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A Comparative Study on Upgrading the Design of Earthquake Resistant Building from Zone II to Zone III

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ABSTRACT:
In recent times there has been increase in frequency and intensity of earthquakes. India is divided into five Earthquake zones. It may be time to revise the zones, keeping in view the ever increasing intensity of Earthquakes. In this paper a comparative study is done for a building in Hyderabad region (Zone II), India. A G+5 building is considered for comparative study. Analysis and design is done using STADD PRO Software and the results are compared for upgrading from Zone II to Zone III.

KEYWORDS:
Seismic Zone, Base Shear, Maximum displacement, IS Codes.

1.INTRODUCTION:
Powerful earthquakes hit different parts of the world causing devastating damage. In today's scenario Seismic risk is a major challenge. It requires all international agencies to evaluate the present scenario and propose the future course of action in terms of seismic safety of buildings. It may be time; the risk factor is increased for seismic design.

2. METHODS OF ANALYSIS:
a) Linear Static analysis
Linear static or equivalent static analysis can be used for regular structures with limited height.

b) Linear Dynamic analysis
Linear dynamic analysis can be performed in two ways, either by response spectrum method or by elastic time-history method.

c) Non-linear Static analysis
Non-linear static analysis is an improvement over linear static or dynamic analysis, it allows inelastic behaviour of the structure. This method is known as Push-Over analysis.

d) Non-linear Dynamic analysis
A non-linear dynamic analysis or in-elastic time history analysis is the only method to describe the actual behaviour of the structure during an earthquake. The method is based on the direct numerical integration of the differential equations of motion by considering the elasto-plastic deformation of the structural element.

3. OBJECTIVE:
The main objective of this paper is to study the difference in results of a building design from earthquake Zone II to earthquake Zone III. The study also includes economical impact.

4. DESIGN PARAMETERS:
IS CODES: 1893, 456, 875, and 13920
Method of Analysis: Linear Static Method of Analysis
Building parameters: Length: 20m
Width: 20m
Height: G+5 (Each floor 3.5m)

Seismic Zone II	
Seismic Intensity	Low
z	0.10
Importance Factor	1.5
Frame type	SMRF
Response Reduction Factor	5.0

Seismic Zone III	
Seismic Intensity	Moderate
z	0.16
Importance Factor	1.5
Frame type	SMRF
Response Reduction Factor	5.0

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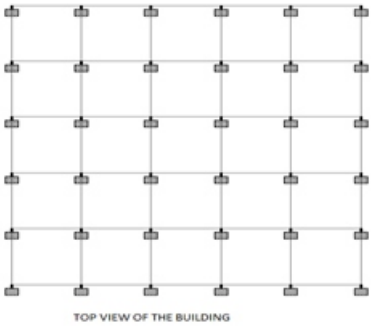
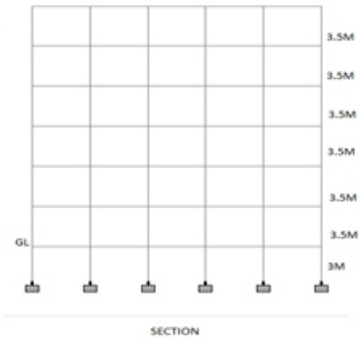

TOP VIEW OF THE BUILDING



SECTION

5. LOADS AND LOAD COMBINATIONS:

Loads:

1) Dead Load DL

2) Live Load LL

3) Earthquake Load EL

Load Combinations:

1.5(DL+LL)

1.2(DL+LL±EL)

1.5(DL±EL)

0.9DL±1.5EL

6. RESULTS:

S.NO	DETAILS	ZONE II	ZONE III
1	COLUMN SIZE	300 X 450MM	300 X 600MM
2	BEAM SIZE	230 X 300MM	300 X 400 MM
3	MAXIMUM BASE SHEAR	216 KN	1585 KN
4	MAXIMUM HORIZONTAL DISPLACEMENT AT TOP	25MM	96MM

CONCLUSIONS:

1)The cost of construction (of RCC frame structure) is 50% more for zone III parameters than zone II parameters.

2)Majority of the existing buildings have to be strengthened to comply with zone III parameters.

3)The recent earthquake in Italy caused severe damage to the properties and life's of the people. It is time to consider the stability of historic buildings. This was the main reason for loss of life, of so many people in Central Italy.

4)Hyderabad has many historical buildings most of them are above 400 years old. These buildings have to evaluated for earthquake forces. Suitable strengthening measures have to be taken for their stability.

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