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Seismic Analysis Of Multistorey Building In Different Zones

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***Abstract**:*

Buildings are symbol of modern city and as such are a crowning achievement of structural engineering. The behavior of a building during earthquakes depends critically on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. Hence, at the planning stage itself, architects and structural engineers must work together to ensure that the unfavorable features are avoided and a good building configuration is chosen. This research work focuses on comparison of seismic analysis of G+6 building .The performance of the building is analyzed in Zone II, Zone III, Zone IV, Zone V. In this paper static analysis and dynamic analysis using response spectrum method is done for a multi-storeyed building. This work includes the analysis and design of G+6 building by using STAAD pro software..

Keywords
Earthquake, STAAD Pro , Seismic Zones.

1. Introduction

The term earthquake can be used to describe any kind of seismic event which may be either natural or initiated by humans, which generates seismic waves. Earthquakes are caused commonly by rupture of geological faults but they can also be triggered by other events like volcanic activity, mine blasts, landslides and nuclear tests. An abrupt release of energy in the Earth's crust which creates seismic waves results in what is called an earthquake. When earthquakes occur, a building undergoes dynamic motion. This is because the building is subjected to inertia forces that act in opposite direction to the acceleration of earthquake excitations. There are many buildings that have primary structural system, which do not meet the current seismic requirements and suffer extensive damage during the earthquake. The buildings which do not fulfill the requirements of seismic design, may suffer extensive damage or collapse if shaken by a severe round motion. The seismic evaluation reflects the seismic capacity of earthquake vulnerable buildings for the future use. According to the Seismic Zoning Map of

IS: 1893-2002, India is divided into four zones on the basis of seismic activities. They are Zone II, Zone III, Zone IV and Zone V.

STAAD Pro is structural engineering software widely used for the design of multistoried buildings. It has become important for civil design engineers to be well equipped with the structural software like STAAD Pro, since most of the companies are using STAAD as a tool for designing massive structures.

2. Model Of The Project

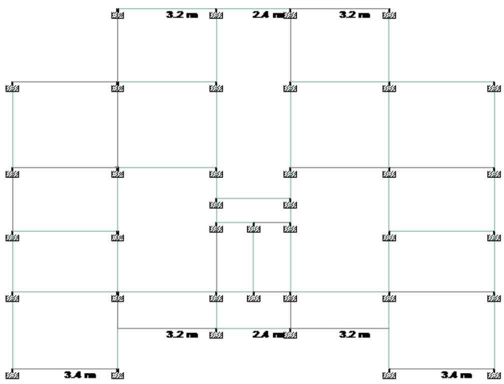

Fig-1 Plan of Structure

Table 1 Details Of The Structure

Type of Structure	RC G+6 Building
Length of Building	15.6 m
Width of Building	14.75 m
Storey Height	2.8m
Area of Individual floor	2319.30 Sq. Ft.
Type of Soil	Medium
Earthquake Zone	I,II,III,IV
Lateral Load Resisting System	Ordinary RC Moment Resisting frame (OMRF)
Response Reduction factor (R)	3.0
Live Load on Building	3 KN/m^2

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Dead Load	For 0.23 mm thick wall -14 KN/m For 0.15 mm thick wall – 7 KN/m

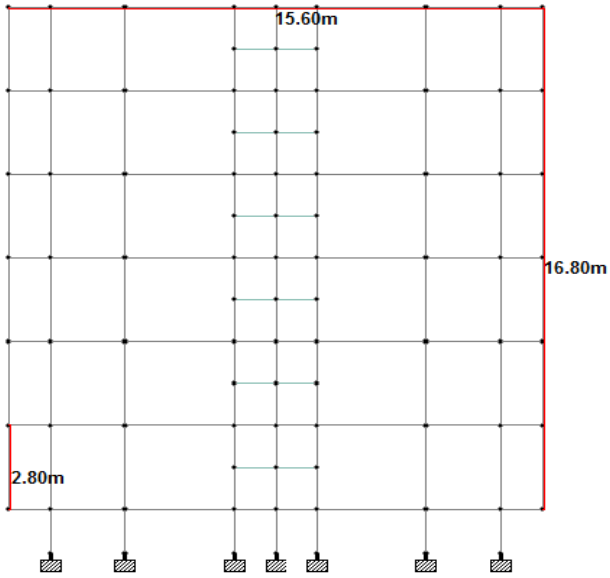

Fig-2 Elevation of Structure

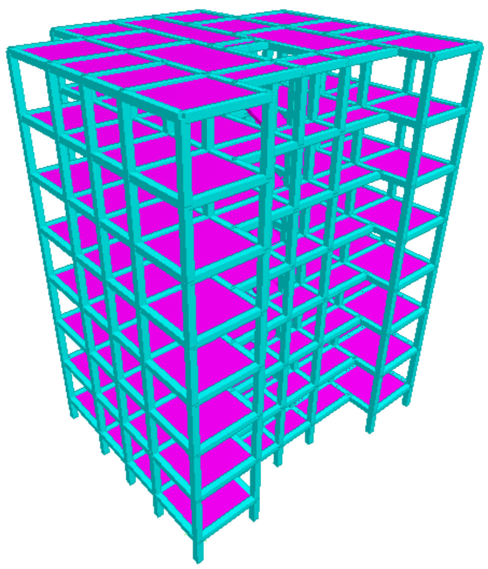

Fig-3 3D view of Structure

3. Methodology

OMRF (Ordinary Moment Resisting Frame).Response Reduction Factor – 3.The analysis is carried out on the same configuration of building for all earthquake Zones as

1) Zone II
2) Zone III
3) Zone IV
4) Zone V

As per the IS 1893 (Part 1) – 2002, Analysis parameters considered in the comparison of Ordinary Moment Resisting Frame(OMRF) are

1) Displacement in X and Z Direction
2) Shear in Z-direction (Fz)
3) Axial Force in X-direction (Fx)
4) Moment in X- direction (Mx)
5) Moment in Z- direction (Mz)

For analysis of structure, 7 load combinations were considered

1) 1.5(DL+LL)
2) 1.2(DL+LL+EQX)
3) 1.2(DL+LL+EQZ)
4) 1.5(DL+EQX)
5) 1.5(DL+EQZ)
6) 0.9DL+1.5EQX
7) 0.9DL+1.5EQZ

However it was found that 2 load combinations are critical for columns. These are 1.5(DL+EQX) or 1.5(DL+EQZ) depending on orientation of columns.

In the STAAD-Pro precautions is taken to take adequate zone factor and response reduction factors depending on case.

For the comparison, Following beams and columns are selected

1) Corner Column
2) Intermediate Column

IV. Seismic Analysis Result

Exclusive data of analysis for these columns and Beams is exported to excel for further analysis and comparison. Based on the data graphs are plotted.

4. Seismic Analysis Result

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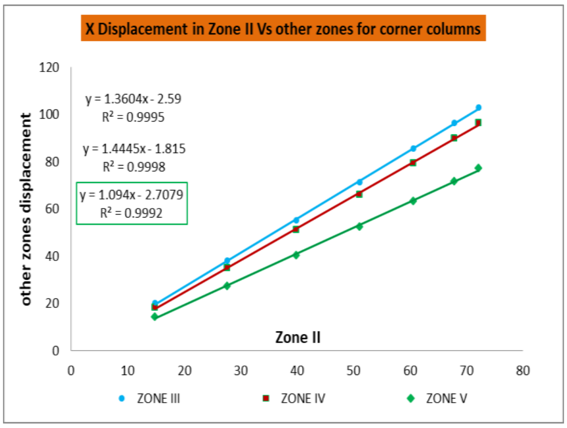

Fig-4 Variation in X Displacement values with respect to zone II

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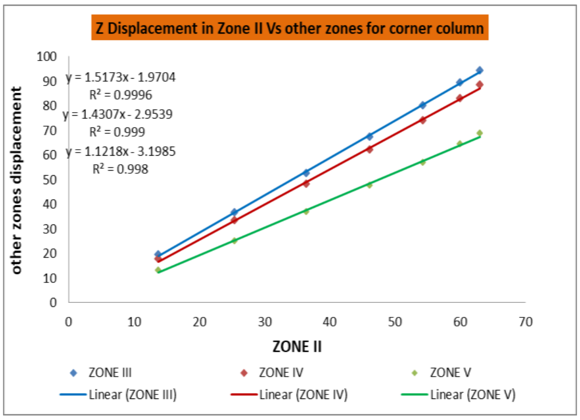


Fig-5 Variation in Z Displacement values with respect to zone II

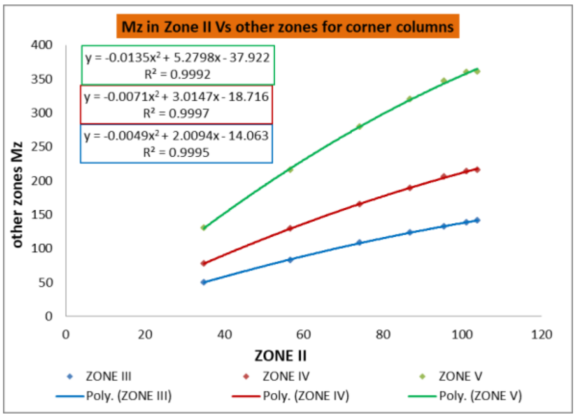


Fig-8 Variation in Mx values with respect to zone II (Corner Columns)

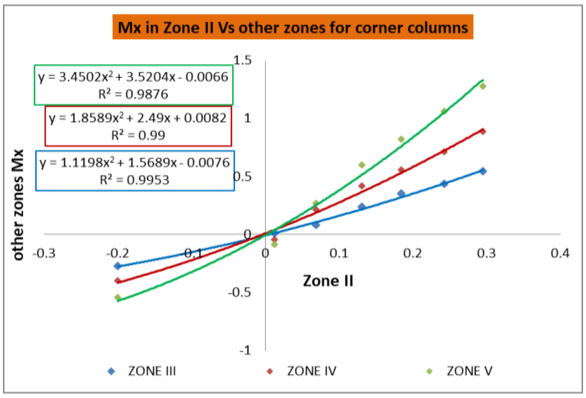


Fig-6 Variation in Mx values with respect to zone II (Corner Columns)

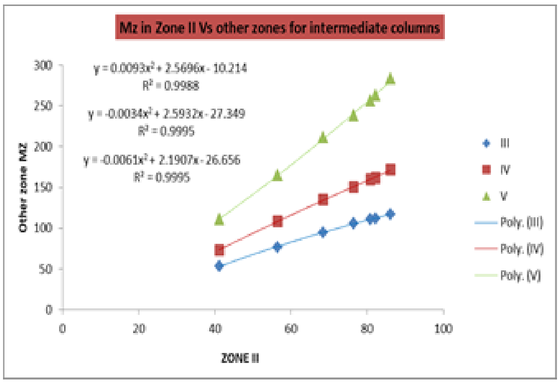


Fig-9 Variation in Mz values with respect to zone II (Intermediate Columns)

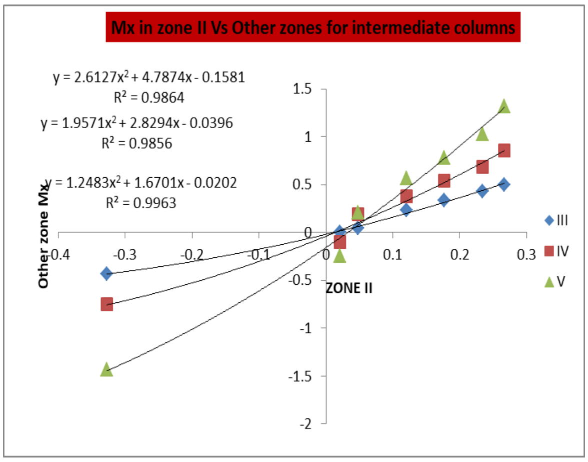
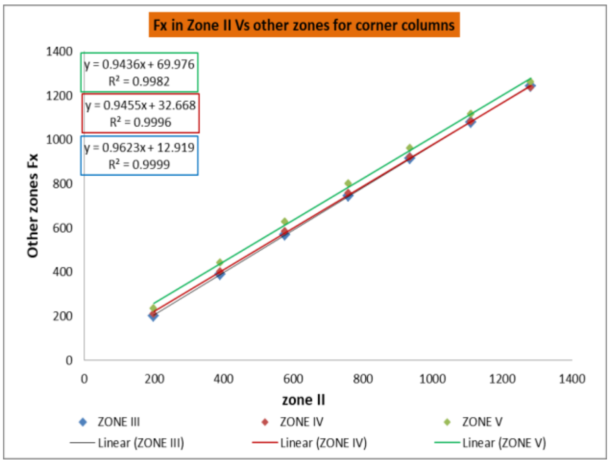


Fig-7 Variation in Mx values with respect to zone II (Intermediate Columns)



-10 Variation in Fx values with respect to zone II (Corner Columns)

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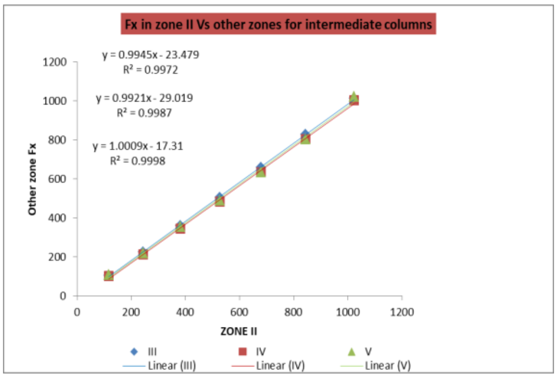

Fig-11 Variation in Fx values with respect to zone II (Intermediate Columns)

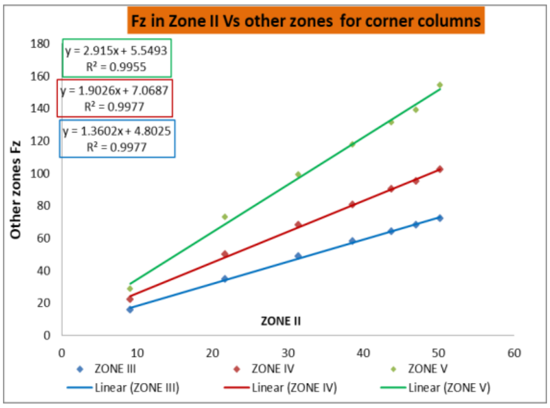

Fig-12 Variation in Fz values with respect to zone II (Corner Columns)

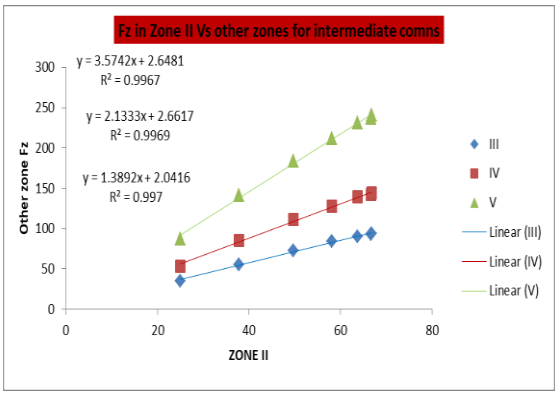

Fig-13 Variation in Fz values with respect to zone II (Intermediate Columns)

5. Conclusions

1. The building is safe for area coming under earthquake zone II.
2. The corner columns in all floor levels were most affected by the axial forces in X direction resulting from all cases of load combinations.
3. The interior columns in all floor levels were most affected by the shear forces in Z direction resulting from all cases of load combinations.
4. Bending moments in columns due to seismic excitation showed much larger values in zone V as compared to other zones.

6. References

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