IMPACT OF WIND ON A RCC TALL STRUCTURE WITH STEEL BRACING

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Abstract : When a structure is subjected to wind and earthquake, it responds by deflecting, drifting and vibration. The wind forces act on exposed surface of structure depending upon direction of wind, topography, height of structure. An earthquake force can be settled into three commonly opposite headings the two even plane (x and y) and the vertical course (z).This movement motive the shape to vibrate or shake in all 3 directions; the foremost path of shaking is horizontal. It may be very critical to don't forget the consequences of lateral masses induced from wind and earthquakes within the evaluation of strengthened concrete systems, specifically for excessive-tall structures along with cantilever projection at exclusive stages. The basic intent of analysis for wind resistant structures is that buildings should be able to resist minor wind forces without any specified modification in structure design.

The present study is to go through deep analysis of structure consisting cantilever projection at different levels subjected to extreme wind load.The structure is located in terrain category 4.The analysis is Carried out with the help of software's ETabs. The building model in the study has 32 storey's with constant storey height of 3.5 m. Ten different models are used to analyze with different bay lengths and the number of Bays and the bay-width along two horizontal direction

I. INTRODUCTION

Nowadays, the increasing population of cities demands more houses and space for living. The high rise building can offer better number of houses and utilizes less space of land. Majority of buildings are constructed with abnormal in plane and with vertical irregularities. Tall buildings are generally effected by wind loads. Wind exerts forces and moments on the structure in the form of wind pressure which is nothing but air distributed across the buildings. Sometimes due to natural calamities and nature of wind, it can take so devastating form that it can alter the internal ventilation system when it enters into the buildings. Hence it becomes very important to study the effect of wind on the building.

When the height of building increases the sway or lateral displacement increases which causes additional forces in the members. In order to reduce this sway many lateral force resisting system were developed like braced hinged frame, rigid frames, rigid frames steel dual system with shear walls, concrete shear wall+ steel rigid frames, etc.in this present study a concrete building is studied with the introduction of steel bracings under the effect of wind forces.the software used I this study is ETABS.

II. OBJECTIVES

A) To perform analysis on G+25 story building and study the behavior of rcc multistory building under wind loading.
B) To study the effect of story displacement, story drift and the time period of the structure subjected to wind loads.
C) To identify the bracing system which can be effective on the tall buildings under the action of wind loading

III. ANALYTICAL MODELING

3.1 DESCRIPTION OF BUILDING

- Model 1: Regular Model G+25 Storey,
- Model 2: G+25 Storey, in this model steel bracing in x-direction
- Model 3: G+25 Storey, in this model steel bracing in Y-direction
- Model 4: G+25 Storey, in this model steel bracing with shear wall
- Model 5: G+25 Storey, in this model shear wall in corner
- Model 6: G+25 Storey, in this model shear wall in corner and center
- Model 7: G+25 Storey, in this model shear wall and core wall and bracing in Y-direction
- Model 8: G+25 Storey, in this model v bracing in x & y direction.

DESIGN WIND SPEED

- The design wind speed is obtained taking into account factors such as risk coefficient, height, terrain roughness, size of structures and local topography.
- It can be mathematically expressed as follows: Vz = Vb*K1*K2*K3
  Where,
  Vz = design wind speed at any height z in m/s;
  K1 risk coefficient
  K2 = terrain, height and structure size factor
  K3 = topography factor
- Category 3 - Terrain with various thoroughly spaced hindrances having the size of building-structures up to 10 m in height with or without a few insulated tall structures.

Class C - Structures and/or their components such as covering, finishing, guttering etc. having extreme dimension (greatest horizontal or vertical dimension) greater than 50 m.

DESIGN DATA

- Building Analysis G+25
- Grade of Concrete M 40(For Columns)
- Grade of Concrete M 30 (For Beams, Slab)
- Column Size 300mm X 900mm, 300mm X 1200mm
- Beam Size 300mm X 530mm
- Slab thickness 150 mm
- Imposed load 3.0 kN/m2
- Floor finish 1.5 kN/m2
- Density of masonry 19 kN/m3
- Wall load 13.32 kN/m

RESULTS AND DISCUSSIONS

TIME PERIOD

- It is nothing but the undamped free vibration of the structure.
- The values of time period obtained by the analysis using Etabs.
- As the structure is not similar and hence time period varies. it is observed that model 3 has the highest time period as it consists of steel bracing in y- direction.

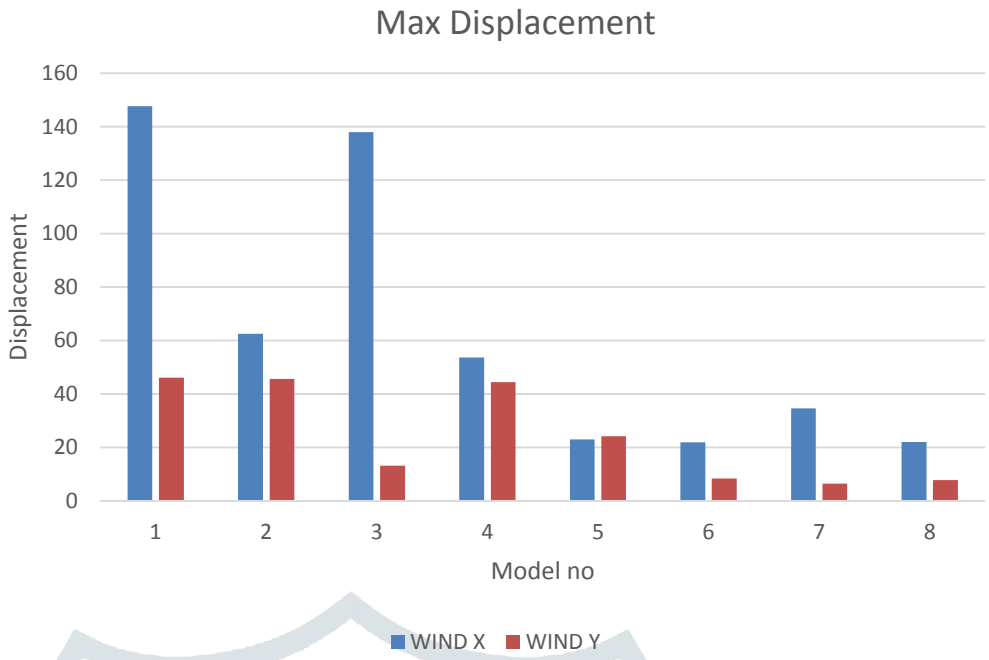
Time Period Calculations	
Model no	Time Period in Second
1	3.067
2	3.441
3	3.604
4	3.508
5	2.402
6	1.534
7	1.802
8	2.506

STORY DISPLACEMENT

- Storey displacement is nothing but the lateral displacement of the Storey relative to the base.
- It is total displacement of its Storey with respect to ground.
- storey displacement is calculated at each storey using ETABS analysis.
- Model which has shear wall in corner and center have minimum displacement values.

Maximum Storey Displacement

MODEL NO	WIND X	WIND Y
1	**147.675**	**46.094**
2	**62.533**	**45.631**
3	**137.931**	**13.177**
4	**53.598**	**44.419**
5	**22.938**	**24.096**
6	**21.821**	**8.336**
7	**34.572**	**6.451**
8	**21.941**	**7.72**



STORY DRIFT

- Story Drift is nothing but the difference in level which can be above or below in terms of displacements.
- It is usually interpreted as the inter story drift between two stories.
- The drift values are designed and noted below, these values are set up by executing by different models using Etabs.
- Model which has shear wall in corner and center have minimum drift values.
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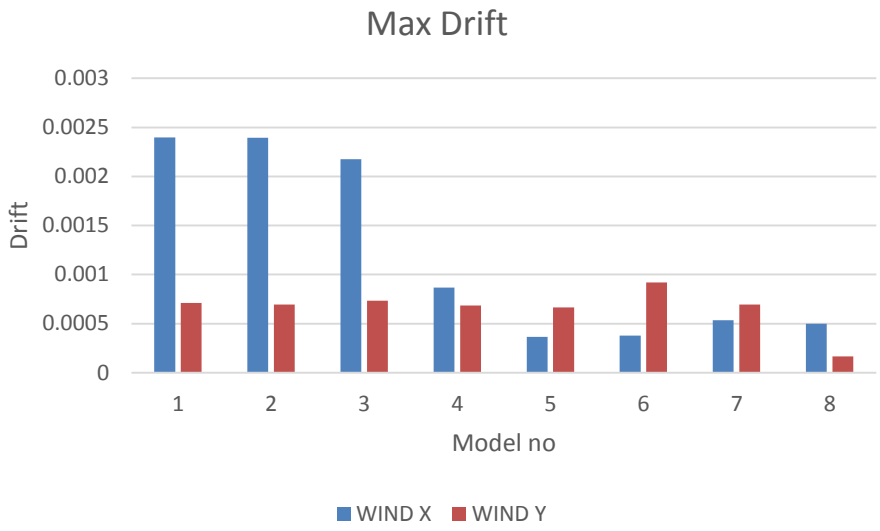
MAXIMUM STOREY DRIFT

MODEL NO	WIND X	WIND Y
1	0.002398	0.00071
2	0.002395	0.000696
3	0.002176	0.000733
4	0.000869	0.000684
5	0.000364	0.000664
6	0.000379	0.000919
7	0.000536	0.000695
8	0.000498	0.000167



CONCLUSIONS

- It also noted that model with sw with steel bracing is very effective under wind loading.
- Model which has shear wall in corner and center have minimum displacement values.
- It is very important to select the shape of the building under the wind loading.
- Changing the terrain category and structure class leads to the change in response of structures.

FUTURE WORK

- Models can be further studied using earth quake loads.
- Models can be further analyzed by using different terrain categories.
- Further study can be done using the soft storey effect in the models.
- Further we can study the effect of wind load on different irregular shape buildings .

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