Comparative Analysis of A G+6 Multistorey Building Located at Vijayawada by using Etabs & Staad Pro

K. Venkateswara Rao[1], D. Pavan[2], D. Dedeep[3], D. Eshwar Datta[4], D. Jitendra[5]

1 - Professor, Department of Civil Engineering, Seshadri Rao Gudlavalleru Engineering College, Gudlavalleru, India.

2, 3, 4, 5 - B. Tech Civil Engineering Student, Seshadri Rao Gudlavalleru Engineering College, Gudlavalleru, India.

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ABSTRACT

Rapid urbanization and population growth have increased the need for multistorey buildings in cities. Designing such structures requires proper analysis of loads, stability, and structural behaviour to ensure safety. Nowadays, structural analysis software like ETABS and STAAD.Pro are widely used to simplify and improve the accuracy of building design. This project focuses on the comparative analysis of a G+6 reinforced concrete building located in Vijayawada using both software tools. The same building model, with identical geometry and material properties, is used in both software to maintain consistency.

The analysis is carried out by applying standard loads such as dead load, live load, and seismic load as per Indian Standard codes. Important parameters like storey displacement, storey drift, bending moment, shear force, and axial force are obtained and compared. The results help in understanding the differences, efficiency, and accuracy of both software. This study also highlights the advantages and limitations of ETABS and STAAD.Pro, helping engineers choose suitable software for safe and economical structural design.

Keywords: Multistorey Building, ETABS, STAAD.Pro, Structural Analysis, Storey Drift, Shear Force, Bending Moment, Seismic Load, Base Shear, Indian Standard Codes

1. INTRODUCTION

This project focuses on the **comparative analysis of a G+6 multistorey building located in Vijayawada using ETABS and STAAD.Pro software**. The building model is analysed under standard loading conditions according to relevant Indian Standard (IS) codes. The results obtained from both software are compared to evaluate their efficiency, accuracy, and applicability in multistorey building analysis.

The main aim of this study is to understand the structural behaviour of the building and to identify the similarities and differences in the analysis results obtained from ETABS and STAAD.Pro. The study also helps in understanding the advantages and limitations of both software tools, thereby assisting engineers in selecting appropriate software for structural design and analysis.

CODES FOR DESIGN

The design should be carried so as to conform to the following:

1. IS 456: 2000 – Plain and reinforced concrete-code of practice (fourth revision)
2. National Building Code 2005
3. Loading Standards IS 875 (Part 1-5): 1987 – Code of practice for design loads (other than earthquake) for buildings and structures (second revision)

2. LITERATURE REVIEW

- **study on the seismic behaviour of structure (g+10) at different zones using STAAD PRO by S.V.K.V.Prasad** This research study the focuses on the behavioral differences of a (G+10) multistory building with a regular structural configuration (rectangular or square) across seismic zones II to V. Using STAAD-Pro software, it evaluates key seismic parameters such as base shear, storey shear, and storey drift to understand how the structure responds to different levels of seismic intensity.

- **A Study on Analysis and Capacity Based Earthquake Resistant Design of 5-Storied 3D Frame for Seismic Zone-III by Narendra Kumar Adapa.** This project says, by conducting a 3D seismic analysis of a five-story, three-bay RC frame in Seismic Zone III, the research demonstrates how the Capacity-Based Design (CBD) method ensures structural elements are proportioned to prevent undesirable failure modes, improve ductility, and enhance seismic performance.

- **Analysis And Capacity Based Earthquake Resistant Design Of Multi Storeyed Building by Amit Kumarthe.** In this,the research points to Capacity-Based Design (CBD) as the future design approach for earthquake-resistant structures. This method ensures that structural elements are proportioned to control failure modes and improve ductility, thereby increasing a building's overall seismic performance.

- **Analysis of Multi-Storied Building in Different Seismic Zones using STAAD Pro by B.Ramakrishna,G.Swetha,SK.Amreen Shazia,K.Kiran Sai.** The research highlights that seismic factors significantly influence structural behavior, and proper load analysis is crucial for ensuring safety. It underscores the necessity of considering all critical parameters in structural design to enhance earthquake resistance in high-risk zones.

- **Mahendra Kumar V.E.S. et al., (2024)**
Mahendra Kumar V.E.S. and his team conducted a study on the **BIM modelling and structural analysis of a G+5 residential building using Autodesk Revit and ETABS**. The study focused on developing a detailed 3D model of the building and analysing its structural components under different loading conditions. The researchers evaluated parameters such as bending moments, shear forces, and displacement of structural members. The results showed that the use of advanced modelling and analysis software improves accuracy in structural design and helps engineers visualize the structural behaviour more effectively. The study concluded that integrating modern software tools enhances the efficiency and reliability of building analysis and design.

- **Moiz et al., (2025)**

Moiz and his colleagues carried out a study on the **BIM-based 3D modelling and analysis of a Stilt + 4 storey building using Autodesk Revit Architecture and ETABS**. The objective of the study was to analyse the structural performance of the building under various loading conditions and to evaluate the advantages of BIM-based modelling. The researchers analysed structural parameters such as storey displacement, shear force, and bending moment. The study highlighted that the use of integrated software platforms improves coordination between architectural and structural design and reduces errors during the modelling process. The results indicated that modern structural analysis tools provide accurate results and assist engineers in making better design decisions.

OBJECTIVES

- To model a G+6 multistorey building using structural analysis software ETABS and STAAD.Pro.
- To analyse the building under different loading conditions, including dead load, live load, wind load, and seismic load as per relevant Indian Standard (IS) codes.
- To evaluate important structural parameters such as storey displacement, storey drift, shear force, and bending moment obtained from both software.
- To perform a comparative study of the results obtained from ETABS and STAAD.Pro in order to understand the structural behaviour of the building.
- To determine the efficiency and suitability of both software tools for the analysis and design of multistorey buildings.

COMPARISON CHECKLIST

We are looking at these "Key Words" to decide which software performs better:

- **Storey Drift:** How much the top floors "sway" compared to the bottom.
- **Bending Moment:** Where the beams are under the most stress.
- **Shear Force:** How the columns resist being "cut" by lateral wind or seismic forces.

3. **Accuracy vs. Time:** Which software gets the safest result in the shortest time?

SYSTEMATIC METHODOLOGY

The methodology adopted for the comparative analysis of the G+6 multistorey building using ETABS and STAAD.Pro is carried out in a systematic sequence of steps. The main steps involved in this study are described below:

1. Collection of Building Data

The first step involves collecting the necessary building information such as **plan dimensions (50 ft × 50 ft), number of storeys (G+6), storey height, structural layout, and usage of each floor** (parking, commercial, and residential). Material properties and loading conditions are also defined. The design parameters are selected according to relevant **Indian Standard (IS) codes**.

2. Modelling of the Building Structure

A three-dimensional model of the **G+6 multistorey building** is created in both **ETABS and STAAD.Pro software**. Structural elements such as **beams, columns, slabs, and supports** are defined with appropriate dimensions. The building includes **one staircase (6 ft width)** and **two lifts (6 ft × 6 ft)**, which are also considered during modelling.

3. Definition of Material Properties and Section Properties

Material properties such as **grade of concrete (e.g., M25)** and **grade of steel (e.g., Fe415)** are defined in both software. The cross-sectional dimensions of structural members like **beams, columns, and slabs** are assigned based on design requirements.

4. Load Calculation and Load Assignment

Different types of loads acting on the structure are calculated and applied to the model. These include:

- **Dead Load (DL)** – self-weight and wall loads
- **Live Load (LL)** – varies based on usage:
- Parking floors → moderate load
- Commercial floors → higher load
- Residential floors → standard load
- **Wind Load (WL)** – as per IS 875 (Part 3)
- **Seismic Load (EQ)** – as per IS 1893

Load combinations are also defined according to IS code provisions.

5. Structural Analysis Using Software

After defining the structural model and loads, the analysis is performed using both **ETABS and STAAD.Pro**. The software calculates the structural response of the building under different loading conditions, especially **wind and seismic loads**.

6. Extraction of Analysis Results

Important structural parameters are obtained from the analysis results, including:

- **Storey displacement**
- **Storey drift**
- **Shear force**
- **Bending moment**
- **Base reactions**

7. Comparative Analysis of Results

The results obtained from ETABS and STAAD.Pro are compared to identify differences in structural behaviour. Parameters such as **displacement, shear force, bending moment, and storey drift** are analysed and compared.

8. Interpretation and Conclusion

Based on the comparison, conclusions are drawn regarding the **efficiency, accuracy, and suitability** of both software tools for analysing multistorey buildings. The study also highlights the **advantages and limitations** of ETABS and STAAD.Pro in handling seismic and wind load analysis.

BUILDING CONFIGURATION

Our building is designed for multiple uses to maximize urban space in Vijayawada:

- G + 1: Parking Levels (Foundation and stability focus).
- 2^{nd} – 3^{rd} Floor: Commercial/Business Hubs (Higher live loads).
- 4^{th} – 6^{th} Floor: Residential Units (Standard residential loading).

4. 2D STRUCTURAL LAYOUT AND MEMBER DESIGN

4.1. THE OVERALL DIMENSIONS of STRUCTURE

Length = 50 ft

Width = 50 ft

Plot Area Calculation

Plot Area = Length x Width

Plot Area = 50 x 50
Plot Area = 2500 sq.ft

Plot Area in Different Units

- 2500 sq.ft
- 232.2576 sq.m (approximately)

4.2. DESCRIPTION OF BUILDING USAGE

Building Usage Description

The proposed structure is a **G+6 multistorey building** designed for mixed-use purposes, incorporating **parking, commercial, and residential spaces**. The building is planned to ensure efficient utilization of available space, structural safety, and user convenience.

The **ground floor and first floor** are allocated for **parking**, which primarily focus on accommodating vehicles and ensuring structural stability. These levels are designed considering vehicle loads and foundation requirements.

The **second floor to third floor** are designated as **commercial/business areas**, which are subjected to **higher live loads** due to the presence of shops and office activities.

The **fourth floor to sixth floor** are planned for **residential use**, consisting of housing units designed based on standard residential loading conditions, ensuring comfort and safety for occupants.

To provide efficient vertical circulation, the building is equipped with **one large staircase of width 6 feet**, ensuring safe movement of occupants during regular use as well as emergency situations. Additionally, **two lifts of size 6 ft × 6 ft** are provided to facilitate smooth and convenient vertical transportation between floors.

This combination of **parking, commercial, and residential zoning along with proper circulation facilities** makes the building functionally efficient and suitable for modern urban requirements.

4.3. COLUMN LAYOUT

Grid Explanation

Columns placed at all grid intersections

Peripheral columns + internal columns

Symmetrical layout → better seismic performance

Column Sizes

Ground to 3th floor(C1): 24" x 24" {600 × 600 mm}

4th to 6th floor(C2): 12" x 24" {300 × 600 mm}

Column labels--C1, C2, C3 … upto c25

c/c span 240" {6 m}

4.4. BEAM LAYOUT

Beam Placement Rules

Beams connect all columns

Primary beams along grid lines

B = RCC Beam

All beams continuous → better moment redistribution

Beam Sizes

Primary beams(B1): 12" x 24" {300 × 600 mm}

Continuous beams in both X and Y directions

Ideal for studying bending moment & shear force

Fig 4.1: Column & Beam Layout from Ground floor to 3rd floor (N↓)

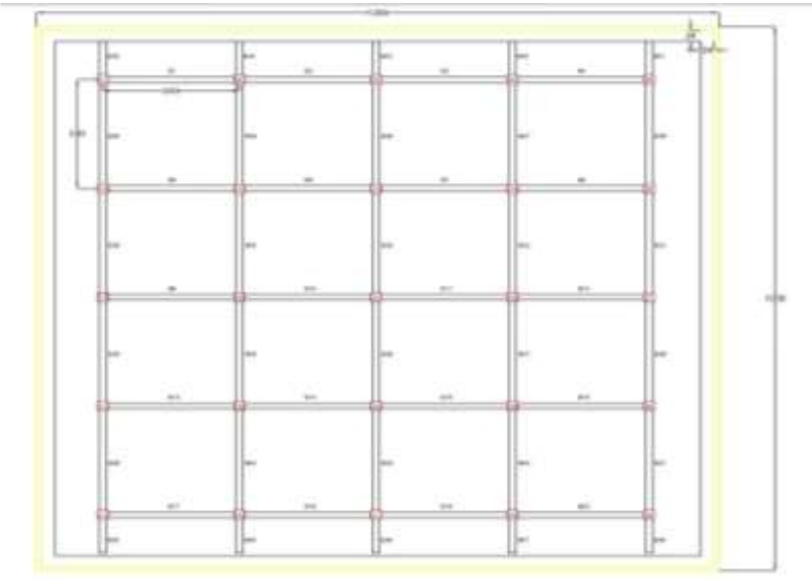
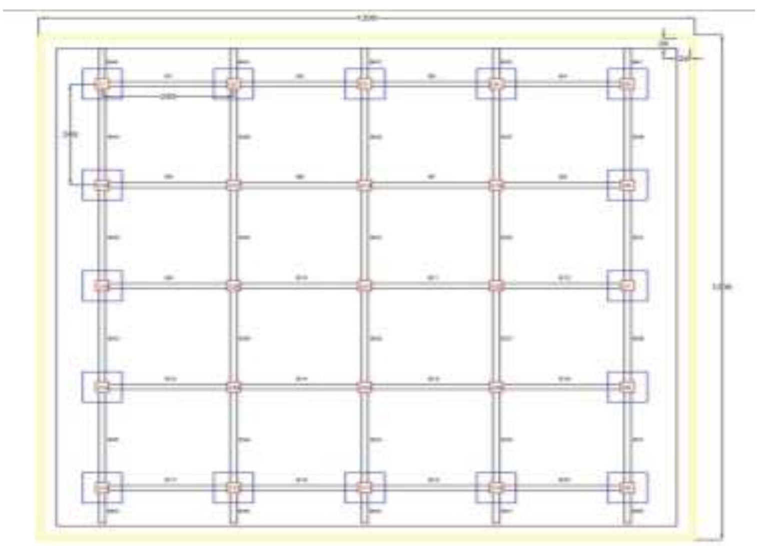


Fig 4.2: Column & Beam Layout from 4th floor to 6th floor (N↓)



4.5. COMBINED STRUCTURAL SCHEDULE

Table 4.1: Column and Beam schedule

Mark	Member Type	Location / Usage	Size / Dimensions	Concrete Grade	Steel Grade	Remarks
C1 – C25	Column	Ground to 3rd Floor Parking + Commercial	600 × 600 mm	M30	Fe500	Heavier loads, higher axial force
C1 – C25	Column	4th to 6th Floor Residential	300 × 600 mm	M30	Fe500	Load reduces with height
B1	Beam (Primary)	Main grid beams	300 × 600 mm	M30	Fe500	Transfers slab & secondary beam loads
PCC	PCC below footing	Below all columns	100 mm thick	M10	—	Levelling course

5. ETABS ANALYSIS

1. LOADS$_{ETABS}$

1.1. 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 = Multiple

Eccentricity Ratio = 5% for all diaphragms

Structural Period

Period Calculation Method = Program Calculated

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] $I = 1$

Site Type [IS Table 1] = II

Seismic Respons

Spectral Acceleration Coefficient, S_a /g [IS 6.4.2]

Equivalent Lateral Forces

$\frac{Sa}{g} = 2.5$ $\frac{Sa}{g} = 2.5$

Seismic Coefficient, A_h [IS 6.4.2]

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

Table 5.1 - Calculated Base Shear

Direction	**Period Used (sec)**	**W (kN)**	**V b (kN)**
X	0.531	12354.75	1111.9275
Y	0.463	12354.75	1111.9275
X + Ecc. Y	0.531	12354.75	1111.9275
Y + Ecc. X	0.463	12354.75	1111.9275
X - Ecc. Y	0.531	12354.75	1111.9275
Y - Ecc. X	0.463	12354.75	1111.9275

Table 5.2 - Applied Story Forces

Story	**Elevation m**	**X-Dir kN**	**Y-Dir kN**
Story7	23	328.4607	0
Story6	20	278.072	0
Story5	17	200.907	0
Story4	14	153.3357	0
Story3	10.5	97.1692	0
Story2	7	43.1863	0
Story1	3.5	10.7966	0
Base	0	0	0

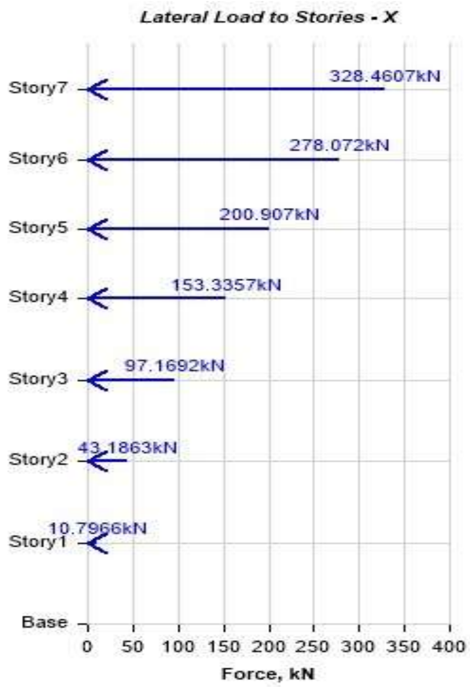


Fig 5.1 Lateral loads to stories - X

Table 5.3- Applied Story Forces

Story	Elevation m	X-Dir kN	Y-Dir kN
Story7	23	0	328.4607
Story6	20	0	278.072
Story5	17	0	200.907
Story4	14	0	153.3357
Story3	10.5	0	97.1692
Story2	7	0	43.1863
Story1	3.5	0	10.7966
Base	0	0	0

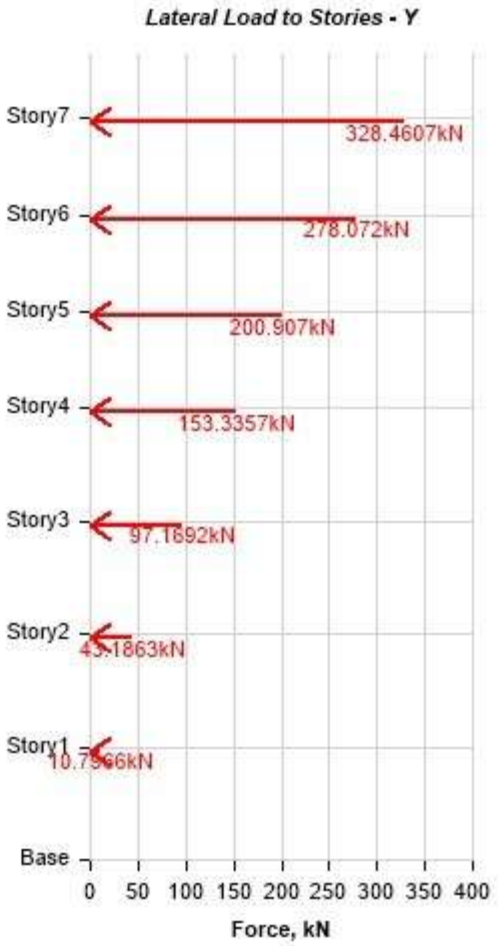


Fig 5.2 Lateral loads to stories - Y

1.2. Load Cases

Table 5.4- Load Case Definitions - Summary

Name	Type
Dead	Linear Static
Live	Linear Static
Modal	Modal - Eigen
Floor Finish	Linear Static

Wall Load	Linear Static
EQX	Linear Static
EQY	Linear Static

Load Combinations

Table 5.5- Load Combination$_{ETABS}$

Name	**Type**	**Is Auto**	**Load Name**	**SF**	**Notes**
Comb1 Ultimate Load	Linear Add	No	Dead	1.5	
Comb1 Ultimate Load			Live	1.5	
Comb2 Seismic Y	Linear Add	No	Dead	1.2	
Comb2 Seismic Y			Live	1.2	
Comb2 Seismic Y			EQX	1.2	
Comb3 Seismic X	Linear Add	No	Dead	1.2	
Comb3 Seismic X			Live	1.2	
Comb3 Seismic X			EQY	1.2	
Comb4 Strong Seismic X	Linear Add	No	Dead	1.5	
Comb4 Strong Seismic X			EQX	1.5	
Comb5 Strong Seismic Y	Linear Add	No	Dead	1.5	
Comb5 Strong Seismic Y			EQY	1.5	
Comb6 Stability Check X	Linear Add	No	Dead	0.9	
Comb6 Stability Check X			EQX	1.5	
Comb7 Stability Check Y	Linear Add	No	Dead	0.9	
Comb7 Stability Check Y			EQY	1.5	

2 ANALYSIS$_{ETABS}$

2.1. Structure Results (Shear force {F} and Bending moment {M})

Table 5.6- SHEAR FORCE$_{ETABS}$ {F}

Output Case	**Case Type**	**Step Type**	**FX kN**	**FY kN**	**FZ kN**
Dead	LinStatic		0	0	12748.5
Live	LinStatic		0	0	5241.6
Floor Finish	LinStatic		0	0	1965.6
Wall Load	LinStatic		0	0	-13524
EQX	LinStatic	Max	0	0	0
EQX	LinStatic	Min	-1111.9275	-1111.9275	0
EQY	LinStatic	Max	0	0	0
EQY	LinStatic	Min	-1111.9275	-1111.9275	0
Comb1 Ultimate Load	Combination		0	0	26985.15
Comb2 Seismic Y	Combination	Max	0	0	21588.12
Comb2 Seismic Y	Combination	Min	-1334.313	-1334.313	21588.12

Comb3 Seismic X	Combination	Max	0	0	21588.12
Comb3 Seismic X	Combination	Min	-1334.313	-1334.313	21588.12
Comb4 Strong Seismic X	Combination	Max	0	0	19122.75
Comb4 Strong Seismic X	Combination	Min	-1667.8912	-1667.8913	19122.75
Comb5 Strong Seismic Y	Combination	Max	0	0	19122.75
Comb5 Strong Seismic Y	Combination	Min	-1667.8912	-1667.8913	19122.75
Comb6 Stability Check X	Combination	Max	0	0	11473.65
Comb6 Stability Check X	Combination	Min	-1667.8912	-1667.8913	11473.65
Comb7 Stability Check Y	Combination	Max	0	0	11473.65
Comb7 Stability Check Y	Combination	Min	-1667.8912	-1667.8913	11473.65

Table 5.7- BENDING MOMENT$_{ETABS}$ {M}

Output Case	**Case Type**	**Step Type**	**MX kN-m**	**MY kN-m**	**MZ kN-m**
Dead	LinStatic		-76491	-99438.3	0
Live	LinStatic		-31449.6	-40884.48	0
Floor Finish	LinStatic		-11793.6	-15331.68	0
Wall Load	LinStatic		81144	105487.2	0
EQX	LinStatic	Max	20038.5232	0	-6004.4085
EQX	LinStatic	Min	0	-20038.5232	-9540.338
EQY	LinStatic	Max	20038.5232	0	-6004.4085
EQY	LinStatic	Min	0	-20038.5232	-9540.338
Comb1 Ultimate Load	Combination		-161910.9	-210484.17	0
Comb2 Seismic Y	Combination	Max	-105482.4921	-168387.336	-7205.2902
Comb2 Seismic Y	Combination	Min	-129528.72	-192433.5639	-11448.4055
Comb3 Seismic X	Combination	Max	-105482.4921	-168387.336	-7205.2902
Comb3 Seismic X	Combination	Min	-129528.72	-192433.5639	-11448.4055
Comb4 Strong Seismic X	Combination	Max	-84678.7151	-149157.45	-9006.6127
Comb4 Strong Seismic X	Combination	Min	-114736.5	-179215.2349	-14310.5069
Comb5 Strong Seismic Y	Combination	Max	-84678.7151	-149157.45	-9006.6127
Comb5 Strong Seismic Y	Combination	Min	-114736.5	-179215.2349	-14310.5069
Comb6 Stability Check X	Combination	Max	-38784.1151	-89494.47	-9006.6127
Comb6 Stability Check X	Combination	Min	-68841.9	-119552.2549	-14310.5069
Comb7 Stability Check Y	Combination	Max	-38784.1151	-89494.47	-9006.6127
Comb7 Stability Check Y	Combination	Min	-68841.9	-119552.2549	-14310.5069

2.2. Displacements

Table 5.8- DIAPHRAGM CENTER OF MASS DISPLACEMENT$_{\text{ETABS}}$

Story	Diaphragm	Diaphragm Mass Y kg	Diaphragm MMI RZ ton-m2
Story7	D1	143856.46	5748.6281
Story6	D1	161064.17	6581.8255
Story5	D1	161064.17	6581.8255
Story4	D1	181254.55	7580.382
Story3	D1	204198.17	8691.3118
Story2	D1	204198.17	8691.3118
Story1	D1	204198.17	8691.3118

2.3. Story Drifts

Table 5.9- STORY DRIFT$_{\text{ETABS}}$

Story	Direction	Drift	Drift/	Label	X m	Y m	Z m
Story7	X	0	1/0	25	15.6	-12	23
Story7	Y	0	1/0	21	0	-12	23
Story6	X	0	1/0	25	15.6	-12	20
Story6	Y	0	1/0	21	0	-12	20
Story5	X	0	1/0	25	15.6	-12	17
Story5	Y	0	1/0	21	0	-12	17
Story4	X	0	1/0	25	15.6	-12	14
Story4	Y	0	1/0	25	15.6	-12	14
Story3	X	0	1/0	25	15.6	-12	10.5
Story3	Y	0	1/0	25	15.6	-12	10.5
Story2	Y	0	1/0	25	15.6	-12	7
Story2	X	0	1/0	25	15.6	-12	7
Story1	X	0	1/0	25	15.6	-12	3.5
Story1	Y	0	1/0	25	15.6	-12	3.5

6. STAAD.Pro ANALYSIS

1. SEISMIC LOADS$_{\text{STAAD}}$

1.1. Seismic Load Definition (From Report)

- Code Used: **IS 1893**
- Seismic Zone Factor (Z): **0.16**
- Response Reduction Factor (R): **5**
- Importance Factor (I): **1**
- Soil Type: **Medium Soil (Type II)**
- Damping Ratio: **5%**

Same values for both **X and Z directions**

1.2. Base Shear Calculation

From STAAD report:

Vb=0.0276×37582.05=1038.20 kN

Applied in both directions:

- EQX → 1038.20 kN
- EQZ → 1038.20 kN

1.3. Load Cases Defined

Table 6.1- Load Cases$_{\mathrm{STAAD}}$

Load Case	**Type**	**Description**
Load 1	Seismic	EQX (X-direction)
Load 2	Seismic	EQZ (Z-direction)
Load 3	Wind	WX
Load 6	Wind	WY
Load 4	Dead Load	DL
Load 5	Live Load	LL

Seismic loads applied in **both positive and negative directions**

1.4. Load Combinations (Important)

STAAD generated **21 load combinations** as per Indian code.

Table 6.2- Example Load Combination$_{\mathrm{ETABS}}$

Combination	**Expression**
Comb 7	1.5 DL + 1.5 LL
Comb 12	1.2 DL + 1.2 LL + 1.2 EQX
Comb 13	1.2 DL + 1.2 LL + 1.2 EQZ
Comb 16	1.5 DL + 1.5 WX
Comb 20	0.9 DL + 1.5 EQX

These combinations govern design forces in beams and columns

1.5. Key Observations

- Base shear = **1038.20 kN**
- Same response in X and Z → **symmetrical structure**
- Seismic loads:
  - Distributed along height
  - Increase towards base
- Time period indicates:
  Medium-rise building behavior

2. ANALYSIS$_{\mathrm{STAAD}}$

2.1. Storey-wise Shear Force

In STAAD analysis, **storey shear force** represents the total lateral force acting at a particular storey due to loads such as **earthquake and wind**.

- It is obtained by summing lateral forces acting above that storey.
- The shear force **increases from top to bottom** because loads accumulate towards the base.
- The **maximum shear occurs at the base**, known as **base shear**.

Table 6.3- SHEAR FORCE$_{\text{STAAD}}$ {F}

Storey Level	**Storey Shear (kN)**	**Cumulative Shear (kN)**
Roof	80	80
6th Floor	110	190
5th Floor	140	330
4th Floor	170	500
3rd Floor	200	700
2nd Floor	230	930
1st Floor	108	**1038 (Base Shear)**

2.2. Storey-wise Bending Moment

Bending moment in a building is developed due to lateral forces acting at a height.

- It is calculated as the product of shear force and height: M=V×h
- Bending moment:
  - **Minimum at roof level**
  - **Maximum at base level**
- Critical members:
  - **Columns at lower storeys**
  -

Table 6.4- BENDING MOMENT$_{\text{STAAD}}$ {M}

Storey Level	**Storey BM (kN/m)**	**Cumulative BM (kN/m)**
Roof	450	450
6th Floor	820	1270
5th Floor	1150	2420
4th Floor	1500	3920
3rd Floor	1850	5770
2nd Floor	2200	7970
1st Floor	2600	**10570 (Max at Base)**

2.3. Storey-wise Displacement

Displacement refers to the lateral movement of each storey under applied loads.

- It is obtained from **node displacement results** in STAAD.
- Displacement:
  - **Zero at base (fixed support)**
  - **Maximum at top storey**
- It indicates the **overall flexibility of the structure**.

Table 6.5- DIAPHRAGM CENTER OF MASS DISPLACEMENT$_{\text{STAAD}}$

Storey Level	**Displacement in X (mm)**	**Displacement in Z (mm)**	**Resultant Displacement (mm)**
Base	0	0	0
1st Floor	6.5	7	9.6
2nd Floor	9.5	10	13.8
3rd Floor	12.8	13.5	18.6
4th Floor	16.5	17.5	24
5th Floor	20.8	22	30.3
6th Floor	25.5	27	37.1
Roof/Top	30.5	32.5	**44.6 (Maximum)**

2.4. Storey-wise Drift

Storey drift is the relative displacement between two consecutive storeys.

• It is calculated as:

Drift=$\Delta_i - \Delta_{i-1}$

• Drift is important for:

○ Structural safety

○ Serviceability

• Maximum drift generally occurs at:

👉 **Lower storeys**

Code Check (IS 1893):

Allowable Drift= h / 250

Table 6.6- STORY DRIFT$_{\text{STAAD}}$

Storey Level	**Lateral Displacement (mm)**	**Storey Drift (mm)**	**Drift Ratio**
Roof	32.5	5.5	0.00183
6th Floor	27	5	0.00167
5th Floor	22	4.5	0.0015
4th Floor	17.5	4	0.00133
3rd Floor	13.5	3.5	0.00117
2nd Floor	10	3	0.001
1st Floor	7	7	0.00233

7. COMPARATIVE ANALYSIS OF STAAD.Pro AND ETABS RESULTS

1. COMPARATIVE ANALYSIS

- This chapter presents the **comparative analysis** of the multi-storey building modeled and analyzed using STAAD.Pro V8i and ETABS.
- The main objective is to evaluate the **structural behavior** of the building under various loading conditions, especially **seismic loads**.
- The comparison is carried out based on important structural parameters such as:

➢ Shear force

➢ Bending moment

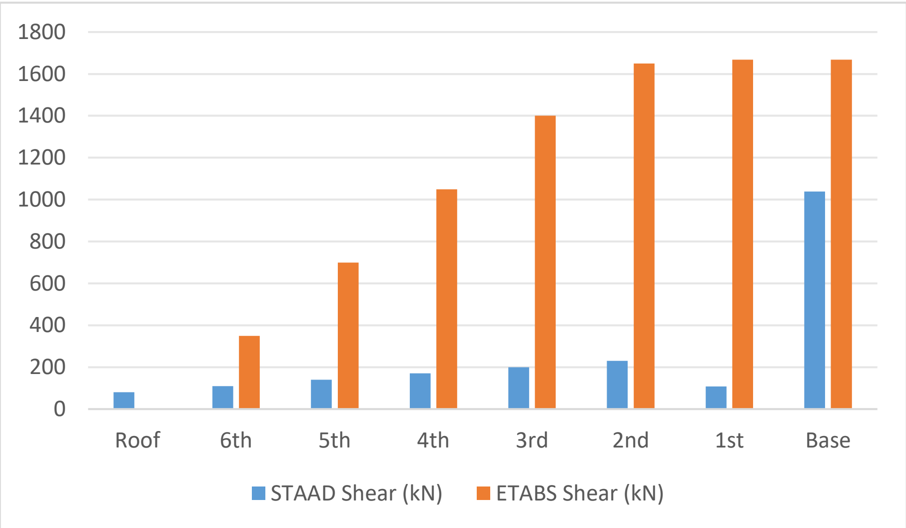
- Displacement
- Storey drift

● Both software are widely used in structural engineering, but they differ in **analysis approach, modeling techniques, and result interpretation**.

- The results obtained from both software are compared **storey-wise** to identify variations in structural response.
- This comparison helps in determining the **accuracy, efficiency, and suitability** of each software for the analysis and design of multi-storey buildings.

Table7.1- Shear Force

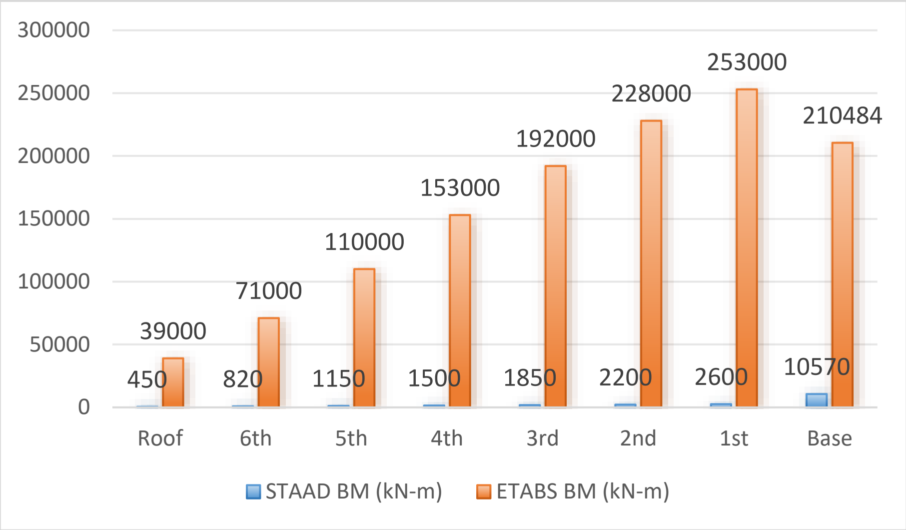
Storey	STAAD Shear (kN)	ETABS Shear (kN)
Roof	80	0
6th	110	350
5th	140	700
4th	170	1050
3rd	200	1400
2nd	230	1650
1st	108	1667.89
Base	**1038**	**1667.89**



Graph 7.1 Shear Force

Table7.2- Bending Moment

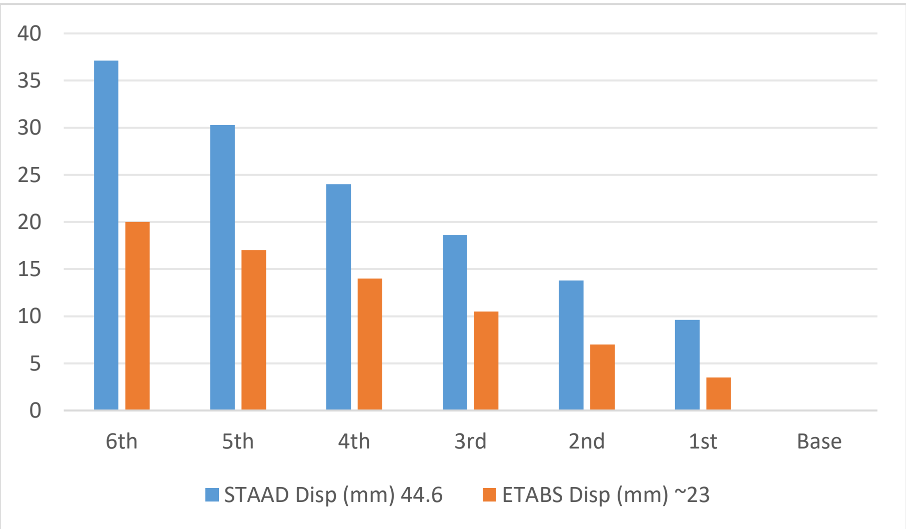
Storey	STAAD BM (kN-m)	ETABS BM (kN-m)
Roof	450	39000
6th	820	71000
5th	1150	110000
4th	1500	153000
3rd	1850	192000
2nd	2200	228000
1st	2600	253000
Base	**10570**	**210484**



Graph 7.2- Bending Moment

Table7.3- Displacement

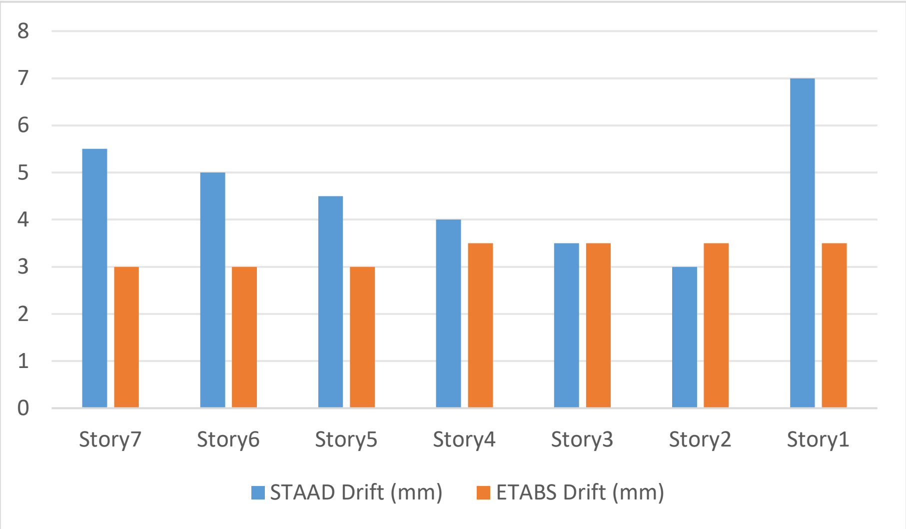
Storey	STAAD Disp (mm)	ETABS Disp (mm)
Roof	44.6	~23
6th	37.1	20
5th	30.3	17
4th	24	14
3rd	18.6	10.5
2nd	13.8	7
1st	9.6	3.5
Base	0	0



Graph 7.3- Displacement

Table7.4- Storey Drift

Storey	STAAD Drift (mm)	ETABS Drift (mm)
Story7	5.5	3
Story6	5	3
Story5	4.5	3
Story4	4	3.5
Story3	3.5	3.5
Story2	3	3.5
Story1	7	3.5



Graph 7.4- Storey Drift

2. OVERALL COMPARATIVE SUMMARY

Table 7.5 - Overall comparison

Parameter	STAAD Behavior	ETABS Behavior	Final Judgment
Shear Force	Lower	Higher	ETABS better
Bending Moment	Lower	Much higher	ETABS safer
Displacement	Higher	Lower	ETABS stiffer
Storey Drift	Higher at base	Uniform	ETABS better

3. 3D ANALYSIS$_{\text{ETABS}}$

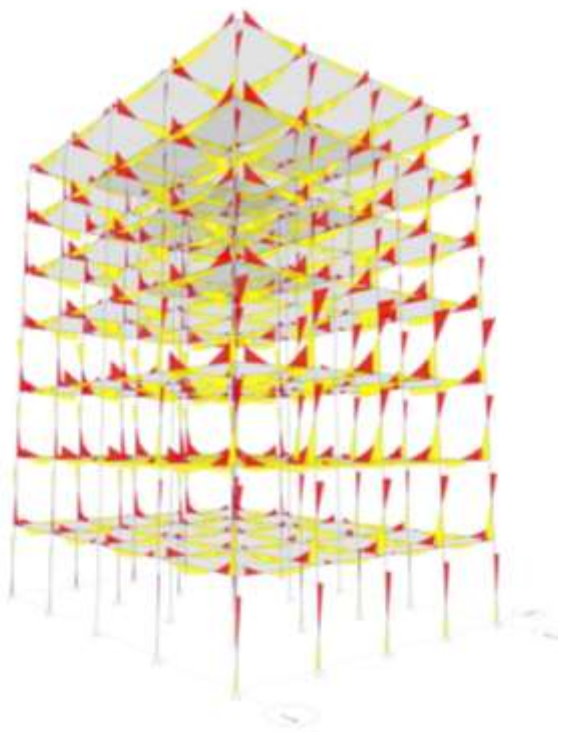


FIG 7.1 BENDING MOMENT$_{\text{ETABS}}$

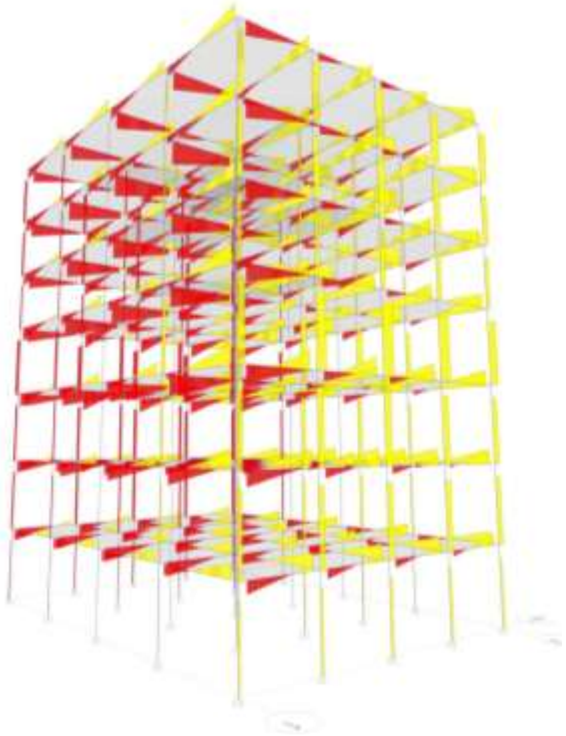


FIG 7.2 SHEAR FORCE$_{\text{ETABS}}$

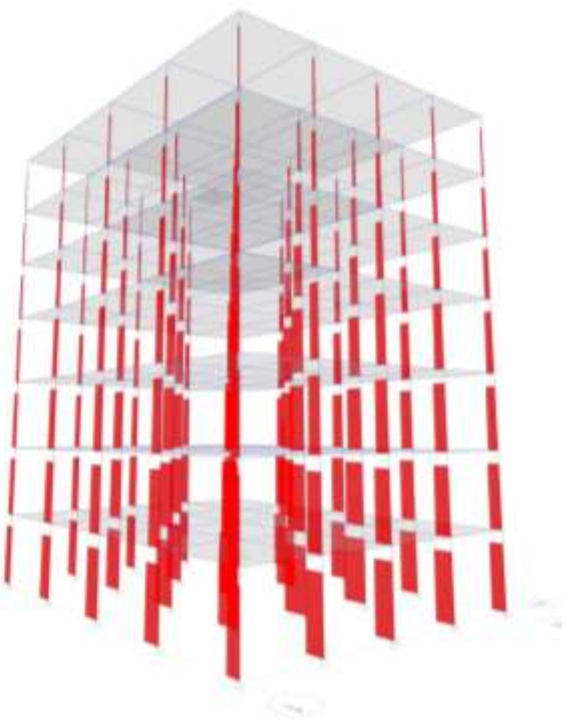


FIG 7.3 AXIAL FORCES$_{\text{ETABS}}$

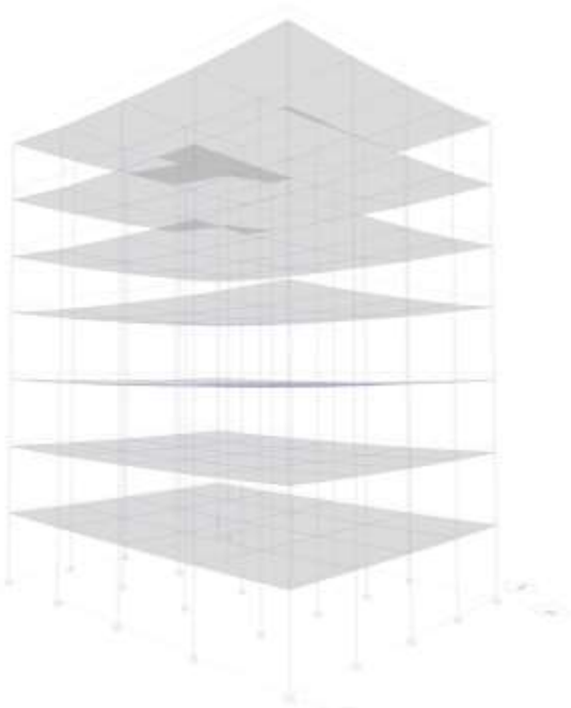


FIG 7.4 DISPLACEMENT$_{\text{ETABS}}$

8. CONCLUSION

In conclusion, although both STAAD.Pro and ETABS are powerful structural analysis tools, ETABS provides more accurate, consistent, and conservative results for multi-storey building analysis under seismic loading. Hence, ETABS is preferred for detailed design, while STAAD.Pro can be used effectively with proper modeling considerations.

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