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Analysis and Design of G+6 Building in Different Seismic Zones by using Software

Shubham Borkar[1], Dr. G.D. Awchat[2]
[1]*M.Tech Student (structural Engg), Department of Civil Engineering, Guru Nanak Institute of Technology, Nagpur, India*
[2]*Associate and Professor, Dean R & D, Department of Civil Engineering, Guru Nanak Institute of Technology, Nagpur, India*

Abstract: ***The principle objective of this project is to analyze and design of G + 6 building in different seismic zones and in different soil types by using ETABS. In this project, all the four zones and three types of soils have been taken under consideration. ETABS (Extended Three Dimensional Analysis of Building System) is a software that is incorporated with all the major analysis engines that are static, dynamic, Linear and non-linear and especially this Software is used to analyze and design the buildings. The present work is to study the behaviour of a G+6 building subjected to earthquake load by adopting Response spectrum analysis. We analyzed G + 6 storey building for all possible load combinations [Dead, Live &Seismic loads]. Seismic loads were taken as per IS 1893: 2002. Our final work was the analysis of G + 6 building under various load combination. We considered a commercial building as specified in the plan. The height from the ground floor to sixth floor is 3.0 m. The structure was subjected to self-weight, dead load, live load and seismic loads under the load case details of ETABS. Seismic load calculations were done with the following IS 1893-2000 (part-1). The materials were specified and cross-sections of the beam and column members were assigned. The supports at the base of the structure were also specified as fixed.***
Keywords: ***ETABS, G+6, Soils, Zones, Analysis, Design.***

I. INTRODUCTION

The design of buildings wherein there is no damage during the strong but rare earthquake is called earthquake-proof design. The engineers do not attempt to make earthquake-proof buildings that will not get damaged even during the rare but strong earthquake. Such buildings will be too robust and also too expensive. The aim of the earthquake resistant design is to have structures that will behave elastically and survive without collapse under major earthquakes that might occur during the life of the structure. To avoid collapse during a major earthquake, structural members must be ductile enough to absorb and dissipate energy by post-elastic deformation. Many researchers have been conducted on this topic and still, it is continuing because more we try to learn more we can minimize the damages and save the lives. According to studies that have been made on seismology about 90% earthquake happens due to tectonics. If we come to civil engineering an engineer's job is to provide maximum safety in the structures designed and maintain the economy. Prior to the analysis and design of any structure, necessary information regarding supporting soil has to be collected by means of geotechnical investigation. A geotechnical site investigation is a process of collecting information and evaluating the conditions of the site for the purpose of designing and constructing the foundation for a structure. Structural engineers are facing the challenges of striving for most efficient and economical design with accuracy in solution while ensuring that the final design of a building and the building must be serviceable for its intended function over its design lifetime. Now a day's various software packages are available in the market for analyzing and designing practically all types of structures viz. RISA, STAADPRO, ETABS, STRUDL, MIDAS, SAP and RAM, etc. The latest version of the seismic zoning map of India given in the earthquake resistant design code of India [IS 1893 (Part1) 2002] assigns four levels of seismicity for India in terms of zone factors. In other words, the earthquake-zoning map of India divides India into 4 seismic zones (Zone 2, 3, 4 and 5) unlike its previous version, which consisted of five or six zones for the country. According to the present zoning map, Zone 5 expects the highest level of seismicity whereas Zone 2 is associated with the lowest level of seismicity. Zone 5 covers the areas with the highest risks zone that suffers earthquakes of intensity MSK IX or greater. The IS code assigns zone factor of 0.36 for Zone 5. Structural designers use this factor for earthquake resistant design of structures in Zone 5. The zone factor of 0.36 is indicative of effective (zero periods) level earthquake in this zone. It is referred to as the Very High Damage Risk Zone. The region of Kashmir, the western and central Himalayas, North and Middle Bihar, the North-East Indian region and the Rann of Kutch fall in this zone. Zone 4 is called the High Damage Risk Zone and covers areas liable to MSK VIII. The IS code assigns zone factor of 0.24 for Zone 4. The Indo-Gangetic basin and the capital of the country (Delhi), Jammu and Kashmir fall in Zone 4. In Maharashtra, the Patan area (Koyananager) is also in zone no 4. In Bihar, the northern part of the state like- Raksaul, near the border of India and Nepal, is also in zone no 4. Zone 3, the Andaman and Nicobar Islands, parts of Kashmir, Western Himalayas fall under this zone. This zone is classified as Moderate

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Damage Risk Zone, which is liable to MSK VII. The IS code assigns zone factor of 0.16 for Zone 3. Zone 2 is liable to MSK VI or less and is classified as the Low Damage Risk Zone. The IS code assigns zone factor of (maximum horizontal acceleration that can be experienced by a structure in this zone is 10% of gravitational acceleration) for Zone.

II. LITERATURE REVIEW

IS 456:2000 [22], this standard is basically used for the plain and reinforced structure. It deals with the design of building according to their requirements. In this code, it has been assumed that the design of plan and reinforced cement concrete work is entrusted to a qualified engineer and that the execution of cement concrete work is carried out under the direction of a qualified and experienced supervisor.

Bruce R.Ellingwood (2001) [7] studied the prospect and future improvement in earthquake resistant and design procedure based on the more rational probability-based treatment of uncertainty are examined.

IS 1893(part1):2002 [21] this standard deals with assessment of seismic loads on various structures and earthquake resistant design of buildings, its basic provision are applicable for building; elevated structures; industrial and stack like structures; bridges; concrete masonry and earth dams; embankments and retaining walls and other structures.

S.K. Ahirwar, S.K.Jain and M.M.Pande(2008): Estimated earthquake loads on multi-story R.C. Framed buildings as per IS:1893-1984 and IS:1893-2002 recommendations. They considered three, five, seven and nine storey buildings and each was analyzed individually. For each building, a set of five individual sequences was decided in the process. The methods of analysis adopted were the Seismic Coefficient method, Response Spectrum method, and Modal Analysis method. Seismic responses viz. storey shear, base shear. Geotechnical Earthquake Engineering (Steven L. Kramer), (2013) deals with the basic concept of earthquake engineering, geotechnical engineering, seismology, and structural engineering. This book deals with the type of damage done by earthquake, measurement of ground motion, hazard analysis and methods for analyzing the ground response during an earthquake.

Anil K. Chopra (2015) [17] this book includes the theory of structural dynamics and application of this theory to earthquake analysis, response and design of structures. This book concerned with the earthquake response and design of the multi-story building with dynamic analysis. Inchara K P, Ashwini G (2016): The main objectives of this study were to study the performance and variation in steel percentage and quantities concrete in R.C framed irregular building in gravity load and different seismic zones. And to know the comparison of steel reinforcement percentage and quantities of concrete when the building is designed as per IS 456:2000 for gravity loads and when the building is designed as per IS 1893(Part 1):2002for earthquake forces in different seismic zones. In this study five (G+4) models were considered. All four models were modeled and analyzed for gravity loads and earthquake forces in different seismic zones. ETABS software was used for the analysis of the models. According to their research, it can be inferred that support reactions tended to increase as the zone varied from II to V, which in turn increased volume of concrete and weight of steel reinforcement in footings and in case of beams, percentage of steel reinforcement increased through zones II to V.

III.CONCLUSION

Using this software ETABS, reduces the time for analysis and design work and gives high accuracy and due to this software, we can get the values of the structure easily and can get the values for any zone & any soil type. The storey drift mainly occurs in the middle storey of the structure, that can easily seen with the help of this software.

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