Earthquake Analysis of Structure by Using ETAB

Mr. Pawan Wani[1], Dinesh Wagh[2], Bhushan Sonawane[3], Sumit Pawar[4], Sejal Tadavi[5], Sanjana Dhangar[6]
[1]*ASST.PROF Dept. Civil Engineering, SSBT;s College Of Engineering&Technology,Jalgaon*
[2,3,4,5,6]*Dept. Civil Engineering, SSBT;s College Of Engineering&Technology,Jalgaon*

***Abstract*—Structural analysis is an important branch of civil engineering that deals with determining the behavior of structures under different types of loads in order to predict the response of structural components. ETABS is one of the leading structural design software tools used in the construction industry. It incorporates various analysis methods such as static, dynamic, linear, and nonlinear analysis, making it suitable for the analysis and design of multistoried buildings.**

Earthquake-resistant design has become essential due to the increasing risk of seismic activity. This paper titled "Earthquake Analysis of Structure Using ETABS" focuses on the analysis of a G+09 storey residential building subjected to earthquake loads. The structural analysis is carried out using the equivalent static method, and the design of structural members is performed according to the guidelines of IS 456:2000.

The study also includes a comparative analysis between manual calculations and ETABS software results. The comparison helps to evaluate the efficiency, accuracy, and advantages of using ETABS for structural analysis and design.

***Index Terms*— Seismic Analysis, ETABS 2022, Displacement, Storey Shear.**

I. INTRODUCTION

Structural analysis is an essential aspect of civil engineering that helps engineers understand how structures behave under different types of loads. With the rapid development of construction technology and the increasing demand for multistoried buildings, the need for accurate and efficient structural analysis methods has become more important than ever.

In modern engineering practice, computer-based structural design software has become a key tool for engineers. ETABS is one of the leading structural design and analysis software programs used in the construction industry today. It is widely adopted by many design and consulting companies for analyzing and designing building structures due to its accuracy, efficiency, and ability to handle complex structural systems.

ETABS provides powerful tools for modeling, analysis, and design of multi-storeyed buildings subjected to various types of loads such as dead load, live load, wind load, and earthquake load. Compared to traditional manual calculations, the use of ETABS significantly reduces analysis time while improving precision and reliability.

II. LITERATURE REVIEW

1) Umer Bin Fayaz1, and Brahamjeet Singh2 (2023)
From the review of previous research studies, it is clear that seismic analysis plays a crucial role in the design of safe and durable buildings. Many researchers have demonstrated that ETABS is a powerful tool for evaluating structural performance under earthquake loads.

2) Nagalakshmi.P, Poojashree. B. S (2019)
The study focuses on analyzing the seismic performance of a multistorey building using ETABS. Earthquakes generate strong lateral forces that can cause serious damage or collapse of buildings. Traditional buildings with fixed foundations transfer earthquake vibrations directly to the structure, which increases structural deformation.

3) Rinkesh R. Bhandarkar, Utsav M Ratanpara, Mohammed Qureshi (2017):
They concluded that the displacement is decreased in shear wall structure as compared to frame structure. The story stiffness is more in shear structure than the frame structure. The story drift is decreased in shear wall structure than the frame structure. They concluded that the performance of shear structure is better than the frame structure. The shear structure is suitable in earthquake prone area due to its higher stiffness and less displacement.

4) Mr. Abhay Guleria (May 2014):

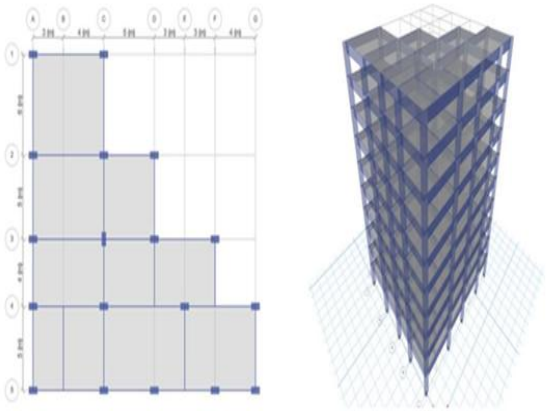
The case study in this paper mainly emphasizes on structural behavior of multi-storey building for different plan configurations like rectangular, C, L and I-shape. He analyzed 15-storey RCC frame building on ETABS software. Post analysis of the structure, maximum shear forces, bending moments, and maximum storey displacement are computed by him and then he compared for all the analyzed cases. After all analysis, he concluded that overturning moment varies inversely with storey height. He also concluded that L-shape, I-shape type buildings give almost similar response against the overturning moment. From dynamic analysis, he studied that mode shapes are generated and it can be concluded that asymmetrical plans undergo more deformation than symmetrical plans.

III. DESCRIPTION OF MODEL STUDY

3.1 Problem Statement

Analysis of a G+09RC framed structure (22.00m x 20.00m) located in Jalgaon (zone IV) for residential purpose with & without shear wall using ETABS and by manual calculations.

Length X Breath	22.00m X 20.00m
No. of Story	G + 09
Beam	450mm x 450mm
Column	600mm x 600mm
Slab Thickness	125mm
Support Condition	Fixed
Thickness of External Wall	230mm
Grade of Concrete & Steel	M-30 & Fe-500



Plan & 3D View

3.2. Methodology

Following Factors were taken into consideration for analysis of G +09 structure.

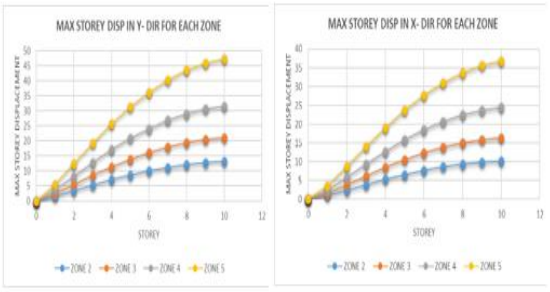
- Zone Factor (Z) – 0.16
- Importance Factor – 1
- Response Reduction Factor (R) – 3

3.3 Load Combination

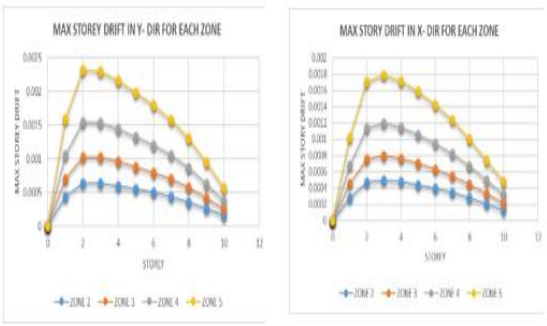
Sr. No.	Load Combination
1	0.9DL + 1.5WL (+X)
2	0.9DL + 1.5WL (+Y)
3	1.29DL+LL)
4	1.2DL+Ll+WL(+X)
5	1.2DL+Ll+WL(+Y)
6	1.5(DL+LL)
7	1.5DL+WL+seis(+X)
8	1.5DL+WL+seis(+Y)
9	0.9dl+1.5seis(+X)
10	0.9dl+1.5seis(+Y)

3.4 Figure

Story Displacement: Story displacement is with respect to base of the structure



Structural Drift: story drift is the horizontal, relative displacement between two consecutive floors in a building caused by lateral forces.



IV. ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my guide and faculty members of the Civil Engineering Department for their valuable guidance, encouragement, and continuous support during the completion of this study titled "Seismic Analysis of Building Using ETABS." Their technical suggestions and motivation helped me understand the concepts of seismic analysis and the application of ETABS software effectively.

I am also thankful to my institution for providing the necessary facilities, resources, and academic environment required to carry out this work successfully. Special thanks to all the authors and researchers whose published papers and references helped in understanding the theoretical background of seismic analysis and base isolation techniques.

V. CONCLUSION

I. The study concluded that:
II. ETABS is a powerful and efficient tool for wind and seismic analysis of buildings.
III. The software reduces analysis time and provides accurate structural results.
IV. Proper analysis helps engineers design buildings that can safely resist earthquake and wind forces.
V. Structural design following Indian Standard codes improves safety and stability of multistorey buildings.

REFERENCES

[1] U. B. Fayaz and B. Singh, "A study of seismic analysis of building using ETABS," vol. 10, no. 6, Dec. 2023, ISSN: 2350-0557.

[2] P. Nagalakshmi, B. S. Poojashree, and B. R. Vidya, "Seismic analysis of building using ETABS," vol. 7, no. 9, 2019, ISSN: 2278-0181.

[3] R. R. Bhandarkar, U. M. Ratanpara, and M. Qureshi, "Seismic analysis and design of multistory building using ETABS," *Int. J. Eng. Dev. (IJED)*, vol. 5, no. 2, 2017, ISSN: 2321-9939.

[4] Guleria, "Structural analysis of a multi-storeyed building using ETABS for different plan configurations," *Int. J. Eng. Res. Technol. (IJERT)*, vol. 3, no. 5, May 2014, ISSN: 2278-0181.