DESIGN AND ANALYSIS FOR G+25 HIGH RISE BUILDING WITH AND WITHOUT SHEAR WALL BY USING ETABS SOFTWARE

Yashwanthkumar S S[1], Kadam Prashant Rokdu[2], Yadav Pradeepkumar Upendra[3], Soni Shyamkumar Ramji[4], Patil Sourabh Anil[5]

[1]Asst Professor, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India
[2] B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India
[3]B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India
[4]B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India
[5]B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India

---***---

ABSTRACT – *This study presents the design and analysis of G+25 multi-storied building with and without shear wall in Zone 3 for understanding the structural behavior under various loading condition, particularly seismic forces. Shear wall are integral components in modern building design, known for their ability tom enhance structural stability and mitigate lateral deformation during seismic events. This study aims to compare the structural performance of multistoried building with shear wall against those without shear wall. Using advanced analytical technique and software tools, such as Finite element analysis, the study evaluates factors such as lateral displacement, inter-story drift, and overall structure integrity. The finding of this analysis contributes to a deeper understanding of the effectiveness of shear wall in improving the seismic resistance of multistoried building, thereby aiding in informed decision-making in structural design.*

Key Words: Shear Wall, Soil Type, Zone Factor, Models, G+25, ETABS.

1.INTRODUCTION

Multi-storied buildings represent a significant portion of urban infrastructure worldwide, accommodating various residential, commercial, and institutional functions. With the increasing urbanization and population density in seismic-prone regions, ensuring the structural integrity and safety of these buildings under seismic loading conditions is paramount. Shear walls, commonly integrated into multi-storied building designs, play a crucial role in enhancing their resistance to lateral forces, particularly seismic forces.

The purpose of this study is to conduct a comprehensive analysis comparing the structural behavior of multi-storied building with shear wall to those without shear wall. By systematically examining the differences in structural response and performance under seismic loading, this analysis aims to provide valuable insights into the effectiveness of shear wall in seismic resistance.

Through advanced analytical techniques and software tools, such as finite element analysis and structural modelling software, the study will evaluate key parameter including lateral displacement inter-story drift and overall structural stability.

1.1 Shear Wall

A Shear wall is a structural element typically made of reinforced concrete or masonry that provides lateral support to a building or structure against horizontal forces such as winds, seismic activity, or accidental impact. Shear walls are designed to resist shear forces, which are forces acting parallel to the surface of the wall.

These walls are often placed strategically throughout the buildings floor plan to form a rigid vertical plane that resist horizontal loads. They are particularly important in high rise building and structures located in seismic zones where lateral force can be significant.

The design of Shear Wall involves careful consideration of factor such as material strength, wall thickness, reinforcement detailing, and connection to the buildings framing system. Shear walls can be solid or made with opening for doors, windows, or other architectural features, but the presence of openings must be carefully accounted for in the design to ensure structural integrity.

Overall, shear walls play a crucial role in ensuring stability and safety of buildings, especially during adverse conditions such as earthquake or strong winds.

1.2 Types and Location of Shear Wall

1. Exterior Shear Wall

- These walls are typically located at the perimeter of a building
- They provide a lateral stability against wind forces and are crucial for resisting wind-induced overturning moment.

2.Interior Shear wall

- Interior shear wall is positioned within the floor plan of the building.
- Interior shear wall can divide the building into smaller segments, enhancing overall structural stability.

3.Core Shear Wall

- Core shear walls are the type of interior shear wall.
- Core shear walls provide primary lateral resistance against winds and seismic forces obtain acting as the backbone of the structural system.

4.Collector shear wall

- Collector shear wall is positioned to collect and distribute lateral forces from other part of the building to the primary shear walls.
- They are typically located at the end of corridor at junction between wings of a building or where lateral load are transferred between floors.

5.Coupled shear wall

- Coupled shear wall consist of two or more shear walls connected by horizontal beams or wall known as coupling beam.
- These walls are design to work together to resist lateral forces and can provide enhance stiffness and strength compare to individual shear wall

6.Inverted shear wall

- Inverted shear walls are the type of shear walls where the majority of the wall mass is located at the top rather than the base.
- This wall is often used in areas with high seismic activity to resist overturning and uplift forces.

2. BUILDING DISCRIPTION

A Building considered is the grid plan having (G+25) stories. Height of each story is 3m. The below details are considered for the Study and Analysis.

Table 2.1 Design Consideration

Building detail	Parameters
Plan dimension	24mx28m
Each bay dimension	4m
Grade of concrete	M40
Earthquake zone	3
Response Reduction factor	5
Seismic zone factor	0.16
Damping ratio	0.05
Structure type	GRID TYPE
Importance factor	1
Soil type	MEDIUM
Number of stories	G+25
Height of stories	3m
Height of building	76.5m
Slab thickness	150mm
Shear wall thickness	200mm
Beam size	300X450
Column size	450X600
Characteristic strength of concrete	40Mpa
Live load	Floor-2kn/m2 Terrace-1.5kn/m2
Dead load	External wall-19.125kn/m2 Internal wall-9.56kn/m2 Parapet load-9kn/m2
Terrain Category	1
Structure class	A

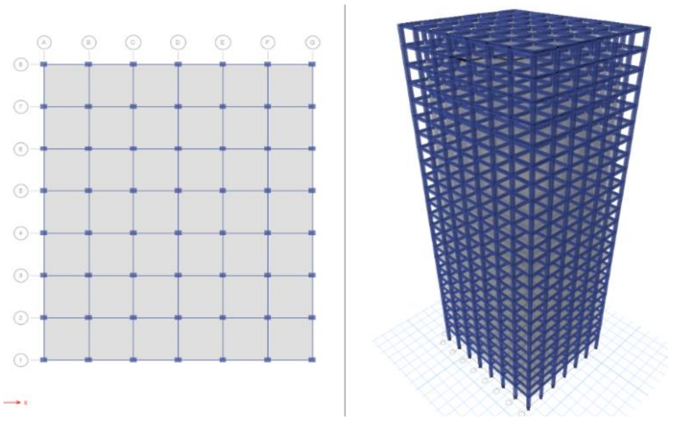

Figure 1: - Structural Plane

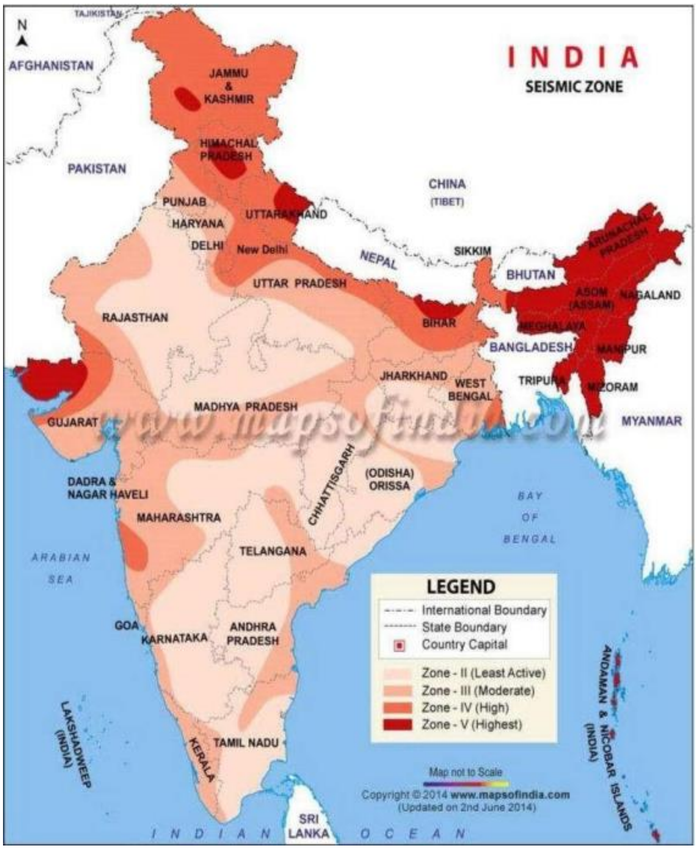

Figure 2: Seismic Zone in India

3.MODELLING AND ANALYSIS

3.1 ETABS

ETABS (Extended Three-dimensional Analysis of Building Systems) is a widely used software for structural analysis and design of buildings. Developed by computers and Structures, Inc. (CSI), ETABS is known for its advanced capabilities in modelling, analysis, and design of complex structural systems. Here an overview of its key features and functionalities:

1. **Modeling:** ETABS allows users to create detailed three-dimensional models of building structures. Various modeling, and object-based modeling. Users can input structural elements such as beams, columns, slabs, walls, and braces
2. **Analysis:** ETABS Provides a range of analysis options including linear and nonlinear static analysis, dynamic analysis, and modal analysis It can handle different types of loads including gravity loads, lateral loads (such as wind and seismic) and temperature loads
3. **Design:** The software offers comprehensive design capabilities for reinforced concrete, steel, and composite structures. It can perform code-based design checks according to various international design codes such as IS Code, ACI, AISC, Eurocode, and more
4. **Visualization:** ETABS Provides powerful visualization tools that allow users to view and manipulate 3D models of Structures. This includes features like graphical display of analysis results, animations of structural behavior, and interactive manipulation of the model.

3.2 MODEL DETAILS

Building is model with using ETABS. Total 5 model is created, 4 with shear wall and 1 without shear wall is done. Based on analysis result parameters is carried out. The following model have been considered.

Model I: - Corner L-shear wall.

Model 2: - Centre box shear wall.

Model 3: - Parallel and core shear wall.

Model 4: - Shear wall.

Model 5: - No shear wall.

3.3 IS CODES USED

1. IS 456-2000: code for RCC structures.
2. Sp-16: code for columns
3. Is-875(part 1): code for dead loads
4. Is-875(part 2): code for imposed loads
5. Is-875(part 3): code for winds loads
6. Is-1893-2016(part 2): earthquake loads

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 04 | Apr 2024 www.irjet.net p-ISSN: 2395-0072

3.4 METHODOLOGY

Drawing Grid Plan In ETABS

↓

Building Modelling in ETABS

↓

Define and Assigning of Materials, Beam, Column etc

↓

Defining of Loads as Per IS- Code 456-2000 & 1893-2016

↓

Analyze the Model & Check for Results

↓

Conclusions

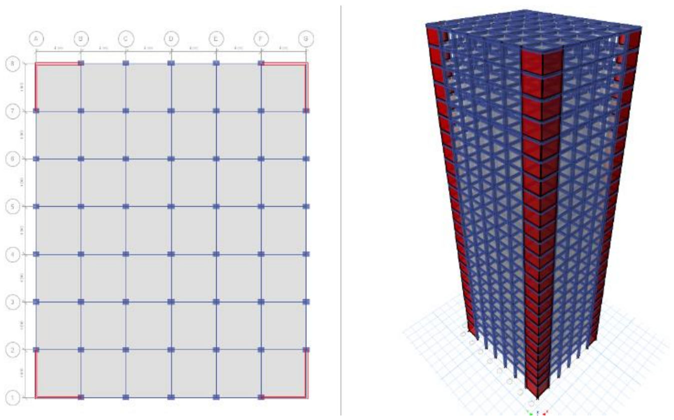

Figure 3: - Model I

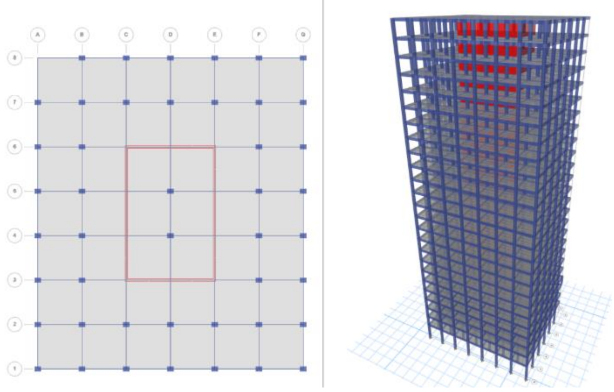

Figure 4: - Model II

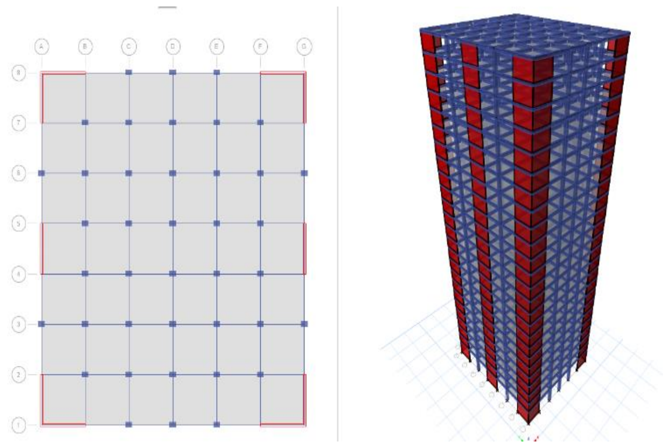

Figure 5: - Model III

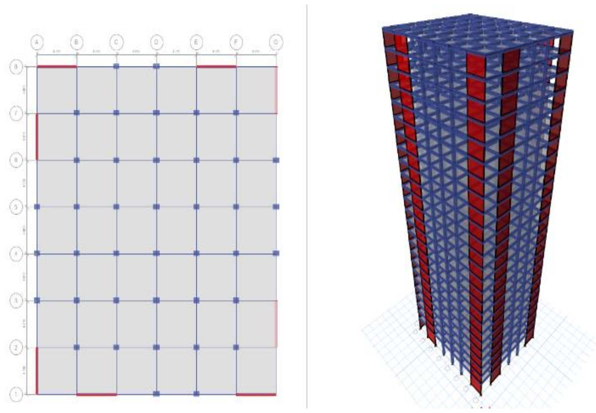

Figure 6: - Model IV

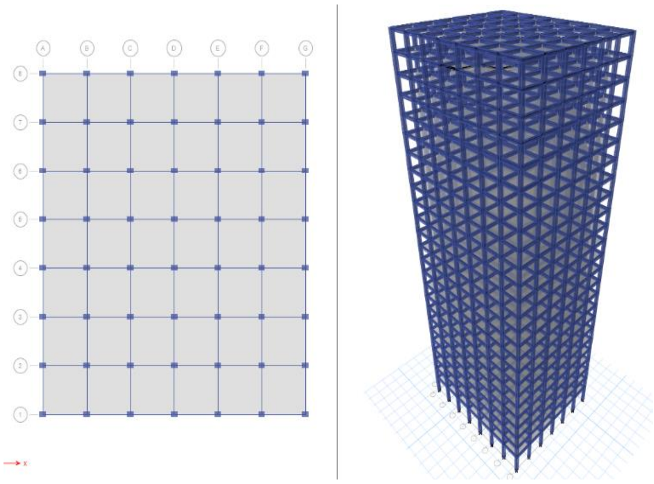

Figure 7: - Model V

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 04 | Apr 2024 www.irjet.net p-ISSN: 2395-0072

4. RESULT AND DISCUSSION

4.1 Lateral Displacement (Dead Load)

Lateral Displacement of model for each floor is shown below

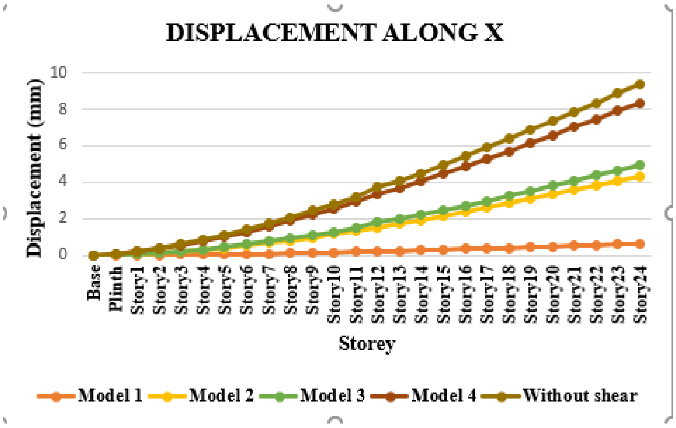

Figure 8: - Lateral Displacement in X-axis

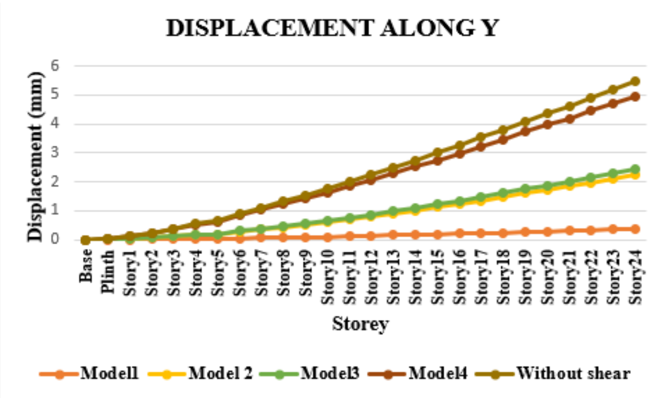

Figure 9: - Lateral Displacement in Y-axis

4.2 Lateral Displacement (Earthquake Load)

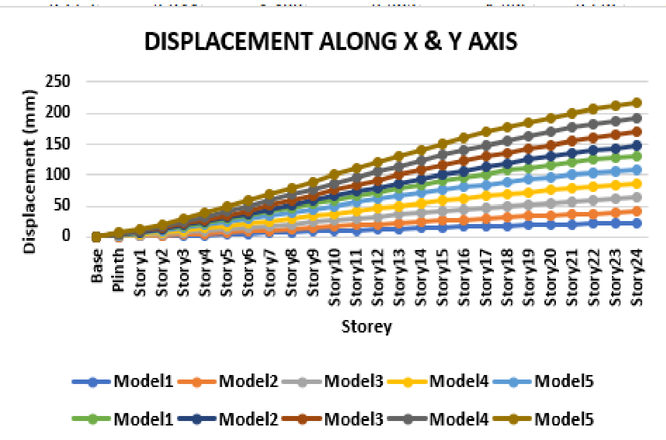

Figure 10: - Lateral Displacement in both direction

4.3 Lateral Displacement (Live Load)

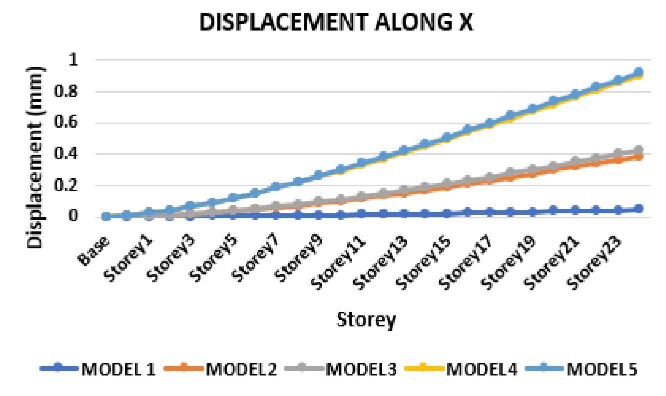

Figure 11: - Lateral Displacement in X direction

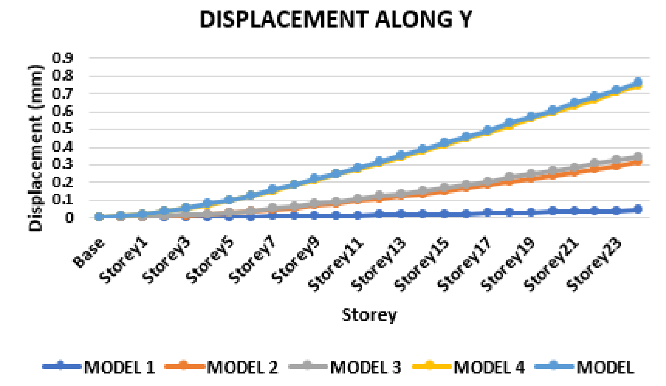

Figure12: - Lateral displacement in Y direction

4.4 Lateral Displacement (Wind Load)

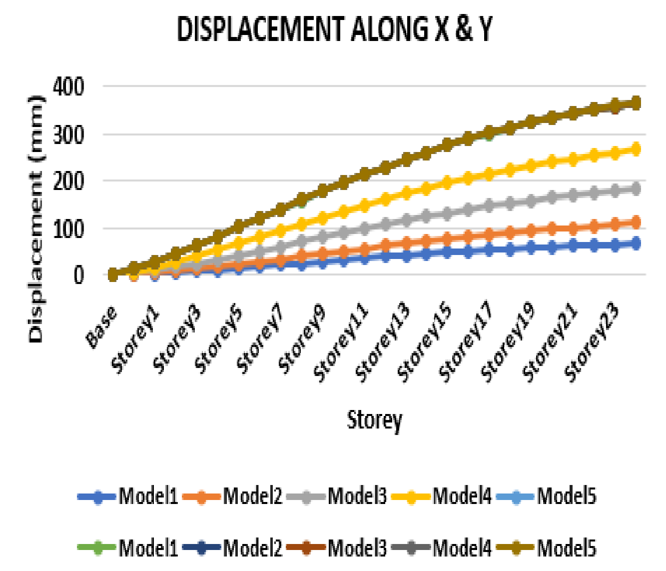

Figure 13: - Lateral displacement in both positive direction

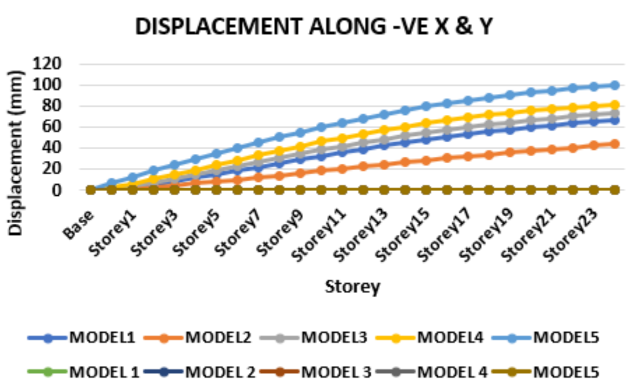

Figure 14: - Lateral displacement in both negative direction

5.CONCLUSION

From the above Graph and analysis, it is very clear that the shear wall is very effective in resisting Lateral displacement forces in all direction and all types of loads. For residential Building shear wall can be used as primary vertical load carrying elements and it effective to use.

6.REFERENCES

1. Susmeet D Bagde, Dr. G D Awchat (may 2019) IRJET
2. Wadmare Aniket, Konapure nijagunappa, Lodha pranav, Sardha Kanhaiyya, Patil krishnakant, B M Malagimani (June 2018) IRJET
3. P Kalpana, R D Prasad, B Kranti Kumar (Dec 2016) IJERA
4. P S Kumbare, A C Saoji (Oct 2012) IJERA

BIOGRAPHIES

Yashwanthkumar S S
(Asst. Professor, Department of Civil Engineering, New Horizon Institute of Technology and Management Maharashtra, India)

Kadam Prashant Rokdu
(B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India)

Yadav Pradeep Upendra
(B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India)

Soni Shyamkumar Ramji
(B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India)

Patil Sourabh Anil
(B.E Student, Department of Civil Engineering, New Horizon Institute of Technology and Management, Maharashtra, India)