International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

A Review of Comparative Study of Seismic analysis in Square and Rectangular Shape of Set-back RC building

Shivam Rajput[1], Meghna[2]

[1]M. Tech Scholar, Department of Civil Engineering, MUIT, Lucknow
[2]Assistant Professor, Department of Civil Engineering, MUIT, Lucknow

---***---

Abstract *In this review paper we study some research paper related to my related topic. The paper is related to seismic analysis of the Setback and hill building in the different plan of the building such as the circular, H, L, T square and rectangular shape according to the IS code 1893 part-1:20002 and 2016. Setback building act under the vertical irregularities by clause 7.2.2 of IS code 1893 part-1:2016 if the A>0.25L. The main purpose of this review paper to know stability of every different shape of the building which act in the vertical irregularities according to IS code 1893part-1 2016. Framed structures constructed as skyscraper building then at back side of the building beam and column disappear. Since these buildings are unsymmetrical in nature, hence attract large amount of shear forces and torsional moments, and show unequal distribution due to varying column lengths.*

Key Words **:**Setback building, Etabs, Seismic Analysis, Time History Analysis.

1. INTRODUCTION

Existing reinforced concrete framed buildings with abrupt lateral changes in the structure at specific levels along the height (i.e. setbacks) perform badly with seismic loads, due to the irregular vertical distribution of stiffness, strength and mass. The main purpose of constructing the setback is that to reduce the effect of the lateral forces on the structure, because we know that due to increasing the height of the building the effect of lateral force on building increasing lateral forces also depend upon the self weight of the building.

1.1 Set-back Building

A setback, sometimes called step-back, is a step-like recession in a wall. Setbacks were initially used for structural reasons, but now are often mandated by land use codes, or are used for aesthetic reasons. In densely built-up areas, setbacks also help get more daylight and fresh air to the street level. Importantly, a setback helps lower the building's center of mass, making it more stable. The figure-1 is given below for the setback building:

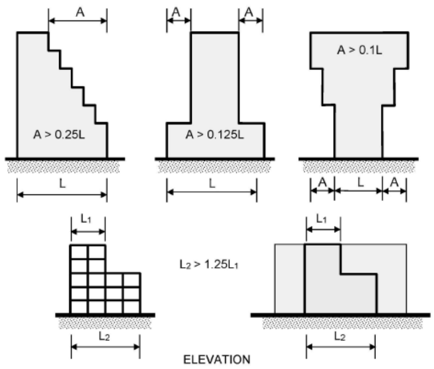

Fig -1: Set-Back Building

2. LITERATURE REVIEW

The conclusion of some research paper given below which is related to seismic analysis of the setback and hill building:

[1]Rutenberg (1993)

Paper written by this author "Lateral load response of setback shear wall buildings" and conclusion given below:

i. The abrupt change in the rigidity of the lateral load resist system of setback tall buildings leads to a complex load redistribution at the setback level This redistribution is not adequately modeled by standard plane frame lateral load analysis procedures because the floor slabs are assumed to be rigid m their own plane, and when shear deformations in the wall are also ignored the planar model becomes even less realistic. Whereas the effect of these flexibilities is usually small m uniform structural wall systems, they can be quite important in setback structures.
ii. The results of the analyses show that for symmetric as well as for asymmetric setbacks the shear flexibility of the walls and the in-plane flexibility of the floor slabs are beneficial since they both reduce the stress concentration at the setback level, They slow the transfer of shear forces and moments from the tower walls to the base structure end walls, and appreciably reduce

the high shear forces carried by the setback level slab.

iii. The contribution of the torsional rigidity of the walls and floor slabs was also studied and was found to be negligible for walls and slabs of normal thickness.

iv. Effect of the floor flexibility on the roof displacement was not found to be significant. Finally, it was pointed out that for lateral load carrying systems comprising walls and/or regular frames the in-plane floor flexibility of the floor slabs can easily be considered by modeling the structural system as a plane grid rather than a plane frame, thus obtaining the need to use space frame programs.

[2]Himanshu Bansal (2012)

Research paper written by this author "Seismic Analysis and Design of Vertically Irregular RC Building Frames" and conclusion given below:

i. According to Response Spectrum Analysis results, the storey shear force was found to be maximum for the first storey and it decreased to a minimum in the top storey in all cases. It was found that mass irregular building frames experience larger base shear than similar regular building frames. The stiffness irregular building experienced lesser base shear and has larger inter storey drifts.

ii. In case of mass irregular structure, Time History Analysis yielded slightly higher displacements for upper stories than that in regular building, whereas as we move down, lower stories showed higher displacements as compared to that in regular structures.

iii. In regular and stiffness irregular building (soft storey), it was found that displacements of upper stories did not vary much from each other but as we moved down to lower stories the absolute displacement in case of soft storey were higher compared to respective stories in regular buildings.

[3] A.M. Yousef (2014)

Research paper written by this author "Seismic performance of HSC dual systems irregular in elevation" and conclusion is given below:

i. The maximum storey drift adopted by the IBC-2012 is conservative in some cases when applied to NSC and HSC dual systems with short period of vibrations, while for long period dual systems the IBC-2012 maximum drift is considerably less than that obtained from the time history analysis.

ii. The limits in IBC-2012 and EC201-2008 identifying the lateral stiffness irregularities do not result in poor seismic behavior for NSC and HSC dual systems with short and long period of vibrations and can be safely relaxed. The limits for lateral stiffness:

iii. Each storey should not be less than 70% of the storey above can be reduced by 10%

iv. The average of lateral stiffness of three adjacent stories should not be less than 80% can be reduced by 20%.

v. The limits of mass and setback irregularities required by the IBC-2012, EC-8 and EC201-2008 are suitable for dual systems with short and long period of vibrations and constructed from NSC and HSC. However, the criteria in the EC-8 for the definition of cases of lateral stiffness and mass irregularities of reinforced concrete dual systems need to be numerically identified instead of using the expression (abrupt changes between stories).

vi. The SELF method of the IBC-2012 is not conservative in some cases when applied to NSC and HSC dual systems with mass or setback irregularities 'with short and long periods'. This method is just conservative when applied to NSC and HSC dual systems with lateral stiffness irregularities. The SELF method of both the EC-8 and the EC201-2008 is conservative when applied to NSC and HSC dual systems with short and long period of vibrations and having lateral stiffness, mass and setback irregularities.

[4] George Georgoussis (2015)

The research paper is written by this author "Approximate seismic analysis of multi-storey buildings with mass and stiffness irregularities" and conclusion given below:

i. An approximate method is presented for the analysis of multi-storey asymmetric setback buildings. Basic dynamic data (periods and base shears) can be estimated with reasonable accuracy and, to some extent, base torques. The proposed method is based on the analysis of two equivalent, single-storey asymmetric modal systems, the masses of which are determined from the first two vibration modes of the uncoupled multi-storey structure and the radius of gyration is computed as a Rayleigh quotient as described in an earlier paper. The stiffness of the supporting elements, at the locations of the real bents, when they represent full-height resisting bents, are determined from the corresponding individual bents when they are assumed to carry, as planar frames, the mass of the complete structure, but an indirect procedure is used for the curtailed bents.

ii. The method may be found useful at the stage of the preliminary design, where the decisions about the structural layout have to be taken prior to a full 3D dynamic analysis. Besides, the method predicts the structural configuration of minimum torsion, which implies that the building elastic response during a ground motion is more or less translational. This response is preserved in the inelastic phase, when the strength assignment of the lateral load resisting bents is derived from a planar static analysis, as a consequence of the almost concurrent yielding of these bents. This is demonstrated in common 8-storey setback buildings under a characteristic ground motion.

[5] Fabio Mazza (2016)

The research paper is written by this author "Nonlinear seismic analysis of RC framed buildings with setbacks retrofitted by damped braces" and conclusion is given below;

i. An irregular vertical distribution of storey damage, represented by the maximum inter-storey drift ratio, is observed for the original UF structures.

ii. The insertion of the HYDBs makes the storey drift distribution almost uniform, reducing the values in the undamaged and moderately damaged ranges at the serviceability and ultimate limit states, respectively.

iii. Local structural damage expressed as maximum curvature ductility demand at the end sections of RC frame members, confirms that the insertion of the HYDBs is highly effective in reducing inelastic response of beams and columns, at both LS and CP ultimate limit states, also producing an almost uniform distribution of ductility demand of the HYDBs along the building height. As further confirmation of the reliability and robustness of the design procedure, comparable values of ductility demand are obtained for different configurations of the HYDBs, inside or outside the bays with setbacks in elevation.

[6] Sameh A. El-Betar (2016)

Research paper written by this author "Seismic vulnerability evaluation of existing RC buildings" and conclusion given below:

i. To evaluate the existing R.C. buildings in Egypt, rapid screening based on FEMA P-154 procedure can be used for a large number of R.C. buildings. ASCE 41-13 methodology can be used for buildings that did not achieve the seismic resistance in rapid visual inspection, as well as individual structure that required evaluated. The priority of estimate is for the old or non-engineered buildings in high seismic regions.

ii. The GLD school buildings tend to be more susceptible under high seismic loads, while school buildings designed according to Egyptian code have a high capacity to resist earthquakes.

[7] Zaid Mohammada (2017)

Paper written by this author "Seismic Response of RC Framed Buildings Resting on Hill Slopes" and conclusion given below:

i. The present study discusses the behavior of hill buildings under seismic load conditions. Two common configurations of hill buildings are parametrically investigated by altering their plan dimensions. All the models are geometrically modeled and analyzed with a finite element code incorporating equivalent static and response spectrum method. The results obtained in the analyses are discussed in terms of seismic parameters such as storey drift, fundamental time period (FTP), top storey displacement, storey shear and base shear in columns at ground level and compared within the considered effects on hill buildings.

ii. The performance of step-back and step-back setback configurations is significantly unlike when compared to each other and entirely different than a building resting on plain ground. The empirical relations given in IS 1893 (Part 1):2002 (Clause 7.6) are unable to depict the correct values of time period in along and across slope direction. Since, the parameters involved in equivalent static method are entirely depend on the time period value, thus this method should not be used to design a hill building. Instead response spectrum analysis of a three dimensional model of complex structures like hill buildings should be carried out to ascertain true behavior.

iii. The step-back setback configurations experience less torsional moments and seismic forces as compared with step-back buildings due to less seismic weight of the structure. Around 45 % reduction in base shear value is observed incase of step-back setback buildings when compared to step-back configurations.

iv. Step-back buildings show higher storey drift and storey shear, making the structures more vulnerable to earthquake forces. Hence it can be stated that the step-back setback buildings perform better than step-back configuration when subjected to seismic loads. Further, maximum storey shear in both the configurations is observed in top most stories thus, structural members experiencing high shear forces and moments under lateral loads should be designed accordingly.

[8]Hema Venkata Sekhar(2017)

The title of Research paper which written by this author "Analyzing the Seismic Behavior of Set-Back Building by Using E-Tabs" and conclusion is given below:

i. Generation of all forces due to unequal distribution of mass will be identified by critical setback ratio along the section of the plan and also in the vertical height of the building.
ii. The ideal appraisals of basic difficulty proportions are RA and RH. The above evaluation conforms to the criteria given in gauges for sporadic structures are considered.
iii. At last, we finish up from the outcomes unpredictable structures are to be treated with appropriate plan and ought to be trailed by all IS code procurements given the guidelines.
iv. It can likewise be reasoned that alteration of quake codes geometric horizontal anomalies appear tube important to determine more preventive ordinates or apply more precise explanatory strategy to distinguish the seismic execution of difficulty building. Especially for structures with basic difficulty proportions assumes a critical part.

3. CONCLUSIONS

After study all research paper which is given in the literature review, the following conclusion come out:

i. The numerical value of the base shear is less as compared to the normal RC building because the self weight of set-back building is less as compared to the normal RC building.
ii. The value of the base shear is depend upon the number of the bay in the building, if the number of the bay in X direction in rectangular and square Set-back building is same but number of the bay in Y direction in rectangular is less as compared to square building then value of the base shear in Y direction in rectangular building is less as compared to the square set-back building.
iii. The value of the natural time period and frequency of the normal RC building is high as compared to Set-back RC building.

REFERENCES

[1] Rutenberg "Lateral load response of setback shear wall buildings" 1993.
[2] Himanshu Bansal "Seismic Analysis and Design of Vertically Irregulars RC Building Frames" 2012, International Journal of Science and Research (IJSR).
[3] A.M. Yousef "Seismic performance of HSC dual systems irregular in elevation" 2014, www.elsevier.com/locate/asej.
[4] George Georgoussis "Approximate seismic analysis of multi-story buildings with mass and stiffness irregularities" 2015, Science Direct.
[5] Fabio Mazza "Nonlinear seismic analysis of RC framed buildings with setbacks retrofitted by damped braces" 2016, journal homepage: www.elsevier.com/locate/engstruct.
[6] Sameh A. El-Betar "Seismic vulnerability evaluation of existing RC. buildings" 2016, http://ees.elsevier.com/hbrcj
[7] Hema Venkata Sekhar "Analyzing the Seismic Behavior of Set-Back Building by Using E-Tabs" 2017, http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=8&IType=1