Design and Comparison of Multi-Storied Building in all Seismic Zones

Preeti Singh[1] Prof. Shraddha Sharma[2]
[1]M. Tech. Student [2]Associate Professor
[1,2]Department of Civil Engineering
[1,2]B.I.T. Durg, India

Abstract— In civil engineering structure seismic design of multi-storey building requires both static and dynamic analysis are perform. Static analysis is performed for regular buildings upto 90m height in zone II & III. Dynamic analysis is performed for both regular and irregular buildings in zone IV & V. Dynamic analysis is eighter performed by the "Time History Method" or "Response Spectrum Method". The weakness arises due to discontinuity in mass, stiffness and geometry of structure. Mass irregularity shall be considered to exist where the weight of any storey is more than 200% of that of its adjacent storeys. There is necessary to construct a structure which is earthquake resistance at a particular level of intensity of shaking a structure. Indian standard codes are used for design of various building elements or members. These elements are designed by using software STAAD Pro. And consider seismic load and wind load. For load combination use code IS 1893:2002. The project consists of G+10 buildings with same plan. Irregular building (T-shape) is compared in all four zones. All these buildings are designed with same height and plan with their respective ideas. The designing has been carried out in STAAD.Pro software (software that deals with analysing and designing of structures. The modelling and graphics of this software is more clear and perfect and easy to understand). All the G+10 building structure and modelled analysed and then designed for all four zones. Results are compared with respect to all zones. The base shear force, volume of concrete, weight of steel and cost effectiveness have been calculated to depict all the differences in structure behaviour when analysed in all four zones in STAAD.Pro software.

Key words: Time History Method, Response Spectrum Method, Static Analysis, Dynamic Analysis, Mass irregularity, STAAD Pro., IS 1893:2002

I. INTRODUCTION

Engineering, Designers and Builders are trying to use different materials to their best advantages keeping in view the unique properties of each materials structurally robust & aesthetically pleasing building are being constructed by combining the best properties at individual material & at the sometime meeting specific requirements of large span, building load, soil condition, time, flexibility & economy high rise buildings are best suited solution. Structural design of building for seismic loads is primarily concerned with structural safety during major ground motion, but serviceability and the potential for economic loss are also of concern.

The main objective of this paper is to study the seismic behaviour of concrete reinforced building in all zones. Also analysis of structure by using Response Spectrum Method has been surveyed. To analyse RCC frame G+10, design the irregular building (T-Shape) and compare base shear, cost effectiveness in all four zones. Also consider the seismic and wind loads on building. The aim of the project is to investigate the effect of seismic loading in regular and irregular structure in four zones. Also consider the wind loading. The study helps in the investigation of strength and cost effectiveness of the buildings.

Earthquake resistant structures are capable of resisting lateral and vertical forces acting on the structure. Shear force was found to be maximum for the first storey and it decreased to minimum in the top storey in all cases. Performance of building during an earthquake depends upon several factors such as stiffness, ductility, lateral Strength, simple and regular configuration. According to codes, earthquake resistant structures are designed to expected earthquake during the design life of the structure. Reinforced concrete building are analysed and designed to meet the requirements of relevant codes of practice. Building designed as per codes provision will survive during earthquake with minor damages of structure elements. The reviews explain the seismic design of building in all four seismic zones.

II. METHODOLOGY

The methodology followed out to achieve the above mentioned objectives is as follows:

1) Review of the existing literatures by different researchers and also by the Indian design code provision for designing the multi-storey seismic building.
2) A broad literature review on the use of multi storey seismic building.
3) Designing of 11 storey residential building in all seismic zones with the STAAD pro.
4) Comparing the base shear and cost effectiveness of seismic building in all zones.
5) Finally, the observations of results and discussions

III. CONCLUSION

As a result of comparison between mentioned analyses it is observed that the base shear obtained by response spectrum analysis and also comparison of cost effectiveness in all zones. Static analysis is not sufficient for high rise buildings and it's necessary to provide dynamic analysis. Response spectrum method of seismic analysis of prediction of shear forces in structural systems. The method involves the calculation of base shear and cost effectiveness.

Zones	Zone II	Zone III	Zone IV	Zone V
Base Shear (KN)	1050	1734.56	2648.327	4117.317

Table 1: Comparison of Base Shear

Zones	Zone II	ZoneIII	Zone IV	Zone V
Volume of concrete (m^3)	820.6	930.1	988.6	1145.5

Table 2: Comparison of volume of concrete

Zones	Zone II	Zone III	Zone IV	Zone V

Weight of steel (Kg)	84913.97	107679	124139.35	172062.69

Table 3: Comparison of weight of steel

Zones	Zone II	Zone III	Zone IV	Zone V
Cost of concrete (Rs.)	3815790	4324965	4596990	5326575

Table 4: Comparison of cost of concrete

Zones	Zone II	Zone III	Zone IV	Zone V
Cost of steel (Rs.)	3553650	4506367	5195232	7200824

Table 5: Comparison of cost of steel

REFERENCES

[1] Bahador Bagheri, Eshan Salimi Firoozabad and Mohammadreza Yahyaei, "Comparative study of the static and dynamic analysis of multi-storey irregular building" International journal of civil, environmental, structural, construction and architectural engineering.
[2] Asha Vijayan, Aswathy prakash, "Study on seismic analysis of multi-storeyed reinforced concrete building with mass irregularities" International journal of science and research.
[3] Mohammed Rizwan Sultan, D. Gouse Peera, "Dynamic Analysis of Multi-storey building for different shopes" International journal of innovative research in advanced engineering.
[4] Anoop Singh, Vikas Srivastava, N.N. Harry, "seismic Analysis and design of building structures in STAAD Pro." International journal of Innovative Research in science, Engineering and Technology.
[5] Tatheer Zahra, Yasmeen Zehra, Noman Ahmed, "Comparison of RC Building for low, moderate, and high seismic categories" International journal of civil and environmental engineering.
[6] Ms. Neha, D. Khobragade, Asst. Prof. Anshul Nikhade, "Effect of seismic forces on multi-storey building for different zones and soil condition" International Journal for technological research in engineering.
[7] Baldev D. prajapati and D.R. panchal, "Study of seismic and wind effect on multi-storey R.C.C., Steel and composite building" International journal of advance in engineering and technology.
[8] Mr. S.Mahesh, Mr.D.B.Panduranga Rao "Compression of analysis and design of regular and irregular configuration of multi-storey building in various seismic zones and various type of soila using ETABS and STAAD" IOSR journal of mechanical and civil engineering.
[9] K Aparna Srivastav "Seismic analysis and Design of g+5 residential building" International journal of lastest trends in engineering and technology.
[10] S.K. Ahsirwar, S.K. jain and M.M. Pande "Earthquake loads on multi-storey buildings as per IS: 1893-1984 and IS: 1993-2002; a comparative study" world conference on Earthquake engineering.

