International Journal of Scientific Research and Engineering Development-– Volume2 Issue 2, Mar –Apr 2019
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

EFFECT OF STIFFNESS OF DIFFERENT SHAPES OF BUILDING TO SEISMIC ZONES

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Abstract:

The objective is to conduct a literature review to provide importance to develop a computational model on which linear / non-linear, static/ dynamic analysis is performed. The first part of this chapter presents a summary of various parameters defining the computational models, the basic assumptions and the geometry of the selected building considered for this study.Analysis of any structure for resisting earthquake is the basic need of this study. In this project analysis of a seismic resistant structure is a need of concern, and thereby establishing a comparison between structures with different plan geometry. Here the study is carried out for the behaviour of G + 5 H shaped buildings. The proposed H shaped building size is 29 x 35 m and also properties are defined for the building structure. The model of the building is created in STAAD Pro software . The properties are defined as per IS 1893: 2002 part1.The seismic zone considered for the model of building are in IV zone and soil type is medium. The modelling of building is done for Indian seismic zone IV IS1893 -2002.For given structure loading with applied loads includes live load, earthquake zone and dead load accordingly .Load consumptions are also provided according to the IS1893(part 1):2002.The analysis is carried out to determine max node, displacement and base shear ,stiffness. After analysis results are obtained in the form of graphs which are in turn observed to form conclusions.

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I. INTRODUCTION

India is consider as one of the more disaster prone countries in the world. Earthquake is used to express any seismic occurrence whether natural or caused by human that can produce seismic influence around any particular area .Earthquake are caused generally by rupture of geological faults inside the earth but also by other event such as landslides ,mine blast and atomic tests. If geometry of a building is disturb ,vertical irregular buildings is disturb ,vertical irregular building are discontinuous with respect to geometry therefore due to irregularities in geometry introduce discontinuity in the distribution of more stiffness and strength .

II. LITERATURE REVIEW

- Dileshwar Rana ,Prof Juned Raheem,"**Seismic Analysis of regular and vertical geometric irregular RCC framed building**", International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 04 | July-2015 t is observed in the structure are irregular structure configuration either in plan or in elevation were often cause major causes of collapse during earthquake .It is concluded that the critical bending moment of irregular frames is more than the regular frame for all building heights .This is due to decrease in stiffness of building frames .Thus there is need for providing more reinforcement for irregular frames.

- Sabahat J. Ansari and Dr.S.D.Bhole "**Comparitive study of symmetric and asymmetric L-shaped and T-shaped multi-storey frame building subjected to gravity and seismic loads with varying stiffness**", IJSTE - International Journal of Science Technology & Engineering | Volume 2 | Issue 10 | April 2016 The study has overview the past Earthquake studies have irregularities such as soft storey ,torsional irregularities vertical and plan irregularities etc .This paper presents an overview of performance of the torsionally

balanced and unbalanced building also called as symmetric and asymmetric building subjecting to seismic analysis .Three building models L-shaped & T- shaped buildings are considered for study which are constructed for study ,which are constructed on uniform soil in seismic zone –III of India (as per IS1893-2002),one symmetric &3asymmetric in stiffness distribution .It is concluded that the performance of the models in which stiffness of plan size considered is found better when compared with the models in which stiffness of plan is ignored.

- Akhil R.Awasthy ,S.Kumar.“**Seismic Analysis of Regular and Irregular Buildings with Vertical Irregularity using STAAD Pro**” International Research Journal of Engineering and Technology (IRJET) (June2017). This study includes the modelling of regular and H-shape plan G+10 storey .
  The performance of this framed building during study earthquake motions depends on the distribution of stiffness, strength, and mass in both the horizontal and vertical planes of the building.
  The main aim of this work is comparative study of the stiffness of the structure by considering the three models in Regular Structure and three models in Plan irregular structure with different Vertical irregular structure. All models are analysed with dynamic earthquake loading for the Zones V .Result found from the response spectrum analysis that in irregular shaped building displacements are more than that of regular shaped building. All building frames are modeled & analysed in software Staad .Pro V8i. Various seismic responses like base shear, frequency, node displacement, etc. are obtained. The overall performance of regular building is found better than irregular building. The seismic performance of multistory regular building is determined by Response Spectrum analysis in STAAD Pro. Software.

- Prof.Shrikant R. Bhuskade,“**Effect of different shapes of building on Natural Time period during Earthquake”, Journal of Structural Technology Volume 2 Issue 2 2017**
  This study has been done on different shapes & structural systems have significant effect on their seismic performance . . Unsymmetrical buildings result in highly indeterminate distribution of forces making the analysis and prediction more complicated. L-shaped buildings are among those unsymmetrical structures which are most commonly found in practice in the form of school, office, commercial buildings. In this work three dimensional models of L-shaped buildings are investigated for their seismic performance, varying bay length and storey height. The modeling of structures analysis is carried out using STAAD Pro V8i, also the performance is analysed providing brick infill and compared with, without infill condition. Performances is measured in terms of displacements, axial forces, bending moments, effect of stiffness, shear forces and compared for those conditions mentioned in the identified column viz., corner, intermediate and interior.It is concluded that By providing brick infill, the moments have reduced by more 20 percent in comparison to those **Mr. Mirghaderi,Khafaf,“Lateral Stiffness of Pyramid Shape Building with inclined column’s”International earthquake synopsis 2007.**In pyramid structures reduction of stiffness in height don’t uniform and affects of inclined column in some stories, otherwise, this fact incertitude the regularity of pyramid building and this means equivalent lateral force procedure isn’t sufficient for design pyramid building and need to analysis with modal response spectrum or other appropriate and intricate analysis such as nonlinear static analysis or time-history for design these structures. Therefore in this paper numerous categories of pyramid buildings with different stories and slopes are selected, and design and analysis are done .It is concluded that the lateral stiffness in symmetric and asymmetric pyramid building has much further value than regular structures. The relative lateral stiffness between each adjacent storey exceeded from seismic codes requirement. (According to ASCE 7-05 [2])
  Because of exceed limitation of relative lateral stiffness refer to seismic codes ASCE 7- 05 [2], these structures have irregularity in structure systems because lateral stiffness is more than 70% of that storey above therefore equivalent lateral force procedure isn’t sufficient for design pyramid building and need to analysis with modal response spectrum or other appropriate and intricate analysis.
  without infill material and Shear forces have reduced by approximately 30 percent in excess in models with brick infill compared to without infill case.

- P.B Lamb ,Dr R.S.Londhe,‘**Seismic Behaviour of Soft First Storey’s IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) (Dec 2012).** Due to Earthquake there is increased awareness for the need to evaluate and improve the seismic performance of multi storied reinforced concrete buildings. There are several numbers of factors affecting the behaviour of building. Stiffness irregularity in vertical direction is

one of them, as a result of which soft storey is formed. In the dissertation work a parametric study is performed on multi storied building with soft first storey, located in seismic zone IV. It is intended to describe the performance characteristics such as stiffness, shear force, bending moment, drift. The study is carried out on a building with the help of different mathematical models considering various methods for improving the seismic performance of the building with soft first storey. Analytical models represent all existing components that influence the mass, strength, stiffness and deformability of structure .It is concluded that the use of cross bracing significantly increases the first storey stiffness .Stiffer columns are effective in reducing the stiffness irregularity & drift. Shear walls are found to be most effective in reducing the stiffness irregularity ,storey drift &strength demand in first storey.

- **Mr. Mirghaderi,Khafaf,"Lateral Stiffness of Pyramid Shape Building with inclined column's"International earthquake synopsis 2007.**In pyramid structures reduction of stiffness in height don't uniform and affects of inclined column in some stories, otherwise, this fact incertitude the regularity of pyramid building and this means equivalent lateral force procedure isn't sufficient for design pyramid building and need to analysis with modal response spectrum or other appropriate and intricate analysis such as nonlinear static analysis or time-history for design these structures. Therefore in this paper numerous categories of pyramid buildings with different stories and slopes are selected, and design and analysis are done.It is concluded that the lateral stiffness in symmetric and asymmetric pyramid building has much further value than regular structures. The relative lateral stiffness between each adjacent storey exceeded from seismic codes requirement. (According to ASCE 7-05 [2])
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- **Bhattacharya S.P, Chakraborty S.K,"Estimation of storey shear of a building with Mass and Stiffness variation due to Seismic excitation" international journal of civil and structural engineering volume 1, no 3, 2010 .** Mass and stiffness are two basic parameters to evaluate the dynamic response of a structural system under vibratory motion. High rise and multi-storeyed buildings are behaved differently depending upon the various parameters like mass-stiffness distribution, foundation types and soil conditions. 2001 Bhuj earthquake in Gujrat, India demonstrated the damage and collapse of the buildings due to the irregularities in structural stiffness and floor mass. This paper attempted to investigate the proportional distribution of lateral forces evolved through seismic action in each storey level due to changes in mass and stiffness of building. As per the BIS provisions, a multi-storey symmetrical building is considered as simplified lump mass model for the analysis with various mass and stiffness ratios. The sway pattern of multi-storeyed building under seismic excitation is taken under consideration with parabolic shape functions. The result concludes as a building structure with high mass and stiffness ratio provides instability and attracts huge storey shear. A proportionate amount of mass and stiffness distribution is advantageous to control over the storey and base shear.

- **"Shaikh Abdul Aijaj Abdul Rahman, Girish Deshmukh,"Seismic Response of Vertically Irregular RC Frame with Stiffness Irregularity at Fourth Floor" International Journal of Emerging Technology and Advanced Engineering (Aug2013)** Structural engineer's greatest challenge in today's scenario is constructing seismic resistant structure. Uncertainties involved and behavior studies are vital for all civil engineering structures. The presence of vertical irregular frame subject to devastating earthquake is matter of concern. The present paper attempts to investigate the proportional distribution of lateral forces evolved through seismic action in each storey level due to changes in stiffness of frame on vertically irregular frame. As per the Bureau of Indian Standard (BIS) 1893:2002(part1) provisions, a G+10 vertically irregular building is modeled as an simplified lump mass model for the analysis with stiffness irregularity at fourth floor. To response parameters like story drift, story deflection and story shear of structure under seismic force under the linear static & dynamic analysis is studied. This analysis shows focuses on the base shear carrying capacity of a structure and performance level of structure under severer

zone of India. The result remarks the conclusion that, a building structure with stiffness irregularity provides instability and attracts huge storey shear. A proportionate amount of stiffness is advantageous to control over the storey and base shear.

III. CONCLUSIONS

Paper presents It is concluded from review of literature that stiffer column are more effective to resist the strength of column.
A proportionate amount of stiffness is advantageous to control over the storey and base shear.

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8. "Estimation of storey shear of a building with Mass and Stiffness variation due to Seismic excitation" studied by Bhattacharya S.P1, Chakraborty S.K.
9. "Seismic Response of Vertically Irregular RC Frame with Stiffness Irregularity at Fourth Floor",studied by Shaikh Abdul Aijaj Abdul Rahman, Girish Deshmukh.

