Low cost Construction Expertise by using local available materials in Jijjiga, Ethiopia.

K.Udhaya Kumar, Henock

ABSTRACT

This paper targets to argument out the numerous stages of low cost building constituents for low cost housing by underlining the dissimilar building skill like bonus of local obtainable resources and the economic gains attained by its adoption. In a building for footing, walls, doors and windows, floors and roofs are the most essential components, which can be analyzed separately, based on the needs thus, improving the speed of construction and reducing the construction worth. The major current methods of construction schemes considered here are namely, structural stone walls, wooden columns and trusses, grass roofing components. Here we just performed the comparison between first class material and nearby obtainable low cost materials. From the result we identified that low cost materials provides 18.14 percent profit than first class materials.

Keywords: Replacement, Local available material, Footing, Walls, Doors, Windows, Floors, Roofing components.

1. INTRODUCTION

Housing inadequacy is largelystroked amongst the low income group societies. This is growing with the unbroken growth of cost of construction at all stages. This requirements the use of appropriate and cost effective tools in house construction. The cost of construction increased by 50% over small price rises due to hike in cost of basic building material and labor in a span of 20 years. Nowadays many cost control techniques are being introduced in project works to optimize the project cost. With the development of technologies, it becomes necessary to have a critical examination of various technique and construction materials, at periodical interval, so as to discard ineffective techniques and materials[1].

2. STAGES OF CONSTRUCTION METHODS

✓ Site inspection and clearing
✓ Layout of column centerline and placement of markers
✓ Put on and establishing reference elevation
✓ Construction of batter boards
✓ Transferring of centerline marks to the batter board

• K.Udhaya Kumar is currently working as a lecturer in jigjiga University, Ethiopia, E-mail: udhayakorp@gmail.com
• Henock is currently working as a HOD in jigjiga University, Ethiopia, E-mail: author_name@mail.com

✓ Excavation works
✓ Fabrication of wooden column up to 3.3 m
✓ Erection of wooden column
✓ Construction of stone wall
✓ Fabrication of wooden roof framings
✓ Construction of roof framing
✓ Anchor setting and installation
✓ Construction of roof cover
✓ Finishing works
✓ Clearing and release

3. ANALYSIS AND INTERPRETATION

3.1: Cost calculation by using low cost materials

3.1.1: Materials used
✓ Stone for wall and floor finishing
✓ Cement, sand and water to produce mortar
✓ Wood for truss and column
✓ Grass for roof covering
✓ Timber for interior table

3.1.2. Quantity of materials needed

A. Stone : \[ A = \pi R^2 \] (for external wall)
\[ = 3.14(1.3)^2 \approx 5.31\,m^2 \]
\[ A = \pi r^2 \] (For internal wall)
\[ = 3.14(1)^2 = 3.14\,m^2 \]
A = \((\pi R^2/360)-(\pi r^2/360)\) for opening
\[ = 0.88-0.52 \quad (a=60^\circ) \]
\[ = 0.36\,m^2 \]

Fig.1. Ground floor plan

Area of stone = external – internal – opening
\[ = 5.31-3.14-0.36 = 1.81\,m^2 \]

Depth = 0.8m

Volume of stone = \( A^*D = 1.81*0.8 = 1.45\,m^3 \) (for wall)

Area of pavement = \( 3.14*1.6^2 \) - area of wall
\[ = 8.04 - 1.81 = 6.23\,m^2 \]
Depth = 0.1m

Volume of pavement = 6.23*0.1 = 0.62m³

Total volume of stone = 1.45+0.62 = 2.07m³

B. Wood: for column 6*3 = 18m
   For truss = 32m
   Total = 50m

C. Grass: 3.14*1.6² = 8.04m²

D. Timber: 3.14*0.5² = 0.8m²

E. Nail: 1.5kg

F. Cement: 2qtl

G. Sand: 1.05m³

H. Water: 0.75m³

**Material Cost**

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate in birr</th>
<th>Cost in birr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stone</td>
<td>m³</td>
<td>2.07</td>
<td>200</td>
<td>414</td>
</tr>
<tr>
<td>Wood</td>
<td>m³</td>
<td>50</td>
<td>7</td>
<td>350</td>
</tr>
<tr>
<td>Grass</td>
<td>m²</td>
<td>8.04</td>
<td>20</td>
<td>160.8</td>
</tr>
<tr>
<td>Timber</td>
<td>m³</td>
<td>0.8</td>
<td>100</td>
<td>80</td>
</tr>
</tbody>
</table>

**Table 1**

**Labor costs**

<table>
<thead>
<tr>
<th>Type</th>
<th>No</th>
<th>Uf</th>
<th>No of days they work</th>
<th>Daily cost in birr</th>
<th>Total cost in birr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forman</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>250</td>
<td>1250</td>
</tr>
<tr>
<td>Mason</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Carpenter</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>D.labor</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>80</td>
<td>800</td>
</tr>
</tbody>
</table>

Total = 2850

**Table 3**

**Equipment costs**

<table>
<thead>
<tr>
<th>Type</th>
<th>No</th>
<th>No of hrs used</th>
<th>Hourly rental cost</th>
<th>Total cost in birr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools</td>
<td>2</td>
<td>16</td>
<td>2</td>
<td>64</td>
</tr>
</tbody>
</table>

Total = 64

Total unit cost = A+B+C = 1834.8+2850+64 = 4748.8 birr

Cost for locally available material used = 4748.8 birr
(237.44 dollar) (1 dollar = 20 birr)

4: Cost calculation by using first class materials or high cost materials

4.1. Materials used:

HCB - for wall, Concrete - for column & slab, Steel - for truss, GA sheet - for roof cover, Marble - for interior table.
4.2. Quantity of materials used

1: HCB

C = 2πr

= 2 * 3.14 * 1.2

= 7.54m

H = 0.5m

A = 7.54 * 0.5

= 3.77m²

Total area of HCB = A = 3.77 - 0.68 = 3.09m²

2: Concrete

For column = 6 * 3 * 0.2 * 0.2 = 0.72m³

For slab = 3.14 * (1.5)² = 0.71m³

Total volume of concrete = 1.43m³

3: Steel

= 38m² * 0.03² * 0.03 = 3.42m³ * 7855.62kg/m³

= 268.66kg

4: EGA sheet

= πr²

= 3.14 * (1.5)²

= 7.07m²

5: Marble

= 3.14 * (0.5)²

= 0.79m²

6: PVC floor finish

A = 3.14 * (1.5)²

= 7.07m²

7: Bar (Φ10)

For column: - Number of bar = 6 * 4 = 24

Length = 24 * 3.3 = 79.2m

Weight (kg) = 79.2 * 0.617 = 48.87kg

For ground slab: - no of bar = 10 * 2 = 20

Length = 15 * 2 = 30m

Weight (kg) = 30 * 0.617 = 18.51kg

Total weight = 48.87 + 18.51 = 67.38kg

Unit rate analysis for high cost or first class materials

Table 3

Material cost

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit</th>
<th>Qty</th>
<th>Rate</th>
<th>Cost in birr</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCB</td>
<td>m²</td>
<td>3.09</td>
<td>274</td>
<td>846.7</td>
</tr>
<tr>
<td>Concrete</td>
<td>m³</td>
<td>1.43</td>
<td>1520</td>
<td>2173.6</td>
</tr>
<tr>
<td>Steel</td>
<td>Kg</td>
<td>268.66</td>
<td>36</td>
<td>9671.8</td>
</tr>
<tr>
<td>EGA sheet</td>
<td>m²</td>
<td>7.07</td>
<td>300</td>
<td>2121</td>
</tr>
<tr>
<td>PVC</td>
<td>m²</td>
<td>7.07</td>
<td>800</td>
<td>5656</td>
</tr>
<tr>
<td>Bar</td>
<td>Kg</td>
<td>67.38</td>
<td>36</td>
<td>2425.68</td>
</tr>
<tr>
<td>Total (A)</td>
<td></td>
<td></td>
<td></td>
<td>22894.78</td>
</tr>
</tbody>
</table>

Table 5

Labor cost

<table>
<thead>
<tr>
<th>Type</th>
<th>No</th>
<th>Uf</th>
<th>No of the work days</th>
<th>Daily cost</th>
<th>Total cost in birr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forman</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>250</td>
<td>1250</td>
</tr>
<tr>
<td>Mason</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Welder</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>D.labor</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>80</td>
<td>800</td>
</tr>
<tr>
<td>Bar bender</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Total (B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2950</td>
</tr>
</tbody>
</table>
Table 6

Equipment cost

<table>
<thead>
<tr>
<th>Type</th>
<th>No</th>
<th>No of hours used</th>
<th>Hourly rental cost</th>
<th>Total cost in birr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibratory</td>
<td>1</td>
<td>8</td>
<td>37</td>
<td>296</td>
</tr>
<tr>
<td>Tools</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>Total (C)</td>
<td></td>
<td></td>
<td></td>
<td>328</td>
</tr>
</tbody>
</table>

Total cost A+B+C=22894.78+2950+328=26172.78

= 26172.78 birr [2]

Cost for locally available material used = 26172.78 birr (1308.639 dollar) (1 dollar = 20 birr)

5. CONCLUSION

The above list of proposal for decreasing construction cost is of whole nature and it differs conditional upon the nature of the building to be constructed, budget of the owner, geographical location where the house is to be constructed, availability of the building material, decent construction management performs etc. However it is necessary that good planning and design methods shall be adopted by using the services of an skilled engineer or an architect for supervising the work, thereby achieving overall cost effectiveness to the extent of 18.14% in actual practice.

In our project the construction cost done by using low cost materials is 4748.8 birr (237.44 dollar) and the construction cost done by using high cost or first class materials is 26172.78 birr (1308.639 dollar). This shows low cost materials highly reduce the construction cost 21423.98 birr (1071.199 dollar).

6. RECOMMENDATION

Housing should be provided:-

- Safe
- Low cost
- Clean
- Comfortable
- Built with low embodied energy materials
- Need only low working energy.
- Need to grow cost effective construction technologies mitigate the effects of natural hazards.

- Need to temporary expensive & scarce building materials and components by low cost locally available materials to suit local design brand.

Various aspects for cost reduction:-

- Functional design of buildings
- Optimum use of building materials
- Justification of specifications
- New construction materials and techniques

Low Cost Building Materials Characteristics should be:-

- Easy to making
- Easy affordability
- Easy Assembly
- Faster & cheaper construction
- Effective Excess utilization
- Energy efficient and Environment friendly
- Low Cost or Cost Effective Housing Aims to reduce the cost of construction and at the same time not sacrifice any element of safety or serviceability of the house over the life cycle.

Low cost or cost efficient housing must be: strong.

- Durable
- Functional
- Aesthetic
- Environment friendly
- Ecological & appropriate
- Strong
- Energy efficient
- Affordable & adoptable
- Appropriate technology

REFERENCES