Analysis of High Rise Multistoried Building With and without Shear Wall By Response Spectrum Method

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Abstract - *Structural engineers are primarily concerned with determining how a structure behaves when subjected to horizontal forces, and appropriate stiffness is essential for high-rise buildings to withstand horizontal forces caused by wind and earthquakes. Shear walls, which are added to the inside of the proposed building, are used to combat horizontal forces, such as lateral stresses created by earthquakes, and to offer greater stiffness to the structure. This work uses Response Spectrum Analysis to investigate the use of with and without Shear walls at various positions in a G + 15 multi-story residential building, as well as the nature of the structure exposed to earthquakes. Storey drift, storey displacement, storey pressures, storey response, storey shear, and storey stiffness are investigated in a multi-story building with G + 15. The whole structure is analysed and modelled using the software ETABs 2016 in seismic zone 3 for a regular structure, and it is concluded that the structure with symmetrically positioned shear walls will perform better in terms of all seismic parameters than the constructions without shear walls.*

Key Words: *Shear wall, Response Spectrum, Seismic Analysis , Storey Drift*

1. INTRODUCTION

Earthquake is a natural terrible calamity that results from a rapid release of energy beneath the earth's surface. It is considered one of the greatest natural disasters since it causes a portion of the earth's surface to shake up, as well as all manufactured items, living and non-living creatures on it. The vibrations are caused by the energy emitted and are caused by internal and external substances within the surface, resulting in loss of life and structural damage. Earthquakes can have a wide range of intensities and magnitudes, so it's critical to look into the seismic behaviour of RC structures for various functions such as base shear, displacements, and so on. A dynamic analysis should be carried out to figure out the maximal reaction to a base excitation in order to make a structure safe and research its nature during earthquakes. When a structure is subjected to quake shaking, shear walls are created to counteract the consequences of lateral loads and to provide the appropriate strength and stiffness. When compared to all other lateral force resisting methods, shear walls are the most effective, especially for tall buildings and lift situations

2. WHAT EXACTLY IS SHEAR WALL?

Shear walls, which can be created as vertically oriented wide beams in a reinforced concrete framed structure, are used to mitigate the effects of lateral loads operating on buildings. These are given in addition to slabs, beams, and columns in a structure, and they provide the required rigidity, particularly in residential constructions, and they serve as a case in a structure. Shear walls have been widely used in mid- and high-rise structures during the past two decades. Shear walls are extremely significant in buildings, particularly tall ones, because they are particularly vulnerable to lateral loads and seismic pressures

3. OBJECTIVE OF THE STUDY

1. To examine the behaviour of multi-story buildings with and without shear walls, as well as the results for the seismic zone 4 analysis.
2. To determine the shear wall's position so that it can efficiently resist lateral loads.
3. By performing dynamic analysis, the structure was analysed in terms of base shear, displacements, drifts, storey stiffness, and storey forces, by modifying the stiffness of the structure along its height in different seismic zones of India

4. METHODOLOGY AND PARAMETERS

The flow chart explains the full approach. In this research paper, Regular shape Structure is considered and is shown in figure 1 with shear wall and without Shear wall. The G+15 high-rise building, with a length of 46.1 m, is used in this analysis. G+15 stories with typical storey height of 3 m with bottom height of 4.1 m. Fixed type of Support conditions of a specific type are taken into account

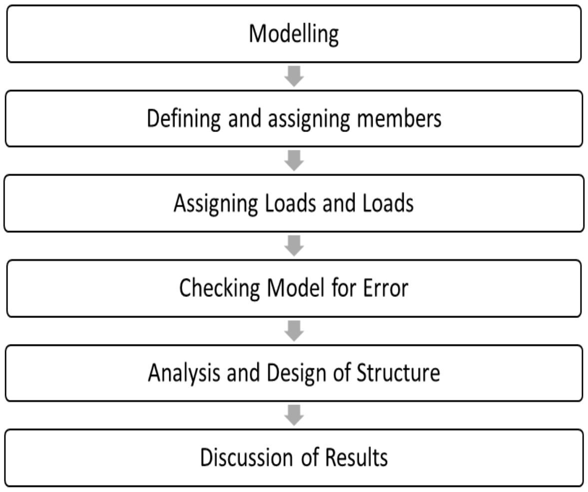

Fig-1: Methodology

Table -1: Details and Dimensions of Multistorey Building Model

Title	Specification
Beam Size	300*500 mm
Column Size	600*600 mm
Slab Thickness	150 mm
Thickness of Shear Wall	200 mm
Concrete Grade	M30
Steel And Rebar	HYSD415
Floor to Floor Height	3 m

Table -2: Load Calculation:

Type of Load	Calculation
Wall Load	6.8 kN/m
Live Load	5 kN/m
Seismic Load	AS per IS 1893:2016

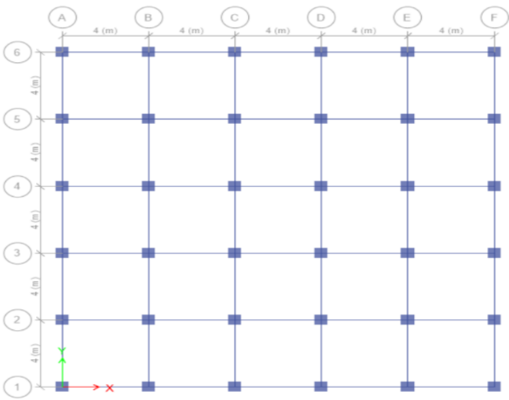

Fig-2: Plan of Building Without Shear wall

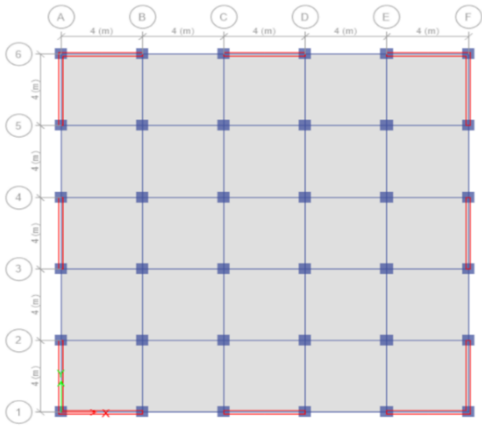

Fig-3: Plan of Building With Shear wall

5. MODELLING:

The figures below show a floor plan and a three-dimensional image of a building. ETABS software is used to model and analyse the complete structure. All models are analysed for gravity loads and lateral loads (Seismic and Wind) with various load combinations. Both the gravity and lateral loads are calculated in accordance with Indian standards. Defining of property: The material Attribute was first defined. We can add additional materials to our structural components by assigning the necessary details in defining (beams, Columns, and slabs.) After the Defining of all the property now we have to assign the property step by step.

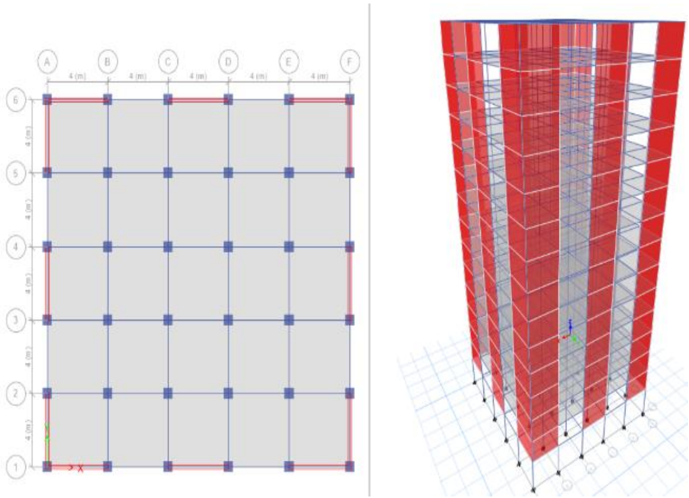

Fig-4: Floor Plan & 3D Building View

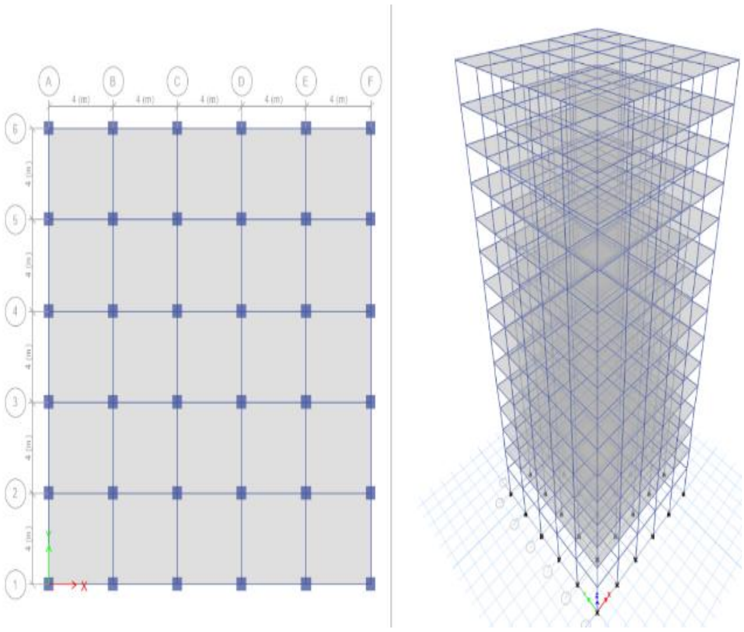

Fig-5: Floor Plan & 3D Building

6. Analysis And Design Check:

The constraints are drawn and shown in the following figures after analysing all structures in the ETABS. The load combinations are selected from all the load combinations analysed are 1.2(DL + LL + EQX) , 1.2(DL + LL + EQY), 1.2(DL+LL+ WLX) , and 1.2(DL+LL+WLY).

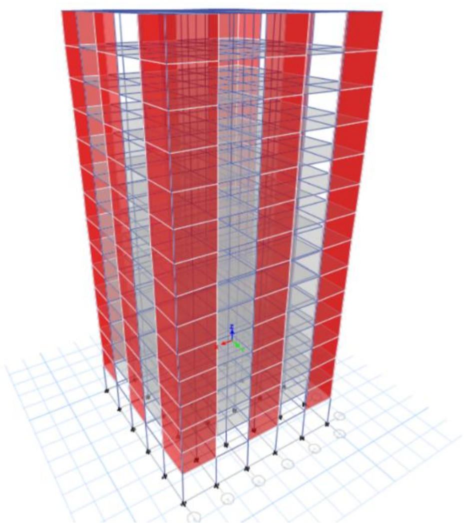

Fig-6: Building with Shear wall

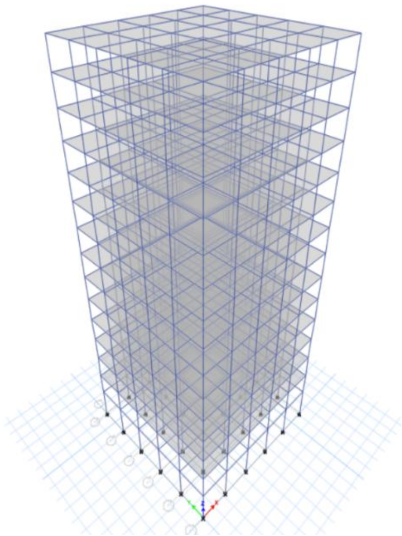

Fig-7: Building without Shear wall

7. Result and Discussions:

In this paper building having shear wall and without Shear wall are analaysis with help of ETABs Software. All the model are analysis in the seismic zone 4. By using the analysis result various graphs are plotted and compare with the different parameters. Following results are drwan in this paper . Storey Drift , Story Forces,Storey Stiffness.

7.1 Story Drift:

In this graph Shows the compression between the building having shear wall and without shear wall in Eathquake in X Direction . In the paper WSW stands for With shear wall and WOSW stands for without Shear wall .

Below the shows the variation of storey drift with storey no. in Earthquake in X &Y direction for the building having shear wall and without shear wall.

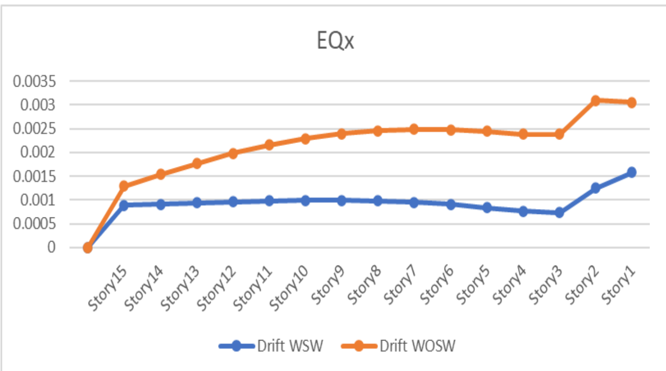

Fig-8: Storey Drift for EQ in X Direction

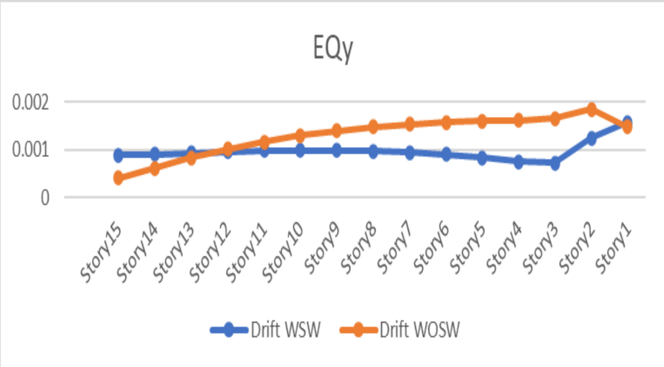

Fig-9: Storey Drift For EQ In Y Direction

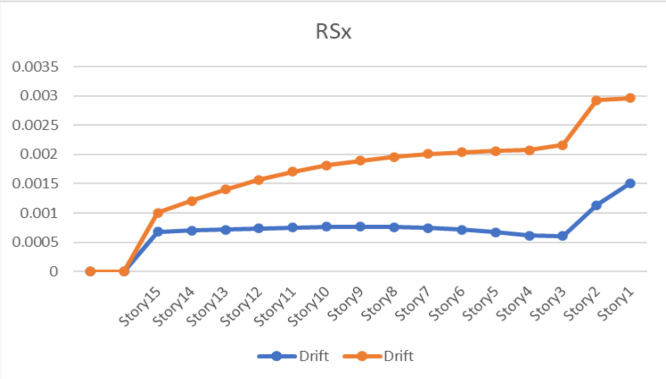

Fig-10: Response Spectrum In X Direction

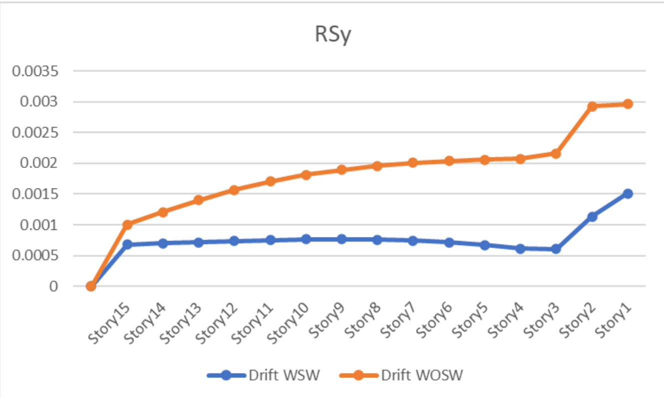

Fig-11: Response Spectrum In Y Direction

7.4 Stiffness:

The lateral force causing unit translational lateral deformation in that storey is estimated as the storey stiffness, with the bottom of the storey prevented from moving laterally, i.e., only translational motion of the bottom of the storey is constrained while it is free to rotate. AS shown in the graphs Storey Stiffness between the building having shear wall (WSW) and without shear wall (WOSW) in X and Y Direction. Graphs shows the variation between them.

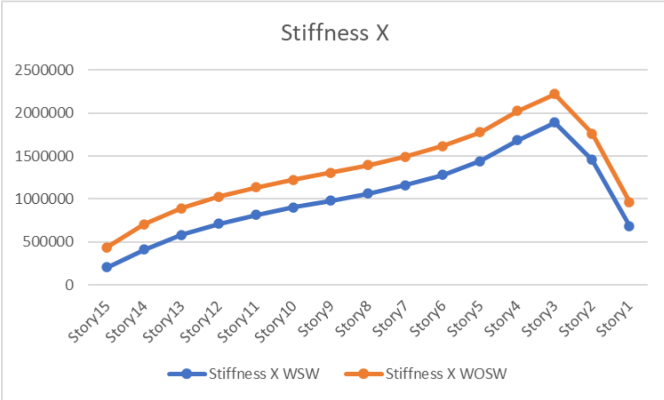

Fig-12: Storey Stiffness in X direction

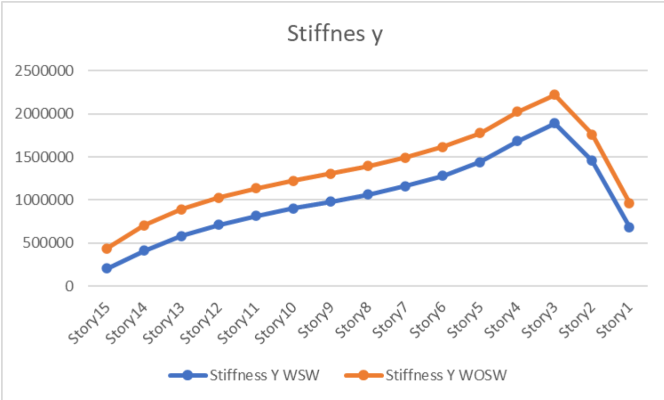

Fig-13: Storey Stiffness in Y Direction

7.5 Storey Shear:

As the graphs shows below that the storey Shear is maximum at the first storey and minimum at the top of the building in both building having having shear wall and without the shear wall which is permissible under IS code.

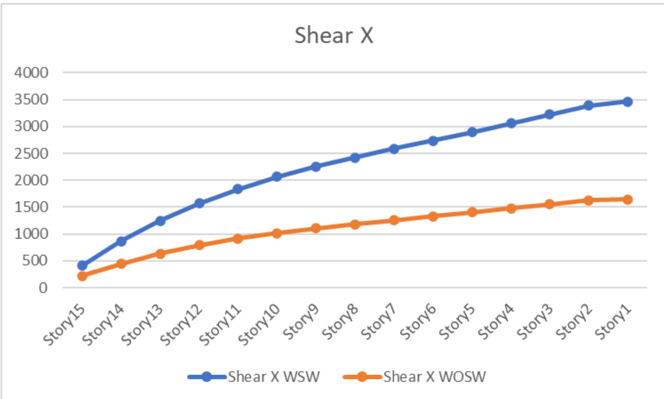

Fig-14: Storey Shear in X Direction

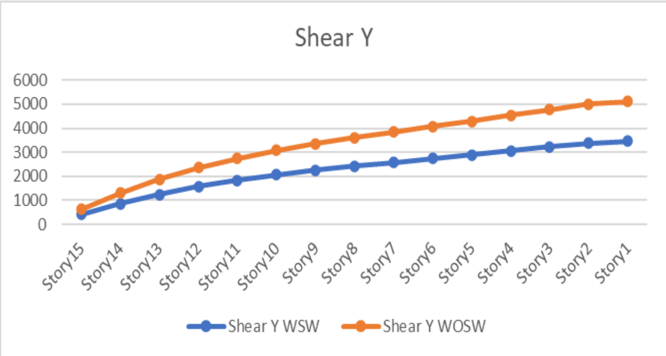

Fig-15: Storey Shear in Y Direction

8. Conclusion:

- ❖ Two different buildings are considered with shear wall and without shear wall shapes evaluated for study in ETABS, by the method of Response Spectrum namely I-shaped, shear wall are used in building.
- ❖ There has been a decrease in lateral displacement and storey drift for the two distinct types of buildings investigated, i.e. G+15. structures with shear walls vs. regular buildings Shear walls are not embedded in RC structures.
- ❖ The parameter storey stiffness has a significant impact on earthquake incidence, and it is shown to be greater for G+15 storey buildings with an I-shaped shear wall. In compared to structures without shear walls, shear wall performs better.
- ❖ Wind does not dominate the analysis in zone 4 and has no effect on the results, indicating that wind plays no role in the building analysis in zone 4.

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