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Effect of Intensive Wind Load on High Rise Structure near Seashore

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ABSTRACT: This research work consist of Intensive wind load on high RCC structure near coastal line. In this research work, RCC G+15 high rise structure has been taken near coastal line of India (Arabian Sea).Wind load analysis is carried out by considering IS875-2015 part III. 55 m/s basic wind is considered for Intensive wind load analysis. The main aim of research work is to withstand highrise structures against wind catatropes.

KEYWORDS:G+15, High Rise Structure, wind load,IS875-2015 part III

I. INTRODUCTION

'Wind' or 'air in motion' usually creates a natural movement of air parallel to the earth surface creating a fast-moving current. It is caused due to the variation of temperature in the earth's atmosphere which in turn creates pressure differences, making the air or 'wind' to move from the high pressure region to the low pressure region. In the East Pacific Ocean, Atlantic Ocean, and Caribbean Sea, tropical cyclones are generally referred to as hurricanes. In the Western Paciffic region they are more often referred to as typhoons, and simply cyclones in the areas surrounding the Indian Ocean. Hurricane, tropical cyclone, and typhoon are different names for the same phenomenon: a cyclonic storm system that forms over the oceans. It is caused by evaporated water that comes off of the ocean and becomes a storm. The Coriolis Effect causes the storms to spin, and a hurricane is declared when this spinning mass of storms attains a wind speed greater than 120 km/hr

As the demand for taller, lighter and more slender structures continues to increase, so does the importance of designing for wind-induced building motion. Tall structures that meet the code for lateral drift requirements can still sway in strong winds. The recent disasters in United States due to the hurricanes also prove that existing buildings are not fully wind resistant Therefore it becomes necessary to review the computing techniques that are currently in use for the determination of along wind load. It is believed that ultimately wind load estimation will be made by taking into account the random variation of wind speed with time but available theoretical methods have not matured sufficiently at present for use in the Indian standard code. The procedure makes use of hourly mean wind speed and cumbersome charts to arrive at the Gust Factor. Following section discusses the steps to obtain along wind response as IS875-2015 part III. Building of height 46 m, analyzed as per the IS875-2015 part III. Manually and used ETABS program, the results are compared. This paper discusses the methods for calculating along wind response by Static Method and the gust factor method and by considering the effects of change in terrain category, as described by the present IS- IS875-2015 part III with the help of examples of tall buildings 46 m.

Year	Location	Casualties
7October,1737	Bengal, India	Over300,000
10October,1780	CaribbeanIslands	20,000to30,000
5October,1864	Calcutta ,India	50,000to70,000
1876	BengalIndia	200,000
1881	Haiphong,Vietnam	300,000
6June1882	Bombay ,India	Over100,000
16October1942	Bengal, India	Over35,000
28May,1963	Bangladesh	22,000

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II. OBJECTIVE

1.The objective of this project is to design high rise structures, along with foundation details, and to analyze it.
2.To carry out the Wind Analysis on G+15 RCC Structure by using IS875-2015 part III

III. METHODOLOGY

A study involving dynamic effect of wind load on RC buildings and study the behavior of the buildings. The gust factor method is used to determining along wind load effect. The methodology worked out to achieve the above-mentioned objectives is as follows:
1) As a part of research the international standards and their provisions were critically studies. For this purpose following codes were considered: Indian Standard - IS875-2015 part III
2) The E-TABS software is used to develop 3D model and to carry out the analysis. The lateral loads to be applied on the buildings are based on the Indian standard IS875-2015 part III
3) Comparative study on the result obtained from the above analysis.
4) Result and discussions.

IV. SYSTEM DEVELOPMENT

A) Materials

The grade of the concrete considered is M 30 with the compressive strength of 30 kN/m^2.TheFe 500 grades of the HYSD bars are considered for rein forcing steel.

B) Load Calculations

Dead Load- These includes the weight of all the components at each level, i.e., roof including parapets, roof finishes, slabs, beams, head room including plasters and surface cladding, etc., at each floor level including fixed masonry or other partition walls, infill walls, columns, slabs and beams, weight of the stairs, cantilever balconies, parapets and plastering or cladding wherever used. The dead loads may be calculated on the basis unit weights of materials given in IS 875 Part-I 2015. Unless more accurate calculations are warranted, the unit weights of plain concrete and reinforced concrete made with sand and gravel or crushed naturalstone aggregate may betaken as 24kN/m3 and 25 kN/m3 respectively
External wall = 12.42 kN/m
Internal wall = 9.72 kN/m
Parapet wall = 2.7 kN/m
Floor load = 3.75 kN/m2
Live Load: It has two components i.e., Sustains, which is less uncertain and acts over a long period, for example: Furniture and other one is Transient, which is more uncertain and acts over a short period, for example: People. Live Loads include adequate allowance for ordinary impact conditions. Weight of machinery and moving loads shall be increased for impact. Imposed loads are taken as per IS 875 Part 2, which deals with the loads on roofs, floors, stairs, balconies, etc., for various components. Let the live load is assumed as 3 kN/m2
Wind Load: For Wind possesses kinetic energy by virtue of its velocity and mass, which is transformed into potential energy of pressure when a structure obstructs the path of wind. Natural wind itself is neither steady nor uniform; it varies along the dimensions of the structures as well as with time. When the complete assembly of the lattice structures is considered, wind forces on different members of the structure are only partially correlated and time varying. IS code is referred for wind load analysis is IS 875-2016 part 3

C) Load Combination:

The load combinations for design purpose shall be the one that produces maximum forces and effect and consequently maximum stresses from the following combination of loads:
Dead Load + Live Load
Dead Load+Live Load+WindLoad
Dead Load +Wind Load

D) Member Properties:

Sr. No.	MemberName	SizesOf Member	SectionAnd Property
1	Beam	300 mmX330mm	Fe500& M 30
2	Column	500 mmX600mm	Fe500& M 30
3	Slab	150 mm	Fe500& M 30
4	ExternalWall	230 mm	Brick Masonry
5	InternalWall	180 mm	Brick Masonry
6	ParapetWall	150 mm	Brick Masonry

V. WIND LOAD ANALYSIS

A). DesignWindSpeed(Vz):

The basic wind speed (V_b) for any site shall be obtained and shall be modified toincludethefollowing effectsto get design windvelocityatanyheight forthechosenstructure

- Risklevel
- Terrainroughness,heightandsizeofstructure
- Localtopography

It can be mathematically expressed as follows

$Vz=V_b K_1 K_2 K_3\ K_4$

Where,

Vz = Design Wind Speed at any height z in m/s

V_b =Basic Wind Speedin m/s

K_1 =1.08

K_2 = 1.166

K_3 =1

K_4 = 1.30

Vz=55 x 1.08 x 1.166 x 1 x 1.30

Vz=60.92 m/s

b). DesignWindPressure (Pd):

Pd= Kd X Ka X Kc X Pz

Kd= Wind directionality factor for buildings as per clause 7.2.1

Kd= 1.0

Ka=Tributory Area

Ka= 3m x 3m

Kc= Combination Factor

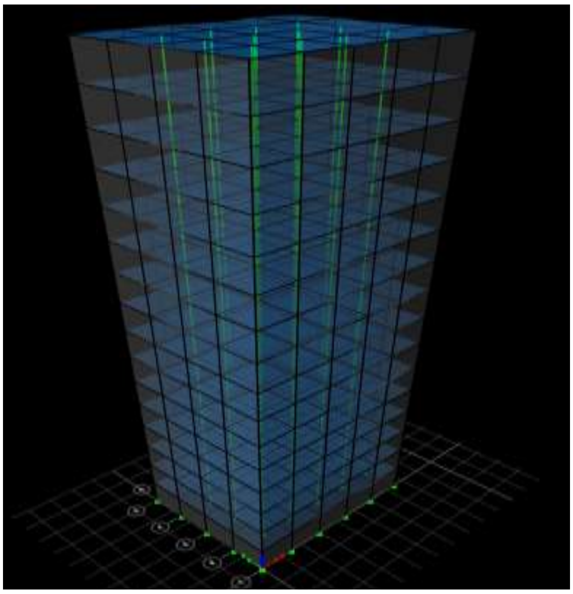
Kc=0.9

Pd= Kd X Ka X Kc X Pz

Pd= 1 x 1 x 0.9 x 0.6 x 60.92^2

Pd= 2009.34 N/m^2

VI. MODEL IN ETABS



FigureNo1 G+15 RCC Structure inETABS

VII. RESULT AND DISCUSSION

A) DesignWindPressure

Design wind pressure is found 2009.34 N/m^2 by manual wind load Analysis

Design wind pressure is found 2188 N/m^2 by Csi. Etabs software wind load Analysis

B) Base Reaction

Base Reaction is found out 2023 KN by Csi. Etabs software wind load Analysis

c) Maximum Storey Displacement

Maximum storey displacement found in permissible range as per Indian Standards. It is near about 12.22 mm

VIII. CONCLUSION

Following are the conclusion taken from wind load analysis of G+15 RCC structure.

1. Design wind pressure is found more in Csi. Etabs software wind load Analysis than manual Calculations.
2. Base Reaction is found out 2023 KN
3. For making high rise structure safe against high wind pressure, importance factor should be taken maximum.
4. The gust factor decreases with the height, because as the height of the frame.
5. Storey drift goes on increasing on the total

height of the building frame increases.

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