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Analysis and Design of G+20 multi storied building with and without shear walls by changing orientation of column: A Review

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***ABSTRACT*— In recent day population expansion of India is highly growing, day by day need of land for shelter purpose is increase. For fulfilling this required of infrastructure but land availability is now restricted and in future multistoried system mostly adopted in India and all over world. The construction is designed in such a way that lowering damage during an earthquake makes the structure uneconomical, as the earthquake may or may not occur during the structure's life span and is an uncommon occurrence. In this paper G+20 existing RCC framed structure has been analyzed and designed by using with and without shear walls by changing orientation of column in Nagpur location by using STAAD Pro v8i. Our loads considerations are dead loads, wind loads, imposed loads and seismic loads. The structure is designed for earthquake forces in accordance with IS 1893 (Part 1): 2002. Nagpur it's come in a II seismic zone. The IS 1893 (Part 1): 2002 contains general provisions on earthquake hazard assessment applicable to all buildings. The primary goals of this article are seismic analysis and design of a G+20 multi-story building utilising STAAD Pro v8i. A multi-story building is discussed in this paper. The static approach was used to investigate earthquake and wall loads.**

Keywords— Analysis and Design, Shear wall, Dead load, Wind load, Seismic load, STAAD Pro.

INTRODUCTION

The Earthquake is sudden violent movement of the earth surface. It is capable of destroying all structures on Earth's surface. Ground shaking, soil liquefaction, landslides, cracks, avalanches, fire, and tsunamis are all symptoms of an earthquake. According to seismology studies, tectonics is responsible for 90% of earthquakes. When it comes to civil engineering, an engineer's goal is to offer optimum safety in the structures constructed while also maintaining economic viability.

The majority of study has been conducted on this area, and it is still ongoing. We need to understand more so that we can minimise earthquake damage to buildings and save lives. The earthquake zone map is divided into four Seismic zones that is zone 2, 3, 4 and 5 Unlike the country's former seismic zones, which included five or six zones.

Due to increase the population of India For need of land is increase for this purpose construction of multistoried building seismic analysis of such kind of structure very essential. The building heights are increase and for this purpose the stiffness of the structures becomes more important for the multi storied building. In this paper G+20 multistoried building is analyses and design with shear walls are provided to the building for Nagpur location which comes in a Zone II by using STAAD Pro v8i. This software are useful for the design and analysis seismic loads for high rise structures. shear wall are used for to resist the seismic load. Its having very high strength and stiffness which provides stability to multi storied structure. Shear wall is design for resist the seismic forces and safe the structure under repeated loads. Shear wall is vertical member of the structure. It is also known as bearing wall which resist the lateral forces which come into the high rise structure.

LITERATURE REVIEW

Vishal V. Gupta, Ashwin Soosan Pillai, Akash Bharmal and Prof. Jaydeep B. Chougale (2020):

The work in this paper is based on a comparative investigation of the effect of column orientation and shear wall position on G+ 13 storeyed earthquake resistant structures in STTAD Pro. The multi-story building is equipped with shear walls. Shear walls are reinforced concrete structural walls that are designed to withstand lateral loads. The analysis has been completed for seismic zone III (Mumbai). The floor height was set at 3.5, and the damping ratio was set at 0.05. The loads calculation has been done by IS (1893:20020 (Part-1). For consideration

eight different models with same loading structure has been take and analyses. Based on the results and structure analysis, graphical representation is also created. A comparison study is performed for lateral displacement, storey drift, and concrete structure quantity.

Sangeeta uikey and Er. Rahul satbhaiya (2020):

The author's research study discussed seismic analysis of tall buildings utilising STAAD Pro software for design and analysis. The method employed is a limited state design that adheres to the Indian standard code of practise. In this work, they analysed frames and personally validated the software's correctness with the results produced. The results obtained are quite accurate and precise. They designed and analysed a G+4, G+9, G+14, and G+19 story building and tested it for all potential load combinations. The study's goal is to compare structural performance in different seismic zones and soil conditions.to compare the seismic response of a multistory building without the use of a shear wall.

T. Jayakrishna, K. Murali, Powar satish and J seetunya (2018):

It is difficult to construct and analyse a G+7 multi-story building of regular and irregular design under earthquake conditions. Regular and irregular multistory residential buildings are designed and analysed in this research utilising the response spectrum method and STAAD Pro. They carried out the dynamic analysis and assumed a material with linear static properties. Seismic analyses are performed for several seismic zones and the results of all zones are compared. It includes taking the soft soil.They compare the base shear, period node displacement, and frequencies of different irregular and regular buildings for each zone in this paper.

Abhishek Mishra, Anurag Tripathi and Kumar vanshaj (2022):

In this paper seismic analysis and design of a G+20 multi story building for zone II are performed using STAAD Pro V8i with and without shear walls. The major goal of this work is to compare the storey drift, storey displacement, and base shear with and without the effect of a concrete shear wall using a linear static technique. The SMRF RC frame structure building model was created with STAAD Pro V8i and compares multi-story buildings with and without shear walls.

MD Zubair Pasha and SK Jain (2022):

The basic concept of seismic analysis for earthquake resistant structure is that buildings should be able to resist minor earthquake without damaging the structure. In this paper G+20 RC building is analysis and design for four different earthquake zones in India. This analysis is carried out by using STAAD Pro V8i. This study examines the various bay lengths, number of bays, and bay widths along the horizontal direction. Different seismic zone factor values are calculated and compared for four different zones.

Narla Mohan, A. Mounika Vardhan (2017):

In this paper work is done analysis of high rise structure of RC buildings in different zone using Etabs. The building having G+20 storeys with constant storey height of 3m and it analysis done for different seismic zone of India. This model is used to analyse varied bay lengths, bay numbers, and bay widths along the horizontal direction. Different values are taken and compare their results for each seismic zone of India.

METHODOLOGY

IS codes like 1893:2002 (part 1) and IS 456:2000 was referred for design of multistoried building. This design required architectural plan. A size of beams and columns for analysis and design purpose is collected from a construction site of high rise building.

Following steps are used for modelling in STAAD Pro:

1. Structural modeling: Create a 3D model of the G+20 multistoried building in STAAD Pro, including all the structural components like columns, beams, slabs, and shear walls. Assign material properties and section properties to the different components.

2. Load analysis: Apply the loads to the structure including dead load, live load, wind load, and earthquake load as per the relevant codes and standards. Perform load combinations to determine the critical load cases for the structure.

3. Shear wall placement: Place shear walls in different locations and orientations to analyze the effect on the structures behavior. Compare the results with and without shear walls to determine the most effective shear wall placement.

4. Design and optimization: Based on the load analysis results, design the structural components like columns, beams, slabs, and shear walls for strength and stability. Maximize the design by adjusting the dimensions of the components and changing the

shear wall placement to achieve the best structural performance in the multi storied building.

5. Code Observance: Confirm that the design complies with the relevant codes and standards, including building codes, seismic codes, and wind codes. Assemble any necessary adjustments to the design to meet the code requirements.

6. Analysis and Results: Analyze and Review for the results of the analysis and design to determine if the structure meets the required performance criteria. Evaluate the effects of the shear wall placement on the multi storied building's behavior and determines if the building is safe and stable under various loading conditions.

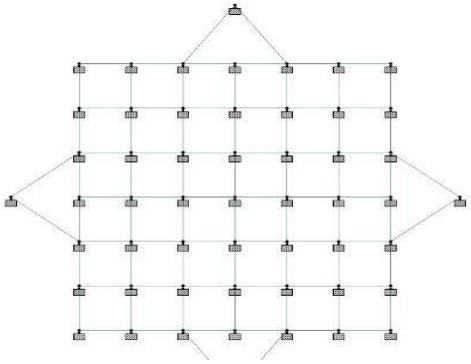

Fig. 1 Grid plan of Building

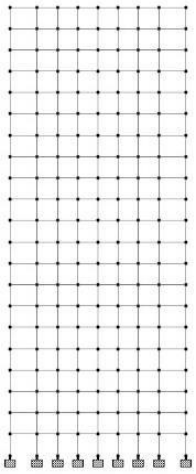

Fig. 2 STAAD 2D model of Building

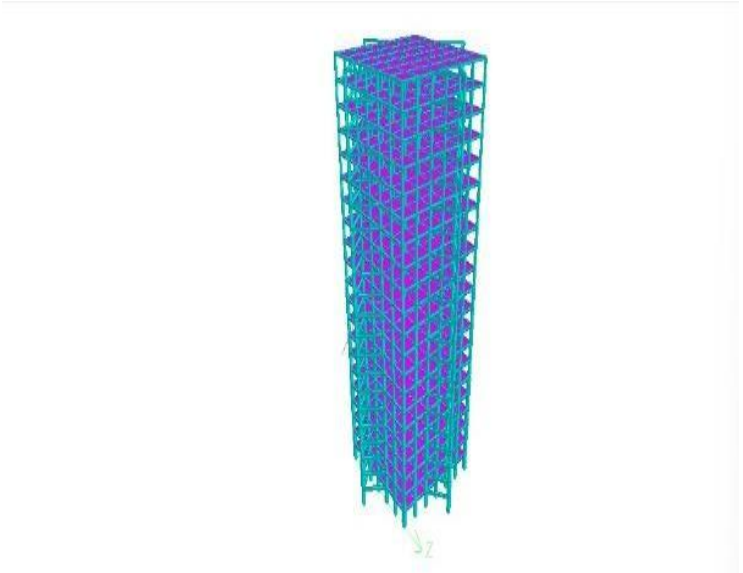

Fig. 3 STAAD 3D model of Building

CONCLUSION BASED ON LITERATURE REVIEW

- Analysis and design of a G+13 story building without a shear wall, as well as a G+13 storey building with shear walls in various locations with the same loading pattern and cross section.
- The behavior of G+20 multistoried building under seismic load as per IS 1893:2002 (part-1) by using software STAAD Pro has been studied.
- STAAD pro has analysed several load cases such as dead load, live load, and seismic load for various zones in India.
- The STAAD Pro analysis is provide complete guidelines for seismic analysis and gives the precise and accurate result as compared to manual calculation.
- Maximum storey drift in medium soil continues from zone II to zone III in the G+4, G+9, G+14, and G+19 RC frames.

- The behaviour of a structure differs depending on its shape in the case of regular and irregular buildings. Thus, the structure should be analysed for each specific angle and designed to have the greatest shear force and moments.

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