Volume : 2 | Issue : 5 | May 2013 • ISSN No 2277 - 8160

Research Paper | Engineering

A Comparative Study Of Wind Forces On High-Rise Buildings as Per Is 875-Iii (1987) and Proposed Draft Code (2011)

Hemil M. Chauhan	P.G. Student, G.E.C Dahod, Gujarat, India.
Manish M. Pomal	Asst. Prof. Applied Mechanics Department, G.E.C Dahod, Gujarat, India.
Gyayak N. Bhuta	Asst. Prof. Applied Mechanics Department, G.E.C Dahod, Gujarat, India.

ABSTRACT

The correct estimation of the wind forces acting on tall buildings is very essential for the safe design of structural elements. The influence of static & dynamic velocity fluctuations on the along wind loads for these structures are determined using Force coefficient method & Gust Factor Method respectively. In this Paper 60 m & 120 m buildings is analyzed using both the codes using ETABS Software v9.6 is done with variations in four Terrain Categories & Six basic wind speeds. Both codes are used for analysis and results (calculations of S.F, B.M & Displacements) obtained are compared and discussed.

KEYWORDS: High rise buildings, Gust Factor Method, Along Wind Force, Comparison of codes.

INTRODUCTION

Comparative study of the wind is done on a high rise buildings by using the Indian standard codes such as IS: 875 (Part 3) – 1987 and IS Draft : 875 (Part 3) – 2011 and also using ETABS v9.6. Analytical Method given in the IS codes is usually acceptable for a building with regular shape and size mostly based on the geometric properties of the building and without incorporating the effects of the nearby buildings.

Wind effects on static structures

In the case of static structures the flow interacts only with the external shape of the structure. When the structure is very stiff, deflections under the wind loads will not be significant, and the structure is said to be "Static". As the lowest mode frequencies are high, there is little energy in the spectrum of atmospheric turbulence available to excite resonance. The only design load parameter of importance is the maximum load likely to be experienced in its lifetime. The parameters most relevant to the assessment of design loading are Influence functions, size parameters of the structure, load duration and assessment of load for design.

Wind effects on dynamic structures

In the case of dynamic structures, there is an additional interaction with the motion of the structure. When the structure is sufficiently flexible, the response to wind loads is significant to the design of the structure. The conventional approach to the analysis of dynamic response of lightly damped structures is by resolving the response into the natural modes of vibration, characterizing each normal mode as a set of model parameters: 1) Model shape, 2) Model mass, 3) Model stiffness and 4) Model damping. Using these parameters a frequency response function can be defined that describes the dynamic characteristics of the structures.

0.1 Analysis of building for variation

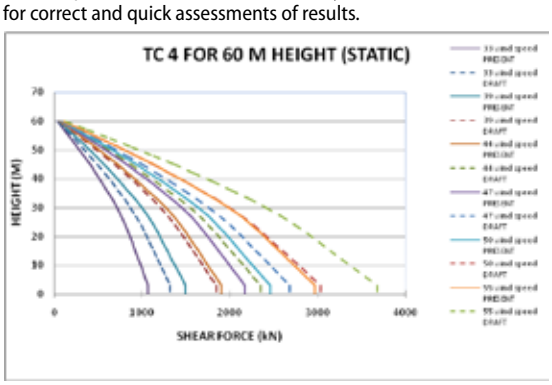
Wind Zone : All six basic wind speeds.
Terrain Category : I, II, III, and IV
Class of Building : C
Topography : Flat
Wind speeds, design wind pressure, loads to the building are calculated using standard IS codal Provision.

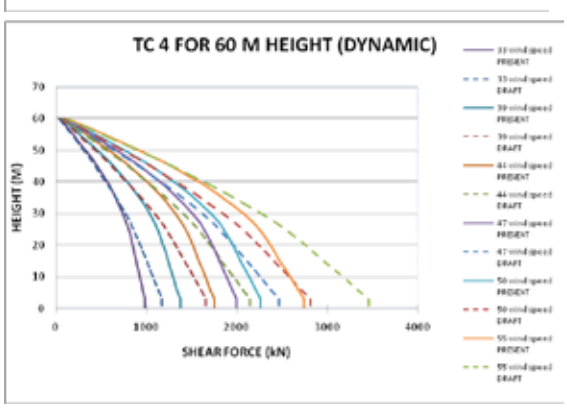
2. Building description

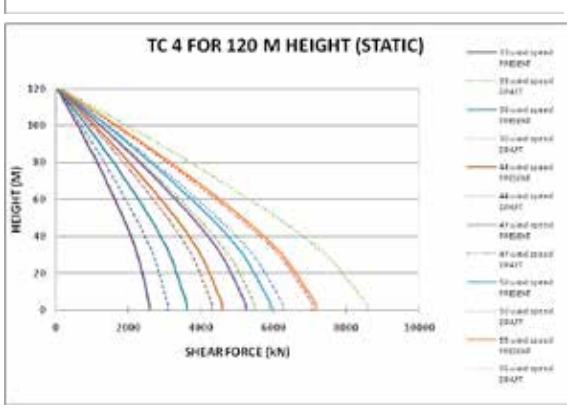
Two multi storied RC buildings are considered for the study. Building 1 has plan dimension 24m in length & 18m in breadth and height is considered 60m.Building 2 has plan dimension 30m in length & 24m in breadth and height is considered 120m.The along wind direction is considered along larger dimension of plan. Storey height is considered 3m for both cases and 6m c/c bay is taken for both directions for both buildings.

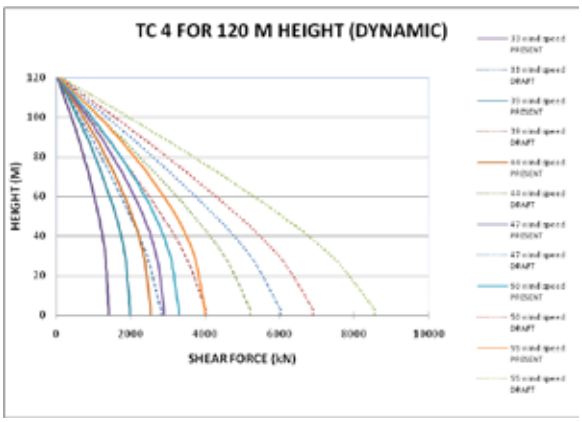
2.1 Static and Dynamic (Gust) pressures

A computer programmed is prepared for finding the static and Dynamic (Gust) pressures and shear forces. Analysis is done in ETABS Software for correct and quick assessments of results.









3. Results and discussions

- Both buildings, in static analysis, give almost same values of shear forces & bending moments for TC-1 & TC 2.But in TC 3 & TC 4, IS draft code gives higher values of S.F & B.M.
- Both buildings, in dynamic analysis, IS draft code gives less values of shear forces & bending moments for TC-1 & TC 2.But in TC 3 & TC 4, IS draft code gives higher values of S.F & B.M.

4. Conclusions

- Comparison of 60 m building in TC 2 under dynamic analyses for wind speeds such as 33,39.44,47,50,55 m/s , the IS Present code gives respectively 18.73%, 17.67%, 16.08%, 15.51%, 15.58% & 14.63% increase in base shear compared to IS Draft code.
- Comparison of 60 m building in TC 4 under dynamic analyses for wind speeds such as 33,39.44,47,50,55 m/s , the IS Draft code gives respectively 19.51%, 20.93%, 22.41%, 23.32%, 24.34% & 26.14% increase in base shear compared to IS Present code.
- Comparison of 120 m building in TC 2 under dynamic analyses for wind speeds such as 33,39.44,47,50,55 m/s , the IS Present code gives respectively 10.42%, 8.80%, 7.76%, 5.96%, 5.93% & 5.30% increase in base shear compared to IS Draft code.
- Comparison of 120 m building in TC 4 under dynamic analyses for wind speeds such as 33,39.44,47,50,55 m/s , the IS Draft code gives respectively 98.14%, 101.85%, 105.75%, 107.71%, 109.98% & 114.14% increase in base shear compared to IS Present code.
- Static analysis gives critical results of S.F & B.M in TC 4 for both buildings.
- The drastic increase in the force values is found because of the significant change in K2 factors calculated as per IS draft code-2011.
- The computation of along Wind Load as per the present code is cumbersome and difficult to program as it uses various charts. Further the present code makes use of mean hourly wind velocity, which is not consistent with other International Codes. The IS draft code uses 3 second gust speed for computation of Gust factor (Dynamic Response factor) and gives simple formulas to evaluate the Gust factor and forces.
- In general, IS draft code-2011 is more accurate and more direct than present code for estimating response parameters such as acceleration and forces.

REFERENCES

Holmes J.D., Tamura Y. and Krishna P.(2009), "Comparison of wind loads calculated by fifteen different codes and standards, for low , medium and high rise buildings", Proceeding of 11th | American Conference on Wind Engineering, San- Juan, Puerto Rico, June 22-26, 2009. | Suresh P., Panduranga R., Rama J.S.,(2012) "Influence of diagonal braces in RCC multi-storied frames under wind loads", International Journal of Civil and Structural Engineering, August 2012. | | B. Dean Kumar, B.L.P. Swami (2010) "Wind effects on tall building frames-influence of dynamic parameters", Indian Journal of Science and Technology, May 2010. | Swati D. Ambadkar, Vipul S.Bawner (2012) "Behavior of multistoried building under the effect of wind load", International Journal of Applied Sciences and Engineering Research, 28 August 2012. | | | L.Halder and S.C.Dutta (2010) "Wind effects on multistoried buildings: A critical review of Indian codal provisions with special references to American standards", Asian Journal of civil Engg. (Building and Housing) Vol.11 No.3-2010. | IS 875-PART 3(1987) "Code of practice for design loads (other than earthquake) for buildings and structures", Bureau of Indian Standards, New Delhi. | | IS 875-PART 3(2011) "Code of practice for design loads (other than earthquake) for buildings and structures", Bureau of Indian Standards, New Delhi. | An explanatory handbook on Indian standard code of practice for design loads (other than earthquake) for buildings & structures. | An explanatory handbook on proposed IS 875(part III) wind loads on buildings & structures. | | ETABS Videos and Manuals. |