734 | 0.0021 |
| Modal | 11 | 0.112 | 0.0001 | 0.1532 | 0.0001 | 0.8957 | 0.9265 | 0.0021 |
| Modal | 12 | 0.089 | 0.0684 | 1.419E-05 | 0.0001 | 0.9641 | 0.9265 | 0.0022 |
| Modal V | 1 | 1.824 | 0.4671 | 0.0355 | 2.374E-06 | 0.4671 | 0.0355 | 2.374E-06 |
| Modal V | 2 | 1.664 | 0.0971 | 0.2171 | 6.205E-06 | 0.5642 | 0.2527 | 8.579E-06 |
| Modal V | 3 | 1.185 | 0.0011 | 0.2857 | 1.56E-05 | 0.5653 | 0.5384 | 2.418E-05 |
| Modal V | 4 | 0.493 | 0.1532 | 0.0033 | 4.316E-06 | 0.7185 | 0.5417 | 2.85E-05 |
| Modal V | 5 | 0.461 | 2.131E-05 | 9.693E-07 | 0.0035 | 0.7185 | 0.5417 | 0.0036 |
| Modal V | 6 | 0.391 | 2.765E-05 | 0.0003 | 0.0023 | 0.7185 | 0.542 | 0.0059 |
| Modal V | 7 | 0.337 | 0.0006 | 0.0033 | 0.0038 | 0.7191 | 0.5453 | 0.0097 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal V | 8 | 0.3 | 0.0006 | 0.0003 | 0.0131 | 0.7196 | 0.5456 | 0.0229 |
| Modal V | 9 | 0.244 | 1.473E-05 | 0.0017 | 0.0283 | 0.7197 | 0.5472 | 0.0512 |
| Modal V | 10 | 0.175 | 1.384E-05 | 0.0017 | 0.2452 | 0.7197 | 0.5489 | 0.2964 |
| Modal V | 11 | 0.14 | 3.785E-05 | 0.0009 | 0.4266 | 0.7197 | 0.5499 | 0.7231 |
| Modal V | 12 | 0.064 | 5.538E-06 | 0.0006 | 0.1897 | 0.7197 | 0.5505 | 0.9128 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.0224 | 0.1904 | 0.0589 | 0.0224 | 0.1904 | 0.0589 |
| Modal | 2 | 0.1406 | 0.041 | 0.2006 | 0.163 | 0.2315 | 0.2595 |
| Modal | 3 | 0.1916 | 0.0006 | 0.1877 | 0.3546 | 0.2321 | 0.4472 |
| Modal | 4 | 0.0026 | 0.0837 | 0.0123 | 0.3572 | 0.3157 | 0.4594 |
| Modal | 5 | 0.0022 | 0.0052 | 0.0002 | 0.3594 | 0.3209 | 0.4597 |
| Modal | 6 | 0.0332 | 0.0073 | 0.118 | 0.3926 | 0.3282 | 0.5777 |
| Modal | 7 | 0.0704 | 0.0002 | 0.0698 | 0.463 | 0.3283 | 0.6475 |
| Modal | 8 | 0.0012 | 0.0488 | 0.0033 | 0.4642 | 0.3772 | 0.6508 |
| Modal | 9 | 0.0336 | 0.007 | 0.0448 | 0.4978 | 0.3842 | 0.6956 |
| Modal | 10 | 0.0014 | 0.0411 | 0.0016 | 0.4992 | 0.4253 | 0.6971 |
| Modal | 11 | 0.1477 | 9.536E-07 | 0.0313 | 0.6469 | 0.4253 | 0.7284 |
| Modal | 12 | 3.775E-06 | 0.0644 | 0.0002 | 0.6469 | 0.4897 | 0.7286 |
| Modal V | 1 | 0.0224 | 0.1904 | 0.0589 | 0.0224 | 0.1904 | 0.0589 |
| Modal V | 2 | 0.1406 | 0.041 | 0.2006 | 0.163 | 0.2315 | 0.2595 |
| Modal V | 3 | 0.1916 | 0.0006 | 0.1877 | 0.3546 | 0.2321 | 0.4472 |
| Modal V | 4 | 0.0022 | 0.085 | 0.0107 | 0.3568 | 0.3171 | 0.4579 |
| Modal V | 5 | 0.0015 | 0.0049 | 2.068E-06 | 0.3583 | 0.322 | 0.4579 |
| Modal V | 6 | 0.0009 | 0.004 | 0.0011 | 0.3593 | 0.326 | 0.459 |
| Modal V | 7 | 0.0021 | 0.0003 | 0.0082 | 0.3614 | 0.3263 | 0.4672 |
| Modal V | 8 | 0.0008 | 0.0004 | 0.0106 | 0.3622 | 0.3267 | 0.4778 |
| Modal V | 9 | 0.001 | 0.0001 | 0.0041 | 0.3632 | 0.3267 | 0.4819 |
| Modal V | 10 | 0.0311 | 0 | 0.002 | 0.3943 | 0.3267 | 0.4839 |
| Modal V | 11 | 0.0163 | 8.056E-06 | 0.0016 | 0.4106 | 0.3267 | 0.4855 |
| Modal V | 12 | 3.059E-05 | 1.609E-06 | 0.0017 | 0.4107 | 0.3267 | 0.4871 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.824 | 0.000123 | 3.4E-05 | -2.778E-07 | -0.507472 | 1.773485 | 0.814709 | 1E-06 | 1E-05 |
| Modal | 2 | 1.664 | -5.6E-05 | 8.4E-05 | 4.492E-07 | -1.271602 | -0.823029 | 1.503586 | 1E-06 | 1E-05 |
| Modal | 3 | 1.185 | -6E-06 | -9.6E-05 | -1E-06 | 1.48439 | -0.0984 | 1.454647 | 1E-06 | 3E-05 |
| Modal | 4 | 0.494 | 7E-05 | 1.1E-05 | 3.377E-07 | 0.173361 | -1.175508 | 0.371649 | 1E-06 | 0.00016 |
| Modal | 5 | 0.436 | 1.887E-07 | 2E-06 | -7E-06 | 0.160184 | 0.291901 | 0.052429 | 1E-06 | 0.00021 |
| Modal | 6 | 0.424 | 2.2E-05 | -4.4E-05 | -3.968E-07 | -0.617483 | -0.346527 | -1.153157 | 1E-06 | 0.00022 |
| Modal | 7 | 0.303 | -9.323E-06 | -6.3E-05 | 2E-06 | -0.89968 | 0.055749 | 0.686968 | 1E-06 | 0.00043 |
| Modal | 8 | 0.248 | 5.6E-05 | 8E-06 | -1E-06 | 0.11778 | -0.898114 | 0.193772 | 1E-06 | 0.00064 |
| Modal | 9 | 0.195 | 1.6E-05 | -3.9E-05 | -3E-06 | -0.621229 | -0.340025 | -0.710303 | 1E-06 | 0.00104 |
| Modal | 10 | 0.166 | -4.4E-05 | -8E-06 | -2E-06 | -0.129075 | 0.8241 | 0.132183 | 1E-06 | 0.00144 |
| Modal | 11 | 0.112 | 1E-06 | -7.1E-05 | 1E-06 | -1.3031 | 0.003969 | 0.593889 | 1E-06 | 0.00316 |
| Modal | 12 | 0.089 | 4.7E-05 | 1E-06 | 2E-06 | 0.006589 | -1.031282 | 0.044494 | 1E-06 | 0.00499 |
| Modal V | 1 | 1.824 | -0.000123 | -3.4E-05 | 2.778E-07 | 0.507472 | -1.773485 | -0.814709 | 1E-06 | 1E-05 |
| Modal V | 2 | 1.664 | -5.6E-05 | 8.4E-05 | 4.492E-07 | -1.271602 | -0.823029 | 1.503586 | 1E-06 | 1E-05 |
| Modal V | 3 | 1.185 | 6E-06 | 9.6E-05 | 1E-06 | -1.48439 | 0.0984 | -1.454647 | 1E-06 | 3E-05 |
| Modal V | 4 | 0.493 | 7.1E-05 | 1E-05 | 3.747E-07 | 0.158315 | -1.184815 | 0.347519 | 1E-06 | 0.00016 |
| Modal V | 5 | 0.461 | 1E-06 | 1.775E-07 | -1.1E-05 | 0.132528 | 0.285184 | 0.004828 | 1E-06 | 0.00019 |
| Modal V | 6 | 0.391 | -1E-06 | 3E-06 | 9E-06 | 0.104462 | 0.257835 | 0.110563 | 1E-06 | 0.00026 |

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| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal V | 7 | 0.337 | 4E-06 | -1E-05 | 1.1E-05 | -0.157217 | 0.072196 | -0.304706 | 1E-06 | 0.00035 |
| Modal V | 8 | 0.3 | -4E-06 | 3E-06 | 2.1E-05 | 0.097945 | -0.077798 | 0.345218 | 1E-06 | 0.00044 |
| Modal V | 9 | 0.244 | -1E-06 | 7E-06 | -3E-05 | -0.106079 | -0.029687 | 0.215703 | 1E-06 | 0.00066 |
| Modal V | 10 | 0.175 | -1E-06 | 7E-06 | 8.9E-05 | 0.598219 | 0.000723 | 0.148525 | 1E-06 | 0.00129 |
| Modal V | 11 | 0.14 | -1E-06 | 6E-06 | -0.000118 | 0.432946 | -0.011535 | 0.134166 | 1E-06 | 0.00203 |
| Modal V | 12 | 0.064 | 4.244E-07 | -5E-06 | -7.9E-05 | -0.018757 | 0.005155 | -0.136574 | 1E-06 | 0.00979 |

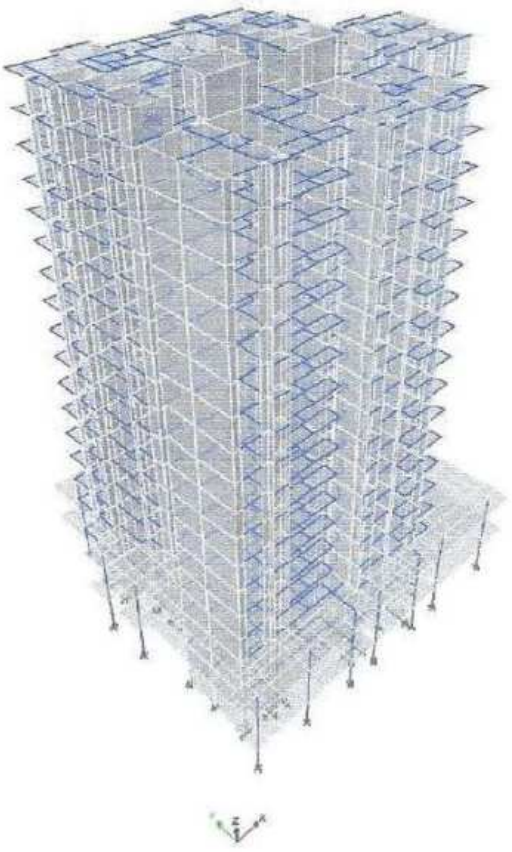
**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 96.41 |
| Modal | Acceleration | UY | 100 | 92.65 |
| Modal | Acceleration | UZ | 1.77 | 0.22 |
| Modal V | Acceleration | UX | 99.43 | 71.97 |
| Modal V | Acceleration | UY | 97.82 | 55.05 |
| Modal V | Acceleration | UZ | 100 | 91.28 |

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ETABS® version 17
Integrated Building Design Software



# Report for Block 3B,9A and 9B

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WX | Diaphragms | From Diaphragms | 0 | 0.7 | 0.7 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |
| WY | Diaphragms | From Diaphragms | 90 | 0.7 | 0.7 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

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## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQXP | Seismic | X + Ecc. Y | 5 | No | User Specified | 0.79 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.79 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.739 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYN | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.739 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.79 | 0.033053 | 151887.1217 | 5020.35 |
| 5 | 0.79 | 0.033053 | 151887.1217 | 5020.35 |
| 5 | 0.739 | 0.035334 | 151887.1217 | 5366.8153 |
| 5 | 0.739 | 0.035334 | 151887.1217 | 5366.8153 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.79$ sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] $Z = 0.16$
Response Reduction Factor, R [IS Table 9] $R = 5$
Importance Factor, I [IS Table 8] $I = 1.2$
Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**Equivalent Lateral Forces**

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

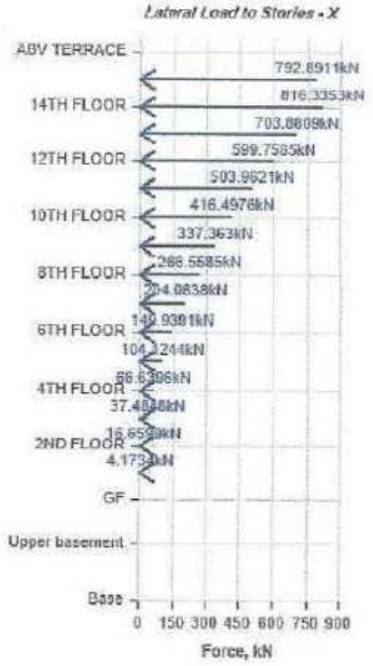
**Calculated Base Shear**

| Direction | Period Used (sec) | W (kN) | $V_b$ (kN) |
|---|---|---|---|
| X + Ecc. Y | 0.79 | 151887.1217 | 5020.35 |

**Applied Story Forces**

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 792.8911 | 0 |
| 14TH FLOOR | 52.55 | 816.3353 | 0 |
| 13TH FLOOR | 49.55 | 703.8809 | 0 |
| 12TH FLOOR | 46.55 | 599.7565 | 0 |
| 11TH FLOOR | 43.55 | 503.9621 | 0 |
| 10TH FLOOR | 40.55 | 416.4976 | 0 |
| 9TH FLOOR | 37.55 | 337.363 | 0 |
| 8TH FLOOR | 34.55 | 266.5585 | 0 |
| 7TH FLOOR | 31.55 | 204.0838 | 0 |
| 6TH FLOOR | 28.55 | 149.9391 | 0 |
| 5TH FLOOR | 25.55 | 104.1244 | 0 |
| 4TH FLOOR | 22.55 | 66.6396 | 0 |

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**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 97.16 |
| Modal | Acceleration | UY | 100 | 95.51 |
| Modal | Acceleration | UZ | 26.34 | 1.53 |
| Modal V | Acceleration | UX | 97.74 | 67.99 |
| Modal V | Acceleration | UY | 97.64 | 65.51 |
| Modal V | Acceleration | UZ | 100 | 92.4 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal V | 12 | 0.066 | 0.0012 | 2.942E-05 | 0.1534 | 0.6799 | 0.6551 | 0.924 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.0143 | 0.2177 | 0.0338 | 0.0143 | 0.2177 | 0.0338 |
| Modal | 2 | 0.001 | 0.01 | 0.5532 | 0.0153 | 0.2277 | 0.5871 |
| Modal | 3 | 0.2734 | 0.0114 | 0.0005 | 0.2886 | 0.2391 | 0.5876 |
| Modal | 4 | 0.0009 | 0.0011 | 6.608E-06 | 0.2895 | 0.2402 | 0.5876 |
| Modal | 5 | 0.0009 | 0.0009 | 0 | 0.2905 | 0.2411 | 0.5876 |
| Modal | 6 | 0.0001 | 0.0068 | 0.0695 | 0.2905 | 0.2478 | 0.6571 |
| Modal | 7 | 0.0035 | 0.2442 | 0.0017 | 0.294 | 0.492 | 0.6588 |
| Modal | 8 | 0.2431 | 0.0077 | 0.0005 | 0.5372 | 0.4997 | 0.6593 |
| Modal | 9 | 0.021 | 0.0067 | 0.016 | 0.5582 | 0.5064 | 0.6753 |
| Modal | 10 | 0.0083 | 0.0648 | 0.0187 | 0.5665 | 0.5711 | 0.694 |
| Modal | 11 | 0.059 | 0.0675 | 0.0137 | 0.6255 | 0.6386 | 0.7076 |
| Modal | 12 | 0.0862 | 0.0303 | 0.0198 | 0.7117 | 0.669 | 0.7274 |
| Modal V | 1 | 0.0143 | 0.2177 | 0.0338 | 0.0143 | 0.2177 | 0.0338 |
| Modal V | 2 | 0.001 | 0.01 | 0.5532 | 0.0153 | 0.2277 | 0.5871 |
| Modal V | 3 | 0.2734 | 0.0114 | 0.0005 | 0.2886 | 0.2391 | 0.5876 |
| Modal V | 4 | 0.0009 | 0.0011 | 6.255E-06 | 0.2895 | 0.2402 | 0.5876 |
| Modal V | 5 | 0.0009 | 0.0009 | 0 | 0.2905 | 0.2411 | 0.5876 |
| Modal V | 6 | 0.0005 | 0.0002 | 2.865E-05 | 0.291 | 0.2412 | 0.5877 |
| Modal V | 7 | 0.0007 | 0.0028 | 1.686E-05 | 0.2917 | 0.244 | 0.5877 |
| Modal V | 8 | 0.0001 | 0.0008 | 0.0015 | 0.2919 | 0.2448 | 0.5892 |
| Modal V | 9 | 0.0279 | 0.0024 | 0.0034 | 0.3198 | 0.2473 | 0.5925 |
| Modal V | 10 | 1.85E-05 | 0.0163 | 0.0008 | 0.3198 | 0.2636 | 0.5933 |
| Modal V | 11 | 0.001 | 0.005 | 0.0003 | 0.3208 | 0.2685 | 0.5936 |
| Modal V | 12 | 0.0011 | 0.0012 | 0.0012 | 0.3219 | 0.2697 | 0.5948 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.414 | 0.000123 | 2.7E-05 | -4.769E-08 | -0.351546 | 1.418922 | -0.406708 | 1E-06 | 2E-05 |
| Modal | 2 | 1.284 | 2.9E-05 | 9E-06 | 1.125E-07 | -0.091488 | 0.303394 | 1.644237 | 1E-06 | 2E-05 |
| Modal | 3 | 1.07 | -3.1E-05 | 0.000124 | 4.986E-07 | -1.53751 | -0.325008 | 0.051429 | 1E-06 | 3E-05 |
| Modal | 4 | 0.902 | 1E-06 | -3E-06 | -1.1E-05 | -0.08922 | -0.102638 | 0.005682 | 1E-06 | 5E-05 |
| Modal | 5 | 0.748 | -3.136E-07 | 1E-06 | 9E-06 | 0.088691 | 0.088799 | 0.001259 | 1E-06 | 7E-05 |
| Modal | 6 | 0.415 | 1.2E-05 | 3E-06 | 5E-06 | 0.029155 | -0.249658 | -0.582744 | 1E-06 | 0.00023 |
| Modal | 7 | 0.393 | -6.5E-05 | -1.2E-05 | 1E-06 | -0.17325 | 1.502698 | -0.090713 | 1E-06 | 0.00026 |
| Modal | 8 | 0.298 | -1E-05 | 6.7E-05 | 3.476E-07 | 1.450033 | 0.266315 | -0.047197 | 1E-06 | 0.00044 |
| Modal | 9 | 0.233 | -8E-06 | 1.6E-05 | -1.1E-05 | 0.426289 | 0.248224 | -0.279678 | 1E-06 | 0.00073 |
| Modal | 10 | 0.202 | -3.7E-05 | -1E-05 | 3E-06 | -0.268326 | 0.774084 | -0.302057 | 1E-06 | 0.00097 |
| Modal | 11 | 0.127 | -3.4E-05 | 3.1E-05 | 1E-06 | 0.714096 | 0.789988 | 0.258356 | 1E-06 | 0.00245 |
| Modal | 12 | 0.122 | -2.2E-05 | -4.2E-05 | -4E-06 | -0.863492 | 0.529757 | 0.311147 | 1E-06 | 0.00265 |
| Modal V | 1 | 1.414 | -0.000123 | -2.7E-05 | 4.769E-08 | 0.351546 | -1.418922 | 0.406708 | 1E-06 | 2E-05 |
| Modal V | 2 | 1.284 | -2.9E-05 | -9E-06 | -1.125E-07 | 0.091488 | -0.303394 | -1.644237 | 1E-06 | 2E-05 |
| Modal V | 3 | 1.07 | -3.1E-05 | 0.000124 | 4.986E-07 | -1.53751 | -0.325008 | 0.051429 | 1E-06 | 3E-05 |
| Modal V | 4 | 0.902 | 1E-06 | -3E-06 | -1.1E-05 | -0.089157 | -0.102617 | 0.005529 | 1E-06 | 5E-05 |
| Modal V | 5 | 0.748 | 3.136E-07 | -1E-06 | -9E-06 | -0.089385 | -0.089046 | 0.001503 | 1E-06 | 7E-05 |
| Modal V | 6 | 0.473 | 1E-06 | 4.009E-07 | 4E-06 | 0.068474 | -0.037964 | -0.011832 | 1E-06 | 0.00018 |
| Modal V | 7 | 0.382 | -1E-06 | -1E-06 | -9E-06 | 0.079686 | -0.15987 | 0.0096 | 1E-06 | 0.00027 |
| Modal V | 8 | 0.327 | -6E-06 | 2E-06 | 1.1E-05 | -0.032637 | 0.087462 | 0.085205 | 1E-06 | 0.00037 |
| Modal V | 9 | 0.269 | 8E-06 | -1.3E-05 | 1.4E-05 | -0.491538 | -0.149709 | -0.128101 | 1E-06 | 0.00054 |
| Modal V | 10 | 0.18 | 5E-06 | -3E-06 | -5.2E-05 | 0.012649 | -0.388322 | -0.06213 | 1E-06 | 0.00121 |
| Modal V | 11 | 0.137 | 3E-06 | -1E-06 | 0.000126 | 0.091253 | -0.214194 | -0.036822 | 1E-06 | 0.00211 |
| Modal V | 12 | 0.066 | 6E-06 | -1E-06 | -6.2E-05 | 0.096919 | -0.103359 | -0.076342 | 1E-06 | 0.00909 |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 1.414 | 0.707 | 4.443 | 19.7405 |
| Modal | 2 | 1.284 | 0.779 | 4.894 | 23.9508 |
| Modal | 3 | 1.07 | 0.934 | 5.87 | 34.4574 |
| Modal | 4 | 0.902 | 1.109 | 6.9651 | 48.5129 |
| Modal | 5 | 0.748 | 1.337 | 8.4032 | 70.6134 |
| Modal | 6 | 0.415 | 2.409 | 15.136 | 229.1 |
| Modal | 7 | 0.393 | 2.548 | 16.0077 | 256.2455 |
| Modal | 8 | 0.298 | 3.353 | 21.0664 | 443.7914 |
| Modal | 9 | 0.233 | 4.298 | 27.0073 | 729.3922 |
| Modal | 10 | 0.202 | 4.946 | 31.0747 | 965.6371 |
| Modal | 11 | 0.127 | 7.87 | 49.4494 | 2445.2383 |
| Modal | 12 | 0.122 | 8.197 | 51.5016 | 2652.41 |
| Modal V | 1 | 1.414 | 0.707 | 4.443 | 19.7405 |
| Modal V | 2 | 1.284 | 0.779 | 4.894 | 23.9508 |
| Modal V | 3 | 1.07 | 0.934 | 5.87 | 34.4574 |
| Modal V | 4 | 0.902 | 1.109 | 6.9651 | 48.5128 |
| Modal V | 5 | 0.748 | 1.337 | 8.4017 | 70.5886 |
| Modal V | 6 | 0.473 | 2.116 | 13.293 | 176.7028 |
| Modal V | 7 | 0.382 | 2.615 | 16.4288 | 269.9069 |
| Modal V | 8 | 0.327 | 3.054 | 19.1916 | 368.3191 |
| Modal V | 9 | 0.269 | 3.715 | 23.3449 | 544.9823 |
| Modal V | 10 | 0.18 | 5.545 | 34.8394 | 1213.787 |
| Modal V | 11 | 0.137 | 7.31 | 45.9324 | 2109.7851 |
| Modal V | 12 | 0.066 | 15.177 | 95.3585 | 9093.2393 |

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**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.414 | 0.601 | 0.0297 | 0 | 0.601 | 0.0297 | 0 |
| Modal | 2 | 1.284 | 0.0344 | 0.0033 | 5.067E-07 | 0.6354 | 0.033 | 5.977E-07 |
| Modal | 3 | 1.07 | 0.0377 | 0.6145 | 9.95E-06 | 0.6731 | 0.6475 | 1.055E-05 |
| Modal | 4 | 0.902 | 0.0001 | 0.0004 | 0.0047 | 0.6732 | 0.6479 | 0.0047 |
| Modal | 5 | 0.748 | 3.935E-06 | 2.859E-05 | 0.0033 | 0.6732 | 0.6479 | 0.008 |
| Modal | 6 | 0.415 | 0.006 | 0.0003 | 0.001 | 0.6792 | 0.6482 | 0.009 |
| Modal | 7 | 0.393 | 0.1671 | 0.0055 | 0.0001 | 0.8463 | 0.6537 | 0.0091 |
| Modal | 8 | 0.298 | 0.0043 | 0.1781 | 4.836E-06 | 0.8506 | 0.8318 | 0.0091 |
| Modal | 9 | 0.233 | 0.0025 | 0.0108 | 0.0053 | 0.8531 | 0.8426 | 0.0143 |
| Modal | 10 | 0.202 | 0.0542 | 0.0038 | 0.0003 | 0.9073 | 0.8464 | 0.0146 |
| Modal | 11 | 0.127 | 0.0451 | 0.0375 | 4.63E-05 | 0.9523 | 0.8839 | 0.0147 |
| Modal | 12 | 0.122 | 0.0192 | 0.0712 | 0.0007 | 0.9716 | 0.9551 | 0.0153 |
| Modal V | 1 | 1.414 | 0.601 | 0.0297 | 0 | 0.601 | 0.0297 | 0 |
| Modal V | 2 | 1.284 | 0.0344 | 0.0033 | 5.067E-07 | 0.6354 | 0.033 | 5.977E-07 |
| Modal V | 3 | 1.07 | 0.0377 | 0.6145 | 9.95E-06 | 0.6731 | 0.6475 | 1.055E-05 |
| Modal V | 4 | 0.902 | 0.0001 | 0.0004 | 0.0047 | 0.6732 | 0.6479 | 0.0047 |
| Modal V | 5 | 0.748 | 3.934E-06 | 2.856E-05 | 0.0032 | 0.6732 | 0.6479 | 0.008 |
| Modal V | 6 | 0.473 | 0.0001 | 6.433E-06 | 0.0007 | 0.6733 | 0.6479 | 0.0086 |
| Modal V | 7 | 0.382 | 1.247E-05 | 2.208E-05 | 0.0031 | 0.6733 | 0.648 | 0.0118 |
| Modal V | 8 | 0.327 | 0.0015 | 0.0002 | 0.0047 | 0.6748 | 0.6481 | 0.0165 |
| Modal V | 9 | 0.269 | 0.0023 | 0.0065 | 0.0074 | 0.6771 | 0.6547 | 0.0239 |
| Modal V | 10 | 0.18 | 0.0011 | 0.0003 | 0.1098 | 0.6783 | 0.655 | 0.1337 |
| Modal V | 11 | 0.137 | 0.0004 | 3.812E-05 | 0.6368 | 0.6787 | 0.655 | 0.7705 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

Table 1.7 - Response Spectrum Function - IS 1893:2016

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

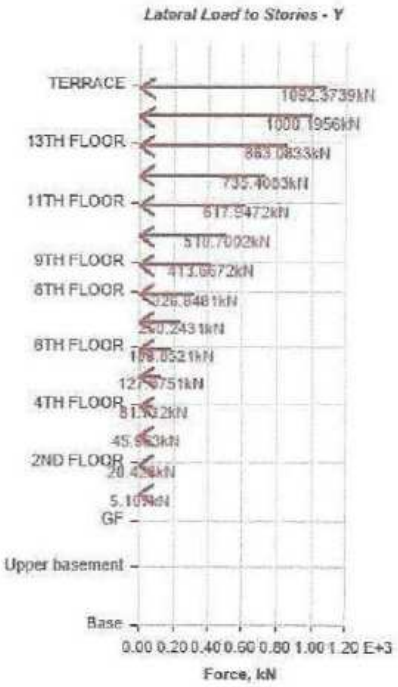
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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 1092.3739 |
| 14TH FLOOR | 52.55 | 0 | 1000.1956 |
| 13TH FLOOR | 49.55 | 0 | 863.0833 |
| 12TH FLOOR | 46.55 | 0 | 735.4083 |
| 11TH FLOOR | 43.55 | 0 | 617.9472 |
| 10TH FLOOR | 40.55 | 0 | 510.7002 |
| 9TH FLOOR | 37.55 | 0 | 413.6672 |
| 8TH FLOOR | 34.55 | 0 | 326.8481 |
| 7TH FLOOR | 31.55 | 0 | 250.2431 |
| 6TH FLOOR | 28.55 | 0 | 183.8521 |
| 5TH FLOOR | 25.55 | 0 | 127.6751 |
| 4TH FLOOR | 22.55 | 0 | 81.712 |
| 3RD FLOOR | 19.55 | 0 | 45.963 |
| 2ND FLOOR | 16.55 | 0 | 20.428 |
| 1ST FLOOR | 13.55 | 0 | 5.107 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.642$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

Importance Factor, I [IS Table 8] $I = 1$

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 1.753413$

**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 + Ecc. X | 0.642 | 185055.0781 | 6275.2041 |

**Applied Story Forces**

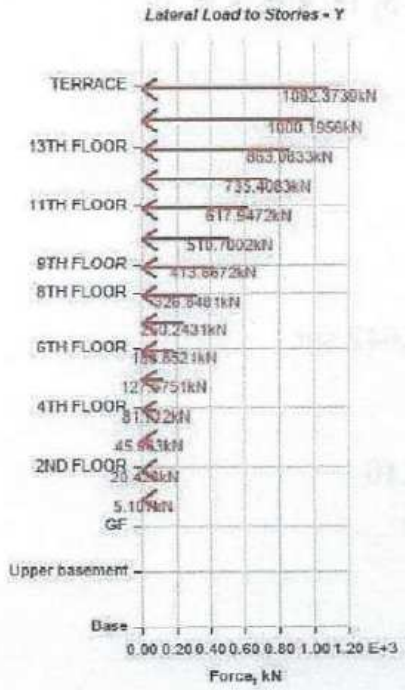
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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 0 | 1092.3739 |
| 14TH FLOOR | 52.55 | 0 | 1000.1956 |
| 13TH FLOOR | 49.55 | 0 | 863.0833 |
| 12TH FLOOR | 46.55 | 0 | 735.4083 |
| 11TH FLOOR | 43.55 | 0 | 617.9472 |
| 10TH FLOOR | 40.55 | 0 | 510.7002 |
| 9TH FLOOR | 37.55 | 0 | 413.6672 |
| 8TH FLOOR | 34.55 | 0 | 326.8481 |
| 7TH FLOOR | 31.55 | 0 | 250.2431 |
| 6TH FLOOR | 28.55 | 0 | 183.8521 |
| 5TH FLOOR | 25.55 | 0 | 127.6751 |
| 4TH FLOOR | 22.55 | 0 | 81.712 |
| 3RD FLOOR | 19.55 | 0 | 45.963 |
| 2ND FLOOR | 16.55 | 0 | 20.428 |
| 1ST FLOOR | 13.55 | 0 | 5.107 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.642$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

Importance Factor, I [IS Table 8] $I = 1$

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 1.753413$

**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 + Ecc. X | 0.642 | 185055.0781 | 6275.2041 |

**Applied Story Forces**

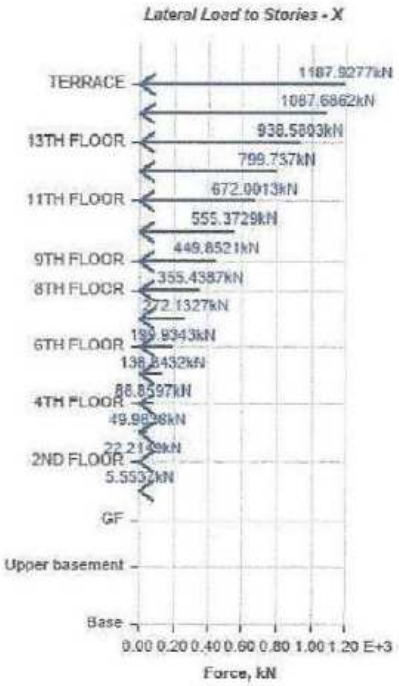
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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 1187.9277 | 0 |
| 14TH FLOOR | 52.55 | 1087.6862 | 0 |
| 13TH FLOOR | 49.55 | 938.5803 | 0 |
| 12TH FLOOR | 46.55 | 799.737 | 0 |
| 11TH FLOOR | 43.55 | 672.0013 | 0 |
| 10TH FLOOR | 40.55 | 555.3729 | 0 |
| 9TH FLOOR | 37.55 | 449.8521 | 0 |
| 8TH FLOOR | 34.55 | 355.4387 | 0 |
| 7TH FLOOR | 31.55 | 272.1327 | 0 |
| 6TH FLOOR | 28.55 | 199.9343 | 0 |
| 5TH FLOOR | 25.55 | 138.8432 | 0 |
| 4TH FLOOR | 22.55 | 88.8597 | 0 |
| 3RD FLOOR | 19.55 | 49.9836 | 0 |
| 2ND FLOOR | 16.55 | 22.2149 | 0 |
| 1ST FLOOR | 13.55 | 5.5537 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.708$ sec

**Factors and Coefficients**

Seismic Zone Factor, Z [IS Table 3] $Z = 0.16$
Response Reduction Factor, R [IS Table 9] $R = 5$
Importance Factor, I [IS Table 8] $I = 1.2$
Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 1.473226$

**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 - Ecc. Y | 0.708 | 185055.0781 | 6824.1183 |

**Applied Story Forces**

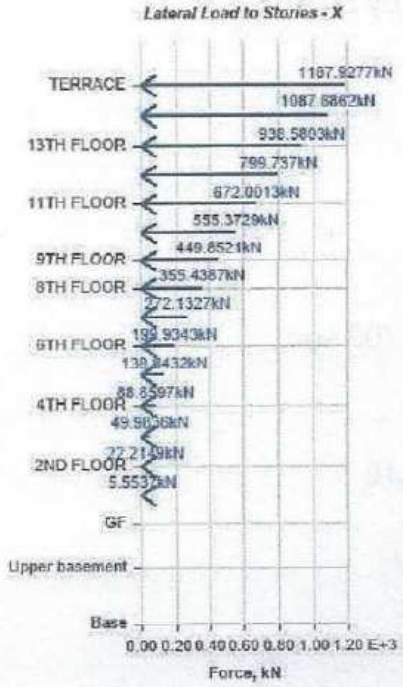
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| | | | |
|---|---|---|---|
| basement | | | |
| Base | 0 | 0 | 0 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| TERRACE | 55.5 | 1187.9277 | 0 |
| 14TH FLOOR | 52.55 | 1087.6862 | 0 |
| 13TH FLOOR | 49.55 | 936.5803 | 0 |
| 12TH FLOOR | 46.55 | 799.737 | 0 |
| 11TH FLOOR | 43.55 | 672.0013 | 0 |
| 10TH FLOOR | 40.55 | 555.3729 | 0 |
| 9TH FLOOR | 37.55 | 449.8521 | 0 |
| 8TH FLOOR | 34.55 | 355.4387 | 0 |
| 7TH FLOOR | 31.55 | 272.1327 | 0 |
| 6TH FLOOR | 28.55 | 199.9343 | 0 |
| 5TH FLOOR | 25.55 | 138.8432 | 0 |
| 4TH FLOOR | 22.55 | 88.8597 | 0 |
| 3RD FLOOR | 19.55 | 49.9836 | 0 |
| 2ND FLOOR | 16.55 | 22.2149 | 0 |
| 1ST FLOOR | 13.55 | 5.5537 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper | 5.9 | 0 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X + Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.708$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = \frac{1.36}{T}$ $\frac{S_a}{g} = 1.473226$

**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 + Ecc. Y | 0.708 | 185055.0781 | 6824.1183 |

**Applied Story Forces**

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# 1 Loads

This chapter provides loading information as applied to the model.

## 1.1 Auto Wind Loading

**Table 1.1 - Auto Wind - IS 875:2015 (Part 1 of 2)**

| Load Pattern | Loading Method | Exposure Width Type | Angle deg | Cp,wind | Cp,lee | Top Story | Bottom Story | Include Parapet | Parapet Height m | Vb meter/sec | Terrain Category | k1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WX | Diaphragms | From Diaphragms | 0 | 0.7 | 0.7 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |
| WY | Diaphragms | From Diaphragms | 90 | 0.7 | 0.7 | TERRACE | GF | Yes | 1.2 | 50 | 3 | 1 |

**Table 1.1 - Auto Wind - IS 875:2015 (Part 2 of 2)**

| k3 | k4 |
|---|---|
| 1 | 1 |
| 1 | 1 |

## 1.2 Auto Seismic Loading

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 1 of 2)**

| Load Pattern | Type | Direction | Eccentricity % | Ecc. Overridden | Period Method | User T sec | Top Story | Bottom Story | Z Type | Z | Soil Type | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQXP | Seismic | X + Ecc. Y | 5 | No | User Specified | 0.708 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQXN | Seismic | X - Ecc. Y | 5 | No | User Specified | 0.708 | TERRACE | GF | Per Code | 0.16 | II | 1.2 |
| EQYP | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.642 | TERRACE | GF | Per Code | 0.16 | II | 1 |
| EQYN | Seismic | Y + Ecc. X | 5 | No | User Specified | 0.642 | TERRACE | GF | Per Code | 0.16 | II | 1 |

**Table 1.2 - Auto Seismic - IS 1893:2016 (Part 2 of 2)**

| R | Period Used sec | Coeff Used | Weight Used kN | Base Shear kN |
|---|---|---|---|---|
| 5 | 0.708 | 0.036876 | 185055.0781 | 6824.1183 |
| 5 | 0.708 | 0.036876 | 185055.0781 | 6824.1183 |
| 5 | 0.642 | 0.03391 | 185055.0781 | 6275.2041 |
| 5 | 0.642 | 0.03391 | 185055.0781 | 6275.2041 |

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Table 2.3 Modal Participation Factors

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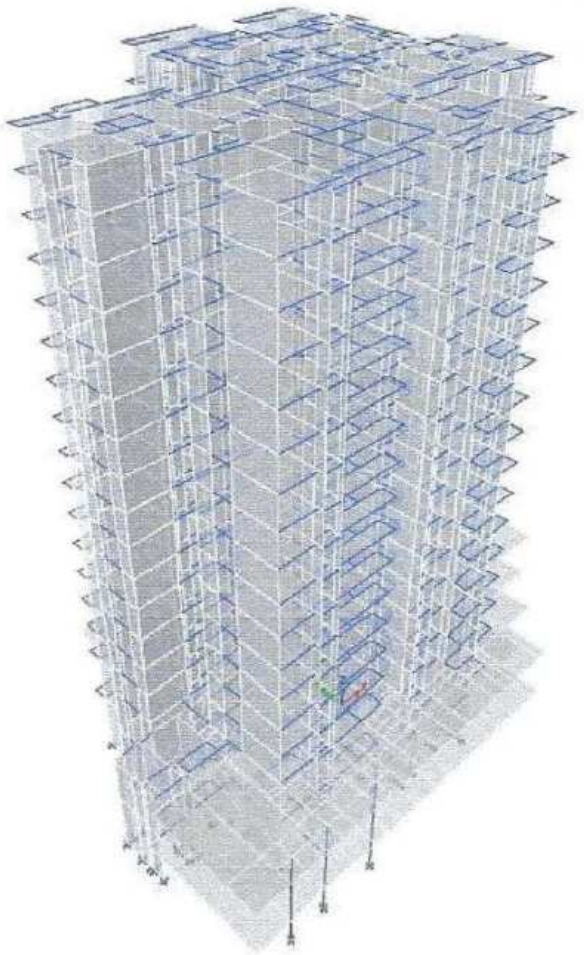


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**Table 2.4 - Modal Load Participation Ratios**

| Case | Item Type | Item | Static % | Dynamic % |
|---|---|---|---|---|
| Modal | Acceleration | UX | 100 | 97.71 |
| Modal | Acceleration | UY | 100 | 95.39 |
| Modal | Acceleration | UZ | 14.05 | 0.9 |
| Modal-V | Acceleration | UX | 97.6 | 67.81 |
| Modal-V | Acceleration | UY | 97.53 | 64.92 |
| Modal-V | Acceleration | UZ | 100 | 90.35 |

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| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal-V | 12 | 0.081 | 1.36E-05 | 7.132E-07 | 0.2234 | 0.6781 | 0.6492 | 0.9035 |

**Table 2.2 - Modal Participating Mass Ratios (Part 2 of 2)**

| Case | Mode | RX | RY | RZ | Sum RX | Sum RY | Sum RZ |
|---|---|---|---|---|---|---|---|
| Modal | 1 | 0.0002 | 0.1824 | 0.1679 | 0.0002 | 0.1824 | 0.1679 |
| Modal | 2 | 0.0221 | 0.0662 | 0.3881 | 0.0223 | 0.2486 | 0.556 |
| Modal | 3 | 0.2711 | 0.004 | 0.0235 | 0.2934 | 0.2527 | 0.5795 |
| Modal | 4 | 0.0036 | 0.0002 | 0.0005 | 0.297 | 0.2528 | 0.58 |
| Modal | 5 | 0.0001 | 0.0004 | 0.0069 | 0.2971 | 0.2532 | 0.5869 |
| Modal | 6 | 0.0038 | 0.1399 | 0.0528 | 0.301 | 0.3931 | 0.6396 |
| Modal | 7 | 0.0004 | 0.1207 | 0.0769 | 0.3014 | 0.5138 | 0.7165 |
| Modal | 8 | 0.1613 | 0.0014 | 0.0203 | 0.4627 | 0.5152 | 0.7368 |
| Modal | 9 | 0.0939 | 0.003 | 0.0562 | 0.5567 | 0.5182 | 0.7929 |
| Modal | 10 | 0.0015 | 0.0956 | 0.0023 | 0.5582 | 0.614 | 0.7953 |
| Modal | 11 | 0.1517 | 0.0088 | 0.0001 | 0.7099 | 0.6228 | 0.7953 |
| Modal | 12 | 0.0104 | 0.1 | 0.0086 | 0.7203 | 0.7228 | 0.8039 |
| Modal-V | 1 | 0.0002 | 0.1824 | 0.1679 | 0.0002 | 0.1824 | 0.1679 |
| Modal-V | 2 | 0.0221 | 0.0662 | 0.3881 | 0.0223 | 0.2486 | 0.556 |
| Modal-V | 3 | 0.2711 | 0.004 | 0.0235 | 0.2934 | 0.2527 | 0.5795 |
| Modal-V | 4 | 0.0011 | 1.327E-05 | 4.53E-05 | 0.2945 | 0.2527 | 0.5795 |
| Modal-V | 5 | 0.0026 | 0.0002 | 0.0008 | 0.2971 | 0.2529 | 0.5803 |
| Modal-V | 6 | 0.0001 | 1.894E-05 | 0.0024 | 0.2972 | 0.2529 | 0.5828 |
| Modal-V | 7 | 0.0016 | 0.0086 | 4.979E-05 | 0.2988 | 0.2615 | 0.5828 |
| Modal-V | 8 | 0.0006 | 0.0084 | 0.0021 | 0.2994 | 0.2699 | 0.5849 |
| Modal-V | 9 | 0.0004 | 0.0019 | 0.0014 | 0.2998 | 0.2718 | 0.5864 |
| Modal-V | 10 | 0.0056 | 0.0045 | 0.0003 | 0.3053 | 0.2764 | 0.5866 |
| Modal-V | 11 | 3.095E-06 | 0.0006 | 0.0002 | 0.3053 | 0.277 | 0.5869 |
| Modal-V | 12 | 0.0102 | 0.0061 | 0.0006 | 0.3155 | 0.2831 | 0.5874 |

**Table 2.3 - Modal Participation Factors**

| Case | Mode | Period sec | UX kN-m | UY kN-m | UZ kN-m | RX kN-m | RY kN-m | RZ kN-m | Modal Mass kN-m-s² | Modal Stiffness kN-m |
|---|---|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.508 | 9.8E-05 | -2E-06 | -1E-06 | 0.03739 | 1.127483 | 0.73452 | 1E-06 | 2E-05 |
| Modal | 2 | 1.433 | 6.2E-05 | 3.1E-05 | 2.672E-07 | -0.385087 | 0.679417 | -1.116943 | 1E-06 | 2E-05 |
| Modal | 3 | 1.2 | -1.6E-05 | 0.00011 | -1E-06 | -1.348731 | -0.167789 | 0.274839 | 1E-06 | 3E-05 |
| Modal | 4 | 0.614 | 2E-06 | -3E-06 | -1.3E-05 | -0.156364 | 0.032539 | -0.040343 | 1E-06 | 0.0001 |
| Modal | 5 | 0.545 | 5E-06 | -1E-06 | 2E-06 | 0.020925 | -0.049735 | -0.148607 | 1E-06 | 0.00013 |
| Modal | 6 | 0.445 | -4.2E-05 | -9E-06 | 4.118E-07 | -0.160643 | 0.987509 | 0.411851 | 1E-06 | 0.0002 |
| Modal | 7 | 0.422 | -4E-05 | -1E-06 | -2E-06 | -0.054752 | 0.917039 | -0.497031 | 1E-06 | 0.00022 |
| Modal | 8 | 0.353 | -6E-06 | 4.7E-05 | 2E-06 | 1.040458 | 0.099477 | -0.255231 | 1E-06 | 0.00032 |
| Modal | 9 | 0.315 | 5E-06 | -4E-05 | 3E-06 | -0.793851 | -0.145172 | -0.424964 | 1E-06 | 0.0004 |
| Modal | 10 | 0.226 | 3.9E-05 | 6E-06 | -1E-06 | 0.101064 | -0.817255 | -0.086075 | 1E-06 | 0.00077 |
| Modal | 11 | 0.15 | -1E-05 | 4.7E-05 | 3.801E-07 | 1.008994 | 0.247017 | 0.016721 | 1E-06 | 0.00176 |
| Modal | 12 | 0.128 | -3.2E-05 | -1.1E-05 | -1E-06 | -0.264715 | 0.834959 | -0.16621 | 1E-06 | 0.00242 |
| Modal-V | 1 | 1.508 | -9.8E-05 | 2E-06 | 1E-06 | -0.03739 | -1.127483 | -0.73452 | 1E-06 | 2E-05 |
| Modal-V | 2 | 1.433 | -6.2E-05 | -3.1E-05 | -2.672E-07 | 0.385087 | -0.679417 | 1.116943 | 1E-06 | 2E-05 |
| Modal-V | 3 | 1.2 | -1.6E-05 | 0.00011 | -1E-06 | -1.348731 | -0.167789 | 0.274839 | 1E-06 | 3E-05 |
| Modal-V | 4 | 0.619 | -1E-06 | 2E-06 | 7E-06 | 0.086566 | -0.009816 | 0.012067 | 1E-06 | 0.0001 |
| Modal-V | 5 | 0.611 | 2E-06 | -2E-06 | -1.1E-05 | -0.131732 | 0.034973 | -0.05123 | 1E-06 | 0.00011 |
| Modal-V | 6 | 0.592 | 2E-06 | -2.784E-07 | 2E-06 | 0.028999 | -0.01149 | -0.088026 | 1E-06 | 0.00011 |
| Modal-V | 7 | 0.462 | 2E-06 | 9.617E-08 | 1E-05 | 0.102058 | -0.244897 | -0.012651 | 1E-06 | 0.00018 |
| Modal-V | 8 | 0.399 | -5E-06 | -1E-06 | -1E-05 | 0.063076 | 0.242671 | -0.082671 | 1E-06 | 0.00025 |
| Modal-V | 9 | 0.308 | 2E-06 | -2E-06 | -9E-06 | -0.050009 | 0.114819 | 0.067545 | 1E-06 | 0.00042 |
| Modal-V | 10 | 0.189 | -3.701E-07 | 3E-06 | -5.2E-05 | -0.193648 | -0.177815 | -0.02945 | 1E-06 | 0.0011 |
| Modal-V | 11 | 0.149 | 4.048E-07 | -2E-06 | -0.000103 | 0.004557 | -0.065763 | 0.027283 | 1E-06 | 0.00177 |
| Modal-V | 12 | 0.081 | -1E-06 | -1.202E-07 | -6.7E-05 | 0.261252 | 0.206417 | -0.043005 | 1E-06 | 0.00597 |

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## 2 Analysis Results

This chapter provides analysis results.

### 2.1 Modal Results

**Table 2.1 - Modal Periods and Frequencies**

| Case | Mode | Period sec | Frequency cyc/sec | Circular Frequency rad/sec | Eigenvalue rad²/sec² |
|---|---|---|---|---|---|
| Modal | 1 | 1.508 | 0.663 | 4.1675 | 17.3683 |
| Modal | 2 | 1.433 | 0.698 | 4.3852 | 19.2297 |
| Modal | 3 | 1.2 | 0.833 | 5.2363 | 27.4194 |
| Modal | 4 | 0.614 | 1.627 | 10.2257 | 104.5645 |
| Modal | 5 | 0.545 | 1.836 | 11.5335 | 133.0221 |
| Modal | 6 | 0.445 | 2.247 | 14.1207 | 199.3931 |
| Modal | 7 | 0.422 | 2.369 | 14.8822 | 221.4787 |
| Modal | 8 | 0.353 | 2.836 | 17.8188 | 317.5111 |
| Modal | 9 | 0.315 | 3.179 | 19.9732 | 398.9288 |
| Modal | 10 | 0.226 | 4.418 | 27.7602 | 770.6262 |
| Modal | 11 | 0.15 | 6.673 | 41.9276 | 1757.9261 |
| Modal | 12 | 0.128 | 7.83 | 49.1994 | 2420.5847 |
| Modal-V | 1 | 1.508 | 0.663 | 4.1675 | 17.3683 |
| Modal-V | 2 | 1.433 | 0.698 | 4.3852 | 19.2297 |
| Modal-V | 3 | 1.2 | 0.833 | 5.2363 | 27.4194 |
| Modal-V | 4 | 0.619 | 1.615 | 10.1468 | 102.9569 |
| Modal-V | 5 | 0.611 | 1.636 | 10.2797 | 105.6731 |
| Modal-V | 6 | 0.592 | 1.689 | 10.6117 | 112.6074 |
| Modal-V | 7 | 0.462 | 2.164 | 13.5943 | 184.8059 |
| Modal-V | 8 | 0.399 | 2.505 | 15.741 | 247.7779 |
| Modal-V | 9 | 0.308 | 3.245 | 20.389 | 415.7107 |
| Modal-V | 10 | 0.189 | 5.281 | 33.182 | 1101.0429 |
| Modal-V | 11 | 0.149 | 6.693 | 42.0516 | 1768.3332 |
| Modal-V | 12 | 0.081 | 12.293 | 77.2378 | 5965.6822 |

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**Table 2.2 - Modal Participating Mass Ratios (Part 1 of 2)**

| Case | Mode | Period sec | UX | UY | UZ | Sum UX | Sum UY | Sum UZ |
|---|---|---|---|---|---|---|---|---|
| Modal | 1 | 1.508 | 0.475 | 0.0001 | 1.37E-05 | 0.475 | 0.0001 | 1.37E-05 |
| Modal | 2 | 1.433 | 0.1893 | 0.0468 | 3.523E-06 | 0.6643 | 0.0469 | 1.722E-05 |
| Modal | 3 | 1.2 | 0.012 | 0.6011 | 4.361E-05 | 0.6763 | 0.648 | 0.0001 |
| Modal | 4 | 0.614 | 0.0001 | 0.0004 | 0.0081 | 0.6764 | 0.6484 | 0.0081 |
| Modal | 5 | 0.545 | 0.0011 | 2.646E-05 | 0.0001 | 0.6776 | 0.6484 | 0.0083 |
| Modal | 6 | 0.445 | 0.0879 | 0.0036 | 8.368E-06 | 0.7654 | 0.6521 | 0.0083 |
| Modal | 7 | 0.422 | 0.0784 | 0.0001 | 0.0002 | 0.8438 | 0.6522 | 0.0085 |
| Modal | 8 | 0.353 | 0.002 | 0.1075 | 0.0002 | 0.8458 | 0.7597 | 0.0087 |
| Modal | 9 | 0.315 | 0.0012 | 0.078 | 0.0003 | 0.847 | 0.8377 | 0.009 |
| Modal | 10 | 0.226 | 0.0737 | 0.0015 | 2.717E-05 | 0.9207 | 0.8392 | 0.009 |
| Modal | 11 | 0.15 | 0.0053 | 0.1085 | 7.129E-06 | 0.926 | 0.9477 | 0.009 |
| Modal | 12 | 0.128 | 0.0511 | 0.0062 | 1.995E-05 | 0.9771 | 0.9539 | 0.009 |
| Modal-V | 1 | 1.508 | 0.475 | 0.0001 | 1.37E-05 | 0.475 | 0.0001 | 1.37E-05 |
| Modal-V | 2 | 1.433 | 0.1893 | 0.0468 | 3.523E-06 | 0.6643 | 0.0469 | 1.722E-05 |
| Modal-V | 3 | 1.2 | 0.012 | 0.6011 | 4.361E-05 | 0.6763 | 0.648 | 0.0001 |
| Modal-V | 4 | 0.619 | 3.713E-05 | 0.0002 | 0.0023 | 0.6763 | 0.6481 | 0.0023 |
| Modal-V | 5 | 0.611 | 0.0001 | 0.0003 | 0.006 | 0.6765 | 0.6484 | 0.0083 |
| Modal-V | 6 | 0.592 | 0.0002 | 3.824E-06 | 0.0002 | 0.6766 | 0.6484 | 0.0086 |
| Modal-V | 7 | 0.462 | 0.0003 | 0 | 0.0048 | 0.6769 | 0.6484 | 0.0133 |
| Modal-V | 8 | 0.399 | 0.001 | 4.787E-05 | 0.0046 | 0.6779 | 0.6485 | 0.0179 |
| Modal-V | 9 | 0.308 | 0.0002 | 0.0002 | 0.0039 | 0.6781 | 0.6486 | 0.0219 |
| Modal-V | 10 | 0.189 | 6.76E-06 | 0.0005 | 0.1321 | 0.6781 | 0.6491 | 0.1539 |
| Modal-V | 11 | 0.149 | 8.083E-06 | 0.0001 | 0.5262 | 0.6781 | 0.6492 | 0.6801 |

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## 1.3 Functions

### 1.3.1 Response Spectrum Functions

Table 1.7 - Response Spectrum Function - IS 1893:2016

| Name | Period sec | Acceleration | Damping | Seismic Zone | Z | Soil Class | I | R |
|---|---|---|---|---|---|---|---|---|
| RSP | 0 | 0.0192 | 5 | III | 0.16 | II | 1.2 | 5 |
| RSP | 0.1 | 0.048 | | | | | | |
| RSP | 0.55 | 0.048 | | | | | | |
| RSP | 0.8 | 0.03264 | | | | | | |
| RSP | 1 | 0.026112 | | | | | | |
| RSP | 1.2 | 0.02176 | | | | | | |
| RSP | 1.4 | 0.018651 | | | | | | |
| RSP | 1.6 | 0.01632 | | | | | | |
| RSP | 1.8 | 0.014507 | | | | | | |
| RSP | 2 | 0.013056 | | | | | | |
| RSP | 2.5 | 0.010445 | | | | | | |
| RSP | 3 | 0.008704 | | | | | | |
| RSP | 3.5 | 0.007461 | | | | | | |
| RSP | 4 | 0.006528 | | | | | | |
| RSP | 4.5 | 0.006528 | | | | | | |
| RSP | 5 | 0.006528 | | | | | | |
| RSP | 5.5 | 0.006528 | | | | | | |
| RSP | 6 | 0.006528 | | | | | | |
| RSP | 6.5 | 0.006528 | | | | | | |
| RSP | 7 | 0.006528 | | | | | | |
| RSP | 7.5 | 0.006528 | | | | | | |
| RSP | 8 | 0.006528 | | | | | | |
| RSP | 8.5 | 0.006528 | | | | | | |
| RSP | 9 | 0.006528 | | | | | | |
| RSP | 9.5 | 0.006528 | | | | | | |
| RSP | 10 | 0.006528 | | | | | | |

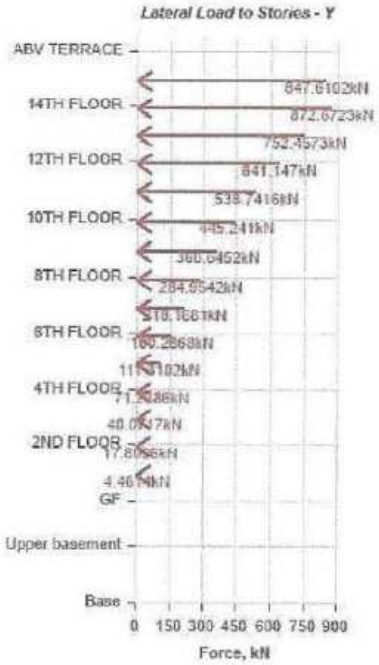
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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 0 | 40.0717 |
| 2ND FLOOR | 16.55 | 0 | 17.8096 |
| 1ST FLOOR | 13.55 | 0 | 4.4614 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 0 | 847.6102 |
| 14TH FLOOR | 52.55 | 0 | 872.6723 |
| 13TH FLOOR | 49.55 | 0 | 752.4573 |
| 12TH FLOOR | 46.55 | 0 | 641.147 |
| 11TH FLOOR | 43.55 | 0 | 538.7416 |
| 10TH FLOOR | 40.55 | 0 | 445.241 |
| 9TH FLOOR | 37.55 | 0 | 360.6452 |
| 8TH FLOOR | 34.55 | 0 | 284.9542 |
| 7TH FLOOR | 31.55 | 0 | 218.1681 |
| 6TH FLOOR | 28.55 | 0 | 160.2868 |
| 5TH FLOOR | 25.55 | 0 | 111.5102 |
| 4TH FLOOR | 22.55 | 0 | 71.2386 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.739$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**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 + Ecc. X | 0.739 | 151887.1217 | 5366.8153 |

**Applied Story Forces**

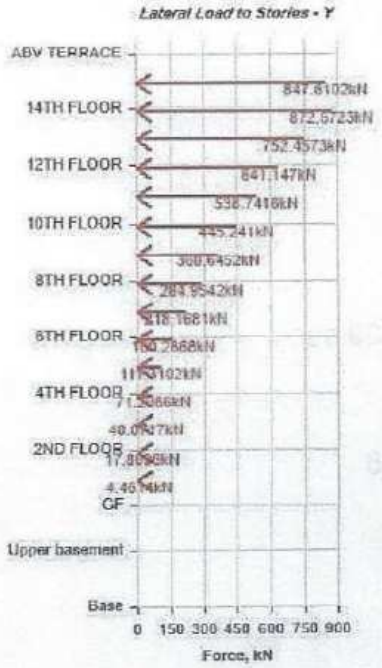
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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 0 | 40.0717 |
| 2ND FLOOR | 16.55 | 0 | 17.8096 |
| 1ST FLOOR | 13.55 | 0 | 4.4614 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 0 | 847.6102 |
| 14TH FLOOR | 52.55 | 0 | 872.6723 |
| 13TH FLOOR | 49.55 | 0 | 752.4573 |
| 12TH FLOOR | 46.55 | 0 | 641.147 |
| 11TH FLOOR | 43.55 | 0 | 538.7416 |
| 10TH FLOOR | 40.55 | 0 | 445.241 |
| 9TH FLOOR | 37.55 | 0 | 360.6452 |
| 8TH FLOOR | 34.55 | 0 | 284.9542 |
| 7TH FLOOR | 31.55 | 0 | 218.1681 |
| 6TH FLOOR | 28.55 | 0 | 160.2868 |
| 5TH FLOOR | 25.55 | 0 | 111.3102 |
| 4TH FLOOR | 22.55 | 0 | 71.2386 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = Y + Eccentricity X

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.739$ sec

**Factors and Coefficients**

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

Response Reduction Factor, R [IS Table 9] $R = 5$

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

Site Type [IS Table 1] = II

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**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 + Ecc. X | 0.739 | 151887.1217 | 5366.8153 |

**Applied Story Forces**

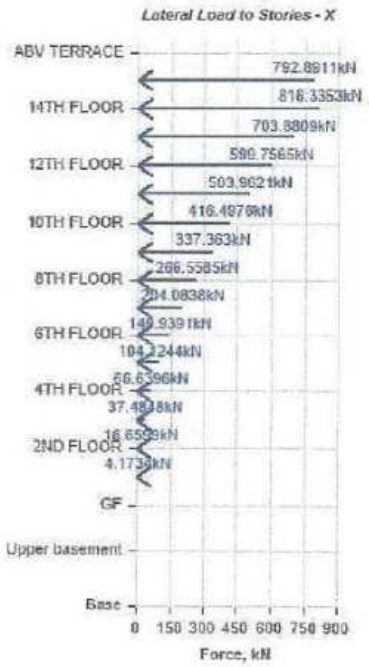
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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 37.4848 | 0 |
| 2ND FLOOR | 16.55 | 16.6599 | 0 |
| 1ST FLOOR | 13.55 | 4.1734 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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| Story | Elevation | X-Dir | Y-Dir |
|---|---|---|---|
| | m | kN | kN |
| ABV TERRACE | 58.55 | 0 | 0 |
| TERRACE | 55.55 | 792.8911 | 0 |
| 14TH FLOOR | 52.55 | 816.3353 | 0 |
| 13TH FLOOR | 49.55 | 703.8809 | 0 |
| 12TH FLOOR | 46.55 | 599.7565 | 0 |
| 11TH FLOOR | 43.55 | 503.9621 | 0 |
| 10TH FLOOR | 40.55 | 416.4976 | 0 |
| 9TH FLOOR | 37.55 | 337.363 | 0 |
| 8TH FLOOR | 34.55 | 266.5585 | 0 |
| 7TH FLOOR | 31.55 | 204.0838 | 0 |
| 6TH FLOOR | 28.55 | 149.9391 | 0 |
| 5TH FLOOR | 25.55 | 104.1244 | 0 |
| 4TH FLOOR | 22.55 | 66.6396 | 0 |

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## IS 1893:2016 Auto Seismic Load Calculation

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

**Direction and Eccentricity**

Direction = X - Eccentricity Y

Eccentricity Ratio = 5% for all diaphragms

**Structural Period**

Period Calculation Method = User Specified

User Period $T = 0.79$ sec

**Factors and Coefficients**

| | |
|---|---|
| Seismic Zone Factor, Z [IS Table 3] | $Z = 0.16$ |
| Response Reduction Factor, R [IS Table 9] | $R = 5$ |
| Importance Factor, I [IS Table 8] | $I = 1.2$ |
| Site Type [IS Table 1] = II | |

**Seismic Response**

Spectral Acceleration Coefficient, $S_a/g$ [IS 6.4.2] $\frac{S_a}{g} = 2.5$ $\frac{S_a}{g} = 2.5$

**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 - Ecc. Y | 0.79 | 151887.1217 | 5020.35 |

**Applied Story Forces**

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| | | | |
|---|---|---|---|
| 3RD FLOOR | 19.55 | 37.4848 | 0 |
| 2ND FLOOR | 16.55 | 16.6599 | 0 |
| 1ST FLOOR | 13.55 | 4.1734 | 0 |
| GF | 10.55 | 0 | 0 |
| Upper basement | 5.9 | 0 | 0 |
| Base | 0 | 0 | 0 |

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