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Planning Analysis and Design of Multi-storeyed Building

Dr. M. John Robert Prince, Anandu C, Ashwin R Pillai, Jeevan S Prince, Bijin Biju

Professor, Department of Civil Engineering, St.Thomas College of Engineering and Technology, Kerala, India

U.G Student, Department of Civil Engineering, St.Thomas College of Engineering and Technology, Kerala, India

U.G Student, Department of Civil Engineering, St.Thomas College of Engineering and Technology, Kerala, India

U.G Student, Department of Civil Engineering, St.Thomas College of Engineering and Technology, Kerala, India

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ABSTRACT: The development and growth of the town also plays a major role in accommodation problems to peoples living there as a solution to this here by proposing a project entitled planning analysis and design of multistoreyed building for residential purpose. The rise in population and less availability of land adversely affected, construction of multistorey building is to serve many people in limited area. Each floor consists of four number of houses, Ground floor is used for parking, lift and stair room, lounge , fire exit room etc. Apartment building is planned in “AutoCAD” analysed by “STAAD Pro” and “REVIT Architecture software” is used for 3D diagrams and renderings.

KEYWORDS: Structural integrity, Zoning regulations, cost estimation and safety measures.

I. INTRODUCTION

The objective of planning and analysis and design of a multi-storey building is to create a structurally sound, aesthetically pleasing, and functional space that accommodates multiple residents sustainably. The aim is to optimize space utilization, incorporate sustainable practices, and ensure the building meets local regulations. The solution involves a collaborative approach among architects, engineers, and construction teams to create a safe and efficient living environment. The properties sought after include efficient space allocation, robust structural integrity, energy efficiency, and a harmonious aesthetic. It represents a complex and meticulous process, requiring careful consideration of various factors to ensure structural integrity, functionality, and aesthetic appeal. This undertaking typically begins with a comprehensive assessment of the site, taking into account geographical features, local regulations, and environmental considerations. The analysis phase involves a thorough examination of the project's requirements, such as the number of units, space utilization, and intended functionalities. Subsequently, architects and engineers collaborate to design a structurally sound and visually pleasing apartment building, incorporating elements of efficiency, safety, and modern living. The benefits encompass providing housing for multiple families within a compact footprint, optimizing land use, fostering community living, and potentially enhancing the surrounding. This integrated approach aims to create a harmonious and sustainable living space that aligns with both the urban landscape and the needs of its future inhabitants.

The process of design commences with planning of a structure, primarily to meet the functional requirements of the user or the client. The functional requirements and the aspect of aesthetics are looked into normally by an architect while the aspect of safety, serviceability, durability and economy of the structure for its intended use over life span of the structure are attended by the structural designers. Many times, a structural engineer is required to act in capacities of both the architect and the structural designer. Accurately forecasting the cost of future projects is vital to the survival of any construction. From an Owner's perspective the cost estimate may be used to determine the project scope or whether the project should proceed. Our project also deals with the complete estimation, costing and submission of statutory drawing of the proposed building

II. METHODOLOGY

The project's proposed site lies in Thiruvalla, Pathanamthitta district, Kerala. Initial steps involve a site visit to explore various execution approaches. Data collection encompasses calculating the site area via Google Earth, assessing



environmental conditions, road accessibility, and existing structures. Conceptual design entails planning the apartment layout and applying solutions using AutoCAD. Detailed design covers structure design, floor count, and dimensions, analyzed for safety using STAAD Pro V8i and IS 456-2000 standards. A detailed 3D model enhances project visualization. The final step involves creating a rendered model using Google SketchUp and Revit, tailored to project needs.

III. DESIGN METHODOLOGY

The design of a reinforced concrete structure should ensure that it is safe, stable, and durable throughout its lifetime. To achieve this, the design process must consider the structure's strength, stiffness, and economy. There are three methods used to design reinforced concrete structures: the Working Stress Method (WSM), the Ultimate Load Method (ULM), and the Limit State Method (LSM). The Limit State Method is used in this project. The Limit State Method is based on the idea of designing a structure to withstand all loads that may act on it throughout its lifetime while meeting serviceability requirements, such as limitations on deflection and cracking. The acceptable limit for safety and serviceability requirements before failure occurs is called a Limit State. The goal of the design is to achieve acceptable probabilities that the structure will not become unfit for its intended use, that is, it will not reach a limit state. All relevant limit states must be considered in the design process to ensure an adequate degree of safety and serviceability. The structure should be designed based on the most critical limit state and checked for other limit states. The design should use characteristic values for material strength and applied loads that consider variations in material strengths and the loads to be supported. These characteristic values should be based on statistical data where available, and on experience where such data are not available. The design values should be derived from the characteristic values using partial safety factors. Limit states can be categorized into two types: the Limit State of Serviceability and the Limit State of Collapse. The Limit State of Serviceability ensures that the structure meets acceptable criteria for its intended use without causing any issues like excessive deflection, vibration, cracking, or other functional problems. The Limit State of Collapse is assessed from rupture of one or more critical sections and buckling due to elastic or plastic instability, including the effects of sway where appropriate, or overturning. The resistance to bending, shear, torsion, and axial loads at every section should not be less than the appropriate value at that section produced by the probable most unfavourable combination of loads and the structure using the appropriate partial safety factor.

IV. SOFTWARE USED

AutoCAD, first introduced in 1982 by Autodesk, revolutionized computer-aided design (CAD) by bringing it to personal computers, making it accessible to a wider audience. With its continuous updates and annual releases, AutoCAD remains a dominant force in various engineering fields, offering both 2D and 3D drafting capabilities. Its Graphical User Interface (GUI) simplifies drafting and designing processes, enabling users to create complex structures efficiently. Features like COPY, OFFSET, ROTATE, and MOVE streamline tasks, while import/export functions facilitate collaboration between different design software.

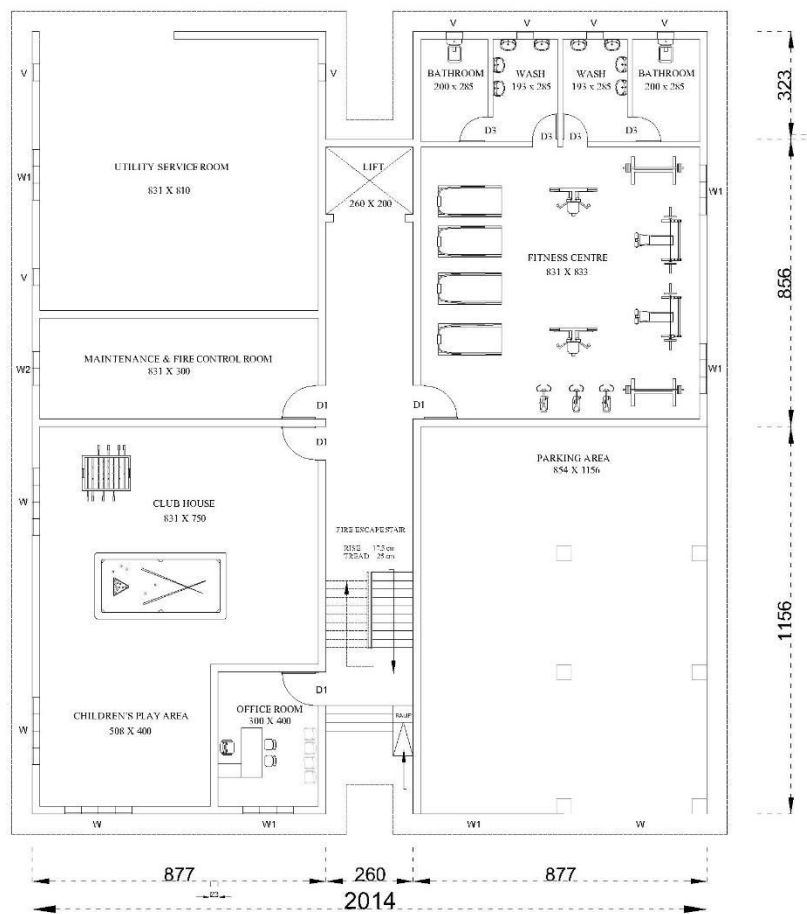
STAAD Pro V8i, developed by Research Engineers International and later acquired by Bentley Systems, is renowned for its user-friendly interface and advanced capabilities in designing and analyzing complex structures. Supporting numerous international codes, STAAD Pro enables engineers to model various types of structures, from space frames to trusses, with flexibility and precision. Its GUI and input file system empower users to create and analyze structures effectively, ensuring thorough structural analysis and design optimization.

Revit, tailored for civil engineers, provides comprehensive tools for creating detailed 3D models of infrastructure projects. With its collaborative environment, engineers can design, analyze, and visualize projects like roads, bridges, and tunnels. Precise modeling of terrain and integration with other disciplines' models enhance project coordination, while detailed documentation aids in conveying design intent effectively.

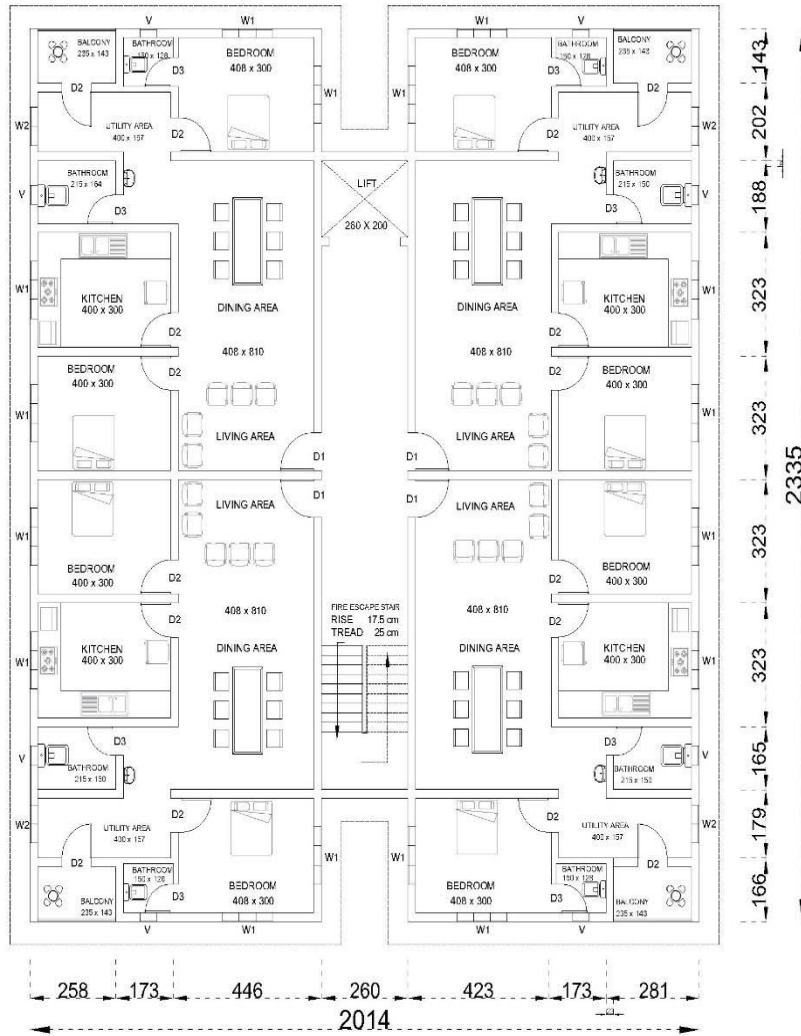


The project outlined involves a residential building with 20 flats across G+4 stories. Utilizing a R.C.C framed structure with specific geometric details and materials such as M20 concrete grade and Fe 415 steel grade ensures structural integrity and safety. AutoCAD, STAAD Pro, and Revit are integral tools in realizing this project, facilitating efficient design, analysis, and documentation processes.

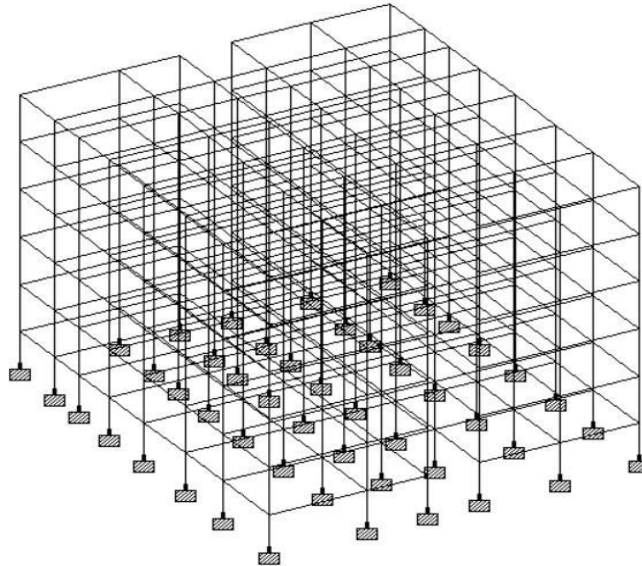
V. FLOOR PLAN, ELEVATION & SECTION



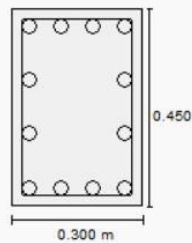
GROUND FLOOR PLAN



FIRST FLOOR PLAN



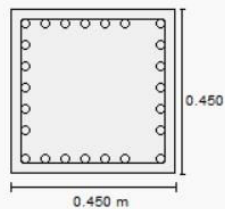
Beam no. = 594 Design code : IS-456



Design Load	
Load	4
Location	End 1
Pu(Kns)	-44.54
Mz(Kns-Mt)	190.15
My(Kns-Mt)	0.67

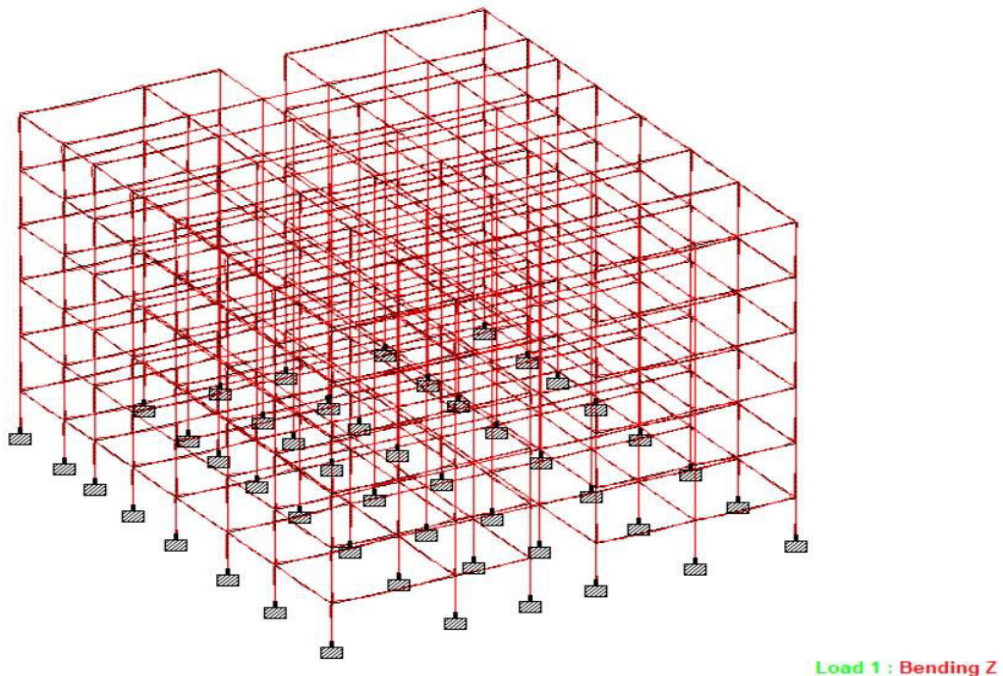
Design Parameter	
Fy(Mpa)	415
Fc(Mpa)	20
As Reqd(mm ²)	3456
As (%)	2.79
Bar Size	20
Bar No	12

Beam no. = 38 Design code : IS-456



Design Load	
Load	4
Location	End 1
Pu(Kns)	3290.02
Mz(Kns-Mt)	4.06
My(Kns-Mt)	5.11

Design Parameter	
Fy(Mpa)	415
Fc(Mpa)	20
As Reqd(mm ²)	6475
As (%)	3.72
Bar Size	20
Bar No	24



VI. CONCLUSION

In conclusion, the planning analysis and design of a multi-storied building involve meticulous consideration of architectural, structural, and functional aspects. A comprehensive approach is crucial to ensure efficient space utilization, structural integrity, and a positive living experience for residents. Collaborative efforts among architects, engineers, and designers are essential for a successful project that meets both aesthetic and practical requirements. During the planning phase, careful consideration of spatial requirements, zoning regulations, and environmental factors is paramount. The analysis stage involves a detailed examination of structural integrity, safety measures, and the optimization of resources. Finally, in the design phase, aesthetic appeal, functional efficiency, and resident well-being are intricately woven together. Successful execution necessitates collaboration among architects, engineers, and designers to create a harmonious living space that not only meets regulatory standards but also enhances the quality of life for its occupants. The holistic approach to this process ensures the development of a multi-storied apartment that seamlessly blends form and function, setting the foundation for a thriving community.

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