



EFFECT OF WIND LOAD ON TALL STRUCTURE IN DIFFERENT TERRAIN AND ASPECT RATIO

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ABSTRACT

Wind and Tall Structure are same side of a coin. More the structure is tall more will be wind load acting over it, This paper deals with effect of wind load over a structure in different terrain category along with different aspect ratio in terms of displacement. As wind load is most susceptible and dominant load on tall structure. As we know wind blows with high speed in flat terrain and slow in rough terrain as flat terrain don't have obstruction to stop or to retain the flow of wind however rough terrain provides such kind of obstruction resulting into lesser speed of wind. More over wind terrain category are also explained in this paper as per IS Code 875 part-3. The Models were made and analyzed in ETABS-2015 package. G+10, G+15, G+20 models were taken for study and aspect ratio 0.5, 1.0, 1.5, 2.0 are considered. The plots are been drawn for every displacement in terrain category and for every aspect ratio. This paper gives displacement of every storey in different terrain category along with different aspect ratio. This paper gives good package of information about variation of displacement in different terrain and aspect ratio.

KEYWORDS : Wind Pressure, TC-1, TC-2, TC-3, TC-4, Displacement, Aspect Ratio.

I. INTRODUCTION

As India is rapidly developing nation horizontal space in the country has been constraint day by day. Due to this horizontal space constraint, need of utilizing vertical space has been given due importance. Vertical space utilization directly indicates construction of tall structure. Tall structures can be constructed in four different wind category i.e. terrain category 1, terrain category 2, terrain category 3 and terrain category 4. Terrain Category can be explained according to IS Code as follows:

Category 1: Exposed open terrain with few or no obstructions and in which the average height of any object surrounding the structure is less than 1.5m.



Fig.1 Terrain Category-1

Category 2: Open terrain with well scattered obstruction having heights generally between 1.5 to 10m



Fig.2 Terrain Category-2

Category 3: Terrain with numerous closely spaced obstruction having the size of building structure up to 10m in height with or without a few isolated tall structures.



Fig.3 Terrain Category-3

Category 4: Terrain with numerous large high closely spaced obstructions.



Fig.4 Terrain Category-4

II. OBJECTIVES

1. To compare effect of wind load in different terrain category.
2. To evaluate displacement caused in different storey due to wind load.
3. To examine effect of change of aspect ratio of building with respect to different terrain category.
4. To suggest an optimum aspect ratio for achieving minimum displacement.

III. LITERATURE REVIEW

1. Mohammed Asim Ahmed, Moid Amir, Savita Komur, Vijainath Halhalli. "EFFECT OF WIND LOAD ON TALL BUILDINGS IN DIFFERENT TERRAIN CATEGORY"

This paper deals with the displacement occurred in G+10, G+20 and G+30 structure due to wind load in different terrain category. Models are made and analyzed in ETABS 2015 package. The percentage displacement of each storey is carried out and plots are also drawn. In this paper comparison of displacement of every storey in every single terrain category is done. Some conclusion are also drawn out as with increase in height displacement of top storey also increases, In terrain category 1 displacement are more than compare to other three terrain category.

2. K. Vishnu Haritha, I. Yamini Srivalli. "Effect of Wind on Tall Building Frames - Influence of Aspect Ratio".

This paper deals with the aspect ratio and the displacement of G+10, G+15 and G+20 storey Buildings. The aspect ratio consider for the analysis are 1, 2, 3. The analysis for this study was carried out in STAAD Pro. Plots are drawn for aspect ratio and displacement. Paper also states that wind effect is more predominant on tall structure depending on location and height of structure. Some conclusion drawn from this paper are displacement of G+20 is more than G+10 and G+15 for every aspect ratio. Displacement decreases with increase in aspect ratio.

3. Gitadevi B. Bhaskar, Homeshwari V.Gedam. "Effect of Wind Load on High Rise Buildings Considering Aspect Ratio – A Review"

This paper gives the review of different paper with shows aspect ratio and displacements occurred due to them. This also conclude that performance is based on wind load which effecting the high rise building. The literature studies the various building on different height with respected their aspect ratio. The aspect ratio is an important factor for high rise building at various zone. Thus codes plays very vital role in design and analysis.

4 . Chandradhara G. P, Vikram.M.B. "Effect of wind load on the aspect ratio of the building".

In this paper aspect ratio 0.25, 0.5, 1.0, 1.5 and 2 are consider. Wind speed consider is 50m/s, and terrain category 2. They also assumed 4 different load case as per IS 875 part 5:1987 which are LC-1: 1.5 (DL+LL), LC-2: 1.2 (DL+LL+WL), LC-3: 1.5 (DL+WL) and LC-4: (0.9DL+1.5WL). Using the above load condition they plotted graphs for variation of axial load and moment over the column. Conclusion made are as aspect ratio increases moment in the column decreases for wind load and moment remain same for gravity loads. Axial force in the column are almost same for all load case when the height of building is less than 15 mtrs.

IV. CONCLUSION

Wind is highly predominant load acting on tall structures which causes certain amount of displacement in every storey, this displacement of a storey are found after the analysis of the structure which are useful in accordance with tall structure. This displacements varies with aspect ratio of a building as well as with change in a terrain category. The plots for the displacements as per terrain category for every single storey call be plotted. When different paper were reviewed no paper could combinedly say about aspect ratio and terrain category which I found to be important. Thus effect of wind load can be studies with different aspect ratio along with different terrain category so that variation in displacement could be found out.

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2. been carried out on these five locations. In order to study the speeds at these locations, spot speed study has
3. been conducted. Based on the detailed analysis, the improvement measures have been recommended. The
4. identified Black spots are Hanumanthwaka, Yendada junction, Cricket stadium junction, Carshed junction, and
5. Madhurwada junction. The important factors considered for analysis include: Daily variation of accidents,
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REFERENCES

- [1.] Mohammed Asim Ahmed, Moid Amir, Savita Komur, Vajjainath Halhalli: "EFFECT OF WIND LOAD ON TALL BUILDINGS IN DIFFERENT TERRAIN CATEGORY". IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
- [2.] K. Vishnu Haritha, I. Yamini Srivalli. "Effect of Wind on Tall Building Frames - Influence of Aspect Ratio". International Journal of Research in Civil Engineering, Architecture & Design Volume 1, Issue 1, July-September, 2013, pp. 01-06, © IASTER 2013 www.iaster.com, ISSN Online: 2347-2855, Print: 2347-8284.
- [3.] Gitadevi B. Bhaskar, Homeshwari V.Gedam. "Effect of Wind Load on High Rise Buildings Considering Aspect Ratio – A Review". International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 5 Issue XI November 2017- Available at www.ijraset.com
- [4.] Chandradhara G. P, Vikram.M.B. "Effect of wind load on the aspect ratio of the building". IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 45-49 www.iosrjournals.org