

Seismic Analysis of G + 10 STOREY Building with Various Locations of Shear Walls Using ETABS

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Abstract— Shear walls are specially designed structural members provided in the multi-storey buildings to resist lateral forces. These walls have very high in-plane strength and stiffness, which can resist large horizontal forces and can support gravity loads. There are lots of literatures available to design and analyse the shear wall. However, what is the optimum location of shear wall in multi-storey buildings is discussed in many literature. It is very necessary to determine effective, efficient and ideal location of shear wall to get effective performance of the buildings. These walls are more important in seismically active zones when shear forces on the structure increases due to earthquakes. Various research studies have been performed on the analysis of shear wall and its performance under the seismic forces. This paper presents the literature review of various studies done earlier on the factors which affect the performance of shear walls such as location of shear walls, configuration and different types of shape.

Keywords: Shear wall, Seismic Analysis, multi-storey building, ETABS

I. INTRODUCTION

In present time as the population is increasing the horizontal development is converting in to vertical development which is leading to the high demand for the earth quick resistance building especially in earthquake prone areas. For the prevention of collapse of the building due to large lateral load we need earthquake resistance building. To achieve that we have shear walls which is Lateral load (wind, earthquake) resisting RCC member for multi-storey buildings. It is very important to know the effective and efficient location of wall to get economical structure. Shear walls act as rigid vertical diaphragm which transfer's the applied lateral force into the ground. Its behaviour depends upon thickness, length, shape and position. In the present study discussed various literature to understand the behaviour of wall based on their shape, configuration and location.

II. REVIEW OF LITERATURE

Ahamad Shaik Akhil and Pratap K.V. 2020 Studied that dynamic analysis of G+20 multi storied residential building provided with shear wall in various location for different seismic zones where done for determining the parameter like storey drift, base shear, maximum allowable displacement and torsional irregularity by adopting Response spectrum analysis. the analysis and modelling for the whole structure is done by using prominent FEM integrated software named ETAB in all the seismic zones of India prescribed by IS 1893 (Part-1) -2016, in this project the dynamic analysis carried out on type -III (soft soil) for a irregular structure in plan in all the zones as specified and it is concluded that the structure with shear wall that is case where building with shear wall at

four corner ends placed symmetrically will show better results in terms of all the seismic parameters when compared with the structure without shear wall and with shear wall that is case having shear wall at one end.

Prasad V.V. et al. (2014), Determined the optimum location of shear walls in U-shaped building by changing different configurations. They have analysed the (G+15) storey building by using static method of analysis in ETABS. Different parameters studied in this analysis were time period for all structures in different modes of building, base shear for different soil conditions and maximum lateral displacement in all structures for different soil conditions. It has been concluded that the shear walls and their positions have a significant influence on the time period. It has been found that time period decreases by adding shear wall. The value of base shear is more for soft soil, then medium soil and then hard soil. The lateral displacement comes out to be more in case of structure under soft soil, then medium soil, then hard soil. It decreases by adding shear wall. The base shear is increasing by adding shear walls due to increase in seismic weight of the building. They have finally concluded that structure with minimum time period is the optimum.

Tarun Magendra et. al. 2016 Determined the optimum position of shear wall in multi-storey-building by changing different configurations They have analysed the multi-storey building by using static method of analysis in ETABS. Different parameters studied in this analysis like maximum storey drift, maximum storey displacement, storey shear and storey over turning moment. It has been concluded that the shear walls and their positions have a significant influence on the considered parameter.

Hiremath G.S and Hussain M. (2014), Analysed the different configurations of shear walls of 25 storey building with ETABS and determined the effective, efficient and ideal location of shear wall also study have been done with varying thickness of shear wall all analysis was performed non-linear static analysis that is pushover analysis on all the models. Four different models of shear walls have been analysed and their lateral displacements and drifts were compared to find out the optimum results. It involves two cases in terms of thickness of shear wall, first deals with the uniform thickness of shear wall throughout the height while the second case involves shear wall of varying thickness with height. It was observed that building with varying thickness in decreasing order throughout height proved to be behaving well in comparison to building with uniform thickness.

Dodiya Jaimin et. al. (2018), Studied that G+20 multi-storey building with shear wall using ETAB software it determined the basic component like displacement and base shear this analysis has been carried using ETABS software for the analysis purpose Equivalent static method, Response spectrum method and Time history methods are adopted. It has been considered 4 different model with different

configuration of shear wall and maximum displacement have been tabulated for each model and concluded the result for best configuration.

Phadnis P.P and Kulkarni D.K 2013, In this project it has been studied G+3 and G+10 storey RCC frame of five different models with different shear wall configuration. The analysis has been carried out using ETABS and their analysis is based on equivalent static and response spectrum method carried out as per IS 1839-2002 (part-I) their seismic performance assessed by performing elastic time history analysis for the analysis recorded of the EL Centro , California earthquake .In this studied different parameter like Fundamental Natural Period , Lateral Displacement are determined .

Eswaramoorthi P and Sylviya B (2018), Studied G+4 storey RCC frame which is subjected to Earthquake loading in different seismic zone and different model is there by changing the location of shear wall by using ETABS Seismic analysis performed by linear dynamic response spectrum method which is used to calculate the earthquake load as per IS 1893-2002 (Part I). Four different model like Structure without shear wall, structure with Shear wall at periphery, structure with shear wall at intermediate, structure with shear wall at core were made for analysis. The result has been calculated on the basis of parameter like storey displacement, storey shear and maximum storey displacement for each model. It is studied the structural wall are most effective when placed at the periphery of the building.

Dhoke Rahul et al 2019 In this research author studied four different models of G + 14 storey building which is considered in two seismic zones. The parameters on which the results are compared are Maximum storey displacement, Maximum storey drift, Maximum overturning moments and the best amongst position of shear wall is to be evaluated. This study presents the impact of seismic loads on flat slab R.C.C structures with different positioning of shear walls as per IS-norms.

Sardar S. J. and Karadi U. N. (2013), in the project, study of 25 storeys building in zone V was presented with some investigation which was analysed by changing various locations of shear walls for determining parameters like storey drift, storey shear and lateral displacement by using standard package ETABS. Creation of 3D building model was done for both linear static and linear dynamic method of analysis and influence of concrete core wall provided at the centre of the building was also studied. It has been found that the model-5 (when shear wall placed at centre and four shear walls placed at outer edge parallel to X and Y direction) shows better location of shear wall since lateral displacement and inter-storey drift are less as compared to other models.

Harne V. R. (2014), considered a RCC building of six storeys placed in Nagpur subjected to earthquake loading in zone-II. An earthquake load was calculated by seismic coefficient method using IS: 1893 (Part I) - 2002. These analyses were performed using STAAD Pro. A study was carried out to determine the strength of RC shear wall of a multi-storey building by changing shear wall location. Three different cases of shear wall position for a 6-storey building were analysed: shear wall provided along periphery, L type and cross type shear wall were taken in this study and these

were located at different location such as periphery, at corner and at middle positions. Three types of load combinations were considered out of which 1.5 (DL + EQX) gives the worst effect The comparison of these models for different parameters like shear force, bending moment, lateral displacement, storey drift and storey shear has been presented in terms of graph and the results were discussed on the basis of these graph. The lateral deflection of column in the model of shear wall provided along periphery is reduced as compared to other two models. It reduces up to 33.33% and 32.06% as compared to models with L type shear wall and cross type shear wall respectively. It was concluded that model with shear wall provided along periphery is more efficient than all other types of shear wall.

III. CONCLUSION

From the study of above literature there is following point to be concluded-

- It is studied that maximum displacement and storey drift value are found to be higher in seismic zone V as compared to other zones. Seismic zone II, III and VI which indicate the displacement can be reduced by making structure with uniform stiffness and also shear walls placed at outer four corners. Structure with uniform stiffness and shear walls placed and outer four corners gives less value in terms of maximum displacement, storey drift and base shear.
- The shear wall and its position have significant influenced on the time period but it is not influenced by type of soil and the better performance for structure having low time period.
- For U shape building the centre of mass and centre of rigidity is influenced by adding and positioning of shear wall but it is not dependent on type of soil.
- When the shear walls are placed at centre of the geometry in the form of box or at corner in symmetrical way the structure behave more stable manner so it is providing better to use lift in structure.
- It was observed that building with varying thickness in decreasing order throughout the height at middle outer span achieves highest reduction in displacement due to increased lateral stiffness and decrease in seismic weight of the structure.
- Fundamental natural period decreases when the effect of shear wall is considered.

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