

AutoCAD-Based Planning and Cost Optimization of a Low-Cost Residential Building

**Aniket Deepak Darkunde, Krushna Sanjay Gavhane,
Yash Laxman Ambekar, Viraj Sanjay Sawant**

Diploma Student, Department of Civil Engineering

Sujit Rameshwar Ambade

Assistance Professor, Department of Civil Engineering

Prof. Akanksha Anil Mhaske

Head of Department, Department of Civil Engineering

Dr. Ramesh Suryabhan Gadakh

Principal, Sau Sundarbai Manik Adsul Polytechnic

Department of Civil Engineering, Sau Sundarbai Manik Adsul Polytechnic College, Chas,
Ahilyanagar, Maharashtra

ABSTRACT

Low-cost housing is an important requirement for providing affordable and functional residential spaces. Increasing construction material and labour costs make efficient planning an important part of residential building design. This research presents an AutoCAD-based approach for planning a low-cost residential building on a 20 ft × 30 ft plot. The proposed layout focuses on efficient space utilization, reduction of unnecessary circulation area, and practical arrangement of rooms. AutoCAD is used as the principal drafting and measurement tool for developing the proposed building plan. The study combines building planning, area calculation, preliminary quantity estimation and cost analysis. The proposed approach demonstrates how accurate digital drafting can support economical residential planning. Actual material quantities and costs should be finalized using the completed drawing, structural design and current local rates.

KEYWORDS

AutoCAD, Low-Cost Housing, Residential Building, Cost Optimization, Quantity Estimation, Building Planning, Civil Engineering.

1. INTRODUCTION

Housing is one of the basic requirements of society. However, increasing land, material and labour costs create difficulties in developing affordable residential buildings. Efficient planning at the initial design stage can help improve usable space and identify unnecessary construction requirements.

AutoCAD is a computer-aided design and drafting software widely used for preparing accurate 2D drawings and technical documentation. In civil engineering it can be applied to building plans, structural drawings, site layouts, roads, drainage and other engineering drawings. The present study applies these capabilities specifically to low-cost residential planning.

2. AIM OF THE STUDY

The main aim of this research is to develop an AutoCAD-based residential building plan for a 20 ft × 30 ft plot and investigate how efficient space planning can support preliminary construction cost optimization.

3.OBJECTIVES OF THE STUDY

1. To prepare a residential building plan using AutoCAD.
2. To utilize a 20 ft × 30 ft plot efficiently.
3. To provide essential residential spaces within the available area.
4. To calculate built-up and carpet/usable areas from the drawing.
5. To establish a method for preliminary quantity estimation.
6. To prepare a preliminary construction cost estimate using current local rates
7. To compare conventional and proposed planning parameters.
8. To identify planning factors that may contribute to cost optimization.

4.LITERATURE REVIEW

Computer-Aided Design has become an important part of engineering design and documentation. Previous CAD studies report that CAD-based drafting can reduce the time required for preparing and modifying drawings and that digital drawings are easier to store, duplicate and share. Published research on Indian affordable housing has also examined relationships between planning efficiency, built-up-to-carpet-area ratio, construction cost and embodied energy. The present study combines CAD-based planning with measurable area and cost parameters.

5.PROPOSED CASE STUDY

A conceptual single-storey 2BHK residential building is selected for a 20 ft × 30 ft plot. Plot area = 600 sq.ft (55.74 m²). Proposed spaces include living room, two bedrooms, kitchen, toilet/bathroom and circulation space. The final dimensions should be balanced within the plot after considering applicable setbacks, wall thickness, ventilation and local development requirements.

6.AUTOCAD-BASED BUILDING PLANNING

The proposed workflow is: Plot selection, Space requirement, Preliminary layout, AutoCAD 2D drawing, Dimension Area calculation, Quantity estimation, Cost estimation, Comparison, Result. The AutoCAD drawing should contain plot boundary, walls, doors, windows, room names, dimensions and relevant annotations. Separate layers may be used for walls, opening, dimensions and text.

7.METHODOLOGY

Step 1 – Collection of information. Step 2 – Plot selection. Step 3 – Space planning. Step 4 – AutoCAD drafting. Step 5 – Area analysis. Step 6 – Quantity estimation. Step 7 – Cost analysis. Step 8 – Comparison of the proposed and conventional layouts.

8.AREA AND QUANTITY ESTIMATION

Plot Area = Length × Width = 20 × 30 = 600sq.ft. The built-up area and carpet/usable area must be measured from the final AutoCAD drawing. Built-up-to-carpet ratio = Built-up Area / Carpet Area. Concrete, masonry and plaster quantities should be calculated from final dimensions. Detailed RCC and reinforcement quantities require structural design.

9.COST ANALYSIS

Total Cost = Material Cost + Labour Cost + Other Construction Costs. Major material categories include cement, steel, masonry units, sand and aggregate. Final cost should be calculated from actual measured quantities and current local rates.

10.COST OPTIMIZATION APPROACH

Cost optimization focuses on efficient room arrangement, reduction of unnecessary circulation, compact planning, practical dimensions, reduced unnecessary wall length, and appropriate placement of doors and windows.

11.COMPARISON FRAMEWORK

The proposed layout can be compared with a conventional layout using plot area, built-up area, carpet area, builtup/carpet ratio, material quantity, preliminary cost and cost per square foot.

12.RESULTS AND DISCUSSION

The study is expected to show that AutoCAD provides an efficient platform for accurate digital drafting, easy modification, dimensioning and area analysis. Final results should be based on the completed AutoCAD drawing and verified quantity/cost calculations.

13.LIMITATIONS

The proposed 20 ft × 30 ft building is a conceptual research case study. Final planning must follow local development regulations and setbacks. Structural member sizes and reinforcement should be determined through structural analysis. Construction cost varies by location, date, material specification and labour rates.

14.FUTURE SCOPE

Future research can compare multiple residential layouts, integrate BIM, include embodied-energy analysis, investigate alternative building materials, incorporate rainwater harvesting and passive design, and use detailed local Schedule of Rates.

15.RECOMMENDATIONS

Civil engineering students should develop both AutoCAD skills and fundamental engineering knowledge. Practical CAD projects should include real building dimensions, measurement, quantity estimation and drawing standards. Final drawings should be checked against applicable standards and by a qualified professional.

Comparison Table

Parameter	Conventional Layout	Proposed Layout
Plot area	600sq.ft	600sq.ft
Built-up area	From drawing	From drawing
Carpet/usable area	From drawing	From drawing
Built-up/carpet ratio	Calculate	Calculate
Material quantity	Calculate	Calculate
Preliminary cost	Calculate	Calculate
Cost per sq.ft	Calculate	Calculate

16.REFERENCES

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17.CONCLUSION

This research proposes an AutoCAD-based method for planning a low-cost residential building on a 20 ft × 30 ft plot. The method integrates residential space planning, digital drafting, area analysis, preliminary quantity estimation and cost comparison. Efficient planning can help identify unnecessary built-up area and improve the relationship between usable space and construction requirements.