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Review on Parametric Study of High Rise Structure with respect to Positioning of Shear Walls

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***Abstract:*— High rise buildings are becoming need of today's situation with the population increasing day by day. A trend to high rise building is being seen in the developing cities of India to tackle the housing demand. The buildings become more and more susceptible to the lateral loads because of the wind and earthquake with increased height. Lateral loads can develop high stresses, produce sway movement or even may cause vibration in the structure. Therefore, it is very important for the structure to have sufficient strength against vertical loads together with adequate stiffness to resist lateral loads. Shear walls are among the most common lateral load resisting systems. The usefulness of the shear walls in the structural planning of the multistory buildings has long been recognized. But there are many factors such as placement of shear walls, its thickness, aspect ratio, plan of the building which affects the response of the building towards lateral loads.**

In the present study an attempt is made to study the effect of the position of shear walls on bending moment, shear force, axial force and torsional force. The detailed investigations are carried out for zone V of Seismic zones of India as per IS 1893 (part 1):2002, considering primary loads (dead, live and seismic loads) and their combinations with appropriate load factor using Staad-Pro.

***Key word:*-- high rise building, susceptible, lateral loads, earthquake, stiffness, thickness, aspect ratio, multistory**

I. INTRODUCTION

The use of shear walls started in 1940. They are deep, vertically cantilevered, reinforced concrete beams. Their primary function is to resist the combined effect of vertical and lateral forces due to gravity loads and wind or earthquake forces. Shear walls are among the most common lateral load resisting systems. This is due to their ability in providing lateral stiffness and strength for the structure. It is observed that the buildings with shear walls have performed well as compared to bare frames in the past earthquakes.

The shear walls require special detailing in the high seismic regions.They are commonly located along the lift, staircase and core regions. They are built in wood, concrete, masonry or steel.The walls are very stiff, with considerable depth in the direction of lateral loads. These shear walls are provided at selected bays in both the orthogonal directions based on the feasibility considerations and are integrated with columns of the frame such that there is no physical separation between the columns and the walls.The buildings incorporated with properly designed and detailed shear walls increases the life safety and lowers the property damage during earthquakes. In addition to considerable strength, structural walls can dissipate a great deal of energy if detailed properly. Shear Walls are an invaluable structural element when protecting buildings from seismic events.

II. SCOPE AND OBJECTIVE

The objective of the present study is to critically study the utility of the presence and placement of shear wall in high rise building structure including the parametric study to improve the overall response and effectiveness of the structure for lateral loadings. The response of the structure is to be seen in terms of storey displacements, storey drift and column forces. The analytical models are developed in SAP2000 software. The overall specific objectives of this study are:-

- To accurately simulate the behavior of frame wall structure in the software.
- To find the best suitable positioning of shear walls for building.
- To study the effect of shear wall positioning on bending moment, shear force, axial force and torsional force.

III. LITERATURE REVIEW

Numerous researches have been carried out on the shear wall – frame behavior, nonlinear behavior of wall-frame structure, parametric studies on tall buildings with shear wall, various modeling techniques of shear wall on software. The literature survey deals with the shear wall behavior discussed by researchers, various modeling techniques proposed, effect of positioning of the shear wall in the building etc.

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Dr. K.V.G.D. Balaji and K.Lovaraju (2013)1, have worked on effective location of shear wall on performance of building frame subjected to lateral loads .For this study, 8-story building with a 3-meters height for each story, regular in plan is modeled. These buildings were designed in compliance to the Indian Code of Practice for Seismic Resistant Design of Buildings. The buildings are assumed to be fixed at the base. They observed that RCC Frames with Shear Walls are able to resist more base-shear than that of normal RCC Frames and shear wall placing at adequate locations is more significant in case of base shear and displacement.

H.S. Jadhav and Anuja Walvekar (2015)2, worked on parametric study of flat slab building with and without shear wall to seismic performance. Response spectrum method is used for the analysis of structure. A 15 storey building with RC shear wall and without shear wall is taken for this study. The different location of shear wall is used to study the effect of changing location. Building with shear wall is preferred because of considerable difference in storey displacement, time period, base shear and storey drift.

S K Hirde and N K Shelar (2015)3, study on the effect of positioning of RC shear walls on seismic performance of buildings resting on plain and sloping ground. They found that there is significant improvement observed in seismic performance of building on leveled ground as well as on slopes by providing shear walls with different configurations since lateral displacement and member forces reduces considerably in building due to provision of shear walls. The straight shape (or rectangular) shear walls configuration proves to be better among all configurations for resisting the lateral displacement.

M R Suresh1, Ananth Shayana Yadav (2015)4, The main objective is to determine the optimum position of shear wall by taking irregular plan of the building. After the analysis it is observerd that the plan without shear wall gives more displacement and more drift as compare to the plan with shear wall along with four edges. therefore by providing shear wall along four edges we can reduce storey displacement, storey drift, storey shear and we can increase strength and stiffness of the structure. Therefore it is concluded that by providing shear wall along four edges is found to be the optimum position of shear wall

Rajesh Jayarambhai Prajapati &Vinubhai. R. Patel (2013)6, study the effect of different position of shear wall on deflection in high rise building. As per results it is observed that there is marginal reduction in deflection, by introducing side centre shear wall and shear wall at centre. But the deflection is reduced by introducing shear wall at corner along both directions. Width of building is too small compare to length of building in plan in present work so wind case is governing case in our building.

Venkata Sairam Kumar.N, Surendra Babu.R and Usha Kranti.J 7; presented that shear walls are structural systems which provide stability to structures from lateral loads like wind, seismic loads etc. These are constructed by reinforced concrete. Shear walls resist major portions of lateral loads in the lower portion of the buildings and the frame supports the lateral loads in the upper portions of building which is best suited for soft storey high rise building. In India base floors are used for parking and garages or offices and upper floors are used for residential purposes.

Anshul Sud, Raghav Singh Shekhawat, Poonam Dhiman(2014)8 conducted a research on Best Placement of Shear Walls In an RCC Space Frame Based on Seismic Response. They found that lateral load resisting capacity of the frame increases significantly in case of shear wall introduction, as is clear from the story displacements in x and z directions. lateral displacements are minimum in x-direction and merely 29% of the displacement of simple frame (from 34.83 mm to 9.96 mm). The frame with shear walls at mid-sides performs best for earthquake in z-direction. The reduction in response is as high as 83% (60.9 mm to 10.14 mm).

Bozdogan K.B.,Deierlein et.al.,(2010)9 discussed in detail the modeling issues, nonlinear behavior and analysis of the frame – shear wall structural system. An approximate method which is based on the continuum approach and one dimensional finite element method to be used for lateral static and dynamic analyses of wall-frame buildings is presented.

IV. CONCLUSION

From the above literature, it is seen that the research related to the placement of shear walls is done as performance based analysis. Researchers studied various parameters like enhancement of stiffness, drift, member forces in building to observe perfect location of shear wall location in building frame for construction.

- Lateral load resisting capacity of the frame increases significantly if combined with shear walls
- Good control over the displacement and storey drift can be achieved if the shear walls are located symmetrically in plan.
- Shear walls should be placed in such a fashion that center of gravity of the building should be coinciding with the hardness center of the building in order to reduce the undesirable torsional effects.

- There is marginal reduction in deflection, by introducing side center shear wall, shear wall at center. But the deflection is reduced drastically by introducing shear wall at corner along both directions.
- Building with shear wall is preferred because of considerable difference in storey displacement, time period, base shear and storey drift.
- By providing shear wall along four edges we can reduce storey displacement, storey drift, storey shear and also we can increase strength and stiffness of the structure.
- Shear walls are one of the most effective building elements in resisting lateral forces during earthquake. By providing shear walls in proper position can be minimized effect and damages due to earthquake and winds. Stiffness of building increases due to adding shear wall, hence reducing the damage to structure

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