**Current Trends in Technology and Science**

**www.ctts.in, ISSN: 2279-0535, March 2022, Volume: 11, Issue: 2**

# 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 multistorey residential building and 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 multistorey building with G + 15. The whole structure is analysed and modelled using the software ETABs 2016 in seismic zone 4 for a stable structure, and it is concluded that the structure with symmetrically positioned shear walls performs better in terms of all seismic parameters the constructions without shear walls.*

**Keywords** *Shear wall, Response Spectrum, Seismic Analysis, Storey Drift.*

## Introduction

An 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 and all manufactured items, living and non-living creatures. 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. Dynamic analysis should be carried out to determine the maximal reaction to a base excitation 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 provide the appropriate strength and stiffness. Compared to all other lateral force resisting methods, shear walls are the most effective, especially for tall buildings and lift situations.

## What exactly is the 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 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 incredibly significant in tall buildings because they are particularly vulnerable to lateral loads and seismic pressures.

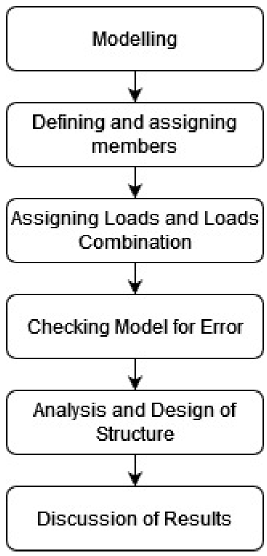



**Figure 1.** Methodology

## The objective of the study

1. To examine the behaviour of multistorey buildings with and without shear walls and the seismic zone 4 analysis results.
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 structure's stiffness and height in different seismic zones of India.

## 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 a shear wall and without a Shear wall. The G+15 high-rise building, with a length of 46.1 m, is used in this analysis. G+15 stories with a typical storey height of 3 m and a bottom height of 4.1 m. Fixed type of Support conditions of a specific type is taken into account.

**Table No. 1 Details and Dimensions of Multistorey Building Model**

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

**Table No.2 Load Calculation**

| Type of Load | Calculation |
|---|---|
| Wall Load | 6.8 kN/m |
| Live Load | 5 kN/m |
| Seismic Load | AS per IS 18932016 |


**Figure 2.** Plan of Building Without the Shear wall

**Modelling** The figures below show a floor plan and a three-dimensional building image. ETABS software is used to model and analyse the complete structure. All models are analysed for various load combinations for gravity and lateral loads (Seismic and Wind). Both the gravity and lateral loads are calculated following Indian standards.

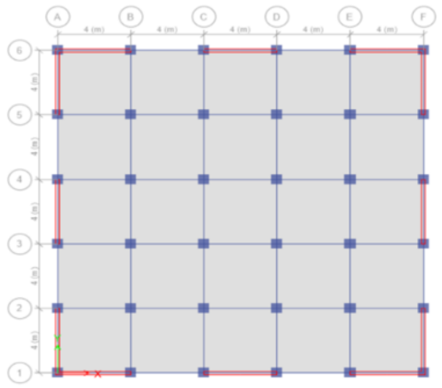



**Figure 3**. Plan of Building With Shear wall

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 defining all the properties, we have to assign the property step by step.

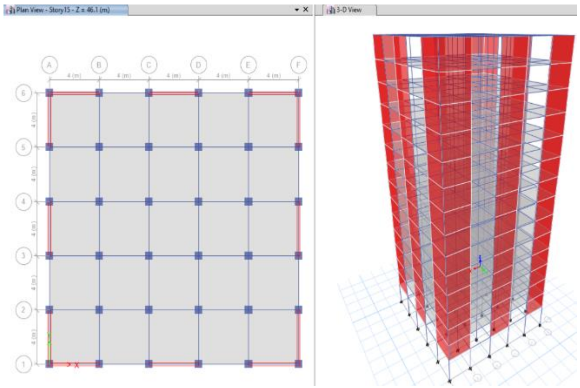


Figure 4. Floor Plan & 3D Building View

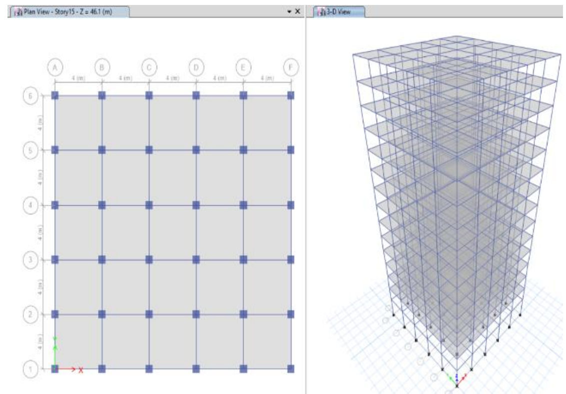


Figure 5. Floor Plan & 3D Building View

**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).

www.ctts.in, ISSN: 2279-0535, March 2022, Volume: 11, Issue: 2

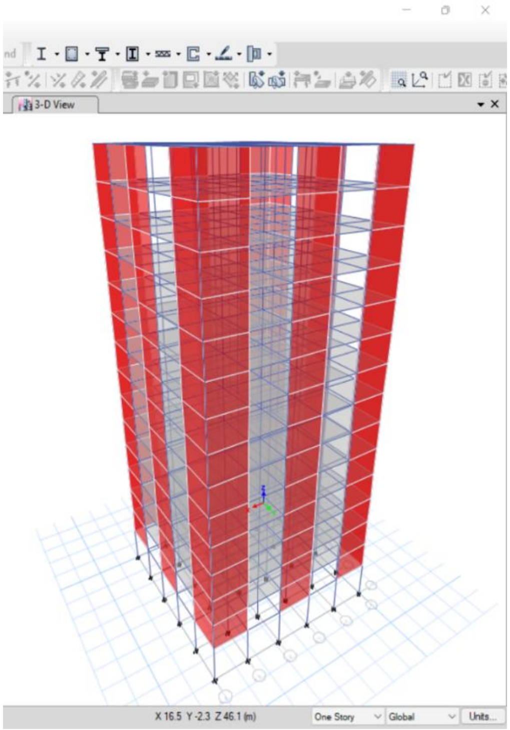



Figure 6. Building with Shear wall

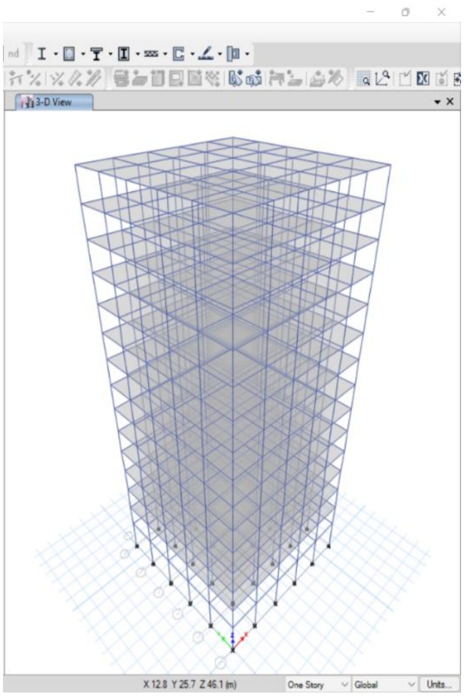
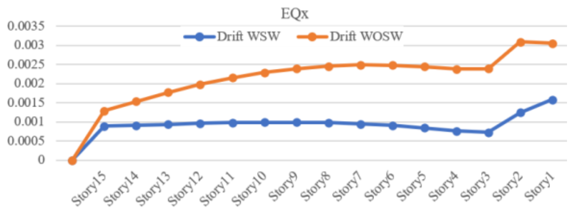


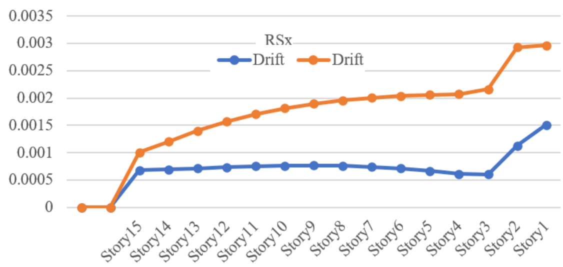

Figure7. Building without Shear wall

**Result and Discussions** In this paper, building with a shear wall and without a Shear wall is analysis with the help of ETABs Software. All the models are analysed in seismic zone 4. The analysis result for various graphs is plotted and compared with the different parameters. The following results are drawn in this paper. Storey Drift, Story Forces, Storey Stiffness.

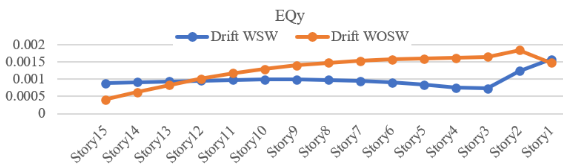
**Story Drift** This graph Shows the compression between the building having shear wall and without shear wall in an Earthquake in X Direction . In the paper, WSW stands for With shear wall, and WOSW stands for without Shear wall. Below the shows, the variation of storey drifts with the storey no. in Earthquake in X &Y direction for the building having shear wall and without the shear wall.



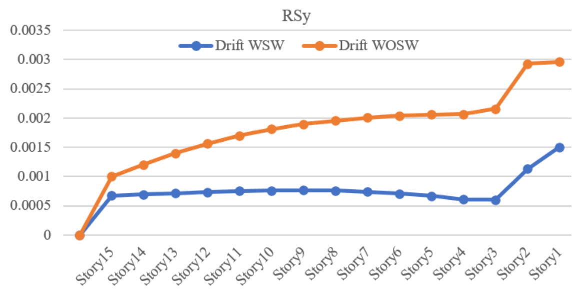

**Storey Drift for EQ in X Direction**




**Response Spectrum In X Direction**



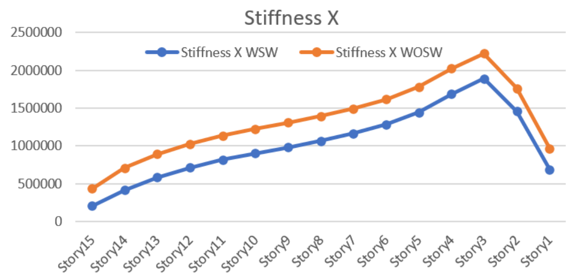

**Storey Drift For EQ In Y Direction**



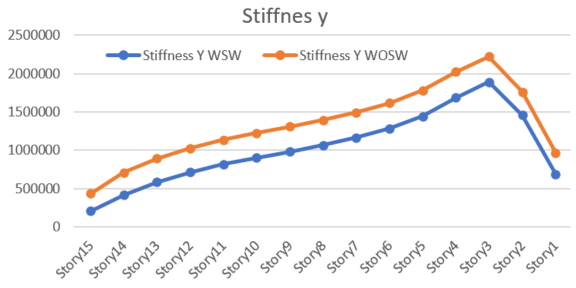

**Response Spectrum In Y Direction**

**Story Stiffness**

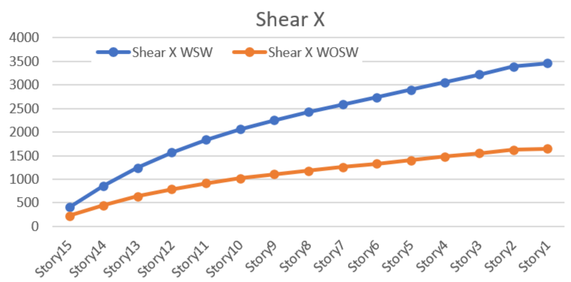
The lateral force causing unit translational lateral deformation in that storey is estimated as the storey stiffness, with the bottom of the storey prevented from moving laterally, i.e., only translational motion of the bottom of the storey is constrained while it is free to rotate. AS shown in the graphs,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



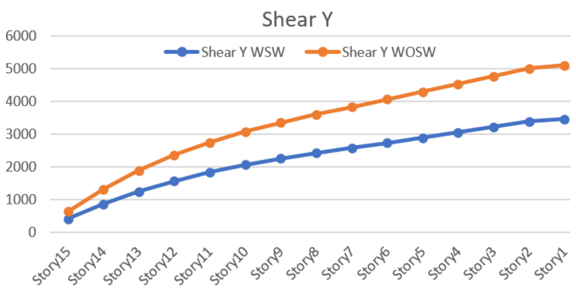

**Storey Stiffness in the X direction**




**Storey Stiffness in Y Direction**




**Storey Shear in X Direction**




**Storey Shear in Y Direction**

**Storey shear**

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

**Conclusion**

Two different buildings are considered with shear walls and without shear wall shapes evaluated for study in ETABS; using Response Spectrum, namely I-shaped, a shear wall is used in the 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 significantly impacts earthquake incidence, and it is shown to be more significant for G+15 storey buildings with an I-shaped shear wall. In comparison to structures without shear walls, shear wall performs better. Wind does not dominate the analysis in zone 4 and does not affect the results, indicating that wind plays no role in the building analysis in zone 4.

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