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WIND ANALYSIS OF HIGH RISE STRUCTURAL FRAME

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Abstract - The value of high-rise buildings has been re-evaluated due to the fast development of urban populations across the world. The impact of wind loads on the structure has been identified as one of the main factors that can affect the design of such buildings. The study aims to analyse the effects of wind load on a building structure with aspect ratio. i.e. H/W ratio, where H is the total height of the building frame and W is the width of building frame is carried out in STAAD PRO and loadings is applied according to IS875(Part3):2015.The analysis of multi storied building for class B zone for wind forces in terrain category TC-3 is carried out. 3-D model is prepared for G+25 multi storied building in STAAD PRO.

***Key Words*:** High Rise Building, Story Drift, Story Displacement, Bending moment.

1.INTRODUCTION

Wind load has always found a prominent mention with reference to Civil Engineering Structures' design having a very prudent impact on High Rise Structures due to its dynamic nature. Wind load has always found a prominent mention with reference to Civil Engineering Structures' design having a very prudent impact on High Rise Structures due to its dynamic nature. As the effect of wind load on tall structures is distributed over the wider surface with the intensity of load also being high. The main objective of this project is to analyse and design a multi-storeyed building(G+25) in 3 dimensional frame taking into consideration, the predominant effect of impeding wind load. The design methods used in STAAD-Pro analysis are Limit state design conforming to Indian Code of practice. High –rise structure are complicated to analyse and consume a lot of time for generic, but vast calculation using conventional manual method, making STAAD Pro an easy to use alternative which provides us a fast and accurate results for analysing and designing structure. The main objective of this study are to analyse the effect of different wind velocities and the effect of wind on different height of the multi storied buildings.

2. Body of Paper

LITERATURE REVIEW

Ashish Padiyar, Vipin Verma,"(2020) Effect of Wind Load on High Building with Different Aspect Ratio Using Staad Pro"; International Research Journal of Engineering and Technology (IRJET) : In order to estimate the design loads of a G+11 structure, he conducted a comparative examination of wind loads. The goal of this study is to figure out the design loads for a structure with a variety of aspect ratios that is subjected to wind loads in a given location. In this study, the wind loads of a multi-story structure are investigated using the IS 875 code. In this analysis, various loads such as wind load and static load are applied to the G+11 storey building.

Madhurima Dutta," (2017)WIND ANALYSIS AND DESIGN OF A MULTI STORIED STRUCTURAL FRAME CONSIDERING USING STAAD PRO", International Journal of Advances in Mechanical and Civil Engineering, ISSN: 2394-2827, Volume-4, : Create programme STAAD pro v8i is used to design and analyse a tall G+28 storey structure. The amalgamation of Static and wind loads are both considered. In A towering G+28 storey structure is designed in this research. STAAD pro, a design programme, was used to analyse the data. The static and wind loads are combined in v8i. taken into consideration As a result of the influence of wind stress on the framework, and the story-by-story variance of the outcome In terms of different parameters, they are compared.

Vikrant Trivedi, Sumit Pahwa," (2018) Wind Analysis and Design of G+11 Storied Building Using STAAD-Pro"; International Research Journal of Engineering and Technology (IRJET): He conducted a comparative assessment of wind loads in order to determine the design loads of a G+11 structure. The purpose of this investigation is to determine the design loads for a structure that is subjected to wind loads in a specific area. A multi-story structure is examined for wind loads using the IS 875 code in this study. The G+11 storey building is studied in this analysis, and various loads such as wind load and static load are applied.

B Dhana Babu, K Sasidhar, (2020) "Wind Analysis and Design of Highrise Residential Building by Using STAAD.Pro International Journal for Modern Trends in Science and Technology They discuss how high-rise constructions require more time to calculate due to the time-consuming and labor-intensive computations required by traditional manual techniques. They also employed STAAD-Pro software, which is a rapid, efficient, user-friendly, and accurate platform for assessing and constructing buildings. The main goal of this project is to use STAAD Pro software to analyse and design a multi-story structure using a G+11 (3-dimensional frame). The design entails using STAAD Pro to analyse the whole structure. Limit State Design, as defined by the Indian Standard Code of Practice, is employed in the STAAD-Pro analysis. STAAD-PRO, they conclude, is a highly powerful tool that can save a lot of time and is extremely precise in design.

K. Vishnu Haritha, Dr.I. Yamini Srivallie (2015)"Effect of Wind on Tall Building Frames - Influence of Aspect Ratio"; International Journal of Research in Civil Engineering, Architecture & Design): According to them, depending on the structure's location and height, wind has a greater impact on tall structures. They also highlighted how the equivalent static approach is used to analyse wind loads on structures with various aspect ratios in their article. By adjusting the number of bays, the aspect ratio may be changed. For this study, the aspect ratios 1, 2, and 3 were taken into account. STAAD PRO is used to carry out the analysis.

Building Specification

Static linear study of a G+25 storey building under wind load with aspect ratios (H/B ratio). The building has a total height of 78 metres and only a width of 25 metres. The parameter is changing. There are 5 bays on the x-axis and 5 bays on the y-axis. Along the z-axis, there are bays. The wind speed is set at 47m/s.

Table-1: Building Specification

Number of Stories	G+25
Utility of Building	Residential Building
Type of construction	R.C.C. Framed Structure
Story Height	3m
Wind zone	IV
Shape of Building	Rectangle
Location	Delhi
Beam Size	450mm*300mm
Column Size	750mm*800mm

Plan and Elevation of Building:-

The structure has G+25 stories with a total height of 78 metres, with each level being 3 meter.

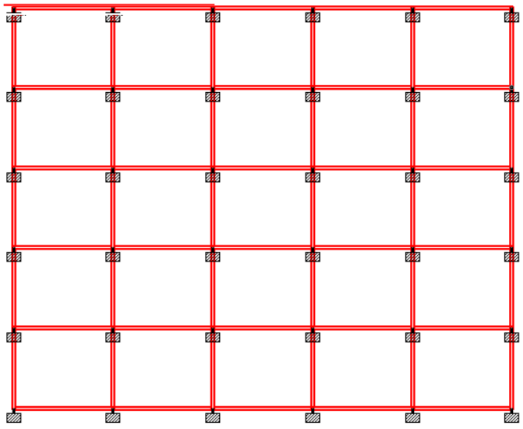

Fig 1 Top view of structure

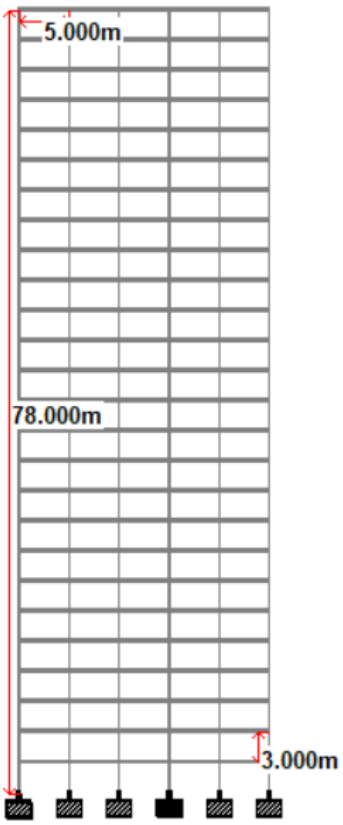

Fig2 Elevation of structure

METHODOLOGY

Step 1- To build the plan, we use the coordinate system to first give the nodes and then link them with the command "ADD BEAM."

Step 2- Select all nodes, then use translation repeat with a step spacing of -3m, a global orientation of Y, and a number of steps of 1.

Step 3- By choosing all plan beams and repeating the process with a step spacing of 3m, a global direction of Y, and a number of steps of 1

Step 4- Assigning the structure with supports**.**

Step 5- Assigning attributes to the structure, such as specifying the beam and column dimensions.

Step 6- Wind Load Definitions: We input the intensity information, i.e., wind intensities with regard to height, in Wind Load Definitions.

Step 7- Load case details-

- Dead Load (DL)
- Live Load (LL)• Wind Load (WL-X and WL-Z)

Step 8- Loads are assigned to the structure.

Step 9- Analysis

Step 10- Design is carried out in accordance with IS 456:2000

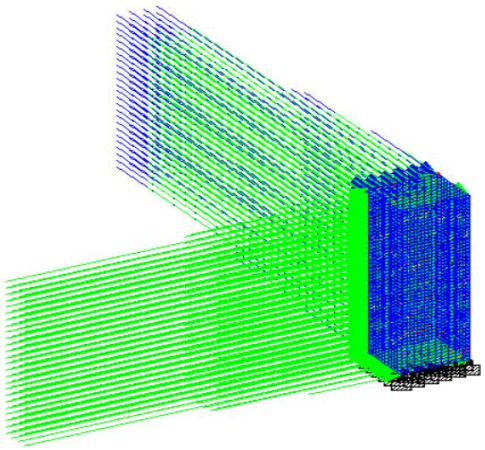

Fig3 Wind load on structure

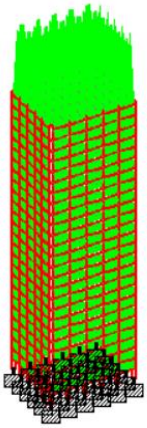

Fig4 Self weight of structure

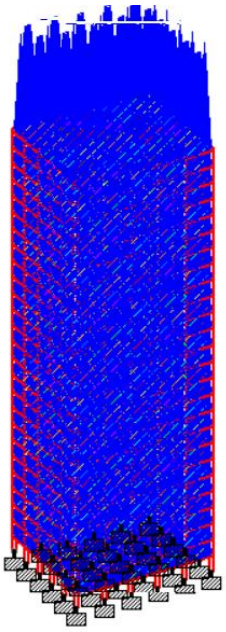

Fig5 Different load cobination on structure

Fig6 3D rendering of structure

RESULTS

The results of the analysis were tabulated, including lateral displacements, storey drift and bending moment. The inquiry is ongoing.The structure of the G+25 level was explored.

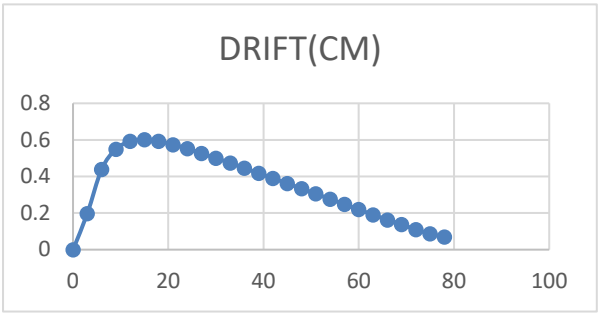

Fig7 Graph between Height vs. Storey Drift

In this Fig Height (m) are taken on X axis and Storey Drift taken on Y axis. The graph is drawn for Rectangular shape Structure.Maximum drift of structure occurs at 12m.

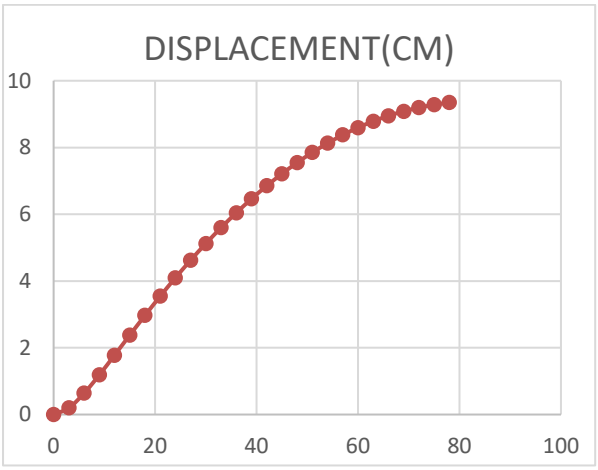

Fig8 Graph between Height vs Avg. Displacement

In this Fig. Height (m) are taken on X axis and Avg. Displacement taken on Y axis. The graph is drawn for Rectangular shape Structure. Maximum displacement of structure is at 78m of the height.

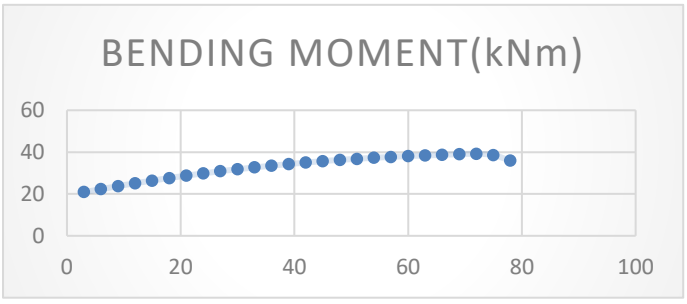

Fig9 Graph between Storey vs. Bending Moment

In this Fig , shows Height (m) are taken on X axis and Bending Moment taken on Y axis. The wind load is applied on the outer edge columns from top to bottom and it is observed that the values of Bending Moment starts decreasing by 72m of height.

3. CONCLUSIONS

The outcome is examined by examining the type of change in values of various parameters such as displacement, axial force, and bending moment at various sections and heights of the structure, for example. The quantity of nodal displacement rises with height in the case of nodal displacement.The value of Beam end Force grows as a result of the post processing result with nodal displacement, and the beam bending moment becomes more varied at the top compared to the bottom section of the structure. The more efficient and intense the wind load at the higher portion of the structure, the better.

It may be summarised as follows based on the values of several parameters:

1. The average displacement rises as the height increases, according to the data.

2. When a wind load is applied over the length of an RCC rectangular structure, it demonstrates that it has greater storey drift than other RCC structures.

3. With increasing wind velocity and building height, the maximum bending moment of different building heights rises.

Only wind load was used as a dynamic load in this investigation, which was done for a few load situations. Different combinations of load scenarios can be studied further with various types of dynamic loads, as dynamic loads play a significant part in multi-story buildings.

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