Construction of Low Cost Less Time (LCLT) Houses by using Wood

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ABSTRACT

Most common problem of the countries is the post-sovient space is the low availability of housing. A rather large number of houses annually become obsolete, destroyed as a result of natural disaster. Therefore this project deals with the modern trend of housing construction in wood and is reoriented to the market of low-rise construction and durability. The number of days for construction of the building in wood is 31 days and the cost for construction of wood houses need is 491374 as per the plan which is referred to deal this project. This leads to the application of earthquake resistant structures.


I. INTRODUCTION

Wood has been used and adapted by humans since the earliest recognition that they could make use of the materials they found around them. As they used it to meet a varying array of human needs, in peace and in war, in farming and in industry, people gradually came to understand something of the unique nature of wood. Its properties were first understood by experience, more recently by systematic research and refined observation. Wood is still essential to human life, but has evolved over the ages from a simple, readily available natural material to a modern industrial and engineering material, with a unique ability to contribute to human life both as a material for use and as a key element in the natural world of the forest.

II. TESTS ON WOOD

➢ Bending test
➢ Absorption test
➢ Compression test
2.1 BENDING TEST

**TABLE 1.** Dimensionality Test of Different Woods

<table>
<thead>
<tr>
<th>Types of woods</th>
<th>1(inch)</th>
<th>2(inch)</th>
<th>2.5(inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver wood</td>
<td>0.15</td>
<td>0.32</td>
<td>0.45</td>
</tr>
<tr>
<td>Teak wood</td>
<td>0.33</td>
<td>0.53</td>
<td>0.72</td>
</tr>
<tr>
<td>Neem wood</td>
<td>0.29</td>
<td>0.50</td>
<td>0.64</td>
</tr>
</tbody>
</table>

![Bending test of wood](image1)

**Figure 2.** Bending test of wood

2.2 ABSORPTION TEST

**Table 2.** Absorption Test of Different Woods

<table>
<thead>
<tr>
<th>Wood Names</th>
<th>Thickness Of Wood (Inches)</th>
<th>Initial Weight W1 (K G)</th>
<th>Final Weight W2 (K G)</th>
<th>Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver wood</td>
<td>2 ½</td>
<td>2.55</td>
<td>2.71</td>
<td>6.27</td>
</tr>
<tr>
<td>Teak wood</td>
<td>2</td>
<td>2.51</td>
<td>2.63</td>
<td>4.78</td>
</tr>
<tr>
<td>Neem wood</td>
<td>1</td>
<td>0.84</td>
<td>0.92</td>
<td>9.52</td>
</tr>
</tbody>
</table>

![Absorption test](image2)
2.3 COMPRESSION TEST
Length:-49.5mm
Height:-54.5mm

Table 3. Compressive Strength Test of Different Woods

<table>
<thead>
<tr>
<th>WOOD NAMES</th>
<th>THICKNESS OF WOOD</th>
<th>AREA (MM²)</th>
<th>LOAD (N)</th>
<th>COMPRESSION STRENGTH (N/MM²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver wood</td>
<td>2 1/2</td>
<td>2697.75</td>
<td>89000</td>
<td>32.99</td>
</tr>
<tr>
<td>Teak wood</td>
<td>2</td>
<td>2697.75</td>
<td>183000</td>
<td>67.83</td>
</tr>
<tr>
<td>Neem wood</td>
<td>1</td>
<td>2697.75</td>
<td>115000</td>
<td>42.62</td>
</tr>
</tbody>
</table>

Figure 3. Water Absorption Test of Wood

Figure 4. Compressive Strength of Wood
IV. RESULTS & DISCUSSION

4.1 Estimation of a conventional building

![Plan of a Conventional Building](image)

**Figure 5.** Plan of a Conventional Building

**Table 5.** Estimation of Conventional Building

<table>
<thead>
<tr>
<th>SL/NO</th>
<th>PARTICULATERS</th>
<th>NO</th>
<th>LENGHT</th>
<th>WIDTH</th>
<th>HIGHT</th>
<th>QUANTITY</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brickwork</td>
<td>1</td>
<td>94</td>
<td>1</td>
<td>10.5</td>
<td>987</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30cm wall</td>
<td>1</td>
<td>76.84</td>
<td>0.66</td>
<td>10.5</td>
<td>537.82</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20cm wall</td>
<td>1</td>
<td>76.84</td>
<td>0.66</td>
<td>10.5</td>
<td>537.82</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total=</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>1524.82</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deduction</td>
<td>30cm wall</td>
<td>1</td>
<td>4</td>
<td>6.9</td>
<td>1</td>
<td>27.6</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>4</td>
<td>6.9</td>
<td>4</td>
<td>1</td>
<td>110.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>2</td>
<td>1.5</td>
<td>1.5</td>
<td>1</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20cm wall</td>
<td>2</td>
<td>4</td>
<td>6.9</td>
<td>0.67</td>
<td>36.98</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D1</td>
<td>2</td>
<td>3.3</td>
<td>6.6</td>
<td>0.67</td>
<td>29.19</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>D2</td>
<td>2</td>
<td>3</td>
<td>6.23</td>
<td>0.67</td>
<td>25.05</td>
<td>Total=</td>
<td>233.72 cu ft</td>
</tr>
<tr>
<td>Lintel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25.74 cu ft</td>
</tr>
<tr>
<td>Columns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>88.57 cu ft</td>
</tr>
<tr>
<td>Beams</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>72.74 cu ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total=</td>
</tr>
</tbody>
</table>

Total brick work = 1524.82 cu ft
Total deduction= 420 cu ft
net brick work = 1104.05 cu ft

2 Concrete work  RCC Roof 1 30 40 0.5 600 (600-staircase)

2.1 Lintel
30cm wall 1 94 1 0.5 47
20cm wall 1 76.84 0.67 0.5 25.74
Total= 72.74 cu ft

2.2 Columns
30cm wall 1 11 1 10.5 115.5
20cm wall 1 0.66 0.66 10.5 4.57
Total= 120.07 cu ft

2.3 Beams
Walls 1 94 0.5 1 47
Formica 1 60 1 1 60
Walls 1 76.84 0.5 0.67 25.74
Total= 132.74 cu ft
Total concrete required (528.5+25.74+120.07+132.74) 807.05 cu ft

3 Plastering
Outside 2 23 0.083 14.5 55.36 cu ft
2 26 0.083 14.5 62.58 cu ft
Inside 182.83 cu ft
Roof 93.61 cu ft
Total plastering= 394.39 cu ft

Deduction
D 3*2 4 0.083 6.9 13.77 cu ft
D1 2*2 3.3 0.083 6.6 7.23 cu ft
D2 2*2 3 0.083 6.23 6.2 cu ft
W 4*2 6.9 0.083 4 4.25 cu ft
V 2*2 1.5 0.083 1.5 0.75 cu ft
Total= 32.2 cu ft

net quantity=(394.39-32.2) 360.19 cu ft
4.2 Total Quantities for Superstructure

Table 5. Total Quantities for Superstructure

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>DESCRIPTIONS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete</td>
<td>25 cub m</td>
</tr>
<tr>
<td>2</td>
<td>Bricks</td>
<td>18000 no’s</td>
</tr>
<tr>
<td>3</td>
<td>Plastering</td>
<td>10.21 cub m</td>
</tr>
<tr>
<td>4</td>
<td>Distemper wash (same as plastering area)</td>
<td>274 sq m</td>
</tr>
<tr>
<td>5</td>
<td>Paint (same as plastering area)</td>
<td>274 sq m</td>
</tr>
<tr>
<td>6</td>
<td>Weather proofing on the top of roof</td>
<td>(30’×40’)-(6’×12’) 1128 sq ft</td>
</tr>
<tr>
<td>7</td>
<td>Inside flooring</td>
<td>38 sq m</td>
</tr>
<tr>
<td>8</td>
<td>Parking flooring</td>
<td>35 sq m</td>
</tr>
<tr>
<td>9</td>
<td>Steel</td>
<td>tonne</td>
</tr>
</tbody>
</table>

4.3 Rate per Quantity as per SR Report 2018-19 (Bangalore)

Table 6. Rate per Quantity as per SA Report

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>DESCRIPTIONS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete (M20)</td>
<td>4110.17 INR per cu m</td>
</tr>
<tr>
<td>2</td>
<td>Table Moulded bricks</td>
<td>678 INR per 100 no’s</td>
</tr>
<tr>
<td>3</td>
<td>Mortar (1:2)</td>
<td>5308 INR per cu m</td>
</tr>
<tr>
<td>4</td>
<td>Distemper primer</td>
<td>67.8 INR per L</td>
</tr>
<tr>
<td>5</td>
<td>Whitening</td>
<td>18.64 INR per kg</td>
</tr>
<tr>
<td>6</td>
<td>Wall paint</td>
<td>169.5 INR per L</td>
</tr>
<tr>
<td>7</td>
<td>Weather proofing agent</td>
<td>216 INR per L</td>
</tr>
<tr>
<td>8</td>
<td>20mm thick red granite</td>
<td>1624 INR per sq m</td>
</tr>
<tr>
<td>9</td>
<td>Cement concrete tiles</td>
<td>191 INR per sq m</td>
</tr>
<tr>
<td>10</td>
<td>Sealer foe tiles</td>
<td>1.7 INR per sq m</td>
</tr>
<tr>
<td>11</td>
<td>Mild steel bars</td>
<td>33899 INR per tonne</td>
</tr>
<tr>
<td>12</td>
<td>Shuttering and centering cost</td>
<td>215 INR per sq m</td>
</tr>
</tbody>
</table>
4.4 Rate Analysis of Conventional Building

Table 7. Rate Analysis of Conventional Building

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Descriptions</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Concrete (25*4110.17)</td>
<td>102754.25 INR</td>
</tr>
<tr>
<td>2.</td>
<td>Mason charge (12*25000)</td>
<td>300000 INR</td>
</tr>
<tr>
<td>3.</td>
<td>Bricks (18000*6.78)</td>
<td>122040 INR</td>
</tr>
<tr>
<td>4.</td>
<td>Plastering (10.21*5308)</td>
<td>54194.68 INR</td>
</tr>
<tr>
<td>5.</td>
<td>Distemper wash (274*67.8)</td>
<td>18577.2 INR</td>
</tr>
<tr>
<td>6.</td>
<td>Whitening (500*18.64)</td>
<td>9320 INR</td>
</tr>
<tr>
<td>7.</td>
<td>Paint 2 coat (2<em>274</em>169.6)</td>
<td>92940.8 INR</td>
</tr>
<tr>
<td>8.</td>
<td>Labour charge (2<em>20</em>395)</td>
<td>15800 INR</td>
</tr>
<tr>
<td>9.</td>
<td>Weather proofing on the top of roof (105*216)</td>
<td>22680 INR</td>
</tr>
<tr>
<td>10.</td>
<td>Inside flooring (38*1624)</td>
<td>61712 INR</td>
</tr>
<tr>
<td>11.</td>
<td>Labour (38*580)</td>
<td>22040 INR</td>
</tr>
<tr>
<td>12.</td>
<td>Parking flooring (35*191)</td>
<td>6685 INR</td>
</tr>
<tr>
<td>13.</td>
<td>Labour (35*50)</td>
<td>1750 INR</td>
</tr>
<tr>
<td>14.</td>
<td>Steel (3*33899)</td>
<td>101697 INR</td>
</tr>
<tr>
<td>15.</td>
<td>Binding wire (15*56)</td>
<td>840 INR</td>
</tr>
<tr>
<td>16.</td>
<td>Total =</td>
<td>933030.93 INR</td>
</tr>
</tbody>
</table>

4.5 Time Estimation for Conventional Building by Using Bar Chart

Figure 6. Bar Chart for Building Time Estimation (Total 92 Days)
4.6 Rate Analysis of Wood

Total quantity of wood required = 2045 sq ft or 190 sq m
Hard wood cost per sq m is 1636 INR.
To fix 1 sq m it will cost around 473 INR.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Descriptions</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Total cost for wood (190*1636)</td>
<td>310840 INR</td>
</tr>
<tr>
<td>2.</td>
<td>Total fixing cost will be (190*473)</td>
<td>89770 INR</td>
</tr>
<tr>
<td>3.</td>
<td>Painting cost</td>
<td>23052 INR</td>
</tr>
<tr>
<td>4.</td>
<td>Flooring</td>
<td>67712 INR</td>
</tr>
<tr>
<td>5.</td>
<td>Total</td>
<td>491374 INR</td>
</tr>
</tbody>
</table>

Table 8. Rate Analysis of Wood House

Difference between wood estimation and building estimation
933030.93 - 491374 = 441656.93 INR

4.7 Foundation estimation for wooden houses

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>No</th>
<th>Length</th>
<th>Breadth</th>
<th>Depth</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PCC</td>
<td></td>
<td>101.522</td>
<td>3.936</td>
<td>1.64</td>
<td>655.328</td>
</tr>
<tr>
<td>2.</td>
<td>30cm</td>
<td>1</td>
<td>81.27</td>
<td>3.936</td>
<td>1.64</td>
<td>524.600</td>
</tr>
<tr>
<td>3.</td>
<td>20cm</td>
<td>1</td>
<td>81.27</td>
<td>3.936</td>
<td>1.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1179.928</td>
</tr>
<tr>
<td>4.</td>
<td>Stone work</td>
<td>2</td>
<td>183</td>
<td>1.31</td>
<td>1.31</td>
<td>628.09</td>
</tr>
<tr>
<td>5.</td>
<td>Brick work</td>
<td>2</td>
<td>183</td>
<td>1</td>
<td>1</td>
<td>366</td>
</tr>
</tbody>
</table>

Table 9. Foundation Estimation for Wooden Houses

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Descriptions</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Total quantity of concrete required</td>
<td>33.5 cu m</td>
</tr>
<tr>
<td>2.</td>
<td>Cost of the concrete required</td>
<td>4110.17*33.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=137690.695 INR</td>
</tr>
<tr>
<td>3.</td>
<td>Total quantity of bricks required</td>
<td>5200 no's</td>
</tr>
<tr>
<td>4.</td>
<td>Cost of bricks</td>
<td>5200*6.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=35800 INR</td>
</tr>
<tr>
<td>5.</td>
<td>Total quantity of stone required</td>
<td>17.8 cu m</td>
</tr>
<tr>
<td>6.</td>
<td>Cost of the stone</td>
<td>17.8*2918</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=51940 INR</td>
</tr>
<tr>
<td></td>
<td>Total cost of the foundation</td>
<td>225430.690</td>
</tr>
</tbody>
</table>

Table 10. Cost of the foundation
4.8 Treatment Required for the Wood

Termite - Borate treatment @ 5:1 ratio
Water proofing - Linseed oil
             - Walnut oil
             - Tung oil
Fire proofing - Fire retardant cable coating paint

4.9 Cost of Treatment Required for the Wood

Table 11. Cost of Treatment Required for the Wood

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Termite</td>
<td>29189</td>
</tr>
<tr>
<td>2.</td>
<td>Water proofing</td>
<td>73695</td>
</tr>
<tr>
<td>3.</td>
<td>Fire proofing</td>
<td>32000</td>
</tr>
<tr>
<td></td>
<td>Total cost =</td>
<td>134884</td>
</tr>
</tbody>
</table>

4.10 Total Cost of Wooden House

Table 12. Total Cost of Wooden House

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Descriptions</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Stone</td>
<td>51940</td>
</tr>
<tr>
<td>2.</td>
<td>Brick</td>
<td>35880</td>
</tr>
<tr>
<td>3.</td>
<td>Wood (superstructure)</td>
<td>513414</td>
</tr>
<tr>
<td>4.</td>
<td>Wood roof</td>
<td>125183</td>
</tr>
<tr>
<td></td>
<td>Total cost</td>
<td>726417</td>
</tr>
</tbody>
</table>

4.11 Time Estimation for Wood by Using Bar Chart

Figure 7. Bar Chart for Wood Estimation (Total 31 Days)
III. CONCLUSION

The optimum days for constructing wood building are 31days for ground floor compared to the conventional building. The cost of the constructing material is vulnerably less as compared to normal building materials. As wood bending capacity is good; it is applicable to the earthquake resistant areas.

IV. FUTURE SCOPE

In future the construction Cost and Time of wood house will get reduced if the foundation is designed with the selected wood which gives more strength with fewer prices.

V. REFERENCES

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