International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 141-144 www.ijaem.net ISSN: 2395-5252

# Wind load on a Tall Building with Square Cross-Section using Ansys Software

Vaibhav Saxena[1], Dr.AsthaVerma[2]
[1]M.TechStructural Engineering College of Technology, Pantnagar
[2] Assistant Professor Department of Civil Engineering College of Technology,Pantnagar

Submitted: 25-05-2022 Revised: 01-06-2022 Accepted: 05-06-2022

**ABSTRACT-**In developing countries, population are rising very rapidly has forced to emphasis on design and construction of multilevel tall buildings. Civil Engineering is a fundamental element of our society. The tall structures of buildings are designed to persist the rigid loads. However, they may be exposed to the dynamic load such as wind effect, cyclone, and earthquakes etc. The impact of wind loads are to consider for the design of high rise building as there are many failures of structures have appeared inIndia due to wind. Wind-induced vibrations instructures increases the importance of structuraldesign as the use of high-strength, lightweightmaterials, longer floor spans, and more flexible framing systems are used, results instructures that are more prone to vibrations. From thepresent study it can be concluded that wind effects aresignificant compared to gravity effect. This paper discussesthese challenges and the engineering solutions that theyrequire to successfully design a tall building which is notonly stable, safe and stronger under wind loads but alsoperforms excellently providing usable and highlyfunctional design structure

**KEY WORDS:**High- rise building, Wind effects.

## I. INTRODUCTION

[1] Wind engineering is seen primarily as the interaction of air with man-made structures in the Earth's atmosphere. The purpose of wind engineering is to analyze the impact of wind loads on these structures and the potential damage to buildings. Currently, due to urbanization, the available space is not growing while the population is growing rapidly, especially in urban areas. Thus, there has been a change in the shape and size of the structures from large horizontal structures in earlier times to tall straight buildings with unusual and unusual shapes in recent times. [2] Such structures are very simple and flexible with the introduction of new building materials and construction methods. Such tall buildings are easily infested with air due to low-rise construction under indirect wind action, therefore, the effects of air load on these buildings should be guaranteed by a high degree of confidence in ensuring their safety. These structures are often built in many places and their behaviour and reactions are different from that of a single building.

Although much information can be found in various international codes about traditional architectural responses, for example, IS 875 (Part 3): 2015, no information on abstract architecture or interference effects can be found in any international codes.

[3] Various aerodynamic adjustments are applied to the surface raising buildings to prevent or reduce that wind they can be divided into major and minor changes. Great changes are the ones that have the biggest impact on ideas of architecture and structure, e.g. obstacles to heights, shrinkage, openings, turns structural condition, receding, structural distortion. [4] Alittle changes with limited effects on architecture and engineering ideas, examples of corner changes like sharp corners, chamfered corners, recession, rotation of corners and structural position in relation to the most common direction of strong winds

## II. METHODOLOGY

The Dimension of square shaped building(100x100mm) as shown inFig.1 and with height 700mm as shown in Fig.2 and plan of building as shown in Fig.3 and domain size as shown in the Fig.4. Such large domain is good enough for vertex generation on leeward side of building to avoid backflow of wind.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 141-144 www.ijaem.net ISSN: 2395-5252

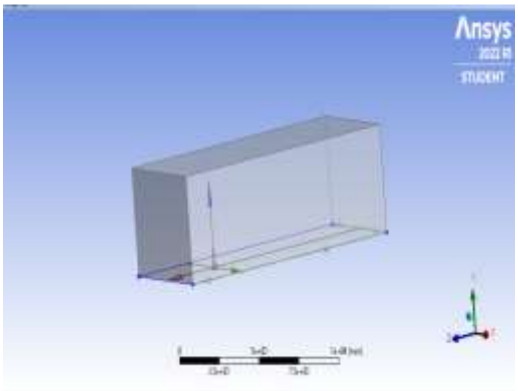



Fig.1- Square Cross-section Building with Domain

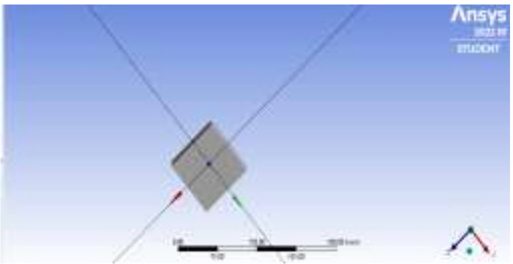



Fig.2- Plan of Square cross-section Shaped Building

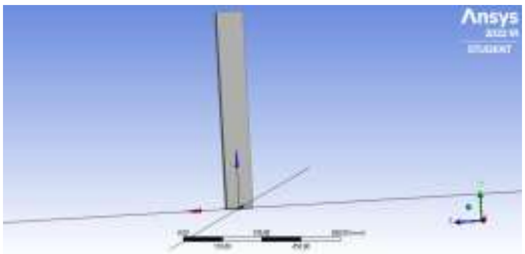



Fig.3- Elevation Square Cross-section Building

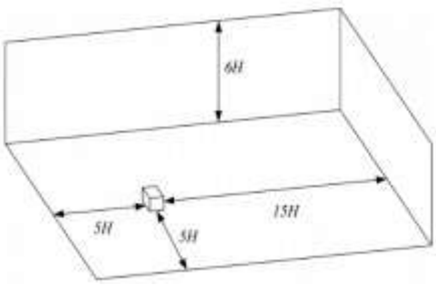



Fig.4 - Domain Dimension

[5] In general, the mechanism to slow down this movement is caused by movement can be divided into two ways; 1) Structural Modification2) Aerodynamic Modification. More than two requirements can be satisfied with the use of a mass damper or with a well-designed building like Burj Dubai. As development, the structure of the building is complete directed developmental improvements that can reduce adjusting the swirls and reducing the vortex effect to destroy.

ANSYS CFX is used for purpose of analysis since it mainly focuses to study aerodynamic applications. Meshing of the domain is done using tetrahedral elements.

Meshing is done finer near surfaces of building in order to get good results on surface of building as shown in Fig.5.

All the faces i.e Face A, Face B, Face C, Face D, as shown in the Fig.6.

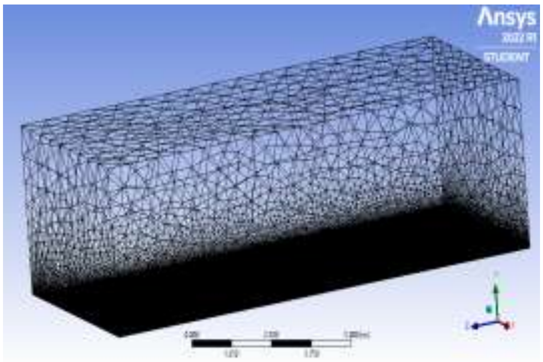



Fig.5- Meshing of Domain and Building

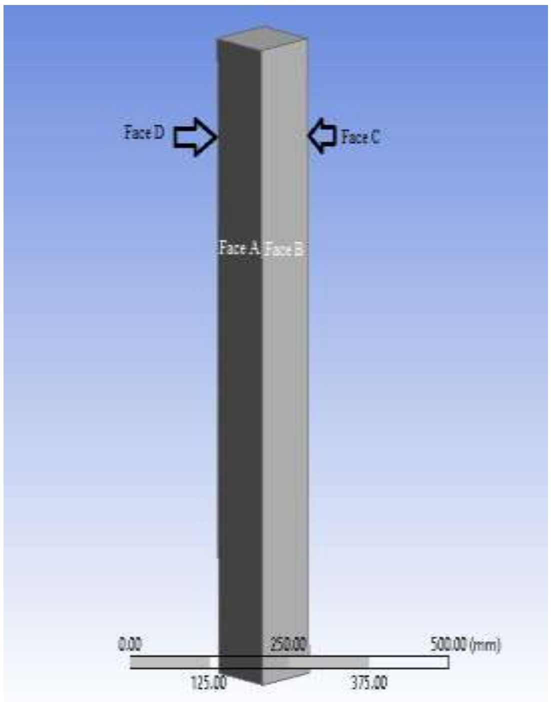



Fig.6 – Faces of Building.

**WIND SPEED**

[6] From the lofty abodes of the earth, when the effects of resistance are indifferent, air movement is present driven by pressure gradients in the

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 141-144 www.ijaem.net ISSN: 2395-5252

atmosphere, which is in line with the effects of physics Flexible star temperature of the earth. This air quality speed is considered because the gradient rotates speed.

The basic wind speed (Vz) of any site is provided by

$V_z = V_b.k_1.k_2.k_3$

Where,

$V_z$ = wind speed per hour per m / s, at a height of z

$V_b$ = the basic wind speed of the region in m/s

$k_1$ = probability factor (risk coefficient)

$k_2$ = terrain roughness and height factor

$k_3$ = topography factor

**DESIGN WIND PRESSURE**

Design air pressure at any height above normal will be found in the next relationship between air pressure and wind speed:

$P_z = 0.6\ V_z^2$

Where,

$P_z$ = Air pressure designing at N/m2 at altitude 'z' m

$V_z$ = design wind speed in m/s

**Wind Pressure And velocity distribution**

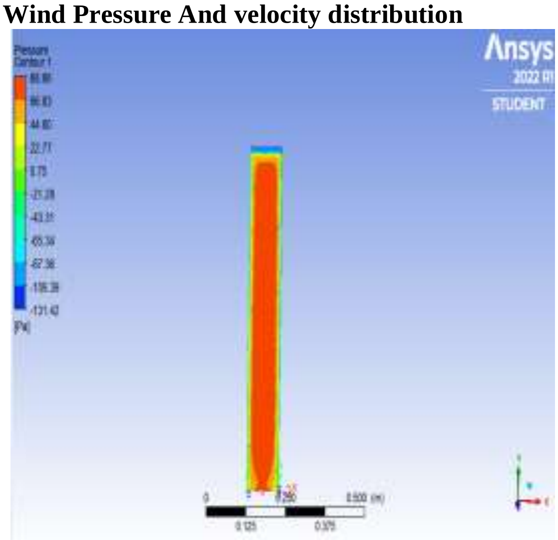
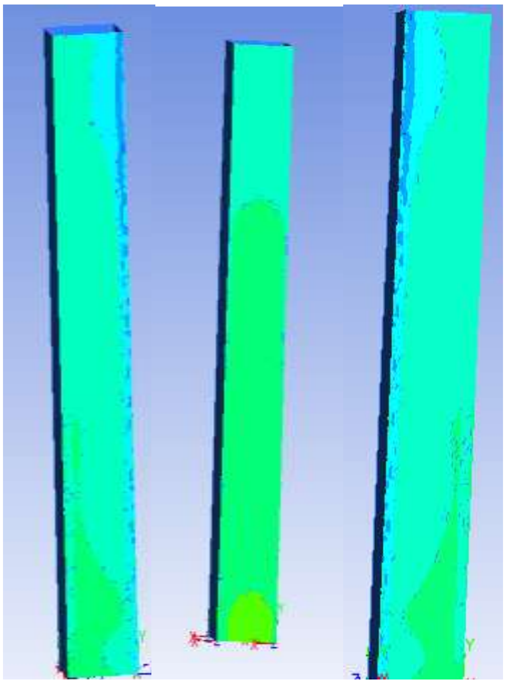



Fig 6- Pressure for Building Face A.



Face B Face C Face D

Fig.7- Pressure contour of all Faces of Building

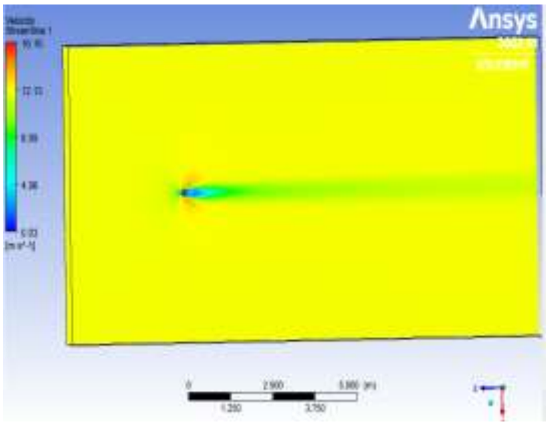



Fig.8- Velocity distribution

## III. RESULT AND DISCUSSION

Analysis of model were conducted using ANSYS CFX 2022 R1. Meshing is done using tetra-hedron method and the size square cross section high rise building (100x100)mm.Based on above data in ANSYS produces results in terms of relative pressure. Globalpressure,eddyviscosity and temperature etc. Different slip conditions are used no slip wall used for all the faces of building and ground and free slip walls for all the walls of domain (inlet,outlet, side walls).

We have found that the value of pressure is positive on the top i.e 88.86N/$m^2$ and negative as we go centre to bottom of building and and at the bottom 131.42N/$m^2$ as shown in Fig.6 and I

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 141-144 www.ijaem.net ISSN: 2395-5252

compared my results with IS 875 (Part 3);2015.Pressure contours for the isolated square shaped building as shown in Fig.7 for the different faces of building i.e Face B, Face C Face D [7] also I compared my result with Roy and Kumar (2016). Velocity is maximum at the top i.e 16.16m/s minimum at the bottom of the building as shown in Fig.8.

## IV. CONCLUSION

- Current research is being conducted to investigate the behavior of the height of the building under the air load around the building in various angles and by using existing transformations.
- ANSYS The CFX tool is used to perform analysis by creating an atmosphere tunnel as a model. Air flow is considered to be the liquid that enters air tunnel
- This paper has considered many of the key factors associated with the design of tall buildings in the wind loading effects.
- The standard design requirements for structural and operational power take on some significance in the case of a tall building design as a significant flexible reaction can be attributed to both the bath and air-conditioning processes.

## REFERENCES

[1]. IS: 875 (Part 3);2015 . Indian Standard Code of Practice for Design Wind Load on Buildings and Structures, Second Revision, New Delhi, India, 2015.
[2]. AS/NSZ 1170.2: 2002. Structural Design Action,Part2:Wind Actions,Australian,New-Zealand Standard, Sydney, Wellington, 2002.
[3]. P. Mendis, T. Ngo, N. Haritos, A. Hira, Wind Loading on Tall Buildings, The University of Melbourne, Australia, 2007.
[4]. Mahesh Bariya , Bhairav Thakkar, Civil Engineering Department, Navrachana University, Vadodara (India), 2016.
[5]. J .Revuz , D.M. Hargreaves and J.S. Owen, On the domain size for the steady-state CFD modelling of a tall building, The University of Nottingham, Nottingham, UK, 2012.
[6]. Mohammad Javed1, Satish Kumar2Enhancementof Tall Buildings Under theWind load,Department of Civil Engineering, Rama University Kanpur India, 2022.
[7]. K. Roy and A. Kumar Bairagi, Wind pressure and Velocity around steppedunsymmetrical plan shape tall building using cfdsimulation– a case study,2016.