

# COMPARATIVE STUDY ON THE SEISMIC ANALYSIS OF MULTISTOREY RC STRUCTURE WITH VARYING PERCENTAGE OF DIAPHRAGM DISCONTINUITY

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**Abstract** - In multi-storeyed rcc building, critical damages due to earthquake forces are developed due to the present of irregularities present in the structure. Due to present of diaphragm irregularity in the structure makes uneven distribution of mass, stiffness and strength along the diaphragm and hence weakens the structure. Commonly, now a days it is required to have openings in the floor slabs of the buildings throughout their height or at some sections for elevators or staircase shafts, mezzanine floors, lighting requirements or some architectural criteria. These openings in the diaphragms cause stress concentration near discontinued joints and may increase torsional component. In this project the effect of diaphragm discontinuity of 0,5,10,12,16,20 percentage of opening with slab thickness of 100, 125, 150, 175 mm in 12 storey R c building was analysed in e tab 2017 software using response spectrum method. The parameters like storey displacement, storey drift and base shear will be compared and studied.

**Key Words:** Diaphragm discontinuity, slab thickness, storey displacement, base shear

## 1.INTRODUCTION

Earthquakes are one of the most vulnerable, destructive and highly unpredictable dynamic forces which arrives with enough energy to bring down whole building in a matter of seconds. From the past earthquakes studies indicate that the majority of building collapses in the past earthquakes were due to deficient seismic design and lack of knowledge in the seismic behavior of structures as well as not following the codal criterion. Earthquake resistant structures are designed with vertical as well as lateral load resisting systems, which are capable of transmitting the developed inertial forces originating from the mass centres throughout the structure up to the foundation.

Floor and roof slabs act as horizontal diaphragms in building systems by ensuring that vertical components act together under gravity and seismic loads. In addition to the gravity loads, they also transfer the inertia forces induced by their own masses, to the vertical elements (columns and walls) on which they rest. Such discontinuities are created by openings in the slabs which may be required for elevator

core or staircase, lighting or architectural function respectively. When these openings are large, it affects the rigidity of a diaphragm and consequently the distribution of lateral load to the vertical structural elements. Large openings or cut-outs in floors interrupt load paths and it may prevent smooth, direct transfer of forces to the vertical elements. This results in stress concentration which can cause brittle damage in structural elements at the discontinuity.

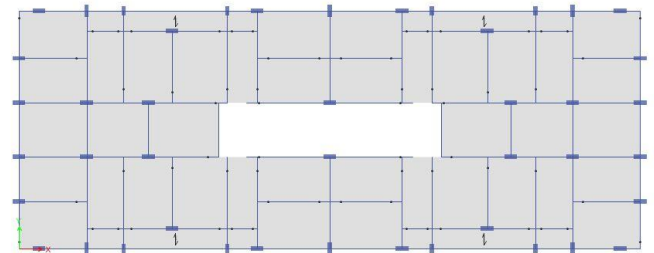


Figure 1 slab with diaphragm discontinuity.

## 1.1 OBJECTIVE

The main objectives of undertaking the present study are as follows:

- To study the seismic response of R.C. Multi-storey building with Diaphragm irregularity with various percentage of opening using response spectrum method of analysis.
- To evaluate the effect of slab thickness in building on seismic response of the structure.
- To compare the seismic response of the building in terms of base shear, ratio of maximum to minimum displacement of a floor, inter storey drift and storey lateral displacement.

## 1.2 SCOPE

The scope of this study includes, performance based seismic analysis of a 12 storey Reinforced Cement Concrete building located in zone 3 resting on medium type soil with

diaphragm discontinuity using response spectrum analysis. For response evaluation of the buildings, linear dynamic analysis were carried out using codes – IS 1893: 2016 (Part 1) 2016. The entire procedure of modelling, analysis, design and performance evaluation was carried out using ETABS 2017 software.

Analyse of g+12 storey R.C. buildings with and without diaphragm discontinuity using ETABS software is as follows.

- To assess the effects of diaphragm discontinuity of 0,5,10,12,16,20 percentage of the slab opening using response spectrum that is linear dynamic analysis.
- To assess the performance of R.C. framed buildings with the slab section of 100,125,150,175 mm thickness
- Compare the parameter like displacement, storey drift, base shear.

## 2. Literature Review

[1]Sahu, Reena, and Ravi Dwivedi. "Seismic Analysis of RC Frame with Diaphragm Discontinuity." IOSR Journal of Mechanical and Civil Engineering, Volume 14, Issue 4, Aug. 2017).

In this present paper the g+12 storey building was model with 0, 4,16,24,36 % of opening in slab was analysed using static and response spectrum method of analysed using stad pro software. The basic aim was to analysed and compared the design parameter like base shear, storey drift, displacement and time period of the building.

Results shows that as percentage of opening increase, storey drift increase in all the model. The result of parameter listed above were higher in static analysis compared to response spectrum method of analysing.

[2]Vinod V, Pramod kumar h v. "influence of stiffness discontinuous diaphragm characteristics on the seismic behaviour of rc structure" International Journal of Scientific Development and Research (IJS DR) ,Volume 2, Issue 6, June 2017, ISSN: 2455-2631.

In this paper study of the behaviour of various parameters like base shear, storey drift, displacement and time period with diaphragm opening on the seismic behavior of g+4 and g+8 structure was analysed. The effect of discontinuities in the diaphragm was kept 0%, 10%, 20%, and 30% opening. For this work, e tab 2015, software was used. Response spectrum analysis method listed in is 1893 part 1 was performed in this software. Designing parameters such as base shear, storey drift, displacement and time period of the building was compared.

Result showed that Value of base shear, time period, drift and displacement decreased with increasing percentage of opening except structure with 20% opening gives vulnerable result compared to other.

[3]Amaranth Dodamani, Prof Sujeet Patil, "Seismic analysis of multi-storeyed building with diaphragm discontinuity". International Research Journal of Engineering and Technology (IRJET). Volume: 07 Issue: 09 | Sep 2020

In this paper a regular G+15 storey RC buildings with slab opening provided at central part, corner and peripheral location of building was used. Structure was analysed with different stiffness modifiers listed in is code 16700:2017 .for analysing purpose ETABS (2018) was used. Response spectrum method was adopted for the analysis .the basic parameters like storey displacement, storey drift, base shear, displacement were studied and compared with regular building without any opening provided in the structure.

Value of base shear, time period, drift and displacement decreased as percentage of opening increases. Regular building that do not considered stiffness modifier give less value of base shear, time period, drift and displacement compared with building that takes stiffness modifier into consideration.

[4]Pooja P. Dhanani, Krutarth Patel, Bijal chaudhari. "Behavioural study for seismic response", Journal of Emerging Technologies and Innovative Research (JETIR). Volume 5, Issue 5, 2018, (ISSN-2349-5162).

In present study,G+18 storey building with Different Diaphragm Discontinuity of 22 percentage at different location such as at corner, at central part, 'c' shape opening at boundary of building, 'H' shape opening at center in plan Were Analyzed using response spectrum method of analyzing. ETABS 2016 was used to determine the Seismic Response of the Building and Compare Parameters. The result of Displacement, Base Shear, Story Drift and Fundamental Natural Period was derived and studied.

Result shows that storey drift increases 63% than regular building. Time period of discontinuous building was 53% increased and displacement of 80% with increasing value was found.

[5]Monish, S Karuna "A Study On Seismic Performance Of High Rise Irregular Rc Framed Building", International Journal of Research in Engineering and Technology, Volume: 04 Issue: 05 | May-2015, eISSN: 2319-1163 | p ISSN: 2321-7308

In this research paper the main aim was to study the behavior of 20 storey structure with two different types of plan irregularities present in it namely diaphragm discontinuity and re-entrant corners. These irregularities are listed in clause 7.1 of IS 1893:2002(part1) code. Various irregular models with c shape, h shape, plus shape opening were considered. For the study ETABS was used to determine the seismic response of the building. The models were analyzed using static equivalent method and dynamic method.

Result shows that as number of storey increase, displacement increases. H shaped building was the most vulnerable in its behaviour. Static analysis gives higher result than dynamic analysis.

## 3. CONCLUSION

From the above research paper it is possible to analyze the the multi storey rc frame structure with various percentage of opening in slab using response spectrum method of analysis in e tab software. Today due to architectural aspect

and from elevation point of view cut out is necessary in building so its effect should be analyzed in the behavior of structure.

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