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Comparative Analysis of a Multistory R.C Building Frame using R.C Bracing at Different Locations

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Abstract -Bracing systems are used to resist against deformation and node displacement during seismic action. In this work, a (G+2) storey has been taken for analysis , X- type R.C. bracing, R.C building frame has been considered, analyzed for seismic zone-lll, according to the IS code (IS1893-2002) by using STAAD-pro.V8i (series 4)package.Special moment resisting frame(SMRF) and medium soil are also used, the parameters are considered such as node displacement (in x-direction and z-direction) and maximum reaction in y-direction. To compare the result for different models. Our model-ll is more effective than other model.

Key Words: R.C BRACINGS, STAAD-pro. V8i (series4) package,IS 1893-2002, SMRF, medium soil,maximum reaction, Node displacement.

INTRODUCTION

Earthquake are caused generally by rupture of geological faults inside the earth but also by other events such as volcanic movement, landslide, mine blasts and atomic tests. If there is a built structure on the earth's surface seismic waves and wind induced loads will propagate into the structure causing it to vibrate. Multi-storey building frames may be considered the most widely used kind of structures, especially in urban and residential areas. Population growth and land scarcity increase the need of these types of structures. Substantial and rapid expansion of this necessity in the early decades of the twentieth century, led to the creation of different methods of frames analysis. Nodes serve a number purposes: they define locations of elements and provide an FEA link between elements. They also function as external supports. Nodal supports are aligned with the global coordinates and are either free or rigid in each direction (degree of freedom). The structure must have sufficient strength to resist the seismic forces and also wind-induced forces. The structure must have adequate stiffness to satisfy occupant comfort and serviceability criteria and the external forces may produce dynamic response in the structure. If we will do so much calculations for a high rise building to determine the node displacement value and the reaction due to node displacement on the building members 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.V8i(series 4) package, will make it easier. An R. C. Medium rise G+2 storeis building is subjected to an earthquake loading in Zone-III has been considered. The result of this work revealed that an improvement is noticed in considered R.C. building frame when the X-type bracings are arranged in different floor level. The most efficient location found of X-type Bracing is for model-ll.

GEOMETRY AND MODELLING

Loads acting on the structure :

-Dead Load (DL) and Live load (LL) : As per IS 875 (Part 1) (1987) and IS 875 (Part 2) (1987), respectively.

-Seismic load (SL) : As per IS 1893 (Part1)(2002) 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.

SL: Zone : III (Z=0.16)

Rock/ soil type : Medium

Rock and Soil site factor : 2

Response reduction factor: 5

Importance factor: 1

Damping : 5%

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+2

Plan size - 9m x 9m

(Each grid size 3m x 3m)

Size of all columns - 300mm × 300 mm

Total height - 9m

Floor to floor height - 3.0m

Ground storey height From Foundation - 3.0m

Depth of slab - 125 mm

Support condition – Fixed

The elevations of the R.C. building with and without R .C bracing as shown in Fig. 1 has been considered to carry out the study.

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,

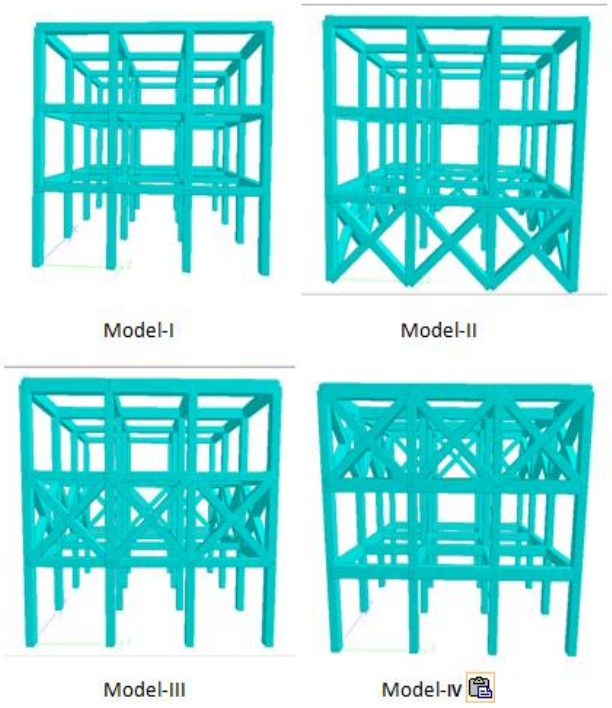

Fig-1:Screenshots of considered Models

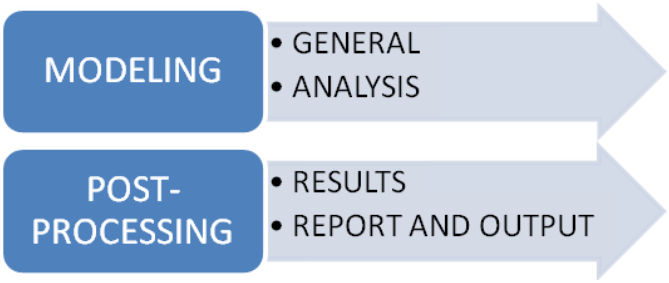

Fig-2:Flowchart of steps of analysis

RESULT AND GRAPHS

NOTE:

1) Minus (-) sign shows decreasing percentages.

2) Plus(+) sign shows increasing percentages

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

Table.1.Maximum Node Displacement (mm)

DIRECTION	Model -I	Model-II	Model-III	Model-IV
X	1.204	1.026	1.029	1.399
Percentages variation w.r.t. model-I		-14.786	-14.535	16.196
Z	1.736	1.098	1.388	1.269
Percentages variation w.r.t. model-I		-36.751	-20.046	-26.901

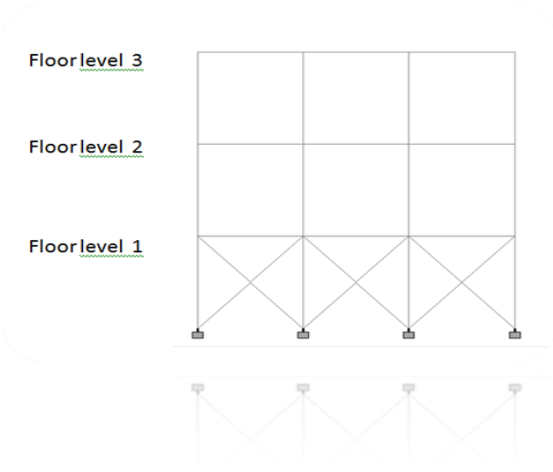

Fig-3:Screenshort of different floor levels.

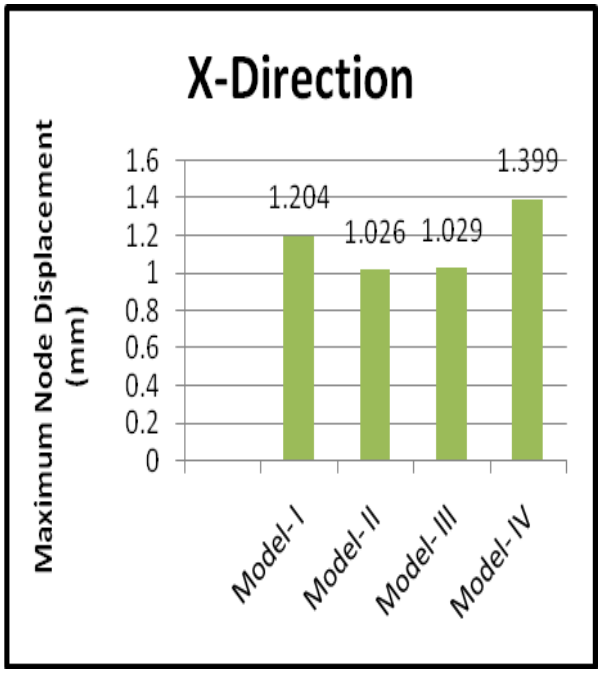

Fig.4. Maximum Node displacement (mm) in X-direction for node-2

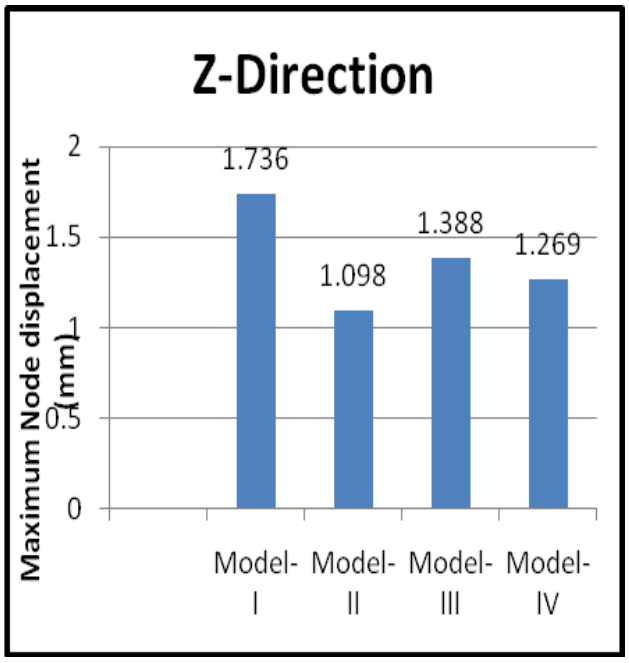

Fig.5. Maximum Node displacement (mm) in Z -direction for node-29

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	18	2.399	1.233	2.5	3.217
Percentages w.r.t. model-I			-48.60	4.21	34.098
Y	18	336.225	330.776	335.275	338.975
Percentages w.r.t. model-I			-1.621	-0.283	0.818
Z	19	2.488	0.914	2.31	3.217
Percentages w.r.t. model-I			-63.264	-7.154	29.301

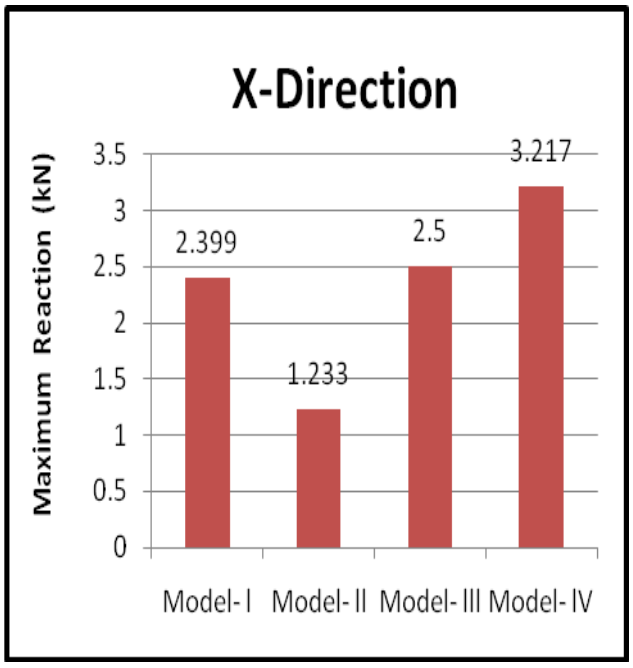

Fig. 6. Maximum reaction for Node-18

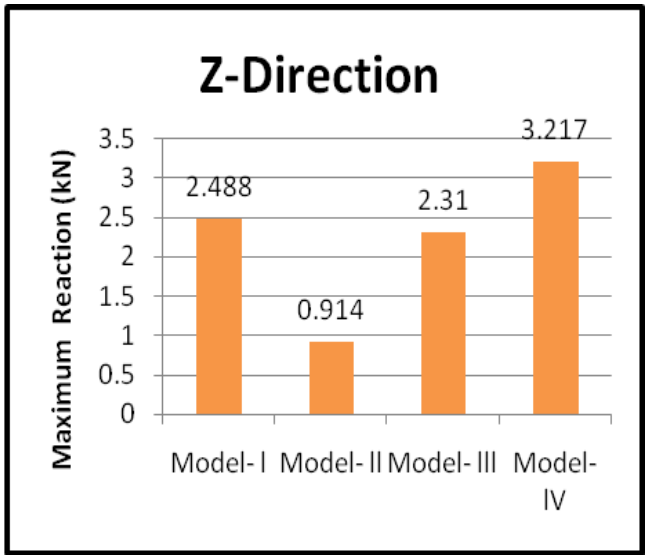

Fig. 7. Maximum reaction for Node-19

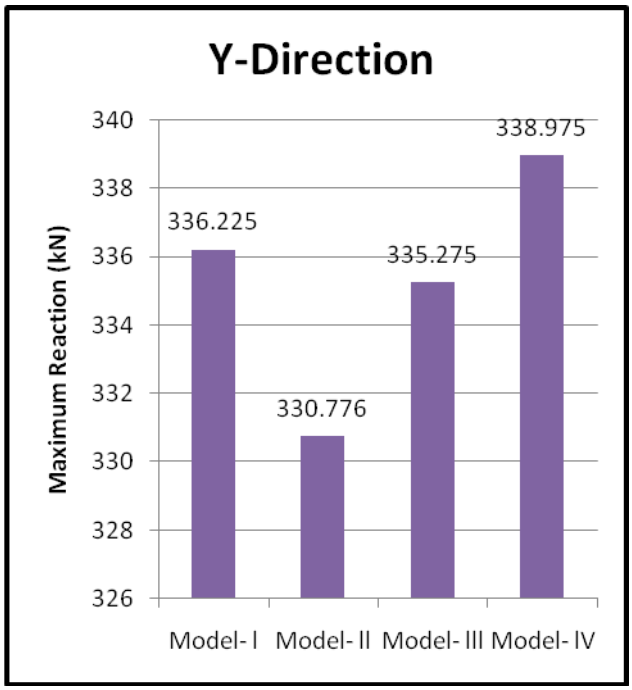

Fig. 8. Maximum reaction for Node-18

DISCUSSION

A. Maximum Node Displacement

When model - I was analyzed maximum node displacement was found at that node 29, the minimum node displacement in x- direction for Model –II i.e., 1.03mm &in z - direction for Model – II i.e., 1.388mm .That mean the node displacement

of node 29 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 1.03mm due to model-II.

In ours analysis, the node displacement is found to be maximum at floor level 3 and [3]also gives the same results that means maximum node displacement is at topmost storey . [2] also gives the node displacement increased with the increase in storey height.

B. Maximum Reaction

In ours work , the Model-II is much effective than other all models. For model-II the reaction all in x,y & z direction are foundminimum i.e., 1.233kN, 330.776kN & 0.914kN respectively . For nodes 18, 18 & 19, this work is done in x,y &z directionsrespectively. These nodes are selected on the basis of maximum reaction obtained when model-IV was analyzedand after for Model- I.

CONCLUSIONS

The behavior of a R.C. building was analyzed with X- types R.C bracing at different floor level and conclusion may be drawn from this study.

A. Node Displacement

Node displacements are found max. at top floor. Node displacement of node no. 29 was found to be most reduced when X- types R.C bracing used & the most effective location of R.C bracing is for Model-lI.

B. Maximum Reaction

The minimized reaction values is to be found for model-II for all nodes i.e., 18, 18 & 19. Therefore this work concludes that the model-lI is more effective than other models. Therefore X –types R.C bracing on floor level 1 of an R.C. building is fulfill requirements better than other locations.

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