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Analysis of A Tall Structure Using Staad.Pro Providing Different Wind Intensities as Per 875 Part-III

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ABSTRACT

In this research paper, the effect of wind velocity and structural response of building frame on sloping ground has been studied. Considering various frame geometries. Combination of static and wind loads are considered. For combination, 10 cases in different wind zones are analyzed. STAAD- Pro v8i software has been used for analysis purpose. Results are collected in terms of axial force, Shear force, moment, Storey-wise drift and Displacement which are critically analyzed to quantify the effects of various heights of structure.

Keywords : Staad.Pro, Structural Analysis, Storey Displacement, Bending Moment, Shear Force.

I. INTRODUCTION

Wind load is one of the essential plan loads for common building structures. For long traverse spans, tall structures and high towers or pole structures, wind load might be taken as a basic stacking, and confounded element wind stack impacts control the auxiliary outline of the structure. In this manner information of the dynamic qualities of an imperative structure under wind stacking turns into a necessity in building outline and in scholarly review. In the progressing inquire about venture on tall structures, the investigation of wind-incited requests is ordered as: along-wind and crosswind reactions. These requests are brought about by various components. Moving along the wind-actuated is because of the impacts of turbulence effect while the opposite part is identified with the impacts of windstorm. Then again the impact of twist load on tall structures conveyed over the more extensive surface as well as it has higher power. Besides, in high hazard seismic zone the seismic execution of structures are considered as the essential significance which impact other deliver seismic zones, might be the impact of effect powers coming about because of earth development more prominent than the powers created by wind loads and thusly, Seismic stacking decides frame and last outline of the structure (with this presumption that as for the every universal code what's more, models, wind and tremor stacks never at the same time apply on the structure.

Figuring of ground slant is key to numerous conventional Geographical Information Systems (GIS) applications.

Incline is a vital part in logical, military and regular citizen investigations. Different strategies exist for figuring incline. Manual incline era, in view of shape line data, is a since a long time ago settled and by and large worthy strategy. Multistoreyed building outlines on slanting ground will come up in expansive number in future circumstances. In such manner reasonable examination and outline of these building outlines on slanting ground are of central significance. In the current time, such Multi-storeyed building edges are outlined utilizing STAAD-Pro v8i programming. This inspiration has prompted this review on impact of various slanting point in Multi-storeyed building outlines (2D-Frames). Different arrangements of these building casings of slanting ground profile format have been considered alongside different stack mix of element examination along wind heading and wind strengths.

The main objectives of our research work is as follows:

1. To study the variation in forces of tall structure due to different geometries of buildings.
2. To study the effect of different wind velocity on sloping ground structure as per IS 875 part-III.
3. To study the effect of tall structures by comparing different heighted structures.

II. METHODS AND MATERIAL

This study deals with comparative study of wind behaviour of high rise structures building frames with three geometrical configurations as per 875(Part-III):1987 under the wind effect static analysis a comparative study has been carried out which resulted in terms of Maximum displacements, wind forces, Maximum bending moments, Maximum Axial force, Maximum shear force, drift and reactions.

The study is done as:

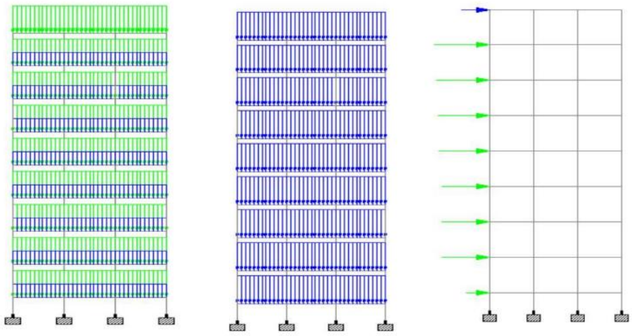
Step-1 selection of building geometry of 3D frame.
Step-2 Selection of sloping angle of ground.
Step-3 selection of 5 wind zones (33, 39, 44, 47 and 55 m/s) as per IS- 875 (part-III):1987.
Step-4 Formation of load combination (8 load combinations in x & z-direction)

Load case no.	Load cases
1	D.L
2	L.L
3	W.L
4	(D.L+L.L)
5	(D.L+W.L)
6	1.5(D.L+L.L)
7	1.5(D.L+W.L)
8	1.2 (D.L+L.L+W.L)

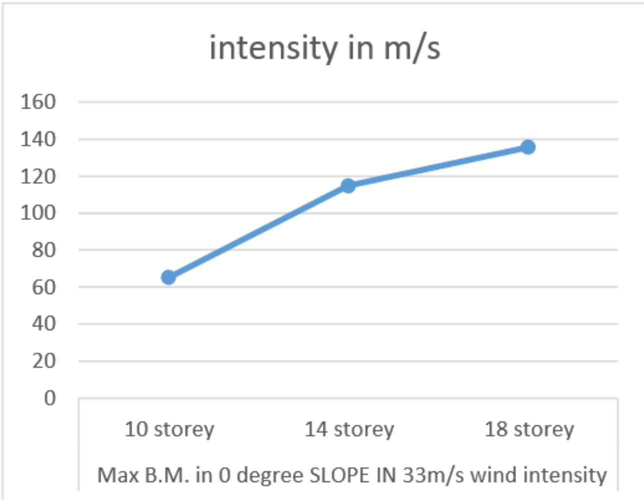
Step-5 Modelling of building frames using STAAD-Pro v8i software.

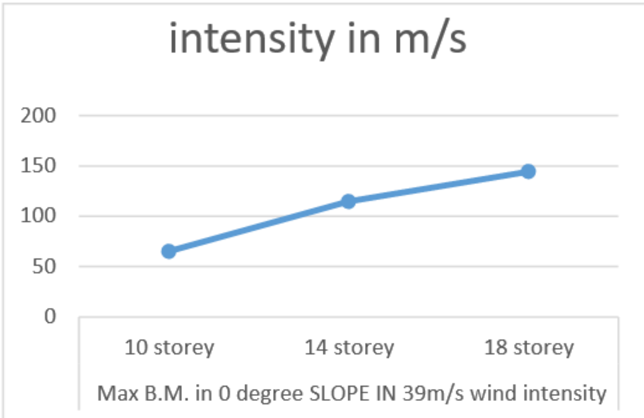
Step-6 Analysis considering different height of building frame and different angle sloping ground frame models, wind zones and each load combinations.

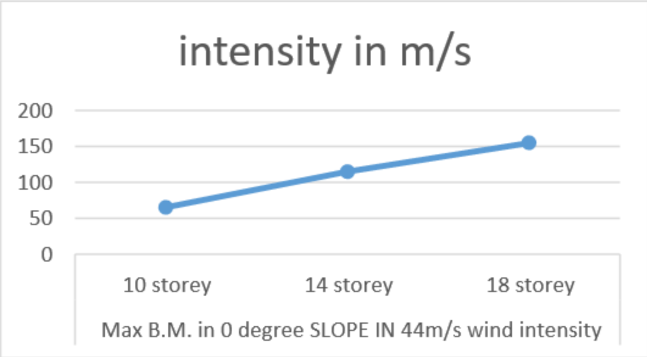
Step-7 Comparative study of results as wind forces, Max bending moments, Maximum Axial force, Max displacements, story wise displacement, Maximum shear force, Maximum Axial force.

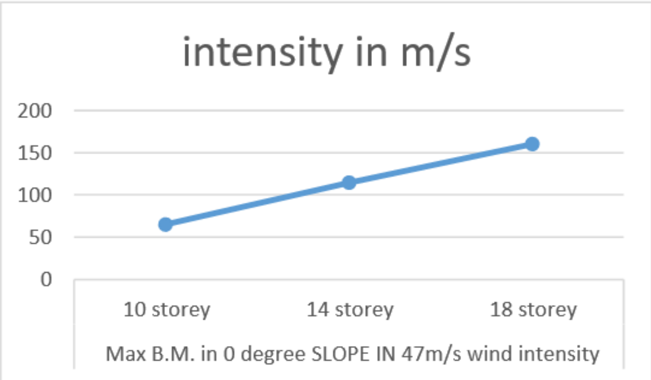


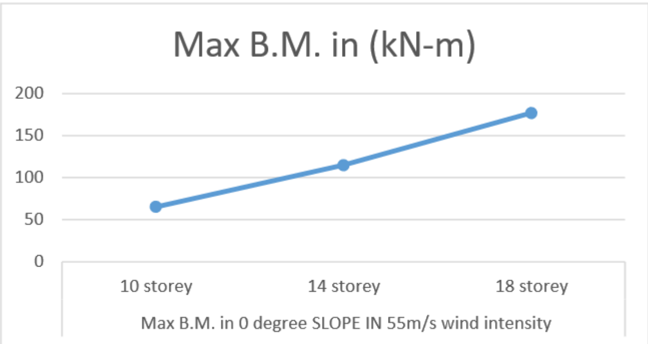
III. RESULTS AND DISCUSSION



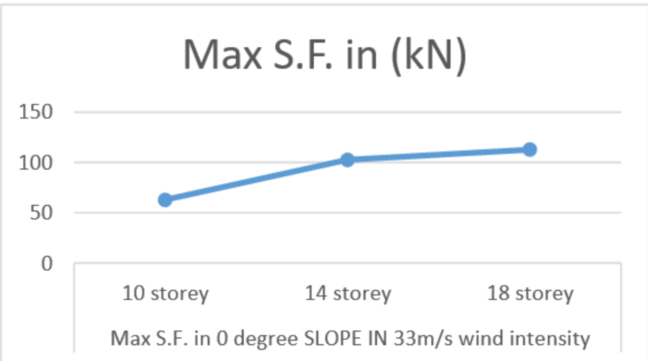


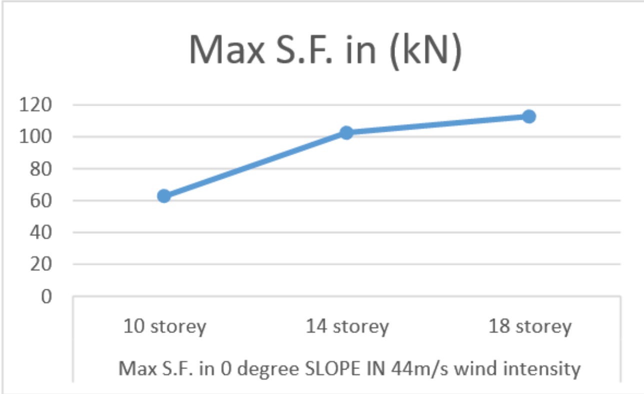

intensity in m/s
200
150
100
50
0
10 storey
14 storey
18 storey
Max B.M. in 0 degree SLOPE IN 44m/s wind intensity

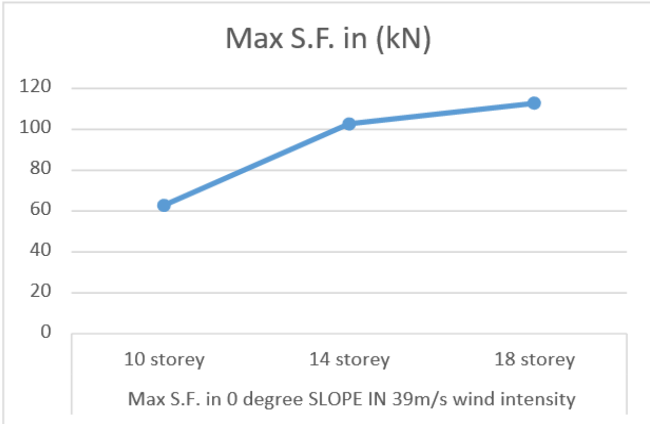

intensity in m/s
200
150
100
50
0
10 storey
14 storey
18 storey
Max B.M. in 0 degree SLOPE IN 47m/s wind intensity


Max B.M. in (kN-m)
200
150
100
50
0
10 storey
14 storey
18 storey
Max B.M. in 0 degree SLOPE IN 55m/s wind intensity

SHEAR FORCE


Max S.F. in (kN)
150
100
50
0
10 storey
14 storey
18 storey
Max S.F. in 0 degree SLOPE IN 33m/s wind intensity


Max S.F. in (kN)
120
100
80
60
40
20
0
10 storey
14 storey
18 storey
Max S.F. in 0 degree SLOPE IN 44m/s wind intensity


Max S.F. in (kN)
120
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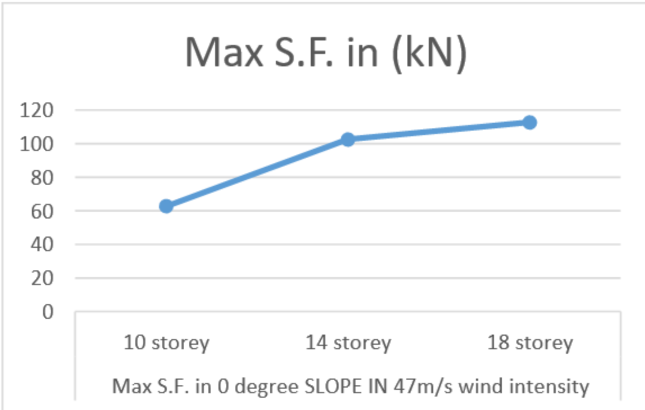
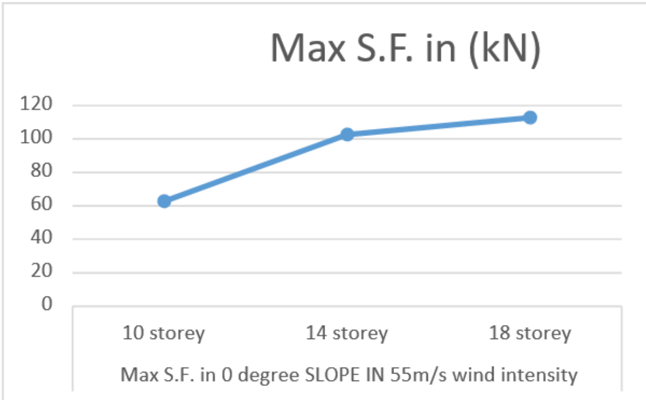
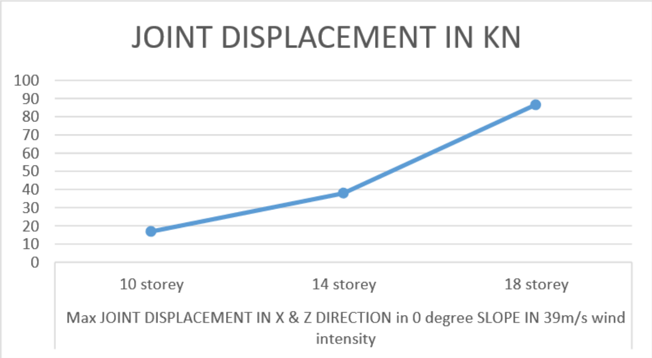
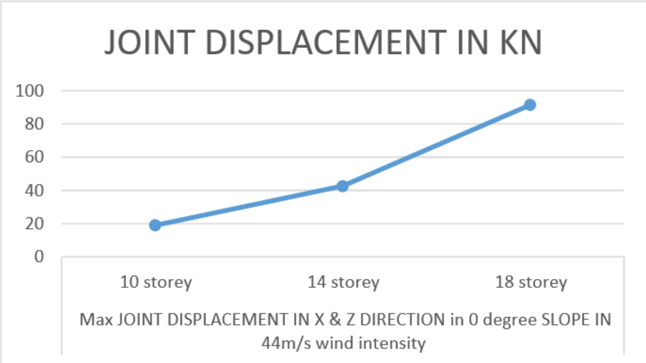
80
60
40
20
0
10 storey
14 storey
18 storey
Max S.F. in 0 degree SLOPE IN 39m/s wind intensity

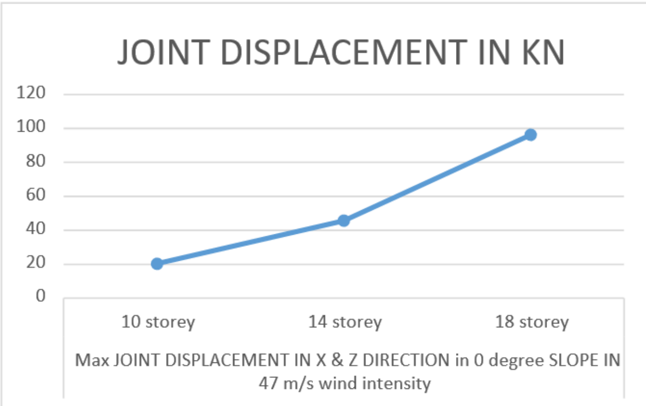

Max S.F. in (kN)
120
100
80
60
40
20
0
10 storey
14 storey
18 storey
Max S.F. in 0 degree SLOPE IN 47m/s wind intensity

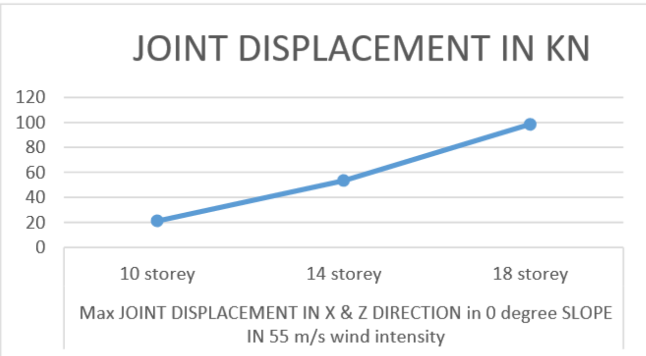

Max S.F. in (kN)
120
100
80
60
40
20
0
10 storey
14 storey
18 storey
Max S.F. in 0 degree SLOPE IN 55m/s wind intensity

JOINT DISPLACEMENT









IV.CONCLUSION

Following are the conclusions as per study-

- ✓ In wind zones, maximum displacement is seen in zone-VI and minimum in zone-I means zone-VI is critical
- ✓ In wind zones, maximum bending moment is seen in zone-VI and minimum in zone-I means zone-I provide better stability.
- ✓ In wind zones, maximum shear force is seen in zone-VI and minimum in zone-I means zone-I provide better stability.

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