Seismic Analysis of Different RCC Multistorey Structure by Considering Plain and Composite Shear Wall

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ABSTRACT

Developments made of shear wall are high in quality, they significantly oppose the seismic power, wind powers and even can be based on soils of feeble bases by embracing various ground change methods. In recent decades, shear walls and shell structures are the most appropriate structural forms, which have caused the height of concrete buildings to be soared. So, recent RC tall buildings would have more complicated structural behavior than before. The shear wall arrangement is one of the most regularly used lateral load resisting, system in multistory building structure. The present work, concern of three types of the structure i.e. without shear wall, plain shear wall and composite shear wall and present the results with different multistorey structure. The composite shear wall consists of a steel boundary frame attached to one side of the concrete shear wall. For seismic analysis response spectrum method has been used in STAAD.Pro software. In this work, it has been shows after comparing all types of structure where considered composite shear wall in different locations, all are under design consideration by giving efficient results like base shear wall and lateral deflection, but the less and minimum value is found in composite shear wall at location 4 (composite shear wall at the corners).

Keywords: *Open ground building, Composite shear wall, Seismic analysis, response spectrum analysis.*

I. INTRODUCTION

Shear walls are vertical elements of the horizontal force resisting system. Shear walls are constructed to counter the effects of lateral load acting on a structure. In residential construction, shear walls are straight external walls that typically form a box which provides the entire lateral support for the building. When shear walls are designed and constructed properly, and they will have the strength and stiffness to resist the horizontal forces. In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. Examples are the reinforced-concrete wall or vertical truss. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure and occupants; create powerful twisting (torsion) forces.

The composite shear walls involve of a steel plate shear wall coupled with reinforced concrete walls to one side or both sides of the steel plate using mechanical connectors such as bolts or shear studs. Some of the composite shear wall arrangements. The use of the composite shear walls is in buildings in recent years while not as regularly as the other lateral load resisting systems.

II. PROBLEM IDENTIFICATION

RC multi-storey buildings are adequate for resisting both the vertical and horizontal load. When such building is designed without shear wall, beam and column sizes are quite heavy and there is problem arises at these joint and it is congested to place and vibrate concrete at these places and displacement is quite heavy which induces heavy forces in building member. Localizing and quantifying potential damage in large and complex structures is one of the most challenging problems in developing a robust and reliable structural health monitoring system.

III. METHODOLOGY

The structure details taken from literature with different cases i.e. case I, II and case III. The case I, II and III represents the mulltistorey types of building structure. Case I represents for G+10, case II for G+15 and case III is G+20 structure for without, plain and composite shear wall frame structure.

Parameters	Value
Young's modulus of M20 concrete, E	$2.8 \times 10^7 \mathrm{kN/m^2}$
Grade of concrete	M25
Grade of steel	Fe 415
Density of Reinforced Concrete and Steel	$25\ \mathrm{kN/m^3}, 78\ \mathrm{kN/m^3}$
Modulus of elasticity of brick masonry	$2100 \times 10^3\ \mathrm{kN/m^2}$
Density of brick masonry	$20\ \mathrm{kN/m^3}$
No. of storey	G+10, G+15, G+20
Beam size	0.3m x 0.5 m
Column size	0.5 m x 0.5m
Shear wall thickness	0.2 m
Height of all storeys	32 m
Height of each floor	3m
Earthquake Zone	IV
Damping Ratio	5%
Importance factor	1.0
Type of Soil	Medium
Type of structure	Special Moment Resisting Frame

Figure 1. Side plan view of G+10 multistorey structure

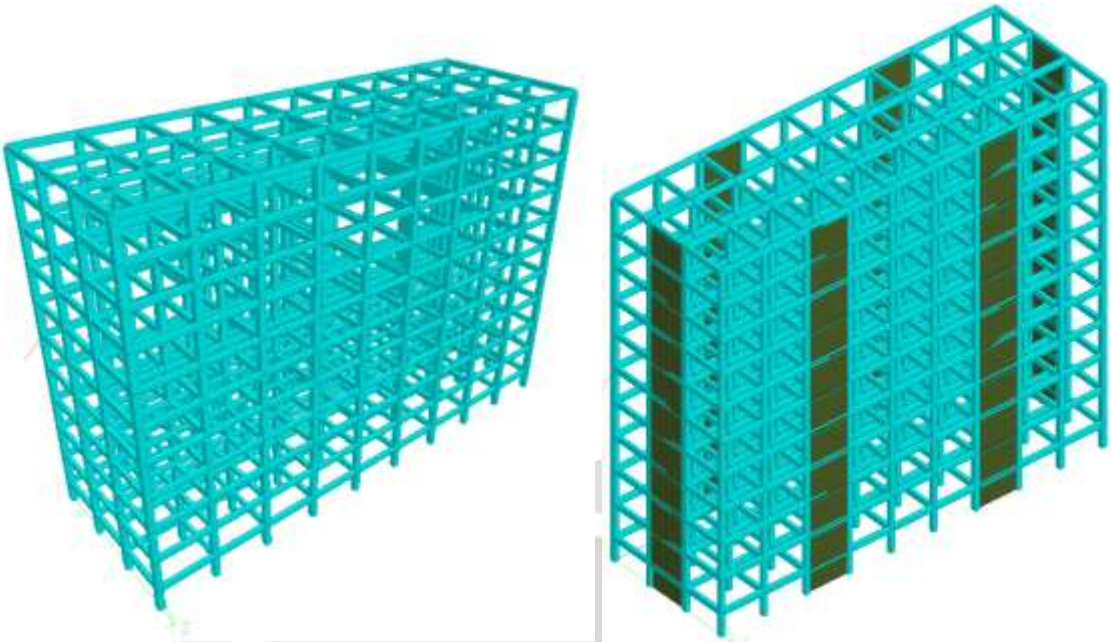

Figure 2. Structure of G+10 considering without shear wall and considering shear (plain and composite wall)

IV. RESULT AND DISCUSSIONS

The present work has been considered the G+10, G+15 and G+20 RCC structure with without shear wall, shear wall and composite shear wall with different locations. The work is compared all structural results such as base shear and deflection found in building structure.

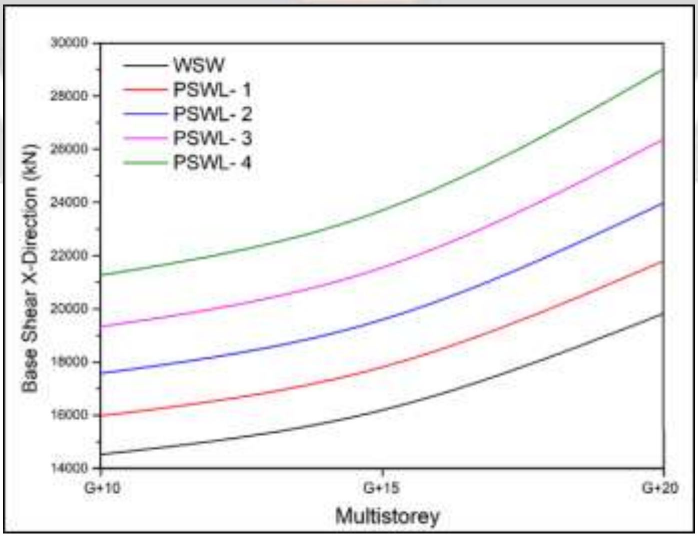

Figure 3. Graph represents the base shear in X-direction in multistorey structure by considering without shear wall and with plain shear wall in different locations

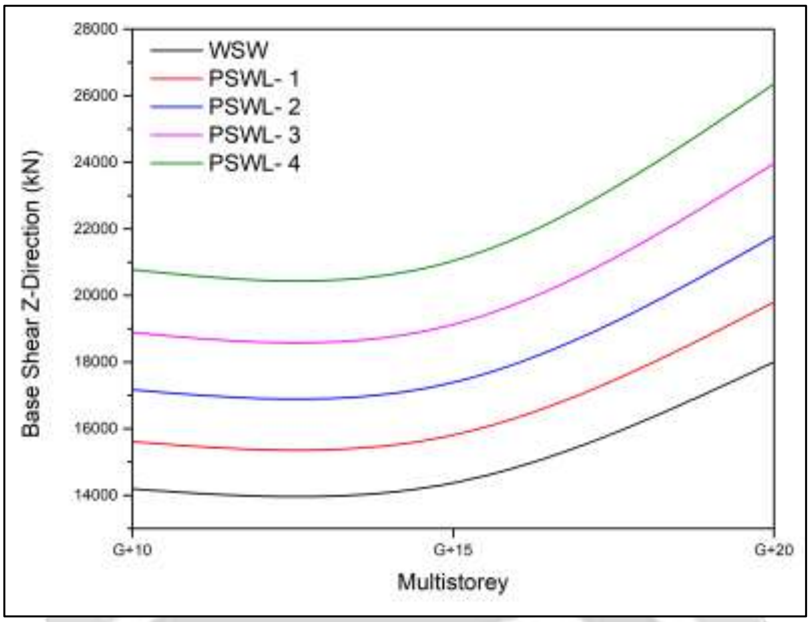

Figure 4. Graph represents the base shear in Z-direction in multistorey structure by considering without shear wall and with plain shear wall in different locations

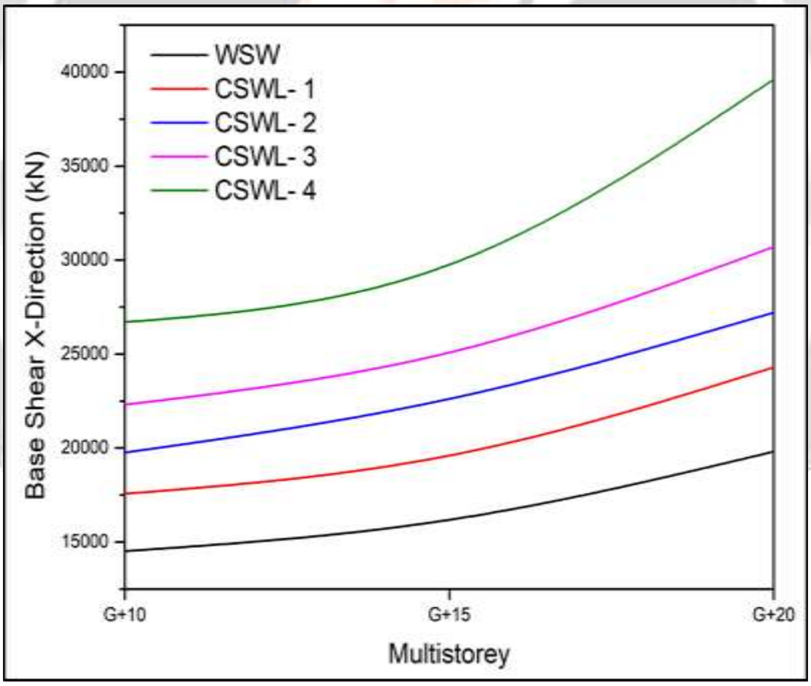

Figure 5. Graph represents the base shear in X-direction in multistorey structure by considering without shear wall and with composite shear wall in different locations

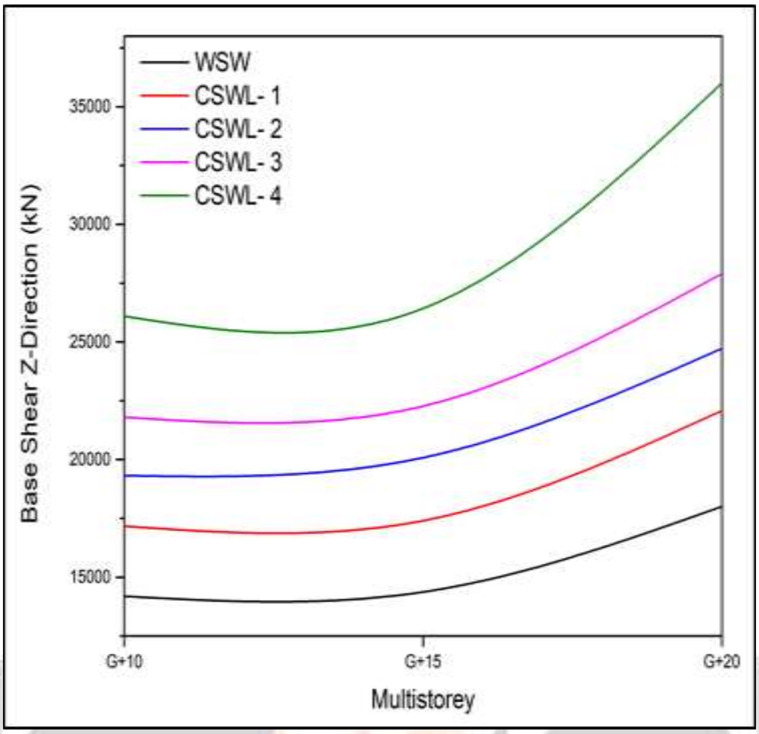

Figure 6. Graph represents the base shear in Z-direction in multistorey structure by considering without shear wall and with composite shear wall in different locations

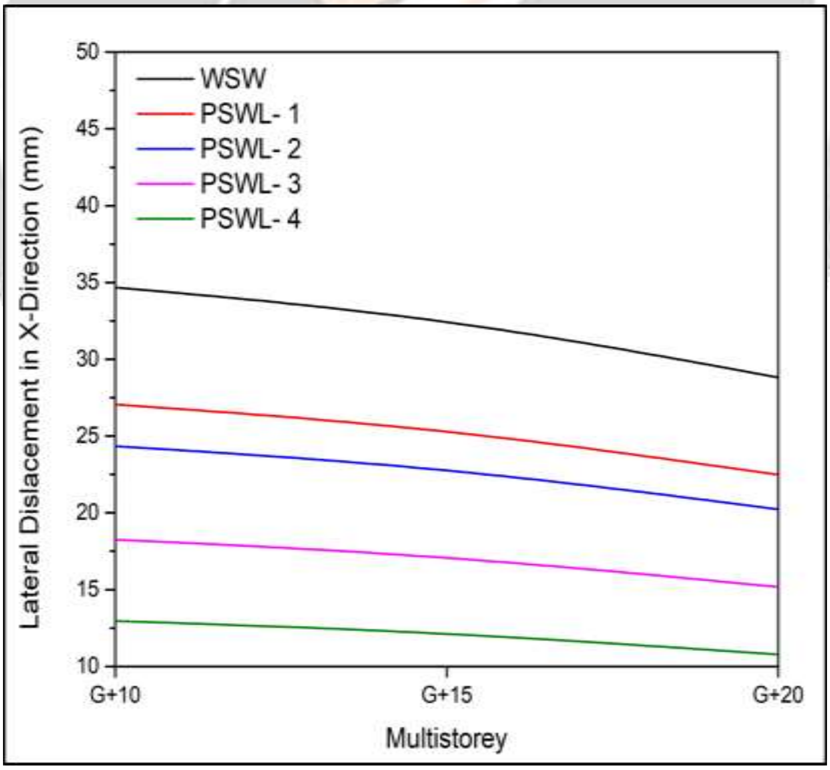

Figure 7. Graph represents the maximum lateral displacement in X-direction in multistorey structure by considering without shear wall and with plain shear wall in different locations

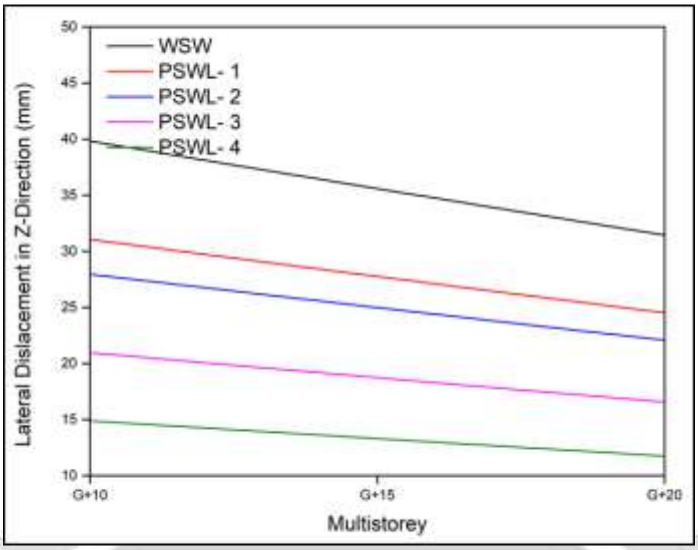

Figure 8. Graph represents the maximum lateral displacement in Z-direction in multistorey structure by considering without shear wall and with plain shear wall in different locations

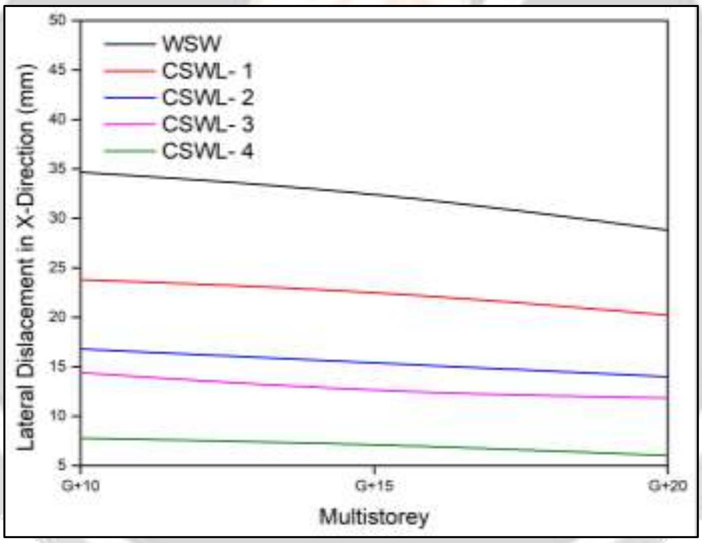

Figure 9. Graph represents the maximum lateral displacement in X-direction in multistorey structure by considering without shear wall and with composite shear wall in different locations

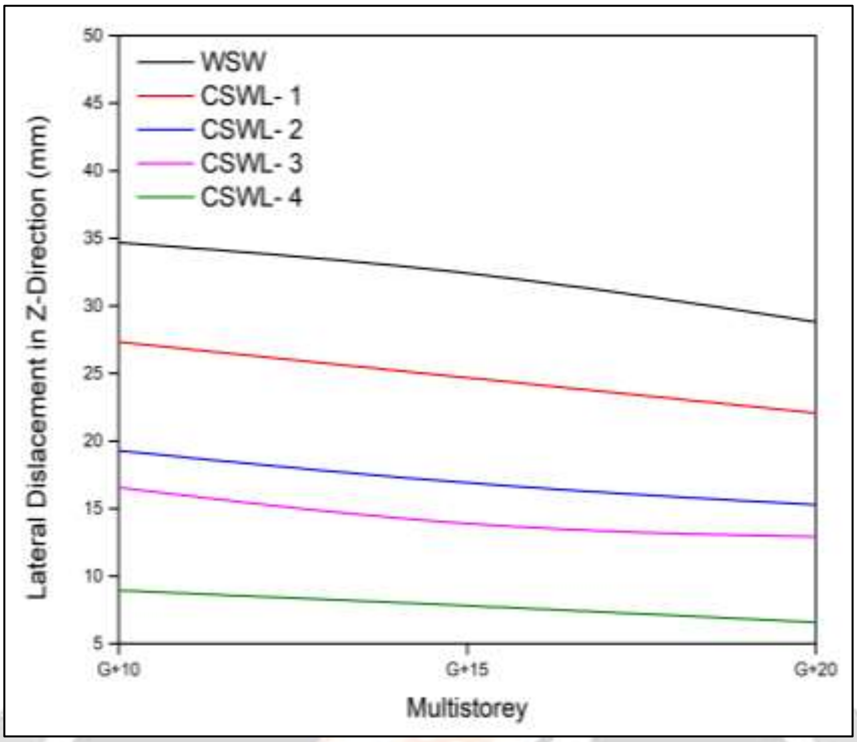

Figure 10. Graph represents the maximum lateral displacement in Z-direction in multistorey structure by considering without shear wall and with composite shear wall in different locations

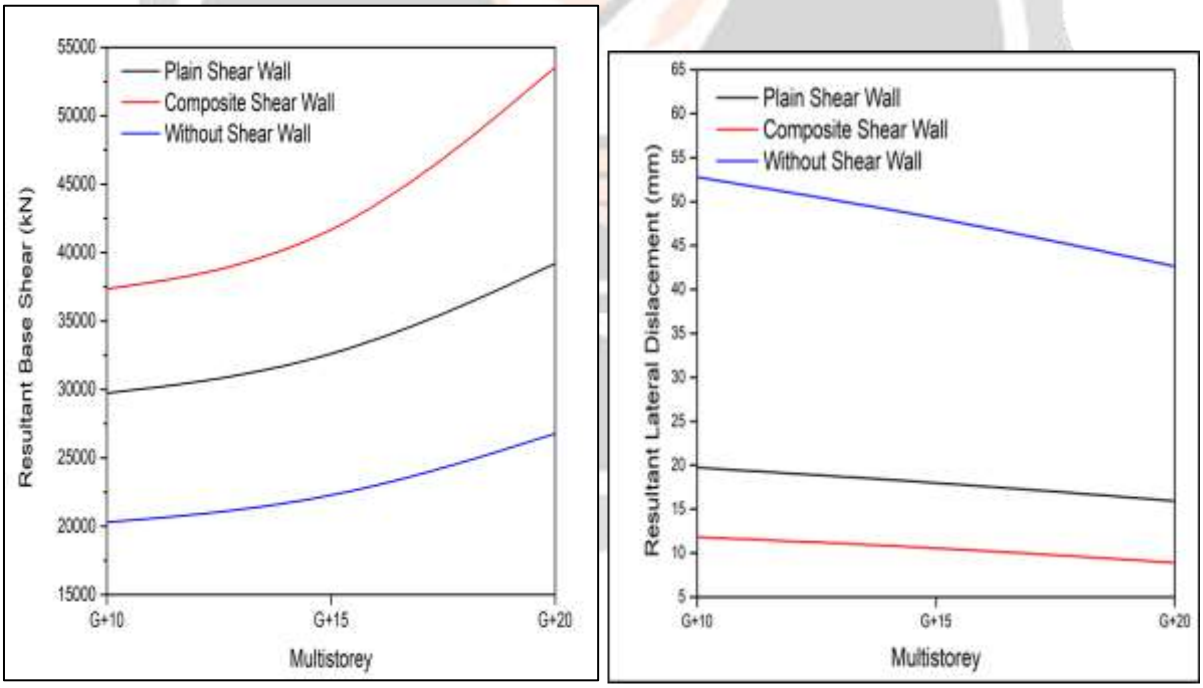

Figure 11. Graph represents the resultant base shear (left) and lateral displacement (right) in without shear wall, plain shear wall and composite shear wall with respect to different multistorey structure

After explaining all the above figures, tables and statement, it shows that the composite shear wall at location 4 can provide us the best strength and quality as compared to others and it can use it in the future. Due to composite shear walls have construct pre-casted or in place provides the stability and stiffness in erection.

V. CONCLUSIONS

- In this present work has been considered the three high rises building structure such as G+10, G+15 and G+20 without and with composite including composite shear wall. To perform the seismic analysis, the Response spectrum has been used in STAAD.Pro structure analysis software by considering boundary conditions such as dead load, live load, wind load etc.
- In this work, it has been concluded that the consideration of plain or composite shear wall in different locations, all are under design consideration by giving efficient results like base shear wall and lateral deflection, but the less and minimum value is found in composite shear wall at location 4 (composite shear wall at the corners).
- Also, it has been concluded that the composite shear wall provides us the best strength and quality as compared to others. Due to composite shear walls have construct pre-casted or in place provides the stability and stiffness in erection.
- The application of composite shear wall provides lesser footmark; hence it is very beneficial from architectural argument by providing more useable floor space mainly in high rise structures. The slighter weight of composite shear wall will result in minor foundations as well as lesser seismic forces.

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