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The Seismic Analysis of Multi Storied Building with Shear Walls of Different Shapes: A Literature Review

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Abstract: **A shear wall is a wall that used to resist the shear, produce due to lateral forces. Shear walls are added to that Building interior to provide more strength, stiffness to building when the exterior walls cannot provide sufficient strength and stiffness. It is necessary to find out that effective shape of shear wall. These present work deals with a study on improvement of shape of shear walls in symmetrical high rise building. In symmetrical buildings, center of gravity and center of rigidity coincide, so that shear walls are placed symmetrically. In these work a high rise building with different shapes of shear walls is considered for analysis. The multi store building with G+14 storey's are analyzed for storey drift story displacement and base shear using ETABS software. For the analysis of these building for seismic loading with all Zones (Zone-II, III, and IV & V) is considered. The analysis of these building is done by using dynamic method (Response spectrum analysis). The useful of shear walls in the structural planning of multistory buildings has long been recognized. When walls are situated in the advantageous positions in a building, they can be the very efficient in resisting lateral loads originating from wind or earthquakes etc. Reinforced concrete framed buildings are adequate for the resisting both vertical and horizontal loads acting on them of buildings. Extensive research has been done in the design and analysis of shear wall in high-rise buildings. However, significance of shear wall in high-rise irregular or unsymmetrical structures is not much discussed in literature.**

Keywords: Shear wall, ETABS,

I. INTRODUCTION

Adequate stiffness is to ensured in high rise buildings for resistance to lateral loads induced by wind or seismic events. Reinforced concrete shear walls are designed for buildings located in the seismic areas, because of their high bearing capacity, high ductility and rigidity etc. In high rise buildings, beam and column dimensions work out large and heavy reinforcement at the beam-column joins are quite heavy, so that, there is lot of clogging at these joints, it is difficult to place and vibrate concrete at these places which does not contribute to the safety of the buildings. These practical difficulties call for the introduction of shear walls in High rise buildings. Buildings engineered with structural walls are almost always stiffer and then framed structures, reducing the possibility of the excessive deformation and hence damage. RC multi storied buildings are adequate for the resisting both the vertical and horizontal load.

When such buildings are designed with and without shear walls, beams and column sizes of quite heavy. Shear walls may become imperative from point of view economical and control large deflection. Lateral forces, that is, the forces applied horizontally to the structure derived from winds or earthquakes cause shear and overturning moments in the walls. The shear forces tend to tears the wall just as if you had a piece of paper attached to the frame and changed into frame's shape from a rectangle to parallelogram. The changing of shape from a rectangle to parallelogram is referred to be racking. At the end of shear walls, there is the tendency for that wall to be pushed down at the end away from the force. This action may provide resistance to overturning moments. Lateral loads can also develop high stresses, produce sway movement and cause vibration. Therefore, it is very important to have sufficient strength for the structure against the vertical loads. Earthquake and wind forces are the only major lateral forces that affect to the buildings. The function of lateral load resisting systems is structure form is to absorb the energy induced by these lateral forces by moving or deforming without collapse. The determination of structural form of a tall building, high rise building would be perfectly involved only the arrangement of the major structural elements to the resist most efficiently the various combinations of the lateral loads and gravity load. The taller and more the slanders

Structure, the most important of the structural factors become and the more necessary it is to be choosing an appropriate structural form or the lateral loading system for the building. In high rise buildings which are designed for a similar purpose of the same height and material, the efficiency of the structures can be the compared by their weight per unit floor area. Shear walls are specially designed structural walls included in the buildings to be resisting horizontal forces that are induced in the plane of the wall due to wind, earthquake and other forces etc. They are mainly flexural members and usually provided in the high-rise buildings to avoid the total collapse of the high-rise buildings under seismic forces. Shear wall has high in-plane stiffness and strength which can be used to the simultaneously resist large horizontal loads and support gravity loads. However, when the buildings are tall, say more than the fourteen stories or so, beam and column sizes workout large and reinforcement at the beam and column junction works out quite heavy.

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So that, the lot of congestion at these joints and it is difficult to place and vibrate concrete at these places, which does not contribute to the safety of the buildings. These practical difficulties can call for introduction of shear walls in high-rise buildings. Deep straight walls or the H shaped, U shaped, W shaped and T shaped shear walls were used based on functional and architectural requirement of the high-rise building.

II. DIFFERENT SHAPES OF SHEAR WALLS

The shape and location of the shear wall have significant effect on the structural behavior under lateral loads. Lateral loads are distributed through the structure acting as the horizontal diaphragm, to the shear walls, parallel to the force of the action. The core eccentrically located with respect to the building shapes has to carry out torsion as well as bending and direct shear. These shear wall resist horizontal forces because their high rigidity as deep beams, reacting to shear and flexure against the overturning. However the torsion may also develop in the building symmetrical featuring of shear wall arrangements when wind acts on the facades of the direct surface textures or when wind does not act through the centre of building's mass. Shear walls are rectangle in cross section, i.e. one dimension is much larger than the other. While rectangular cross-section is frequent, L- and U-shaped sections are also used. Thin walled hollow RC shafts around the elevator core of structure also act as shear walls, and should be taken advantage of to resist the earthquake forces. The Shear Wall shapes used in this work are,

(a) U – Section
(b) W – Section
(c) H – Section
(d) T – Section

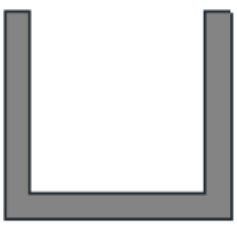


Figure 1.U – Section

Figure 2.W – Section

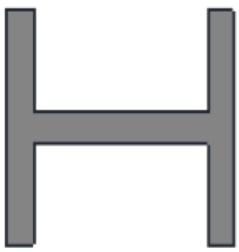


Figure 3.H – Section

Figure 4.T – Section

III. MODELLING OF BUILDING

Here the study is carried out for the behavior of G+14 and building with shear walls of four different shapes in all zones. The general software ETABS has been used for the modeling.

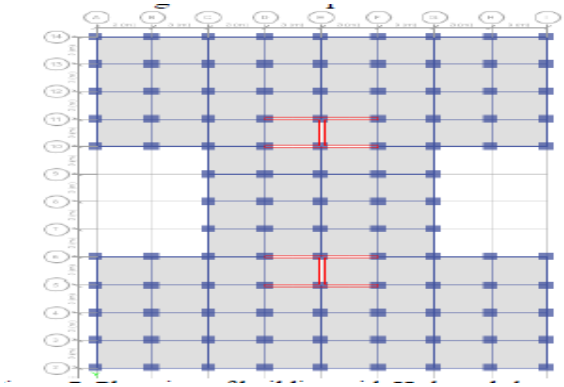
It is more user friendly and versatile program that offers the wide scope of the features like static and dynamic analysis, non- linear dynamic analysis and non-linear static pushover analysis, etc.

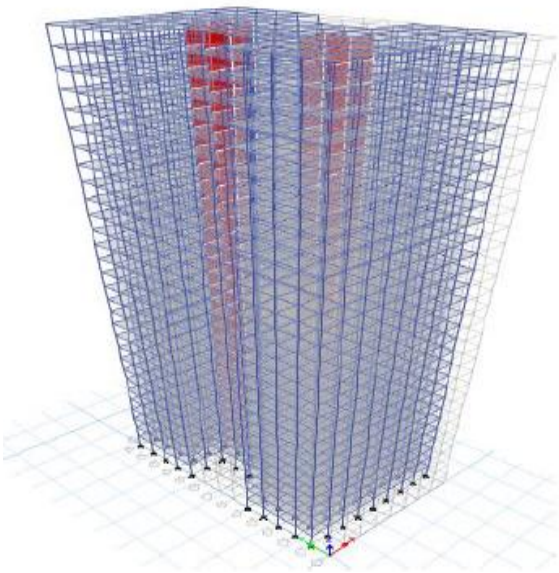
A) Building Plan And Dimension Details

Table below shows the details of building.

Table 1 Building deatails

Total height of building	45 m and 90 m
No. of stories	15 and 30
Height of each storey	3 m
Grade of concrete	M30
Grade of steel	Fe415
Depth of slab	150 mm
Size of beams	400 X 600 mm
Size of columns	800 X 800 mm
Shear wall thickness	230 mm
Plan area	720 m^2





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IV. CONCLUSION

In the present study, an attempt is made to the study of seismic behavior of the building with shear walls of four different Shapes in all zones comparing. First part of the study included the dynamic analysis of Building. The storey drift, story displacement and base shear will be obtained and comparative table of these results for all the shapes of shear wall will be presented and also comparison of shapes of shear walls in different zones like zone-II, III, IV, V needs to be executed.

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