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EFFECT OF WIND FORCES ON MULTISTOREYED STRUCTURES

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Abstract—*It is very essential to consider the effects of lateral loads induced from wind and earthquakes in the design of reinforced concrete structures, especially for high-rise buildings. A computer program is developed to analyze the structural buildings behavior under wind pressure defined considering all factors in the codes. In present study, Multi-storey buildings with 5 and 10 storeys have been modeled using software package ETABS. This paper also deals with the effect of the variation of the building height on the structural response of the building. The significant of this work is to estimate the design loads of a structure which is subjected to wind loads in a particular region.*

Keywords— ETABS, Lateral loads, Earthquakes, Reinforced concrete structures, High-rise buildings, Wind pressure.

I.INTRODUCTION

In order to design a structure to resist wind loads, the forces on the structure must be specified. The exact forces that will occur during the life of the structure cannot be anticipated. Most National Building Codes identify some factors according to the boundary conditions of each building considered in the analysis to provide for life safety. A realistic estimate for these factors is important, however the cost of construction and therefore the economic viability of the project is essential.

Many times, wind engineering is being misunderstood as wind energy in india. On the other hand, wind engineering is unique part of engineering where the impact of wind on structures and its environment being studied. More specifically related to buildings, wind loads on claddings are required for the selection of the cladding systems and wind loads on the structural frames are required for the design of beams, columns, lateral bracing and foundations. For the analysis purpose a 5 and 10 storey building is selected. The wind loads are estimated by Indian code IS: 875 (Part-3) - 1987.

A. Wind analysis

The basic wind speed (Vb) for any site shall be obtained from IS 875 and shall be modified to get the design wind velocity at any height (Vz) for a chosen structure.

$$V_z = V_b k_1 k_2 k_3$$

Where, Vz = design wind speed at any height z in m/s, Vb= Basic wind speed in m/s, k1 = probability factor (risk coefficient), k2= terrain roughness and height factor and k3= topography factor.

II. PROBLEM DEFINITION

A square plan configuration is considered for the study. Modeling, analysis and design of the structure is done in ETABS software.

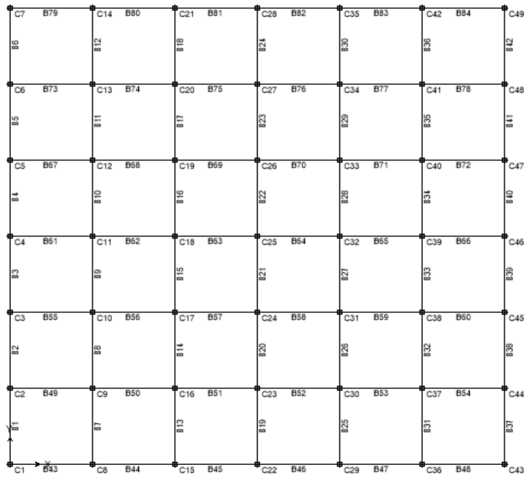


Figure-1 Plan of a regular structure considered

III. RESULTS AND DISCUSSIONS

Table I: Design Axial force in column

S.No	COLUMN	HEIGHT(m)	
		15(5 STOREY)	30(10 STOREY)
1	C1	488.06	1048.36
2	C6	908.62	1842.97
3	C13	1714.46	3293.67
4	C25	1696.54	3393.81
5	C45	902.28	1872.46
6	C49	488.06	1048.36

Graph-1 : Comparison of design Axial force in column

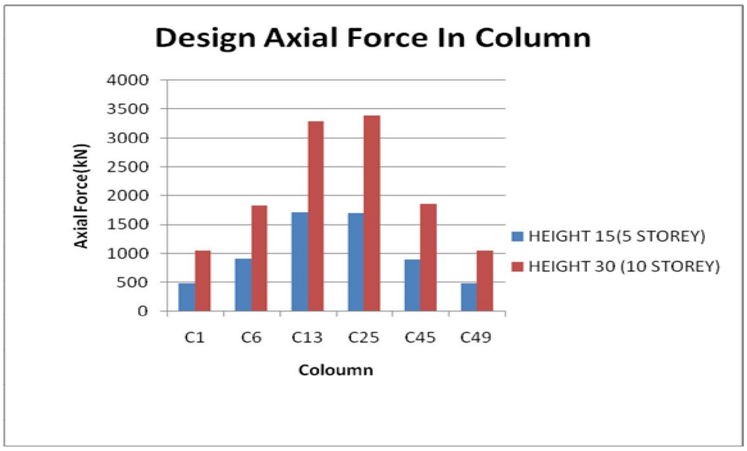


Table II: Design bending moment in columns

S.No	COLUMN	HEIGHT(m)	
		15(5 STOREY)	30(10 STOREY)
1	C1	26.499	38.293
2	C6	52.24	65.981
3	C13	25.765	12.463
4	C25	24.982	11.265
5	C45	53.389	67.77
6	C49	30.046	38.293

Graph 2: Comparison of design bending moment in column

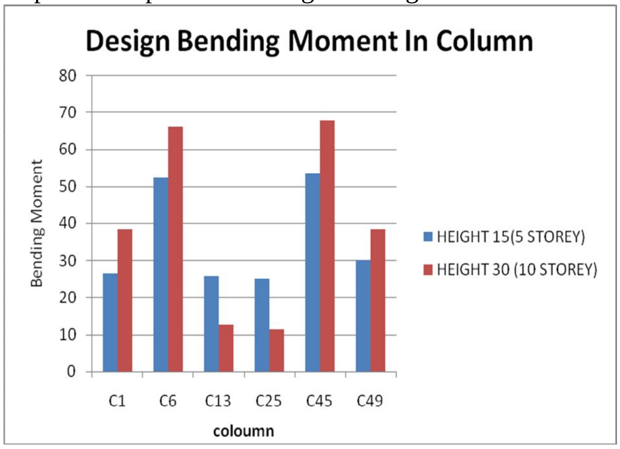


Table III: Design Shear force in columns

S.No	COLUMN	HEIGHT(m)	
		15(5 STOREY)	30(10 STOREY)
1	C1	20.24	26.82
2	C6	36.8	46.68
3	C13	14.42	8.38
4	C25	13.35	6.51
5	C45	37.49	47.81
6	C49	20.94	26.82

Graph 3 : Comparison of design shear force in columns

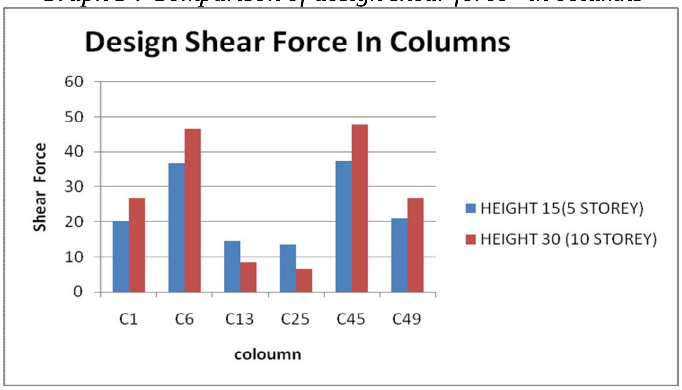


Table IV: Design bending moment in beams

S.No	Beam	HEIGHT(m)	
		15(5 STOREY)	30(10 STOREY)
1	B6	40.459	49.293
2	B22	72.054	71.994
3	B37	72.053	49.293
4	B61	76.426	92.567
5	B66	75.088	92.567
6	B69	72.768	71.994

Graph 4 : Design bending moment in beams

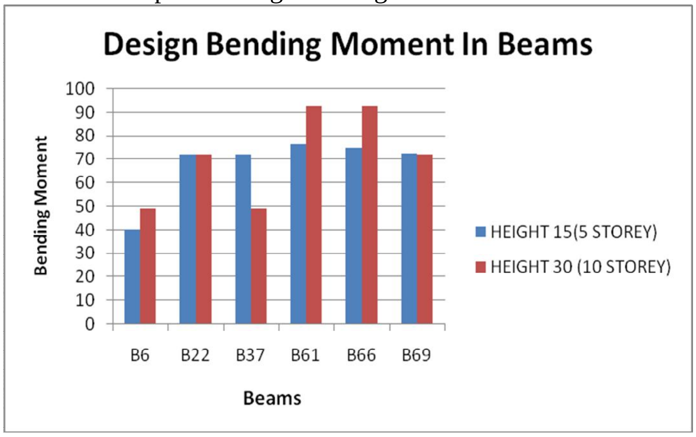
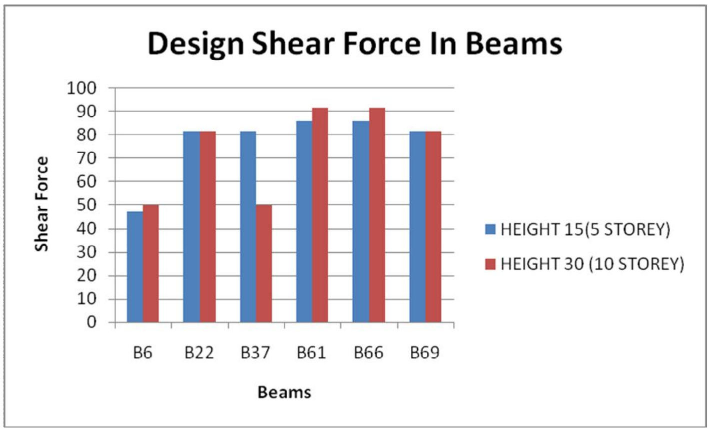


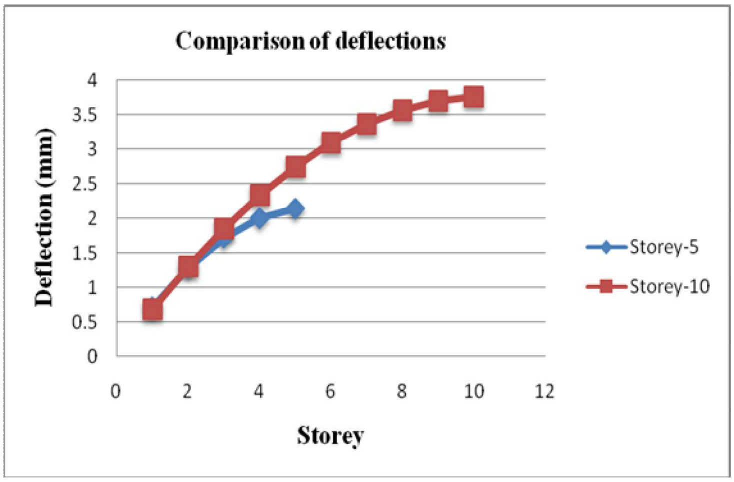
Table V: Design Shear force in beams

S.No	Beam	HEIGHT(m)	
		15(5 STOREY)	30(10 STOREY)
1	B6	47.21	50.04
2	B22	81.74	81.73
3	B37	81.74	50.04
4	B61	86.03	91.74
5	B66	86.03	91.74
6	B69	81.74	81.73

Graph 5: Design shear force in beams



Graph 6: Comparison of deflections



IV. Conclusions

- The effective parameters for wind forces affecting any building are the area subjected to wind as well as the intensity of wind defined by the code according to it's the location.
- The wind loads increases with height of structure.
- Structures should be designed for loads obtained in both directions independently for critical forces of wind or earthquake.
- Comparison of various design parameters is carried out and respective results are plotted.

REFERENCES

[1] Burea of indian standards: IS-875, part 1 (1987), Dead Loads on Buildings and Structures, New Delhi, India.
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[3] Burea of indian standards: IS-875, part 3 (1987), Wind Loads on Buildings and Structures, New Delhi, India.

