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Seismic and Wind Analysis of RCC Building with Different Shape of Shear Wall and Without Shear Wall

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***Abstract:** In India, about 50-60% of the total area is vulnerable to the seismic activity. Earthquakes are the vibrations or the motion of the ground due to release of energy. The vibrations or ground motion are the important factors to analyze and design, the earthquake resistant structure. So, to reduce the impact of earthquake different efforts has been done in this field. Basically, earthquake exerts lateral as well as vertical forces so to dissipate those forces and the vibration in system earthquake resistant structure has been design. The design of earthquake resistant structures depends on providing stiffness, strength and inelastic deformation which withstand the earthquake forces. As the height of the structure increases the lateral loads acted on the structure increases and decrease in the stiffness, so to counteract those shear walls and different damping devices has been used.*
***Keywords:** IS Code 1892-Part-1:2016; U - Section, Z- Section, H-Section, T-Section*

I. INTRODUCTION

Shear wall is a structural component used to resist the both gravity loads and lateral loads (earthquake and wind loads). The structure is still damaged due to some or the other reason during earthquakes. Behavior of structure during earthquake motion depends on distribution of weight, stiffness and strength in both horizontal and planes of building. To reduce the effect of earthquake reinforced concrete shear walls are used in the building. These can be used for improving seismic response of buildings. Shear Wall are the vertical structural member which starts from foundation and run throughout the height of building. Shear wall thickness varies from 150mm to 400mm, depending on the number of stories, thermal insulation and design period. RCC shear wall has high in plane stiffness, at the same time resist massive horizontal masses and support gravity masses in the direction of orientation of the walls, there by serving advantageous in many Structural Engineering applications and reducing the risk of damage in prevent the roof or floor on top of from excessive side-sway. Shear walls are having different shapes at different location such as Z shape, box shape, T shape, L shape, Quadrant shape etc. Generally, shear wall is located as a core wall or it is located at different position either at different corner or different edges.

II. OBJECTIVE OF THIS STUDY

A. Most of the residential buildings have been designed only for dead and live loads. People are not aware of the seismic design of buildings. But for the various buildings which are located in the zone IV or V needs to be seismic resistant.
B. To study scope of knowledge of shear wall
C. Shear walls are considered for the frame at different position for the studyof all over analysis.
D. To study behavior of the structure for different Shape of shear wall at different locations.
E. The variation of story drifts of the models to be studied

III. LITERATURE REVIEW

Shear wall is a structural member used to resist lateral forces i.e., parallel to the plane of the wall. For slender walls where the bending deformation is more, Shear wall resists the loads due to Cantilever Action. In other words, Shear walls are vertical elements of the horizontal force resisting system. In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. Examples are the reinforced-concrete wall. 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 the failure of the structures byshear. Shear walls are especially important in high-rise buildings subject to lateral wind and seismic forces. Generally, shear walls are either plane or flanged in section, while core walls consist of channel sections. They also provide adequate strength and stiffness to control lateral displacements.

A. *Lateral Load Resisting Systems*

The Lateral Load Resisting Systems are used to resist forces resulting from wind and seismic activity. The various systems are as shown in fig1.1

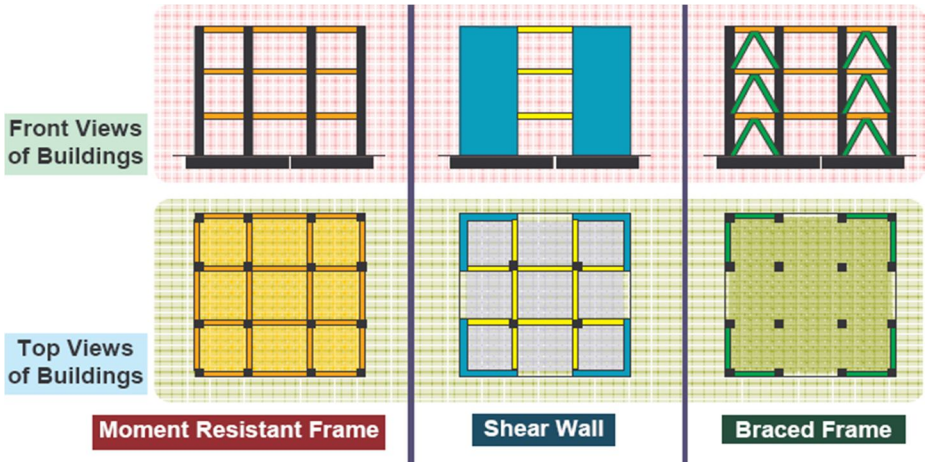

Fig 1. Lateral Load Resisting System

B. *Shear Wall Buildings*

Reinforced concrete (RC) buildings often have vertical plate-like RC walls called Shear Walls in addition to slabs, beams and columns. These walls generally start at foundation level and are continuous throughout the building height. Their thickness can be as low as 150 mm, or as high as 400 mm in high rise buildings. Shear walls are usually provided along both length and width of buildings. Shear walls are like vertically-oriented wide beams that carry earthquake loads down wards to the foundation. Reinforced concrete walls, which include lift walls or shear walls, are usual requirement of reinforced concrete multistory or high-rise buildings. Constructing the shear wall in tall, medium and even short buildings will be effective and in turn reinforce the structure significantly making more economical than the bending frames.

Most RC buildings with shear walls also have columns; these columns primarily carry gravity loads (i.e., those due to self-weight and contents of building). Shear walls provide large strength and stiffness to buildings in the direction of their orientation, which significantly reduces lateral sway of the building and thereby reduces damage to structure and its contents. Since shear walls carry large horizontal earthquake forces, the overturning effects on them are large. Thus, design of their foundations requires special attention. Shear walls should be provided along preferably both length and width as shown in fig 1.2

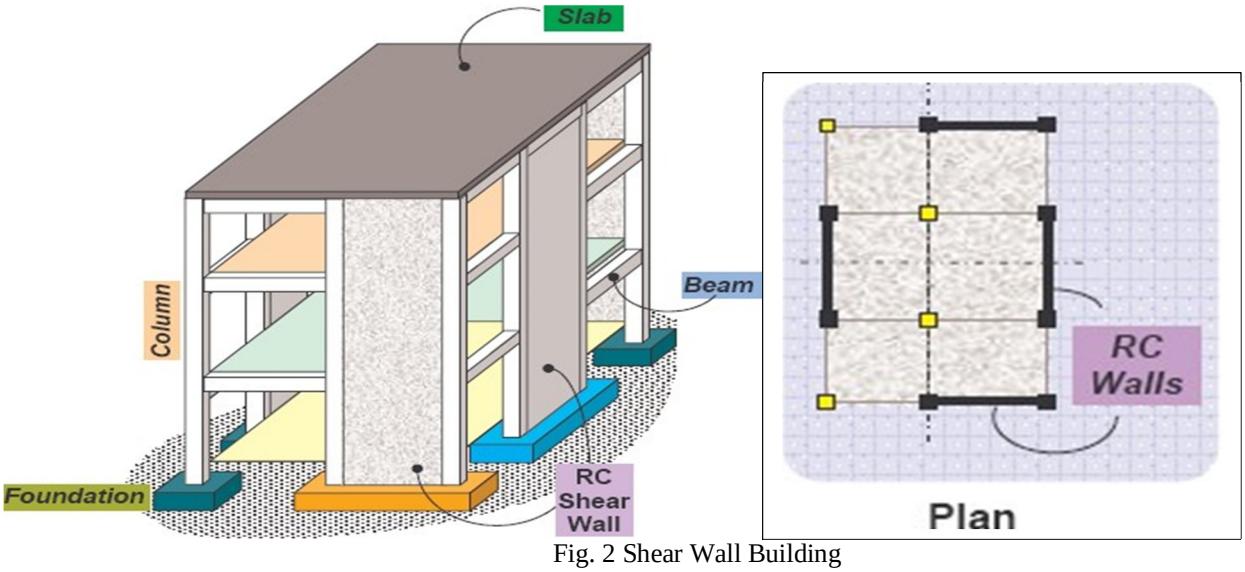

Fig. 2 Shear Wall Building

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C. Different Shapes of Shear Wall

Walls The shape and location of shear wall have significant effect on their structural behavior under lateral loads. Lateral loads are distributed through the structure acting as a horizontal diaphragm, to the shear walls, parallel to the force of action. A core eccentrically located with respect to the building shapes has to carry torsion as well as bending and direct shear These shear wall resists horizontal forces because their high rigidity as deep beams, reacting to shear and flexure against overturning. However, torsion may also develop in building symmetrical featuring of shear wall arrangements when wind acts on the facades of direct surface textures or when wind does not act through the center 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 the structure also act as shear walls, and should be taken advantage of to resist earthquake forces.

The Shear Wall shapes used in this work are,

1) U – Section
2) Z – Section
3) H – Section
4) T – Section

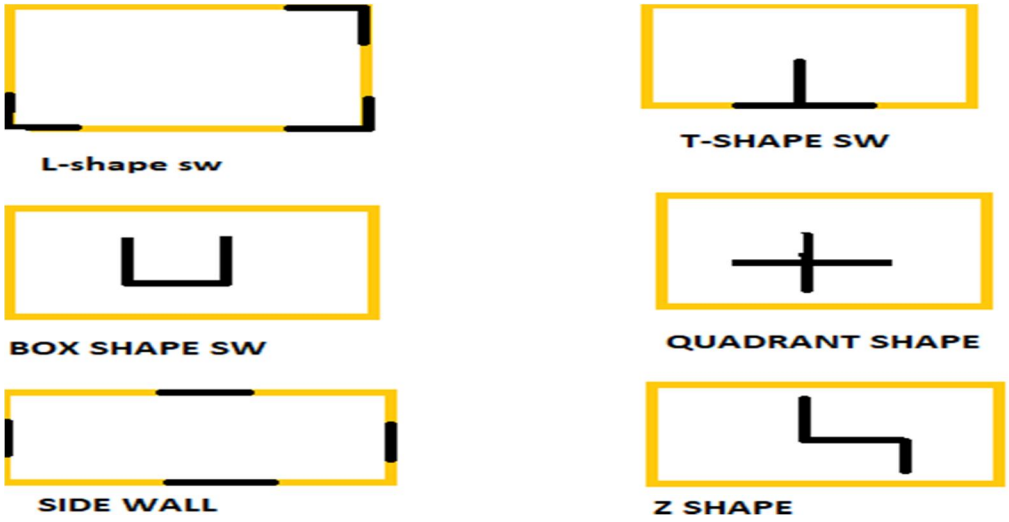

Fig 3 Shape of Shear Wall

D. General Requirements

Design of shear wall is done as per IS 13920:1993 (clause no. 9). The following recommendations are made in the code:
The requirements of this section apply to the shear walls, which are part of the lateralforce resisting system of the structure
The thickness of any part of the wall (fig. 2.7) shall preferably, not be less than 150 mm. thinner walls have a tendency to buckle out of plane

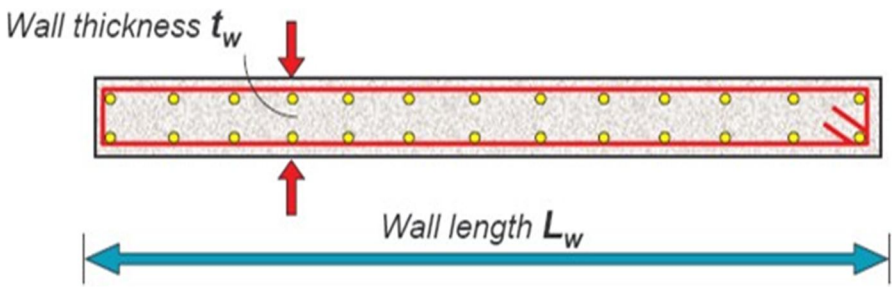

Fig. 1.5 Thickness of Wall

The probable reasons for the need of proper analysis of a building may be as follows:

1) Buildings have not been designed and detailed to resist seismic forces.
2) Buildings may have designed for seismic forces, before the publication of current designseismic codes.
3) The lateral strength of the building does not satisfy the seismic forces as per the revised seismiczones or designed base shear.
4) Construction is apparently of poor quality.
5) There have been additions of change of use of building with increased vulnerability

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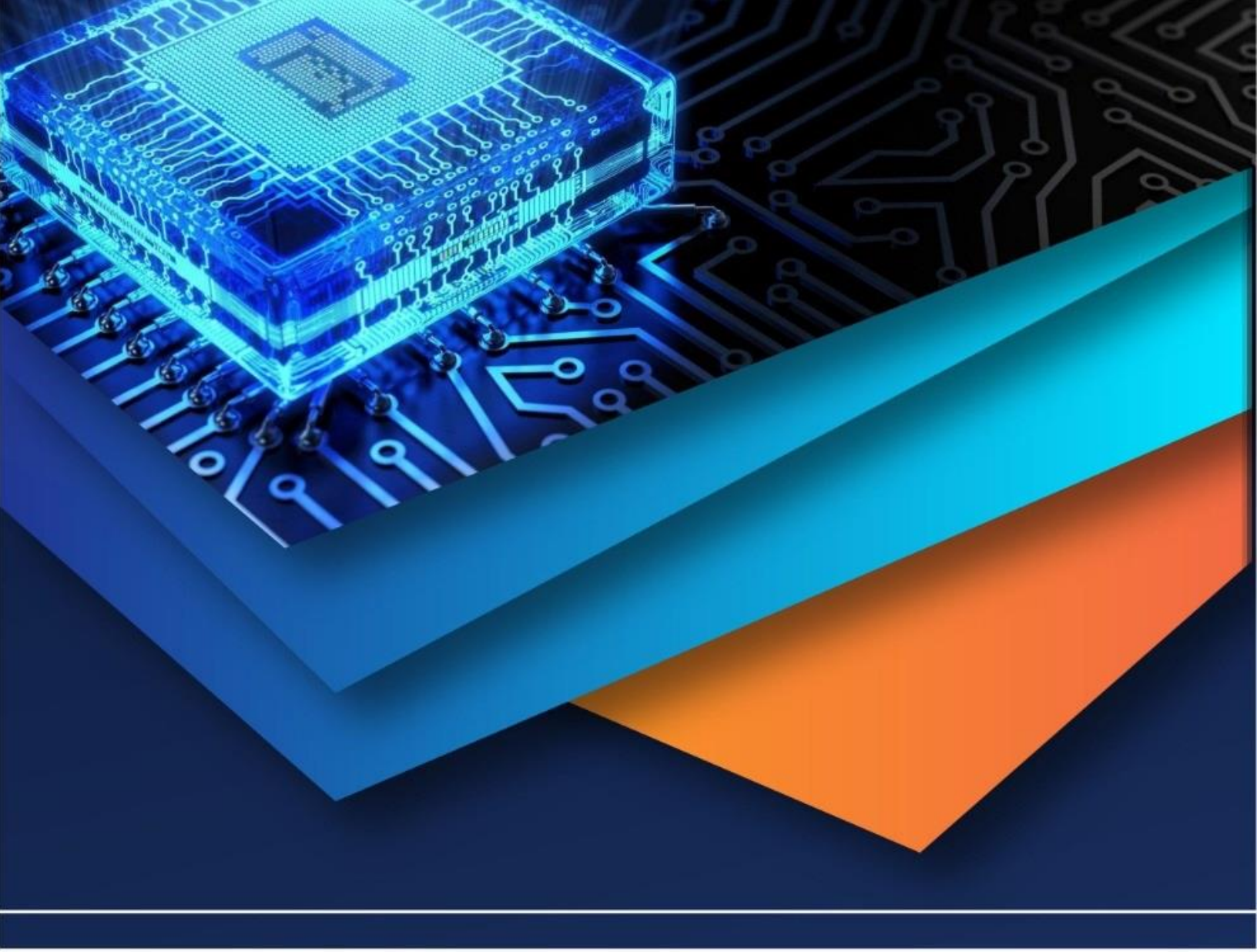

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