Wind Analysis of 20 Storey RC Structure with and without Shear Wall

Mr. Vivek Bandgar[1], Prof. M. V. Nagendra[2]
[1]*P.G. student, Padmabhooshan Vasantraodada Patil Institute of Technology*
[2]*Associate Professor, Padmabhooshan Vasantraodada Patil Institute of Technology*

Abstract **In common, for the design of high-rise buildings, both wind as well as seismic loads needs to be measured. prevailing criteria for carrying out analysis for seismic loads and wind loads are different. As per IS 875(Part 3):1987, when wind interacts with a structure, both positive and negative pressure occur concurrently, the structure must have adequate strength to defy the applied loads. Load exerted on the structure is transferred to the structural system then passing through the foundation and finally transferred to the earth. The wind pressure is essentially a function of exposed basic wind speed, topography, building height, exposed area, and shape of the building. Here we have concentrated on wind loads. It radically changes the behavior of high-rise structure as the height and wind speed increases. Usually shear wall is used in the high-rise building. To carry out the modeling and analysis for 20 storey building with and without shear wall E-TABS software is used. Comparison of the 20 storey structure with and without shear wall is then undertaken**

Index Terms **- High-rise RC structure, wind analysis.**

I.INTRODUCTION

For high rise buildings, the structural design depends on the wind load as its dynamic in nature. As the effect of wind load on high rise structures is dispersed over the wider surface and the amount of the load is also high. The main aim of this project is to analysis and design the multi-storey building in 3 dimensional frames considering the predominant effect of wind load. The design methods used in ETABS analysis are Limit State (1) Design conforming to Indian Standard Code of Practice. High-rise structures are complicated to analyze and it takes lots of time for cumbersome calculations using conventional manual methods. ETABS is easy to use software and provides us a fast, efficient, and accurate result for analyzing and designing structures. The main objectives of this study are to analyze the effect of different wind velocities and the effect of wind on different height of the multi storied building.

II. OBJECTVE

1. To study the effect of wind load on high-rise structure without provision of shear wall.
2. To study the effect of wind load on high-rise structure with provision of shear wall.

III. PROBLEM DEFINATION AND ANALYSIS

1. The modelling of structure is done using finite element-based software E-TAB.
2. The plan of the building selected for the modelling is 36 m in X- direction and 30 m in Y-direction.
3. Selected building is 20 storeys building with typical height of 3m each.
4. The size of each span is 6 m x 5 m.

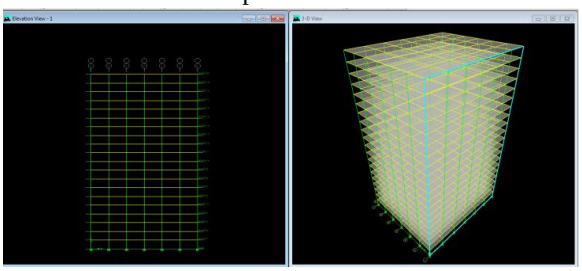

Fig 1: 3D view of 20 storey structure without shear wall

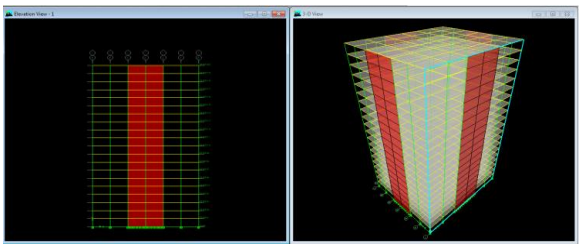

Fig 2: 3D view of 20 storey structure with shear wall

IV. METHOD OF WIND LOAD ANALYSIS

The two structures analyzed in this work are assumed to be located in Darbanga region with load intensity 55.

Design Wind Speed (Vz)

Vz = Vb x k1 x k2 x k3

Where;

Vz = Design Wind Speed at Any Height 'Z' In M/S.

Vb = Basic Wind Speed (clause 5.2, appendix a)

k1 = Probability Factor (Risk Coefficient, clause 5.3.1)

k2 = Terrain, Height and Structure Size factor (clause 5.3.2) and

k3 = Topography Factor (clause 5.3.3) (* clause taken from IS: 875 (part 3)-1987)

III. Design Wind Pressure (Þz):

$Þz = 0.6(Vz)^2$

where,

Þz =design wind pressure in N/m² at height _Z'and Vz = design wind velocity in m/s at height _Z'. (clause 5.4, Pg. No -12, IS: 875 (part 3)-1987)

V. RESULTS

Results of 20 storey structure without shear wall:

Maximum Displacement:

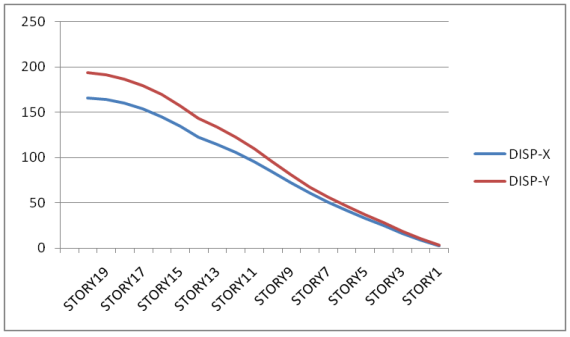

Fig.3: Maximum Displacement of structure

Storey drift

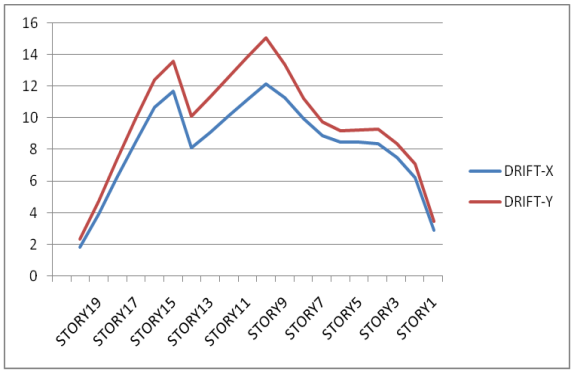

Fig.4: Maximum Drift of structure

Results of 20 storey structure with shear wall:

Maximum Displacement:

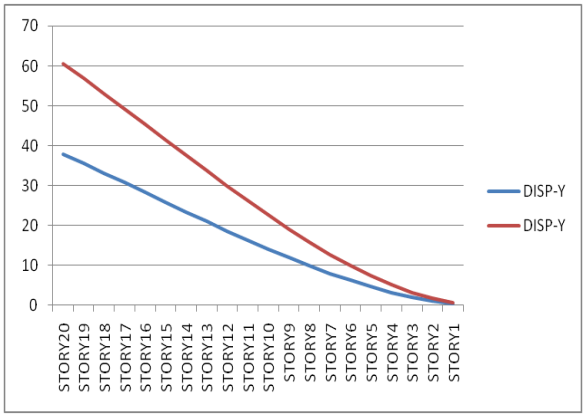

Fig.5: Maximum Displacement of structure

Storey drift

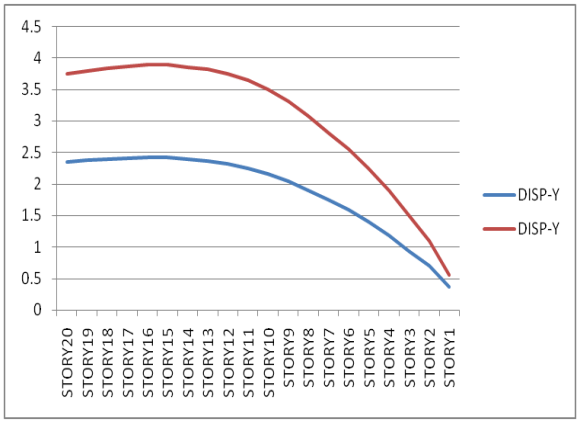

Fig.6: Maximum Drift of structure

Comparative graphical representation of 20 storey structure with and without shear wall:

Maximum Displacement:

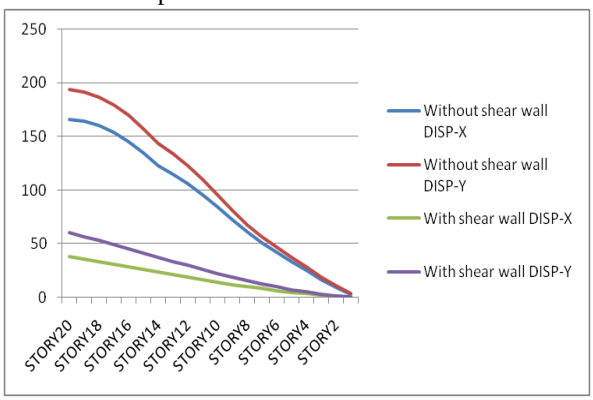

Fig.7: Comparative Maximum Displacement of structure with and without shear wall

Storey drift

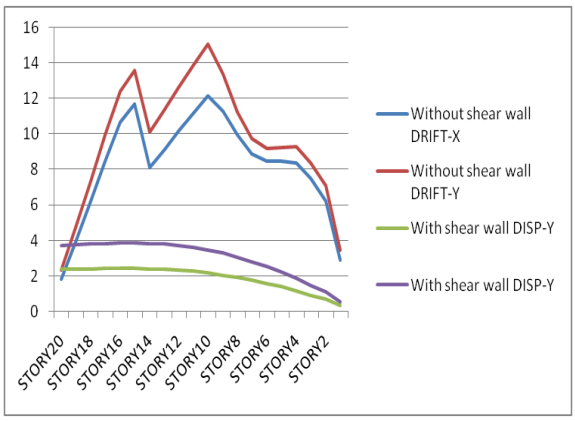

Fig.8: Comparative Maximum Drift of structure with and without shear wall

VII. CONCLUSION

The results obtained for 20 story structure with and without shear wall after subjected to wind analysis can be concluded as following:

1. A 20-storey structure without provision of shear wall undergoes maximum displacement as high as up to 200mm whereas the same structure after equipped with shear wall undergoes displacement not more than 60mm which is much lesser.
2. The storey drifts values of 20storey structure without provision of shear wall tend to exceed maximum permissible limit whereas the drift values of 20 storey structure with shear wall remain well within the permissible limit.

REFERENCES

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