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EFFECT OF STRUCTURAL SHAPE ON WIND ANALYSIS OF MULTISTORIED RCC STRUCTURES

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ABSTRACT

The recent advancement in building system has structural shape and vertical growth impact. Though the aesthetic view of structure plays an important role but lateral stability also has its vital importance. In this study Multi-storey (G+25) structure with different shape is modelled in the ETABS 2015 software, to check its lateral load stability in concern with the wind load. Four models having different structural shape is analysed for displacement and story drift and the effect of wind is analysed for different structural shape. The wind prone zone area is considered and parameters regarding the case have selected to analyse the model. All considered structure is compiled using RCC frame design system. The aim of this study is to obtain the best suitable structural shape for stability in wind prone area.

Keyword: Different structural shape, ETABS, RCC structure, Story Drift, Wind analysis.

I INTRODUCTION

1.1 General

The recent trends in construction have given most importance to vertical growth, as the city grows in vertical aspect there is need to design structure which has given more importance to vertical growth. The vertical growth in structure can be fulfilled by constructing the high rise structure.The study involves different high rise structures used generally for residential, commercial and hospital building, which is typically square shape, rectangular shape, U-shaped building and Bundled tube symmetric RCC structure. Generally square, rectangular, U-shaped building is used for high rise structure but symmetric bundled tube structure is used to construct typical high rise structure in which special provision are made for wind, in these structure wind can easily pass by though the openings provided in the intermittent floor. These spacing for wind is provided for regular height to nullify the effect of displacement cause by the wind.

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The lateral load generally applied to the building by earthquake and wind load in this study (G+25) RCC building analysed for characteristic wind load for extent of diaphragm and applied on extent of each story. Based on these load combination load taken by IS: [875 Part (5)] that is 1) Imposed load2) Dead load 3) Wind load is applied in all cases, on the behalf optimisation made for effect cause by different load combination and the effective load pattern causing most displacement and drift is calculated. The direct relation is adapted to design optimistic section for building structure to have proper sustainable design which can easily withstand against the wind load.

1.2 Litraure Review

Shaikh Muffassir, L.G. Kalurkar (1) Presented the work on comparative study on both RCC and Composite structure analysed for different plan configuration found that U-shape building is not preferable for wind prone zone for (G+5) (G+15) (G+25) structure. The comparative study concluded that composite structure are ductile than RCC structure therefore Composite structure are preferred in wind prone zone.

Alfa Rasikan, M.G. Rajendran (2) presented the work regarding wind behaviour of building with and without shear wall, concluded fifteenth storyand twentieth story building when analysed for wind in presence and absence of shear wall. The percentile displacement in fifteenth story to twentieth is less for provision of shear wall, mean the shear wall structure gives the less displacement due resisting lateral wind load displacement.

Abhay Guleria (3) presented the earthquake lateral load effect on high rise building system as per (IS 1893: part 1:2002). The modelling and analysis carried out by ETABS and different plan configuration, found that L-shape and I-shape structure perform same in overturning moment, story drift and story displacement in earthquake analysis, study also involves the shape importance in effect of earthquake prone zone.

Sanhik Kar Mjumdar, Priyabrata Guha (4) Presented both effect seismic and RCC on (G+5) structure by using STADD PRO. Study carried out for bending moment due to earthquake and wind load found that the bending moment due to earthquake in G+ 5 structures is greater as compared to bending moment caused by wind lateral loads.

1.3 Objective

The study is focused for G+ 25 structures built in RCC material, the object of study to find displacement in structure and story drift in all the structure mentioned. The displacement and drifts performance in wind prone zone. The study also important to design proper section using ETABS software. Result are analysed for Effective structure in wind lateral load prone zone.

II SYSTEM DEVELOPMENT

In this study the square shape, Rectangular shape, U shaped and bundled tube symmetric structure is considered for modelling. In addition RCC structure is analysed for different load combination such as dead load , live load and wind load as per IS Code 875 (Part 5)-1987. Parameter for study which is taken is shown in Table

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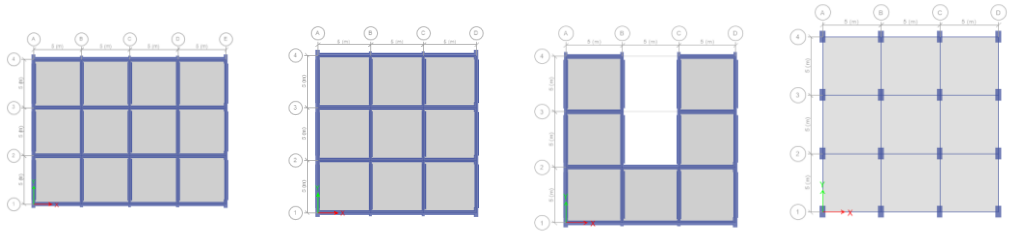

Fig.1- plan view all buildings

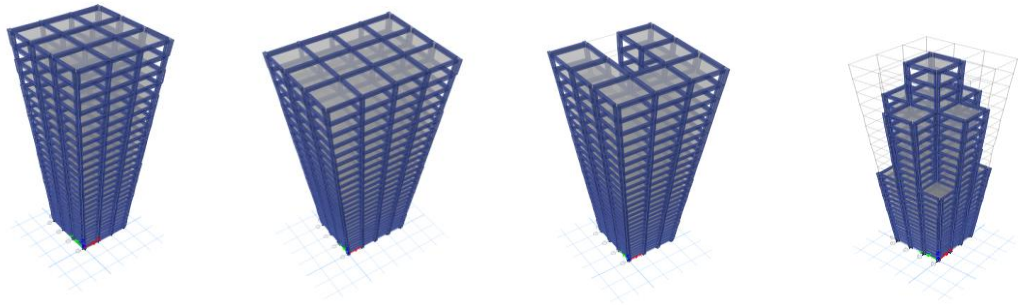

Fig. 2- 3d view of square, rectangular-shape, U-shape, bundled tube symmetric RCC building

Table 1: Material Properties

Grade of Concrete	M25
Grade of Reinforcing steel	Fe 415
Density of Concrete	25 KN/m³
Density of Brick masonry	20 KN/m³
Damping ratio	5%

Table 2: General Specification of Building

Plan dimension	15mx15m
(G+25)	83.1 m
Storey Height	3.1 m
Bottom Storey Height	2.5 m
Thickness of wall	230 mm

Table 3: Section for RCC Building

RCC	Section
Beam	350X700
Column up to 16th story	
Column 1	900x1100
Column 2	700x1100
Column 3	500x1000
Column from 16th to 27th story	
Column 4	450x1000
Column 5	400x900
Column 6	300x700

Table 4: Specification of Loading

Floor load	1 KN/m²
Live load	4 KN/m²
Wall load	12 KN/m²
Structural class	B
Basic wind speed	50 m/s
Risk coefficient (K1)	1
Topography factor (K3)	1
Wind design code	IS 875:1987 (Part 3)
RCC design code	IS 456:2000
Steel design code	IS 800:2007

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All these structural shape and section properties are analysed in the area like structural class B; typically can be indicated in Coastal region of India and Madras and nearby topographical area. The basic speed in such region is about 50 m/s. Bottom story aspect is considered as of 2.5m for deep foundation to have foundation stability.

III RESULT AND DISCUSSION

The analysis which carried out for G+25(Square, Rectangular, U-Shape and Bundled symmetrical shape) shows that the two parametric variation. First is the story displacement and second is the story drift. Story displacement is the movement of each floor due to lateral forces of wind in either X or Y direction. The maximum impact of the displacement is found in the X direction.

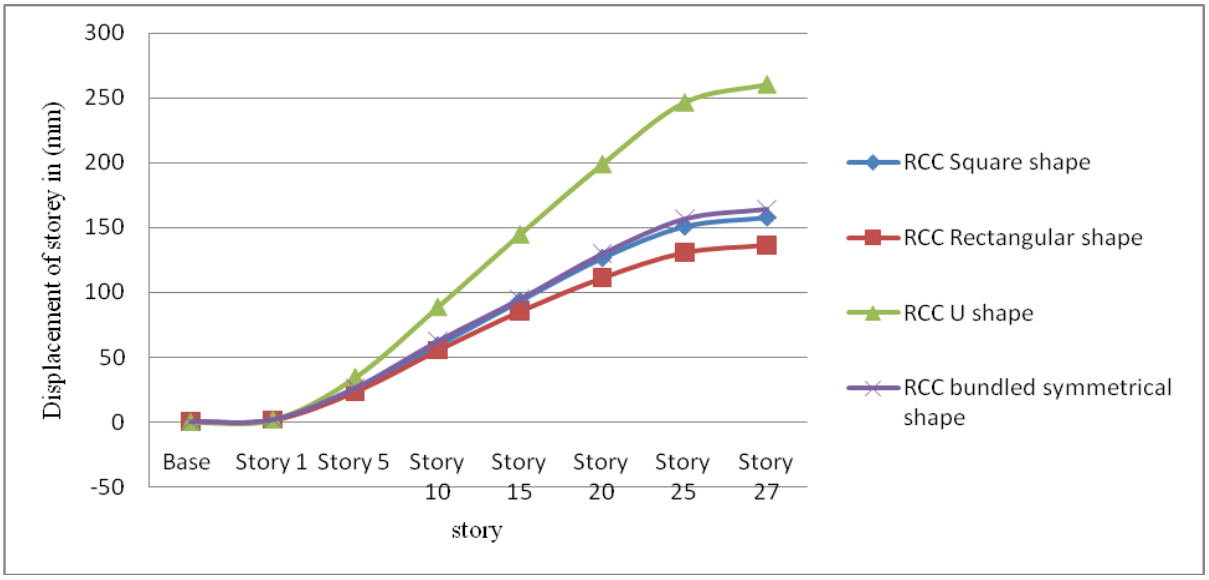

Fig.3- story displacement for G+25 RCC structure

Amongst the displacement result it has found that RCC U-shape structure is more prone to displace by 260mm and followed by RCC bundled symmetric shape. Comparing this result RCC rectangular shape is more reluctant for displacement found out to be 138mm.

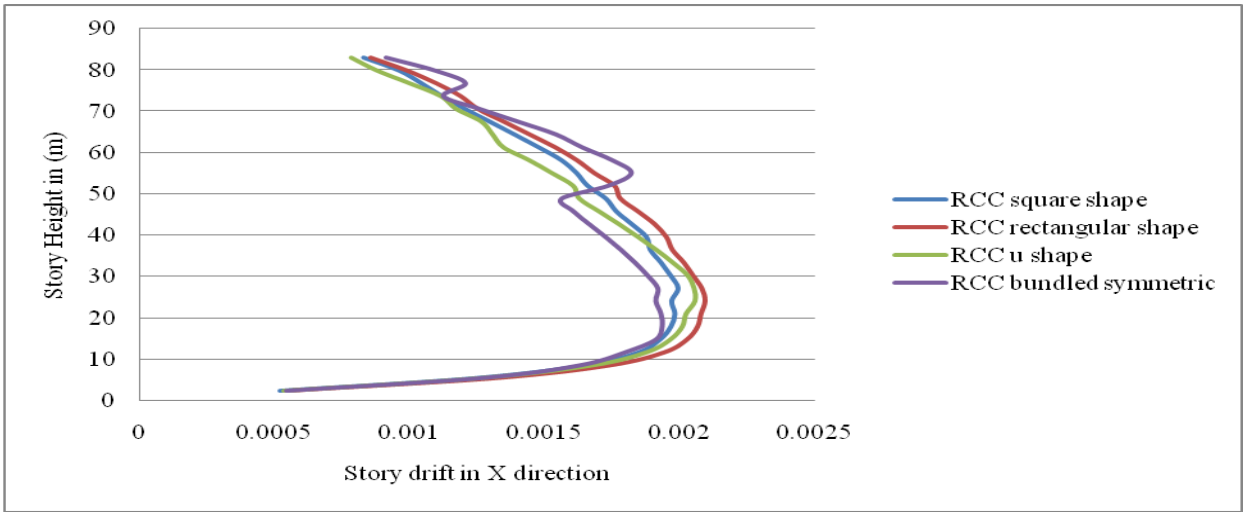

Fig.4- story drift for G+25 RCC structure

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The analysis for story drift shows that story drift is irregular in RCC bundled symmetric shape because its structural irregularity at regular interval height. The RCC Square and Rectangular structure has less drift as indicated in graphs.

IV CONCLUSION

1) RCC structure is preferred for stiffness and durability in high rise structure.
2) The study concluded that the effective shape for to resist wind lateral load is rectangular shape structure for G+25 consideration.
3) Generally symmetrical structure is preferred for high rise structure but in this case square shape found to be less stiff compare to rectangular structure in wind load consideration.
4) The structure in RCC made bulky and less economical but more rigid and durable in nature.
5) U-shape structure is not preferred as it gives the maximum displacement and maximum drift due to its geometric shape most susceptible for wind load.
6) Bundled tube symmetric RCC structure is need to analysed for special provision and improved cladding surface to attain optimised result.

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