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Study on Seismic Analysis of Multi Storied Reinforced Concrete Building with Mass Irregularities

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Abstract: ***The failure of structure starts at points of weakness. This weakness arises due to discontinuity in mass, stiffness and geometry of structure .The irregularity in the building structures may be due to irregular distributions in their mass, strength and stiffness along the height of building. Mass irregularity shall be considered to exist where the weight of any story is more than 200 percent of that of its adjacent storey's. Here analyze a multi storied RC building of earthquake intensity III by Time history analysis. Also study the effects of Seismic behavior on the building in terms of seismic responses such as Storey displacement, Storey drift, and Base shear of the structure .From the above analysis we can conclude that building without any mass irregularities are the better structures for resisting seismic loads. If any mass irregularities are exists, that must be concentrated on bottom, to or top or any central areas of building.***

Keywords: Base Shear, Storey Drift, Storey Displacement, Time History, Mass Irregularity

1. Introduction

During an earthquake, failure of structure starts at points of weakness. Generally weakness is due to geometry, mass discontinuity and stiffness of structure. The primary objective in designing an earthquake resistant structure is to ensure that the building has enough ductility to withstand the earthquake load. The performance of building during an earthquake depends upon several factors such as stiffness, ductility, lateral strength, Simple and regular configuration. My work focuses on study of multi storied R.C.C. building with Mass irregularity in ETAB 2015software.

Prof. Swapnil B & Basavalingappa (2015)[1] had conducted a study on evaluation Comparative Analysis on the Seismic Behavior of Combined RC-Masonry. In their study Irregularity is considered in the form of Mass in G+9 multi storied R.C.C. and Composite building and compared both R.C.C. Equivalent static and Response spectrum methods are used to analyze the building as per IS 1893 (Part 1):2002 using SAP 2000 software. The study shows that Composite structures having mass irregularity will better perform than R.C.C. structures.

Sagar & Rajashekhar (2015)[2]had conducted a study on Review paper on seismic responses of multi stored RCC building with mass irregularity.Their findings are ,From many past studies it is clear that effect of earthquake on structure can be minimize by providing shear wall, base isolation etc.

Fabio Nard & Gerard (2015)[3] had conducted a study on Comparative Analysis of Multi storied RCC and Composite Building due to Mass IrregularityTwo time histories (i.e. Koyna and Bhuj) have been used to develop different acceptable criteria (base shear, storey displacement, storey drifts).

Mr. Gururaj B & Dr. Basavraj S. Balapgol (2014)[4] are conducted a study on Seismic Analysis of Multi-storeyed RCC Buildings Due to Mass Irregularity By Time History Analysis. They are found out that the displacement obtained by Equivalent static analysis is higher than Dynamic analysis such as Response Spectrum and Time History Analysis.

P. P. Chandurkar & Dr. P. S. Pajgade (2013)[5] conducted a study on Seismic Analysis of RCC Building with and Without Shear Wall and their findings are When Changing the position of shear wall it affect the attraction of forces, so that wall must be in proper position, If the dimensions of shear wall are large then major amount of horizontal forces are taken by shear wall and Providing shear walls at adequate locations substantially reduces the displacements due to earthquake,

All the above studies show that the composite structures having mass irregularity will perform better than R.C.C. structures.Shear force was found to be maximum for the first storey and it decreased to a minimum in the top storey in all cases.The stiffness irregular building experienced lesser base shear and has larger inter storey drifts.Time history analysis shows significant less base shear than that from response spectrum analysis.

2. Methodology

In this work the seismic analysis of multi stored RCC building is carried out with time history analysis Method considering mass irregularity at different floor levels with the help of ETABS software. First to create a model of a regular building of G+11 storey building throughout the structure. Themodel consist of a G+11 storey building with mass irregularity in 1st, 5th and 10th floor by providing a varying dead load on structure.Compare these three models

by time history analysis. Also compare the natural frequency, base shear and story drift of the structure.

3. Modelling in Etabs

The Following are the specification of G+10 storied commercial building located in seismic zones III.The RCC multi storied building is used for the study.

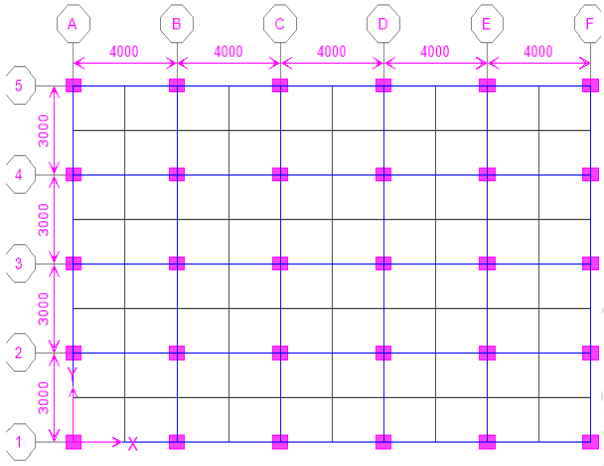

Figure 1: Plan of RCC building

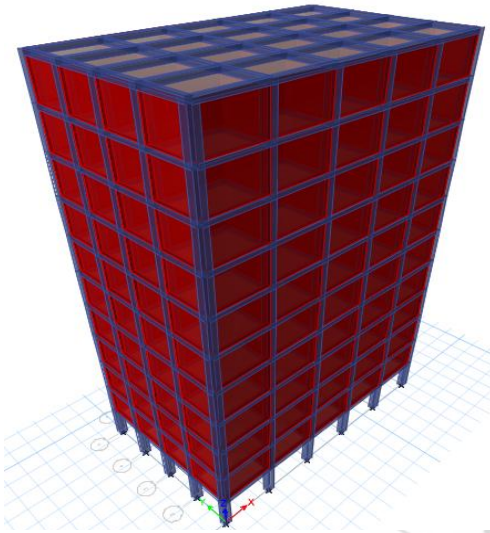

Figure 2: Building Model

4. Analysis

After assigning the loads to the structure, analysis is done to evaluate the shear force bending moment and dynamic results in form of base shear, storey drift and lateral forces. After analysis design can be executed in ETABS as it includes various international codes and the structure can be designed using these codes.

5. Results and Discussions

After analysing the models various results are obtained. And these results are evaluated by preparing various graphs. The graphs are compared to understand the behaviour of building by providing mass irregularities in various floors and to determine which section is more effective in resisting lateral loads.

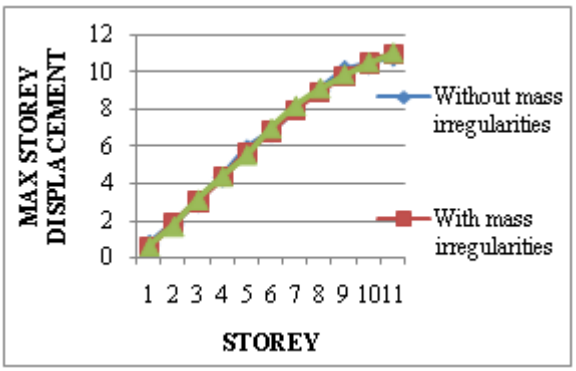

Figure 3: Maximum storey displacement

From maximum storey displacement curve on x and y direction with and without mass irregularity in the buildings shows than on both directions the value of storey displacement is same Result shows a linear variation. The three building models show comparatively same displacement in x and y directions.

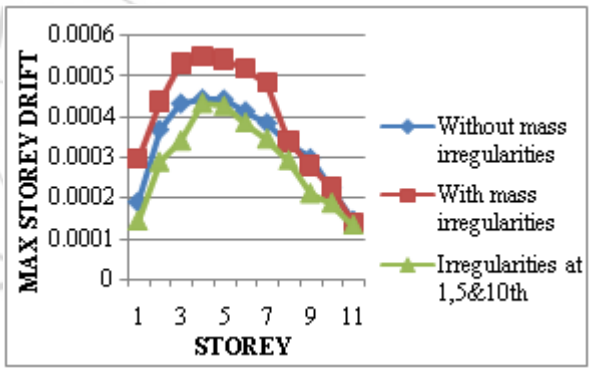

Figure 4: Maximum storey drift

The storey drift value is increases in building with mass irregularities than the building without mass irregularities. Here the buildings with mass irregularities on the 1st ,5th and 10th floor gives better results than the other two buildings.

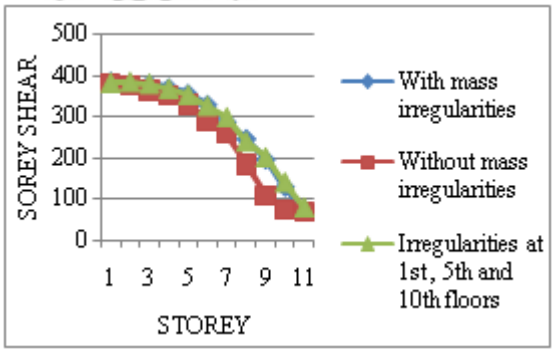

Figure 5: Maximum storey shear

In the case of maximum storey shear the building without mass irregularities and with irregularities in 1st,5th and 10th floors of the building gives better results than fully mass irregular one.

6. Conclusions and Future Scope

6.1 Conclusions

The selected models were analysed using response spectrum method and the conclusions obtained from the analysis are as follows:

- In case of maximum storey drift the buildings with mass irregularities on the 1st ,5th and 10th floors give better results than the other two buildings.
- The values of maximum storey shear the building without mass irregularities and with irregularities in 1st,5thand 10th floors of the building gives better results than mass irregular one.
- From the above finding we can conclude that building without any mass irregularities are the better structures for resisting seismic loads. If any mass irregularities are exists that must be concentrated on bottom, to or top or any central areas of building parts.
- In the case of maximum storey displacements the three building models showing comparatively same displacement in x and y directions. In between these the mass irregularities at 1st 5th and 10th building gives better result.

6.2 Future Scope

- This work can be compared with an irregular structure by using ETAB software.
- Also can be done with another software and compare the results.
- Response spectrum analysis also can implement for the further studies.
- This work also can be performed on composite structures.

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