A REVIEW ON INFLUNCE OF THE SHEAR WALL IN TALL INFLUENCE STRUCTURE WITHOUT ANY COLUMN

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Abstract - These days, modern residential buildings are getting higher and higher. The way these structures perform is significantly impacted by the impact of lateral loads from wind and earthquakes. Structural engineers frequently substitute shear walls for columns in their designs. Though they do a great job of resisting lateral shear, the shear walls frequently cause the structure to become unduly stiff. Although columns increase a structure's ductility, they frequently cannot withstand the full shear. As a result, choosing the appropriate ratio of shear walls to columns for structures of a given height becomes essential. Many models have been analyzed in ETABS and STAAD PRO software with different conditions of shear wall position, shapes, soil types, and seismic zones, all of which have an effect of dead load, live load, seismic load, and wind load.

Key Words: **tall irregular Structure, shear wall, Seismic Load, E-tabs, Staad pro.**

1.INTRODUCTION

Taller buildings are preferred these days due to the fast urban population growth, limited amount of available land and high cost of available land. Lateral load becomes increasingly significant as a structure's height increases. Wind load and seismic load are also significant factors in tall structures. Shear wall systems and diagrid structural systems have recently become the most common used lateral load resisting systems. Shear walls have very high plane stiffness and strength, allowing them to resist large horizontal loads while also supporting gravity loads, making them very useful in many structural engineering applications.

An earthquake is a variation in ground vibrations. Unpredictable earthquakes can happen at any time or place, and our nation has had numerous earthquakes that have severely damaged buildings and claimed lives. Therefore, the building must be designed by the design engineers to be resistant to damage brought on by the effects of seismic actions. These experiences have shown the latest advancements in strengthening the resistance to seismic actions, and proper execution of those actions is necessary to prevent damages from earthquakes. Shear walls are an excellent method of providing earthquake resistance to multistorey reinforced concrete structures. The structure is still damaged as result of one or more earthquakes. The behavior of a structure during an earthquake is determined by the distribution of weight, stiffness, and strength in both the horizontal and vertical planes of the structure. These can be used to improve building seismic response.

Various types of irregularities:

1. Vertical stiffness irregularity, 2. mass irregularity, 3.in plan irregularity, 3.out of plan irregularity, 4. vertical geometry irregularity, 5. discontinuity irregularity, 6. torsional irregularity, 7.non orthogonal irregularity.

Brief introduction about antilia: Two US architecture firms, Hirsch Bedner Associates in Los Angeles and Perkins & Will in Chicago, designed the building. The building was designed to withstand a magnitude 8 earthquake.[6] The top six floors are private areas. The design of the house includes flowers and the sun. Following Nita Dalal Ambani's admiration for the modern Asian interiors at the Mandarin Oriental, New York, which were also created by them, they were consulted. The building has a total of 27 floors, a height of 173 meters (568 feet), an area of more than 6,070 square meters (65,340 square feet) and 168 - parking, a restaurant and 9 elevators, a theatre for 50 people, a garden with a terrace, a swimming pool, a spa, health centre, temple and an igloo with snowflakes falling from its walls.

Figure 1: Antilia Mumbai, India [1]

1.2 Objectives

- To investigate the structure's seismic behaviour using IS 1893:2002.
- To analysis the true results of irregular buildings with and without shear walls by comparing various models in terms of story drift, story displacement, base shear, etc.
- Additionally examine the precise location and shape of the shear wall in the irregular structure.
- To investigate the impact of seismic loading on buildings when the structure consists solely of shear walls.

2. Literature Review

[1] G. Vamshi Pratap and d. Radha "comparative analysis of behavior of horizontal and vertical irregular buildings with and without using shear walls by ETABS software." Journal of Engineering Sciences [1]

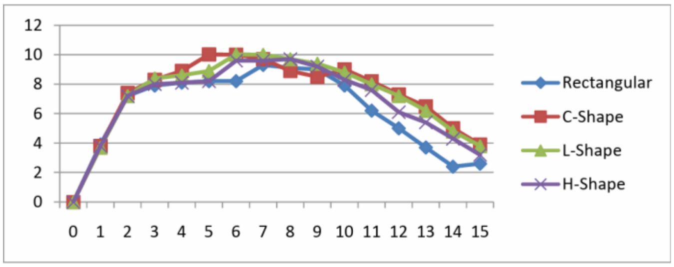
This research looked at G+11 multi-story building design horizontal and vertical irregular models with and without shear walls in zone 2. Height of the building is 36m. The foundation for this structural analysis is IS 456:2000, and the ETABS software is utilised to analyse. Furthermore, a governing role in analysis is played by various load combinations, wind load and seismic load. The study's main goal is to compare various parameters, such as story displacement, story drift, and the building's seismic behaviour, using IS 1893:2002.

Based on the study, shear walls are the vertical members which are generally used to reduce the intensity of the lateral loading also wind load and seismic loads. It observes that, the value of story drift is high in the absence of a shear wall, and the presence of a shear wall increases the stiffens of the structure.

[2] Pritam c. pawade, Dr. P.P. Saklecha, Milind R. nikhar "Comparison and analysis of regular and irregular configuration of multistorey building in various seismic zones and various type of soil" International Advanced Research Journal in Science, Engineering and Technology [2]

RC multistory buildings are vulnerable to the strongest earthquakes. It was discovered that irregular mass, stiffness, and strength distributions or irregular geometrical configurations are the primary causes of RC building failure. comparing the results of the analyses for the braced tube and diagrid structures. Primary goal of this research paper is to use Staad Pro software to analyse the behaviour of G+15 multistorey RC buildings with various plan configurations, including rectangular buildings and L, C, and H shapes, in accordance with the seismic provisions recommended in IS 1993:2002. As per the author, several soil types, such as hard, medium, and soft soil, have been taken into consideration during the investigation and compare the outcomes of the Liner and Nine Lenier dynamic analyses, as well as concepts such as Maximum Overturning, Story Drift, base shear Story Displacement, and Story Shear.

It was demonstrated that irregular shapes suffer significantly during earthquakes, particularly in high seismic zones. The top floor of an L-shaped building experiences the maximum story drift, whereas a rectangular-shaped building experiences the minimum story drift. Maximum bending and axial force moment also happens on the building's H-shape. When it comes to building shapes, the C shape is the most preferred.

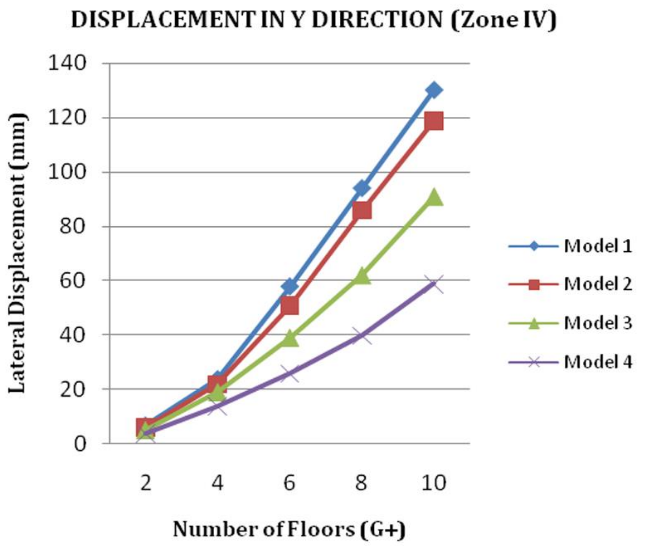


Story Drift for Various Shapes of Buildings

[3] Vinay Sanjeev Kumar daman "Comparative Study on Multistoried RCC Structure with and without Shear Wall by using SAP2000 v17" International Research Journal of Engineering and Technology [3]

The primary goal of the current study is to identify the best location for shear walls in multi-story buildings. Four distinct models are used to examine the efficacy of RCC shear wall construction. The first model is a bare frame system, and the three other types of frames each have a different shear wall location. Buildings with G+10 stories that are situated in distinct zones are subject to an earthquake load. The evaluation of a building's performance is based on the lateral displacements of every story. The analysis is carried out using the structural finite element analysis method and SAP2000 software. With the help of SAP2000, one model for bare frame type residential building and three models for dual type structural system are generated in this paper.

The analysis presented above indicates that, in comparison to all other models, the corner type shear wall exhibits the least amount of deflection. Shear walls absorb a significant portion of horizontal forces if their dimensions are large. According to the above response spectrum analysis, the corner type shear wall has the least deflection in zones 5 and 4, which are high earthquake intensity areas.



[4] MD. Mahboob Rahmani, Misbah Danish Sabri "Comparative Analysis of Regular and Irregular Buildings with and without Shear wall" International Research Journal of Engineering and Technology [4]

The purpose of this work is, use ETAB software to compare the seismic behavior of multi-story buildings with horizontal irregularity to that of regular buildings by varying heights (between 10 & 20 story range) with and without shear walls in zone 4 and medium soil. Also coupled shear walls have been studied to better understand the advantages and disadvantages of framed structures versus shear wall structures. It shown the different types of models for analysis. Type 1 structures are regular framed structures with and without shear walls. Types 2, 3, 4, and 5 are L-shaped irregularly framed structures. Types A and B are T-shaped irregularly framed structures. Types C and D are framed structures. And compare the various parameter like base shear, time-period.

It finds that the earthquake's effect is relatively more powerful than the four wind loads up to ten stories; after that, the wind load might be the high-rise structure's governing load. When a shear wall is present, the structure is more rigid than when it is not. However, seismic forces are entirely distinct. Essentially, they are forces of inertia that rely on the mass of the structures.

[5] Nikhil Pandey "Stability Analysis of Shear Wall at Different Locations in Multi-Storied Geometrically Irregular Building Using ETABS" International Journal of Engineering Research in Current Trends [5]

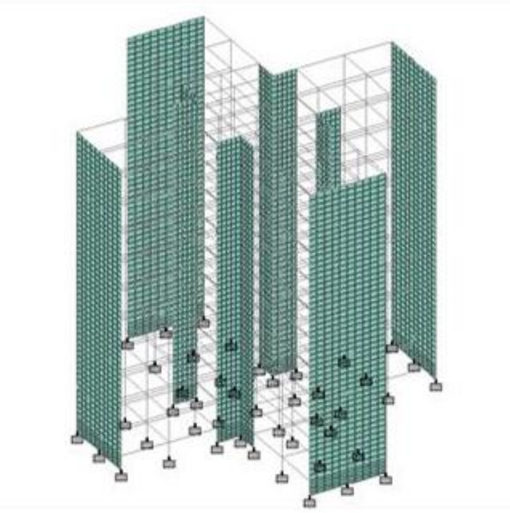
This report uses ETABS software to compare the effects of a with and without shear wall on the structure of G+20 multi-storey irregular building. Seismic analysis is performed using IS 1893:2002. For analysis, zone 5 with importance factor 1.5 is chosen. The purpose of the analysis is to determine, how the shear wall affects the dynamic characteristics of the building as well as a few other parameters like story displacement, shear drift, base shear and torsion effect with the help of various 8 models were analysis with different shape of shear wall like H, I and at different corners.

The analysis determined that the best location for a shear wall in a multi-story building is near the core of the building and I-shape shear wall placed in the center of the building to reduce story displacement, story drift, and overturning moment.

[6] Shylaja N, Ashwini R M and Babu E R "Seismic Analysis of Diagrid Structure on Sloping Ground" IOP Conference Series: Materials Science and Engineering (2019) [6]

This research paper presents a comprehensive examination an optimum location of shear wall in a 10-story, plus-shaped building with longer wings. Moreover, to understand seismic responses, a three plus-shaped ten-story building structure at zone 5 and medium soil with different positioning of shear walls (shear wall at edges, shear wall at core, shear wall at edges and re-entrant corners) is analysed using the response spectrum method of dynamic analysis and compare the few other parameters like story displacement, shear drift, base shear and torsion effect.

The study confirms that shear wall at edges and re-entrant corners perfume well in zone 5 and shown the lower value for torsional moment.



3D model of the structure with shear wall at edges and re-entrant corners

3. CONCLUSIONS

It concludes that, up to ten stories, the earthquake's effect is comparably more effective than the four wind loads; however, beyond that point, the wind load may serve as the high-rise structure's governing load. The structure is more rigid when a shear wall is present than when one is absent.

- It observes that, the value of story drift is high in the absence of a shear wall, and the presence of a shear wall increases the stiffness Sof the structure.
- The value of base shear and displacement (zones 5 and 4) is lower in the rectangular building when compared to the other models.
- According to the above response spectrum analysis, the corner type shear wall has the least deflection in zones 5 and 4, which are high earthquake intensity areas.
- The best location for a shear wall in a multi-story building is near the core of the building and an I-shape shear wall placed in the center of the building to reduce story displacement, story drift, and overturning moment.
- It is evident that the building's stability and strength are greater in its shear walled structure than in its non-shear walled one.

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[3] Vinay Sanjeev Kumar daman “Comparative Study on Multistoried RCC Structure with and without Shear Wall by using SAP2000 v17” International Research Journal of Engineering and Technology

[4] Nikhil Pandey “Stability Analysis of Shear Wall at Different Locations in Multi-Storied Geometrically Irregular Building Using ETABS” International Journal of Engineering Research in Current Trends

[5] Nikhil Pandey “Stability Analysis of Shear Wall at Different Locations in Multi-Storied Geometrically Irregular Building Using ETABS” International Journal of Engineering Research in Current Trends

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INDIAN STANDARDS: -

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[2] IS 456:2000 plain and reinforced concrete-code of practice.