

# SEISMIC ANALYSIS BY VARIANCES IN IRREGULARITIES OF R.C.C. STRUCTURE

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**Abstract—** The building are R.C.C structure domestically used for residential purpose. This research work is concerned with the analysis for building of R.C.C structure for the safety purpose of future earthquake In this paper an analytical study is made to find response of different irregular structures and regular structure located in severe zone V. Analysis has been made by taking 15 storey R.C.C building by static and dynamic methods using ETABS 2013 and IS code 1893-2002 (part1). Linear Equivalent Static analysis is performed in zone I and II for regular R.C.C buildings up to 90m or 80m height, Dynamic Analysis should be performed in zone IV and V for irregular and regular buildings. Dynamic Analysis can take the form of a dynamic Time History Analysis or a linear Response Spectrum Analysis. Behavior of R.C.C structures will be found by comparing responses in the form of storey displacement for irregular and regular structures. Different type of analysis methods such as response spectrum method and equivalent static method are adopted in order to study the displacement of storey . Pushover curve is obtained, the main objective to perform this analysis is to find time history and also displacement vs. base shear graph analysis will be carried out taking BHUJ earthquake. In this present work two types of structures considered are reinforced concrete irregular and regular R.C.C buildings of 15 storey and are analyzed by two method i.e. dynamic and static methods. For time history analysis past earthquake ground motion record is taken to study response of all the R.C.C structures. Presently there are six models. One is of regular structure and remaining are irregular structural models.

**Keywords—**Seismic load, stresses, shear force, high rise building, staad Pro, bending moment, deflection

## 1. INTRODUCTION

Failure of structure starts at points of weakness, During an earthquake. This weakness arises due to discontinuity in mass, stiffness and geometry of structure. The structures having discontinuity are termed as irregular structures. Irregular structures contribute large portion of urban infrastructure. During earthquakes Vertical irregularities are one of the major reasons of failures of structures. For example structures with soft storey were the most notables structures which collapsed.

So, the effect of vertically irregularities in the seismic performance of structures becomes really very important. Height-wise changes in mass and stiffness render the dynamic characteristics of these buildings different from the ‘regular’ building. IS 1893 definition of Vertically Irregular structures: The irregularity in the R.C.C building structures may be due to irregular distributions in their, stiffness, strength and mass along the height of building. When such R.C.C. buildings are constructed in high seismic zones, the analysis and design becomes more complicated and difficult. There are two types of irregularities-

1. Plan Irregularities
2. Vertical Irregularities.

Vertical Irregularities are mainly of five types:

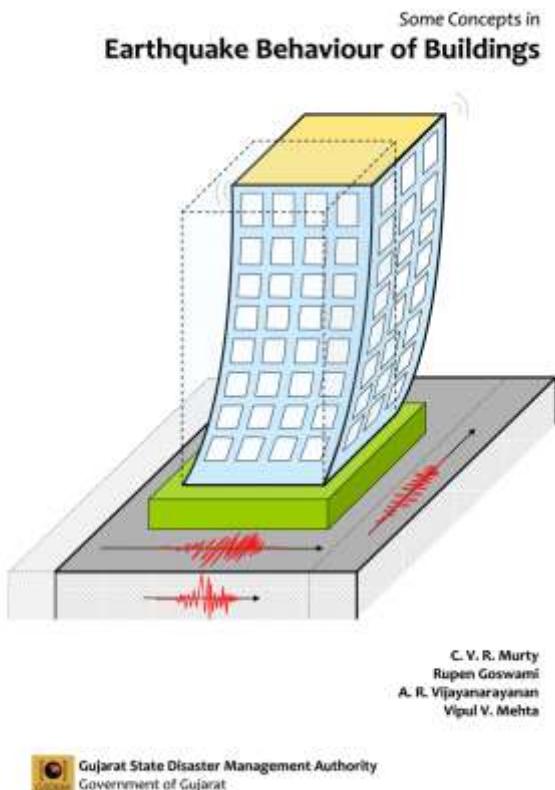
- i) a) Stiffness Irregularity — Soft Storey-A soft storey is one in which the lateral stiffness is not greater than 70 percent of the storey above or not greater than 80 percent of the average lateral stiffness of the three storeys above.
- b) Stiffness Irregularity — Extreme Soft Storey-An extreme soft storey is one in which the lateral stiffness is not greater than 60 percent of that in the storey above or not greater than 70 percent of the average stiffness of the three storeys above.[5]
- ii) Mass Irregularity-Mass irregularity shall be considered to exist where the seismic weight of any storey is more than 200 percent of that of its adjacent storeys. In case of roofs irregularity more need not be considered.
- iii) Vertical Geometric Irregularity- A structure is considered to be irregular Vertical geometric when the horizontal dimension of the lateral force resisting system in any storey is more than 150 percent of that in its adjacent storey.
- iv) In-Plane Discontinuity in Vertical Elements Resisting Lateral Force- An in-plane offset of the lateral force resisting elements not less than the length of those elements.
- v) Discontinuity in Capacity — Weak Storey-A weak storey is one in which the storey lateral strength is less than 80 percent of that in the storey above.

As per IS 1893, Part 1 Linear static analysis of structures is used for regular structures of limited height as in this process lateral forces are calculated as per code based fundamental time period of the structure. Linear dynamic analysis are an improvement over linear static analysis, as this analysis produces the effect of the higher modes of vibration and the actual distribution of forces in the elastic range in a better way.

Buildings are designed as per Design based earthquake, but the actual forces acting on the structure is far more than that of

DBE. So, in higher seismic zones Ductility based design approach is preferred as ductility of structure narrows the gap. The primary objective in designing an earthquake resistant structure is to ensure that the building has enough ductility to withstand the earthquake forces, which it will be subjected to during an earthquake.

past studies it is clear that effect of earthquake on different type of structure can be minimize by providing shear wall, base isolation etc.



## 2. METHODOLOGY

If the structure is not properly designed and constructed with required quality they may cause large destruction of structures due to earthquakes. Time history analysis is an useful technique for seismic analysis of structure when the structure shows nonlinear response. This method is step by step analysis of the seismic responses of a structure to a specified loading that may change with time. 1) Extensive literature survey by referring books, technical papers carried out to understand basic concept of topic. 2) Selection of type of structures. 3) Modeling of the selected structures 4) Analytical work is to be carried out. 5) Interpretation of result and conclusion. In the present work it is proposed to carry out seismic analysis of multistoried RCC buildings using time history analysis method considering mass irregularity at different floor levels with the help of ETABS software.

## 3. CONCLUSION

Many of the studies have shown seismic analysis of the RCC structures with different irregularities such as mass, stiffness irregularity and vertical geometry irregularity. Whenever a structure having different irregularity, it is necessary and very important to analyse the building or R.C.C buildings in various earthquake zones. From many

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