International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

SEISMIC ANALYSIS OF VERTICAL IRREGULAR BUILDING FRAMES

Dr. Ramakrishna Hegde[1], Ravi kiran[2], Supreetha[3]

[1]Head of Department, Department of Civil Engineering, Srinivas School of Engineering, Mangalore, India
[2]Assistant Professor, Department of Civil Engineering, Srinivas School of Engineering, Mangalore, India
[3]M. Tech Students, Department of Civil Engineering, Srinivas School of Engineering, Mangalore, India

---

Abstract – *India is a large country. Nearly two thirds of its area is earthquake zone. Irregular building constitutes a large portion of the modern urban infrastructure. This may lead to building structures with irregular distributions in their mass, stiffness and strength along the height of building. The lateral load on the structure is the most important study trending nowadays, the lateral load on varying floor level structures should be considered load and also earthquake load are taken into account. In this study, response spectrum analysis is carried out to study and analyze the regular and irregular building and its effect with different position of buildings. An attempt has been made on G+21 building to get the results of storey displacement, storey drift, time period and base shear. Analysis is carried out in ETABS-2015 software. The present study is on the analysis of regular and irregular building such as center position and corner position using response spectrum analysis.*

Key Words: **Storey displacement, storey drift, base shear, time period, ETABS.**

1. INTRODUCTION

Regular buildings said to be same plan and irregular buildings are asymmetric plan. There are two types of irregularities such as horizontal irregularity and vertical irregularity. The various factors contributing to the structural damage during earthquake are vertical irregularities, irregularity in strength and stiffness, mass irregularity, torsion irregularity etc. the behavior of a building during an earthquake depends on several factors, stiffness, adequate lateral strength, ductility, simple and regular configuration. Here five frames and their lateral storey displacement, storey drift, base shear have been computed to obtain the effect of irregularities.

1.1 SCOPE OF STUDY

Buildings with same types of the zonal condition and for the same category can be adopted. Regular and irregular buildings i.e. center position and corner position building can be adopted. It shows the behavior of different position of the buildings. Analysis of response such as storey displacement, storey shear, storey drifts and time period is carried out using the ETABS 2015.

1.2 OBJECTIVE OF STUDY

The objective of this study is:-

a. Response spectrum analysis is carried out using ETABS2015 software
b. To determine the storey drift , storey displacement, time period and base shear
c. The concept behind the project is analysis of regular and irregular building of different position of buildings.

2. NARRATIVE OF MODEL

The present work involves analysis of regular and irregular building i.e. center position and corner position. In this project, modeling and analysis are carried for G+21 stories modeling and analysis is done using ETABS-2015 software. There are three models model 1 consists regular building, model 2 consists irregular building for center position and Model 3 consists irregular building for corner position. The dimension of all models of bay length 4m x5m. Each model is done by ETABS.

2.1 BUILDING DESCRIPTIONS

a. Material properties

Young's modulus of (M25) concrete	25*1000 kN/m^3
Density of reinforced concrete	25kN/m^3
Density of steel	Fe415
Poisson's ratio	0.2

b. Details of building

Plan area dimension for regular building	(4 *5) m
Plan area dimension for irregular building	(4*5)m
No. of floors in two models	G+21

Storey height at ground floor	3.0m		
Typical floor height	3.0m		

c. Member properties

Thickness of slab	150mm
Columns size for the building	(600x600) mm
Beam dimensions for the building	(450x600) mm

d. Loads considered

Typical live load	3kN/m^2
Floor finish	2kN/ m^2
Wall load	11.7kN/m^2

e. Seismic forces

Importance factor, I	1.0
Response reduction factor	3
Seismic zone factor	0.16
Type of soil	Medium soil

2.2ETABS MODEL GENERATION

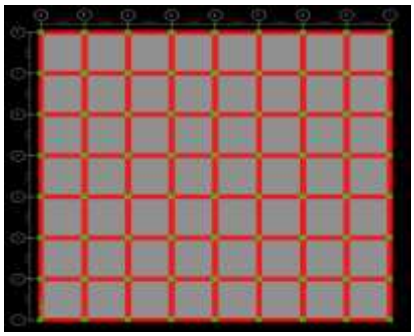

Figure 1:Plan view of Regular Building

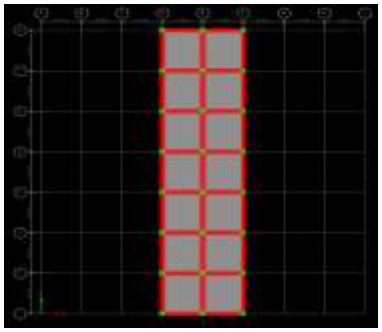

Figure 2:Plan of irregular building for center position

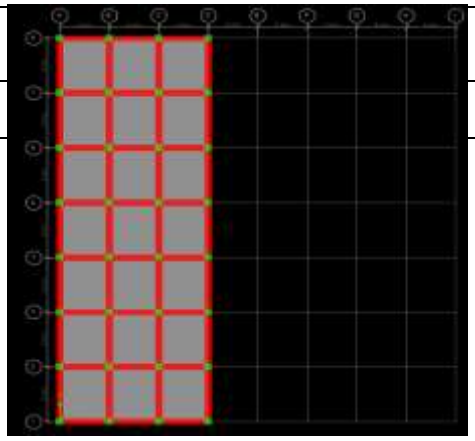

Figure 3:Plan of irregular building for corner

3. RESULTS AND DISCUSIONS

3.1 STOREY DISPLACEMENT

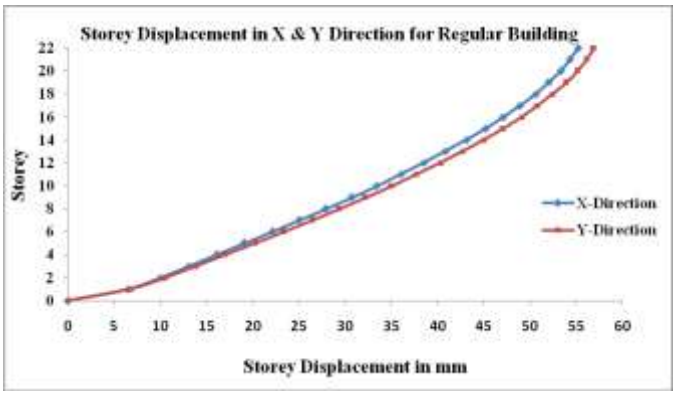

Figure 4: Storey displacement for regular building along X and Y direction

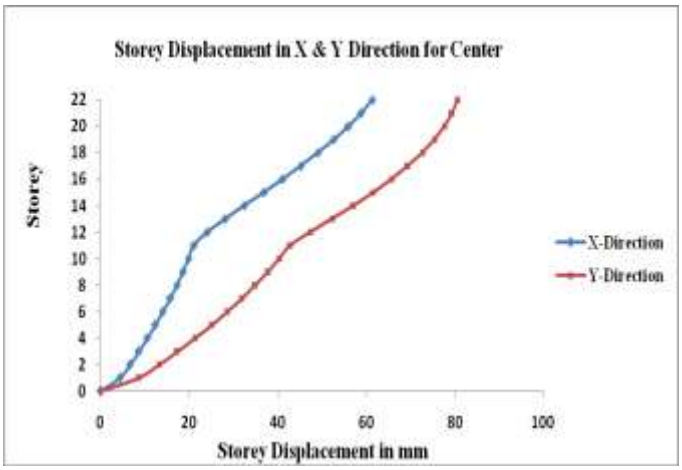

Figure 5: Storey displacement for irregular position for center along X and Y direction

Figure 6: Storey displacement for irregular position for corner along X and Y direction

Figure 7: Comparison result for Storey displacement along X direction

Figure 8: Comparison graph for Storey displacement along Y direction

3.2 STOREY SHEAR

Figure 9: Storey shear for regular building along X and Y direction

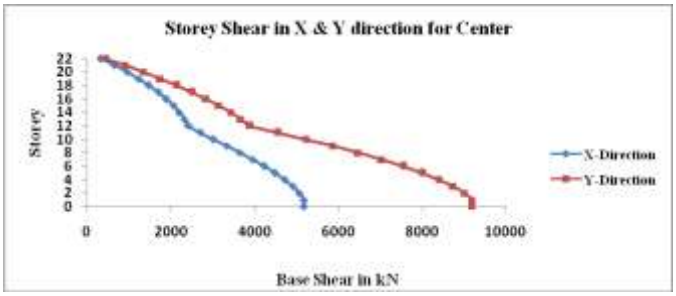

Figure 10: Storey Shear for irregular center position along X and Y direction

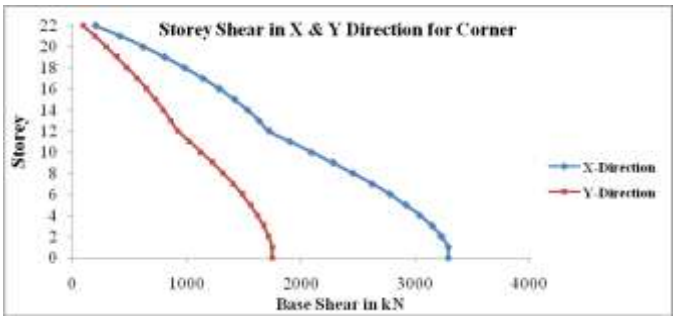

Figure 11: Storey shear for irregular corner position along X and Y direction

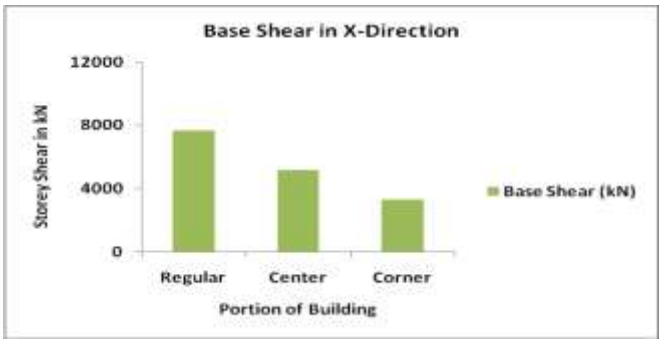

Figure 12: Comparison graph for Storey shear along X direction

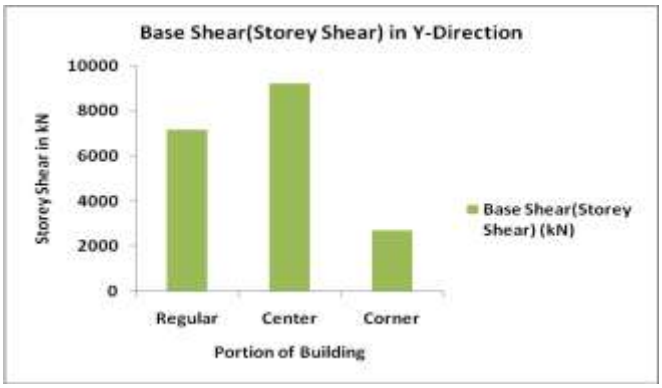

Figure 13: Comparison graph for Storey shear along Y direction

3.3 STOREY DRIFT

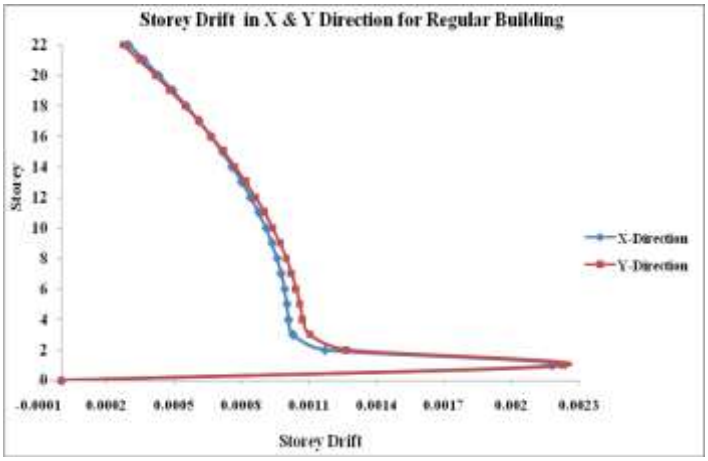

Figure 14: Storey drift for regular building along X and Y direction

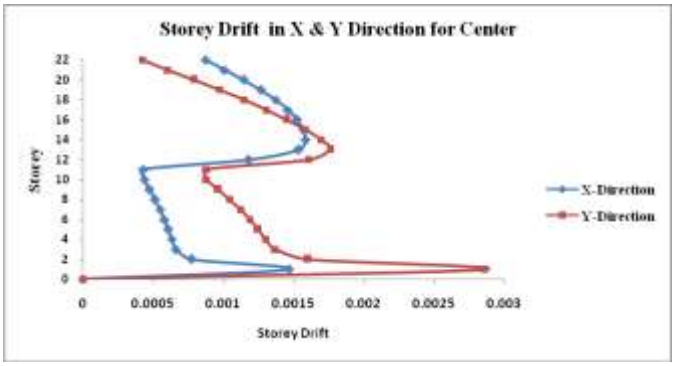

Figure 15: Storey drift for irregular center position along X and Y direction

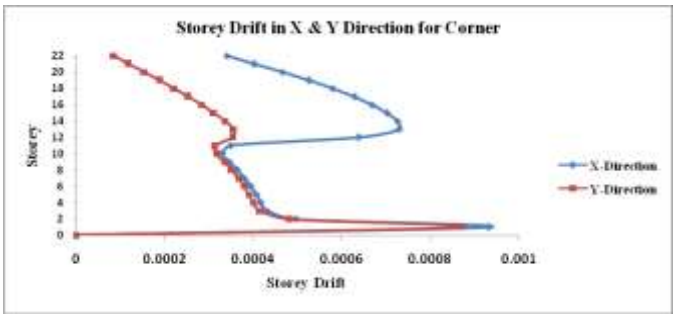

Figure 16: Storey drift for irregular corner position along X and Y direction

Figure 17: Comparison graph for Storey drift along X direction

Figure 18: Comparison graph for Storey drift along Y direction

3.4 TIME PERIOD

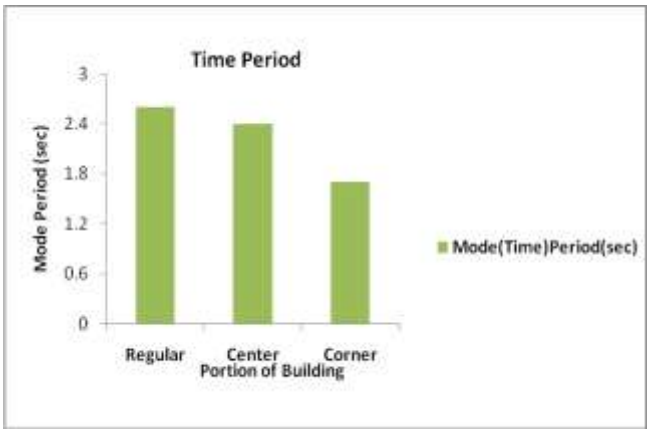

Figure 19: Time period Variation of regular and irregular building

4. RESULT AND DISCUSSION

1. **Storey displacements:** It was found that X and Y directions the displacement increased when compared to center position of the building. The displacement at 22nd storey in X direction for reduces by regular building and corner position is 55.2mm and 32.6mm respectively and Y direction 56.9mm and 21.6mm.
2. **Base shear:** Base shear values for regular and irregular building is observed to From the obtained results it is found that for X and Y directions the shear increased when compared to centre position of building. The shear for 22 storeys in X direction for reduces by regular building and corner portion are 1093.8kN and 202.3kN respectively and Y direction 1012.3kN, 93.9kN.
3. **Storey Drift:** From the obtained results it is found that for X and Y directions the displacement increased when compared to center portion of building. The displacement at 22nd storey in X

direction for reduces by regular building and corner portion are 0.0003 and 0.0003 respectively and Y direction 0.0003, 0.00008.

4. **Time period:** From the fig. 4.19 it is observed that the mode period in Regular & Irregular i.e. Center and Corner values are 2.6sec, 2.4sec and 1.7sec. There are decreases in natural period for different position of Irregular building compared to Regular building Structure.

4.1 CONCLUSIONS

- It is observed that Storey Displacement values for regular building is more when compared to the irregular buildings.
- It is observed that Storey Drift values for irregular building is more when compared to the regular buildings.
- It is observed that Base Shear values for irregular building is more when compared to the regular buildings.

4.2 FUTURE SCOPE

- Buildings with different types of the zonal condition and for the different category can be adopted.
- Further studies can be carried out for providing different shape of buildings such as L shape, C shape, E shape etc.

REFERENCES

[1] Arlenkar, J.N., Jain, S.K., Murty, C.V.R., (1997), "Seismic Response of RC Frame Buildings with Soft First Storey's", Proceeding of the CBRI Golden Juubilee Conference on National Hazards in Urban Habitat, Vol.24, PP.719-734.

[2] Gururaj B.Katti, Mr. Sagar B.Patil [2015], Study of Behavior of Plan & Vertical Irregularity by Seismic Analysis, Vol.81, No.10, PP.42-49

[3] Jala Mushina O beed, Dr.B. Dean Kumar [2013], Study of Dynamic analysis of regular and irregular high rise building, 2(8), PP 716-722.

[4] J.p.AnnieSweetlin,R.Saranraj&P.Vijayakumar[2016], Comparison of Displacement for Regular and Irregular due to seismic forcre, Vol.135, No.8, PP.925-937.

[5] Le.Yee.Mon [2014], Comparative Study on Dynamic Analysis of Irregular Building with Shear Walls, Vol.22, PP.77-92.

[6] N.Anvesh, Dr. ShaikYajdani, K. Pavan Kumar [2015],Effect of Mass Irregularity on Reinforced Concrete Structure Using Etabs, Vol.2, No.3,PP.364-371.

[7] Satyaveni Allipilli, Ramesh DuttChilakapati, Dr. HarinadhaBabuRaparla[2014],Impact of Plan Irregularity to Opt a Suitable Structural Framing System in the Analysis and Design of Multi-Storied Buildings, Vol.6, No.2, PP.223-244.

[8] ShaikhMuffassir, L.G. Kalurkar [2016], study of wind analysis of multi-story composite structure for plan irregularity, Vol.28 (1), PP.96-107.

[9] S.Mahesh, Dr.PandurangRao [2013], Comparison of analysis and design of regular and irregular configuration of multi-Storey building in various seismic zones and various types of soils using ETABS and STAAD, PP 35-52.

[10] IS: 1893(Part-1)-2002 Indian Standard Criteria Earthquake Resistant Design Of Structures, Bureau Of Indian Standards New Delhi.

[11] IS: 456:2000 Indian Standard Codes for Practice for Plain Reinforced Concrete for General Building Construction. Bureau of Indian Standards New Delhi.