

Structural Behavior of High-Rise Building with Composite Shear Wall

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Abstract—A shear wall is a vertical, planar structural element designed to provide lateral load resistance by acting as a cantilever fixed at its base, primarily resisting in-plane shear forces, bending moments, and axial forces induced by wind, seismic, or other horizontal loads, and transferring these loads efficiently to the foundation while controlling overall structural drift and deformation. When wind flows around a building, it exerts positive pressure on the windward face and suction on the leeward and side faces. These pressures, which increase with height due to greater wind speeds, are quantified using design codes like IS 875 (Part 3) through factors for terrain, topography, and structure geometry. In wind analysis, a shear wall acts much like a vertical cantilever beam fixed at the base. The stiffness of the wall significantly reduces overall building sway and controls storey drift, thereby improving occupant comfort and protecting non-structural components. If multiple shear walls are present, wind induced forces are distributed among them in proportion to their relative stiffness, ensuring an efficient load sharing mechanism. In this study, the effect of presence of shear walls in RCC and composite structures in being analysed on basis of storey displacement, storey drift, stiffness, lateral force and base shear for G+20, G+25, G+30 buildings. Effectiveness of shear wall is being studied with the help of Twelve different models. Model 1 is G+20 RCC building with 300 thickness shear wall, Model 2 is a G+20 RCC building contains 300 mm thick composite shear wall with a 25 mm thick steel plate, Model 3 is G+25 RCC building with 300 thickness shear walls, Model 4 is a G+25 RCC building contains 300 mm thick composite shear wall with a 25 mm thick steel plate, Model 5 is G+30 RCC building with 300 thickness shear wall, Model 6 is a G+30 RCC building contains 300 mm thick composite shear wall with a 25 mm thick steel plate, Model 7 is G+20 RCC building with 400 thickness shear wall, Model 8 is a G+20 RCC building contains 400 mm thick composite shear wall with a 25 mm thick steel plate,

Model 9 is G+25 RCC building with 400 thickness shear wall, Model 10 is a G+25 RCC building contains 400 mm thick composite shear wall with a 25 mm thick steel plate, Model 11 is G+30 RCC building with 400 thickness shear wall, Model 12 is a G+30 RCC building contains 400 mm thick composite shear wall with a 25 mm thick steel plate. The wind analysis is performed at different heights, such as 60 m, 75 m, and 90 m, with velocities of 44 m/s. The behaviors of the structure by using the Static analysis method and dynamic analysis method. The present study has been done by ETABS 2022. The comparison of the plan configurations also highlights the interaction between parameters such as storey displacement, storey drift, storey stiffness, and overturning moment response.

Index Terms—Steel Plate Shear Wall, Composite Shear Wall, Storey Displacement, Storey Stiffness, Storey Drift, Wind Analysis.

I. INTRODUCTION

The rapid growth of urbanization has led to the construction of taller and more slender buildings, making them increasingly vulnerable to lateral forces such as wind and seismic actions. Among these, wind loads are particularly significant in high-rise structures due to their continuous and dynamic nature. Excessive lateral displacement, storey drift, or instability caused by wind can compromise not only the structural safety but also the comfort of occupants. Therefore, the incorporation of lateral load-resisting systems is a fundamental aspect of modern structural design. Shear walls are one of the most effective solutions employed to counteract these lateral forces. A shear wall is a vertical structural element, generally constructed of reinforced concrete, that acts as a cantilever beam fixed at the base and resists horizontal forces through

shear and bending. Owing to their high stiffness and load-carrying capacity, shear walls significantly reduce lateral deflections and help maintain structural integrity under wind loads. They are especially advantageous in high-rise construction, where traditional frame action alone may not provide sufficient resistance against wind-induced effects. The role of shear walls in wind analysis extends beyond resisting forces; they also contribute to serviceability by controlling sway and reducing vibrations that affect occupant comfort. With the advancement of computational tools like ETABS and other finite element software, designers can model and analyze the behavior of shear wall systems with precision, optimizing them for both safety and economy. As a result, shear walls have become an integral element in the structural systems of tall buildings, ensuring resilience against wind loads and enabling the sustainable growth of vertical urban environments.

II. REVIEW OF LITERATURE

A.A.Kale and S.A Rasal ^[1] developed the seismic and wind analysis in multistorey buildings. In 2015 S. Bahadır Yuksel, Alptuğ Unal ^[2], extended this work by to investigate the seismic behaviors of CSW having L section folded plate as longitudinal reinforcement in boundary regions. K. Sai Lakshmi et al ^[3] focused on Steel sheets with shear studs shows ductile behaviour in double skin composite shear wall and showed higher shear resistance in static loading Also Steel plate silica fume concrete composite shear wall can reduce the displacement Vineeth Vijayan et al. [4] Steel plate thickness in composite shear walls influences the overall load bearing capacity and shear studs are more effective than lateral ties which was experimentally demonstrated by Wei Wangaet et al ^[5] V. B. Dawari et al. ^[6] took the composite shear wall with encased steel profiles for the study were RCC with I-sections and hollow box steel sections at different locations was selected. Composite shear wall with L shaped elements with double skin type by Wenhui He et al. ^[7] experimentally concluded that the overall seismic performance was satisfactory in terms of energy dissipation, deformation and ductility. Xiao Yang et al. ^[8] analyzed the Increase in stiffness and shear capacity is observed in a new composite shear wall were a high ductile engineered cementitious

composite (ECC) is used as an alternative to ordinary concrete panels.

Ozaki et al. ^[9] investigated the in-plane shear behavior of a double-skin plate composite wall with boundary elements, Hurmet Kucukgoncu and Fatih Altun.^[10] experimentally demonstrated the performance of external RC shear wall for strengthening frames. The one-by-one storey intact and damaged RC frame models were selected which consist of external shear wall with steel tie and beam were subjected to reverse cyclic loading. Sanjivan Mahadik et al. ^[11] examined the behaviour steel fibre reinforced concrete shear wall (SFRC) under later loading. Authors used ETABS software to model concrete shear wall with and without opening and steel fibre reinforced concrete shear wall with same specification as the selected conventional model. Study of composite shear wall in comparison with steel plate shear wall and conventional shear wall for G+20 storey building was done by Mahammadaskak Memon and Ashutosh Patel ^[12]. As per the Response spectrum, it was found out that composite shear wall gives better results in terms of resistance and ductility when compared to RCC shear wall.

Deepna u et al ^[13] analyzed the effect of various thickness of RCC shear wall, steel plate shear wall and steel plate infill composite shear wall on G+ 20 storey building and compared the base shear and storey drift using ETABS. Milan Sitapara et al. ^[14] carried out linear static pushover analysis for G+ 15 storey steel building with steel plate shear wall and composite shear wall. Composite shear wall (CSW) used in this study was with two 5 mm thick steel plate on both side of RCC core 70 mm thick wall and with shear connectors. Anamika Tedia and Dr. Savita Maru ^[15], further carried out the design and analysis of G+5 storey composite building consists of steel beam, steel encased column, profiled deck slab and foundation. In this study static and dynamic analysis is compared using STAAD PRO software and cost analysis is also done in comparison with RCC building.

Pratham Singh ^[16] presented Comparative study of Wind Analysis on structural shape with & without Shear Wall. The study was to show the recent advancements in building systems with a structural shape and vertical growth impact. A multi-story (G+25) structure with different shapes was modelled in the ETABS 2015 software to check its lateral load stability concerning wind loads. Prathibha Reddy T,

Athira Haridas and S.A. Rasal, et al. ^[17] has studied the seismic behaviour of high-rise buildings using composite shear walls. The research compares different types of composite shear wall systems such as double skin composite shear walls, steel plate encased shear walls, steel plate encased walls with I-sections, and shear walls with I-sections with conventional RCC shear walls.

Devendra R. Hargunani and S.A. Rasal ^[18] stated Advances in Composite Walling and Shear Wall Design for Seismic Resilience in High-Rise Buildings: A Comprehensive Review. They represented comparative study of research papers presents a comprehensive study of various aspects related to composite walling and shear walls in high-rise buildings. The papers focus on investigating the behaviour, performance, and advantages of different types of shear walls under lateral loads and seismic events. Nancy Kashyap, Swati Chaudhary ^[19] compared Comparative Study of Different Shear Wall on Irregular Structure. inter-storey drift, and storey stiffness. These results are then compared with those obtained from reinforced cement concrete (RCC) shear wall models to evaluate the relative efficiency and structural behavior of both systems under wind loading. A shear wall is a rigid vertical member. the lateral forces acting in a structure. These walls are mostly used in an earthquake zone. RCC structures are transferring lateral forces slab to beam, beam to column, column to the foundation, and foundation to soil. Anjana R K Unnithan et al. ^[20] studied for steel plate shear wall (SPSW) in G+ 9 storey building in seismic zone III. The model selected is with Shear wall located at core and centrally at the four sides. Response spectrum analysis with ETABS is used for the study. Displacement, storey drift, storey shear, overturning moment is analyzed for various steel plates shear wall.

Based on the literature survey, it is essential to study the wind performance of different types of composite shear walls in high rise buildings, along with the effect of varying their thickness. Detailed research because the use of composite technology can potentially reduce the size of structural members without compromising strength. Such an approach would be highly beneficial in densely populated cities like Mumbai, where limited land availability makes the construction of high-rise buildings a necessity.

Wind loads on these tall structures are influenced by both wind velocity and the building's geometry. While high-rise buildings are already designed to resist vertical loads such as dead loads and gravity loads from beams, their response to lateral forces becomes equally significant. The distribution of these lateral forces along the building height plays a crucial role in ensuring stability and safety. Hence, investigating the performance of composite shear walls under wind effects is vital for enhancing the efficiency and resilience of tall structures.

III. OBJECTIVES OF THE STUDY

1. The objective of the present research is to examine the response of different types of shear walls (SW) and composite shear walls (CSW) in G+20, G+25, and G+30 buildings under wind loading.
2. The study also aims to evaluate the effectiveness of steel plates used in composite structures, which act as reinforcement and reduce the reliance on conventional reinforcement, thereby achieving significant savings in both construction time and cost.
3. The performance of composite shear walls (CSWs) is assessed through key parameters such as overall displacement, inter-storey drift, and storey stiffness. These results are then compared with those obtained from reinforced cement concrete (RCC) shear wall models to evaluate the relative efficiency and structural behavior of both systems under wind loading.
4. For this study, the high-rise building models of G+20, G+25, and G+30 storeys have been developed with shear walls of two different thicknesses, 300 mm and 400 mm, to evaluate their structural response.

IV. METHOD OF ANALYSIS

A. Static Analysis Method

Static wind analysis can be applied to buildings incorporating composite shear walls (CSWs) to evaluate their lateral performance under wind loading. In this approach, wind forces are calculated based on factors such as wind speed, building height, shape, and terrain. These forces are then distributed along the height of the building and applied as lateral loads at each floor level.

For high rise structures with CSWs, static analysis allows the assessment of key structural responses, including lateral displacement, inter-storey drift, and storey stiffness. Composite shear walls, which combine reinforced concrete with steel plates, enhance the stiffness and strength of the structure. This increased rigidity often results in reduced lateral displacements and storey drifts compared to conventional RCC shear walls under the same wind load.

B. Dynamic Analysis Method

Dynamic wind analysis evaluates the time-dependent behavior of high-rise buildings with composite shear walls (CSWs) under fluctuating wind loads. Unlike static analysis, which applies steady lateral forces, dynamic analysis accounts for wind gusts, turbulence, and other aerodynamic effects that can cause vibrations and oscillations, particularly in tall or flexible structures where resonance or dynamic amplification may significantly influence performance.

In CSW equipped buildings, the composite action of steel plates and reinforced concrete increases stiffness and strength, affecting natural frequencies, damping, and mode shapes. This analysis considers these properties to assess critical responses such as lateral displacement, inter-storey drift, storey stiffness, accelerations, and overall stability, often using spectral analysis, response spectrum methods, or time-history simulations to capture a realistic wind-structure interaction.

V. STRUCTURAL MODELLING

A. Modelling of Sub-structure

In the present study, high-rise buildings are analyzed under wind loading conditions using the dynamic analysis method. Three building configurations of 20, 25, and 30 storeys (G+20, G+25, and G+30), designed with an H-shaped floor plan, are considered. Shear walls are positioned either at the core/lift area or at the building corners. Structural modelling and analysis are performed in ETABS 2022, in compliance with IS 456:2000 and IS 875 (Part 3):2015 provisions, for seismic Zone III. The buildings are assumed to have fixed supports at the base. To evaluate the influence of shear walls, twelve distinct models are developed both with and without shear walls, and incorporating either

conventional RCC columns or composite shear walls. The comparative assessment is carried out with respect to key structural performance parameters such as storey displacement, storey drift, stiffness, lateral force, and base shear. The modelling details of the building shown in table 1.

Table-1: General Specification of Building for ETABS modelling:

Parameter	Details
Plan Dimensions	20 m × 20 m
Structural Configuration	H-shaped RCC framed building
Number of Storeys Considered	G+20, G+25 & G+30
Typical Storey Height	3.0 m
Column Dimensions and Grade:	
Ground to 3 rd floor	400mm × 1500mm (M50)
3 rd floor to 5 th floor	400mm × 1400mm (M50)
5 th floor to 10 th floor	400mm × 1200mm (M50)
10 th floor to 30 th floor	400mm × 800mm (M50)
Beam Dimensions and Grade	300mm × 600mm (M40)
Slab Thickness & Grade	150mm thick slab (M40)
Shear Wall Thickness & Grade	300mm & 400mm (M50)
Grade of Reinforcement Steel	Fe 415
Density of Concrete	25 KN/m ³
Software Used for Analysis	EATBS 2022

These are the general description of the analytical model that contents general specification of the structure about its grade and density of steel and concrete, damping ratio, thickness of the shear wall, thickness of walls, and general height of the structure. The specified parameters were incorporated into the ETABS model to simulate the building's behavior and obtain results corresponding to the effects of wind loading on the structure.

Table-2 outlines the adopted loading pattern, which served as the basis for evaluating the structural response through dynamic analysis.

Table 2. Specification of loads

Floor Load	2 KN/m ²
Live Load	4 KN/m ²
Wall Load (AAC Block)	5.52 KN/m
Basic wind speed	50 m/s
Terrain Category	2
Risk coefficient (K1)	1
Topography factor (K3)	1
Importance factor	1
Wind Design Code	IS 875:2015 (Part3)
RCC Design Code	IS 456:2000
Steel Design Code	IS 800:2007

B. Modelling of Super-Structure

A common building plan was adopted for the modelling and analysis of multi-storey high-rise buildings using ETABS. Three building configurations, namely G+20, G+25, and G+30 storeys, were considered to evaluate the structural behaviour of two different shear wall systems: conventional reinforced concrete (RCC) shear walls and composite shear walls (CSWs). For each configuration, shear wall thicknesses of 300 mm and 400 mm were considered. The developed analytical models were subjected to structural analysis to investigate and compare their response at different building heights and shear wall thicknesses, as illustrated in Fig. 1 and Fig. 2.

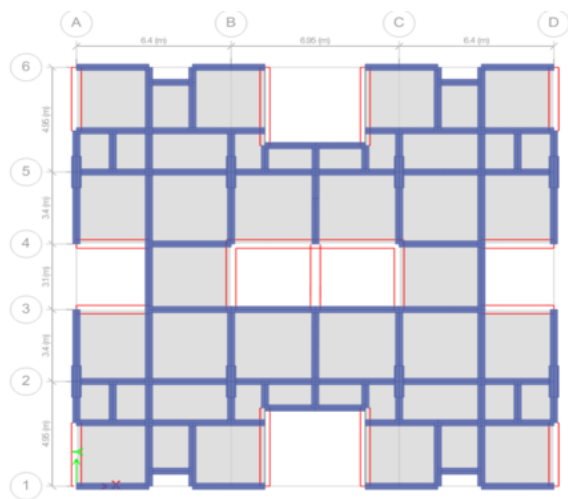


Fig. 1: Typical Floor Plan

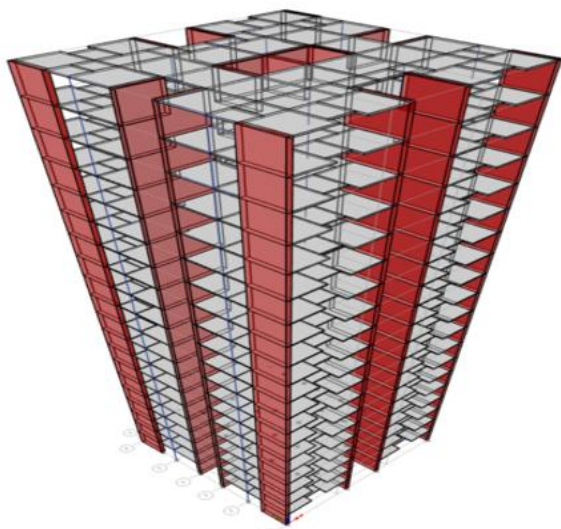


Fig. 2: 3D View of H Shaped Model with Shear Walls

Two different types of composite shear walls are selected for the research and are modelled as below in table 3.

Table 3. Composite Shear Wall Types and Modelling Details

Type	Configuration	ETABS Section Details.
Double Skin Composite Shear Wall	Two steel Plates of 25 mm thick of grade Fe 345 are provided at both the ends of the central RCC panel/wall of 250 mm and 350 mm to form 300 mm and 400 mm CSW respectively.	

VI. RESULTS AND DISCUSSION

From the dynamic analysis, the responses of the models with conventional RCC shear walls and composite shear walls were obtained and plotted graphically. The graphical results compare the structural responses of RCC and composite shear wall models for 300 mm and 400 mm wall thicknesses. The comparison was carried out for different building heights, namely G+20, G+25, and G+30 storeys, to evaluate the effect of building height and shear wall type on the overall structural behaviour.

A. Lateral Displacements

According to IS 456:2000, the maximum allowable lateral displacement is considered as $(H/500)$, where (H) is the total height of the building. Accordingly, the permissible maximum lateral displacements for the 20-storey, 25-storey, and 30-storey models are 120mm, 150mm, and 180mm, respectively. Since the lateral displacement is maximum at the top storey, the maximum displacement obtained for each model is considered for the comparative study and plotted graphically. It is observed that the maximum lateral displacements of all the analysed models remain within the specified allowable limits.

Fig.3 and Fig.4 present the lateral displacement results obtained from dynamic analysis in the X and Y directions for the 20th, 25th, and 30th storeys, respectively. The results for both 300 mm and 400 mm thick composite shear walls, along with the corresponding RCC shear wall models, are compared in Fig.3 and Fig.4.

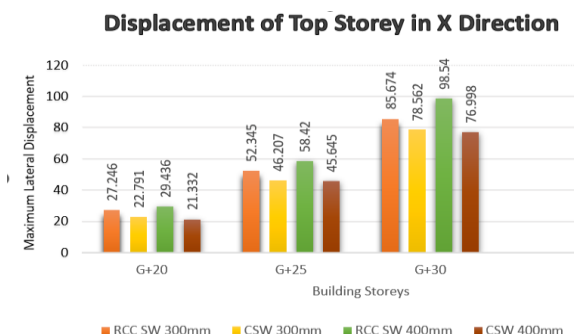


Fig.3: Displacement of models with 300 mm and 400 mm thickness SW & CSW at top storey in X direction.

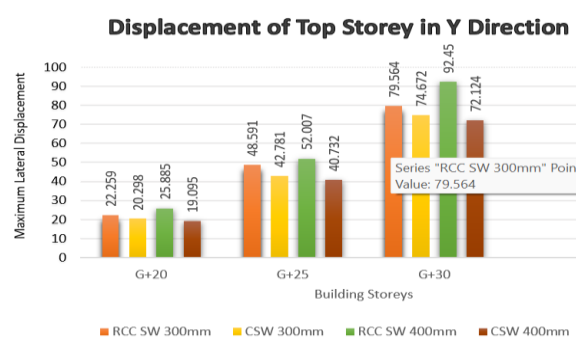


Fig.4: Displacement of models with 300 mm and 400 mm thickness SW & CSW at top storey in X direction.

Fig.3 and Fig.4 clearly shows that Composite shear walls reduces the displacements where maximum decrease in maximum lateral displacement of the top storey in the both X- directions and Y-directions for G+20, G+25, and G+30 storey buildings, considering four structural configurations, namely RCC Shear Wall (SW) 300 mm, Composite Shear Wall (CSW) 300 mm, RCC SW 400 mm, and CSW 400 mm.

The results show a systematic increase in top-storey displacement with an increase in building height, which is expected because taller structures generally exhibit greater lateral flexibility under lateral loading. In the X-direction, the RCC SW 300 mm configuration records displacements of 27.246 mm, 52.345 mm, and 85.674 mm for G+20, G+25, and G+30, respectively, whereas the corresponding CSW 300 mm values are 22.791 mm, 46.207 mm, and 78.562 mm, indicating displacement reductions of approximately 16.35%, 11.73%, and 8.30%, respectively. Similarly, for the 400 mm wall configuration, the RCC SW produces 29.436 mm, 58.420 mm, and 98.540 mm, while the CSW 400 mm gives significantly lower values of

21.332 mm, 45.645 mm, and 76.998 mm, corresponding to reductions of approximately 27.53%, 21.86%, and 21.86% for G+20, G+25, and G+30, respectively.

A similar trend is observed in the Y-direction: the RCC SW 300 mm values are 22.259 mm, 48.591 mm, and 79.564 mm, compared with 20.298 mm, 42.781 mm, and 74.672 mm for CSW 300 mm, resulting in reductions of approximately 8.80%, 11.95%, and 6.15%. For the 400 mm configuration, the RCC SW values of 25.885 mm, 52.007 mm, and 92.450 mm are reduced to 19.095 mm, 40.732 mm, and 72.124 mm with CSW 400 mm, representing reductions of approximately 26.23%, 21.68%, and 21.99%, respectively. The comparison therefore demonstrates that CSW consistently provides lower top-storey lateral displacement than the corresponding RCC shear-wall system in both principal directions and for all three building heights, with the CSW 400 mm configuration showing the most favourable displacement-control performance.

Although the absolute displacement increases as the building height increases from G+20 to G+30, the comparative advantage of the composite system remains evident, particularly for the 400 mm configuration, where approximately 22–28% reduction in lateral displacement is achieved relative to the corresponding RCC SW system. The results indicate that the composite shear-wall system provides improved control of lateral deformation and a more favourable displacement response, demonstrating its potential as an effective lateral-load-resisting system for medium- to high rise structures. Thus, based strictly on the displacement response obtained in the present analytical study, the CSW configurations demonstrate a favourable structural performance compared with the corresponding RCC shear-wall configurations, particularly in terms of limiting top-storey lateral displacement in both X and Y directions. The results also indicate that increasing building height leads to greater lateral deformation, whereas the use of composite shear walls helps in reducing the maximum lateral displacement under wind loading.

B. Storey Drift

Storey drift is defined as the relative lateral displacement of one storey with respect to the storey immediately below it. As per the relevant provisions of the Indian Standard code, the storey drift of a

building shall not exceed 0.004 times the storey height. The analysis results indicate that the introduction of composite shear walls (CSWs) leads to a reduction in storey drift compared with conventional RCC shear wall systems. To quantify the improvement, the responses of the CSW models are evaluated in terms of percentage difference with respect to the corresponding RCC shear wall models. For the G+20, G+25, and G+30 storey buildings, the maximum storey drift is observed predominantly at the intermediate or middle storeys for both 300 mm and 400 mm wall thicknesses.

Therefore, these critical storey levels are selected for a detailed comparison of the drift response of the RCC and composite shear wall systems. The percentage difference in storey drift between the two structural systems is calculated at the identified critical storey levels, and the corresponding results are presented graphically in Fig. 5 and Fig. 6. The observed reduction in storey drift demonstrates the effectiveness of composite shear walls in controlling lateral deformation and improving the overall lateral response of high-rise structures. Storey drift of above-mentioned storey levels is graphically plotted as in Fig. 5 and Fig. 6.

The maximum storey drift in both the X and Y directions shows a consistent increase with the increase in building height from G+20 to G+30 for all structural configurations. In the X direction, for the G+20 storey building, the maximum drift decreases from 0.000581 for RCC SW 300 mm to 0.000472 for CSW 300 mm, representing a reduction of approximately 18.76%, while for the 400 mm wall, the drift decreases from 0.000499 to 0.000419, corresponding to a reduction of approximately 16.03%.

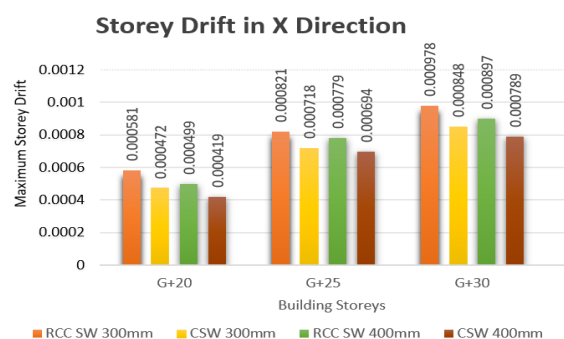


Fig:5: Storey Drift in X Direction of 300 mm and 400 mm thick SW & CSW models.

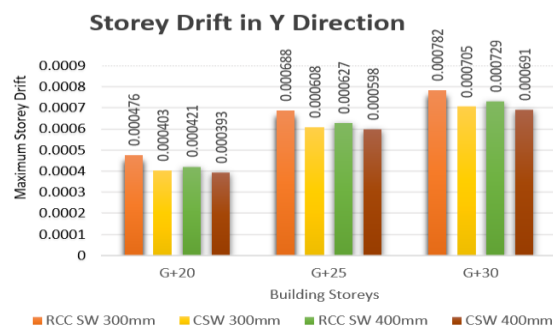


Fig:6: Storey Drift in Y Direction of 300 mm and 400 mm thick SW & CSW models.

For the G+25 building, the drift reduces from 0.000821 to 0.000718 for the 300 mm configuration, giving a reduction of 12.55%, whereas the 400 mm configuration shows a reduction from 0.000779 to 0.000694, corresponding to 10.91%. For the G+30 building, the maximum drift decreases from 0.000978 to 0.000848 for the 300 mm configuration, representing a reduction of 13.29%, while the 400 mm configuration decreases from 0.000897 to 0.000789, giving a reduction of 12.04%.

Similarly, in the Y direction, for the G+20 building, the maximum storey drift decreases from 0.000476 to 0.000403 for the 300 mm configuration, representing a reduction of 15.34%, while the 400 mm configuration decreases from 0.000421 to 0.000393, corresponding to 6.65%. For the G+25 building, the 300 mm configuration shows a reduction from 0.000688 to 0.000608, equivalent to 11.63%, whereas the 400 mm configuration decreases from 0.000627 to 0.000598, representing a reduction of 4.63%. For the G+30 building, the drift decreases from 0.000782 to 0.000705 for the 300 mm configuration, giving a reduction of 9.85%, while the 400 mm configuration decreases from 0.000729 to 0.000691, corresponding to 5.21%.

Overall, the results indicate that the CSW systems consistently exhibit lower maximum storey drift than the corresponding RCC shear wall systems in both principal directions, demonstrating improved control of lateral deformation. The reduction in drift is more pronounced for the 300 mm CSW configuration, while the 400 mm configuration also provides a consistent reduction, although comparatively smaller in the Y direction. Thus, the X & Y direction results demonstrate that the CSW configurations consistently

reduce storey drift compared with the corresponding RCC shear wall models.

C. Storey Stiffness

Storey stiffness represents the resistance offered by each storey against lateral deformation caused by wind loading. The storey stiffness of all the investigated models was evaluated in both the X and Y directions. The results indicate that the maximum storey stiffness occurs at the bottom-most storey for all the structural models. The stiffness generally decreases along the height of the building due to the variation in structural configuration and lateral load distribution. This increased stiffness contributes to better resistance against wind-induced lateral deformation and improves the overall lateral stability of the structure. Fig.7 and Fig.8 presents the maximum storey stiffness obtained at the bottom most storey level for investigated models in the X and Y directions, respectively. The comparative results demonstrate the influence of composite shear walls on the lateral stiffness characteristics of G+20, G+25, and G+30 storey buildings under wind loading.

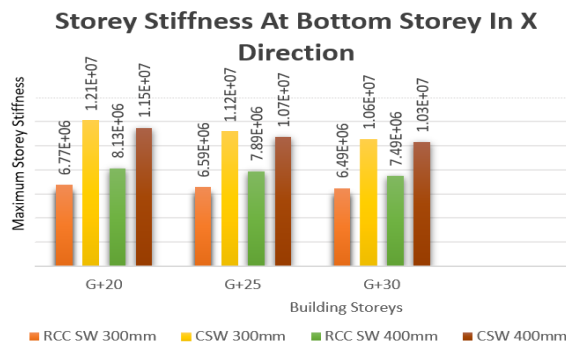


Fig:7: Storey Stiffness in X Direction of 300 mm and 400 mm thick shear wall models

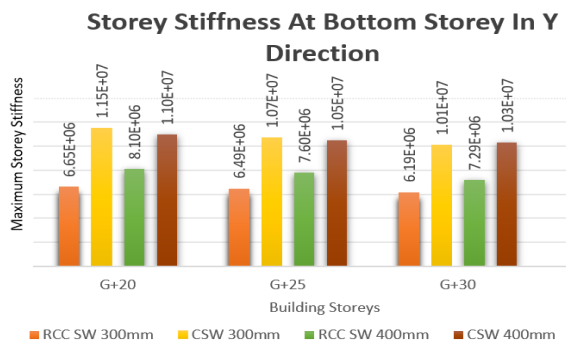


Fig:8: Storey Stiffness in X Direction of 300 mm and 400 mm thick shear wall models

From the above graphs presented in Fig. 7 and Fig.8, it can be observed that the introduction of composite shear walls (CSWs) significantly enhances the storey stiffness of the structures compared with conventional RCC shear walls. The X-direction results indicate that the composite shear-wall systems provide substantially higher bottom-storey stiffness than the corresponding RCC shear-wall systems for all three building heights. For the 300 mm wall thickness, the stiffness of the CSW model is 12.10×10^6 kN/m compared with 6.77×10^6 kN/m for RCC SW in the G+20 building, representing an increase of approximately 78.73%. For G+25, the stiffness increases from 6.59×10^6 kN/m to 11.20×10^6 kN/m, corresponding to approximately 69.95%. For G+30, the corresponding increase is from 6.49×10^6 kN/m to 10.60×10^6 kN/m, giving approximately 63.33%.

For the 400 mm wall thickness, the RCC shear-wall stiffness is 8.13×10^6 , 7.89×10^6 and 7.49×10^6 kN/m for G+20, G+25 and G+30, respectively, whereas the corresponding CSW values are 11.50×10^6 , 10.70×10^6 and 10.30×10^6 kN/m. Thus, the CSW models show stiffness increases of approximately 41.45%, 35.61% and 37.52%, respectively. The results clearly demonstrate that replacing conventional RCC shear walls with composite shear walls considerably enhances the lateral stiffness of the structure. The Y-direction for the investigated building configurations is presented in the graph.

The results indicate that the composite shear-wall (CSW) models exhibit considerably higher storey stiffness than the corresponding RCC shear-wall (RCC SW) models for all building heights. For the 300 mm wall thickness, the bottom-storey stiffness increases from 6.65×10^6 kN/m for the RCC SW model to 11.50×10^6 kN/m for the CSW model in the G+20 building, representing an increase of approximately 72.93%. For the G+25 building, the stiffness increases from 6.49×10^6 kN/m to 10.70×10^6 kN/m, corresponding to an increase of 64.87%, while for the G+30 building, it increases from 6.19×10^6 kN/m to 10.10×10^6 kN/m, corresponding to 63.17%. Similarly, for the 400 mm wall thickness, the CSW models show increases of approximately 35.80%, 34.62% and 41.29% for G+20, G+25 and G+30, respectively, compared with the corresponding RCC SW models. Overall, the results demonstrate that the introduction of composite shear walls significantly enhances the lateral stiffness of the building in the X & Y-direction. The higher stiffness

of the CSW systems indicates greater lateral rigidity and improved resistance to lateral deformation compared with conventional RCC shear-wall systems.

VII. CONCLUSION

Based on the analytical results obtained from ETABS, the following conclusions are drawn:

- Double-skin CSWs improved the overall lateral performance of G+20, G+25 and G+30 high-rise buildings under wind loading.
- CSWs reduced lateral displacement by 6.15–27.53% compared with conventional RCC shear walls.
- Storey drift decreased by 4.63–18.76%, indicating better control of inter-storey deformation.
- Storey stiffness increased by 34.62–78.73%, contributing to improved structural stability.
- The 400 mm CSW models generally performed better than the 300 mm models.
- Even with increasing building height, CSWs maintained lower displacement and drift and higher stiffness than RCC systems.

Overall, CSWs are an effective lateral-load-resisting system for high rise buildings under wind loading. Further studies should consider nonlinear, seismic, connection and experimental investigations for practical application.

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