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# Comparative Study on Seismic and Wind Response of G+12 Residential RCC Frame Building with and Without Shear Walls Using Staad Pro - A Review

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**Abstract-** In recent years, the rapid growth of urban population and limited land availability has led to the increasing construction of high-rise residential buildings. These structures are highly susceptible to lateral loads such as earthquake and wind forces, which can significantly affect their stability and safety. The present review paper focuses on the comparative study of seismic and wind response of a G+12 residential Reinforced Cement Concrete (RCC) frame building with and without shear walls. Shear walls are widely used as an effective lateral load-resisting system due to their high stiffness and strength. This study reviews various research works related to seismic analysis, wind effects, and the performance of shear walls in RCC structures. It highlights the importance of shear walls in reducing storey displacement, storey drift, and improving overall structural stability. The review also emphasizes the use of advanced structural analysis tools such as STAAD Pro for accurate modeling and analysis of buildings under different loading conditions. From the reviewed literature, it is observed that buildings with shear walls perform better compared to those without shear walls under both seismic and wind loads. However, a research gap exists in the combined analysis of seismic and wind effects on high-rise buildings. This study aims to address this gap and provide insights for safer and more efficient structural design practices.

**Keywords:** Seismic Analysis, Wind Load, Shear Wall, RCC Building, High-Rise Structure, Storey Drift, Displacement, STAAD Pro, Structural Stability.

## I. INTRODUCTION

The construction of multi-storey and high-rise buildings has increased significantly due to rapid urbanization and population growth. In cities, where land is limited and costly, vertical expansion has become the most practical solution to accommodate residential and commercial needs. However, as the height of buildings increases, their behavior under lateral loads such as earthquakes and wind becomes more critical and complex. These forces can cause significant displacement, structural damage, and even collapse if not properly considered during design. Earthquakes are one of the most dangerous natural disasters, causing severe damage to buildings and infrastructure. Past earthquakes, such as the 2001 Bhuj earthquake and the 2015 Nepal earthquake, have shown that poorly designed structures are highly vulnerable to seismic forces. Similarly, wind loads also play an important role in high-rise buildings, especially in open terrain and urban areas, where wind pressure increases with height and can cause sway and vibration. Reinforced Cement Concrete (RCC) frame structures are widely used in construction due to their strength, durability, and cost-effectiveness. However, conventional RCC frames alone may not be sufficient to resist lateral loads effectively. To overcome this limitation, shear walls are introduced as vertical structural elements that provide additional stiffness and strength to the building. Shear walls help in reducing lateral displacement, storey drift, and improving overall stability. With the advancement in technology, structural analysis has become more accurate and efficient using software tools like STAAD Pro. These tools allow engineers to model complex structures and analyze their behavior under various loading conditions as per Indian Standard codes such as IS 1893 (Part 1):2016 and IS 875 (Part 3):2015. This review paper aims to study and compare the seismic and wind response of a G+12 RCC residential building with and without shear walls by reviewing existing research works. The objective is to understand the effectiveness of shear walls in improving structural performance and to identify research gaps for future studies.

## II. LITERATURE REVIEW

In recent years, extensive research has been carried out on the seismic and wind behavior of multi-storey RCC buildings, particularly focusing on the role of shear walls in improving structural performance. Many researchers have analyzed buildings with and without shear walls and concluded that shear walls significantly enhance stiffness, reduce lateral displacement, and improve overall stability.

[1] Mohd Zahid et al. (2025) studied the seismic behavior of a G+5 building with and without bracing using STAAD Pro. The analysis was done using the response spectrum method under different seismic zones. The study found that base shear and displacement increase with seismic intensity. It highlighted the importance of dynamic analysis for accurate structural performance.

[2] Saurabh Sharma et al. (2025) analyzed a G+12 building under seismic and non-seismic conditions. The results showed that seismic loads significantly increase displacement, forces, and material cost. It was observed that ignoring seismic effects can lead to unsafe design. The study emphasized the need for seismic-resistant design.

[3] Vikas Gautam et al. (2024) studied a G+10 building with and without shear walls. The results showed that shear walls reduce displacement and storey drift effectively. Buildings without shear walls showed more deformation. The study concluded that shear walls improve structural stiffness and safety.

[4] Aaquib Ansari et al. (2024) reviewed structural models with and without plate elements. The study found that irregular buildings show higher displacement and drift. It also showed that modeling with plate elements gives more accurate results. Proper modeling is essential for safe design.

[5] A.B. Dehane et al. (2023) compared buildings with and without shear walls using STAAD Pro. The study found that shear walls increase stiffness and reduce lateral deformation. It also improves load-carrying capacity. Proper placement of shear walls is important.

[6] Payal Bahale et al. (2023) reviewed the role of shear walls in RCC buildings. The study showed that shear walls reduce displacement and torsional effects. It also highlighted the impact of irregularity in buildings. Proper design improves structural performance.

[7] Ankit Sonkar et al. (2023) studied a G+10 building with and without shear walls under seismic and wind loads. The results showed reduced displacement and improved stability with shear walls. It also emphasized the importance of proper location. Shear walls enhance safety.

[8] Pinaki et al. (2023) compared STAAD Pro and ETABS for buildings with shear walls. The study found that both software give similar results. Shear walls placed at corners improve stiffness. Minimum shear wall area can also give safe design.

[9] Ruchika Sarode et al. (2023) analyzed a G+8 building with shear walls. The results showed reduced displacement and storey drift. Full shear wall configuration gave better performance. It improved structural stiffness.

[10] Aazim Nisar et al. (2023) studied a G+5 building in seismic Zone V. The study found that shear walls improve strength and reduce vulnerability. Proper positioning enhances performance. It is important for high seismic zones.

[11] Ayesha Ansari et al. (2023) studied irregular buildings with different shear wall locations. The results showed that proper placement reduces storey drift. It improves stability and load distribution. Irregular buildings need careful design.

[12] Radhika Rajeev et al. (2022) reviewed various studies on shear wall performance. The study found that shape and position of shear walls affect behavior. Proper placement improves efficiency. It reduces displacement and cost.

[13] Rishab Jain et al. (2022) analyzed a G+15 building with and without shear walls. The results showed reduced displacement and drift with shear walls. It increased stiffness and stability. Shear walls are essential for high-rise buildings.

[14] Ahmed Raza Khan et al. (2021) studied buildings with shear walls under load combinations. The study found that shear walls reduce deformation. It improves lateral resistance. Wind effects were also considered.

[15] Sonali Jivane et al. (2021) studied seismic response in different zones. The results showed that displacement and drift increase with seismic intensity. Dynamic analysis methods give better accuracy. It is important for high-rise buildings.

[16] Prathibha Reddy et al. (2021) studied seismic and wind effects on buildings. The results showed that shear walls reduce displacement and drift. Regular buildings performed better. Shear walls improve stability.

[17] Mohd Sarmad Khan et al. (2021) compared buildings with and without shear walls. The study found reduced drift and displacement with shear walls. It improved stiffness and safety. It also showed economic benefits.

[18] Abhishek Patil et al. (2021) compared seismic and non-seismic loads on buildings. The results showed higher forces under seismic conditions. It highlighted the need for seismic design. Ignoring seismic loads is unsafe.

[19] Hardik Mandwe et al. (2021) studied a high-rise building with shear walls. The study found reduced displacement and sway. Shear walls improved load transfer. It enhanced structural stability.

- [20] Rachita Raul et al. (2019) analyzed a G+7 building using STAAD Pro. The study found that proper modeling improves accuracy. It ensures safe load transfer. Structural design becomes efficient.
- [21] Manibhushan Kumar et al. (2018) studied different shear wall locations. The results showed that proper positioning reduces displacement. It improves stiffness and performance. Incorrect placement reduces efficiency.
- [22] Rajat Srivastava et al. (2018) studied seismic behavior of G+9 building. The results showed that dynamic analysis gives better results. Proper design improves safety. Irregularities increase risk.
- [23] Mukesh Sharma et al. (2018) compared buildings with and without shear walls. The results showed reduced drift and displacement with shear walls. It improved structural stiffness. Proper placement is important.
- [24] Kanchan Rana et al. (2017) studied effect of shear wall location. The results showed that symmetrical placement reduces torsion. It improves stability and performance. Proper location is critical.
- [25] Avani Mandlik et al. (2016) compared RCC and steel structures. The study found steel structures perform better under lateral loads. RCC structures have higher weight. Material choice affects performance.

### III. RESEARCH GAP

From the detailed review of the above 25 research papers, it is clearly observed that many researchers have studied the seismic behavior of RCC buildings and the effect of shear walls on structural performance. Most of the studies focused on comparing buildings with and without shear walls and concluded that shear walls significantly improve stiffness, reduce displacement, and enhance overall stability. Some studies also analyzed irregular buildings and emphasized the importance of proper placement of shear walls. In addition, several researchers used different software tools like STAAD Pro and ETABS for analysis and compared their results. However, it is found that many studies are limited to either seismic analysis or wind analysis separately, and very few have considered the combined effect of both loads on high-rise buildings. Furthermore, most of the previous research works are focused on low-rise or mid-rise buildings such as G+5, G+7, or G+10 structures, and limited studies are available for higher buildings like G+12 under combined loading conditions. There is also a lack of detailed comparative studies considering modern Indian Standard codes such as IS 1893 (Part 1):2016 and IS 875 (Part 3):2015 together. Another important gap identified is that the influence of shear wall configuration under both seismic and wind forces simultaneously is not deeply explored in many studies. Additionally, some research works have not provided a clear comparison of key parameters such as storey drift, displacement, and base shear in a combined loading scenario. Therefore, there is a need for a comprehensive study that analyzes and compares the behavior of a G+12 RCC residential building with and without shear walls under both seismic and wind loads using advanced analysis methods. This study aims to fill this gap by providing a detailed comparison of structural performance and identifying the effectiveness of shear walls in improving safety and stability.

### CONCLUSION

From the overall review of the selected literature, it can be concluded that lateral loads such as earthquake and wind have a significant impact on the behavior of multi-storey RCC buildings. Most of the studies clearly indicate that buildings without shear walls are more flexible and experience higher displacement, storey drift, and structural instability. On the other hand, the inclusion of shear walls greatly improves the stiffness, strength, and overall performance of the structure under lateral loading conditions. It is also observed that the location and configuration of shear walls play a very important role in achieving optimal structural performance. The literature also highlights that dynamic analysis methods such as response spectrum analysis provide more accurate results compared to static methods, especially for high-rise buildings. The use of modern software tools like STAAD Pro has made structural analysis more efficient and reliable. However, most studies have focused on either seismic or wind loads individually, and limited research has been conducted on their combined effect. Therefore, there is a need for further studies that consider both types of loads together to ensure safe and economical design. Overall, the literature strongly supports the use of shear walls as an effective solution for improving the performance of RCC buildings subjected to lateral forces.

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