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Seismic Evaluation of Vertical Irregular Building with Setback

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Abstract - *Earthquake is a natural phenomenon which could happen anywhere and causes damages, as we know that earthquake is hazardous and it's very important while designing a building should be considered, earthquake mostly damage the buildings at their weakest points, these weak point arise due to discontinuity in stiffness, mass and geometry, the structures having these discontinuities named as irregular structures. And we know irregular structures now a days contribute a large portion of urban infrastructure. Vertical irregular structure or geometrically irregular structures is one of those buildings which face more damage and is the reason of failure of structures, the object of the present work is to evaluate the seismic behavior of vertical irregular building frame as it begins form irregular and end to regular structure. For this purpose, 10 frames of multi-story buildings are considered. To study the behavior, the response parameters selected are displacement, story drift, as well as base shear and peak story shear, all the frames are assumed to be located in zone 5, for analysis STAAD.PRO software is used.*

Key Words: **setback building, vertical irregular, response spectrum analysis, story drift, displacement, base shear, peak story shear**

1.INTRODUCTION

Earthquake is one of the most critical or we can say the most signal phenomenon for engineers from earlier since now and obviously to future, many researches and investigations with the help of technology is done and somehow the effect of earthquake is reduced but still we know that there is much work to do in earthquake especially for engineering. During earth motion mostly the waves which arise, effect on structures at the weak points of structure to collapse or damage the structure, in irregular structures these weakness points are define as mass irregularity, stiffness irregularity, strength irregularity in both horizontal and vertical directions, the behavior of irregular structures than regular is different during earthquake, in regular structures the distribution of mass stiffness and strength is uniform and there is no discontinuity in mass, stiffness and strength the structure works as a one part and face much lesser damage during earthquake. But, in irregular structures because of irregular distribution of mass, stiffness, strength, discontinuity and the un uniform load pattern or distribution these structures face more damages and even these structures collage or damages from these irregular points.

2. Objectives

As this study deals with those structures which are vertically irregular with setback and the objective which are carrying out are:

1. To evaluate the seismic behavior of vertical irregular structures with setback against ground motion using response spectrum analysis method.
2. Analysis of regular structure by using STAAD.PRO in term of story drift, displacement, peak story shear, base share.
3. Analysis of vertical irregular building with setback in term of story drift, displacement, peak story shear, base shear.
4. Comparison of vertical irregular building with setback and regular building to access some important points.

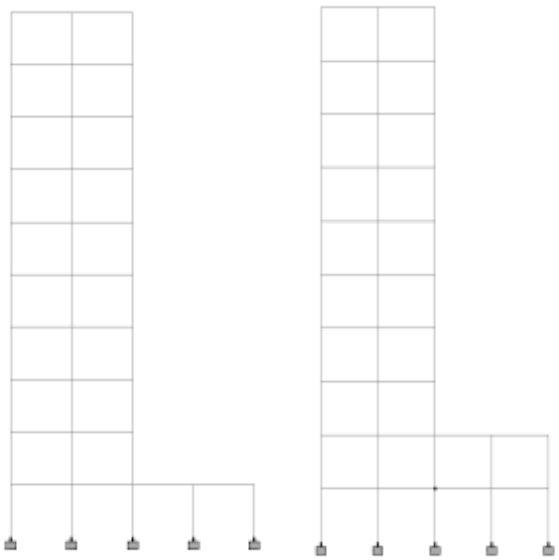
2. Methodology

The steps undertaken in the present study to be are as follow:

1. Study of literature review.
2. Select a set of regular and vertical irregular building models with 10 story, with equal story height of 3m.
3. Perform response spectrum analysis for each of building models taken in this study.
4. Analysis and comparison of the results and outcomes of the analysis.
5. Detailed discussion on the result with the help of graphs and tables for each building models and reaching to the conclusion.

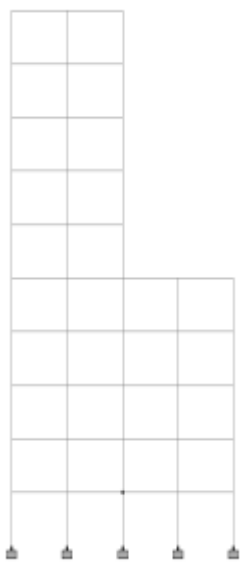
3. Structural modeling

Building plan dimensions of 16m x 16m, bay spacing of 4m along both directions and story height of 3m is selected. All irregular and regular building are modeled and analyzed using STAAD.PRO V8i SS6 software. Total nine vertical irregular building with setback, one regular building in considered in the resent study. Irregular frames are named as IR1, IR2, IR3, IR4, IR5, IR6, IR7, IR8, IR9 and RB.

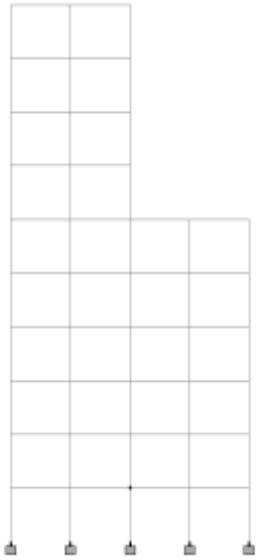


IR1

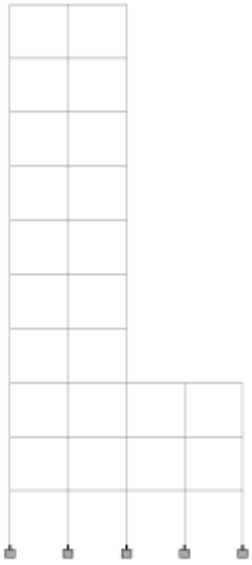
IR2



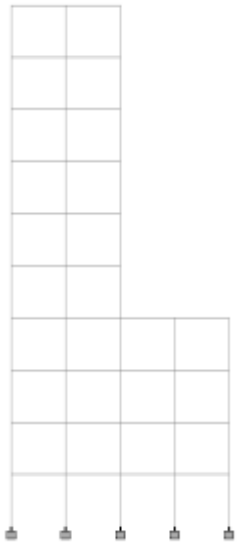
IR5



IR6



IR3



IR4

IR7

IR8

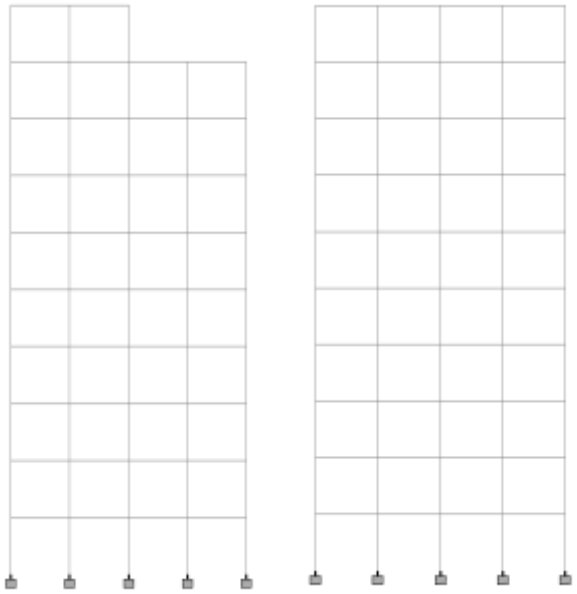


Fig – 1: Configuration of different building models

Siesmic load corresponding to seismic zone 5 of IS 1893:2002 is considered for the analysis.

The properties of matertial and and building are shown below.

a) Material property

Concrete grade = M25

Density or concrete = 25 KN/m^3

b) Dimension of structural elements

Column size = 450mm x 450mm

Beam size = 450mm x 300mm

Slab thikness = 125mm

Story height = 3m

c) Seismic parameters

Zone : 5

Important factor : 1

Response reduction factor (R) : 5

d) Loads on building

Live load on floor = 3KN/m^2

4. Results and Discussion

Response spectrum analysis of all the models revels that setback effects significantly influence the seismic parameters. All parameters shows maximum value at the level of setback, the setback is mostly the main result of collapes of buildings, the result shows that building is weak at the setback level when earthquake happens the response of vertical irregular building with setback is weak, and even it cause to collapes. Result of response spectrum anlaysis for IRs and RB are obtained and metioned below.

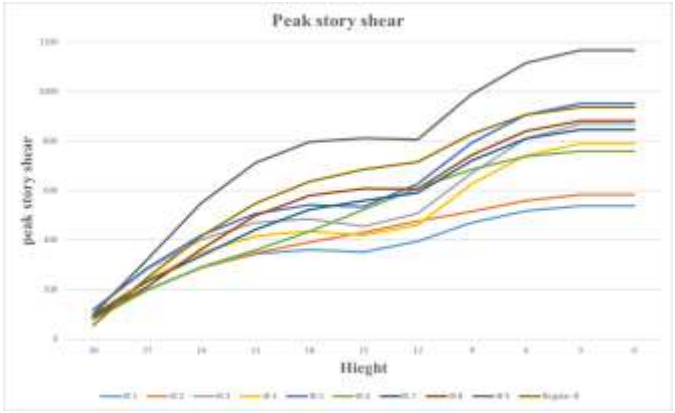


Chart – 1: Peak story shear

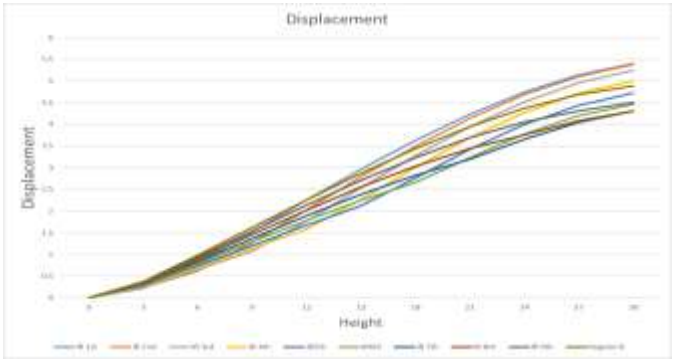


Chart – 2: Displacement

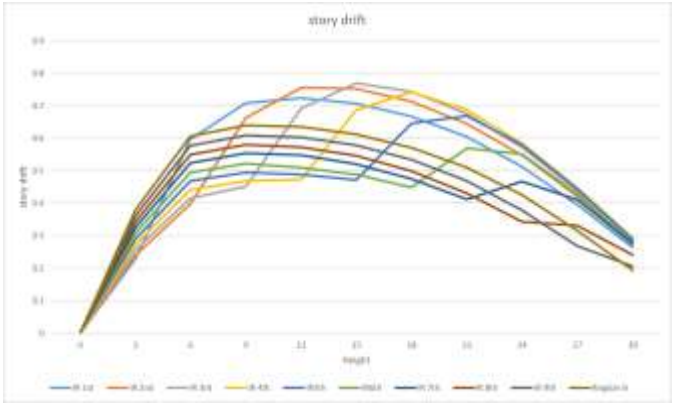


Chart – 3: Story drift

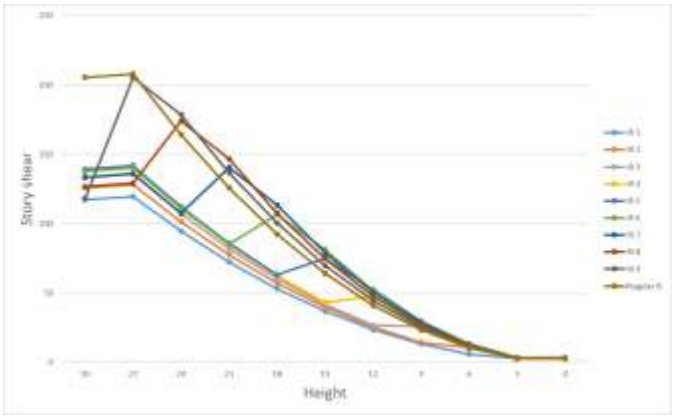


Chart – 4: Story shear

5. CONCLUSIONS

Based on thesis word done following conclusions can be express according seismic evaluation of building with setback.

1. For all vertical irregular frames with setback considered, displacement value for IR1, IR2, IR3, IR4, IR5, IR6, IR7, IR8 and IR9 at the level of setback increases, and the result shows that the top node displacement in case of irregular frames in more than that of the RB, except for IR5, IR6, IR7, IR8 and IR9.

2. In case of setback irregular frames, a sudden extreme change in story drift due to setback has been observed, it indicates that in setback floor the story drift value extremely goes higher, while story drift for RB is normal

3. Peak story shear for irregular structures is less than regular structure but for IR 9 its higher than regular building.

4. Story shear fall down at the setback level.

The analysis shows that the vertical irregularities widely effect the performance of RCC buildings under seismic loading, as for as possible these irregularities must be avoided, but if it introduced they must be properly designed

REFERENCES

1. IS 1893 (part) 1: 2002, Indian standard criteria for earthquake resistant design of structures.

2. Mangesh S. Suravase, Prashant M Pawar, EFFECT OF GEOMETRICAL PLAN IRREGULARITIES ON RCC MULTI-STOREY FRAMED STURCUTURE, Vol. 47, May 2017, number5

3. Thowdoju Deepthi, S B Sankar Rao, STUDY OF IRREGULAR RC BUILDING UNDER SEISMIC EFFECT, August 2016, Vol 2, issue 15, PP:29 – 38.

4. Sumit Gurjar, Lovish Pamecha, SEISMIC BEHAVIOUR OF BUILDINGS HAVING VERTICAL IRREGULARITIES, Vol 3, April 2017, issue X.

5. Pavani Taliskula, Dr.V.A.Prasad, SEISMIC FRAGILITY ANALYSIS OF REGULAR AND VERTICAL SETBACK RC FRAME BUILDINGS, Vol 5, November 2015, Issue 11, (part-5), pp.120-132.

6. Milind V. Mohod, Nikita A. Karwa, SEISMIC BEHAVIOUR OF SETBACK BUILDINGS, Vol 3, September 2014, Issue 9.

7. Rakshith Gowda K.R, Bhavani Shankar, SEISMIC ANALYSIS COMPARSION OF REGULAR AND VERTICALLY IRREGULAR RC BUILDING WITH SOFT STOREY AT DIFFERENT LEVEL, Vol 1, July 2014, Issue 6.

8. Kovvuri Naga Raju, EFFECT OF SETBACK ON RC FRAMED BUILDINGS IN FUNDAMANTAL PERIOD, Vol 3, May 2015, Issue 5.

9. Himanshu Bansal, Gagandeep, SEISMIC ANALYSIS AND DESIGN OF VERTICALLY IRREGULAR RC BUILDING FRAMES, Vol 3, August 2014 Issue 8.

10. Piyush Mandloi, Prof. Rajesh Chaturvedi, SEISMIC ANALYSIS OF VERTICAL IRREGULAR BUILDING WITH TIME HISTORY ANALYSIS, Vol 14, July-August 2017, Issue 4 Ver 3.

11. Resmitha Rani Antony, P R Sreemahadevan Pillai, EFFECT OF VERTICAL IRREGULARITIES ON SEISMICE PERFORMANCE OF RC BUILDINGS, Vol 7, October 2016, Issue 10.

12. Dileshwar Rana, Juned Raheem, SEISMIC ANALYSIS OF REGULAR AND VERTICAL GOEMETRIC IRREGULAR RCC FRAMED BUILDING, Vol 2, July 2015, Issue 4,