ANALYSIS AND DESIGN OF G+6 BUILDING IN DIFFERENT SEISMIC ZONES OF INDIA USING STAAD PRO: A REVIEW

Kavita Verma[1], Ahsan Rabbani[2*]
[1]Post graduate student, Department of Civil Engineering, Kalinga University,
New Raipur, Chhattisgarh, India

[2]Assistant Professor, Department of Civil Engineering, Kalinga University,
New Raipur, Chhattisgarh, India

Abstract: *Any structure should be designed in such a way that damages in the structure should be reduced during an earthquake which makes the building little uneconomical, because earthquake may or may not be occur in fixed time period it is a rare phenomenon. This paper is made to analyze and design G+6 building in different seismic zones of India using STAAD Pro. IS 1893(part1):2002 is use for earthquake force analysis. When we are going from zone II-zone V variations are increases. Variations include steel percentage, maximum shear force, maximum bending moment, maximum deflections etc.*

Keywords: Staad Pro.; Earthquake; Structure; Analysis

1 INTRODUCTION

The project involves analysis and design of G+6 building in different seismic zones of india using STAAD Pro computer software. STAAD Pro is used because of the following reasons:-

1. It is very easy to operate and understand and result accuracy is 99%.
2. It follows the standard of Indian standard codes.
3. It can solve one problem in many ways.
4. It gives very accurate solutions.

STAAD Pro is a software which allows all the users to draw the basic frame and give dimensions and load values. Then according to the given values or criteria software analyze the structure and design it with complete reinforcement for RCC frames. The design of building depends on the necessary requirements according to IS code. The minimum requirement is the structural safety against various types of loads i.e. dead loads, wind loads, imposed loads, and any other load which we want to bear by the structure. This safety against loads are obtained by laying down the design load values.

In this topic many researches are done but it is still in continuation because if we gain more knowledge about seismic analyze, more we can minimize the damages due to earthquake.and saves lives of people. according to seismologist 90% earthquake occurs due to tectonic plates but from the engineer's point of view an engineer has to construct an structure which provide safety in the structure at low cost(i.e. maintain the economy). Now a days peoples are facing many problems like land scarcity, cost of land etc. increase in population and development of industry is the main reason for moving of people from rural area to urban area due to this increased population demand of constructing high rise building in increasing day by day for both remedial as well as office purpose. Lateral forces are the major factor for high rise building. If building is not properly designed for lateral forces it will cause complete collapse of the structure. The earthquake resistance building are designed according to design factors. The design factors may be type of foundation, purpose of structure, importance of structure etc.

2. Literature Review

A research on seismic behavior of structure due to change in percentage of steel and volume of cement concrete for various RCC framed structure was done by [1]. In this paper the author study various factors which affect the building the factor may be gravity load, seismic forces or any other factor. According to their research they find that for Zone II to Zone V

1. In case of exterior column support reaction varies from 11.5% to 41.7%.
2. In case of edge column support reaction varies from 11.7% to 63.6%
3. In case of exterior column support reaction is very less.

The variation in percentage of steel for external beam varies from0.53% to 1.22% and for internal beam it is varies from 0.77 to 1.4%. There is no necessity to change the bottom reinforcement for seismic and non seismic design.

The author [2] study the behavior of structure under the action of percentage variation and variation in quantities in different seismic zones and analyse the effect on the cost of construction. According to their research they concluded that due to increase in support reaction variation in quantities are also increased in exterior and edge columns and for interior column footings variations are very small. There is large variation in reinforcement for the whole structure between gravity load and seismic forces are 12.93, 18.35, 41.39, and 89.05.

The author [3] carried out study related to seismic design in RC Frame structure to fulfill the following objective-
1. To study of performance of structure under varying percentage of steel and quantities of concrete in different seismic zones of India.
2. Find out the comparison between the quantities of concrete and steel reinforcement percentage when designed by two different IS codes (i.e. IS 456:2000 for gravity load and IS1893:2002 for earthquake forces).
In this study the author prepare five models. out of this five models four models are designed and analyzed for earthquake forces and gravity loads for different seismic zones of India using a computer software ETABS. The result concluded from this research is that the support reactions are tends to increase from Zone II to V which causes increase in the weight of steel and volume of concrete. Also studied to find out comparison between seismic and wind design in eastern United States. For low rise structures seismic design forces are at time may be sufficient. For design base shear for either seismic analysis or wind analysis soil classification is a major factor for low rise building for sites of Chicago and New York lateral forces are not very much important. So only wind load is the only factor which is the major factor for proportioning in rocky foundation especially where the wind forces are higher.

The researcher [4] done analytical study for finding some alternate sources for seismic analysis which reduces the destructions occurred during an earthquake. He use a computer software ETABS for modeling of the whole structure. In this analysis he provide RCC in two different manner-
1. To increase the stiffness of the column he uses stiff column.
2. To increase the load carrying strength by providing infill wall paneling frame.

The researcher [5] carried out study on when the building is subjected to static and dynamic loading they done different arrangement in soft storey building to analyze the seismic behavior of soft storey building. By this study they find that if they provide infill in place of soft storey it improves the resistant behavior of the structure. The researchers [6] carried out some study based on investigation of some factors which help us to understand the behavior of soft storey building. For this study they use STAAD Pro 2006 for modeling of whole structure. They use five different models for the whole analysis process. Using STAAD Pro they done study on displacement, storey shear etc. The researchers [7] carried out comparative study of modeling of building using ETABS by pushover analysis for following conditions-
1. Soft storey building with shear wall.
2. Soft storey with steel bracings.

The researchers [8] carried out investigation to know-
1. The behavior of the structure for different no of storey.
2. Effect of masonry infill in the building.
Seismic analysis is a process by which we understand the seismic behavior of the structure in a simple manner. In past time all the buildings are designed only for gravity load not for seismic analysis. But now a days buildings are also designed for seismic forces.

The researcher [9] in his paper done dynamic analysis of high rise building for Konya and Bhuj earthquake and it is carried out by two different methods of analysis-
1. Time distance analysis
2. Response spectrum analysis
Results obtained by two different methods are properly studied and modeled using a computer software ETABS.

The researcher [10] found that the storey shear force is highest at lower floors and decreases with increases in floor i.e. lower at top floor. They found that mass irregular structure experiences more base shear as compared to similar regular building.
The researchers [11] worked on the topic seismic analysis of framed RC structure. For this study a G+30 storied regular building is considered. For this study STAAD Pro software is used for static and dynamic analysis with design parameter of IS-1893-2002 for zone II and III. Researchers [12] study common pattern of variation in seismic analysis such as displacement, base shear etc. from this study it is concluded that time history method is necessary for safety in multistory building.

3. CONCLUSIONS

Steel percentage of column

1. From zone II to Zone V variations are higher.
2. Steel percentage varies from 0.9 to 1.6 and 2.5 in case of exterior column
3. Steel percentage varies from 0.9 to 1.6 and 2.5 in case of edge column

4. Steel percentage varies from 1.13 to 2.01 and 2. in case of interior column

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