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COST EFFECTIVE – ECOFRIENDLY SUSTAINABLE HOUSING

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Abstract

There have been advances in construction technology which have been rapid and in a sense universal. Its application and implementation has cut across regions and cultures around the world and have opened architectural possibilities challenging imagination. Suitable to all climate zones, use of cement and steel particularly termed as conventional materials, use of such energy intensive conventional materials now dominate almost all construction making it environment imperative and increasingly costlier technology. Though modern technologies are effective and stable we can learn a great deal from traditional methods (locally available material incorporated with skill and technology so as to not improvise strength) or a blend of the two old and the new creating synergy which can be meaningful, relevant and even explosive. The modern can provide the vitality and stability while the traditional can contribute with decomposable, environment friendly material that can accessed easily and create aesthetic ambience at lower cost (with regard to LIG). Cost effective technologies in particular assume a special significance in our country.

Keywords: Cost effective, Energy intensive, LIG (lower income group), Rammed earth, Rat trap, Sustainable.

I. INTRODUCTION

India as vast she is, she is blessed with diversity in cultures, people and there outlook towards material artifacts. Depending on these diversities and mother natures aggressiveness in climate the country also has a varying diversity of construction. From use of stone and mud to use of only bamboo it is a matter of great research to learn from these diversities that have been acquired after hundreds of trial and error to suit the topography and climate of the region. It is indeed fascinating that we still have remains of such shelters across the country and the world.

The need of shelter is the need of all and hence with increasing population and rise in number of people not able to construct suitable dwelling is infect there dependence on conventional material which is byproduct from industry i.e. requires energy to be produced making its price rise constantly and degrading environment at the same time.

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Bricks -5 lakh bricks consume 1 acre of agricultural land, 1 lakh bricks emit 31 tonnes of carbon dioxide.

Fresh water – a bag of cement needs 350 to 500 liters of water, thus 60% of construction material is water

Cement –factories emit 90 kgs of carbon dioxide to produce 50 kg cement bag.

Sand -10 to 15 % of building material used in house construction is precious river sand.

Steel –production of 1 tonnes of steel emits 4,3 tonnes of carbon dioxide.

Today's building methods make an adverse impact on environment as they consume materials from non-renewable sources and despite having the demerit they are universally backbone of construction throughout the world, because of the fact that they provide rigidity and stability to the structure. And an abode without strength is not as satisfactory, hence out competing traditional methods.

In order to incorporate traditional methods or locally available renewable materials in construction to make a dwelling cost effective and eco friendly and at the same time rigid and stable we should first use the blend of the two technology by creating maximum effectiveness of both, and slowly changing the overall perception of the community that can not afford aesthetic adobe.

Where the traditional methods can be used in supporting walls, roof, floor, roof, etc and the modern technology can be used for construction of foundation and columns to provide stability to the structure.

II. IMPACT AND IMPLEMENTION

A. Benefit

- Housing for LIG with reduction of cost.
- Reduced dependence towards conventional materials, by use of renewable biodegradable and recyclable traditional materials.

B. Technology

Housing for poor is all about reduced cost. However it is reality that there is inevitable attraction to use steel and cement (energy intensive material) whose cost rises continuously presumably there have been search for cost effective construction technologies.

Traditional building materials and practices can indeed yield structures which are stable , lasting and can fulfill the engineering requirement of present day. In the past architect like **Laurie Baker** has demonstrated how brick and mud can lead to a most comfortable abode.

C. Transfer of technology

Cost effective construction technologies combine best from the traditional with the most appropriate from modern. To any construction particular feature depends critically upon attitude and orientation of and engineer and architect, It can not be conceived if both are not convinced of the design and technology utilized therefore such technology should be implemented with relevance to such utility where both groups move from relative ignorance and apathy to conviction and enthusiasm. There has been urbanized perception to disregard skills and practices of villages while it is forgotten that the same backward villages have had the skills of the blacksmith who produced statuettes with powder metallurgy even unmatched today. The architects and engineers who created Taj Mahal or the tomb of Sher Shah Suri.

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III. METHODOLOGY

Suitable construction can be carried out by procedural advancement towards roof. To implement both technologies differentiate the structure to – foundation, walls, ventilation, roof, and floor. Comparison of low cost structure to conventional structure.

IV. FOUNDATION

The design of foundation should depend on the characteristics of load bearing capacity of the ground , to provide rigidity to structure it should be constructed with modern technology in order to bear load of superstructure (cost effective example is trench foundation). Deep foundation for loose earth(areas with black cotton soil), shallow foundation for rocky area, and pile foundation for unstable earth (coastal areas). In seismic zones excavate the foundation to 150 mm below ground level where base concrete is 150 mm thick in 1:3:6 mix.

Treatment at sill level in case foundation is made with normal un-coursed rubble stone masonry the stones should be roughly chiseled and dressed not increase in height or length , all stoned arranged to break joints .height of stone wall is raised to sill level in order to give protection from flood or stagnation of water.

V. WALLING

A. Mud blocks

Locally available murrum is made into mud with equal amounts of sand, silt and clay. Try to achieve the fine particles under the sieve of 0.2 mm for silt and clay and up to 2.0 mm for sand. There is no need of press or ram .fix a terracotta tile on the face end of block mould in order to make it water resistant. If not available coat the face end with bitumen.

After the soil is prepared perform manual test to the mixture , cigar test – roll a piece into a sausage shape or cigar shape press one end and keep rolling until it breaks (if it breaks quickly the mixture is too sandy , if it breaks after a period the mixture is too clalay.)

Biscuit test-make a fat biscuit of the mixture dry it under sun , if it breaks as soon as you pick up it is useless , if it is over baked and crakes have appeared it is not good composition until stabilizers are used and if the biscuit falls after applying pressure but is hard to crumble, it is good mud for construction.

Method of casting make a wooden scantling, apply ash on the casting surface for smooth ejection place the mixture and jam it compressing with pressure until the mud is evenly distribute , file the extra mud and use sponge to provide smooth finish . place the mould under sun for a day and then turn to other side for another day. after the surface is dried remove from the mould and place the block in sun where it can be left for drying after 10 days it is ready to put into construction it will cost around Rs. 1.25 per block.

B. Fly stone with lime

Fly ash when mixed with lime forms a solid incompressible bond when added gypsum its settling time is increased and compressive strength is also increased. After the mix is prepared calcium sulfate is released which is responsible for high strength making it chemically bonded brick

Sand, quarry dust and saw dust can be can be used to make the block more stable as if the amount of fly ash is

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increased the strength of the block is lost.

C. Rammed earth wall

Compressed earth wall or rammed earth wall is a medieval age traditional technology some of its century old buildings are still standing mostly in Iran and Middle Eastern countries.

A mixture of equal proportions of sand, clay , soil and water is prepared (1:1:1:1).

Depending upon climatic conditions some stabilizers may need to be added such as straw, hay, cow dung depending upon local conditions and hence the local hut masons should be enquired to create better suited mix.

VI. ROOFING

The implementation of indigenous building materials and structural forms should be socially harmonized to perform real improvements in the construction types. Bamboo is a low-cost building material available in wide parts of the world: it is lightweight, durable, flexible, and easily cultivated and processed. An interesting use of bamboo for low-cost buildings is the erection of light roofs well-connected to the walls, and the arrangement of frames entirely made by bamboo or with the help of other materials. The mechanical properties of bamboo are relevant in seismic areas: lower inertia involves minor seismic actions and a good connection to the top of the walls. Gable style roof is easy to construct helps in water collection; installation of solar panels as tiles is possible and gives an esthetic look. A layer of mortar can be spread over bamboo mats or bamboo tiles in order to strengthen the structure and cancel out permeability of seepage.

VII. SELF SUFFICIENCY

Installation of solar panel as roof tiles with integrated roof top rain water harvesting system which allows collection of water for cleaning of solar panels or in very dry areas for other use.

VIII. CONCLUSION

The house constructed with such material and design is comparatively a very cost effective and the environmental aspects make it worthy to be implemented while there is lot of disregard for such construction technologies from engineers and architects. the rising prices of conventional material is bringing everybody to the education of these aspects of traditional construction

IX. RESULT

The work done involved a house with front wall made of mud blocks, side walls made of compressed soil. Rear wall made of fly ash stone and lime blocks, roof in gable style over a bamboo truss and solar and rain water harvesting system for the increased self sufficiency. the house proved to be ideal for rural or slum area .

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