A comparative wind analysis of Structure located in different terrain category

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Abstract **- The high rise RCC structures are more massive and less flexible in nature as compare to combined structures. This study investigates the comparison between RCC structure under the effect of wind, in different terrain categories and with variation in height. In addition, the comparison of different plan configuration shows that the response of parameter such as storey displacement, story stiffness, base reaction under effect of wind. The purpose of this analysis is to obtain the response of high-rise structure subjected to wind intensities.**

Index Terms **-RC structure, wind analysis**

I.INTRODUCTION

Any high-rise building can vibrate in both the directions of "along wind" and "across wind" induced by the flow of wind. Present-day high-rise buildings designed to guarantee lateral drift requirements, still may oscillate significantly during windstorm. These oscillations can origin some pressure to the high-rise building as buildings with more and more height becomes more susceptible to oscillate at high speed winds. Sometimes these oscillations may even cause soreness to the occupants even if it is not in a threatening position for the structural damage. So a precise estimation of building motion is an essential requirement for serviceability. There are few approaches to find out the Response of the high-rise buildings to the Wind loads. The work proposed here intends to determine the performance of high-rise RC structure which is subjected to wind loads. The proposed work also aims at formative the effect of wind load in different terrain categories.

II. OBJECTVE

1. To obtain response of building when subjected to wind forces.
2. To obtain response of low, medium height and tall structure subjected to wind loads.
3. To obtain response of building subjected to wind forces in different terrain category.

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 10 and 15 storeys building with typical height of 3m each.
4. The size of each span is 6 m x 5 m.

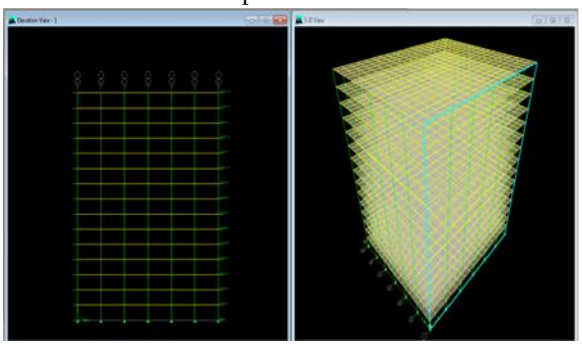

Fig 1: Elevation and 3D view of 15 storey structure

IV. METHOD OF WIND LOAD ANALYSIS

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 10 storey structure:

Maximum Displacement:

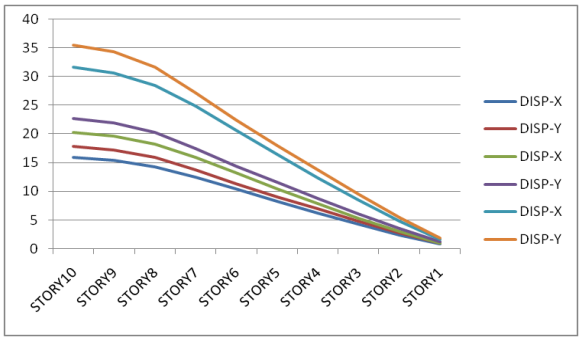

Fig.2: Maximum Displacement of structure

Storey drift of the 10-storey structure

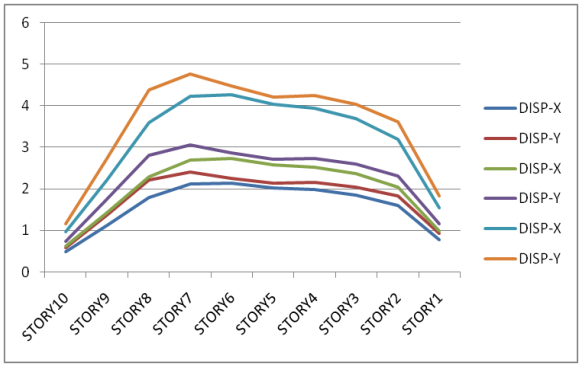

Fig.3: Maximum Drift of structure

Base Reaction

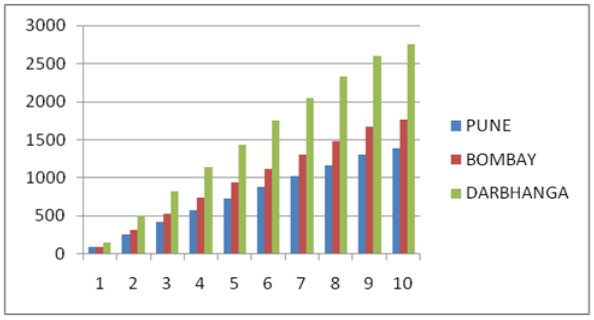

Fig.4: Base Reaction of structure

Results of 15 storey structure:

Maximum Displacement:

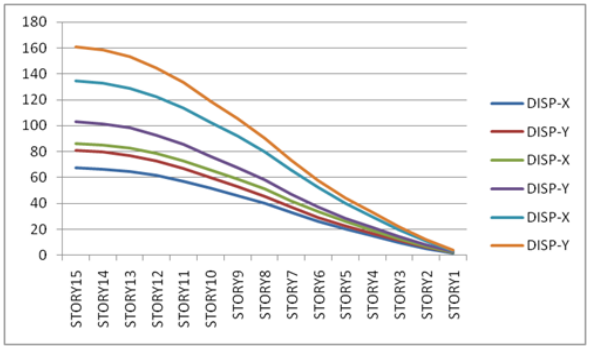

Fig.5: Maximum Displacement of structure

Storey drift of the 15-storey structure

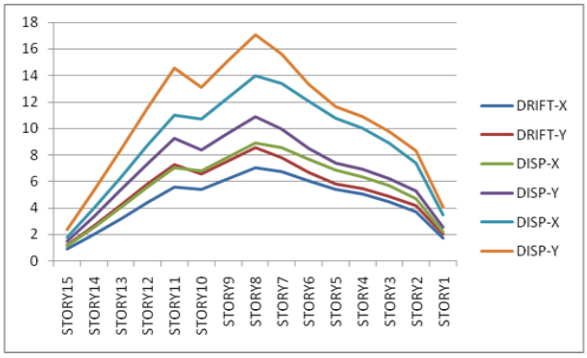

Fig.6: Maximum Drift of structure

Base Reaction

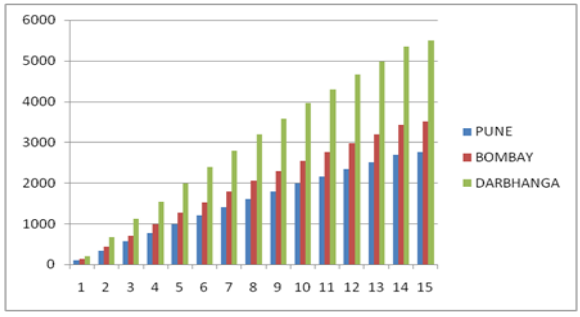

Fig.7: Base Reaction of structure

VII. CONCLUSION

The results obtained for 10 and 15 story structure after subjected to wind analysis can be concluded as following:

1. 1 A 10 storey RC structure subjected to wind loading performs well in all the three terrain categories.
2. A 15 storey RC structure subjected to wind loading performs well in Pune and Mumbai

region. However, the drift values obtained for Darbanga region tend to exceed permissible limit.

3. A 15-storey structure located in terrain category with high wind speed like Darbanga needs to be equipped with lateral load resisting element like shear wall.

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