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A BIM Based Analysis and Design of G+4 Building Using Different Computational Methods

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A B S T R A C T

The study and design of a G+4 building using sophisticated structural analysis tools (ETABS, Robot Structural study, and Building Information Modelling, or BIM) is presented in this project as a thorough technique. Building Information Modelling (BIM) technology provides a cooperative framework for combining structural and architectural elements, allowing for smooth communication and collaboration amongst project participants. According to the study, geometric and non-geometric data relevant to structural analysis and design are captured during the process of creating a comprehensive digital model of the building using BIM software. Once structural analysis and design are completed, the model is transferred to Robot Structural Analysis and ETABS, respectively. In order to verify structural integrity and adherence to pertinent regulations and standards, the study consists of load calculations, seismic analysis, and design optimization Using BIM improves communication, expedites processes, and lowers mistakes and disciplinary issues. Engineers are able to carry out thorough structural evaluations and iteratively improve the design thanks to the integration of sophisticated analytical tools, which produces effective and affordable structural solutions. Throughout the course of a project, using BIM improves collaboration, expedites communication, and reduces mistakes. The use of sophisticated analytical tools enables engineers to investigate several design possibilities, resulting in more effective and economical structural solutions. This study emphasizes how modern analytical tools and BIM have the capacity to completely change the construction industry and open the door to the creation of more resilient and sustainable built environment.

Keywords: Robot Structural analysis, E-Tabs , BIM , Structural Integrity

1. INTRODUCTION

GENERAL

A major development in the field of structural engineering is the combination of Building Information Modelling (BIM) technology with sophisticated structural analysis tools like Robot Structural Analysis and ETABS. Using these advanced software tools in conjunction with BIM's capabilities, this study proposes a fresh method to the analysis and design of a G+4 building. In addition to satisfying customer expectations and strict laws, structural engineers have the difficult task of making sure structures are safe, long-lasting, and economically viable. Inefficient, inaccurate, and inconsistent modelling, analysis, and design procedures are common in traditional approaches to structural analysis and design. Robot Structural Analysis and ETABS software are fully integrated with BIM technology. The project's foundation is BIM, which makes it easier to creation of a thorough digital model that includes the building's structural, architectural, and MEP elements. A comprehensive visualisation of the building may be obtained prior to construction by stakeholders through the use of BIM, which enables real-time collaboration and transparent information exchange. This coordinated strategy reduces mistakes and disputes between the several project disciplines while streamlining workflow and improving communication. Robot Structural Analysis and ETABS software are then used to carry out the project's structural analysis and design phase. These cutting-edge instruments provide unmatched power for analysing intricate structural systems, forecasting their behaviour under various stress scenarios, and fine-tuning designs to satisfy exacting performance standards. Engineers may investigate several design possibilities, evaluate their performance, and iteratively improve designs to attain the best outcomes by utilizing BIM-integrated analysis and design workflows. Engineers can create structurally sound, efficient, and sustainable solutions while optimizing project efficiency and saving costs because to the synergy between BIM and modern analytical tools. ETABS software and BIM with Robot Structural study for the study and design of a G+4 building. Through the use of workflows that include BIM into analysis and design processes, engineers may quickly evaluate the efficacy of several design possibilities, explore a wide range of options, and iteratively refine designs in order to achieve optimal results. Engineers are able to develop structural solutions that are safe, economical, and ecologically friendly by combining BIM with advanced analytical tools. This collaboration also improves project efficiency and lowers costs. The intention is to demonstrate the benefits of using BIM in conjunction with ETABS software, Robot Structural Analysis, and other tools to analyse and design a G+4 building. The paper aims to illustrate the substantial potential of this integrated technique in altering structural engineering methodologies and affecting the direction of future building practices through a thorough analysis of an actual case study.

2. METHODOLOGY

2.1 Robot Structural Analysis

A comprehensive program designed specifically for structural analysis and design; Robot Structural Analysis (RSA) is a product of Autodesk. Applying it to a wide range of loading scenarios allows structural engineers and designers to assess how different constructions behave and perform. Through the use of RSA, engineers may examine how buildings behave when exposed to a variety of loads, including as live loads, wind loads, seismic loads, gravity loads (also known as dead loads), and temperature impacts. The stresses, strains, displacements, and deflections inside the structure may all be assessed by engineers by modelling these loads. In order to evaluate how buildings, react to dynamic loading circumstances, such as earthquakes, wind-induced vibrations, or machinery activity, RSA provides dynamic analysis approaches. Engineers can better comprehend a structure's dynamic behaviour and prevent structural failures or resonance effects by using dynamic analysis. RSA easily exchanges data throughout the many stages of the design and construction process by integrating with other Autodesk products, like Revit and AutoCAD. Interoperability facilitates improved stakeholder cooperation and expedites workflows. Robot Structural Analysis is an adaptable software tool that is essential to the design and analysis of structures. It gives engineers the instruments and capacities they need to guarantee structural safety, maximize designs, and successfully complete projects.

2.2 ETABS

For structural analysis and building design, ETABS (Extended Three-Dimensional Analysis of Building Systems) is a popular software program. ETABS is a full suite of tools for modelling, evaluating, planning, and detailing building structures. It was created by Computers and Structures, Inc. (CSI). In comparison to conventional two-dimensional approaches, ETABS enables engineers to do three-dimensional analysis of building structures, providing for a more realistic depiction of real-world behaviour program has strong modelling features that enable the creation of intricate structural models of structures. Engineers can apply various materials and cross-section characteristics, as well as define parts like beams, columns, slabs, walls, and braces, with ease. ETABS enables users to apply a range of loads to the structure, such as wind, seismic, dead, live, and temperature loads. The program facilitates the automated development of load combinations in compliance with applicable standards and design regulations. Static analysis, response spectrum analysis, time history analysis, and nonlinear analysis are just a few of the analytical techniques that ETABS provides. These techniques assist engineers in evaluating the performance of the building and the structural reaction under various loading circumstances. For enhanced structural design capabilities, ETABS easily interfaces with other CSI software programs like SAP2000 and SAFE. Within the ETABS environment, engineers may carry out thorough design evaluations for steel and reinforced concrete buildings. Users may verify conformity with local rules by utilizing the program, which integrates design provisions from many international building codes and standards. According to the specifications of certain design codes,The ETABS software has an intuitive graphical interface that makes it easier to create models, set up analyses, and visualize results. The toolbars, instructions, and menus of the program are simple for engineers to use.

2.3 Indian codes for analysis

1. Seismic analysis

Indian Standard IS 1893 (Part 1): 2016 - Criteria for Earthquake Resistant Design of Structures: This standard provides guidelines for seismic design of structures in India. It covers seismic zoning maps, design parameters, analysis methods, and detailing requirements for various structural systems.

Indian Standard IS 13920: 2016 - Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces: This standard focuses on detailing requirements for reinforced concrete structures to ensure ductile behaviour under seismic loads.

2. Wind Analysis

Indian Standard IS 875 (Part 3): 2015 - Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures: Part 3 of IS 875 provides guidelines for wind load calculations and design requirements for buildings and structures in India. It covers wind speed maps, terrain categories, and factors affecting wind loads. It provides additional guidelines and requirements for wind load analysis and design, complementing IS 875.

3. CONCLUSIONS

By comparing the two software's results such as Robot structural analysis and ETABS to check which software gives the high accurate results of analysis of G+4 Building using Different load combinations based on the Indian codes and check the Structural Integrity at each place of Building model. Finding isolated zones of Building model take the several measures while designing of any structure by using this two software's. Now a days every structural industry adopts for these software's and looking for the Safety. Robot Structural study and ETABS were both effective methods for doing a thorough structural study of the G+4 building model. These software programs provide sophisticated analytical features, such as dynamic, nonlinear, and static analysis, allowing engineers to evaluate the performance of the structure under many loadings' scenarios. Engineers were able to assess several design options and choose the most effective and economical one through iterative design optimization made possible by the combination of BIM and structural analysis technologies. This iterative method enhanced overall design quality and enabled well-informed decision-making. The research improved the safety and dependability of the building structure and guaranteed regulatory compliance by including pertinent design regulations and standards into the analysis and design process. Ensuring structural integrity and resistance against many hazards, such as seismic and wind stresses, is especially crucial

4. REFERENCES

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