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A REVIEW PAPER ON INTERFERENCE EFFECT BETWEEN TALL BUILDINGS WITH SQUARE CROSS-SECTIONS UNDERWIND LOADS

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Abstract : Wind load on tall square shaped building for wind incidence angle of 0° in isolated condition can be easily estimated by using available code of practice. However, windtunnel tests are required for various wind incidence angles and to investigate the influence of the presence of an interfering building on the major building. In this study, 10 storeys building with square cross section and having 4 bays in both the direction is analyzed for different wind incident angles (0°, 30°, 60°) by using the values of pressure coefficient at different nodes for determining various parameters like deflection, bending moment, storey drift and maximum absolute stress. Furthermore, interference effect by varying the distance (y = 0, 0.5b, b, 1.5b, 2b) between upstreaminterfering building and principal building is also investigated. This analysis isperformed by using Standard package STADD.Pro V8i software and the wind pressure coefficient for different angles of wind incidence and for various configuration of interference is obtained by conducting wind tunnel test and the results are recorded in form of pressure contours. Then using these pressure contours it is concluded that for 0° wind incidence in isolated condition deflection observed from wind tunnel studies and from Indian standard codes are similar. Later, it is found out that from all the available location of shear walls, optimum location is when shear wallis present at central core of building

***IndexTerms* - Gust Effect,Wind Effect.**

I. INTRODUCTION

Moving air is the most basic description of wind. It can also be defined as the movement of air across the earth's surface from high pressure zones to low pressure zone. Because of the unpredictability of wind flow, all research and design effort in this subject has relied heavily on full-scale and wind tunnel study. This has demanded the utilization of costly wind tunnels and data gathering equipment, as well as a significant amount of time and effort to achieve the needed findings. Because there islimited space for construction in densely populated cities, the majority of high-rise buildings are developed there. Due to migration from adjacent villages, Indian townsare seeing a massive demographic increase, resulting in urbanisation, housing demand, and a spike in land prices. Housing has evolved into a revenue-generating business (Kavilkar & Patil, 2014). Wind is a natural phenomenon that generates from changesin the atmospheric pressure and temperature in the atmosphere. Wind loads are the effects of the wind's kinetic energy, which can cause a combination of direct pressure,negative pressure (suction), and drag pressures on structures in their path. The motionsof the air create stochastic wind processes, in which the atmospheric boundary layer, which is close to the earth's surface, is affected by friction from the surface.

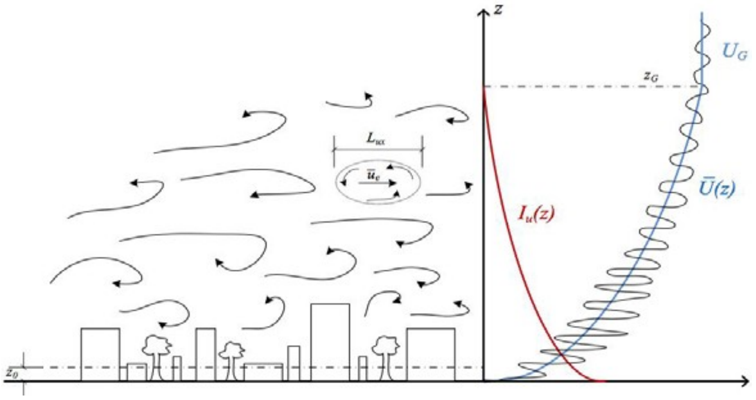


Figure 1.1 Atmospheric boundary layer (Thordal-Christearie & Jorgensen, nsen,2015)

This atmospheric boundary layer affects structures, causing a variety of wind phenomena around them as well as pressures on their surfaces, which engineers find interesting when designing structures. Near the earth's surface, the wind is blowing inthe other direction. The wind speed is lowered due to surface friction. Wind speed begins at zero and grows with elevation until it reaches its "gradient velocity" at gradient heights when friction from the earth's surface has no effect.

II. Wind effects on High- Rise Structures

High-rise structures are always constructed to withstand horizontal and gravitational loads. Wind load is almost as significant as seismic load when planning multi-story buildings. Thus, for the safety of tall buildings, it is critical to compute the estimationof horizontal loads, particularly wind loads.

At the surfaces of an obstruction, the streamlines produce pressure and friction forces. The friction forces act parallel to the surfaces, while the pressure forces act as pressureand suction normal to the surfaces.

The wind flow around an obstacle depends on the shape of obstacle. Shapes are of three types mainly

1) Streamlined bodies- where separation point occurs at wake of body
2) Quassi-streamlined bodies – where the flow is attached until the widest part of cross section, where separation bubbles are created at wake.
3) Bluff bodies – bodies that disturb the flow and their separation point is well before the maximum part of the cross section and large separation bubbles arecreated at the wake.

The gradient height is the height at which the friction of the boundary layer no longerhas a significant impact on wind speed, and it can be as high as 1 km.(Holmes, 2008)Strong turbulence is formed near the earth's surface as a result of friction, with turbulence prevailing at the bottom of the boundary layer and diminishing with height.In Figure 1.2, the separation point of the wind flow is seen at the front of the obstacleat both horizontal and vertical outline.

III. Structural System in High Rise Building

During the last centuries, the design of tall buildings has developed quite significantly,and even more rapidly in the past decades, where the term Supertall and Megatall structures have been introduced. The construction methods for a tall building are not a simple matter, and the constant efforts for developing construction methods to be able to construct even taller structures has led to complex systems inducing more strength and structural stiffness. Because of the increasing population density in the larger cities, primarily high-rise buildings have been developed in recent years. As a result, as the height of the building increases, the construction cost per unit area reduces, the weight per unit area decreases, but the hazard of high velocity at high levels increases. When the wind blows against a building, it puts pressure on all of itsfaces. On the structure, this results in the generation of lateral forces, vertical forces, and moments. These must be assessed in order to control deflections and ensure the occupant's safety.

IV. Objectives and Scope of Current Research

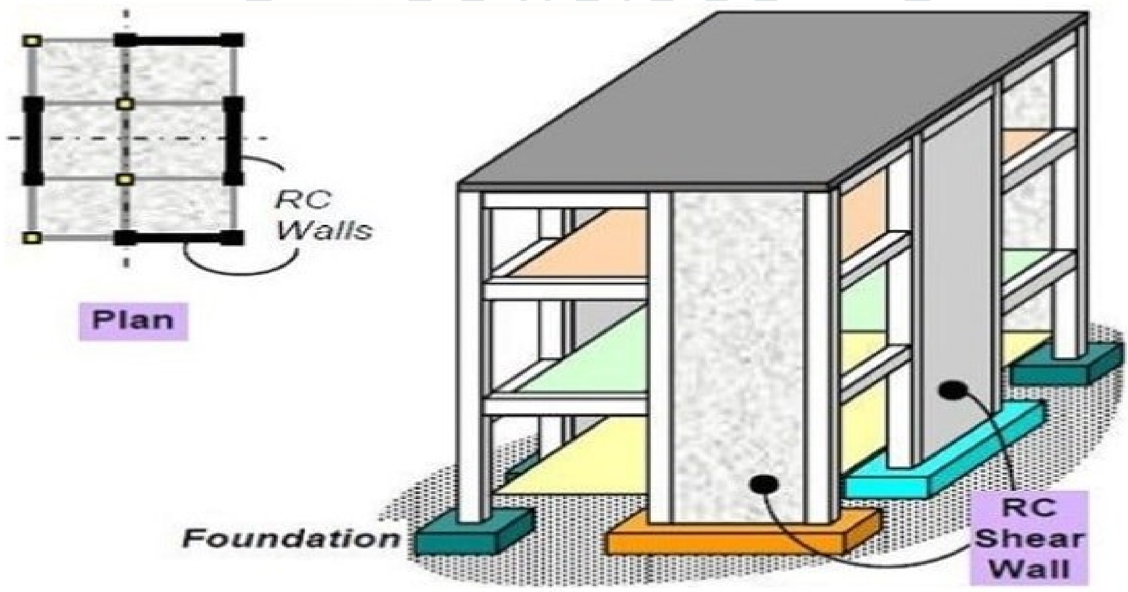
1. Response of isolated Square cross-sectional building at an wind incident angle0°, 30°, 60° with the help of staad.pro using pressure coefficients obtained fromIS 875 (part-3).
2. Find out the effect of interfering building with distance of (Y= 0, b/2, b, 3b/2, 2b.) and the influences of approaching turbulence intensity to be investigated and to find out the interference factor and coefficient of external pressure (Cpe).
3. Response of deflection, and hence bending moment are mainly obtained through analysis in each case and is compared using graphs in this dissertationprogress report.
4. To find the optimum location of shear wall in case of different wind incident angle and different interference configuration.

V. SHEAR WALLS

Shear wall is a structural element that runs from the foundation to the top parapet of abuilding. Shear walls can be made of a variety of materials, Reinforced concrete (RC)buildings typically have vertical plate-like Reinforced concrete walls in addition to slabs, beams, and columns (Figure 1.9). They might be as thin as 150mm or as thick as 400mm in high-rise structures. Shear and uplift forces are the two basic types of forces that a shear wall resists. Shear walls should offer the necessary lateral strength to resist horizontal earthquake forces, as well as lateral stiffness to prevent excessive side-sway of the roof or floor above. Shear walls are divided into several categories. Coupled shear walls, core type shear walls, column support shear walls, frame walls with infill frames, rigid frame shear walls, and so on are some of them. Shear wall behaviour in building also depend upon other factors also, these are

a) Positioning of shear wall in building
b) Material used
c) Length of wall
d) Thichness of wall

They are suitable for tall buildings where the deflection due to lateral forces has to becontrolled. They're simple to put together since the reinforcing detailing is simplistic, and they can be quickly installed on the job site. Furthermore, from an economics perspective, these fences are effective. Shear walls are often installed along the lengthand width of a structure. Damages caused by lateral forces caused by earthquakes and severe winds can be reduced by erecting shear walls. Construction of shear walls will provide building structures more rigidity, decreasing damage to the structure and its contents (Rajoriya & Uttam, 2016).



IV. CONCLLUSION

The scope of the present thesis was to increase the knowledge of how to investigate high-rise buildings exposed to severe wind loads, and thereby to produce a set of floor- by-floor loadings with appertaining load combinations, interpretable for a structural designer.

For different wind incidence angles under isolated condition;

1.) Deflection is less when wind incident angle is 0° and is found to increase as we increase the wind angle from 0° to 60°.
2.) When shear walls are installed on the building's external sides on all four centre spans. In all situations of wind incidence, the deflection of column A and column C isdecreased by a substantial amount. In addition, when the wind is blowing at 60 degrees, the maximum decrease is about 80%.
3.) When shear wall is provided at central core of building deflection is reduced by large amount for column B in all cases of wind incidence. In addition, when the windis blowing at 60°s, the maximum reduction is nearly 70%.
4.) Bending moment in column B for all wind incidence is negligible but values is found to be increasing as wind incidence angle is increased. For column A and C bending moment values are decreased as wind incident angle is increased.
5.) Bending moment is observed to reduce more when shear wall is located at centralcore of building.
6.) When Shear wall is present at the central core of building it increases the amount of area of steel required by the components.

REFERENCES

[1] Ali, M. M., & Moon, K. S. (2007). Structural Developments in Tall Buildings: Current Trends and Future Prospects. *Architectural Science Review*, *50*(3), 205–223. https://doi.org/10.3763/asre.2007.5027

[2] Bajaj, G. P., & B Bhaskar, A. G. (2016). Wind Behavior of Buildings With and Without Shear Wall (in Different Location) for Structural Stability and Economy. *International Journal For Technological Research In Engineering*, *4*(3), 528–532. www.ijtre.com

[3]Balendra, T., Anwar, M. P., & Tey, K. L. (2005). Direct measurement of wind-induced displacements in tall building models using laser positioning technique. *Journal of Wind Engineering and Industrial Aerodynamics*, *93*(5), 399–412. https://doi.org/10.1016/j.jweia.2005.03.003

[4]Bhusare, V. (2016). *research article shape effects on the wind induced response of high rise buildings sawant*. *1990*.