

Cost Estimation of a Building using Cost Effective Building Materials

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Abstract - This project reviews the cost effective construction materials and techniques for building design in the field of civil engineering. It comprises the important analysis and results from the experimental and literature of many authors. Housing is a great problem in today's world. The most basic building material for construction of houses is the conventional burnt clay brick and cement concrete. A significant quantity of fuel is utilized in manufacturing these construction materials. Also, continuous removal of upper surface of soil mass, in producing conventional bricks, creates environmental problems. This project involves cost estimation of a duplex, first by using conventional building materials and then by alternative building materials to determine the total cost that can be reduced by using alternative building materials.

Key Words: Cost effective, AAC blocks, Conventional clay bricks, Fly ash concrete, Cost estimation.

1. INTRODUCTION

Cost effective building materials has taken off in recent year with many builders and new home owners looking for new and different methods of construction that can potentially offset energy cost. Construction of low cost housing by using the low cost building materials increases the access to buildings by low income group peoples. Low cost housing can be achieved by use of efficient planning and project management, low cost materials, economical construction technologies and use of alternate construction methods available. 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. Some alternative building material can be made out of natural materials, while others can help to lower energy costs of the occupant once built. This project involves layout, analysis, design and cost estimation of a duplex, first by using conventional building materials and then by alternative building materials to determine the total cost reduced by using alternative building materials. For completing the project very popular Civil Engineering software's such as AutoCAD, STAAD Pro V8i, and Microsoft Excel for Cost Estimation have been used.

2. LITERATURE REVIEW

Bedabrata Bhattacharjee & A.S.V. Nagender 2007(NIT Rourkela): They used STAAD pro for the analysis and design of a G+21 multi storeyed building. The dead loads acting on the slab were calculated manually while live load, seismic load and wind load have been entered by following respective IS Codes. The design was done using limit state of design according to IS 456:2000. They showed how efficiently and easily such a high rise building can be designed within a very short span of time.

Bredenoord J carried out study on sustainable Housing and Building Materials for Low-income Households; it is observed that sustainable goals for low-cost housing and applications are achievable. Measures concerning the physical development of neighborhoods, such as urban density and connectivity are equally as important as measures concerning community development. The final comprise support for community built organizations, small housing cooperatives (or similar forms of cooperation) and individual households – or small groups – that build and increase their houses incrementally. Adequate design and social organization and support are preconditions for achieving sustainability in incremental housing.

F.Pachecotorgal carried out study on Earth construction and Building materials, it is observed that in this paper earth construction has a major expression in less developed countries, on the other hand the mimetic temptations near more poisoning construction techniques based on reinforced concrete and bricks that fired up are likely to favor a change near a clear unsustainable design. In order to disclosure and highlight the importance of earth construction this article reviews some environmental benefits such as nonrenewable resource consumption, waster generation, energy consumption, carbon dioxide emissions and indoor air quality.

John M.Hutcheso carried out study on project management of low cost housing in developing countries, it is observed that the study of this paper include designs, cost control systems, communications , contract law and planning. An appreciation of the evidence compounded from the problems portrayed

throughout the paper leads to decisions of the need for simplifications of designs, the impact of inadequate local support and hence the need for detailed and complete advanced planning. In addition the conclusions stress the need for the careful collection of self supportive teams of multi-disciplined professionals and sub professionals.

Preetpal Singh carried out study on Low Cost Housing: Need For Today’s World; it is observed that Construction cost in India is increasing at around 50 per cent over the average inflation levels. It have enumerated increase of up to 15 percent all year, mainly due to cost of basic building materials such as steel, cement, bricks, timber and other inputs as well as cost of labour. As a result, the cost of building by means of conventional construction materials and construction is becoming beyond the affordable limits particularly for low-income groups of population as well as a big cross section of middle - income groups. So, there is essential to adopt cost-effective construction methods either by up-gradation of traditional technologies using local resources or applying current construction materials and methods with well-organized inputs leading to economic solutions. By using Low Cost Housing Technologies, we can reduce approx. 25% of the total cost of housing.

R.Caponetto carried out study on Ecological materials and technologies in low cost building systems, it is observed that the high recyclability of natural materials that can be used in low cost building associated with construction techniques capable of exploiting the principles of bioclimatic architecture for liveliness needs allow us to create building environmentally conscious and responsible. At the same time the project of a special block was developed to meet the needs of sustainability and ease of construction.

Swaptikchowdhury carried out study on Prospects of low cost housing in India, it is observed that in this paper alternative construction materials mainly natural material such as bamboo, straw, usage of Bagasse – cement boards and panels, bagasse –PVC boards, Coir-CNSL board, Jute coir composites, coconut and wooden chips roofing materials, Manmade materials like fly ash, aerocon panels, ferro cement, rice husk were studied and the potential of these materials to be used as alternate building materials is brought out.

Sengupta Nilanjan carried out study of appropriateness of cost effective building construction technologies, it is observed that this paper studied the acceptability and adaptability potential of different cost effective building constructions through field survey, literature study and technical calculations and tried to find out the most appropriate one among those.

J.M. Khatib and R. Siddique carried out a study on self compacting cement fly ash concrete it is observed in this

study that adequate strength can be achieved using high percentage of FA in SCC. Using of up to 60% FA as PC replacement can produce SCC with a strength as high as 40 MPa.

D. Manikandan and Dr. S. Gopalakrishnan carried out a study on autoclave aerated concrete in this study it is observed that Aerated light weight concrete is unlike conventional concrete due to some mix materials and properties. Several advantages in AAC blocks are decrease structural elements and reduce the bearing capacity.

Dr. R.R Singh and Er Arpan Jot Singh Sidhu carried out a study on high volume fly ash concrete in this study it is observed that 50% of cement in mix design can be replaced by fly ash without compromising the strength and also reducing the cost at the same time.

3. METHODOLOGY

3.1 Details of the Project

The plot size for the project is 40’x60’ or 12.2mx18.28m. Accordingly the building has been laid in the centre of the plot leaving ample space on all the sides for land scaping and pathways for cars and for parking. General layout details are shown in table 1

Table 1 Plot Details

Area of Plot	40’ x 60’
Plot Details	Front – Main road Left & right side – Private residential buildings Rear – Private residential building
Number of floors	2 (G+1)
Type of construction	Duplex

3.2 Cost Effective Building Materials

The cost effective building materials used for the project in place of conventional building material are shown in the table 2

Table 2 Conventional bulding material used

Conventional building materials	Cost effective building materials
Cement concrete	Fly ash based concrete
Burnt clay bricks	AAC Blocks
River sand	M sand
Cement sand mortar for masonry	Polymer based cement adhesive
Granite flooring	Vitrified tile flooring

3.3 Abstract of Cost Using Conventional Building Material

Sl. NO	Description of Work	Qty	Rate/unit	Amount
1	Earthwork in excavation	74.43 m ³	348	Rs 25901.64
2	Sand filling below plinth	63.61 m ³	577	Rs 36702.97
3	Total RCC work	90.17 m ³	13276	Rs 1197120
4	Brick walls 0.23m	86.27 m ³	7393	Rs 637794.11
5	Half brick masonry	189.04 m ²	773	Rs 146127.92
6	Plaster Work	1592.6 m ²	199	Rs 316941.33
7	Flooring work	341.43 m ²	2190	Rs 747731.7
8	Wall putty work	1592.6 m ²	132	Rs 210232.44
Sub Total				Rs 3318552.11
Add 5% for Contegencies				Rs 165927.60
TOTAL				Rs 3484479.72
Round off				0.28
GRAND TOTAL				Rs 3484480

3.4 Abstract of Cost Using Cost Effective Building Materials

Sl. NO	Description of Work	Qty	Rate/unit	Amount
1	Earthwork in excavation	50.94 m ³	348	Rs 17727.12
2	Sand filling below plinth	63.61 m ³	577	Rs 36702.97
3	Total RCC work	83.13 m ³	12194	Rs 1013700
4	Brick work below plinth	10.62 m ³	7393	Rs 78513.66
5	AAC block wall 0.2m	337.91 m ²	1342	Rs 453475.22
6	AAC block wall 0.1m	192.99 m ²	768	Rs 148216.32
7	Plaster Work	559.86 m ²	199	Rs 111412.14
8	Flooring work	341.43 m ²	1100	Rs 375573.00
9	Wall putty work	1592.6 m ²	132	Rs 210232.44
Sub Total				Rs 2445552.8

	Add 5% for Contegencies	Rs 122277.64
	TOTAL	Rs 2567830.5
	Round off	-0.5
	GRAND TOTAL	Rs 2567830

3.5 Total reduction in cost

The total reduction in cost by using cost effective building material is **Rs 916650**

4. CONCLUSIONS

Through our analysis and comparison, we have managed to find many clear conclusions.

1. Addition of fly ash improves the workability of concrete.
2. Addition of 50% fly ash reduces 7day strength by about 20% when compared to control mix. But it acquires strength almost equal to that of control mix at 28 days and attained higher strength thereafter.
3. All hardened properties are similar for OPCC and HVFAC at 28 days.
4. Even though clay bricks are used for so many years even more than a millennium in the construction field, it has its own limitations too. This makes an impact to go for the alternative building blocks in the construction industry.
5. AAC Blocks being light in weight considerably reduces the dead loads on the structure and increases the speed of construction.
6. It is observed that using AAC Blocks, HVFAC and Vitrified tiles 26.03% of total project cost can be reduced.

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