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Dynamic Analysis of Multi-Storey Building for Seismic Zone-V Using Staad-Pro Software

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ABSTRACT: A building with multiple floors is called a multi-storey building. Buildings today are designed to meet our fundamental needs and provide improved serviceability, and the dynamic load is steadily rising day by day. This paper aims to find the maximum storey displacement, storey drift, frequency and time period for dynamic load by using staad-pro software. In this project, the dynamic analysis is carried out for G + 7 multi-storey libraries building for seismic zone-V and it is concluded that the base shear decreases with building height and the storey's highest displacement is observed at the top.

KEYWORDS: RC Frame Building, Seismic Zone, Dynamic analysis, Staad-pro.

I. INTRODUCTION

The world's population has increased to 8 billion in recent years, and India's literacy rate is rising at an ever-increasing rate. In addition, the dynamic load is increasing as a result of the use of new technologies like vibration machines, mobile phones, sound, music, and automobiles, among other things. This generation has a higher literacy rate than previous generations. Modern infrastructure and a happy environment are needed to raise literacy rates.

The purpose of multi-story buildings is to save money and increase the floor area of the building without increasing the land area. Buildings today are designed to meet our basic needs and provide better serviceability. It is not a problem to build a building, but it is important to build a building that works well and won't break down for a long time [1]. Buildings with more than 150 stories can range from two stories to more than that. Buildings are a good indicator of the county's social progress [2]. In India's metropolitan areas, medium-rise R.C. framed buildings with 8 to 10 or 12 storeys are becoming increasingly popular [3]. When a structure's configurations (dimensional parameters) are nearly symmetrical around all of its axes, it is considered a regular structure. Regular buildings are those that appear the same from both the plan and the elevation [4]. The primary concern of structural engineers is determining how a structure responds to horizontal forces, and high-rise buildings need to be sufficiently stiff to withstand winds and earthquake-induced horizontal forces. to deal with earthquake-induced lateral loads, also known as horizontal forces. Maximum displacement and storey drift values are found to be higher in seismic zone V, and the parameter base shear has its highest value in zone V, according to the study [5]. Because the severity of damage to a structure also depends on its height, seismic analysis of a structure that takes into account all types of loads for any building height is essential when building a multistory structure [6]. When carried out manually, the process of analysis and design turns into a very laborious and time-consuming one. Therefore, to resolve this issue, the majority of today's analysis and design work is carried out using software designed specifically for this purpose. Because different software is based on different analysis and design methods, the final results may not match the actual ones [7]. Structure failure begins at weak points during an earthquake. The structure's discontinuity in mass, stiffness, and geometry is what causes this flaw. Regular structures are structures with continuity [8]. The primary focus of structural analysis is the investigation of a structure's behaviour. People, wind, waves, traffic, earthquakes, and blasts are examples of dynamic loads. Dynamic displacements, time history, and modal analysis are all possible outcomes of dynamic analysis. The process of dynamic analysis takes a long time and requires additional information about the structure's mass as well as an understanding of structural dynamics to interpret analytical results. In urban India, reinforced concrete (RC) frame buildings are the most prevalent type of construction. During their lifetimes, these structures are subjected to a variety of forces, including static forces caused by dead and live loads and dynamic forces caused by wind and earthquake [9]. Storey drift increased from bottom to top in the seismic analysis. Storey drift is predicted to increase from zone II to zone V in both directions. The magnitude of the earthquake's effect and the displacement of each storey determine the amount of drift [10].

II. METHODOLOGY

In this project dynamic analysis of the G+7 library building for seismic zone-V, using staad-pro software. All the specifications of the building are shown in below table-1.

Table-1 Details of G+7 storied Building

S. No.	Project Statement	Size / Dimension / Value
2	Size of beam	230mm X 350mm
3	Size of columns	450mm X 450mm
4	Size of wall	230mm (Main Wall) 115mm (partition & parapet wall)
5	Floor Height	3m
7	Type of Dynamic Analysis Method	Response Spectrum Method
8	Live load	3 KN/m ²
9	Damping Ratio	5%
10	Importance Factor	1.2
11	Response Reduction Factor	5
12	Zone Factor	0.36

The RC frame structure plan fig-1, elevation fig-2 and rendering view fig-3 below shown

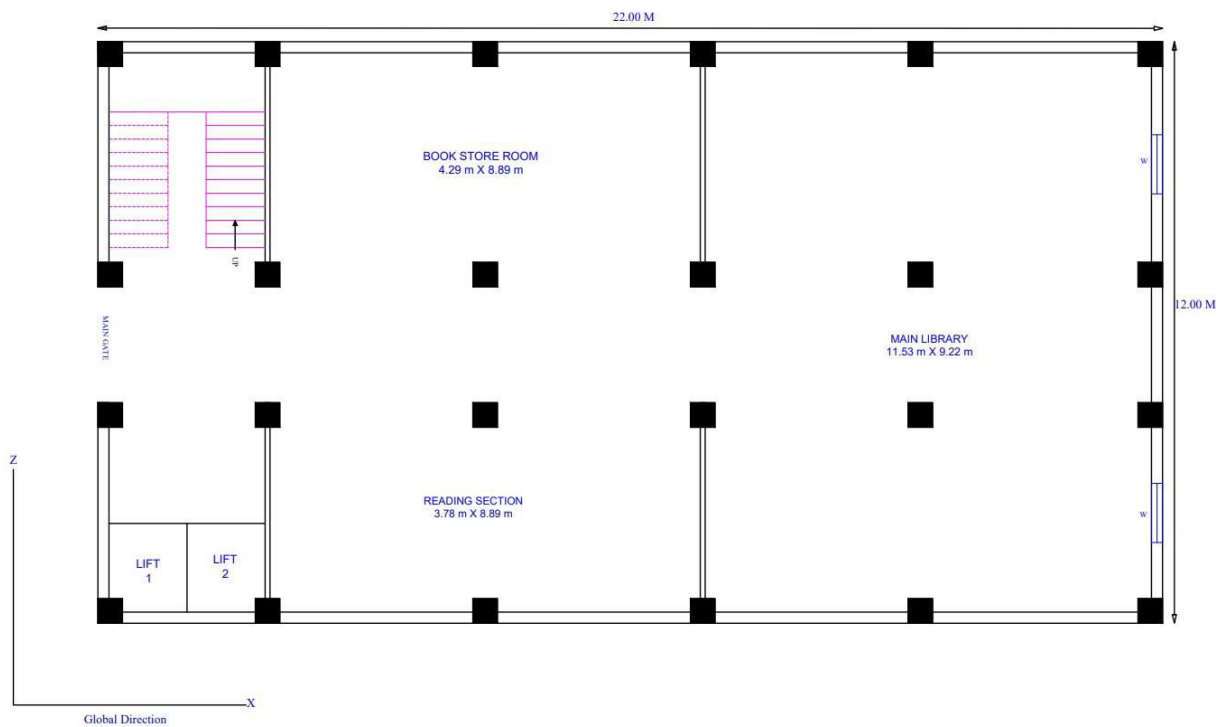


Fig. 1. Plan of the building.

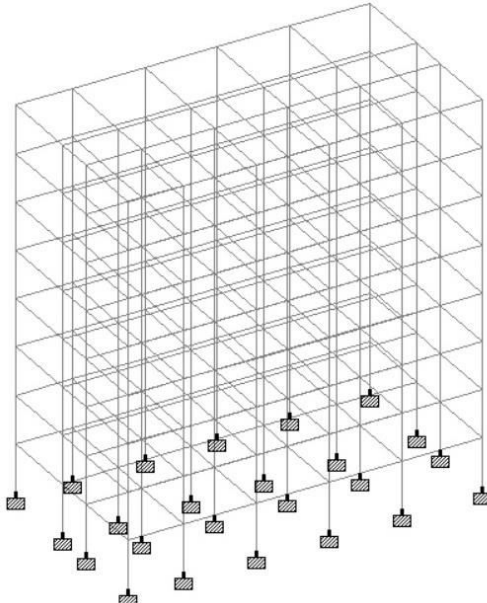


Fig. 2. Elevation of the building.

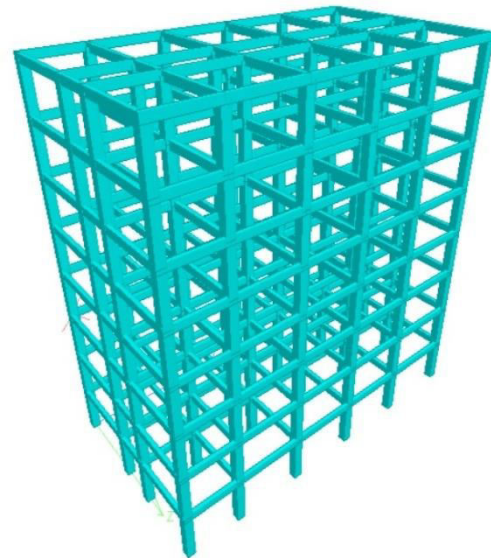


Fig. 3. Rendering View of the building.

III. RESULTS

The outcomes of the structure analysis are discussed in that section. The analysis is carried out using response spectrum techniques. The various results, such as base shear, storey displacement, and storey drift, are depicted in the figure below:

1. Figures 4, 5, 10, and 11 show the maximum displacements and base shear for a G+7 multi-story building in seismic zone V in the global X and Z directions.
2. According to IS 456–2000 and the fundamental time period and frequency of the building for seismic zone-V, response spectrum analysis is carried out with the number of mode shapes taken for analysis being "16". This ensures that the modal mass participation exceeds 90%.
3. According to IS 1893:2016, the building's maximum allowable displacement is 0.004 H.

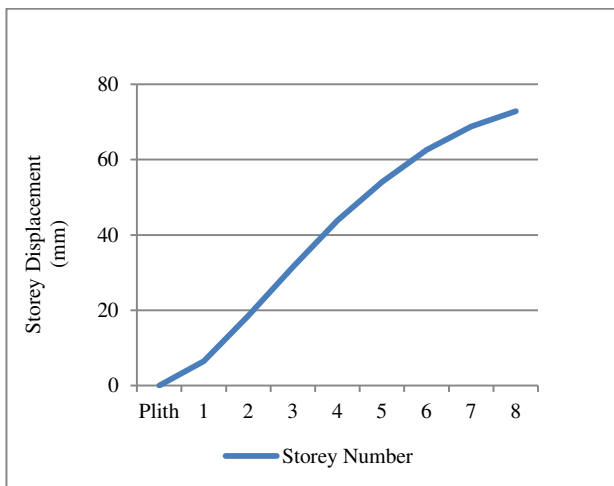


Fig. 4. Max Storey Displacement Along X-direction.

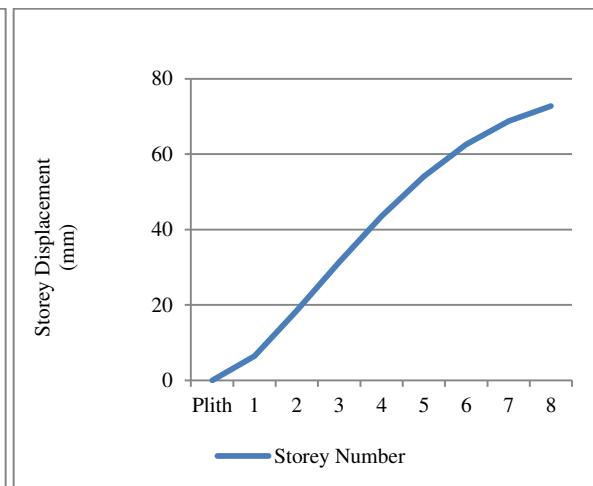


Fig. 5. Storey Displacement Along Z-direction.

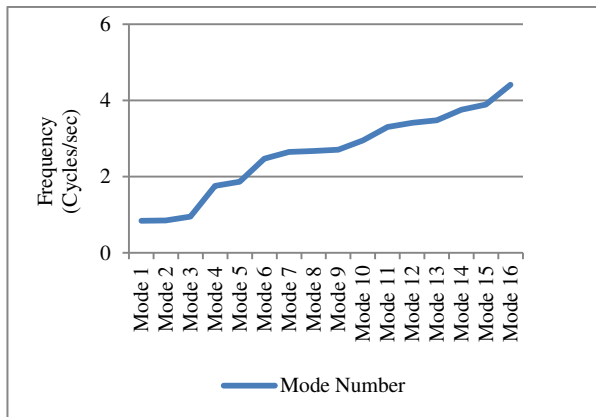


Fig. 6. Frequency.

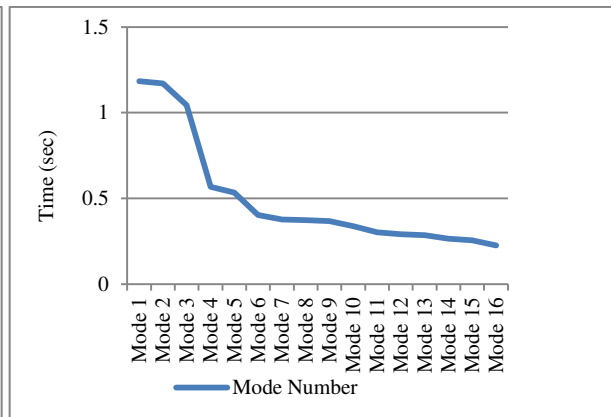


Fig. 7. Fundamental Time Period.

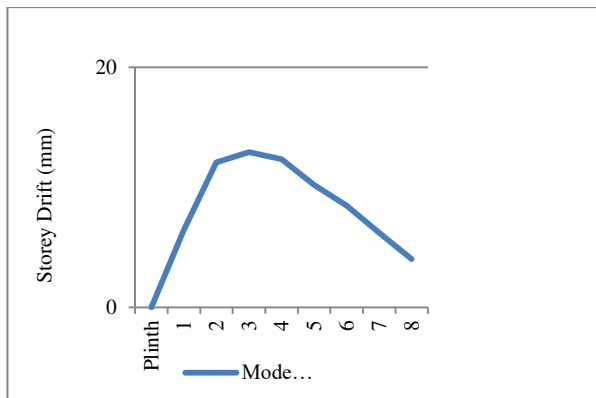


Fig. 8. Max Storey Drift Along X-direction.

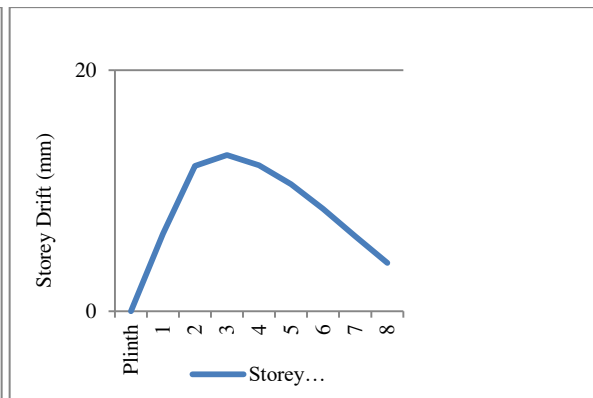


Fig. 9. Max Storey Drift Along Z-direction.

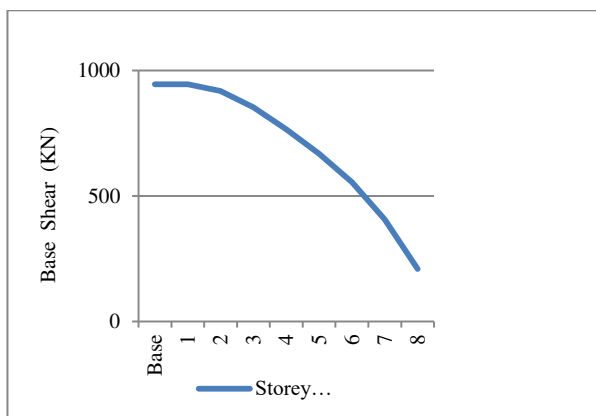


Fig. 10. Base Shear Along Global X-direction.

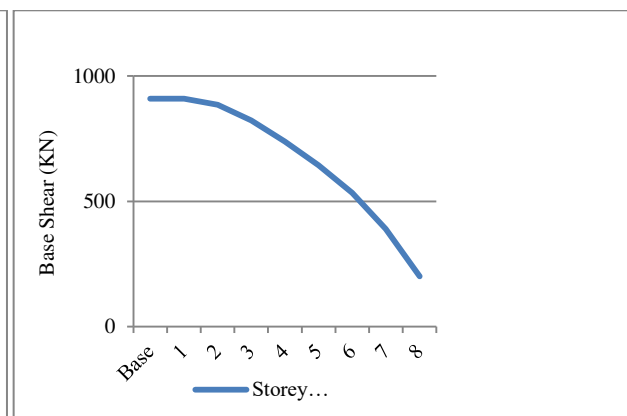


Fig. 11. Max Base Shear Along Global Z-direction.

V. CONCLUSION

The Response Spectrum method is used to conduct a dynamic analysis of the G+7 library building in seismic zone V with medium soil conditions in this report. The following inferences can be made from the present investigation:

1. Storey drift increases significantly as we go from one storey to three storeys, then decreases as we go from three storeys to eight storeys, reaching a maximum value of 12 mm.



2. The storey's highest displacement is observed at the top.
3. The maximum base shear in the Z-directions is 201 KN, and the maximum base shear in the X direction is 209 KN. Base shear decreases with building height.
4. As the mode is increased, so does the frequency value.
5. The fundamental time period decreases as the mode increases.

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