SEISMIC ANALYSIS OF MULTI-STOREY BUILDING OF DIFFERENT SHAPES HAVING DIAPHRAGM DISCONTINUITY

[1]Shahbaz Khan, [2]Dr. V. G. Sayagavi, [3]N. G. Gore
Departent of Civil Engineering
MGM's College of Engineering & Technology, Kamothe
Navi Mumbai, India

Abstract : The main objective of this paper is to select an appropriate shape of building with optimum opening which can resist the seismic forces. In our report, we are going to compare the different shapes of building for various zones having diaphragm discontinuity (i.e. openings in slab) by using ETABS Software. Base shear, storey shear, storey drift, overturning moments, storey displacements, time period and modal mass of different structures for various zones will be compared and optimum percentages of openings will be found out. Dead loads, Live loads, Earthquake loads & Wind loads will be applied as per Indian Codes. The different shapes of building with and without diaphragm discontinuity will be analysed by Response Spectrum Method

***IndexTerms*-DiaphragmDiscontinuity,ResponseSpectrum,OptimumOpeningsBaseShearandStoreyDrift.**

I. INTRODUCTION

Nowadays, people are migrating from villages to urban areas i.e. construction of multi-storeyed buildings has become necessary for residential as well as commercial buildings and land is scarce and expensive particularly in big cities like Mumbai, Kolkata, Chennai, Thane, Pune, Kolkata, etc. So developed cities have emerged as centers for high rise buildings and the modern trend is towards more tall and slender structures. The effect of lateral loads is attaining more importance and the designers are facing problems of providing adequate strength and stability against lateral loads. Earthquakes have become a frequent event all over the world and it is very difficult to predict the intensity, location and time of occurrence of earthquake. Structures which are designed for usual loads like dead, live, wind, etc. may not be necessarily safe against earthquake loading. The earthquake resistance structures are designed based on the following factors: natural frequency, damping factor, type of foundation and ductility of the structure.

II. REVIEW OF LITERATURE

Md Shehzad Choudhary et al. (2018) carried out comparative study on seismic analysis of multi storey building having diaphragm discontinuity using ETABS. A regular 15 and 20 storey RC buildings having shear wall were modeled with and without diaphragm discontinuity and analysed by response spectrum method. They concluded that models having slab opening has lower storey displacement, storey drift, storey shear, modal period than regular building model and variation in the slab thickness reduces the performance of the buildings during earthquake.

J. Sreenath et al. (2018) studied the effect of diaphragm discontinuity in the seismic response of multi-storey building. They have analysed the behaviour of different models with varying diaphragm openings and compared for seismic parameters like maximum dead load, base shear, maximum storey drifts by response spectrum results. The maximum values of shear force were observed in building without diaphragm discontinuity as compared to buildings with different slab openings.

Reena Sahu and Ravi Dwivedi (2017) studied seismic analysis of RC frame with diaphragm discontinuity. They have used static analysis and response spectrum analysis using STAAD.Pro. Various models with varying percentages of diaphragm openings were analysed and compared for seismic parameters like base shear, maximum storey drifts, shear force, bending moment and axial force. The base shear calculated by static analysis was higher than the response spectrum analysis.

III. OBJECTIVE OF PAPER

- To study the seismic performance of a multi- storey building with diaphragm discontinuity by Response Spectrum Analysis.
- The main objective of this project is to compare base shear, storey shear, storey drift, overturning moments, storey displacements, and time period of different structures having for various zones.
- To study the effect of diaphragm discontinuity in the seismic response of multi-storey building.
- To compare the behaviour of different discontinuities in the diaphragm systems during lateral loading.
- The primary objective of this study is to find out that which type of structure is good for which seismic zone.
- To make the building economical and earthquake resistant against seismic effect.

IV. PROBLEM FORMULATION

In previous research studies, the building having diaphragm discontinuity were designed and analysed for different openings. Software's like ETABS, STAAD.Pro, ANSYS, etc. were used. In present study we are going to compare different shapes of building having diaphragm discontinuity of different openings.

Structural Modelling

In present study 4 models of building with different shapes (square, rectangle, C shape and L shape) having diaphragm discontinuity will be modeled for various percentages of opening on ETABS.

Types of Structure: Frame Structure

Material: Steel Fe-415 & Concrete-M40

No of stories: 31 (G+30)

Height of each storey: 3.0 m

Size of Beam: 230mmX600mm

Size of Columns: 1000mmX1000mm

V. METHODOLOGY

Base shear, overturning moments, storey drift and storey displacements is calculated by equivalent static method i.e. seismic coefficient method. After analysis of 4 different models results in terms of base shear, moments, storey drift and storey displacements is compared.

VI. RESULTS AND DISCUSSION

Following results are observed from the analysis of buildings:

Fig.1 and fig.2 shows that base shear and moments at base for irregular building is less as compared to regular building in EQX direction and base shear and moments at base for rectangular building is very less as compared to other buildings.

Fig.3 shows that storey drift for irregular building is less as compared to regular building in EQX direction while fig.4 shows that storey drift for rectangular building is less as compared to other shapes for EQY direction. Same results are observed for storey displacements.

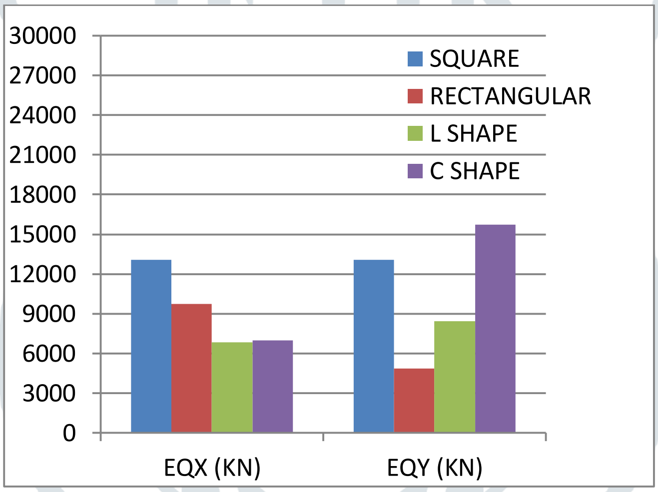

Fig.1 Base Shear

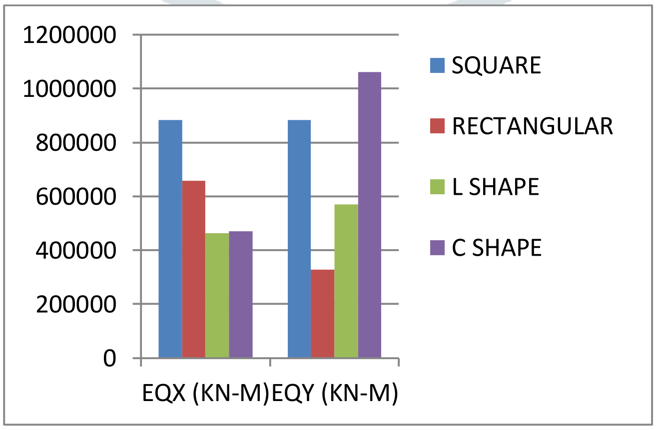

Fig.2 Moments at Base

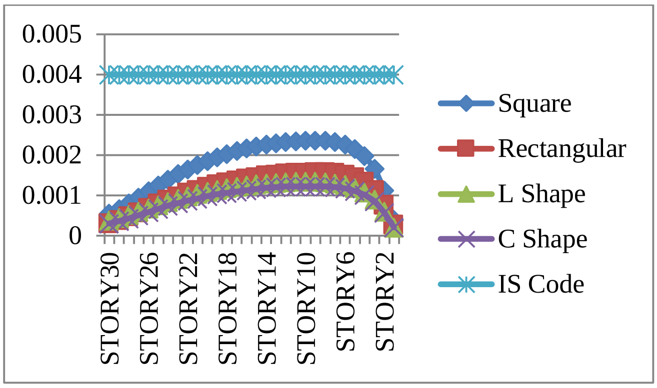

Fig.3 Storey Drift (EQX Direction)

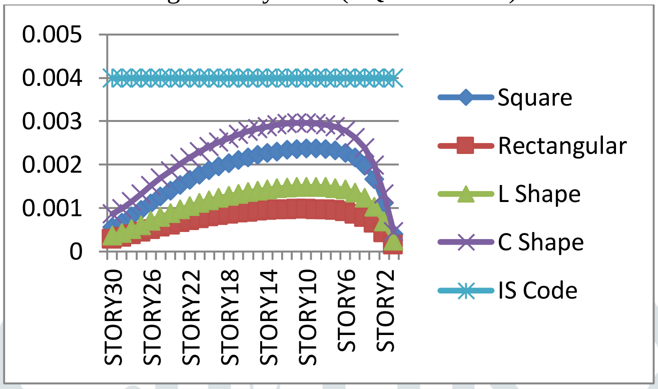

Fig.4 Storey Drift (EQY Direction)

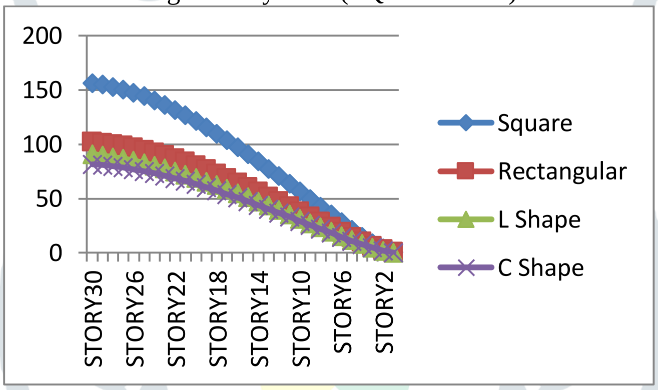

Fig.5 Storey Displacement (EQX Direction)

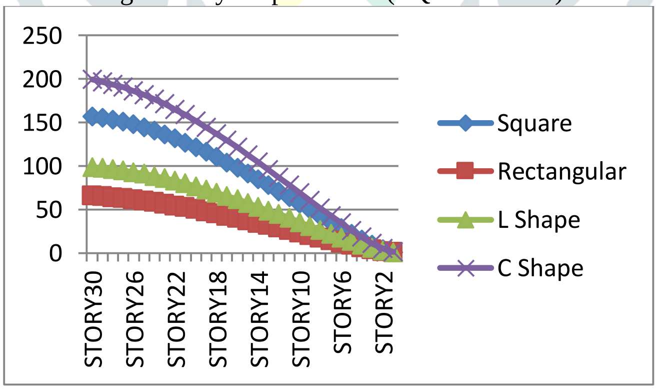

Fig.6 Storey Displacement (EQY Direction)

VII. CONCLUSION

The base shear, moments at base, storey drift and storey displacements for rectangular buildimg is less as compared to irregular building. Further we can provide diaphragm discontinuity to all building and compare all the parameters by response spectrum method for various openings and find out optimum openings.

VIII. References

1. Md Shehzad Choudhary, Syed Arfath, Md Mansoor Ahmed and Nadeem Pasha, "Comparative Atudy on Seismic Analysis of Multi Storey Building Having Diaphragm Discontinuity Using Etabs" Khaja Banda Nawaz College of Engineering, Gulbargs| International Journal of Research in Advent Technology, Vol.6, No.5, May 2018
2. J. Sreenath, Dr. H. Sudharsana Rao and Dr. Vaishali G. Ghorpade, "Effect of Diaphragm Discontinuity in the Seismic Response of multi-storey building" International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES) | e-ISSN:2455-2585, Volume 4, Issue 01, January-2018
3. Reena Sahu and Ravi Dwivedi, "Seismic Analysis of RC Frame with Diaphragm Discontinuity" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)| e-ISSN:2278-1684, p-ISSN:2320-334X, Volume 14, Issue 4 ver. VI, 2017
4. Vinod V and Pramod Kumar H V, "Influence of Stiffness Discontinous Diaphragm Characteristics on the Seismic behaviour of RC structure" | ISSN:2455-2631|June 2017 IJSDR| Volume 2, Issue 6
5. P. P. Vinod Kumar and Dr. V. D. Gundakalle, "Effect of Diaphragm Openings in Multi-storeyed RC framed buildings using Pushover analysis" International Research Journal of Engineering and Technology (IRJET)| Volume:02 Issue:07| Oct-2015
6. P. Suneetha, "Effect of Diaphragm Discontinuity" IJCSIET- International Journal of Computer Science information and Engg| Technologies ISSN 2277-4408| Volume 2-Series 4
7. S. K. Duggal, "Earthquake Resistant Design of Structures" Oxford University Press.
8. IS 456 : 2000, "Plain and Reinforced Concrete- Code of Practice", Bureau of Indian Standards, New Delhi.
9. IS 1893 (Part 1) 2002, "Criteria for Earthquake Resistant Design of Structures", Bureau of Indian Standards, New Delhi.
10. IS 13920-2016, IS 875 (Part 2)-1987, IS 875 (Part 3)-1987