International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 06 | June-2016 www.irjet.net p-ISSN: 2395-0072

ANALYSIS OF TALL BUILDING IN CHIKKAMAGALURU REGION

Susheel S M[1], Sanjith J[2], Vidyashree B S[3] , Ranjith A[4]

[2,4]*Research Coordinator, Department of Civil Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru, India*
[1,3]U G Student, Department of Civil Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru, India

---***---

Abstract-*Tall buildings are slender versatile structures and want to be investigated to establish the importance of wind elicited oscillations or excitation on and across the direction of wind. Wind could be a development of nice complexness owing to the various flow things arising from the interaction of wind with structures. Wind consists of a large number of eddies of varied sizes and movement characteristics carried on in an exceedingly*. general stream of air moving relative to the earth's surface. *This research paper discusses the analysis adopted for the evaluation of tall building under effect of Wind force and examines 30-storied building. This is analyzed under an effect of wind using ETABS. Tall building of height 99m has been analyzed for Chikkamagaluru region. Indian standard code of practice IS-875 (Part 3: 1987) is used for analysis. Here, the lateral story displacements, story shears and story drifts are analyzed for the same wind speeds in different direction for the same structure of dimension (15m X 25m).*

Key Words: Tall Buildings, E Tabs, Wind Force.

1. INTRODUCTION

The primary purpose of every kind of structural systems employed in the building sort of structures is to transfer the gravity load or gravity masses effectively. The foremost common masses ensuing from the result of gravity area unit burden, loading and snow load. Besides these vertical masses, buildings are subjected to lateral masses caused by wind, blasting or earthquake. Lateral masses will develop high stresses, manufacture sway movement or cause vibration. Therefore, it's vital for the structure to possess comfortable strength against vertical masses in conjunction with adequate stiffness to resist lateral forces.

Tall Buildings are a common feature these days in both developed and developing economies and with the increase in population and lack of open spaces instead of single storied constructions, multi-storied buildings are increasingly becoming popular and hence special consideration need to be given for the analysis of these structures by considering the dynamic nature of wind.

2. LITERATURE SURVEY

K Rama Raju et.al,(2013) studied the behavior of the wind and earthquake loads along with the vertical gravity loads on the tall buildings. For their study they have used 3B+G+40 storey RCC high rise building and used STAAD Pro for modeling and used response spectrum method for seismic analysis and gust factor method for wind load analysis as per IS 1893 (part 1) and IS 875 (part 3) respectively. They have calculated the roof displacement; inter storey drift and base shear due to wind load and earthquake load. Finally they have compared the allowable limits prescribed by the code of practices.

Baldev D. Prajapati and D.R. Panchal, (2013) presented a paper on the study of seismic and wind effect on multi-storey RCC steel and composite building, in this paper they have discussed the analysis and design for symmetric high rise multi-storey building (G+30) for the effect of wind and earthquake forces. To resist lateral forces they considered RCC steel and composite buildings with shear wall. For the analysis ETABS software is used to analyze 21 numbers of various models. By comparing the various results due to the effect of wind and seismic loads they have concluded that steel concrete composite building is the most suitable resisting system for lateral forces.

Lodhi Saad and S.S Jamkar, (2015) presented a paper on comparative study on wind load analysis of buildings of various shapes and sizes as per IS 875 (part 3) and ASCE 7-02. In this paper wind load was analytically determined for nine different structure models, which was done using STAAD Pro. For these models wind load response in terms of peak deflections, inter-storey drifts are calculated and compared. By their study they have concluded that for the design of low height and medium height buildings (up to 10 stories) buildings will be more economical and designing of high rise buildings (more than 10 stories) will be safer by the use of design coefficients given in IS 875 (part 3).

3. BUILDING DETAIL AND INPUT DATA

Table-1: Building Details Considered for analysis

Building Details		
Sl.No	**Description**	
1	Dimensions of Building	15m X 25m
2	Height of Building	99 m
3	No. of Stories	30 No's
4	Storey Height	3.3 m
5	Type of Structure	RCC Structure
6	Type of Analysis	Wind Analysis
7	Column size	300 X 300mm
8	Beam size	300 X 450mm
9	Slab thickness	150mm
10	Grade of concrete	M25
11	Grade of steel	Fe 415
12	Region	Chikkamagaluru

Input Data for Analysis		
Sl.No	**Particulars**	
1	Density of Reinforced Concrete	25 kN/m^3
2	Density of Steel	76.9729 kN/ m^3
3	Intensity of live load	5kN/m^2
4	Exterior wall load	20kN/m
5	Interior wall load	15kN/m
6	Risk coefficient Factor (K1)	1.0
7	Topography Factor (K3)	1.0
8	Poisson's Ratio of Concrete	0.2
9	Poisson's Ratio of Steel	0.3
10	Modulus of Elasticity of Steel	2.000X 10^8 kN/m^2
11	Wind Speed Vb (m/s)	33 m/s
12	Terrain Category	3
13	Structure Class	C
14	Wind ward Coefficient (Cp)	1.25

TABLE 2: Input data in ETABS 2015

4. RESULTS AND DISCUSSIONS

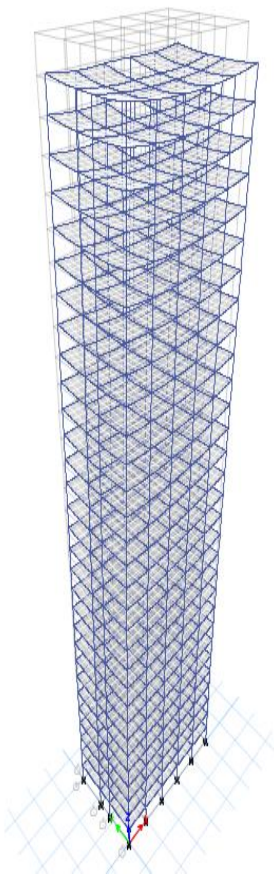

Fig 1: Deformed shape of structure after analysis

4.1 Results due to X Direction wind load.

4.1.1 Maximum roof displacement

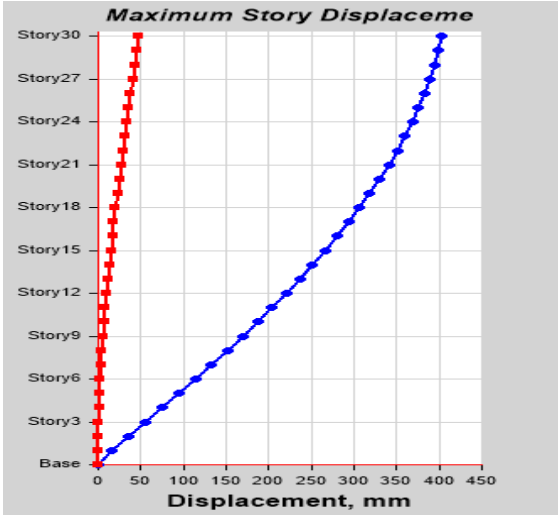

Chart 1: Story displacement graph due to wind x load

Storey displacement is defined as the Lateral deflection or predicted movement of a structure under lateral loads (wind loads).From the aboveresults we can say that story displacement increases with increase in height of the buildings. It acts like a catilever beam, Which is fixed at one end and free at another end. In tall building it is fixed at base and free to the upper side.Since the maximum displacement is at the top, Hence called as maximum roof displacement.

4.1.2. Inter story drift

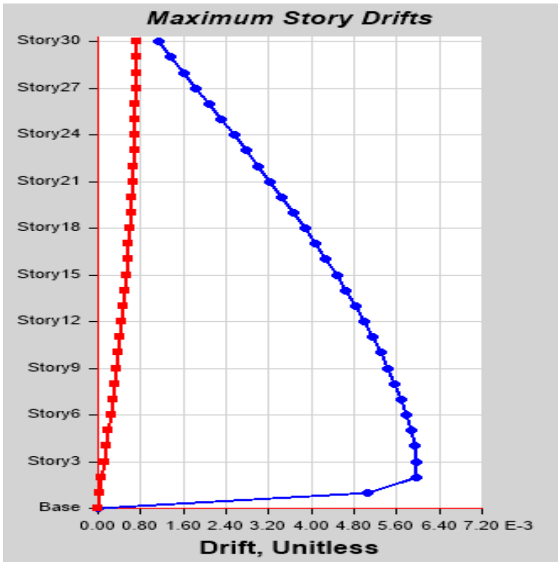

Chart 2: Inter story drift graph due to wind x load

It is defined as the displacement of one level with respect to the level below it. Drift control is necessary to limit damage to interior partitions, elevator and stair enclosures, glass, and cladding systems. Stress or strength limitations in ductile materials do not always provide adequate drift control, especially for tall buildings with relatively flexible moment-resisting frames or narrow shear walls.
Here Maximum inters story drift increases from base to Story 2 with greater rate. From story 2 till story 30 storey drift decreases.

4.1.3. STOREY SHEAR DUE TO WIND X LOAD

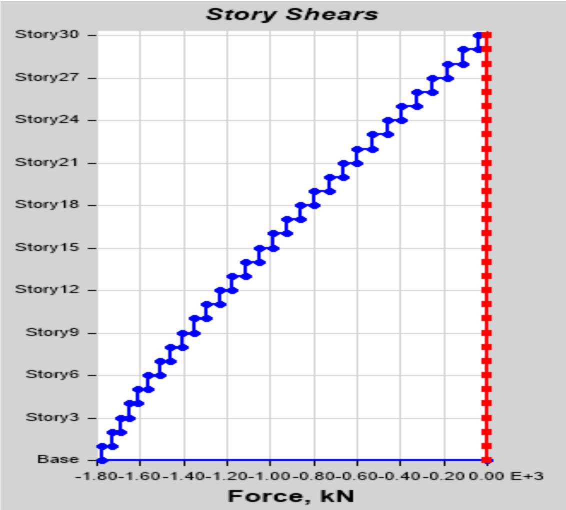

Chart 3 Story shear graph due to wind x load

It is a maximum estimate of lateral force that occurs due to wind load. Storey shear decrease with increase in height linearly. In this report storey shear is maximum at base and gradually decrease to zero at top. The maximum storey shear corresponding to load combination 1.5 times the dead load and wind load is considered.

4.2 Results due to Y Direction wind load.

4.2.1 Maximum roof displacement

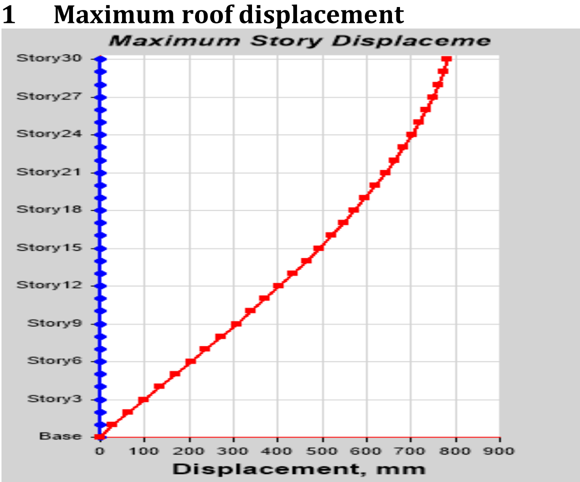

Chart 4: Story displacement graph due to wind Y load

Storey displacement is defined as the Lateral deflection or predicted movement of a structure under lateral loads (wind loads).
From the aboveresults we can say that story displacement increases with increase in height of the buildings. It acts like a catilever beam, Which is fixed at one end and free at another end. In tall building it is fixed at base and free to the upper side.Since the maximum displacement is at the top, Hence called as maximum roof displacement.

4.2.2 Inter story drift

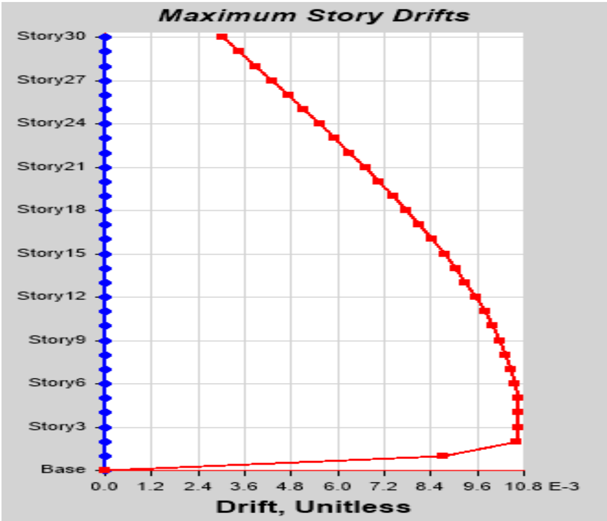

Chart 5: Inter story drift graph due to wind Y load

It is defined as the displacement of one level with respect to the level below it. Drift control is necessary to limit damage to interior partitions, elevator and stair enclosures, glass, and cladding systems. Stress or strength limitations in ductile materials do not always provide adequate drift control, especially for tall buildings with relatively flexible moment-resisting frames or narrow shear walls. Here Maximum inters story drift increases from base to Story 4 at a greater rate. From story 4 till story 30 storey drift decreases with lesser rate when compared from base to storey 4.The maximum storey drift is observed at Storey 4.

4.2.3 STOREY SHEAR DUE TO WIND Y LOAD

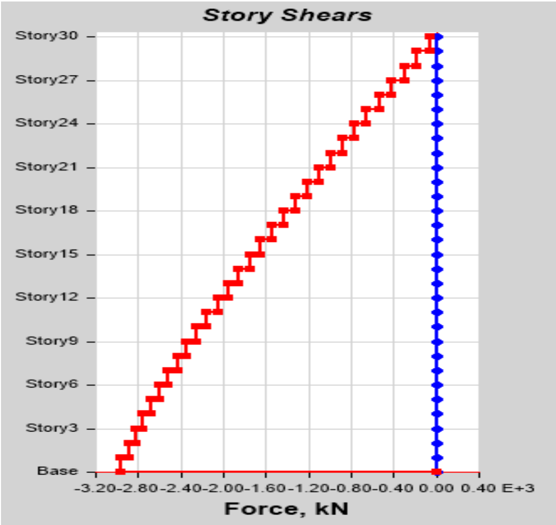

Chart 6 Story shear graph due to wind Y load

It is a maximum estimate of lateral force that occurs due to wind load. Storey shear decrease with increase in height linearly. In this report storey shear is maximum at base and gradually decrease to zero at top. The maximum storey shear corresponding to load combination 1.5 times the dead load and wind load is considered.

5. CONCLUSIONS

Linear static and wind analysis carried out on the 30 story RCC structural building from analysis it is concluded that,

1) Wind forces causes lateral displacement of the building, from the study it is observed that the displacement is maximum at the roof.

2) From the above study it is observed that maximum roof displacement due to wind y load is more when compared to wind x load. Since surface for the application of wind y direction load is more than wind x direction load.

3) From the Analysis, Inter story drift due to wind x load is maximum in story 3 whereas due to wind y load Inter story drift is maximum at story 5.

4) From wind analysis it is evident that storey shear is maximum at base and goes on decreasing with height.

5) All results corresponding to 1.5 times the dead load and wind load values are considered for results.

REFERENCES

[1] Arvind Y. Vyavahare, Godbole. P.N, TruptiNikose,(2012). “Analysis of tall building for across wind response” in International Journal of Civil and Structural Engineering Volume 2, No 3. ISSN 0976 – 4399, PP 979- 986.

[2] Azlan Adnan and SuhanaSuradi,(2008) presented on “Comparison on the effect of earthquake and wind loads on performance of reinforced concrete buildings” In The 14th World Conference on Earthquake Engineering at Beijing in China.

[3] Mendis P., Ngo T., Haritos N., Hira A., (2007), “Wind Loading on Tall Buildings”, EJSE Special Issue: Loading on Structures.

[4] C.M. Chan, M.F. Huang, K.C.S. Kwok, (2010). “Integrated wind load analysis and stiffness optimization of tall buildings with 3D modes”. In science direct.

[5] Baldev D. Prajapathi and D.R Panchal (2013), presented a paper on study of seismic and wind effect on multi storey RCC steel and composite building in an international journal of advances in engineering and technology, volume 6, issue 4, pp 1836-1847, ISSN 22311963.

[6] SreeHarsha J et.al., (2015) presented a paper on analysis of tall buildings for desired angle of diagrids in an international journal of research in engineering and technology, volumn 4, issue 4, pp 635-639, eISSN 2319-1163| pISSN 2321-7308.

[7] IS: 875(part- 3) 1987 code of practice for design loads for tall buildings.