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Effective location of Shear Wall, its significance and displacement analysis

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Abstract - *The need for such structures becomes extremely essential that have the ability to overcome the various types of loadings. For such structures a proper analysis about the supporting members and several other members that support the structure must be done so as to ensure that there is no failure in the structure. With a massive increase in population each year, it becomes necessary to construct high rise buildings so as to cater the needs of the people as per living standard. Considering the past records of earthquakes, there is an urgent demand of earthquake resisting building which might be consummated by providing the shear wall systems within the building. During earthquake RC (Reinforced Concrete) structures are subjected to lateral displacement. Most of the RC structures are designed to resist gravity loads only neglecting the effect of lateral forces arising due to earthquake. Thus to counter the effects of lateral load acting on a structure shear walls are constructed. In high rise constructions, Shear walls form external walls that are straight, typically forming a box which will be providing all of the lateral support for the building. Shear walls when designed and constructed properly, will have the strength and stiffness to resist the horizontal forces.*

Key Words: **Earthquake resistant building, Reinforced concrete, lateral load, lateral displacement, shear wall, stiffness, horizontal forces and external walls.**

1. INTRODUCTION

One of the most commonly used lateral load resisting system in high rise buildings is a shear wall system. It can be defined as structural vertical member that is able to resist combination of shear, moment and axial load induced by lateral load and gravity load transfer to the wall from other structural member. They have high stiffness and strength and can be used to simultaneously resist large horizontal loads and support gravity loads, which significantly reduces lateral sway of the building and thereby reduces damage to structure and its contents. Shear walls in buildings must be located in plan symmetrically to reduce adverse effects of twist in buildings. When shear walls are situated in advantageous positions in the building, they can form an efficient lateral force resisting system by reducing lateral displacements under earthquake loads. Therefore it is extremely essential to determine effective, efficient and ideal location of shear wall. The use of shear walls or their equivalent becomes imperative in certain high-rise buildings if the lateral loading causing inter story deflections, are to be managed.

1.1 Function of Shear wall

Shear walls must provide the mandatory lateral strength so as to resist horizontal earthquake forces. As soon as shear walls measure strong enough, they would transfer the horizontal forces to further parts within the load path below them. These alternative components within the load path are other shear walls, floors, foundation walls, slabs or footings. Shear walls provide lateral stiffness additionally in order to prevent the roof or floor from side-sway excessively. When shear walls measured have enough stiffness, they'll stop floor and roof framing members from moving off their supports. Also, buildings that are sufficiently stiff can sometimes suffer less nonfunctional damage. Shear walls conjointly offer lateral stiffness to stop the roof or floor higher than from excessive sideway. Once shear walls are stiff enough, they're going to stop floor and roof framing members from moving off their supports. Also, buildings that are sufficiently stiff can typically suffer less non-structural damage.

1.2 Scope

In the present study, a typical multi storey (G+10) building is analysed using software ETABS. All the analyses has been made according to the Indian Standard code books. Based on the literature of previous studies most effective positioning of shear walls has been chosen. Analysis is done with model eleven storey high and provided with a shear wall at the corners of the building, at the periphery of each side of the external perimeter without openings and without shear wall.

2. Shear Wall Location and displacement analysis

Shear Walls are analyzed at different locations in the given structure. Given below are the details about the structure and its member components.

The very first case is the one where the structure we have taken is analyzed without any shear wall. The displacements for the first case is then observed. The second case will be drawing of shear walls at the corners of the structure, and the displacements are noted down for the same. Similarly for the third structure the displacements are noted by locating the shear walls at the periphery. The displacement analysis is done in seismic zone 2, 3, 4, 5.

Table -1: Data Assumed

Number of storey	G+10
Typical storey height	3m
column size	500mm X500mm
Beam size	300mm X 600mm
Slab thickness	150mm
Shear wall thickness	300mm
Grade of concrete	M25
Grade of steel	Fe500

Table -2: Displacement analysis

11 storey	Modal 1 displacement (mm)	Modal 2 displacement (mm)	Modal 3 displacement (mm)
Zone 2	130.24	119.13	107.36
Zone 3	203.11	184.5	166.24
Zone 4	301.37	272.65	254.65
Zone 5	442.68	399.55	359.94

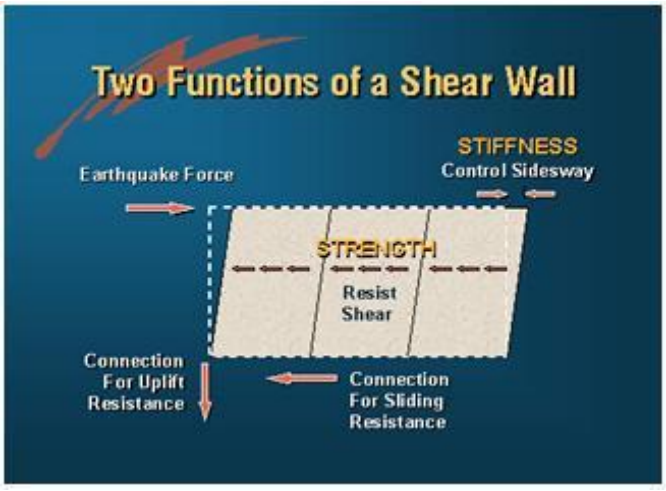

Fig -1: Name of the figure

3. CONCLUSION

The present studies have analyzed bare frame system and in filled frame system without and with shear wall at different locations. Shear walls play a significant role in increasing the performance of building under the lateral forces. In order to ensure same cost, the length and thickness of shear walls have to be kept same in all the studies. The results shows that the presence of shear wall in bare frame structure and in filled frame structure modifies the lateral force behavior of the RC framed building to a large extend. Total displacement of the building decreases considerably when the frame building is provided with shear wall.

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