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A Study on the Impact of Seismic Performance on RCC Frames

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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 and III regions through response spectrum method and time history method in ETABS. The parameters like storey 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.

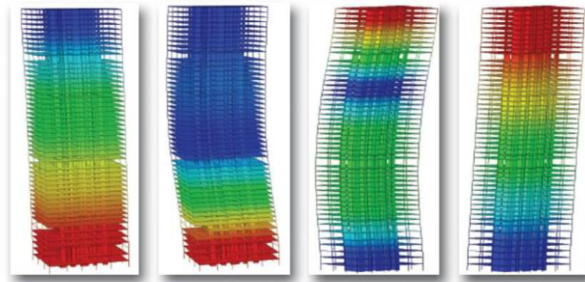


Fig 1 Nonlinear dynamic analysis of building

A. PROBLEM STATEMENT OF GEOMETRY

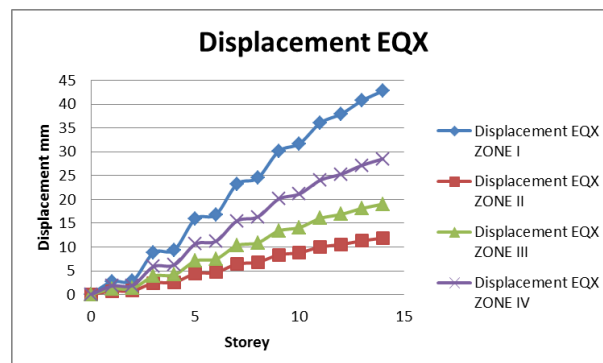
In this project, a G+12-storey structure of a rectangular building with 3 m floor to floor height has been analyzed Non-Linear Dynamic Analysis of multi-storey R.C.C Buildings using ETABS software in multiple seismic zones. The plan selected is Rectangular in shape. It is not the plan of any existing 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

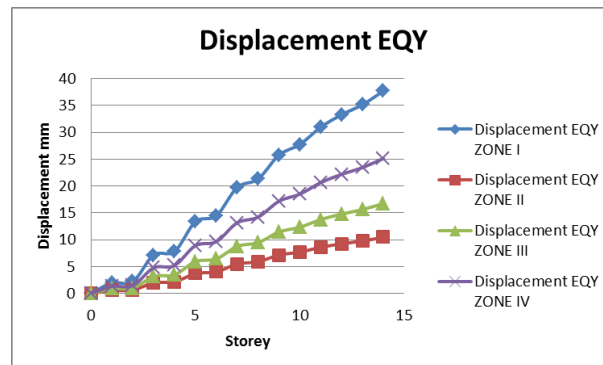
Displacement EQX



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%

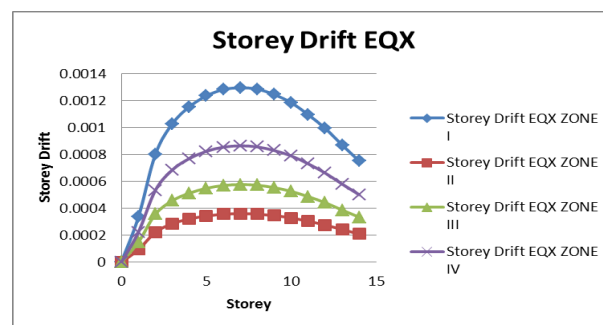
Displacement EQY



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%

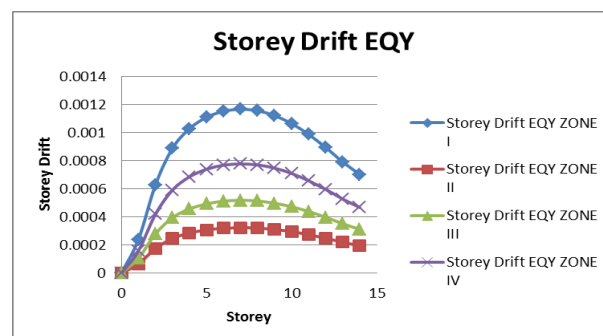
Storey Drift EQX



Graph 3 Storey Drift EQX

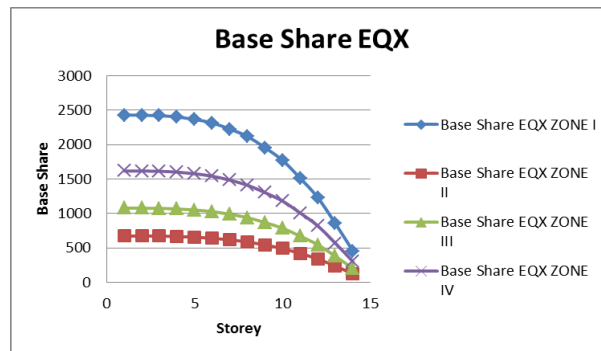
Above Graph shows the results for the Storey Drift for forces of Earthquake from X direction for zone I, II, III & IV from the above graph its conclude that the building in Zone I have more Storey Drift and building in zone II have less Storey Drift than the other two zones by approx. 35-40%

Storey Drift EQY

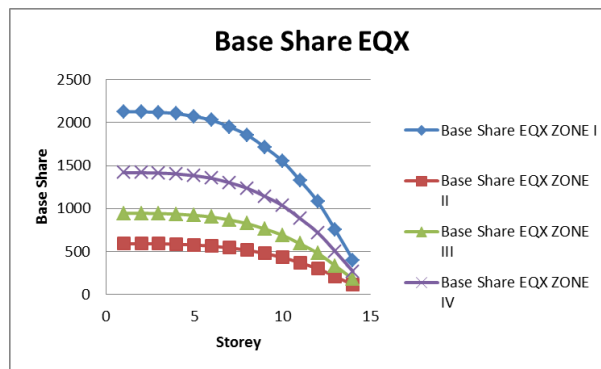


Graph 4 Storey Drift EQY

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 EQY

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% |

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