Comparative Study of Factors Affecting Dynamic And Earthquake Response of RCC Frame Structure

Miss. Sonali Surayakant Jivane[1], Prof. Upase K. S[2]
[1]Dept of Civil Engineering
[2]Guide, Assistant Professor, Dept of Civil Engineering
[1, 2] M.S. Bidve College of engineering Latur.

Abstract- *An earthquake occurs in the form of seismic waves due to sudden release of energy and results in ground shaking. During earthquake, seismic waves propagate through the soil which results in structural damage due to movements within the earth's crust. It impacts the behavior of interaction of components like building, foundation, underlying soils and also overall system behavior. When earthquake occurs, the behavior of a building depends on distribution of mass, strength and stiffness. Generally, the buildings are subjected to various types of forces throughout their existence. The forces can be static forces due to dead and live loads and dynamic forces due to earthquake. In this study, the analysis is carried out for seismic response of (G+12) residential building for zone-I, II , III and IV regions through response spectrum method and time history method in ETABS. The parameters likestorey displacement, storey drift and storey shear are observed for specified zones.*

I. INTRODUCTION

The structural reaction to earthquakes is a complex phenomenon that relies on structural dynamic characteristics and the strength, duration, and frequency of exciting ground motion. While the seismic effect is complex in nature, because of its simplicity, building codes also prescribe equal static load analysis for constructing earthquake-resistant buildings. This is accomplished by reflecting on the prevailing first-mode response and generating equal responses

Seismic analysis is a structural analysis sub-set that is the measurement of the response to earthquakes of a built (or non-building) structure. In regions where earthquakes are prevalent, it is part of the structural architecture, earthquake engineering or structural evaluation and retrofit process (see structural engineering). As seen in the figure, a building has the ability to 'wave' back and forth during an earthquake (or even a severe wind storm). This is called the 'fundamental mode' which is the lowest building reaction frequency. However, most buildings have higher reaction modes, which during earthquakes are uniquely triggered. The figure only reveals the second mode, but the shimmy (abnormal vibration) mode is stronger. Nevertheless, in most situations, the first and second modes appear to do the most harm.

A. Objectives

- To study seismic analysis of the multi-storey buildings (G+12) residential building for multiple seismic zones.
- To Study comparison of failure in multiple seismic zones for G+12 Residential building.
- To study proposing safety measures for G+12 Residential building for seismic zone.

II. METHODOLOGY OF WORK

A. Nonlinear dynamic analysis

In non-linear dynamic analysis, the non-linear properties of the structure are considered as part of a time domain analysis. This approach is the most rigorous, and is required by some building codes for buildings of unusual configuration or of special importance. However, the calculated response can be very sensitive to the characteristics of the individual ground motion used as seismic input; therefore, several analyses are required using different ground motion records to achieve a reliable estimation of the probabilistic distribution of structural response. Since the properties of the seismic response depend on the intensity, or severity, of the seismic shaking, a comprehensive assessment calls for numerous nonlinear dynamic analyses at various levels of intensity to represent different possible earthquake scenarios. This has led to the emergence of methods like the incremental dynamic analysis

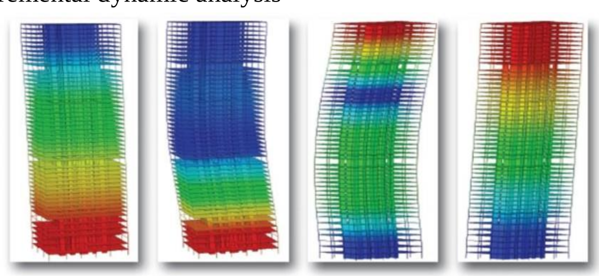


Fig 1 Nonlinear dynamic analysis of building

A. PROBLEM STATEMENT OF GEOMETRY

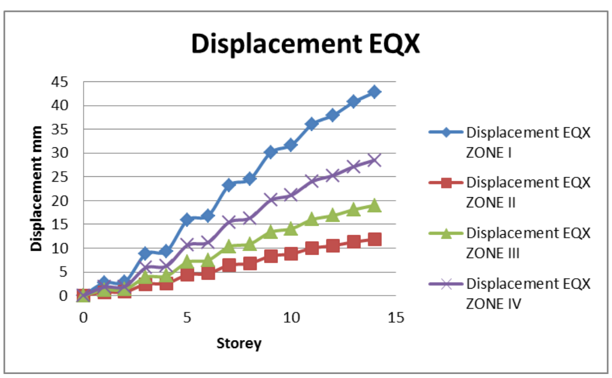
In this project, a G+12-storey structure of a rectangular building with 3 m floor to floor height has been analyzed Non-Linear Dynamic Analysis of multi-storey R.C.C Buildings using ETABS software in multiple seismic zones. The plan selected is Rectangular in shape. It is not the plan of any existing or proposed building but is an architectural plan. The structure has been analyzed for both static and dynamic wind and earthquake forces. Hard soil condition has been selected for the structure.

Sr. No	Parameter	Values
1.	Number of storey	G+12
2.	Base to plinth	1.5 m
3.	Floor height	3 m
4.	Infill wall	200 mm thick
5.	Materials	Concrete M30 and Reinforcement Fe 500
6.	Size of column	300 mm x 600 mm
7.	Size of beam	230 mm x 600 mm
8.	Depth of slab	150 mm
9.	Water Tank	50000 liter

III. RESULTS

A. RESULTS FOR ZONE I, II, III, IV

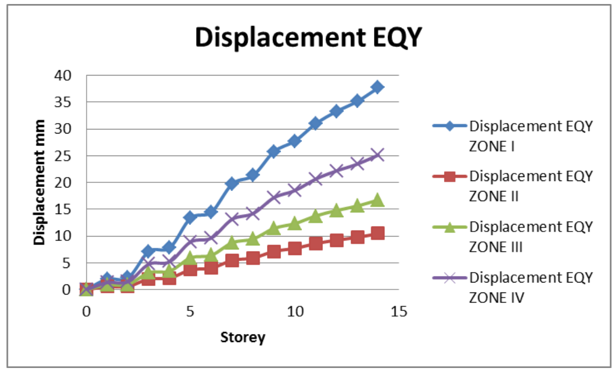
Displacement EQX



Graph 1 Displacement EQX

Above Graph shows the results for the displacement for forces of Earthquake from x direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more displacement and building in zone II have less displacement than the other two zones by approx. 30-35%

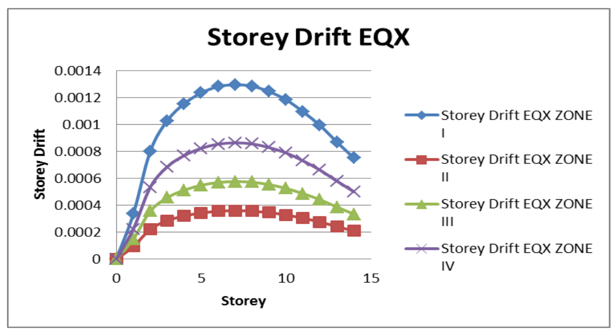
Displacement EQY



Graph 2 Displacement EQY

Above Graph shows the results for the displacement for forces of Earthquake from Y direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more displacement and building in zone II have less displacement than the other two zones by approx. 30-35%

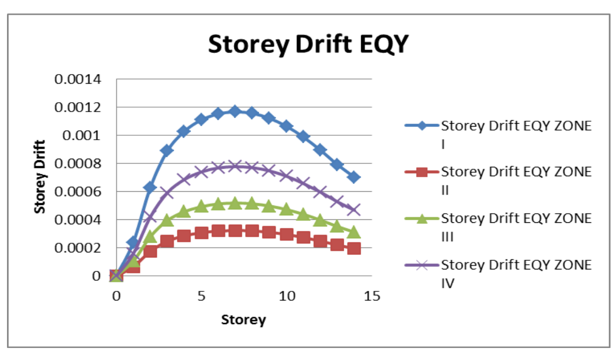
Storey Drift EQX



Graph 3 Storey Drift EQX

Above Graph shows the results for the Storey Drift for forces of Earthquake from X direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Storey Drift and building in zone II have less Storey Drift than the other two zones by approx. 35-40%

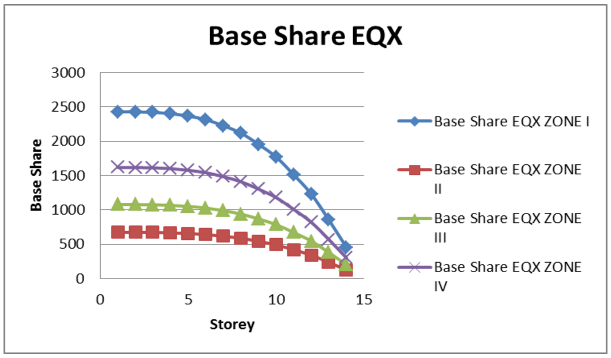
Storey Drift EQY



Graph 4 Storey Drift EQY

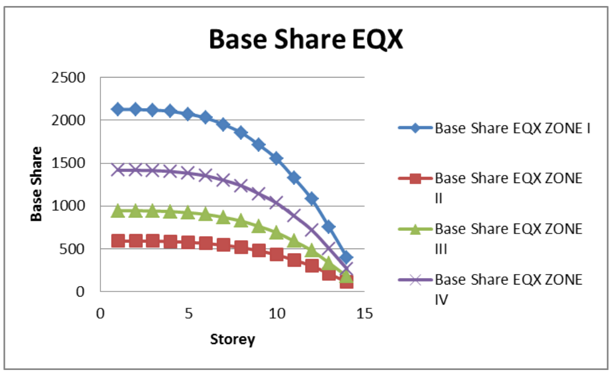
Above Graph shows the results for the Storey Drift for forces of Earthquake from Y direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Storey Drift and building in zone II have less Storey Drift than the other two zones by approx. 35-40%

Base Share EQX



Graph 5 Base Share EQX

Base Share EQX



Graph 6 Base Share EQY

Above Graph shows the results for the Base Share for forces of Earthquake from Y direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Base Share and building in zone II have less Base Share than the other two zones by approx. 30-35%

IV. CONCLUSION

After the analysis G+12 RCC building for Zone I, II, III & IV the results conclude that the zone one required heavy design then IV, III And II Simultaneously The maximum results for storey displacement, Storey Drift, and base Shear are in Zone I so in same model we provide more shear walls to reduce that same results this all conclusion are conclude by following points

	DISPLACEMENT
1	The results for the displacement for forces of Earthquake from x direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more displacement and building in zone II have less displacement than the other two zones by approx. 30-35%
2	The results for the displacement for forces of Earthquake from Y direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more displacement and building in zone II have less displacement than the other two zones by approx. 30-35%
	STOREY DRIFT
1	The results for the Storey Drift for forces of Earthquake from X direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Storey Drift and building in zone II have less Storey Drift than the other two zones by approx. 35-40%
2	The results for the Storey Drift for forces of Earthquake from Y direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Storey Drift and building in zone II have less Storey Drift than the other two zones by approx. 35-40%

	BASE SHARE
1	The results for the Base Share for forces of Earthquake from X direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Base Share and building in zone II have less Base Share than the other two zones by approx. 30-35%
2	The results for the Base Share for forces of Earthquake from Y direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Base Share and building in zone II have less Base Share than the other two zones by approx. 30-35%

REFERENCES

[1] Brajesh Kumar Tondon et al "Seismic Analysis of Multi Storied building in Different Zones" (IJTSRD) Volume 2 , Issue 2. Jan-Feb 2018

[2] Mr. S.Maheshet al "Comparison of analysis and design of regular and irregular configuration of multi Story building in various seismic zones and various types of soils using ETABS and STAAD" IOSR Volume 11, Issue 6 Ver. I (Nov- Dec. 2014)

[3] M B Vikramet al "Comparison And Analysis Of Multi-Storey Building In Various Seismic Zones"International Journal of Emerging Trends in Engineering and Development Issue 7, Vol. 3 (May 2017

[4] Rakshith G M et al "Analysis of G+20 RC Tall Building in Different Zones using ETABS"IJIRSETVol. 8, Issue 5, May 2019
[5] Md. Majid Raza et al "Seismic Analysis and Design of G+10 RC Residential Building" IJESC, June 2019
[6] M Ragini B.Naidu et al "Seismic Analysis of Multi-Storied Building and Critical Study of its Foundations" IJSTE Volume 2 | Issue 10 | April 2016
[7] Tejas Gorle et al "Seismic Analysis of a Multi-storey (G+8) RCC Frame Building for Different Seismic Zones in Nagpur.(M.H.)" (IRJET) Volume: 05 Issue: 04 | Apr-2018
[8] P. Rajeswari et al. "Seismic Analysis And Design Of Multi-storey Building In Different Seismic Zones By Using ETABS" IRJET Volume: 06 Issue: 09 | Sep 2019
[9] Ramanujam I V R et al "Comparative Study Of Seismic Forces Based On Static And Dynamic Analysis As Per IS: 1893 -2002" IJSCER Vol. 4, No. 1, February 2015
[10] Sumit Sharma et al "Comparative study for Seismic Analysis of building using different software" IJAERD Volume 5, Issue 02, February -2018