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Seismic Analysis of Multistoried Symmetrical Building Based on Shear Wall Positions

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***Abstract*: The behaviour of a structure when subjected to some action can be obtained by structural analysis. The dynamic loads mainly consists of wind, waves, traffic, earthquakes, and blast loads. Any structure can be subjected to dynamic loading. Structural symmetry can be a major reason for buildings poor performance under severe seismic loading. Asymmetry contributes significantly to increased lateral deflections, increased member forces and ultimately the buildings collapse. This project is concerned with the study of seismic analysis in an irregular symmetrical building. Multi-storied buildings are behaved differently depending upon the various parameters like mass-stiffness distribution, foundation types and soil conditions. For this study, the parameters involved for analysis is storey displacement, base shear and storey drift. Here, the main aim is to make an analysis based on the different positions of the shear wall.**

Keywords: Structural symmetry, seismic analysis, storey displacement, base shear, storey drift

1. INTRODUCTION

A building should consists of four main parameters, mainly simple and regular configuration, sufficient lateral strength, stiffness and ductility. Buildings having simple regular geometry suffer much less damage than the irregular configuration. Structural analysis is mainly concerned with finding out the behaviour of a structure when subjected to some action. Structural symmetry can be a major reason for buildings poor performance under severe seismic loading. Asymmetry leads to increased lateral deflections, increased member forces and ultimately the buildings collapse. Failure of structures starts at the points of weakness during an earthquake. This weakness mainly occurs due to discontinuity in mass, stiffness and geometry of structure. These discontinuities makes the structures an Irregular structure. During earthquakes, vertical irregularities are one of the major reasons of structural failures. During sudden collapse, structures with soft storey are the most prominent structures to get destructed. So, the effect of vertical irregularities in the seismic performance of structures becomes really important. This project is concerned with the study of seismic analysis and design of multi storey symmetric building. Etabs software is used here. In the present study, the Response Spectrum Analysis (RSA) of irregular RC building is carried out with shear walls provided at different positions of the building.

- To perform seismic analysis on a multistoreyed symmetrical building with regular shear walls and stiffness irregularity
- To develop different building models with shear walls provided at 3 different positions
- To analyse the building by Response Spectrum Method
- To identify the best position of shear wall in building by comparing the results.

2. METHODOLOGY

Methodology employed is Response Spectrum method using ETABS software.

2.1. Modelling of Buildings

Here, the study is carried out for the behaviour of G+15 RC buildings. Floor height provided is 3m and also properties are defined for the building structure.. Building is modelled for Indian seismic zone V from IS 1893-2002.

2.2. Building Plan And Dimensions

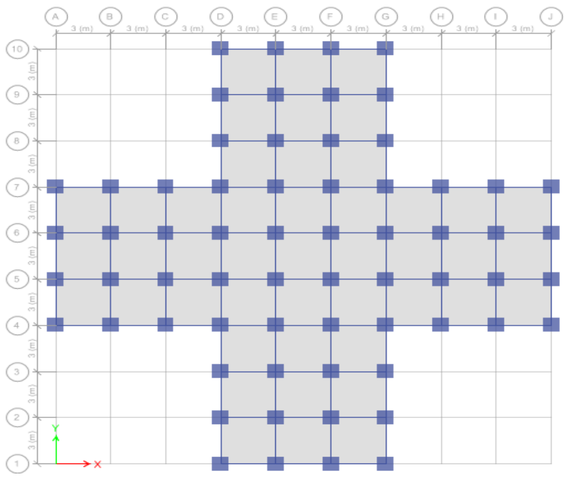

Fig.1. Plan of building

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Table 1. Building details

Type of building	Commercial building
Size of beam	300mm× 500mm
Size of column	900mm × 900mm
Height of each storey	3m
Slab thickness	150mm
Wall thickness	230mm
Soil	Medium
Zone	V

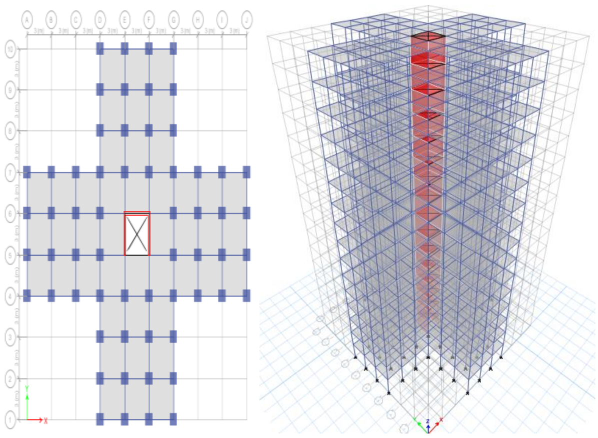

Fig.2 Plan and 3D view of building with shear wall provided at the core (full height of the building)

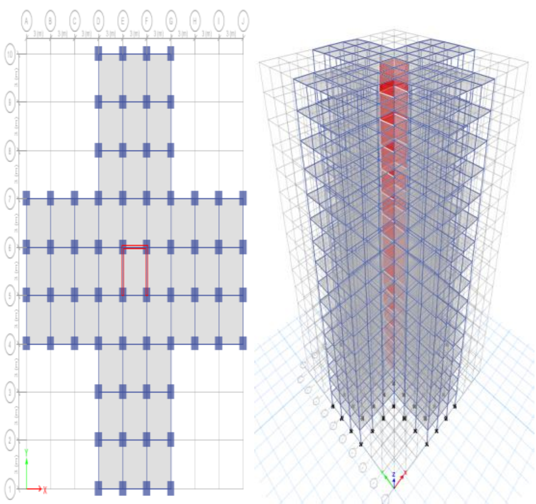

Fig.3 Plan and 3D view of building with shear wall provided at the core (soft storey)

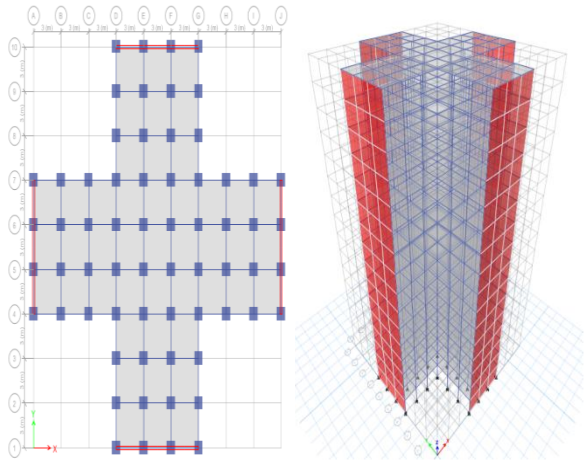

Fig.4 Plan and 3D view of building with shear wall provided at sides (full height of the building)

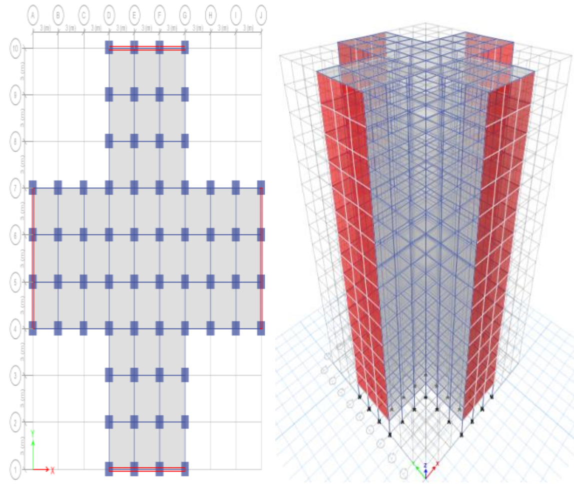

Fig.5 Plan and 3D view of building with shear wall provided at sides (soft storey)

3. COMPARISON OF RESULTS

Table 2.Storey drift values for different positions of shear wall

	Core(full height)	Core(soft storey)	Sides(full height)	Sides(soft storey)
Max. storey drift	0.000857	0.000588	0.000319	0.00041

The percentage reduction of storey drift for shear wall provided at sides(full height of the building) is 62.77% compared to shear wall provided at core position(full height of the building), 45.74% compared to shear wall provided at core(soft storey) and 22.19% compared to shear wall provided at sides (soft storey).

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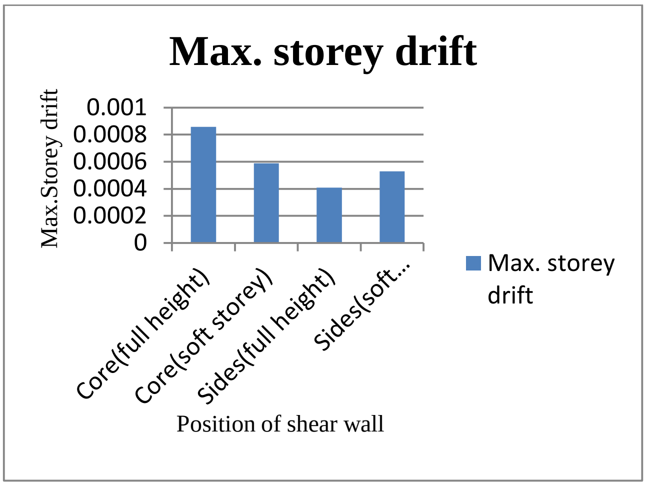

Fig.5 Variation of storey drift for building with different positions of shear wall

Table 3.Storey shear values for different positions of shear wall

	Core(full ht)	Core(soft storey)	Sides(full ht)	Sides(soft storey)
Max. storey shear (kN)	4165.171	3485.604	5699.043	5709.352

The percentage reduction of storey drift for shear wall provided at core (soft storey) is 16.31% compared to shear wall provided at core position(full height of the building), 38.83% compared to shear wall provided at sides (full height of the building) and 38.94% compared to shear wall provided at sides (soft storey).

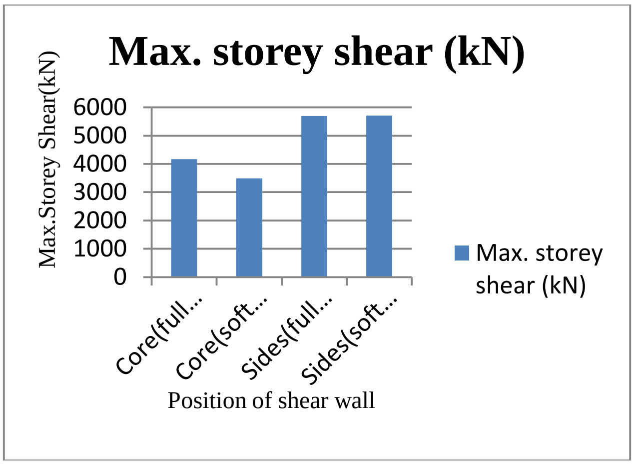

Fig.6 Variation of storey shear for building with different positions of shear wall

Table 4 : Storey displacement values for different positions of shear wall

	Core(full ht)	Core(soft storey)	Sides(full ht)	Sides (soft storey)
Storey displace ment	50.31	24.54	36.90	40.68

The percentage reduction of storey drift for shear wall provided at core (soft storey) is 51.23% compared to shear wall provided at core position(full height of the building), 33.49% compared to shear wall provided at sides (full height of the building) and 39.67% compared to shear wall provided at sides (soft storey).

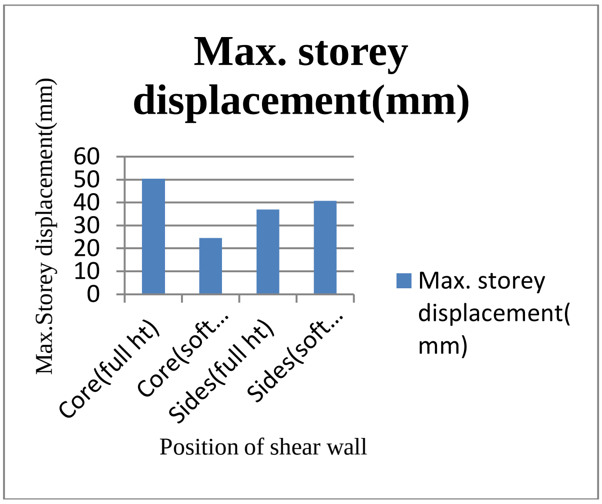

Fig.7 Variation of storey displacement for building with different positions of shear wall

RESULTS AND DISCUSSIONS

Maximum Storey Shear and Maximum Storey Displacement are lowest when the shear wall is placed in the core position having soft storey and greater when the shear wall is placed at the core (full height of the building), sides (full height of the building) and sides (soft storey). Maximum storey drift is lower when the shear wall is placed at the sides (full height of the building) when compared to shear walls placed at the core (full building height, soft storey) and also at sides (soft storey). The shear walls provided at core (soft storey) will give the best results to overcome the destruction occuring during an earthquake.

4. CONCLUSIONS

In the present study, an attempt is made to study the dynamic behavior of building with shear walls provided at 4 different positions, i.e., at core(full height of the building), core (soft storey) , sides(full height of the building) and sides (soft storey). The parameters obtained from the analysis includes storey drift, storey shear and storey displacement. The best position of shear wall is obtained from the analysis. The best results obtained during analysis overcomes the destruction occuring during an earthquake. A comparative table of these results for the analysis has also been presented. The main conclusions obtained from the study are given below:

- Maximum storey shear and maximum storey displacement is lowest when the shear wall is placed in the core position(soft storey) and greater when the shear wall is placed at the sides (soft storey as well as full height of the building) and also the core(full height of the building).
- Maximum storey drift is lowest when the shear wall is placed at the sides(full height of the building) when compared to shear walls placed at the core(full height of the building, soft storey) and sides(soft storey).
- Shear walls provided at core (soft storey) will give the best results to overcome the destruction occuring during an earthquake

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