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Study on Wind Analysis of Multi-Storied Building with Different Shapes and Different Terrain Category.

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Abstract:
ETABS (Extended three dimensional analysis of building system) is the tool to analysing the multi-storey structure. In this study the effect of wind on multi storied structure for the different shapes of structure as well as different terrain category is observed. In addition, the effect of shape on wind analysis is also discussed. The comparison of wind for Rectangular, and -H shape, C shape, L shape Plus shape, Non uniform shape of building structure is presented. The post analysis consist typical characteristic comparison related to storey displacement, storey drift, story stiffness. etc.
Keywords: *E-TABS, Multi-storey building, Wind analysis, Storey Drift, storey displacement, story stiffness.*

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I. INTRODUCTION

In general, for the design of tall buildings wind loads needs to be considered. Governing criteria for carrying out analyses wind loads as per IS 875(Part 3):1987, when wind interacts with a building, both positive and negative pressures occur simultaneously, the building must have sufficient strength to resist the applied loads. Load exerted on the building is transferred to the structural system then passing through the foundation and finally transferred to the ground. The wind pressure is basically a function of exposed basic wind speed, topography, building height, exposed area and shape of the building. Two load cases govern the design of high rise structures, besides dead & live loads: Earthquake loads and wind loads. Here we have concentrated on wind loads. It drastically changes the behaviour of high rise structures as the height and wind speed increases. Usually shear wall is used in the high rise building. To carry out the modelling and analysis for 20 storey building E-TABS software is used. To study the wind motion on these models the structure for static shear wall and steel bracing are used. Comparison of the regular and irregular structures for dynamic properties was studied through the results of displacement, share forces bending moment and storey drift, story stiffness.

1.1: Specifications of structure

Height of structure	64 m
Height of each story	3 m
Thickness of slab	150 mm
Thickness of wall	200 mm

Table 1 : specification of buildings.

1.2: Material properties

Grade of concrete	M 30
Grade of steel	FE 500
Density of concrete	25 cubic m
Density of brick	20 cubic m

Table 2 : specification of materials.

1.3: Specification of loading

Live load	3 KN/M
Wall + floor finish load	24 KN/M
Basic wind speed	39 M/S
Terrain category	1,2,3,4
Importance factor K4	1
Risk co- efficient K1	1.06
Topography factor K3	1
Rcc design code	IS 456: 2000
Wind design code	IS 875 part 3 2015

Table 3 : specification of loading.

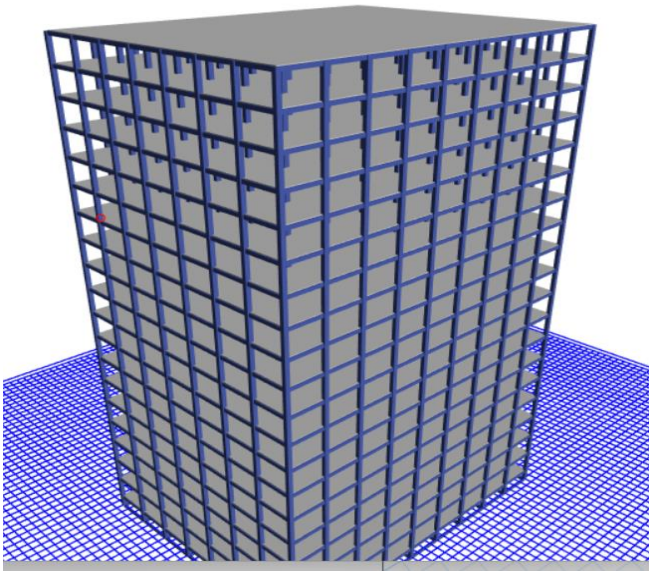

Fig 1: Render view of rectangle shape Building.

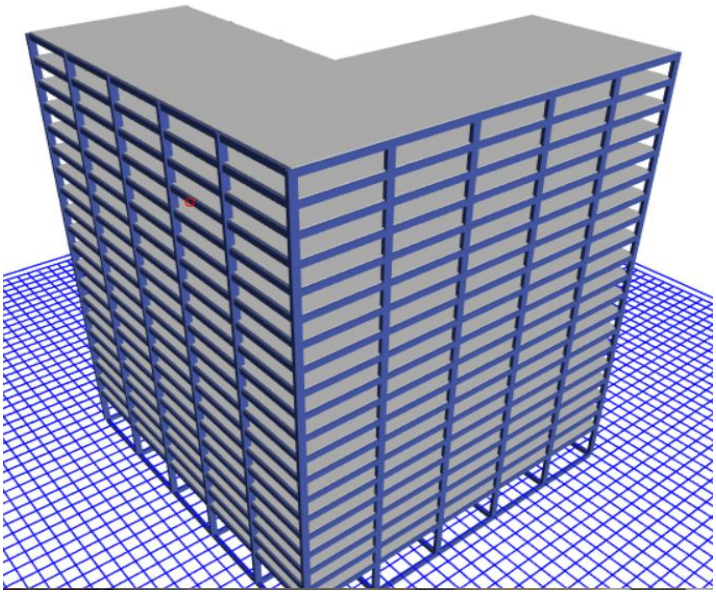

Fig 2: Render view of L shape Building.

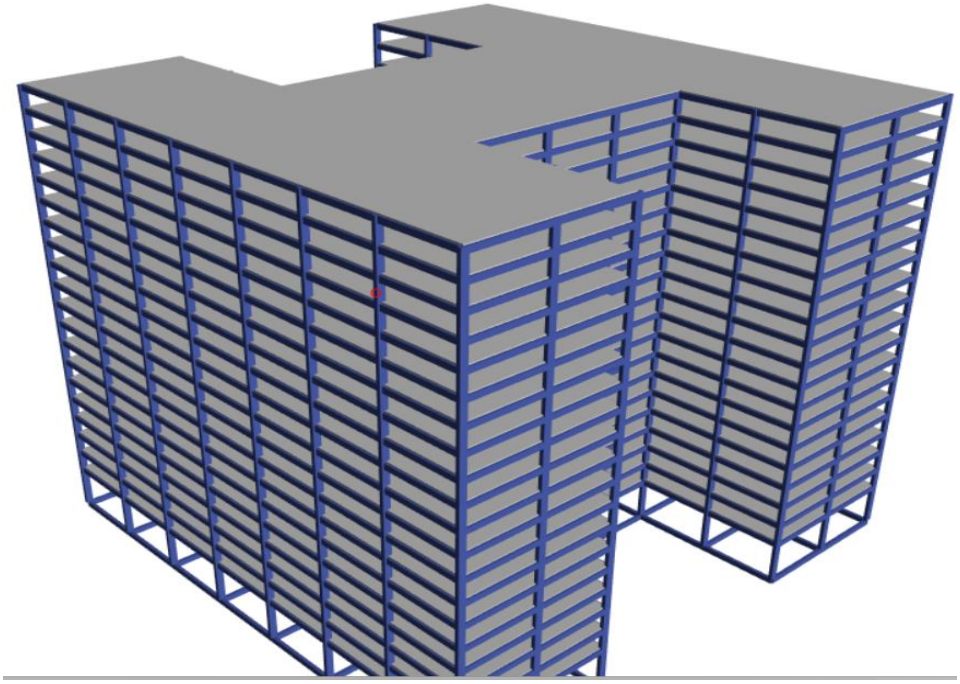

Fig 3: Render view of H shape Building.

II. METHODOLOGY

Draw the various structure of different shapes in e-tab software , assigning the all section and material properties. Also assigning the loads structure for their different terrain category. Analyse the all structures and comparison carried out . The all structures is compare with story displacement, story stiffness and story drift.

III. ANALYSIS RESULTS

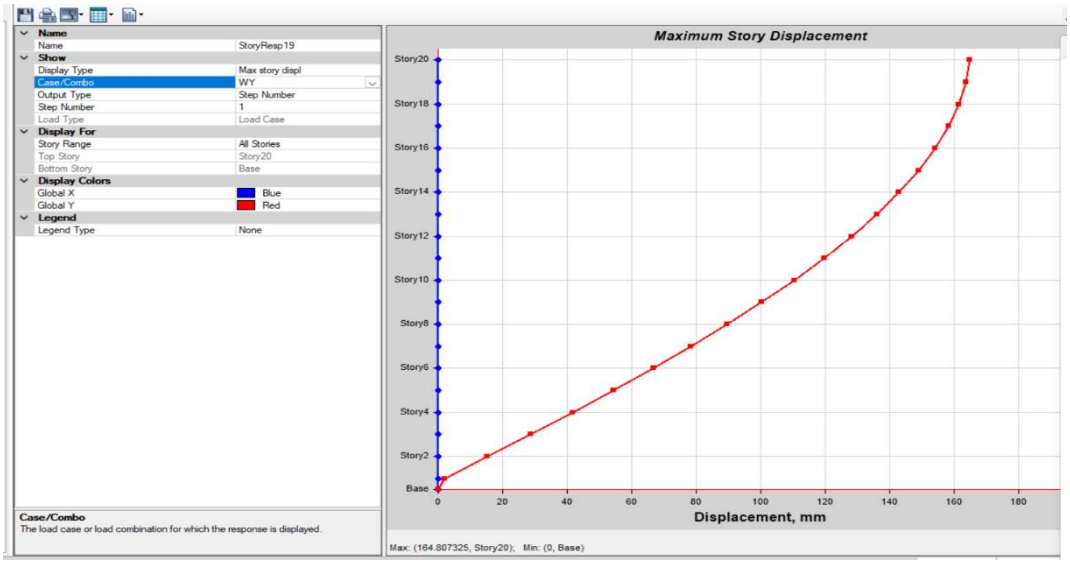

Fig : 4 Story displacement.

	Displacement				Story Stiffness				Drift			
Category Shape	1	2	3	4	1	2	3	4	1	2	3	4
Rectangle	57	51	45	45	4.38	4.37	4.3	4.3	1.62	1.45	1.2	1.22
Non uniform	213	192	170	170	1	1.1	1.1	1.1	6	5.4	4.5	4.5
L	41	36	26	26	450	456	456	456	3.6	3.1	2.3	2.2

H	29	50	40	29	1.07	1.075	1.76	1.78	2.9	5	4	2.95
Plus	205	185	164	164	1.35	1.33	1.32	1.32	6	5.3	4.5	4.5
C	82	91	75	73	2.78	2.78	2.77	2.77	2	2.3	1.7	1.7

Table 4 : Story Displacement ,drift, stiffness results.

IV. CONCLUSION

It can be concluded that for 20 storied buildings with a height of 64 m, by varying its shape and terrain category there will also be variation in the storey drift which will increase with the increase in the height. Similar is the case for joint displacement also. It can be concluded that H-shape and C -shape are the least stable of all the shapes. Rectangle shape and L are the most stable. In case of . Rectangle shape and L shape the stiffness was high as compared to the other cases. The story drift of rectangle and L shape structure is low.

Overall analysis suggests rectangular structure for along wind or across wind direction is preferable due to large stiffness, less displacement against wind and low drift.

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