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Analysis and Design of G+10 Residential Building in Zone-III

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ABSTRACT
Boundaries are basically about providing structure, and structure is essential in building anything that thrives. We shape our home and then our homes shape us, because a home should be more than just something pretty to look at. Our homes should inspire us every day to live the life we dream of and aspire.Land area is shrinking and population is growing daily. As a result, everyone wants a homely flat. Hence our goal is to create buildings that are not only aesthetically pleasing but also adhere to proper standards and take into account how resilient that will be to natural calamities.Structural design is an investigation method of the rigidity, strength and stability of the building. The essential aim in structural analysis and design is to construct a structure capable of overcoming all applied loads without failure during it's intended life. The process of structural design involves various stages such as computation of loads, member design, detailing and many more. The conventional method of structural design and analysis leads to lot of complications and tedious calculations which are time consuming.
Now-a-days plenty number of application software‘s available in the civil engineering field. All the software‘s are developed as the basis of advanced. The analysis which include the effect of dynamic loads such as wind load, seismic load etc… in the present work an attempt has been made to study the efficiency of certain civil engineering application software‘s.This project involves analysis and design of multi-story G+10 Residential building using STAAD Pro which includes forces, moments and deflections. All the drafting and detailing were done by using auto cad. In this project, the design of beams, columns, slabs, stair case, and a shear wall was calculated by the limit state method using IS:456 code. Different loads acting on member are consider according to IS:875[part-I, II, III] and IS:1893 for seismic load.

KEYWORDS: Analysis of multi-storey, Seismic Analysis, STAAD PRO

INTRODUCTION

We shape our home and then our homes shape us, because a home should be more than just something pretty to look at. Our homes should inspire us every day to live the life we dream of and aspire. Beginning with the earliest cave drawings, structures have been used as objects or canvases for a multitude of artistic styles. Many new buildings and other structures now intentionally incorporate

interest in sustainable planning and building methods into their design processes. India is a developing nation, and there will be many large-scale development projects in the future because it has been so long since undeveloped cities needed to grow. In the twenty- first century, there are several on-going projects all over the world; time delays occur, which have an impact on the expansion of the building of large projects. Numerous metropolitan areas are dealing with significant infrastructure growth, whether it be in terms of vertical or horizontal development. We should be concerned about all the factors that act on the building, its weight, and the behaviour of the soil in high-rise constructions.

A body that can resist the applied load without experiencing significant deformation is referred to be a structure. Structures built with the help of civil engineering are designed to perform a certain function, such as providing safe and cost-effective human habitation, transit, bridges, storage, etc. Planning, designing, and building structures are the focus of structural engineering. Establishing the force and displacement of a structure's component's structure is part of the process of structural analysis. The structural system's constituent parts are chosen and precisely specified during the design process. To create a structure that will produce a safe, cost-effective solution is the primary goal of reinforced concrete design.Residential building means a building in which sleeping accommodation is provided for normal residential purposes, with or without cooking or dining facilities, and includes one or more family dwellings, lodging or boarding houses, hostels, dormitories, apartment houses, flats and private garages of such buildings.A building frame consists of number of bays and storey. A multi-storey, multi-paneled frame is a complicated statically intermediate structure. The design of R.C building of G+10 storey frame work is taken up. The size of building with plot area 27m*26m. The building is planned according to NBC (2016) by using AutoCAD. The building is analysed for the maximum and minimum bending moments and shear forces manually. The building subjected vertical loads. The vertical load consists of dead load of structural components such as beams, columns, slabs etc., and live loads. Thus, building is designed for dead load, live load as per IS 875-1987, IS456-2000 and IS1893- 2002/2005.

OBJECTIVES

The main objective of this investigation is to study the Analysis and Design of G+10 Residential building in Zone-III

Objectives of this experimental Investigation

1. To design Residential building as per IS code.
2. To analysis loads manually and comparing with STAAD Pro.
3. To analysis special loads with in calculation of load.
4. To create structure with adequate safety and serviceability under the influence of the relevant loads and actions during the lifetime of the structure.

SOFTWARES USED

The software used in this project is

1. AutoCAD {2019}
2. STAAD.ProV8i {SS6 }

AutoCAD:

AutoCAD is powerful software licensed by auto desk. The word auto came from Autodesk company and cad stands for computer aided design. AutoCAD is used or drawing different layouts, details, plans, elevations, sections and different sections can be shown in Auto CAD.

STAAD. Pro: STAAD Pro is a comprehensive tool for modeling, analyzing, and designing various structures, including buildings, bridges, towers, and more. STAAD Pro is known for its ability to handle complex geometries and various types of analysis, like static, dynamic, and finite element analysis.

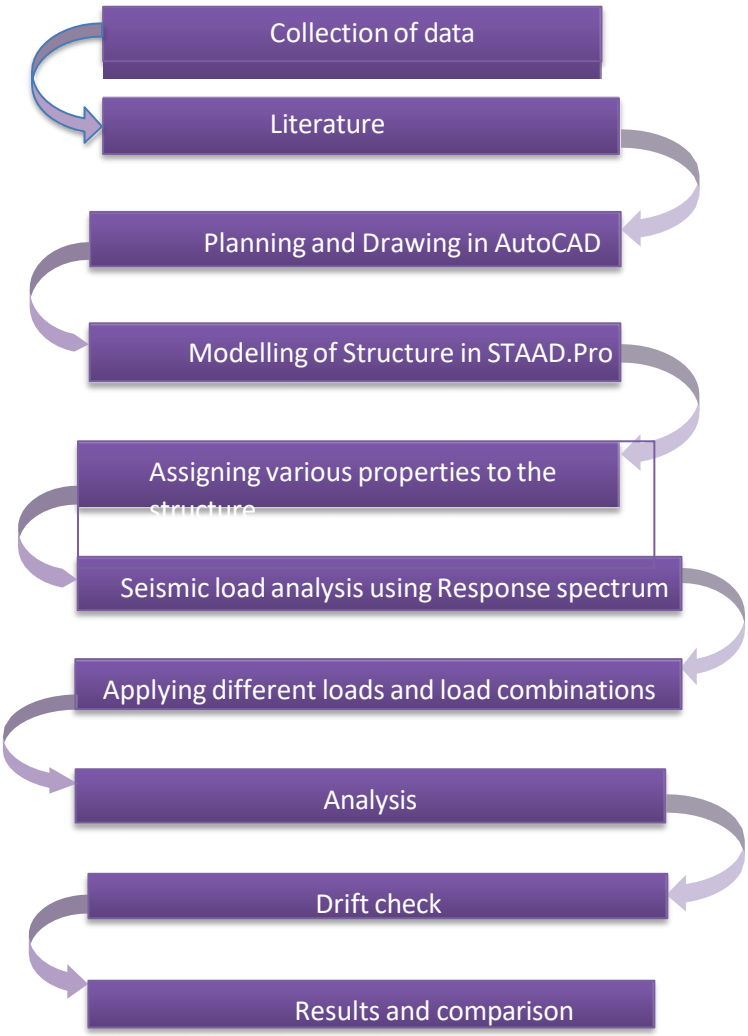
LITERATURE RIVEW

1. **Lalith S. choudhary…et.al (April 2022) :** Seismic analysis and design of G+10 Multi story residential building using STAAD Pro . In this journal, they used two different methods. Equivalent static analysis- is only one mode is considered for each direction and Response spectrum analysis, is an another approach that permits the multiplier modes of response of a building to be taken into account. After from the analysis they concluded that the structure is not falling in compression but falling in tension due to earthquake load imposed on a structure in various zones. And also observed that the variations are drastically higher in Zone II to zone IV.
2. **Kunal wailkar…et.al (May 2021):** Analysis and design of a residential building by using STAAD Pro. They considered the design of one way slab, two way slab, beams, columns, footings, staircase taken as the minimum requirements as suggested by the Indian standard codes. They concluded that the structural elements of building are safe in flexure and shear. On the On comparison of the manual design and geometrical model using STAAD Pro, the area of steel required for beam, column, footing, slab, staircase are comparatively similar to that of the requirement.
3. **Ankul chauhan …et.al(September2020) :** Analysis and Design of Residential building (G+1) using STAAD.Pro. in this paper the design of residential building was done by limit state analysis. The drafting is done by the AutoCAD software and the standard dimensions are followed by the nation building code respectively i.e. the building consists the 2 stories. According to this paper the limit state method proved as economical. The design review found out the structure is safe as economical.
4. **B. Gireesh Babu (2017):** Seismic Analysis and Design of G+7 Residential building Using STAAD.Pro. As mentioned in the paper he observes the response reduction cases for ordinary moment resisting frame. For that case he considered earthquake zone 2 with response reduction factor 3 and importance factor 1. Stared the analysis with simple 2d frame and manually checked the accuracy of the software. He concluded that the structure is under the drift condition and structure is safe and also concluded that no need for the resisting purpose for the structure , that he considered the site location in Hyderabad which lies in zone-2.
5. **Shruti Dixit..et.al (May 2021) :** Analysis and design of G+10 residential building using STAAD Pro. They considered the Zone V having a zone factor of 0.36 and the analysis was done for RCC framed structures and they considered AAC blocks walls for 2BHK Apartment with the plot size 38.5mx25.35m.from the conclusion the reinforcement details for each member can be carried obtained directly after the process of analysis is carried out and in the time of designing some of the columns, beam section, the reinforcement percentage exceeds the maximum limit of reinforcement percentage.
6. **Dhanavath Seva, Bhukya Chandrasekhar, Faria Aseem (NOV 2017):** Design Of Residential Building Using STAAD. Pro. They considered the G+6 residential building that consists five apartments in each floor. The analysis and design of multi-storied residential building with all possible cases of the loadings using STAAD. Pro. The entire structure was calculated by manually when it is compared with software, the small changes are rectified easily with the help of STAAD. Pro.

7. **Mohammad Maaz Ansari.et.al (July 2021):** Design of G+10 storey residential using STAAD Pro. The entire structure was calculated by limit state method as per IS code.Analysis and design of structure have been completed by manual design and staad pro software. All drafting and detailing was done by using Auto cad. From the conclusion, the calculation by both manually as well as software analysis gives same result and Displacement increases as the storey height increases.
8. **Aman, Nalwadgi M, Vishal T(June 2016):** Analysis and Design of G+10 Apartments Building Using STAAD. Pro. They analysis and design were done according to standard specification using STAAD. Pro for static and dynamic loads. The dimensions of structural members are specified and the loads are dead load, live load, floor load, seismic load, wind load and earthquake load are applied. Deflection and shear tests are checked for beams, columns and slabs. The tests proved to be safe. They concluded that we can give more knowledge in practical work when compared to theoretical work.

METHODOLOGY

The methodology which is followed to complete this project is shown as follows**:**



Flow chart for adopting Methodology

CONCLUSION

- In this Project —Analysis and Design of G+10 Residential building in Zone-III‖, the planning,

analysis and design for building was done. It's a G+10 storied building with parking in the basement and the rest of the floors are occupied with apartments.

- All the structural components were designed using AutoCAD. The analysis and design were done according to standard specifications using STAAD Pro.
- The dimensions of structural members are specified and the loads such as dead load, live load, floor load seismic load, wind load and earthquake load are applied.
- Deflection and shear tests are checked for beams, columns and slabs. The tests proved to be safe.
- The story drift condition for considered G+10 building, the base drift=0.0 at every story. This says that the structure is safe under drift condition. Hence shear walls, braced columns are not necessary to be provided. Hence story drift condition is checked for the G+10 building.
- The response of a RCC high rise building under wind load and seismic load is studied as per IS 1893(Part 1) : 2002 and IS 875 (Part 3) :1987 respectively.
- The project was analysed through the response spectrum method, where RSA the method suggest for the high rise buildings that it can give the values accurately with six modes of analysis.
- Using STAAD.Pro the analysis of multi storey building has completed much quicker when compared with manual analysis.
- It is observed that the reinforcement percentage in the section is more in case of software compared to manual calculations.

Hence I conclude that that one can gain more knowledge in practical work when it is combined with the theoretical work.

FUTURE SCOPE

1. To understand basic principles of the structure using IS codes. To analyses the structuraldetails of the structure.
2. It is recommended to provide shear wall on x and z directions, if the area is in higher seismic zone.
3. To prepare the 3D model of the structure by use of the software for detailed design andanalysis.

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