

Study of Building Planning and Estimation for Residential Structures

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Abstract: *Building Planning and Estimation is an important subject in civil engineering that deals with the systematic planning, drawing, quantity calculation, and cost analysis of a building project. This project focuses on the planning and estimation of a residential building by applying the basic principles of building design such as proper room arrangement, ventilation, lighting, privacy, sanitation, and efficient space utilization. It includes the study of essential building components like foundation, plinth, walls, lintel, roof, doors, windows, flooring, and finishing works, along with the preparation of building drawings such as plan, elevation, and section. The project also involves quantity estimation of major construction items such as excavation, concrete, brickwork, plastering, and flooring, followed by cost analysis based on material, labor, and other construction expenses. Overall, this study helps in understanding the practical application of planning and estimation techniques for constructing a safe, economical, and functional residential building, thereby improving both technical knowledge and practical skills in civil engineering.*

Keywords: *Building Planning, Estimation, Residential Building, Cost Analysis, Quantity Surveying, Building Drawing, Construction Materials, Civil Engineering.*

I. INTRODUCTION

Building planning and estimation are fundamental aspects of civil engineering that ensure the successful execution of construction projects. Building planning involves the systematic arrangement and design of spaces such as rooms, walls, doors, and windows to achieve functionality, comfort, safety, and aesthetic appeal [1]. It considers important factors like orientation, ventilation, lighting, privacy, and efficient space utilization, which directly influence the usability and durability of the structure [2]. Proper planning also helps in minimizing construction difficulties and improving overall performance of the building [3].

Estimation, on the other hand, is the process of calculating the quantities of materials, labor requirements, and total cost of construction based on drawings and specifications [4]. It plays a crucial role in budgeting, resource allocation, and cost control, ensuring that the project is completed within the available financial limits [5]. Accurate estimation reduces material wastage, prevents cost overruns, and supports effective project management [6].

In modern construction practices, building planning and estimation are closely interrelated processes where planning provides the layout and design, while estimation provides the financial and quantitative analysis required for execution [7]. The increasing demand for residential and commercial buildings has made it essential to adopt efficient planning techniques and precise estimation methods to achieve economical and sustainable construction [8]. This project focuses on applying these principles to a residential building, including preparation of drawings and detailed quantity estimation to understand real-world construction practices [9][10].

II. PROBLEM STATEMENT

In building construction, improper planning and inaccurate estimation often lead to inefficient space utilization, poor ventilation and lighting, material wastage, cost overruns, and delays in project completion. Many residential building



projects face difficulties due to the lack of proper layout design, incorrect quantity calculations, and insufficient cost analysis before the start of construction. Therefore, there is a need to develop a systematic approach for building planning and estimation that ensures a functional, safe, economical, and well-designed residential structure. This project aims to address these issues by preparing suitable building drawings, studying essential building components, calculating quantities of materials, and estimating the total construction cost for effective project execution.

III . OBJECTIVES

- To study the basic principles of building planning for preparing a functional and comfortable residential layout.
- To prepare building drawings such as plan, elevation, and section for proper visualization of the structure.
- To calculate the quantities of construction materials required for different building components.
- To estimate the total cost of construction based on standard methods and rates.
- To understand the practical application of planning and estimation techniques in residential building construction.

IV. LITERATURE SURVEY

Suyog R. Jadhav et al. (2021), in the paper “Planning, Designing and Estimating of Residential Building,” proposed a systematic approach for the planning, design, and estimation of residential structures using modern drafting tools such as AutoCAD. The study emphasized that proper building planning is essential not only for functional layout and aesthetics but also for ensuring structural safety, durability, and efficient use of space. The authors discussed the role of structural loads such as dead load, live load, wind load, and earthquake load in influencing the building design. The paper also highlighted the importance of accurate quantity estimation and cost calculation using standard methods and Schedule of Rates (SSR). The proposed approach improves construction planning, reduces execution errors, and supports economical project completion.

S. V. Pranathi et al. (2021), in the paper “Planning, Analysis, Design and Estimation of Residential Building,” presented a detailed study of residential building planning integrated with structural analysis and cost estimation. The authors used software tools such as STAAD Pro and AutoCAD for design and structural evaluation based on Indian Standard codes like IS 875 and IS 456. The study focused on calculating structural loads and designing components such as beams, slabs, and columns while also preparing quantity and cost estimates. The proposed system improved the accuracy of structural planning and reduced design-related errors. It also demonstrated that combining manual estimation with software-based analysis leads to better cost control and project efficiency.

G. Sreenivasulu et al. (2025), in the paper “Planning, Analyze, Design and Cost Estimation of Building,” proposed the use of modern engineering tools such as STAAD Pro, ETABS, and Revit for efficient building planning and cost estimation. The study focused on the planning and design of a G+3 residential building while ensuring compliance with building bye-laws and standard engineering practices. The authors highlighted how digital modeling and structural analysis tools help in improving design accuracy, visualization, and decision-making. The estimation part of the study was carried out using Microsoft Excel and manual calculations, which provided a practical comparison of conventional and modern methods. The proposed approach enhanced planning accuracy, reduced material wastage, and improved overall project management.

A. Subhakesavulu et al. (2025), in the paper “A Theoretical and Practical Study of Estimation and Costing of a Residential Duplex Building,” proposed a combined theoretical and practical framework for quantity estimation and cost analysis of duplex residential buildings. The study discussed traditional estimation techniques such as unit rate methods along with modern approaches using digital tools and parametric models. The authors emphasized that accurate estimation is necessary to avoid cost overruns and to ensure proper allocation of construction resources. The proposed model improved financial planning and helped in selecting economical construction alternatives. It also demonstrated the importance of real-time data and historical cost records in enhancing estimation accuracy and project feasibility.



M. Aradhana Rao et al. (2019), in the paper “A Case Study on Estimation and Costing of Multi-Storey Building,” presented a case study focused on quantity estimation and cost analysis of a multi-storey residential building. The study explained various estimation methods such as traditional costing, negotiated pricing, and construction management techniques. The authors analyzed the effect of site conditions, material availability, and budget constraints on project estimation and costing. The proposed methodology provided a step-by-step procedure for calculating quantities and preparing a practical cost estimate for large-scale construction. The study concluded that proper estimation is essential for controlling expenses and completing construction within the planned budget.

Comparison Table

Author & Year	Technology Used	Key Feature	Limitation
Suyog R. Jadhav et al. (2021)	AutoCAD, SSR Method	Planning, design and cost estimation of residential building	Limited structural analysis
S. V. Pranathi et al. (2021)	STAAD Pro, AutoCAD, IS Codes	Integrated planning, analysis, design and estimation	More suitable for multi-storey buildings
G. Sreenivasulu et al. (2025)	STAAD Pro, ETABS, Revit, MS Excel	Digital modeling and accurate cost estimation	Requires software expertise
A. Subhakesavulu et al. (2025)	MS Excel, Parametric Estimation	Practical and theoretical estimation of duplex building	Limited to cost-focused study
M. Aradhana Rao et al. (2019)	Traditional Estimation Methods	Step-by-step costing of multi-storey building	Less focus on modern tools

V. WORKING OF SYSTEM

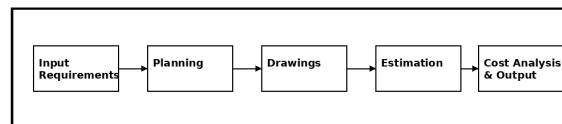


Fig 1: Design of the system

The working of the Building Planning and Estimation System involves a systematic process that starts from understanding user requirements and ends with cost analysis of the building project. Initially, the requirements of the residential building such as number of rooms, area, orientation, and basic facilities are collected. Based on these inputs, building planning is carried out by applying principles like ventilation, lighting, privacy, and efficient space utilization. After planning, detailed building drawings such as plan, elevation, and section are prepared, which provide a clear visualization of the structure. These drawings act as the base for further calculations. In the next stage, quantity estimation is performed, where materials required for construction (cement, sand, bricks, steel, etc.) are calculated using standard methods like the long wall-short wall method or centerline method.

Finally, cost analysis is carried out by considering material cost, labor cost, transportation, and other expenses to determine the total construction cost. This systematic workflow ensures accurate planning, efficient resource utilization, and economical construction of the building.

VI. SYSTEM DESIGN

1. Overview of System

The Building Planning and Estimation System is designed to simplify the process of residential building planning, drawing preparation, quantity estimation, and cost analysis. The system starts with collecting basic building



requirements such as plot size, room arrangement, and user needs. Based on these inputs, a proper building layout is prepared by considering principles like ventilation, lighting, privacy, and circulation. After planning, drawings such as plan, elevation, and section are prepared, which are then used for quantity estimation and cost calculation. The system ensures that the building project is functionally planned, technically correct, and economically feasible.

2. Components of System

2.1 Input Module

This module collects all the necessary data required for planning and estimation. It includes details such as plot dimensions, number of rooms, room sizes, orientation, and user requirements. This information acts as the foundation for preparing the building layout and further calculations.

2.2 Planning Module

The planning module is responsible for arranging the rooms and spaces in a systematic and functional way. It ensures proper utilization of available land and applies important principles such as privacy, grouping, ventilation, natural lighting, and easy circulation within the building.

2.3 Drawing Module

This module includes the preparation of technical drawings such as **plan, elevation, and section**. These drawings help in visualizing the structure clearly and provide the dimensional details required for estimation and construction work.

2.4 Estimation Module

The estimation module is used to calculate the quantity of materials required for different construction works such as excavation, concrete, brickwork, plastering, and flooring. Standard methods like the **Long Wall–Short Wall Method** and **Centerline Method** can be used for quantity calculation.

2.5 Cost Analysis Module

This module calculates the total construction cost by considering the cost of materials, labor charges, transportation, and other site expenses. It helps in understanding the financial feasibility of the project and supports budget planning.

2.6 Output Module

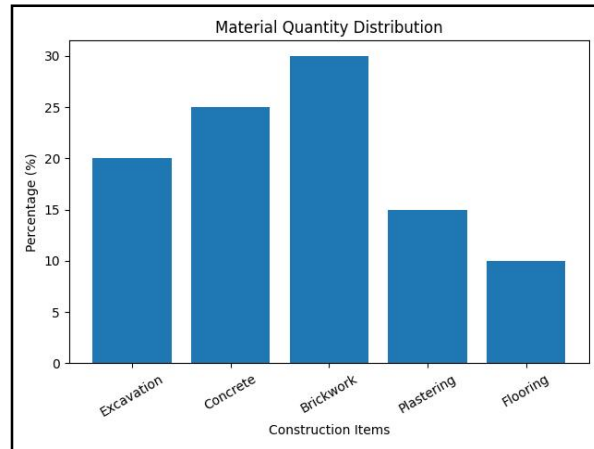
The output module provides the final results of the system in the form of completed building drawings, quantity sheets, and estimated project cost. These outputs are useful for planning, execution, and documentation of the building project.

VII. RESULTS

The Building Planning and Estimation System was successfully applied to a residential building project and produced satisfactory results in terms of planning, drawing preparation, quantity estimation, and cost analysis. The system helped in preparing a proper building layout with well-arranged rooms, adequate ventilation, lighting, and efficient utilization of available space. The plan, elevation, and section drawings provided a clear understanding of the building structure and supported further estimation work.

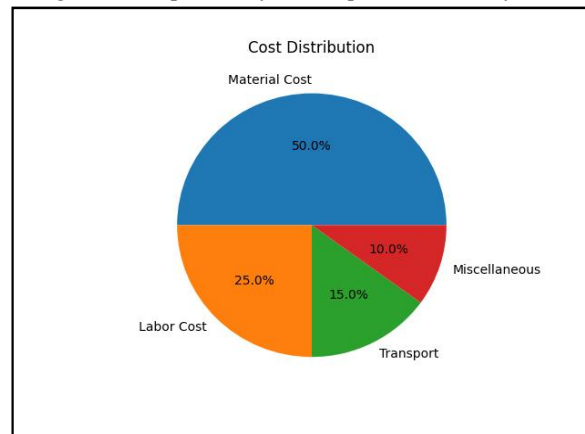
The estimation process gave accurate quantities of major construction items such as excavation, concrete, brickwork, plastering, and flooring. Based on these calculated quantities, the material requirement and total construction cost were determined effectively. The cost analysis helped in understanding the distribution of expenses for materials, labor, and other site-related charges. Overall, the system proved useful in reducing planning errors, improving estimation accuracy, and supporting economical and systematic execution of the building project.





Graph 1: Material Quantity Distribution

The graph shows the proportion of major construction items such as excavation, concrete, brickwork, plastering, and flooring. Brickwork and concrete occupy the highest percentage, indicating their major contribution in building construction. Plastering and flooring have comparatively lower quantities as they are finishing works.



Graph 2: Cost Distribution

The graph represents the distribution of total construction cost among material, labor, transport, and miscellaneous expenses. Material cost forms the largest portion, showing its major impact on overall project cost. Labor and transportation costs also contribute significantly, while miscellaneous expenses are relatively lower.

VIII. CONCLUSION

The project on Building Planning and Estimation was successfully completed and provided a clear understanding of the basic principles involved in residential building construction. It helped in studying important aspects such as building planning, preparation of drawings, quantity estimation, and cost analysis. Through this project, it was observed that proper planning plays a vital role in ensuring efficient space utilization, ventilation, lighting, privacy, and overall functionality of the building.

The estimation and costing process further highlighted the importance of accurate quantity calculation and budget planning before the start of construction. The project improved practical knowledge of construction methods, building components, and estimation techniques used in civil engineering. Overall, this study proved to be highly useful in



understanding how planning, drawing, and estimation are interconnected for the successful and economical completion of a residential building project.

IX. FUTURE SCOPE

The scope of Building Planning and Estimation can be further enhanced with the use of advanced technologies and modern construction practices. In future, software tools such as AutoCAD, Revit, and Building Information Modeling (BIM) can be used for more accurate planning, 3D visualization, and automated quantity estimation. These tools help in reducing human errors, saving time, and improving overall project efficiency.

The system can also be extended to include sustainable and green building concepts, such as energy-efficient design, rainwater harvesting, solar energy utilization, and eco-friendly construction materials. In addition, integration with cost databases and real-time market rates can improve the accuracy of cost estimation. Future developments may also include the use of AI and machine learning for automated design suggestions and cost prediction. Overall, the adoption of digital tools and smart technologies will make building planning and estimation faster, more accurate, and more efficient.

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