

Cost Effective Construction Techniques

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Abstract—Human being's basic needs, whether they live in a cave, a hut, or a castle, are similar. They must have food, clothing, and shelter. Shelter provides protection from extremes of climate and other sources of danger or discomfort to perform certain fundamental human activities such as recreation, food, sleep and work.

While constructing shelter, human beings always have battle against nature. Whether it is plain or undulating regions, the nature provides certain challenges for planning and designing of the building.

Adequate shelter for all people is one of the pressing challenges faced by the developing countries. India is currently facing a shortage of about 17.6 million houses. The dream of owning a house particularly for low-income and middle-income families is becoming a difficult reality. Hence, it has become a necessity to adopt cost effective, innovative and environment-friendly housing technologies for the construction of buildings for enabling the common people to construct houses at an affordable cost. This paper compares construction cost for the traditional and low-cost housing technologies. Construction methods for foundation, walling, roofing and lintel are compared. Strength and durability of the structure, stability, safety and mental satisfaction are factors that assume top priority during cost reduction. The study has proved that using low cost technologies can be a cost-effective construction approach for the industry.

Keywords: Low-Cost, Innovative, Environment-Friendly, Cost Effective, Building Materials

1. INTRODUCTION

Low Cost construction is the way to achieve effective budget in construction and techniques which helps in reducing the cost of construction.

It does not compromise with the strength, performance and life of the structure. It is a misconception that low cost construction is for substandard works and it is by utilizing cheap building materials of low quality. The fact is that Low cost construction is done by proper management of the available resources. Advancements in technology and development in the construction sector is helping in the promotion of Low Cost Buildings.

Cost Effective construction has more to do with budgeting and it can reduce the construction cost through better management, appropriate use of local materials, skills and technology.

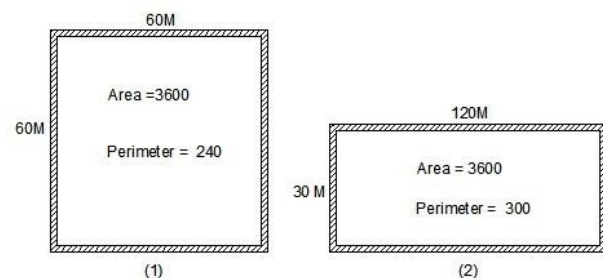
A low-cost house is designed and constructed as any other house with regard to foundation, structure, strength etc. The reduction in cost is achieved through effective utilization of locally available building materials and techniques that are durable, economical, accepted by users and not requiring costly maintenance, Economy is also achieved by postponing finishing and implementing them in phases. Further, it aims at increasing the efficiency of workers, minimizing wastage in design and space and applying good management practices, so that shelter can be provided at prices which people can afford.

Safety with low cost materials is a big question but if the construction is accompanied with low cost material and used in intellect manner with skilled workmanship it can prove to be the best way of cutting the construction cost.

The building construction cost is divided into two parts firstly building material cost i.e.65-70% and labour cost 65-70%. There are some methodologies to cut the construction cost and to achieve the best as discussed below.

2. COST REDUCTION BY PROPER PLANNING

Proper and simple planning by an Architect and his supervision on stages required will reduce the cost of construction. Planning means that the building should be such designed that the units repeat themselves, so that the shuttering material should be used, can be used repeatedly. This can save the time and labour at site in addition to saving in cost of construction.



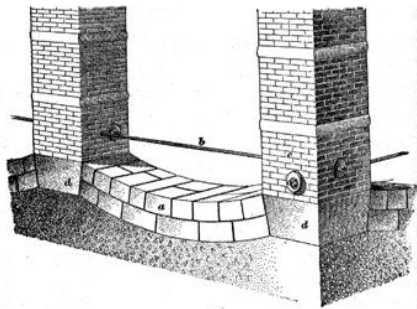
Design of good plan can reduce the cost of rooms planned and boundary wall. The boundary wall length will be shorter for square plot compared to rectangular or triangular plot of the same area. From the figure, it is clear that cost of 60m

length boundary wall can be saved. It is applicable to rooms design also. By planning a square room, the cost of brickwork, plastering, wall base and painting them will cost less.

3. FOUNDATION

It is the most important component as it transfer the entire load from all the floors designed to the ground. So, it is the first area of concern. Foundation constitutes about 10-15% of the total building cost. While using load bearing structure with a foundation of 600 mm depth for normal, gravel, etc soils, also, if we design an arch foundation, we can save up to 40% of total cost of construction. In case of loose, soft and black cotton soil, under-reamed pile foundation is suggested which will save 20-25% of total cost.

It is suggested that by adopting arch foundation in ordinary soil there is reduction in construction cost up to 40%. This kind of foundation will help in bridging the loose pockets of soil which occurs along the foundation. In the case of black cotton and other soft soils it is recommend to use under ream pile foundation which saves about 20 to 25% in cost over the conventional method of construction.



Arch Foundation

4. WALL

A wall constructed with a Rat Trap Bond gives saving of 10-15% in labour cost and 25% in material cost. This bond gives the advantage of thermal comfort and reduction in the quantity of bricks. It also creates aesthetically pleasing wall surface while avoiding the cost of plastering and labour.



Rat Trap Bond for walls

5. DOORS AND WINDOWS

While designing the Doors, windows and ventilators, if we design and fabricate them with steel, we can save up to 30-40% for the door shutters and we can save 25% by using the particle boards, fiber or block boards.

For effective ventilation and light, we provide the windows. If brick or concrete jaali's is provided in place of wooden or glass windows, a saving in cost of 50% is achieved.



Steel Window

6. BRICK JAALI

For low cost housing, the timber windows can be replaced by jaali's. Windows are costly as one square foot of window can cost up to ten times the cost of the simple brick or stone wall it replaces. Windows has a function of outside view, to let light inside the room, to let in fresh air. The cost-efficient replacement is Brick Jaali. Jaali can be of varied patterns, and are efficient in performance.



Brick Jaali for light and ventilation

7. FRAMELESS DOOR AND WINDOW

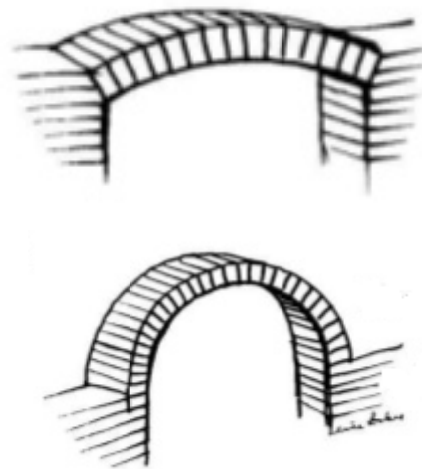
Door and window frames consume substantial amount of timber, which is a scarce and costly material. Elimination of the door and window frame can affect good saving in overall cost. Special types of hinges were developed for fixing shutter without frames. One type is having pivots fixed on top and bottom of the shutter and the other type is having fork and holdfast fixed on sides of the shutters.



Doors and Windows without Frame

8. LINTELS AND CHAJJA'S

The R.C.C. lintels can be replaced by brick arches for small spans and save construction cost up to 30 to 40%. Arches with different shapes give a good architectural pleasing appearance and add beauty to the interiors.



Brick Arches

9. ROOFING

R.C.C. slabs of 4" (100 mm) thick is used for roofing in residential buildings. By adopting rationally designed cast-in-situ construction practices like filler slab and precast elements the construction cost of roofing can be reduced by about 20 to 25%.

The profit gained from use of such methods can decrease the cost of construction and make the low-cost housing accessible to all. The use of low cost alternate building materials also prevents the rise of construction cost due to use of scarce building materials which eventually increase the cost of the project.

Along with the above methods, Areas from where Cost can be Reduced

- Reduce the plinth area by using thinner wall concept. Ex. 150 mm thick solid concrete block wall.
- By using locally available materials like soil cement blocks in place of burnt brick.
 - By using energy efficiency materials which consumes less energy like concrete block in place of burnt brick.
 - By using environmentally friendly materials which are substitute for conventional building components like use R.C.C. Door and window frames in place of wooden frames.
- Preplan every component of a house and rationalize the design procedure for reducing the size of the component in the building.
- Plan each and every component of a house, as the wastage of materials while demolition of the unplanned component of the house can increase the cost.

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11. CONCLUSION

The points discussed are for the awareness and experimented. These are not valid for every building, it varies upon the nature of building to be constructed climatic conditions, soil bearing capacity, availability of materials and good planning and construction management practices etc. if overall methods are adopted, a 25% cost reduction from actual practice is saved.

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