

Comparison of RCC Buildings with a Soft-Storey Irregularity in Different Zones

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ABSTRACT

Soft storey is one of the main reasons for building damage during an earthquake and has been mentioned in all investigation report. Soft storeys in a high rise building play an important role on its seismic performance. At the soft storey level, there is a discontinuity in the rigidity of the structure due to lack of infill walls or due to variation in floor height. Soft storey is generally utilized as a part of auxiliary individuals in a building. Ex-cellar stopping, shops, soft story is floor level in which the stiffness of the floor is under 80% of the normal stiffness of three stories above it. Earthquake occurred in multi-storeyed building shows that if the structures are not well designed and constructed with an adequate strength it leads to the complete collapse of the structures. To ensure safety against seismic forces of multi-storied building, there is need to study of seismic analysis to design earthquake resistance structures. Building irregularities generally become obvious with the effect of a seismic load. It is crucial that the irregularities of structural systems should be considered properly with respect to the conditions determined by the building codes.

KEYWORD: Soft storey, Irregularity, Staad-pro, Earthquake zone, RCC building

INTRODUCTION

Soft storeys in a high rise building play an important role on its seismic performance. At the soft storey level, there is a discontinuity in the rigidity of the structure due to lack of infill walls or due to variation in floor height. It is this continuity which is the cause of structural failure of multi stored buildings under earthquake loads. Severe structural damage suffered by several modern buildings during recent earthquakes illustrates the importance of avoiding sudden changes in lateral stiffness and strength. Recent earthquakes that occurred have shown that a large number of existing reinforced concrete buildings are vulnerable to damage or even collapse during a strong Earthquake. While damage and collapse due to soft story are most often observed in buildings, they can also be developed in other types of structures. The lower level containing the Concrete columns behaved as a soft story in that the columns were unable to provide adequate shear resistance during the earthquake. The buildings with soft storey are very susceptible under earthquake load which create disasters. In the design of earthquake-resistant reinforced-concrete structural systems, the necessity to construct a regular structure is one of the main principles. Building irregularities generally become obvious with the effect of a seismic load. The performance of a building affected by the earthquake ground motion primarily depends on its configuration. One of the influential reasons for the building's collapse recognized from the precedent earthquakes is the irregular configuration of

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building. In this way, the analysis and design of a building with irregular configuration particularly, the ones located in a severe seismic zone, turn into a matter of concern. Mostly, the buildings are possessed with a combination of complicated irregularities and considering a simple or individual irregularity may not govern a judicious prediction of the seismic performance of a building. While designing an irregular building, it is essential to select an appropriate type, degree and location of irregularity.

AIM & OBJECTIVE

Aim: To compare bending moment, shear force, storey displacement and base shear in zone II, III, IV, V of a RCC building having soft storey irregularity at different height using STAAD Pro software.

Objectives:

- To identify generic plan of buildings & to decide the other parameters & geometry.
- To decide soft-storey irregularities at different height.
- To perform seismic analysis of the considered buildings in different zones II, III, IV, V
- To analysis of soft storey for various building.
- To compute maximum shear force, bending moment, multistory displacement & base shear.
- Coparision of shear force, bending moment, storey displacement & base shear in zones II, III, IV, V.

LITERATURE SURVEY

Zabihullah, Singh and Zamir (2020), It presents seismic response of RC structures having various individual and combined complicated geometric irregularities. A G+7 storeyed regular building frame is customized by integrating various geometric irregularities in its horizontal and/or vertical planes. Together with a regular configuration, six number of irregular configurations are analyzed and compared using the Response Spectrum Method as per IS-1893 (Part-1): 2016. The comparison among all the models is carried out based on the Base shear, Fundamental period, Storey Stiffness, Lateral- displacement, Storey Drift, Eccentricity and Torsional irregularity. Out of building models with individual irregularity, the horizontally irregular model (M-V) is verified as the most susceptible during the considered earthquake. Oppositely, the vertically irregular model (M-III) is recognized to have a superior seismic performance. Among the building models with a combination of geometric irregularities, M-VII has displayed a better seismic performance indicating that certain combinations of irregularities may decline the seismic response of a building. [1]

Paidalwar and Awchat (2017), This paper presents the soft storey behavior due to lack of infills at ground floor storey and existence of this case by means of linear static and nonlinear static analysis for midrise reinforced concrete building. Soft storey behavior due to change in infill's amount is evaluated in view of the displacement, drift demand and structural behaviour. The present study shows that infill can improve stiffness of structure but in to some extent, that is not enough to save structure against seismic effect. RC frame building with open first storey's are known to perform poorly in strong earthquake shaking. In this study, the vulnerability of building with soft storey is shown an example building. [2]

Ghalimath and Hatti (2015), Present paper focuses on difference between soft storey and weak storey and also IS code provision related to soft storey. RC frame buildings with open bottom storey are known to perform poorly during in strong earthquake shaking. Thus, it is clear that such buildings will exhibit poor performance during a strong shaking. This hazardous feature of Indian RC frame buildings needs to be recognized immediately and necessary measures taken to improve the performance of the buildings. The phenomena of soft story may arise due to many Different reasons such as change in load carrying and slab system between stories. The abrupt changes which take place in the amount of the infill walls between stories is also one of the frequent reasons of the soft storey behavior. Since infill walls are not regarded as a part of load carrying system, generally civil engineers do not consider its effects on the structural behavior. [3]

Wajid and Shilpa (2017), This paper addresses an endeavor made to ponder the conduct of storey with propping in a tall building structure. Conduct of soft story in standard and unpredictable structure is presented. To wipe out softstory in all floors infill dividers are utilized. Modeling is done using ETABS 2013.[4]

Silpa Rani and Aiswarya (2013), This paper deals with the study of seismic response of a building with soft storey's at different level. The study consists the modelling of a G+6

storeyed irregular RC building. The modeling of the whole building is carried out using the computer program STAAD. Pro V8i software. Parametric studies on displacement, inter storey drift and base shear have been carried out using equivalent static analysis to investigate the influence of these parameter on the seismic behavior of buildings with soft storey. The selected building is analyzed through five models and the comparison of result is carried out. After analysis it is the concluded that Soft storey at ground level is a typical feature in the modern multistorey constructions in urban India. Such features are highly undesirable in buildings built in seismically active areas this has been verified in numerous experiences of strong shaking during the past earthquakes. Multi-storeyed buildings with open (soft) ground floor are inherently vulnerable to collapse due to earthquake load. [5]

Dubule and Ainchwar (2018), have concluded in their paper the storey shear force was found to be maximum for the first storey and it decreases to minimum in the top storey in all cases. The mass irregular structures were observed to experience larger base shear than similar regular structures. The stiffness irregular structure experienced lesser base shear and has larger inter-storey drifts Earthquake occurred in multi-storeyed building shows that if the structures are not well designed and constructed with an adequate strength it leads to the complete collapse of the structures. To ensure safety against seismic forces of multi-storied building, there is need to study of seismic analysis to design earthquake resistance structures. [6]

Donduren and Nakipoglu (2018),have concluded in their paper the soft-storey irregularity, formed because of various reasons was investigated. Various national building codes were compared. In these codes, the soft-storey conditions are more superficially treated. The soft-storey irregularity, which causes great losses under the effect of a seismic load, should be determined with much more national seismic codes, especially in the earthquake-prone countries. [7]

CONCLUSION

From the above literature papers conclusion is as follow:

- The vertically irregular model (M-III) is recognized to have a superior seismic performance. Among the building models with a combination of geometric irregularities, M-VII has displayed a better seismic performance indicating that certain combinations of irregularities may decline the seismic response of a building.
- RC frame building with open first storey's are known to perform poorly in strong earthquake shaking. In this study, the vulnerability of building with soft storey is shown an example building.
- Since infill walls are not regarded as a part of load carrying system, generally civil engineers do not consider its effects on the structural behavior.
- Conduct of soft story in standard and unpredictable structure is presented. To wipe out soft story in all floors infill dividers are utilized. Modeling is done using ETABS 2013.
- Multi-storeyed buildings with open (soft) ground floor are inherently vulnerable to collapse due to earthquake load.
- To ensure safety against seismic forces of multi-storied building, there is need to study of seismic analysis to design earthquake resistance structures.

- The soft-storey irregularity, which causes great losses under the effect of a seismic load, should be determined with much more sensitive numerical calculation methods in the national seismic codes, especially in the earthquake-prone countries.

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