

# ESTIMATION OF RESIDENTIAL BUILDING USING LOW COST MATERIALS

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**ABSTRACT** Affordable housing mainly deals with effective costing and following of sustainable building techniques which helps in reducing the cost of construction without sacrificing the strength, durability and performance. The plan of 2BHK have been considered for Residential building. The total residential building is divided into two parts i.e., Structural and non Structural. As the cost of cement takes major part of total building cost, so we adopted fly ash by replacing cement with percentages of 30%, 40%, 50% for structural elements. The strength tests such as compressive, split test, flexural test have been calculated. From the test results, 40% replacement of fly ash gave required strength for single storey building. For Non- structural elements, the low cost materials such as concrete frames, hollow concrete blocks etc were adopted. This project recommends plan and sustainable materials adopted for a single storied building. After assigning low cost materials for structural and Non- structural elements of building, the quantity and cost is estimated. The overall cost is reduced up to 30% compared to conventional building cost.

**Keywords :** Sustainable building techniques, Building materials, Estimation

## 1. INTRODUCTION

Housing is a basic need of human being. But this is out of the means of low income house holder who constitute majority of population in our country. In India maximum affordability of household was defined to be 5.1 times the household's total gross income as compared to the developed countries. Low cost housing is a different concept which deals with effective costing and following of sustainable building techniques. There is a huge misconception that low cost housing is suitable for only sub normal works and they are built by using cheap building materials of low quality. The fact is that Low cost housing is done by proper management of resources.

The production of Portland cement is not only costly and energy intensive, but it also produces large amounts of carbon emissions. The production of one ton of Portland cement produces approximately one ton of CO<sub>2</sub> in the atmosphere. Fly ash is a byproduct of the combustion of pulverized coal and is collected by mechanical and electrostatic separators from the fuel gases of thermal power plants where coal is used as a fuel. Fly ash is commonly used in concrete in replacement ranging from 0%-30% by weight of the total cementitious material. Large quantities of fly ash are available around the world at low cost and the use of HVFA seems to offer the best solution to rising cement demands. The use of HVFA in concrete has recently gained popularity as a resource efficient, durable, cost effective, sustainable option for OPC concrete application.

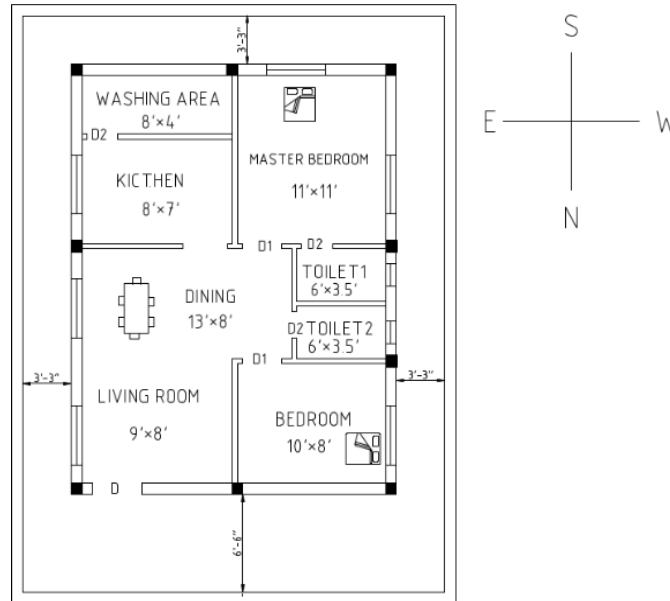
The low cost materials such as Hollow concrete blocks, spiral stair case, concrete flooring, pre cast doors and window frames are recommended for cost reduction of Residential building.

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**CONSTRUCTION OF 2 BHK :**



**Fig: 1.PLAN OF 2BHK**

**DETAILS OF PLAN:**

1. Plot size : 30'\*40'=1200 sq ft 2.Type : detached building 3.Rules:Building bye laws, IS888

4. No of stories : 1
5. Road direction : North
6. From fig :

D = 1.0\*2.0m D1= 0.8\*2.0m

D2=0.7\*

2.0m, W=1.2\*1.2m

**BUILDING ESTIMATE**

**Total building elements are divided into 2 parts:**

- STRUCTURAL ELEMENTS
- NON STRUCTURAL ELEMENTS

**STRUCTURAL ELEMENTS**

The structural elements such as beams ,columns, footings , plinth beam, lintels, sunshades etc are estimated by replacing cement with fly ash with percentages of 30, 40, 50. The different strength test such as compressive strength, flexure , split tests are conducted to know the 28 day strength for those percentages. Finally the particular percentage is recommended to use for structural elements which reduces cement cost by the usage of fly ash.

**OBSERVATIONS:**

- Grade of cement: M25
- Type of cement and brand: OPC & Chettinad cement
- Specific gravity of cement: 3.15
- Specific gravity of coarse aggregates: 2.7

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- Specific gravity of fine aggregates: 2.7
- Fly ash percentages: 30%,40%,50%
- **NON STRUCTURAL ELEMENTS**

For Non-structural elements the low cost materials such as pre cast concrete frames, Hollow concrete blocks, concrete flooring, spiral staircase are provided and cost is calculated.

**2. TEST RESULTS AND DISCUSSIONS:**

From table1, the replacement of 40% fly ash gave appropriate strength compared to 30% and 50%.

**Table 1 Test results of fly ash replacement**

SNO	CONTENTS	CONVENTIONAL CONCRETE	(N/mm <sup>2</sup> )	30%	(N/mm <sup>2</sup> )	40%	(N/mm <sup>2</sup> )	50%	(N/mm <sup>2</sup> )
1	DAYS	7	28	7	28	7	28	7	28
2	CUBES(150*150*150)	30.22	53.77	16.885	33.55	22.44	37.11	15.995	19.33
		41.33	50.66	17.11	21.33	21.995	36	16.66	13.33
	<b>AVERAGE</b>	<b>35.775</b>	<b>52.215</b>	<b>16.9975</b>	<b>27.44</b>	<b>22.2175</b>	<b>36.555</b>	<b>16.3275</b>	<b>16.33</b>
3	BEAMS(500*100*100)	4.5	7.5	4.5	8.5	4.125	8.5	4	7.5
		4.75	5.5	4.75	8	4.25	9	4.5	7
	<b>AVERAGE</b>	<b>4.625</b>	<b>6.5</b>	<b>4.625</b>	<b>8.25</b>	<b>4.1875</b>	<b>8.75</b>	<b>4.25</b>	<b>7.25</b>
4	CYLINDERS(150*300)	2.87	2.97	2.045	2.325	1.552	2.334	1.342	2.19
		3.05	3.11	1.905	2.4015	1.482	2.4015	1.414	2.05
	<b>AVERAGE</b>	<b>2.96</b>	<b>3.04</b>	<b>1.975</b>	<b>2.36325</b>	<b>1.517</b>	<b>2.36</b>	<b>1.378</b>	<b>2.12</b>

**TOTAL COST OF BUILDING:**

The quantities of structural elements such as beams ,footings, columns are calculated by assuming dimensions for the given plan and the materials for those elements such as cement ,fly ash, coarse and fine aggregates were taken and individual quantities are estimated. The cost of different materials had been taken as per Standard schedule rates and the cost is calculated for some elements for Affordable housing according to their quantities and finally the values are compared with conventional residential building.

S.NO	ELEMENTS	AFFORDABLE HOUSING COST	CONVENTIONAL HOUSING COST
1	Slabs	86400	108000
2	Beams	18945	20940
3	Columns	24705	28000
4	Footings	42030	47300
5	Staircase	15000	40000
6	Plastering	14000	28000
7	Bricks	1,20,000	1,27,710
8	Door frames	6420	10400
9	Window frames	11510	18720
10	Flooring	32400	108000
	<b>Total cost</b>	<b>3,71,410</b>	<b>5,37,070</b>

#### NOTE:

- As steel is not replaced with any other low cost material, the quantity and cost of steel have not been included in this report.
- The electrical fixtures and plumbing etc can be taken as contingencies.

#### 3. DISCUSSIONS

- There is an increase of strength with 40% replacement of cement compared to 30% and 50%. It has good workability.
- As fly ash does not give early strengths, we have to wait for 56 days and more for good strengths.

#### 4. CONCLUSION

- After calculating strength of cubes, beams and cylinders with 30%, 40%, 50% of fly ash, the test results for 40% gave appropriate strength compared to conventional concrete. So that 40% fly ash can be recommended.
- Quantity and cost is estimated for structural and non structural elements. Using low cost materials in non structural elements cost can be reduced. So we can adopt them.
- The overall total cost of the Residential building can be saved up to 30%.

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