

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

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## 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 largely stroked 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

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- ✓ 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)  
 $= 3.14(1.3)^2 = 5.31\text{m}^2$   
 $A = \pi r^2$  (For internal wall)  
 $= 3.14(1)^2 = 3.14\text{m}^2$

$A = (\pi R^2 a / 360) - (\pi r^2 a / 360)$  for opening  
 $= 0.88 - 0.52$  (a=60°)

$= 0.36\text{m}^2$  **Fig.1. Ground floor plan**

Area of stone = external – internal – opening  
 $= 5.31 - 3.14 - 0.36 = 1.81\text{m}^2$

Depth = 0.8m

Volume of stone = A\*D =  $1.81 * 0.8 = 1.45\text{m}^3$  (for wall)

Area of pavement =  $3.14 * 1.6^2$  - area of wall  
 $= 8.04 - 1.81 = 6.23\text{m}^2$

Depth = 0.1m

Volume of pavement =  $6.23 \times 0.1 = 0.62 \text{m}^3$

**Total volume of stone =  $1.45 + 0.62 = 2.07 \text{m}^3$**

**B. Wood:** for column  $6 \times 3 = 18 \text{m}$   
For truss = 32m  
**Total = 50m**

**C. Grass :**  $3.14 \times 1.6^2 = 8.04 \text{m}^2$

**D. Timber:**  $3.14 \times 0.5^2 = 0.8 \text{m}^2$

**E. Nail:** 1.5kg

**F. Cement:** 2qtl

**G. Sand:**  $1.05 \text{m}^3$

**H. Water:**  $0.75 \text{m}^3$

Cement	Kg	2	250	500
Sand	m <sup>3</sup>	1.05	200	210
Water	lit	0.75	100	75
Nail	Kg	1.5	30	45
<b>Total</b>				<b>1834.8</b>

**Table 2**

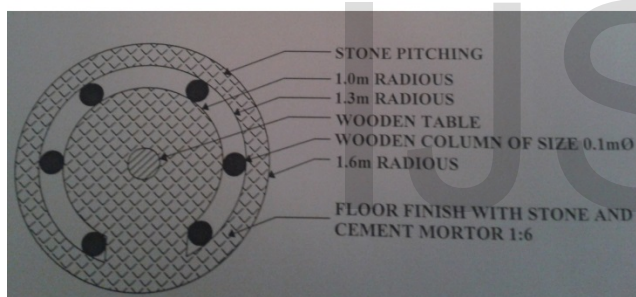
**Labor costs**

Type	No	Uf	No of days they work	Daily cost in birr	Total cost in birr
Forman	1	1	5	250	1250
Mason	1	1	2	200	400
Carpenter	1	1	2	200	400
D.labor	2	1	5	80	800
<b>Total</b>					<b>2850</b>

**Table 3**

**Equipment costs**

Type	No	No of hrs used	Hourly rental cost	Total cost in birr
Tools	2	16	2	64
<b>Total</b>				<b>64</b>



**Fig.1. Ground floor plan**

**Unit rate analysis for low cost or locally available materials**

**Table 1**

**Material Cost**

Type	Unit	Quantity	Rate in birr	Cost in birr
Stone	m <sup>3</sup>	2.07	200	414
Wood	m <sup>3</sup>	50	7	350
Grass	m <sup>2</sup>	8.04	20	160.8
Timber	m <sup>3</sup>	0.8	100	80

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

=4748.8 birr<sup>[2]</sup>

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

$$C=2\pi r$$

$$= 2*3.14*1.2$$

$$= 7.54m$$

$$H=0.5m$$

$$A=7.54*0.5$$

$$= 3.77m^2$$

$$\text{Total area of HCB } A = 3.77 - 0.68 = 3.09m^2$$

### 2: Concrete

$$\text{For column} = 6*3*0.2*0.2 = 0.72m^3$$

$$\text{For slab} = 3.14(1.5)^2 * 0.2 = 0.71m^3$$

$$\text{Total volume of concrete} = 1.43m^3$$

### 3: Steel

$$= 38m * 0.03 * 0.03 = 3.42m^3 * 7855.62kg/m^3$$

$$= 268.66kg$$

$$\text{4: EGA sheet} = \pi r^2$$

$$= 3.14 (1.5)^2$$

$$= 7.07m^2$$

### 5: Marble

$$= 3.14 (0.5)^2$$

$$= 0.79m^2$$

### 6: PVC floor finish-

$$A = 3.14 (1.5)^2$$

$$= 7.07m^2$$

### 7: bar ( $\Phi_{10}$ )-

$$\text{For column: - Number of bar} = 6*4=24$$

$$\text{Length} = 24*3.3=79.2m$$

$$\text{Weight (kg)} = 79.2*0.617=48.87kg$$

$$\text{For ground slab: - no of bar} = 10*2= 20$$

$$\text{Length} = 15*2 = 30m$$

$$\text{Weight (kg)} = 30*0.617 = 18.51kg$$

$$\text{Total weight} = 48.87+18.51 = 67.38kg$$

### Unit rate analysis for high cost or first class materials

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Table 3

Material cost

Type	Unit	Qty	Rate	Cost in birr
HCB	m <sup>2</sup>	3.09	274	846.7
Concrete	m <sup>3</sup>	1.43	1520	2173.6
Steel	Kg	268.66	36	9671.8
EGA sheet	m <sup>2</sup>	7.07	300	2121
PVC	m <sup>2</sup>	7.07	800	5656
Bar	Kg	67.38	36	2425.68
<b>Total (A)</b>				<b>22894.78</b>

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Table 5

Labor cost

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

**Table 6**

**Equipment cost**

Type	No	No of hours used	Hourly rental cost	Total cost in birr
Vibratory	1	8	37	296
Tools	2	8	2	32
<b>Total (C)</b>				<b>328</b>

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 technologiesmitigate the effects of natural hazards.

- Need to temporary expensive & scarce building materialsand components by low cost locally available materials tosuit 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

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