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"Cost Effective Materials in Building Construction"

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ABSTRACT– This project deals with the study of cost-effective construction materials and technologies in rural sector. The basic need of everyone in this world is shelter, but not everyone has the sufficient finance to construct their dream home and have some limitations. Now a days the increase in the cost of construction materials is a great issue that we face in our society, that is due to the scarcity of natural resources. India is a developing country so various constructions are taking place in our country day by day. And also, various researches are now conducted in several places to reduce the cost of building construction. While constructing a building we must aware about the safety of the environment by promoting eco-friendlier construction in our world. Through this we can maintain sustainability. We humans all are highly depend on non-renewable energy resources for various constructions, so natural resources become vanished and cost and demand of materials increases as a result. There should be an end in the increase in the cost of construction field and keep sustainability. The main aim of this project is to reduce the cost of building construction in a housing sector by adopting innovative materials and techniques. By using this innovative idea, we can make a great contribution in the construction industry.

I. INTRODUCTION

- The important need and everyone's dream to have their own home with individual needs.
- Since India is a developing country, the economy has more importance. The house needs to be built-in cost-effective way.
- Low-cost housing refers to the house that are inexpensive to build. It doesn't mean that the houses will be inexpensive to build.
- The goal is to save money in construction of a house.

II. AIM AND OBJECTIVE

AIM- To build a house in most economical way.

OBJECTIVES-

- To select a residential bungalow plan
- To study the factors affecting the cost of the materials
- To give the appropriate solution to reduce the cost of the materials

III. LITERATURE REVIEW

3.1 Vivian et al (2000) explained that adequate shelter for all people is one of the pressing challenges faced by the developing countries.

The dream of owning a house particularly for low –income and middle-income facilities is becoming a difficult reality. Hence it has become a necessity to adopt cost effective, innovative and environment- friendly housing technologies for the construction of houses and buildings for enabling the common people to construct houses at affordable cost.

Findings- Case studies in India are used for the investigation. construction methods of foundation, walling, roofing and lintel are compared. Strength and durability of the structure, stability, safety and mental satisfaction are factors that assume top priority during cost reduction. It is found that about 26.11%and 22.66%of the construction cost can be saved by using low cost housing technologies in comparison with the traditional construction methods in the case studies for walling and roofing respectively

3.2 A.K Kasturba et. al (2014) discusses the use of Laterite as a sustainable building material and highlights its benefits as of a locally available and cheap material as compared to the conventional modern materials.

Findings- The attempt is to develop standards for

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use of Laterite in building applications. The use of Laterite is marginalized because of the lack of standardization and the difficulty in conducting various testing procedures. Standard size laterites of 390x190x190 mm were taken for experimenting and testing procedures for determining its various engineering properties which implied the need for development of a suitable classification since the test sample had shown large variation in strength but, for residential uses it is sufficient and the minimum strength requirement should be reconsidered.

3.3 B.V.V. Reddy (2011) had studied the suitability of manufactured sand as fine aggregate material.

Findings-In this study the characteristics of concrete and mortar using M-sand as fine aggregate were determined and compared with that of concrete with river sand. The mortar made with M-sand showed better engineering properties (compressive strength, better workability, bulk density etc.) as compared to that with river sand. The concrete sample was of M20 & M30 grade which gave very satisfactory results when M sand was used in place of river sand. Hence the test program gave a positive aspect on the suitability of M-sand as an alternative to river sand and also helps in the cost reduction for constructional activities.

IV. METHODOLOGY

- **In 1st Phase: 1.** Selection of plan of a house.
- **2.** Guidelines.
- **3.** Planning.
- **4.** Selection of Material.
- **5.** Conclusion.

- **In 2nd Phase: 1.** Quantity Analysis.
- **2.** Rate Analysis.
- **3.** Comparative Study.

V. MATERIAL DETAILS

5.1. SAND

Sr. No.	M-Sand	River Sand
1	M-Sand manufactured in a factory	This naturally available on river banks
2	The source of Crushed sand is a quarry. It is manufactured by quarry stones, Crushing rocks, or larger aggregate pieces into sand size particles in a factory or quarry.	This is naturally available and extracted from the riverbanks or river beds.
3	The shape of Crushed sand is angular and cubical and has a rough texture and hence, better for concrete.	The shape of natural sand is rounded and has a smooth surface.
4	No moisture content.	Moisture is generally present between the particles. Hence, it affects the assumptions of concrete mix design and quality of concrete.

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5	This sand highly recommended for RCC purposes and brick/block works.	River sand is recommended for RCC, plastering and brick/blockwork.

5.2. BRICKS

5.2.1. Red Bricks:

1. **Heat protection in summer:** Bricks have high thermal mass which is what makes them absorb more heat as compared to AAC blocks. The bricks absorb heat during the day and release it at night. You basically get the best possible option to keep your home warm in winter and comparatively cooler in summer. Days usually require less heat as compared to night which is where the thermal insulation properties of bricks come to play.
2. **Eco-friendly too:** Those of you who commend on the environmental issues of creating red bricks totally forget that these bricks are made from materials that can be easily recycled and used for landfills.
3. **Durability:** Red traditional bricks are known to be more durable and the structures made from them are stronger than the ones made from hollow blocks.

5.2.2.Fly Ash Brick:

1. Fly ash bricks are less costly and lighter in weight. Fly Ash bricks consume only 65 kg cement for the construction of 1 m^3 of brickwork which is less compare to red brick. By using fly ash brick, we can reduce cement consumption up to 50 % as these brick walls not required plastering on both sides.
2. High compressive strength, fewer pours and light-weighted compared to clay bricks. In high-rise building when structural load increase, this brick has lightweight helps in reducing stress on the building Absorb less water compare to red bricks.
3. It is cheaper than the red bricks. Fly ash bricks are made of waste materials that come from the combustion of coal in thermal power plants.

5.3. WOOD

5.3.1. Teak Wood:

Teak is one of the most valuable timbers, "the king under the timbers", in ancient times considered as "a royal timber". Teak is worldwide recognized for its durability and stability, the timber is immense stable, has a high oil content that works as "built-in" natural water repellent and is therefore virtually immune to rotting, fungi and harsh chemicals. Teak is one of the few timbers that can withstand the heat of the desert and will not readily catch fire.

Physical properties:

Teak has a high degree of natural durability, is moderately hard and heavy with low stiffness and shockresistance but an excellent decay resistance and dimensional stability with a good acid resistance.

5.3.2. Blockboards:

Blockboards are generally used to make wardrobe doors, doors, paneling, and partition walls. Blockboard is mostly used when there is lengthy piece of wood is required which makes furniture stiffer or and prevent it from bending. Block board is commonly available in the following sizes in market.

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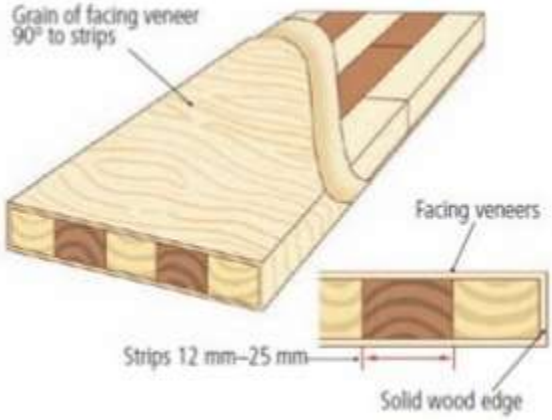

5.4. TILES

5.4.1. Marble:

Marble is a naturally occurring metamorphic rock. Marble flooring is a very high class and commonly used in posh homes, restaurants, hotels, temples, churches, mosques, etc. The slabs of marble at AGL are square or rectangular, and their thickness is 3025 X 1225mm. Marble surface is porous tends to be slippery when used in bathroom

5.4.2. Vitrified Tiles:

It is a man-made ceramic tile, with low porosity, mostly used outdoors. They are of four major types: Soluble salt, double charge, full body and glazed.

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VI. PLAN OF BUILDING

GROUND FLOOR

1ST FLOOR

VII. QUANTITY ANALYSIS

Grade of Concrete: M20 (1:1.5:3)
Volume of Concrete of beam:11.7 m3
Volume of Concrete of column:10.23m3
Volume of Concrete of slab:33.26m3
Total Volume of Concrete:55.19 m3
Dry Volume of Concrete:55.19x1.5=82.78 m3

By Thumb Rule:

Structural Member	Percentage of Steel
Slab	1 % of total volume of concrete
Beam	2% of total volume of concrete
Column	2.5% of total volume of concrete

7.1.Steel:

Steel quantity for slab= Volume of concrete x Density of steel x % of steel of member
=33.26 x 7850 x 0.01
=2610.91 kg
teel quantity for Beam=Volume of concrete x Density of steel x % of steel of member
=11.7 x 7850 x 0.02
=1836.2 kg
Steel quantity for Column=Volume of concrete x Density of steel x % of steel of member
=10.23 x 7850 x 0.025
=2007.64 kg
Steel quantity for Pile:
No. of piles = 15
Size of pile:
1.Lenght=3.35 M
2.Diametre=500 mm
Pile Reinforcement: 6 NO 16 mm HT
Links: 8 HT @ 6" c/c

Bar Diameter (mm)	Weight (kg/m)
8	0.39
10	0.62
12	0.89
16	1.58

Weight of 16 mm dia. Bar = 11.8 x 1.58 = 18.64 kg/bar
Weight of 8 mm dia. Bar= 11.8 x 0.39 =4.6 kg/bar
As per design,
Reinforcement= 2 x 18.64 = 37.28 x 15 (no of piles) = 559.2 kg
Links= 15 x 4.6 = 69.03 kg
Pile Cap = 1695.6 kg
Total Weight of Steel in kg = 8778.58 kg

7.2.Cement:

7.2.1.RCC Work

1/5.5 x 82.78 =15.05 m3 x 1440 = 21673 kg

(Density of cement = 1440 kg/m3)
No bags of cement = 21673/50 = 433.5~435

7.2.2.Brick work:

Brickwork in cubic meter = 59.36 with mortar
Volume of brick without mortar=0.002 cum
0.002 x 23744 = 47.5 cum
Wet volume of mortar =Volume of brickwork with mortar – Volume of brickwork without mortar
=59.36 – 47.5
=11.87 cum+10% 11.87(frog filling, joint filling, wastage, etc.0
=13.05
Dry volume of mortar=13.05+(33% of 13.05) =17.35
Cement: Sand 1:6
Cement=Volume of dry mortar x Ratio of cement x density of cement
Sum of ratio
=17.35 x 1/7 x1440
=3569 kg
1 bag of cement=50 kg
Total number of bags=3569/50=71.38~72 bags

7.2.3.Plastering:

Cement: Sand=1:4
Mortar quantity for plaster=13.7 m3
Consider 20% wastage, joints, etc.,
Wet volume of mortar=16.44m3
Dry volume ofmortar=16.44x1.35= 22.19m3
Cement for plastering= Dry volume of mortar x cement ratio/Total ratio
=22.19x1/5=4.44 m3 x 1440=6390.72 kg (Density of cement=1440 kg/m3)
Total No of bags for plastering = 6390.72/50=127.8 units~130 Bags
Total Bags of cement for Construction=650 units

7.3.Sand:

1.5/5.5 x 82.78=22.57 m3 x 1450 = 32735.7 kg
(Density of sand = 1450 kg/m3)
For brickwork:14.87 cu. meter
Total=37.44 cubic meter x 35.3417=1323.19CFT=13.23 Brass
For Plaster:
Sand=18.4m3 x 35.3417=650 CFT=6.5 brass
Total Sand in brass=19.73 Brass

7.4. Aggregates:

3/5.5 x 82.78 = 45.15 m3 x 1500 = 67729.09 kg
45.15 x 35.3417=1595.67 CFT
(Density of aggregates = 1500 kg/m3)

7.5. Bricks:

23744 units

7.6. Flooring:

1.3 x built up area =1.3 x 2738=3559.4sq ft

7.7. Sanitary Ware:

4 Commodes
4 Basins
3 Shower Sets

7.8. Lights:
40 Ceiling Lights

7.9. Wood (For Doors):
1 main door,3 room doors,2 service doors=145.6 sq ft~150sq ft

VIII. RATE COMPARISON:

Materials **Cost Difference**

1.Steel (8778.58 Kg)
Tata Steel (60Rs/Kg) Kalika Steel 54 Rs/Kg
5,26,714/- 474,043/- 52,671/-

2.Cement (650 Bags)
Birla Super (350Rs/Bag) Ambuja (320 Rs/Bag)
2,27,500/- 2,08,000/- 19,500/-

3.Sand (19.73 Brass)
River Sand (10000/Brass) M-Sand (5500/Brass)
1,97,300/- 1,08,515/- 88,785/-

4.Bricks (23744 units)
Red Brick (9Rs/piece) Fly ash Brick (7Rs/piece)
2,13,696/- 1,66,208/- 47,488/-

5.Flooring (3559.4sq ft)
Marble (150 Rs/sq.ft.) Vitrified Tiles (65 Rs/sq. ft.)
5,33,910/- 2,31,361/- 3,02,549/-

6.Sanitary:
Jaquar Cera
Commode 34,400/- 16,060/-
18,340/-
Wash Basins 13,400/- 8,780/- 4,620/-
Shower Sets 8,025/- 5,850/- 2,175/-

7.Lights (40 Ceiling Lights)
Havells (930 Rs/bulb) Wipro (654 Rs/bulb)
37,200/- 26,160/- 11,040/-

8.Wood (150 sq.ft.)
Teak Wood (700 Rs/sq.ft) BlockBoard (130 Rs/sq.ft)
1,05,000/- 19,500/- 85,500/-

Total:
1897145/- 1264477/- 6,32,168/-

IX. CONCLISION:

- The primary goal of the project was to propose a cost-effective study that addresses the problems of mass housing schemes and the inadequate cost-effectivepractices.For this purpose,identified cost effective building materials and technologies without sacrificing the quality,strength and durability.Newly introducing building material M-sand can be used replacement as river sand.This ceramic sand waste results sustainable and ecofriendly construction. Use of vitrified tiles gives the same finish as marble but saves the cost. Also it reduces the labor charges and reduces the cost of polishing. And these building materials developed properly hold the key to address the current housing needs.
- Block wood is used over teakwood to contain the sustainability, durability in doors. While fly ash bricks are used over red bricks something different from conventional way and also reduces the cost without compromising with the strength
- By using alternatives for conventional materials, we saved 6,32,168 Rs in the project cost.

REFERENCES:

[1]. Abolhassan vafai, Massoud Mofid and Homayoon E.Estekanchi (1997) “Experimental Study of Prefabricated Funicular Shell Units”. EngineeringStructures, Vol.19, No 9, Pp.748-759

[2]. P. Sachithanantham (2012) “Study on Geo-grid Reinforced Shallow Funicular Concrete Shells Subjected to Ultimate Loads”. International Journal of Biotech Trends and Technology-Volume 2 Issue 2 Number 2, April 2012. pp 34-46.

[3]. Prof. Dr. Srividya. V ET. Al., “Stability analysis of the precast slab using porotherm blocks “International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) Vol.3, Special Issue 8, March 2016

[4]. Kasturba, Krishna R Reddy, Venkat Reddy, Use of Laterite as a sustainable building material in developing countries, International Journal of Earth Sciences and Engineering, vol. 7 issue 4 August 2014, pp. 1251-1258

[5]. B.V.V Reddy, Suitability of M-Sand as fine aggregate in mortars and concrete, CSIC project: CP 6597/0505/11-330 date 5th July 2011.