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Analysis Of High Rise Building In Different Seismic Zones In India: REVIEW

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Abstract: This paper proposes the several earthquakes in India have demonstrated in past that high-rise structures are collapsing and becoming vulnerable to earthquake damage. Engineers are needed today to design earthquake resistant structures for various seismic zones in order to reduce seismic damages in high-rise buildings. The purpose of this research is to look into the variation in behavior of a (G+12) building structure with a regular (Rectangular or Square) structural configuration in different seismic zones (zones II to V) in India. The entire structure is examined with STAAD Pro software to access parameters such as bending moment, shear force, deflection, base shear for various seismic zones (zone II to V) in India. seismic analysis by linear static analysis and the analysis is carried out by considering seismic zones (II to V) for medium soil type. In analysing the whole structure considering parameters like loads (live load, dead load, seismic loads) and type of structure, damping ratio, importance factor(I), response reduction factor(R), zone factor(Z) for different cities under different zones plays major role in seismic design.

Index Terms - Base Shear, High Rise Building, Seismic analysis, Staad Pro.

1. INTRODUCTION

Earthquake has always been a threat to human civilization from the day of its existence, devastating human lives, property and man-made structures. It is such an unpredictable calamity that it is very necessary for survival to ensure the strength of the structures against seismic forces. Therefore, there is continuous research work going on around the globe, revolving around development of new and better techniques that can be incorporated in structures for better seismic performance. Obviously, buildings designed with special techniques to resist damages during seismic activity have much higher cost of construction than normal buildings, but for safety against failures under seismic forces it is a prerequisite. Earthquake causes random ground motions, in all possible directions emanating from the epicenter. Vertical ground motions are rare, but an earthquake is always accompanied with horizontal ground shaking. The ground vibration causes the structures resting on the ground to vibrate, developing inertial forces in the structure. As the earthquake changes directions, it can cause reversal of stresses in the structural components, that is, tension may change to compression and compression ma change to tension. Earthquake can cause generation of high stresses, which can lead to yielding of structures and large deformations, rendering the structure non-functional and unserviceable. There can be large storey drift in the building, making the building unsafe for the occupants to continue living there.

Reinforced Concrete frames are the most common construction practices in India, with increasing numbers of high-rise structures adding up to the landscape. There are many important Indian cities that fall in highly active seismic zones. Such high-rise structures, constructed especially in highly prone seismic zones, should be analyzed and designed for ductility and should be designed with extra lateral stiffening system to improve their seismic performance and reduce damages. Two of the most commonly used lateral stiffening systems that can be used in buildings to keep the deflections under limits are bracing system and shear walls

1.1 Objectives:

The objectives of present work are as follows:

- To study the behavior of structure in various seismic zones.
- To study the variations in parameters such as Shear Force, Bending moment and Displacement in all seismic zones as per IS: 1893-2002.
- To ensure safety of building from seismic wave in various zones.

1.2 SCOPE OF THE STUDY

1. The study highlights the effect of seismic zone factor in different zones that is in Zone II, Zone III, Zone IV and Zone V which is considered in the seismic performance evaluation of buildings.
2. The structures need to have suitable Earthquake resisting features to safely resist large lateral forces that are imposed on them during earthquake in different seismic zones, and also construction material, cost and effectiveness in minimizing Earthquake damage in structure.

3. LITERATURE REVIEW

GENERAL

The literature review was carried out under analysis and design of multi-storey building and comparing with different zones.

LITERATURE REVIEW ON ANALYSIS MULTI-STOREY BUILDING USING STAAD.PRO AND COMPARING WITH DIFFERENT ZONES

B Ramakrishna *et al.* [1] they worked on analysis of a multi-stored building [G+5] using STAAD Pro by considering different seismic zones. The analysis of a multi-stored building [G+5] initially for all type of loads (Seismic load, Dead load, Live load and Wind load) and possible load combinations are performed as per Indian codes. The seismic analysis is done under different zones which are Zone-II, Zone-III, Zone-IV, Zone-V and also zone factor values are considered as per IS 1893-2002 (Part-1). By considering each zone factor value and loads including self-weight, member weight, floor weight in seismic load, dead load, live load and wind loads the structure may affect. Also observing the Shear force, bending moment and deflection values for the whole building in different Seismic zones by using STAAD Pro. In analysing the whole structure considering all parameters like all loads (live load, dead load, seismic loads wind load) and type of structure, damping ratio, importance factor, response reduction factor, zone factor/different cities under different zones plays major role in building how it reacts to it and by shear force, bending moment, deflection values states that it is safe in particular zones or all the factors must be taken in consideration to imply the building is safe or not.

Snehal D. Channe *et al.* [2] The study of seismic analysis and design of G+6 multistorey building of regular and irregular configuration is carried out using STAAD pro. Assuming that material properties are linear static and dynamic analysis is performed considering the static behaviour of the material. The analysis is carried out by considering seismic zones iii and for medium soil.

T. Jayakrishna *et al.* [3] These analyses are carried out by considering different seismic zones, and for each zone, the behaviour assesses by taking the Soft Soil. A different response for displacements of base shear, storey drift is plotted for different zones for different types of soils

Bhalchandra p. Alone, Dr. Ganesh Awchat.[4] they have studied on the seismic analysis and design to structures against collapse. Designing a structure in such a way that reducing damage during an earthquake makes the structure quite uneconomical, as the earth quake might or might not occur in its life time and is a rare phenomenon. This study mainly on to understanding the results from STAAD Pro v8i software under gravity loads provision made in IS 456:2000, Results shall satisfy the general criteria from being a failure after analysis Results to improve. The accuracy as per IS code 1893: 2002.

Salahuddin Shakeeb. S. M *et al.* [5] The present study mainly focuses on determining the variation in reinforcement percentage for various seismic zones of India. The current IS code for seismic design i.e.IS 1893-2002 part one suggests that maximum reinforcement should be provided for higher seismic zones, but it doesn’t provide clear information, how much percentage of reinforcement can be used for various seismic zones. In the following work attempt is made to find the percentages required for various seismic zones by considering the effects of infill and without infill. For the study a symmetrical building plan is used with 13 storey and analyzed and designed by using structure analysis software tool ETABS-2013. The study also includes the determination of base shear, displacement, moment and shear and the results are compared between gravity loads and various seismic zones.

Tejas Gorle *et al.* [6] In this study, the seismic analysis of a structural system is to determine the deformations and forces induced by applied loads on a residential G+8 RC frame building is analysed by the linear analysis approaches using STAAD PRO V8i designing software.

Dr. M. S. V. K. V. Prasad *et al.* [7] The purpose of this research is to look into the variation in behaviour of a (G+10) multistory building structure with a regular (Rectangular or Square) structural configuration in different seismic zones (zones II to V) in India. The entire structure is examined with STAAD Pro software to access parameters such as base shear, storey shear, and storey drift for various seismic zones (zone II to V) seismic analysis of regular (rectangular or square) structural configurations Index Terms structural configurations, seismic analysis.

Brajesh Kumar Tondon, Dr. S. Needhidasan.**[8]** This paper describes about the response of building when it is subjected to seismic load, this response can be shown by story drift and base shear. seismic analysis has been performed on (G+8) building which is located in zone 2 & 4 using STAAD Pro software. Analysis has been performed according to IS 1893 PART 1 (2002).

Kiran Chikane *et al*. [9] In this study the aim is to analyze the response of a high-rise structure to ground motion. That is, bare frame, brace frame and shear wall frame are considered in Staad-Pro. and change in the time period, stiffness, base shear, storey drifts and top-storey deflection of the building is observed and compared.

4. PROPOSED MODEL DATA

Sr. no.	Description	Data
1.	Storey Height	3.1m
2.	No. of bays along X direction	5
3.	No. of bays along Z direction	3
4.	Concrete grade used	M30
5.	Unit Weight of Concrete	25 KN/m^3
6.	Slab Thickness	0.2 m
7.	Live Load each floor	3 KN/m^2
8.	Size of Column	0.3x0.6 m
9.	Size of Beams	0.3x0.53 m,0.3x0.45m
10.	Zone (Z)	II to V
11.	Soil Conditions	Medium Soil
12.	Damping Ratio	0.05
13.	Importance Factor (I)	1
14.	Response Reduction Factor (R)	5
15.	Depth of Foundation	4 m
16.	No of Storey	G+12
17.	Live load on roof	0.75 KN/m^2

5. CONCLUSION ON BASIS OF LITERATURE SURVEY:

- Base shear in zone 5 is maximum as compared to the other seismic zones.
- Adding shear wall significantly increases the lateral load carrying capacity of the building. Significant improvement is seen in seismic performance of the building.
- The displacement of structures increased as the seismic zone increases.
- The moments in building increases gradually according to seismic zones, but in some cases certain variation in values has been noticed
- In different seismic zones the displacement values are less for lower zones and it goes on increases for higher zones.

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