"Seismic Analysis of R.C. Multistorey Building Frame with Bracings"

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Abstract— The recent earthquakes have tendancy to damage the structures, in multistorey and high rise structure to prevent against vibration. We can provide Bracing at different locations. The main focus of this work is to analyze an R.C. building frame with X-TYPE R.C. bracing at different locations of a building to know its most effective location. Bracing 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+2) storey , R.C. building frame has been analyzed for seismic zone-III by using STAAD-pro. V8i (series4), special moment resisting frames (SMRF) and medium soil type were used. The method used in this work is Equivalent Static Analysis method. There are various parameters were considered such as maximum shear force in Y –direction, maximum bending moment in Z-direction are taken to compare the result for different model. According to this analysis Model –ll is most effective one.

Key words: Equivalent static analysis, R.C bracing, Staad-pro. v8i (series 4)package, SMRF, Medium soil,is 1893 (part-1)-2002

I. INTRODUCTION

Earthquakes 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.V8i(series 4) package, 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 to provide bracings on multistorey buildings in different locations. Bracing members in R.C. multistorey building is conservative, simple to set up, involve less space and give obliged quality and inflexibility. There are various types of bracing systems like X bracing, V bracing, inverted V bracing, K bracing, Diagonal bracing and so on.

II. LOADING CONSIDERATION

Loads acting on the structure :

- 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 floor level 3) and 1.5 kN/sq.m for floor level 3.
- 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 (Part 1) (2002) approach.
- 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 are given in table 1.

Number of storey	G+2
Plan size	9m x 9m (Each grid size 3m x 3m)
Size of all columns	300mm × 300 mm
Wall thickness (including Plaster)	230mm
Size of beams	450mm × 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

Table 1: Preliminary Data

III. LITERATURE REVIEW

A lot of research work has been done in the direction of Bracing on multistorey buildings. Prof. Sarita Singla, Megha Kalra, Rahul Kalra and Taranjeet Kaur[8] analyzed Behaviour Of R.C Framed Building With Different Lateral Bracing Systems. R. Sabelli , S. Mahin, C. Chang [5] studied the behavior of Seismic demands on steel braced frame buildings with buckling restrained. Ashis Debashis Behera, K.C. Biswal [3] studies 3D Analysis of building frame using Staad Pro. However the study related to R.C Bracing at different floor level has not been yet done much.

IV. OBJECTIVE OF STUDY

1) To judge the effect of Bracing 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 bending moment and maximum shear forces obtained.
4) To understand the purpose of using Bracing using STAAD-pro. through this work .
5) To know the best location of bracing for parameters considered.

V. PROBLEM STATEMENT

The 3D views of the R.C. building with and without bracing as shown in Fig.1. has been considered to carry out the present study.

VI. METHODOLOGY

Steps to model and analyze the R.C. building frame. Firstly go to run structure wizard and select bay frame.

Then follow the following steps given in Fig.2.

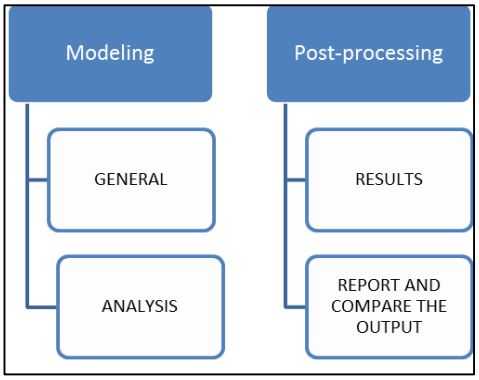

Fig. 2: Analysis steps

VII. RESULT AND GRAPHS

Note:

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

Maximum Shear Force: The values of maximum shear forces are given in Table.2.

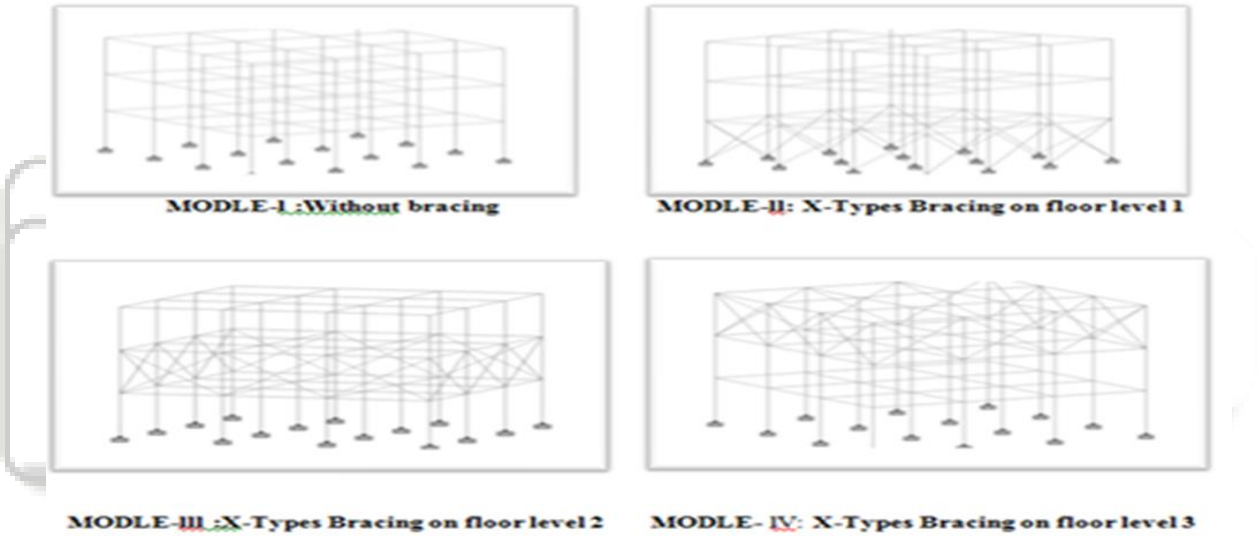

Fig. 1: Screenshots of considered Models

Floor level	Maximum Shear force (KN) -Y direction			
	Model-I	Model-II	Model-III	Model-IV
Floor level 1	32.067	30.278	31.47	32.238
Percentage w.r.t. to Model-I		-5.579	-1.862	0.533
Floor level 2	30.736	29.935	30.193	30.305
Percentage w.r.t. to Model-I		-2.606	-1.767	-1.402
Floor level 3	21.388	20.665	21.15	20.717
Percentage w.r.t. to Model-I		-3.380	-1.113	-3.137

Table 2: Maximum Shear Force

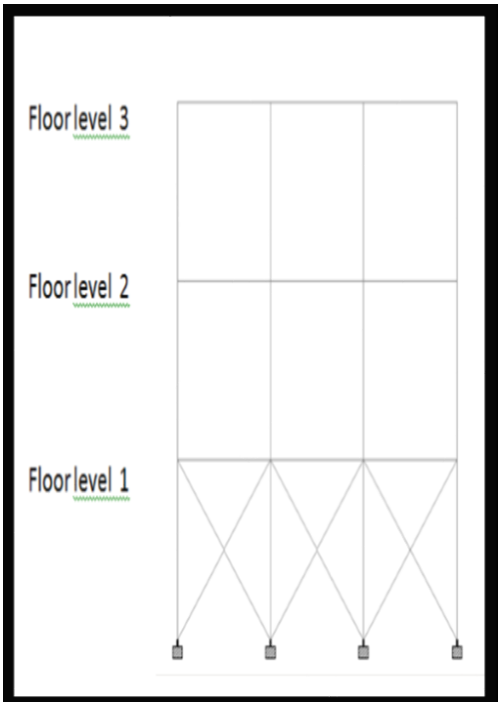

Fig. 3: Screenshot of different floor levels

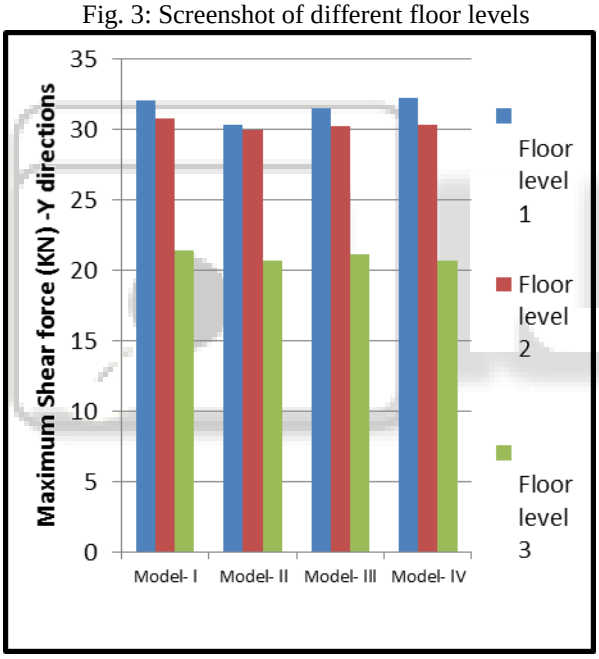

Fig. 4: Graph of Maximum Shear force (KN) -Y directions

A. Maximum Bending Moment : The Value Of Maximum Bending Moment Are Given In Table 3:

FLOOR LEVEL	Maximum Bending Moment (KN-m) Z direction			
	Model-l	Model-ll	Model-lll	Model-lV
FLOOR LEVEL 3	10.459	10.309	10.654	10.584
Percentage w.r.t. to Model-l		-1.434	1.864	1.195
FLOOR LEVEL 2	15.399	15.098	15.5	15.839
Percentage w.r.t. to Model-l		-1.955	0.656	2.857
FLOOR LEVEL 1	16.181	15.303	16.254	16.443
Percentage w.r.t. to Model-l		-5.426	0.451	1.619

Table 3: Maximum Bending Moment

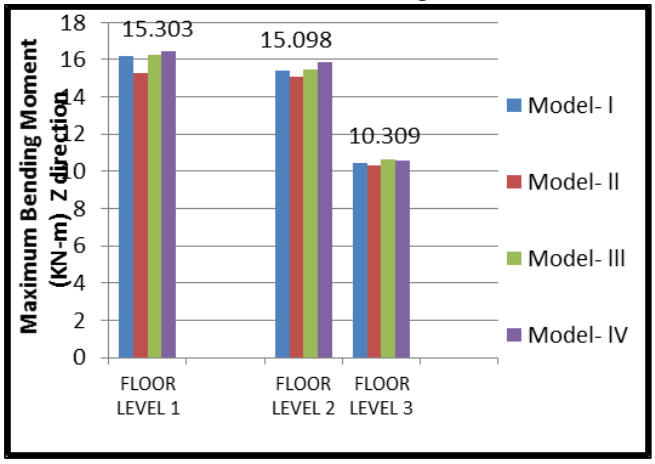

Fig. 5: Graph of Maximum Bending Moment (KN-m) Z direction

VIII. DISCUSSIONS & RESULTS

A. Maximum Shear Force:

The values of maximum shear forces are decreasing as the floor levels are increasing for each model. The values of maximum shear forces are most reduced for Model-II w.r.t. Model- I i.e., 30.278, 29.935, 20.665 for floor level 1,2,3 respectively. the maximum shear force was found in each model for all floor levels and the least value is found for model-II among all four models. The value of maximum shear force for model-II is kN.

As per [8] Shear force is more when no bracings are provided but when bracing members are provide a considerable decrease is seen. As per [2] the bending moment increases as floor level increases. As per [1] when bracing has been provided then shear force was reduced and the same results are found in our work.

B. Maximum Bending Moment:

The values of maximum bending moment are decreasing as the floor levels are increasing for each model. The values of maximum bending moment are least for Model-II w.r.t. Model- I i.e., 10.309, 15.098, 15.303 for floor level 1,2,3 respectively. The maximum bending moment was found in each model for all floor levels and the least value is found for model-II among all four models. The value of maximum bending moment for model-II is 15.098kNm.

As per[8] Bending moment is more when no bracings are provided but when bracing members are provide a considerable decrease is seen. As per [2] the bending moment increases as floor level increases. As per [1] when bracing has been provided then bending moment was reduced and the same results are found in our work

IX. CONCLUSION

The behavior of a R.C. building was analyzed with R.C Bracing at different floor level and conclusion may be drawn from ours study.

1) Maximum Shear Force: The maximum shear force was found in each model for all floor levels and the least value was found for Model II w.r.t. Model-I.
2) Maximum Bending moment: The maximum bending moment was found in each model for all floor levels and the least value was found for Model-ll among all four models and the maximum bending moment for Model-II is found at floor level 1.
3) R.C bracing system shows the efficient and economical measures for RC multistory buildings located in high seismic regions.
4) Structure can be compared and designed easily by using STAAD-pro.

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

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