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Comparative Analysis of a Multistory R.C Building Frame using Floating Column at Different Location

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Abstract — The recent wind load have tendency to damage the structures, in multi storey and high rise structure to prevent against vibration. We can provide floating column at different locations. The main focus of this work is to analyze an R.C. building frame with floating column at different locations of a building to know its most effective location .Floating column is specially design structure column in corporate in building to resist lateral forces that are produced in plane due to wind blasting, earthquakes and other forces. In this work (G+4) storey , R.C. building frame has been analyzed for Building Classification Category II by using STAAD-pro. Exposure B were used. The method used in this work is Equivalent Static Analysis method. There are various parameters were considered such as maximum node displacement , maximum reaction are taken to compare the result for different model. According to this analysis Model –IV is most effective one.

Keywords- Wind analysis, Floating column, Staad- pro, Building Classification Category II, Exposure B

INTRODUCTION

Wind blasting are one of the nature's greatest hazards; throughout historic time they have caused significant loss of life and severe damage to properties, especially to man-made structures. If we will do so much calculations for a high rise building manually then it will take too much time as well as human errors can be occurred so the use of any software like STAAD-pro., will make it easier. The primary purpose of all kind of structural systems used in the building type of structures is to transfer gravity loads effectively. The most common loads resulting from the effect of gravity are dead load and live load. Besides these vertical loads buildings are also subjected to lateral loads caused by wind blasting/earthquake. Lateral loads can develop high stresses produce sway movement or cause vibrations. Therefore it is important for safety and economic to provide floating column on multi storey buildings in different locations. Floating column members in R.C. multi storey building is conservative, simple to set up, involve less space and give obliged quality and inflexibility.

LITERATURE REVIEW

A lot of research work has been done in the direction of Floating column on multistorey buildings. Sampath kumar , V.S.Jagadeesh [6] analyzed Effect of floating column on seismic response of multistory building . Shaikh Muffassir , L.G. Kalurkar [7] studied Study of wind analysis of multistory composite structure for plan irregularity. Nakul A. Patil ,Riyaz Sameer Shah [14]analyzed Comparative Study of Floating and Non-Floating Columns With and Without Seismic Behaviour. Swati D.Ambadkar and Vipul S. Bawner[10] analyzed Behavior of Multi story Building under the Effect of Wind load. Ashis Debashis Behera, K.C. Biswal [5] studies 3D Analysis of building frame using Staad Pro. However the study related to Wind analysis of floating column at different floor level has not been yet done much.

OBJECTIVE OF STUDY

1) To judge the effect of floating column on an R.C. Building when provided at different locations.
2) To analyze an R.C. building frame using STAAD-pro. software setup.
3) To study the results of maximum Node Displacement, maximum reaction obtained.
4) To understand the purpose of using floating column using STAAD-pro. through this work .
5) To know the best location of floating column for parameters considered.

GEOMETRY AND MODELLING

Loads acting on the structure : -Dead Load (DL) and Live load (LL) : As per IS 875 (Part 3) (1987) respectively.
-Wind load (SL) : As per IS 875 (Part3)approach.
DL : Self weight of the structure, Floor load and Wall loads
LL : Assumed Live load 3 KN/sq.m is considered for all floors (except top floor) and 1.5 KN/sq.m for top floor.
Intensity : 1.5

ASCE-7:	2002
Building Classification Category :	Cateory II
Exposure Category:	Exposure B
Structure Type:	Building Structures
Exposure Factor:	1

The preliminary data as is taken up for this study:

Wall thickness (including Plaster) -	230mm
Size of beams -	450mm × 300 mm
Number of storeys -	G+4
Plan size -	12m x 12m (Each grid size 3m x 3m)
Size of all columns -	450mm × 300 mm
Total height -	12m
Floor to floor height -	3.0m
Ground storey height From Foundation -	3.0m
Depth of slab -	125 mm
Support condition –	Fixed

METHODOLOGY

Steps to model and analyze the R.C.C. building frame. Firstly go to run structure wizard and select bay frame. Then follow the following steps given below,

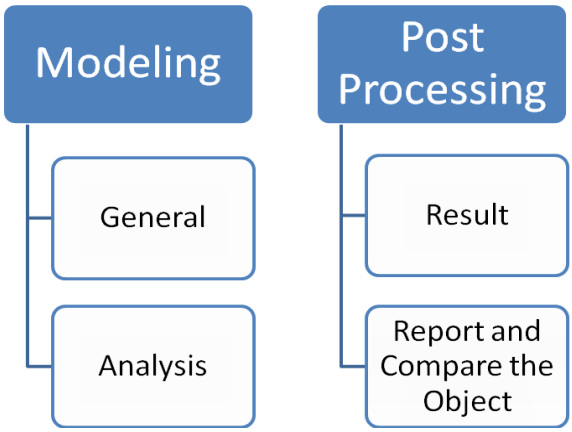

Fig.1: Analysis steps

RESULT AND GRAPHS

NOTE: 1) Minus (-) sign shows decreasing percentages.
2) Plus (+) sign shows increasing percentages

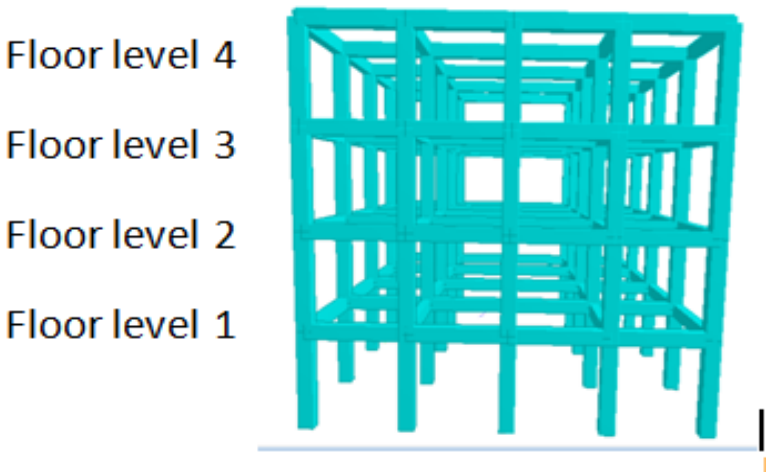

Fig-2:Screenshots of considered Floor level

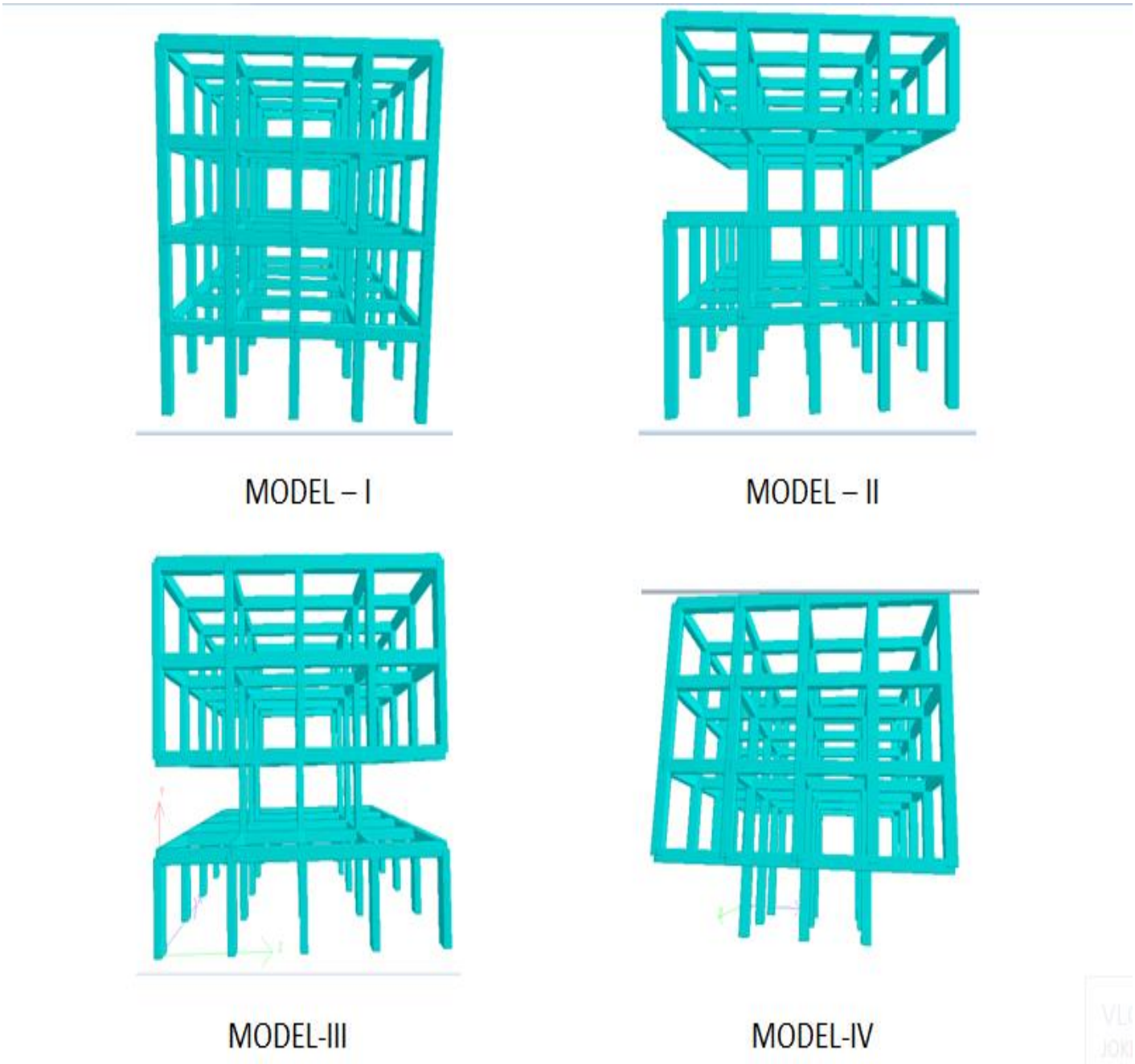

Fig-3:Screenshots of considered Models

A. Maximum Node Displacement:The maximum Node displacement are given in Table.1.

Table.1.Maximum Node Displacement (mm)

DIRECTION	MODEL - I	MODEL - II	MODEL - III	MODEL - IV
X	1.000	2.657	2.133	2.035
Percentage w.r.t Model – I		165.7	113.3	103.5
Z	1.254	3.059	2.444	2.262
Percentage w.r.t Model – I		143.939	94.896	80.382

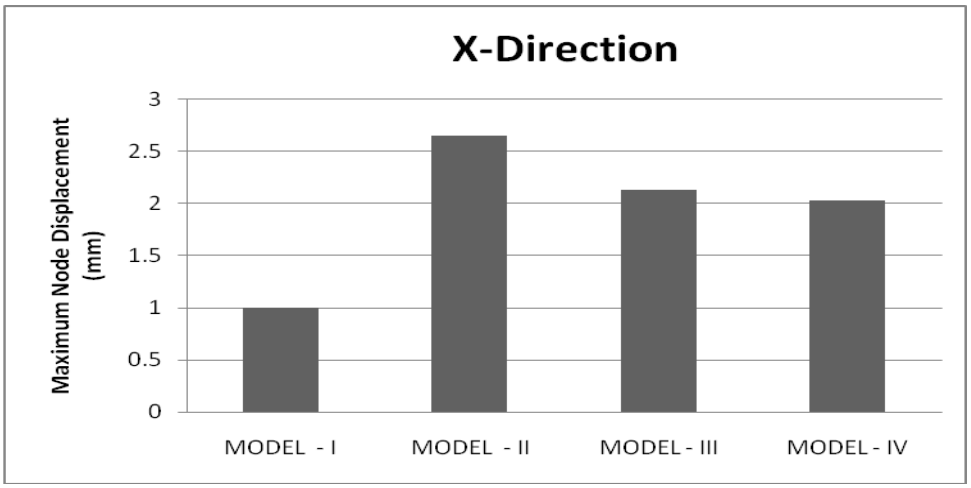

Fig.4. Maximum Node displacement (mm) in X -direction for node-100

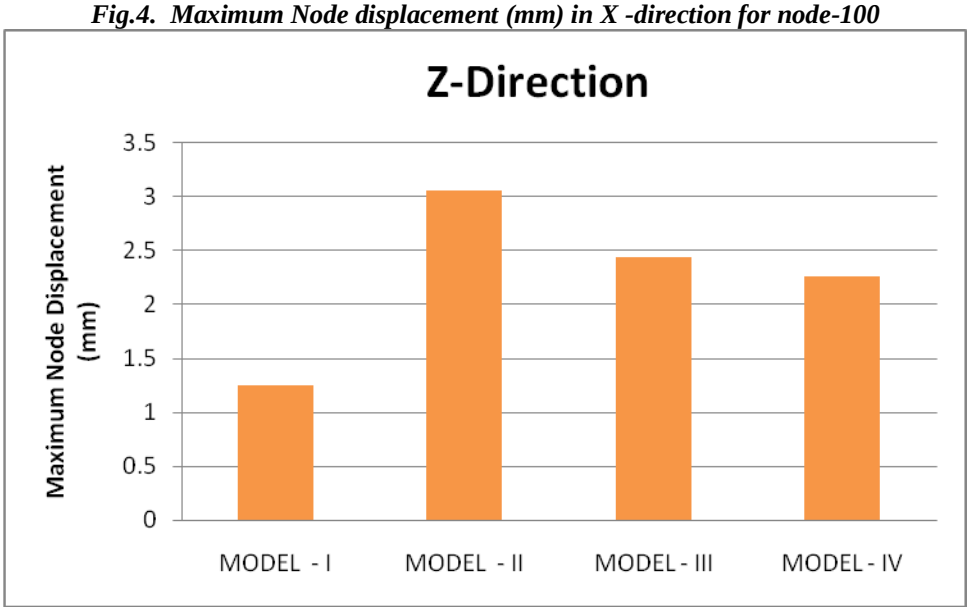

Fig.5. Maximum Node displacement (mm) in Z -direction for node-125

B. Maximum Reaction: The maximum reaction are given in Table .2.

Table .2. Maximum Reaction (kN)

DIRECTION	NODE	MODEL - I	MODEL - II	MODEL - III	MODEL - IV
X	51	4.385	40.227	15.268	7.361
Y	53	720.000	1975.019	1878.468	1441.475
Z	3	3.288	28.308	9.970	5.590

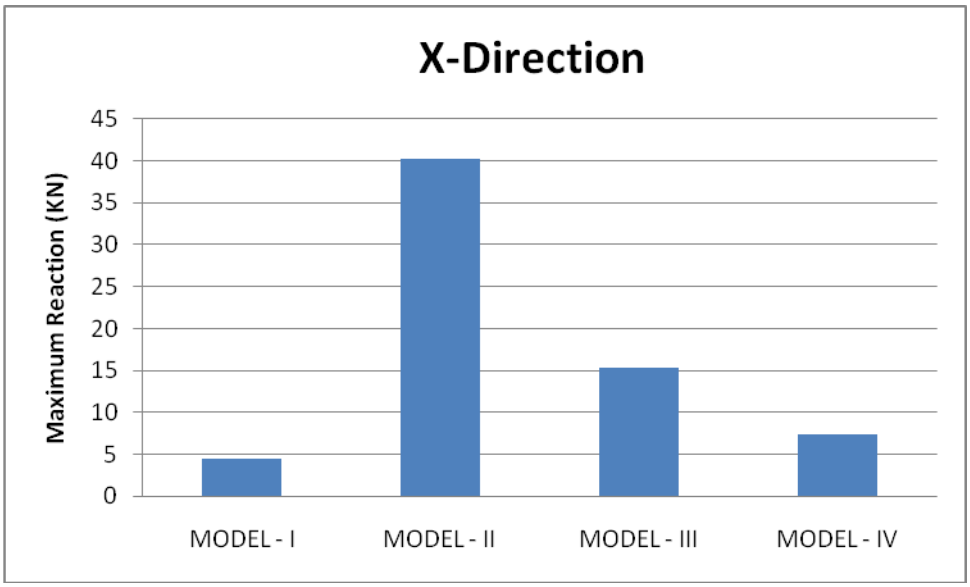

Fig.6 . Maximum reaction for Node-51

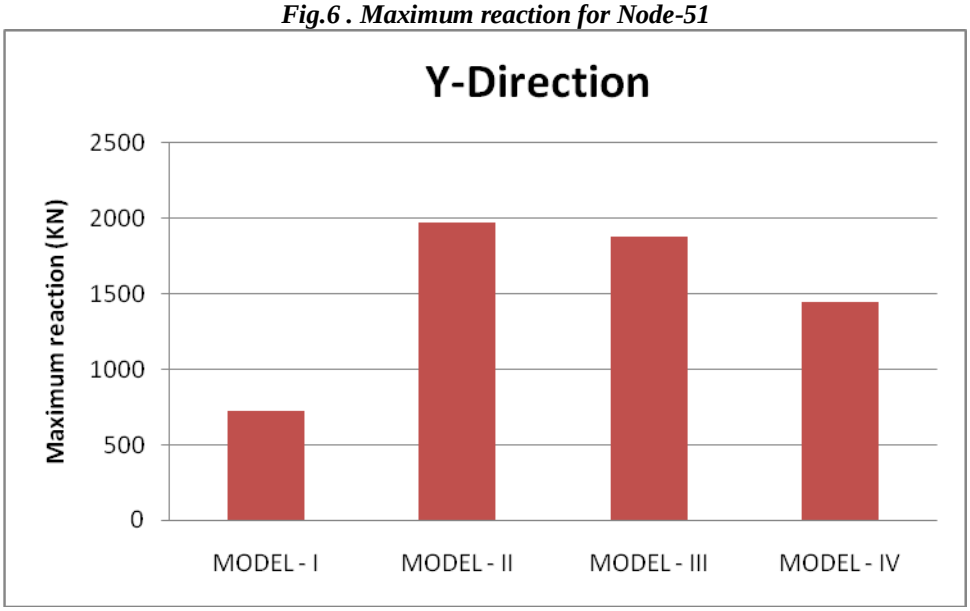

Fig. 7. Maximum reaction for Node-53

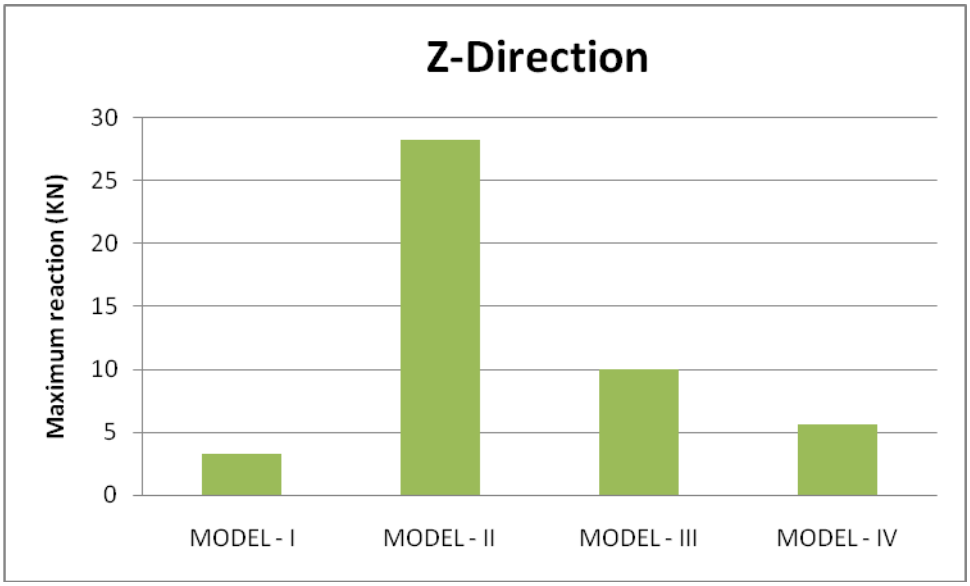

Fig.8 . Maximum reaction for Node-3

DISCUSSIONS & RESULTS

A)Maximum Node Displacement:

When model - I was analyzed maximum node displacement was found at that node 100, the minimum node displacement in x- direction for Model –IV i.e., 2.035mm &in z - direction for Model – IV i.e., 2.262mm .That mean the node displacement of node 125 will be more due to x –direction rather than z- direction & found the same results through analysis. The most reduced value of node displacement is 2.035 mm due to model-IV.

In ours analysis, the node displacement is found to be maximum at floor level 4

B)Maximum Reaction:

In ours work , the Model-IV is much effective than other all models. For model-IV the reaction all in x,y & z direction are found minimum i.e., 7.361kN, 1441.475kN & 5.590kN respectively . For nodes 51, 53 & 3, this work is done in x,y &z directions respectively. These nodes are selected on the basis of maximum reaction obtained when model-IV was analyzed and after for Model- I.

CONCLUSION

In the present investigation, an attempt has been made to compare the wind load behaviour of multi-storied structures with floating columns and the following are the conclusions drawn from observing the above graphs.

A)Maximum Node Displacement:

The maximum Node Displacement was found maximum at top floor .Node displacement of node no. 100 was was found to be most reduced when floating column starts from floor level 1 used and the most effective Model is Model- IV.

B)Maximum Reaction:

The minimized reaction value is to be found for Model –IV for all node i.e.,51,53 and 3.Thereforee this work conclude that the Model-IV is most effective than other models.Therefore floating column start from floor level 1 is fulfill requirement better than other models.

Therefore the overall conclusion is that Model-IV is the most effective among all othe Models.

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