Behaviour of Multistorey RCC Structure with Different Shear Wall Locations Using STAAD.Pro

Manibhushan Kumar[1], Sadiya Saba[2]

[1]PG Student, [2]Assistant Professor,
[12]Department of Civil Engineering,
[12]Rungta College of Engineering and Technology, Bhilai, C.G. INDIA.

***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. The quickness in development process as well as the quality parameters and adequacy to exposed even loads are high. Shear wall framework is one of the great strategies and it gives an astounding way to deal with fortifying and hardening existing working for horizontal powers. Additionally, another potential favorable position of this framework is the relatively little increment in mass related since this is an incredible issue for a few methods. This work capacity to manufacture seismically safe structures with sufficient seismic opposition has expanded fundamentally in the previous couple of decades. Numerous fortified solid edge structures worked in seismically dynamic territories are required to perform deficiently in a seismic occasion. With developing economy, urbanization and inaccessibility of level space expanding expense of land and requirement for agrarian land, skyscraper sprawling structures have turned out to be profoundly ideal in Indian structures situation, particularly in urban. With tall structure structures, not just the building needs to take up gravity loads, yet and in addition horizontal powers. Numerous essential Indian urban communities fall under high hazard seismic zones, thus fortifying of structures for parallel powers is an essential. In this work the aim is to analyzed the response of a high-rise structure to ground motion using Response Spectrum Analysis. Different models, that is, bare frame, shear wall frame with various locations are considered in STAAD.Pro. and change in the stiffness, base shear, story shear and lateral deflection of the building is observed and compared.**

***Index Terms*— RCC Structure, High rise building, Shear Wall, Seismic Analysis, STAAD.Pro,.**

I. INTRODUCTION

Reinforced Concrete (RC) edges are the most widely recognized development rehearses in India, with expanding quantities of skyscraper structures signifying the scene. There are numerous critical Indian urban communities that fall in very dynamic seismic zones. Such tall building structures, developed particularly in very inclined seismic zones, ought to be examined and intended for malleability and ought to be composed with additional parallel solidifying framework to enhance their seismic execution and decrease harms. Two of the most ordinarily utilized sidelong solidifying frameworks that can be utilized as a part of structures to hold the redirections under cut off points are propping framework and shear walls.

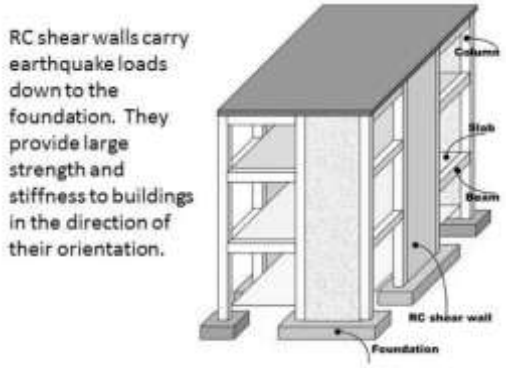


Figure 1. Shear Wall building structure

II. PROBLEM IDENTIFICATION

Shear wall is a structural component which gives Strength should structure starting with parallel loads like wind load Furthermore seismic loads. The firmness and quality about wall might need diminished Toward the decrease in the cement territory and the intermittence of the support because of opening. Should think those reactions of giving openings and the conduct technique of shear wall without openings will be those point of the provided for consider. Hence, it is necessary to show worth of effort on the analysis, plan Also post impacts from claiming shear walls At seismic constrains would connected. In this work, an alternate instance need been made out over those examination and configuration of RCC shear walls should worth of effort crazy All the more point of interest effects and conclusions.

III. METHODOLOGY

To assemble different sorts of work on seismic investigation of high-rise structures and expanding horizontal solidness of the framework different papers and research articles were considered completely and alluded.

3.1 Modeling and Analysis of Building Structure

To assess the conduct of shear wall outline and supported edge, a building design having chosen with various areas of shear wall outline and propped outlines. The investigation of multi-story floors is completed utilizing STAAD V8i programming for extraordinary minute opposing casing arranged in zone III.

Table 1. Building data

Specification	Data
Structure	SMRF
No. of Stories	G+10, G+15, G+20
Type of Building Use	Residential
Young's Modulus, E	$21.7x10^6$ kN/m^2
Grade of Concrete	M25
Storey Height	3m, ground floor 2m
Slab thickness	0.2m
Density of RCC	25 kN/m^3
Beam Size	0.3x0.5m
Column Size	0.5x0.5m
Dead Load Intensity	5 kN/m^2
Live Load Intensity	3.0 kN/m^2
Seismic Zone, Z	IV

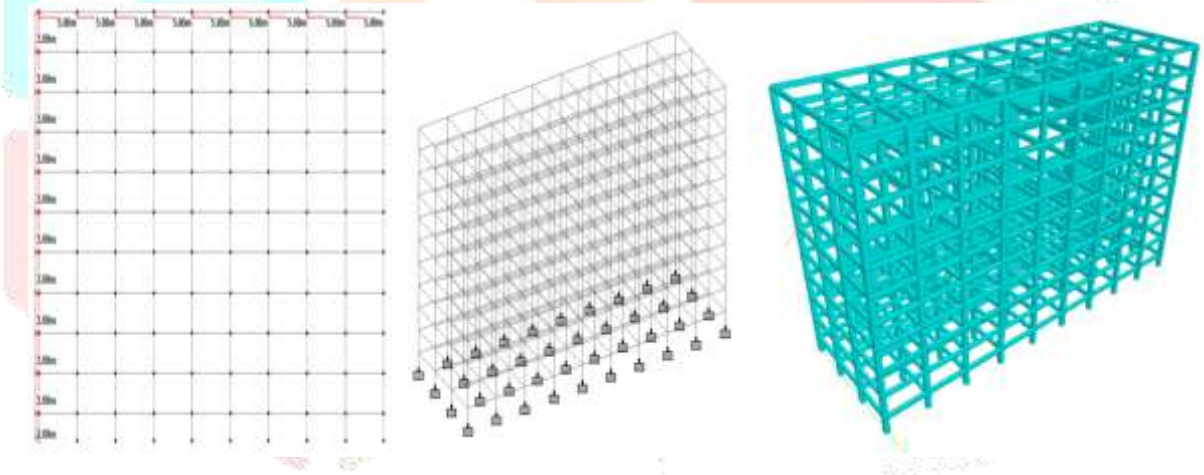
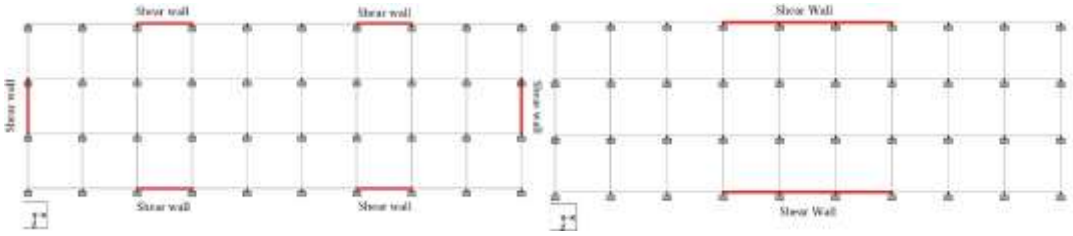
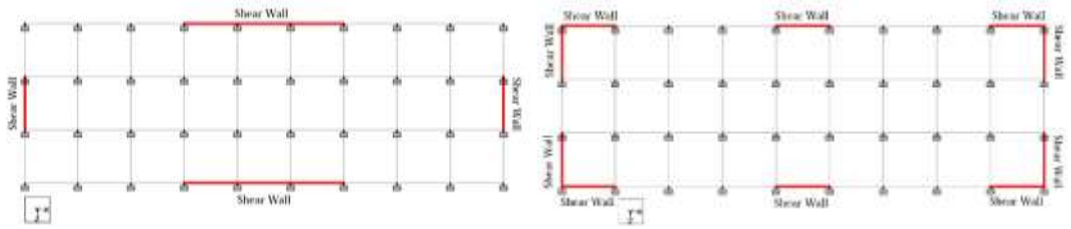


Figure 2. G+10 Structure (Left) Plan view, (Middle) Line Diagram and (Right) 3D rendering diagram of the structure

The Figure 2 shows the G+10 building structure of bare frame with plan, line diagram and 3D structure. Other structure are same as this shown in figure.



(a) Location-1 (b) Location-2



(c) Location-3 (d) Location-4

Figure 3. Plan of G+10 building structure with shear wall at location 1, 2, 3 and 4

As per Figure 2 and Figure 3, all structure for G+10, G+15 and G+20 are defined in this work.

IV. RESULTS AND DISCUSSIONS

In present work done the comparison and improvement of base shear, storey shear and deformation of G+10, G+15 and G+20 RCC structure.

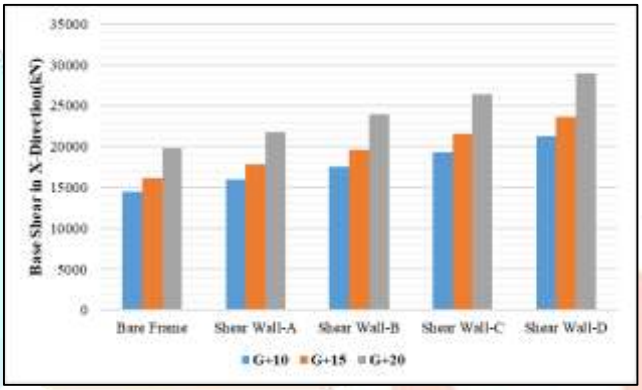


Figure 3. Variation of base shear for ground motion in X- direction

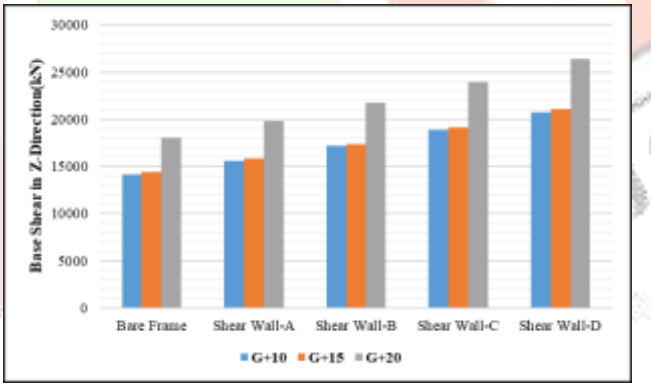


Figure 4. Variation of base shear for ground motion in Z- direction

Figure 3 and Figure 4 indicates that, the base shear was found to be increasing from bare frame to shear wall frame and is even more for frame with shear wall-D. In case of shear wall frame highest base shear is found in case of shear wall-D in corners. In case of shear wall base shear is highest in case of Shear wall-D in X and Z-direction.

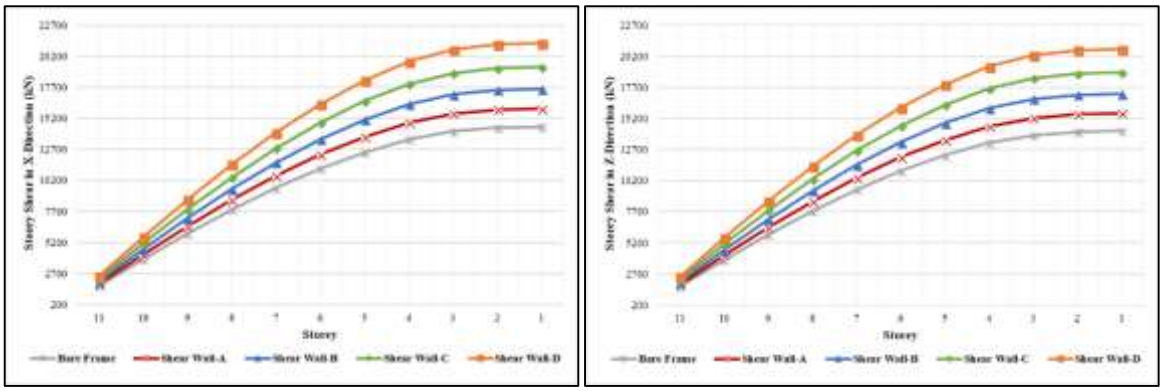


Figure 6. Variation of G+10 storey shear for ground motion in X and Z direction

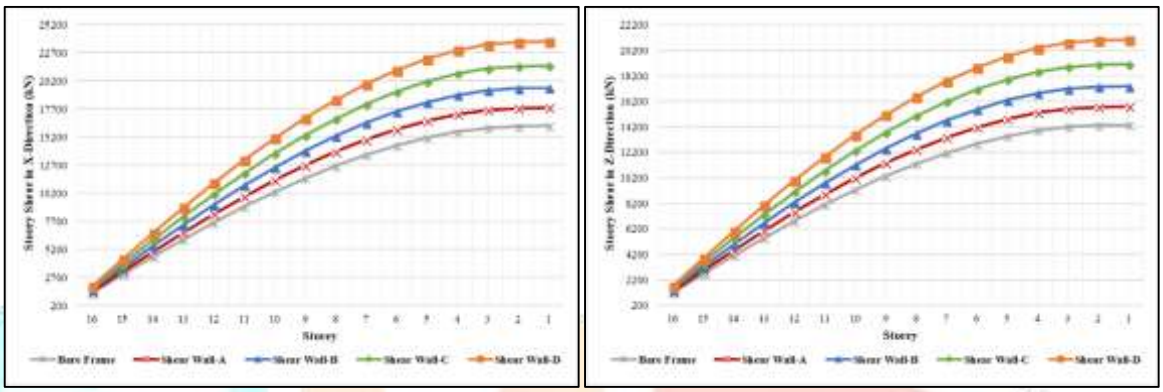


Figure 7. Variation of G+15 storey shear for ground motion in X and Z direction

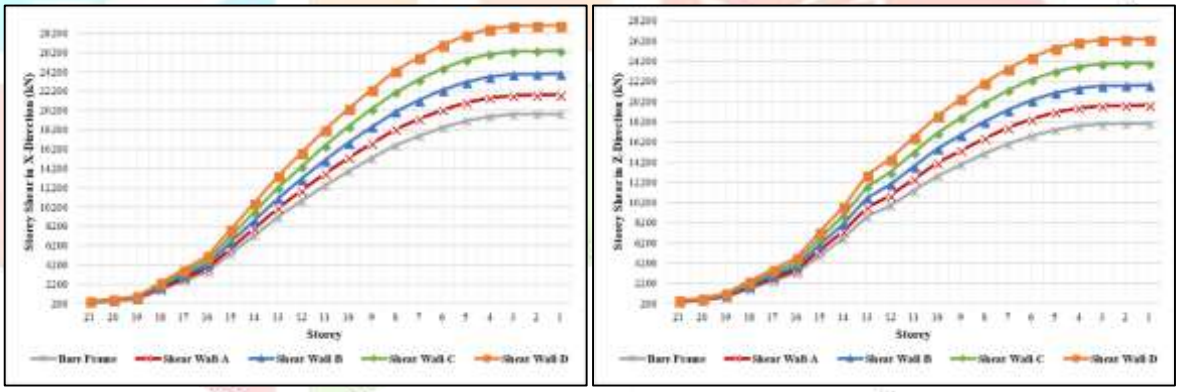


Figure 8. Variation of G+20 storey shear for ground motion in X and Z direction

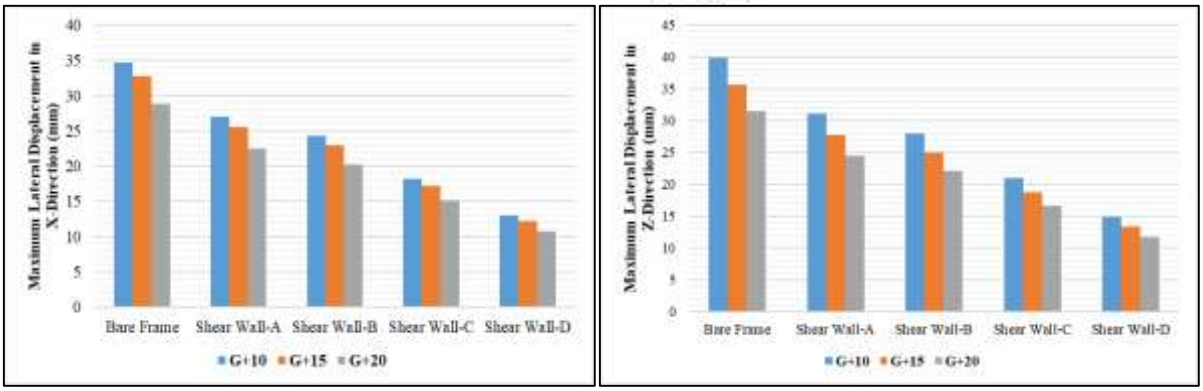


Figure 9. Variation of maximum lateral displacement for ground motion in X and Z-direction

There is increasing in storey shear in the frame due to shear wall. Increasing is more in case of all Shear Wall, mostly in Shear Wall D. For ground motion in X and Z- direction bare frame and Shear Wall A B C is ineffective since in Shear Wall D case shear wall is more useful which are as shown in Figure 6 – Figure 9.

V. Conclusion and Scope of Further Work

The following conclusions were drawn at the end of the work:

- There is a gradual improvement in base shear of the shear wall systems from the base shear of bare frame, indicating increase in stiffness.
- Base shear in case of Shear Wall D is the highest, hence is the most stiff and better option for strengthening the structure.
- Base Shear produced in the Bare Frame is maximum for Imperial Valley Earthquake.
- In case of shear wall system, Shear Wall-D (with shear wall at the corners) are the most effective one than other shear wall systems, effectively reducing lateral deflection in both X- and Z- directions.

Scope of Further Work

Development of shear walls gives record-breaking assurance for the building while the seasons of seismic tremors as well as against vibrations made by impacts in quarry's and furthermore regardless of whether the limit of the building is to be expanded shear walls give enough quality and can unhesitatingly raise the working to another floor Shear walls are thought to be a blessing to the future development industry. Extent of shear walls in development field is enormous.

References

[1] Multistorey Bracing Systems of Reinforced Concrete and Steel –Rigid Frames Subjected to Horizontal Loads- Proposition of Total Evaluation on the Aseismic Capacity for Design, 2014.

[2] Chavan Krishnaraj R., Jadhav H.S., "Seismic Response of RC Building with Different Arrangement of Steel Bracing System.", International Journal of engineering Research and Applications, 2014.

[3] Chandurkar P. P, Dr. Pajgade P. S., "Seismic Analysis of RCC Building with and Without Shear Wall.", International Journal of Modern Engineering Research, 2013.

[4] Viswanath K.G. et al., "Seismic Analysis of Steel Braced Reinforced Concrete Frames." International Journal of Civil & Structural Engineering, 2010.

[5] Esmaili O. et al., "Study of Structural RC Shear Wall System in a 56- Storey RC Tall Building.", The 14th World Conference on Earthquake Engineering October 12-17, 2008, Beijing, China, 2008.

[6] Kappos Andreas J., Manafpour Alireza, "Seismic Design of R/C Buildings with the aid of advanced analytical techniques." Engineering Structures 23 (2001) 319-332, 2000.

[7] P.P Chandurkar, DR. P.S. Pajgade, "Seismic analysis of RCC building with and without shear wall" IJMER, Vol.3, Issue 3, may- june 2013,pp- 1805 -1810,2013

[8] Varsha. R. Harne "Comparative study of strength of RC Shear wall at different location on multi-storeyed Residential building", International Journal of civil Engineering Research. ISSN 2278-3652 Volume5, Number 4, pp 391-400, 204.

[9] Anshuman.S, Dipendu Bhunia, Bhavin Ramjiyani,"Solution of shear wall location in multistorey building",International Journal of Civil and Structural Engineering , Volume 2, No 2,2011.

[10] Dr. B. Kameswari , Dr. G Elangovan ,P. Sivabala, G. Vaisakh, "Dynamic Response of High rise Structures under the Influence of discrete staggered shear wall", IJEST,2011.

[11] Qiuhong ZHAO, Abolhassan Astaneh -ASL," Cyclic Behaviour of traditional and innovative composite shear walls" 13th World Conference on Earthquake Engineering.

[12] Ugale Ashish B. and Raut Harshlata R," Effect of steel plate shear wall on behavior of structure" International Journal of civil Engineering Research. ISSN 2278-3652 Volume5, Number 3, pp 295-300, 2014.

[13] A. K. Marsono and S. Hatami, Evaluation of Coupling Beams Behavior Concrete Shear Wall with Rectangular and Octagonal' Applied Mechanics and Materials Dept. Faculty of Civil Engineering (FKA), University Teknologi Malaysia (2015).

[14] C Y Lin and C L Kuo, Behavior of shear wall with opening, 9th world conference on earthquake engineering august 2-9, 1988.

[15] S. M. Yarnal, S. S. Allagi, P. M. Topalakatti and A. A. Mulla, Non-Linear Analysis of Asymmetric Shear Wall with Openings, International Journal of Engineering Research & Technology (IJERT) Vol. 4 Issues 08, 2015.

[16] T. Dadayan and E. Roudi, Investigations of RC Shear Wall-Frame Structures with Various Openings in Walls under Earthquake Loading, Advanced Materials Research Vol 1020, pp 242-247, 2014.

[17] L. Gong, J. Chen and Y. Su, Research Advances in Seismic Behaviors of Shear Wall with Opening, Applied Mechanics and Materials Vols. 580-583, 2014.

[18] S. K. Mutwalli and Dr. S, Azam, Dynamic Response of High Rise Structures Under the Influence of Shear Walls, Int. Journal of Engineering Research and Applications, 2014.