ESTIMATION OF TRADITIONAL & LOW-COST RESIDNTIAL BUILDING

Estimation of residential building using alternative materials and comparison to traditional building in terms of cost saving.

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Abstract : This study has been undertaken to understand the cost saving of low cost housing comparison than conventional building without compromising the strength, durability and mental satisfaction. In this research, a well-designed 2 story (duplex) plan is designed and its basic estimation has been done. It is saved about 16% in construction of building without including labor cost and some techniques which can be used but not used due to some reasons discussed later on. Cost of building has been saved because of following methods. Use of fly ash brick at the place of clay red brick which saved in rate of wall construction, reduced dead load of the structure, eco-friendly in nature and good thermal conductivity. Fly ash is smooth hence, no plaster is required. Granite tiles is used at the place of marble which reduces the cost without compromising appearance.

Index Terms **– Low-cost housing, estimation, cost-effective, sustainable building, affordable housing**.

I. INTRODUCTION

Today's population of India is the second largest in the world, Requirement of houses and its future development will lead to suffer a lot if not proper planning & methodology for cost effective and fast construction of housing is used on time. Today's population and its growth given a greater importance to the speed of the construction especially for large housing projects. Using alternative inputs and methods at the place of conventional building construction can cut down the construction cost and this alternative inputs & methods is known as low-cost housing technologies. Now a days, a great issue which we face in our society is increase in cost of construction materials due to scarcity of natural resources. To maintain sustainability while constructing a building we must take care about safety and eco-friendly building materials. Currently India is having shortage of 17.8 million houses and having own house is very difficult in reality, especially for low and middle-income families. That's why It is necessary to adopt some innovative ideas, environmental-friendly and cost-effective housing technologies without compromising with security and safety of the buildings and mostly follow the prevailing building codes, so that common people can construct their houses at affordable cost. The factors which are prioritized during cost reduction of low-cost housing are strength and durability of the structure, safety, stability and mental satisfaction. Two case studies were conducted in India and It was found that 26.11% saved in walling and 22.68% saved in roofing of total construction cost including material and labor cost. This proves that using low-cost housing technologies is cost effective approach & also proves the benefits and trends for implementing low-cost housing technologies in the Industry. Use of locally available materials along with improved skills and technology is effective budgeting and technician of construction without sacrificing the strength, performance, and life of the structure. Urbanization is also one of the characteristics for which demand of Affordable housing is increasing. To improve quality of life of most needed buildings is to meet the needs of local conditions. Manufacturing and designing of similar components of factory-made products will reduce in cost and materials wastage also in saving of purchasing cost of materials. Planning of similar type of project, reduce in construction time (as it is fast casting and assembling technique) will lead in decreasing cost of manufacturing and assembling for urban poor's housing. To maintain sustainability while constructing a building we must take care about safety and eco-friendly building materials.

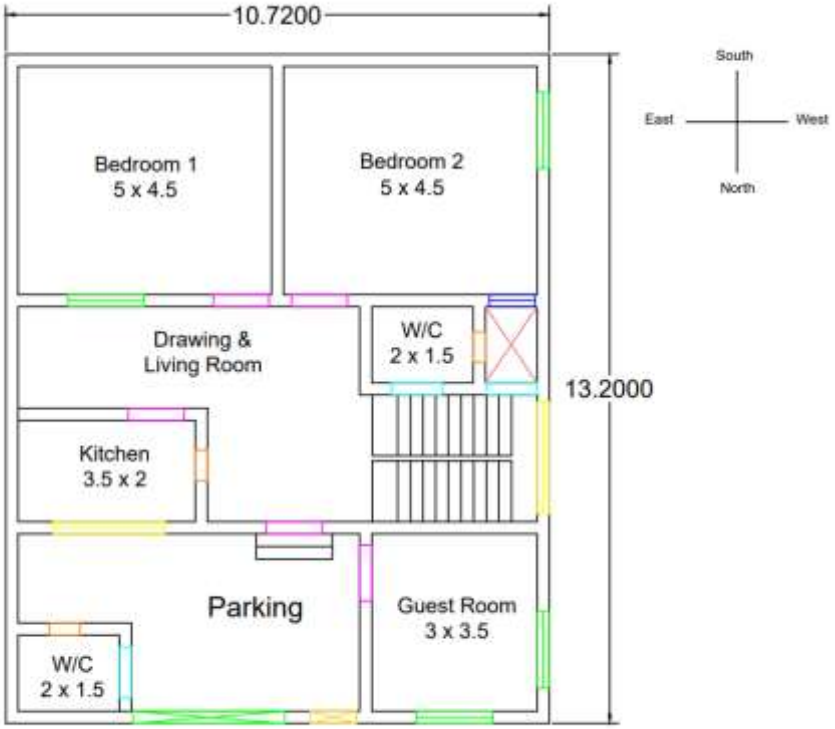
II. LITERATURE REVIEW

Vivian W.Y. Tam (2011) published a research paper on "Cost Effectiveness of Using Low-Cost Housing Technologies in Construction". According to this research paper, currently India is having shortage of 17.8 million houses and having own house is very difficult in reality, especially for low and middle-income families. That's why It is necessary to adopt some innovative ideas, environmental-friendly and cost-effective housing technologies without compromising with security and safety of the buildings and mostly follow the prevailing building codes, so that common people can construct their houses at affordable cost. In this research paper methods of construction such as foundation, walling, lintels and roofing has been compared between traditional housing and low-cost housing technologies. The factors which are prioritized during cost reduction of low-cost housing are strength and durability of the structure, safety, stability and mental satisfaction. Two case studies were conducted in India and It was found that 26.11% saved in walling and 22.68% saved in roofing of total construction cost including material and labor cost. This proves that using low-cost housing technologies is cost effective approach & also proves the benefits and trends for implementing low-cost housing technologies in the Industry.

S.S. Shinde et al. (2013) published a research paper on "Affordable Housing Materials & Techniques for Urban Poor's". This paper reveals that urbanization is one of the characteristics for which demand of Affordable housing is increasing. To improve quality of life of most needed buildings is to meet the needs of local conditions. This research paper is study of use of local materials and engineering projects which is carried out in town Dhule, Maharashtra in the month between July and November, 2012. It is found that techniques used for traditional construction will require minimum 4 to 6 months to construct small ground storied house again quality of materials and workmanship will have another aspect. This research also reveals that factory made products will be particular expected quality and will require 2 to 3 days to assemble at site. Planning of similar type of project, reduce in construction time (as it is fast casting and assembling technique) will lead in decreasing cost of manufacturing and assembling for urban poor's housing. Manufacturing and designing of similar components of factory-made products will reduce in cost and materials wastage also in saving of purchasing cost of materials.

Vishnu et al. (2019) published a research paper "A study on Sustainable Cost-Effective Building Construction in Housing Sector". According to this research, now a days, a great issue which we face in our society is increase in cost of construction materials due to scarcity of natural resources. To maintain sustainability while constructing a building we must take care about safety and eco-friendly building materials. The main aim of this research is to reduce the cost of building construction, this can be achieved by adopting innovative materials and techniques and also by doing this we can make a great contribution to construction sector. This project has been done by data collection, preparation of cost-effective plan, area studying, discussion with legal concerned authorities, comparison of cost-effective building materials and techniques etc. For this purpose, we should use cost effective building materials and innovative technologies without sacrificing the quality, strength and durability. Some building materials which can be used as alternative building materials are bunger sand, ceramic sand, porotherm brick etc. They not only made the construction process fast but also helps in reducing quantity of cement mortar use thereby decreasing the labor and construction costs. Moreover, they also help in reducing the temperature of interior room comparatively traditional concrete blocks. Funicular shell technique can be also use to reduce the construction cost and to provide good design look. By using above construction materials and techniques about 30% were saved on total cost of construction.

III. CONSTRUCTION OF 2 BHK



All Dimensions in meter

Plot Size : 10.72 m x 13.2 m

Building Type : G+1 (Duplex)

Road Direction : North

Door 1 = 1.1 x 2.1 (Pink)

Door 2 = 0.9 x 2.1 (sky blue)

Window 1 = 1.5 x 1.2 (green)

Window 2 = 2.2 x 1.1 (Kitchen)

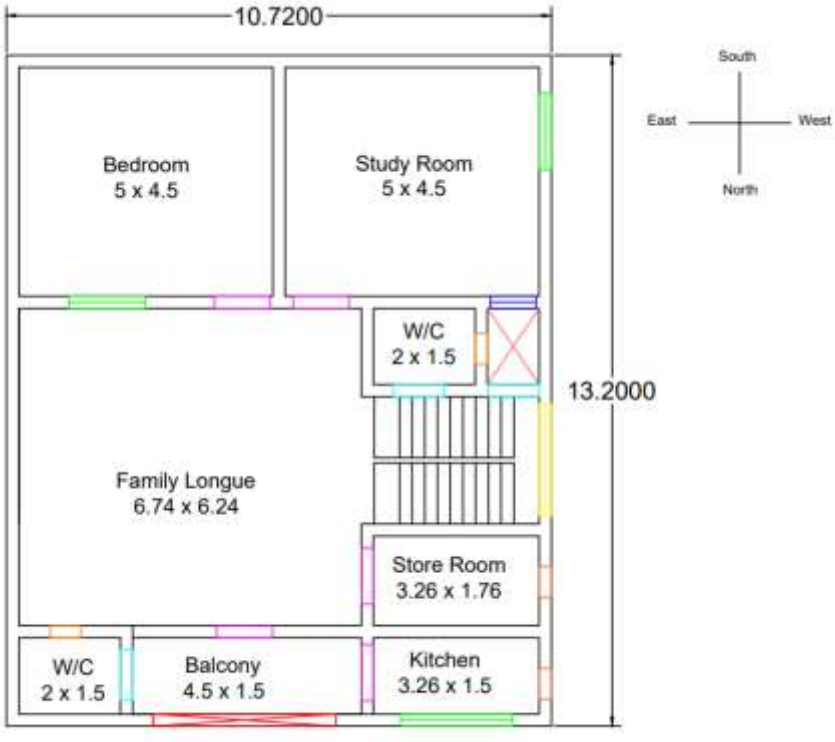
Window 3 = 0.9 x 0.9 (OTS)

Gate (G) = 1 x 2.4 (Yellow)

Main Gate = 3 x 2.4 (Green)

Ventilation (V) = 0.6 x 0.6(Orange)

Fig 1 : Plan of Ground Floor



All Dimensions in meter

Bedroom 1 & 2 (5 x 4.5)

Washroom (2 x 1.5)

Staircase (3.5 x 2.5)

OTS (1.02 x 1.5)

Kitchen G (3.5 x 2)

Kitchen G+1 (3.26 x 1.76)

Guest Room (3 x 3.5)

Family Longue (6.74 x 6.24)

Parking Area (4.76 x 3.5 + 2 x 1.76)

Living Room (3 x 2.5 + 3.74 x 2 + 3 x 1.74) | Store Room (3.26 x 1.76)

Height of Building : 3.2 m

Fig 2 : Plan of First Floor (G+1)

IV. BUILDING ESTIMATE

Total Quantity Estimation

Item No.	Description of Item	Quantity Ground Floor	Quantity First Floor	Total Quantity
1	Excavation	110 m^3	-	110 m^3
2	Brickwork in Foundation up to plinth	52.925 m^3	-	52.925 m^3
3	Earth Filling	55.445 m^3	-	55.445 m^3
3	DPC	27.26 m^2	-	27.26 m^2
4	Brick work in Superstructure	80.60 m^3	54.17m^3	134.77 m^3
5	Flooring	109.66 m^2	111.96 m^2	221.62 m^2
6	Plastering	505.3 m^2	440.65 m^2	945.95 m^2
7	Parapet wall	1.08 m^3	11.25 m^3	12.33 m^3
8	Slab (Roof)	63.67 m^3	63.67 m^3	127.34 m^3
9	Staircase	5.6 m^3	5.6 m^3	11.20 m^3

Traditional Building Rate Analysis

Item NO.	Description of Item	Quantity First Floor	Rate per Unit (Rupees)	Total Rate (Rupees)
1	Excavation	110 m^3	99 per m^3	10890
2	Brickwork in Foundation up to plinth (Clay brick)	52.925 m^3	2742 per m^3	145120
3	Earth Filling	55.445 m^3	Rs 86 per m^3	4768
3	DPC	27.26 m^2	193 per sqm.	5261
4	Brick work in Superstructure (C.B.)	134.77 m^3	2742 per m^3	369539
5	Flooring (Marble)	221.62 m^2	825 per sqm (t=50 mm)	182836
6	Plastering (1;4)	945.95 m^2	192 sqm.	181622
7	Parapet wall	12.33 m^3	2742 per m^3	33808
8	Slab (Roof)	127.34 m^3	4200 per m^3	534828
9	Staircase (Concrete)	11.20 m^3	3800 per m^3	42560
10	**Total**	-	-	1511232

Low-Cost Building Rate Analysis

Item NO.	Description of Item	Quantity	Rate per Unit (Rupees)	Total Rate (Rupees)
1	Excavation	110 m^3	99 per m^3	10890
2	Brickwork in Foundation up to plinth (Fly Ash)	52.925 m^3	2550 per m^3	134958
3	Earth Filling	55.445 m^3	Rs 86 per m^3	4768
3	DPC	27.26 m^2	193 per sqm.	5261
4	Brick work in Superstructure (F. A)	134.77 m^3	2550 per m^3	343663
5	Flooring (Tile)	221.62 m^2	720 per sqm (t=50mm)	159566
6	Plastering	945.95 m^2	No Need of Plaster	0.00
7	Parapet wall (Fly Ash)	12.33 m^3	2550 per m^3	31442
8	Slab (Roof)	127.34 m^3	4200 per m^3	534828
9	Staircase (Steel)	11.20 m^3	2858 per m^3	32010
10	**Total**	-	-	1257386

Total cost of traditional housing = 1511232

5% contingencies (traditional housing) =1586794

Total cost of low-cost housing = 1257386

5% contingencies (low-cost housing) = 1320255

Difference = 1586794 – 1320255 =266539

Percentage = $\frac{difference\ x\ 100}{Traditional\ Building\ cost}$

Percentage = $\frac{266539\ x\ 100}{1586794}$ = **16.80 %**

V. Discussion

1. There are number of techniques which we can use to save cost but not all the techniques are effective all the places. Choose according to local environment and availability.

2. Fly Ash does not give strength early, it takes 56 days and more for good strength.

3. Overall Saving includes material cost and labor cost of construction.

4. Construction activity or technique may have advantages and disadvantages, used on the basis of suitability.

5. Using filler slab technology can reduce cost but it will also increase slab thickness, plaster & painting work.

6. In doors and windows, we can use brick walls as frames and can save cost but again it will not provide better look. If appearance is not an issue so, it can be used at that places.

7. We should use eco-friendly, renewable and fast-growing materials for construction of building e.g., bamboo.

VI. Conclusion

1. By using natural and locally available material transportation cost can be reduced hence material cost can be decreased.

2. By using alternative materials, material cost can be saved up to 16.80% and by utilizing some innovative techniques, cost can be saved even more e.g., using filler slab technology and frameless door and window.

3. Overall Labour cost can be saved in low-cost housing however, not all the time. It also depends upon methods used to save cost of building. Gypsum wall separation can save labour cost, prefab staircase can save cost but filler slab technology increases the labour cost.

VII. References

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