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A Review on Shear wall in High Rise Buildings

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Abstract: *Shear walls are structural elements especially important in high rise buildings subjected to lateral wind and seismic forces. They provide adequate strength and stiffness to the whole lateral displacement. And can be external walls or internal walls around lift shafts & stairwells or sometimes both are provided.The shape and plan position of the shear wall influences the behavior of the structure considerably. Shear walls are generally constructed from reinforced concrete, plywood/timber, unreinforced masonry. In this paper we have aimed to study the various research works done for improving the performance of shear wall and locating its best position in a building. Shear walls have proved to be very successful in resisting strong earthquake so far.*
Keywords*: Shear wall, composite shear wall, STAAD Pro, and seismic analysis.*

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I. INTRODUCTION

Lateral forces caused by wind,earthquake and uneven settlement loads,in addition to the weight of structure and occupants create powerful twisting (torsional) forces.This leads to failure of structure by shear.Shear walls resist lateral forces such as wind forces,seismic forces.So these are generally provided in high rise buildings subjected to lateral forces.Wind and seismic are the most common loads that shear wallsare designed to carry.Shear walls resist in-plane loads that are applied along its height. The applied load is generally transferred to the wall by a diaphragm or collector or drag member. They are built in wood, concrete, and CMU (masonry). Plywood is the conventional material used in wood shear walls but with modern advances in technology and modern building methods, other prefabricated options have made it possible to introduce shear assemblies into narrow walls that fall at either side of an opening. Shear walls are generally oblong in cross-section, i.e., one dimension of the cross-section is much larger than the other. While rectangular cross-section is common, L- and U-shaped sections are also being usedIt has been rightly said that "We cannot afford to build concrete buildings meant to resist severe earthquakes without shear wall."To reduce the damage caused by earthquake shear walls are must.

II. LITERATURE REVIEW

1) P.PChandurkar did a detail study to determine the solution for shear wall location in multi-storey building with the help of four different models. The buildings were modeled using software ETAB Nonlinear v 9.5.0.After analysing ten storey building for earthquake located in zone II,zone III,zoneIV and zoneV essential parameters like lateral displacement,story drift and total cost required for ground floorwere found in both the cases by replacing column with shear wall and conclusion was drawn that shear wall in short span at corner(model 4) is economical as compared with other models.It was observed that shear wall is economical and effective in high rise buildings and providing shear walls at adequate locations substantially reduces the displacement due to earthquake.If the dimensions of shear wall are large then major amount of horizontal forces are taken by shear wall

2) Varsha R. Harneanalysed a six storey building subjected to earthquake loading in zone II using STAAD Pro andcalculated earthquake load using seismic coefficient method (IS 1893 Part II). Four different cases were analysed comprising of a structure without shear wall, structure with L type shear wall, structure with shear wall along periphery, structure with cross type shear wall. The lateral deflection of column for building with shear wall along periphery is reduced as compared to other types of shear walls .It was found that shear wall along periphery is most efficient among all the shear walls considered.

3)Anshuman S.et al.performed elastic and elasto-plastic analyses using STAAD Pro and SAP V 10.0.5(2000) on a fifteen storey building located in earthquake zone IV and calculated bending moment and storey drift in both the cases. Shear forces and bending moment were considerably reduced after providing shear wall. It was observed that the inelastic analysis performance point was small and within elastic limit therefore results obtained using elastic analysis are adequate.

4)Dr. B.Kameswari et.al studied the drift and inter storey drift of a high rise structure for different configuration of shear wall panels and compared it with that of bare frame. The configurations considered are (1)Conventional shear walls(2)Alternate arrangement of shear walls(3)Diagonal arrangement of shear walls (4)Zigzag arrangement of shear walls(5)Influence of lift core walls.The zigzag arrangement of shear wall was found to be better than other configurations as it enhances the strength and stiffness of the structure by reducing the lateral drift and inter storey drift than other types of walls and is most effective in earthquake prone areas.

5) Qiuhong ZHAO et al studiedtraditional composite shear wall and an innovative shear wall. The traditionalreinforced concrete wall is in direct contact with the boundary steel frame whereas in the innovative system there is a gap in between. He conducted cyclic test on both the systems and both of them showed highly ductile and inelastic behaviour and both were able to tolerate more than 17 cycles of inelastic shear displacement and reach maximum inter storey drift of more than 0.05.The innovative composite shear wall system was found to be more ductile than traditional composite shear wall but the strength and stiffness of traditional system was found to be higher. By introducing gap in the innovative system, damage to concrete wall under relatively large cycles was much less than the damage to concrete wall in the traditional system.

6) Ugale Ashish B. and Raut Harshlata R conducted an analysis on behavior of steel plate shear wall in G+6 building frame located in seismic zone III using STAAD Pro and compared it with a Building frame without shear wall.The building with steel plate shear wall showed very less deflection, shear force and bending moment and overall stiffness was found to be increased. It was found that Steel plate shear walls occupy less space than RCC Shear wall.

7) Shahabodin. Zaregairizi investigated on using shear wall and infill to improve seismic performance of existing buildings. On doing static analysis to compare effectiveness of both methods it was observed that concrete in-fills showed greater strength than brick one but brick in-fills accepted large displacement than concrete in-fills. So if they are used in combination their individual negative effects will be reduced.

8) Men Jinje et al proposedan optimization formulation for RC shear wall structures after doing investigation based on conceptual design methodology. A 30 storey tall building with RC shear wall and with rectangular layout was considered. investigation was done on six shear wall structural schemes and parameters like lateral stiffness, ratio of inter storey drift, seismic response force,ratio of torsional period to translational period were calculated and conclusion was drawn that arrangement of shear walls have influence on material consumption and concrete consumption and steel consumption increase with the increase in aspect ratio of the building.

9) Chun Ni et al studied the performance of shear wall with diagonal lumber sheathing by testing on 16 full scale shear walls and determining the effects of hold owns, vertical load and width of lumber sheathing on in plane shear capacity. The in plane shear capacities of shear walls with double diagonal lumber sheathing was found to be 2 - 3 times higher than that of shear walls with single diagonal lumber sheathing.

10) T. Sonos et al proposed the use of crossed inclined bars in joint region to improve the seismic resistance of exterior reinforced concrete beam column joints.

11) A Ravi Kumar et al conducted a thorough study for determining the solution for shear wall location in multi storey building based on its elastic and elasto - plastic behaviours.He analysed a 10 storey building,40m in height for earthquake load using ETABS.He concluded that shear walls are one of the most effective building elements in resisting lateral forces during earthquake and for a developing nation like India shear wall construction is considered to be a back bone for construction industry.

12) Natalino Gattesco et al (9), conducted comparative study with code provision on timber shear walls with particle boards and one opening for windows. From experiments it was found that there is very less difference in shear capacity, ductility and dissipative capacity between perforated and solid walls of equal dimension and there is considerable increase in shear capacity in double number nailed panels.

13) Wen - I Liao et al conducted test on four large scale shear wall, two shear walls under shake table test and two shear walls under reverse cyclic loading. Steel bars were provided at 45 degrees to horizontal which is very close to direction of applied tensile stresses .Dynamic loading on two shear walls induced by shake table was studied and the response time histories for the accelerations and displacements and hysteretic loops was presented.Force displacement hysteric loops was also presented for shear walls under reversed cyclic loading and conclusion was drawn that with placement of steel bars in direction of applied stresses high seismic performance is achieved.

14) A.B. Karnale et al analysed different configurations of shear wall for 6(low rise) and 14storey 'In this paper, researchers presented the results for different configurations of shear walls for 6 storey(Low Rise) and 14 storey (High Rise) building using ETABs software. A comparison was done between the effects observed due to height of structure and it was found that shear wall is more effective in high rise buildings than in low rise buildings.

15) M. Mosoarca, did theoretical and experimental study on failure modes of three types of reinforced concrete shear walls with staggered openings and compared results with results of walls with vertical ordered openings. The failure modes of the structural walls under seismic stress had been identified using calculus programs and cyclic alternated experimental tests

III. CONCLUSION

From the above literature review it can be concluded that providing shear walls at adequate locations substantially reduces the displacement due to earthquake and shear wall along periphery is most efficient among all the shear walls considered. With constructing shear walls damages due to effect of lateral forces due to earthquake and high winds can be optimised. Steel plate shear walls occupy less space than RCC Shear wall. Shear wall along periphery is most efficient among all the shear walls considered. Storey drift of building provided with openings in shear wall is greater than shear wall without openings And also arrangement of shear walls have influence on material consumption and concrete consumption and steel. Placing steel bars in direction of applied stresses increase seismic performance of shear wall. Internal shear walls are more effective than external shear walls. Shear wall is effective in reducing soft storey effect. Shear walls are more effective in high rise buildings than in low rise buildings.

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