ISSN: 2455 – 4200
International Journal of Engineering Research and Modern Education
Impact Factor 6.525, Special Issue, April - 2017
6th National Conference on Innovative Practices in Construction and Waste Management
On 25th April 2017 Organized By
Department of Civil Engineering, Sri Ramakrishna Institute of Technology, Coimbatore, Tamilnadu

A REVIEW ON COST EFFECTIVE BUILDING - A SUSTAINABLE APPROACH

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Cite This Article: J. Jayashree, C. Ramesh & S. T. Namitha Sheen, "A Review on Cost Effective Building – A Sustainable Approach", Special Issue, April, Page Number 1-5, 2017.

Abstract:
Cost effective building technologies aim to cut down construction cost by using alternatives to conventional methods and Input. "It is effective budgeting and technique which help in reducing cost of construction through use locally available material along with improve skills and technology without sacrificing the strength, performance and life of structure''. Cost effective housing satisfies almost most bottom and fundamental human needs for shelter and neglects other needs that people aspire home including psychological, social, and aesthetic needs and ultimately, need for self-actualization. Clearly there is need to look for alternatives; this paper examines and suggests alternatives building techniques and designs that while still providing acceptable housing, do so at reduced costs.

Key Words: Alternate Materials, Basic Need, Conventional Methods, Low Cost & Utilizing Service

1. Introduction:

Basic need of man in today's world is food, clothing and shelter. Having a home for themselves is a dream for people who are from low income group in our country, whether he is a farmer, labor or private employee. Cost of construction is at peak as the amount spent for wages and material have raised. A poor man has to spend his entire life in constructing a house for him selves. Cost effective housing is reasonable for low income owners. India as a developing country, there is a need of cost effective construction technology and materials. A building constructed of low cost doesn't mean to sacrifice with strength or build with operational materials but it means effective use of local materials and techniques that are durable and require less maintenance. Low cost material reduce the cost by using alternative techniques. Shelter is primary to human existence. It has been rightly adjudged second to food in the hierarchy of human needs. Considering the health, welfare and productivity of man, housing plays a significant role. Housing is material symbol and space which is a microcosmic reflection of social and cultural expectation. It reflects the cultural, social and economic values of a society and is the best physical and historical evidence of civilization in a country. The importance of housing to a man cannot be over emphasized. Man spends most of his time in the 'house'. The attitude of man and his urge to work can be influenced by the type of housing provided.

2. A Review on Cost Effective Building:

Rinku Taur, Vidya Devi T (2009) have published a paper on 'Low cost Housing' . In the paper they have discussed that in India, the technology to be adopted for housing components should be such that the production and erection technology be adjusted to suite the level of skills and handling facilities available under metropolitan, urban and rural conditions. They made a point out on the various aspects of prefabricated building methodologies for low cost housing by highlighting the different prefabrication techniques, and the economical advantages achieved by its adoption. In a building the foundation, walls, doors and windows, floors and roofs are the most important components, which can be analyzed individually based on the needs thus, improving the speed of construction and reducing the construction cost. The major current methods of construction systems considered are namely, structural block walls, mortar less block walls, prefabricated roofing components like precast RC planks, precast hollow concrete panels, precast concrete/Ferro cement panels are considered.

P. P. Bhangale, Ajay K. Mahajan (2013) have published a paper on 'Cost Reduction through Cost Effective Construction Techniques' .In it they discussed that, the need of the mass housing targets can be achieved by replacing the conventional methods of planning and executing building operation based on special and individual needs and accepting common denominator based on surveys, population needs and rational use of materials and resources. The conventional methods used for housing must be analyzed and replaced by new developed construction techniques based on technical experiments and analysis. The implementation of any technology using alternate methods on large scale needs a guaranteed market to function and this cannot be established unless the product is effective and economical. The government agencies must support these techniques to promote the low cost construction techniques by making awareness amongst users and contractors executing the works. Partial prefabrication is an operation which is executed under controlled conditions. The essence lies in the systematic approach in building methodology and not necessarily particular construction type or design. The technique followed for low cost housing has to be of intermediate type with less sophistication involving less capital investment. If we adopt the right method at the right place by implementing these technique we can succeed in getting solution over costly housing.

Swaptik Chowdhury, Sangeetha Roy (2013) have published a paper on 'Prospects of Low cost housing in India'. In their paper they discussed, alternate construction materials were studied and the potential of these materials to be used as al- ternate building materials is brought out. Depending on the availability of the materials in a particular region, these materials can be selected as transportation consists of approximately 30% of total construction budget. In most of the developing countries a great challenge is to organize and initiate measures that promote these materials as well as train local artisans and masons in the construction techniques involving these materials. There have been several attempts at local levels to make use of bamboo, mud or natural fibers but it still lacks scientific precisions and proper techniques to be used precisely. Also the us- age of industrial wastes

still needs study on their better usage toxicity. These materials if studied and developed properly hold the key to address the current housing needs.

Ali Haider Jasvi, D.K. Bera (2015) have published a paper on 'Sustainable use of low cost building materials in the rural India'. In the paper they suggested that, Good housing is a need to every human being. Everyone wants to live in big houses which are comfortable. In urban areas there is a shortage of number of houses. People need houses that are attractive, having more life span, larger space area, environmental friendly and cheaper. Therefore cost effective houses and low cost houses are needed to fulfill the demand. The materials that are locally available and technology serve a purpose for low income people. Using cost effective technology will not only save money but also reduce CO_2 emission, save time and faster production. A reduction in cost of 20-30% can be achieved by using alternative methods. New housing technology improves the eco system of the society. Improving housing methodology is essential. Housing is segregated either by design or location. It is essential that different income people must interact with each other to develop the community, it can be done by mixed use development, mixed income development or co-housing.

Oloruntoba Kayode, Ayodele E. Olusegun have published a paper on Local Building Materials: a Tool Towards Effective Low-Income Housing in Nigeria .This study recognized the significance of housing to man and the dismal performance of both government and private sectors in the involvement of housing delivery in Nigeria dates back to the pre-independence. The involvement of individuals in the construction of their building was acknowledged among the lower income earners as a means of providing themselves an affordable housing. It is found that the setback determined in providing housing for the low-income via their personal efforts was hinged on the high cost of the building materials which can be traced to high rates of imported materials used for construction that's attracted much cost compared to the local building materials. The local building materials exhibited lower and affordability cost for the lower income. There are varied alternative material that can serve the need and purpose of the imported materials if proper knowledge and encouragement were given to the Nigerian citizen by the government. As such, the Nigerian citizen will enjoy housing affordability for the lower income earners that constitutes the larger population.

B Bakhtyar, A Zaharim, K Sopian, S Moghimi (2013), have published a paper on Housing for Poor People: A Review on Low Cost Housing Process in Malaysia. In the paper, the Malaysia plans is expected to see the government's continuous effort to ensure that Malaysians of all income levels will have access to adequate, quality and affordable homes, particularly for those under the low-income group. In this regard, the private sector is expected to support the government's initiative to build more low- and low-medium-cost houses in their mixed-development projects while the public sector will concentrate on building low-cost houses as well as houses for government employees, the disadvantaged and the poor in urban and rural areas. To enhance the quality of life of the urban population, the provision of more systematic and well-organized urban services programs will emphasize on sustainable development, promoting greater community participation and social integration of the population. In very short summary this study shows if the authorities (government) can balance low income obligations and developer's profit-making objective then developer can increase the number of permanent affordable housing units and enhance the quality of settlement areas according Malaysia plans' targets.

Bredenoord J (2016) carried out study on sustainable Housing and Building Materials for Low-income Households; it is observed that sustainable goals for low-cost housing and applications are achievable. Measures concerning the physical development of neighborhoods, such as urban density and connectivity are equally as important as measures concerning community development. The final comprise support for community built organizations, small housing cooperatives (or similar forms of cooperation) and individual households – or small groups – that build and increase their houses incrementally. Adequate design and social organization and support are preconditions for achieving sustainability in incremental housing.

Preetpal Singh et al (2016) carried out study on Low Cost Housing: Need For Today's World; it is observed that Construction cost in India is increasing at around 50 per cent over the average inflation levels. It have enumerated increase of up to 15 per cent all year, mainly due to cost of basic building materials such as steel, cement, bricks, timber and other inputs as well as cost of labour. The building cost which includes the amount spent on conventional construction materials and construction is becoming beyond the affordable limits particularly for low-income groups of population as well as a big cross section of middle - income groups. So, there is essential to adopt cost-effective construction methods either by up-gradation of traditional technologies using local resources or applying current construction materials and methods with well-organized inputs leading to economic solutions. By using Low Cost Housing Technologies, we can reduce approx. 25% of the total cost of housing.

Felix Raspall et al (2014) carried out study on Building from End-of-Life: An Alternative Approach for Low-Cost Urban Housing, it is observed that our research investigates the possibilities of beating into the life cycle of construction materials as a basis of unexploited construction components for low-cost housing. In the informal city, a market of salvaged materials is already in place. Though, in the urbanized world, reuse practices in construction are characteristically dismissed. This research contributes with strategies to secure very low-cost housing units consuming reused construction components, focused on the functional, aesthetic and economic aspects.

3. Affordable Housing:

A. General: After food and clothing, the most important basic human need is shelter. A major constraint in meeting this demand is the drastic rise of prices of building materials. This has made the dream of a safe livable house to go beyond the capacity of a poor family. It is important to go for affordable housing by the beneficiaries by alternative construction options other than the conventional constructions which is very is very expensive. The rural people are ready to survive in low cost shelters as they only have the ground by side of city slumps, the land is the issue and we need to go floors building those are affordable. The Cost Effective Building Technology and community's participation in designing social Housing project as a package is the major

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component of affordable housing. Low-cost housing or LCH is slowly getting more spoken on the agenda of developers. While this is understandable, because of the enormous gap between supply and demand, what should be worrying is that high land cost, and lack of connectivity owing to poor infrastructure are proving to be major impediments to LCH in India. Several third world governments have attempted to address the issue through housing policies or programs such as provision of serviced sites and extendible units. Other measures include housing schemes such as subsidized home loans, distribution of (free-) house plans, and through promoting private sector involvement. These attempts have not addressed the issue in full; indications are that the main problem is that all systems that have been tried are aimed at providing conventional housing units using inadequate resources – skills, equipment, materials and finance. The reality though is that most developing countries do not have adequate capital resources to construct conventional dwellings.

B. Logical Approach to Optimize Housing Solutions:

- ✓ There should be a logical approach for providing appropriate technology based on the availability of options, considering its technical and economical analysis.
- ✓ There should be optimal space in the design considering efficiency of space, minimum circulation space.
- ✓ Economy should be considered in design of individual buildings, layouts, clusters etc.
- ✓ While preparing the specifications it should be kept in mind that, cost effective construction systems are adopted.
- ✓ Energy efficiency has gained considerable importance due to energy crisis especially in developing countries. Orientation, built–form, openings & materials play a vital role besides landscaping / outdoor environment.
- ✓ To develop an effective mechanism for providing appropriate technology based shelter particularly to the vulnerable group and economically weaker section.

C. Availability of Natural Fibre in India and Its Application in Building Materials:

Rice Husk
Source: Rice mills
Application: As fuel, for manufacturing building materials and products for production of rice husk binder, fibrous building, panels, bricks, acid proof cement.

Banana Leaves/Stalk
Source: Banana plants
Application: In the manufacturing of building boards, fire resistance fibre board.

Coconut Husk
Source: Coir fibre industry
Application: In the manufacture of building boards, roofing sheets, insulation boards, building panels, as a lightweight aggregate, coir fibre reinforced composite boards.

Groundnut Shell
Source: Groundnut oil mills
Application: In the manufacture of buildings panels, building blocks, for making chip boards, roofing sheets, particle boards.

Jute Fibre
Source: Jute industry
Application: For making chip boards, roofing sheets, door shutter.

Rice/Wheat Straw
Source: Agricultural farm
Application: Manufacture of roofing units and walls panels/boards.

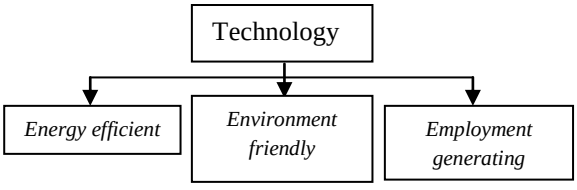
Saw Mill Waste
Source: Saw mills/Wood
Application: Manufacture of cement bonded wood chips, blocks, boards, particle boards, insulation boards, briquettes.

Sisal Fibres
Source: Sisal plantation
Application: For plastering of walls and for making roofing sheets, composite board with rice husk, cement roofing sheet, roofing tiles, manufacturing of paper and pulp.

Cotton Stalk
Source: Cotton plantation
Application: Panel, fibre board, door shutters, roofing sheets, autoclaved cement composite, paper, plastering of walls.

4. Technologies and Alternate Materials for Cost Effective Construction:

A. Technologies for Cost Effective Construction:



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Energy Efficient:

Simple machines - saves energy in production

Raw materials - derived from agro-industrial wastes and natural fibres, requires less energy in production

Products - when used in house, buildings provide better thermal comfort that results in conservation of operational energy.

Environmental Friendly:

Converts agro-industrial waste into alternative material for low cost housing, thus improving waste management & environmental protection

Utilises local resources

Substitutes wood - preserving forest cover

Substitutes top soil - preserving soil for agriculture

Employment Generating

Simple machines - with manual handling, increases employment for unskilled and semi-skilled workers

Small enterprises - can be set up at decentralized locations

Production of components - involves local people after short training

B. Alternate Materials for Cost Effective Construction:

Techniques	Materials
Roof & Floor: 1. Filler slab 2. Brick panel roofing 3. Flat slab 4. L&T Flex table system	**Natural Materials:** 1. Bamboo fibre 2. Earth 3. Straw fiber 4. Baggase fiber 5. Jute & coir fiber 6. Sisal fiber 7. Banana fiber 8. Rice husk
Wall Construction: 1. Soil stabilized block 2. Hollow concrete block 3. Rat trap bond 4. Thin joint construction 5. Fly ash sand lime bricks 6. Aerated concrete blocks	**Manmade Materials:** 1. Fly ash 2. Aerocon panels 3. Ferro cement 4. Recycled steel reinforcement 5. Precast R.C.C
Other Techniques: 1. Aluminium formwork/ Mivan formwork 2. Tunnel formwork 3. Gypsum area separation wall 4. GFRG panel building system	-

5. Advantages of Using Alternate Materials for Cost Effective Construction:

- ✓ Filler slab is most economical than traditional slab as it shows a saving of 16%, 44%, 17% of cement, steel and cost in two-way slab and 33%, 46%, 25% in one way slab respectively .
- ✓ Brick panel saves 19% per m^3 and Rs 418 in cement, 19% per m^3 and Rs 21 in sand, 19% per m^3 and Rs 127 in aggregate, and 38% per m^3 and Rs 536 in steel
- ✓ Soil stabilized bricks are 27.7% of lower cost when compared to country fired bricks walls, where country fired bricks use Rs 934 per m^2 there soil stabilized bricks use Rs 736 per m^2, they are less air pollution, energy consumption, carbon emission
- ✓ Aluminium form work is a comparatively high cost construction but give high quality and speed construction which can be used in places where speedy construction is required. GFRG buildings show a saving of 50.8%, 35.2%, and 27.47% of cement, steel and cost to convectional buildings.
- ✓ Flat slab the total quantity of steel and concrete used are 8.644m^3 and 1294m^3 as compared to conventional building which uses 10593m^3 of steel and 1505.25m^3 of concrete and the cost saving percentage in flat slab is 15% in B+G+3 building respectively .
- ✓ Hollow cement concrete blocks are used for those areas where the load is not coming directly on wall, the cost saving is by 17.78%.
- ✓ Rat trap bond are much economical than convectional bricks as they reduce the usage of bricks by 25% and the mortar by 40% , and reducing the load by 8% while giving same compressive strength with a saving of 57% in cement cost, 20% saving in bricks, and 61% saving in sand.

6. Conclusion:

The review paper describes a list of approaches for reducing construction cost is of general nature and it varies depending upon the nature of the building to be constructed, budget of the owner, geographical location where the house is to be constructed, availability of the building material, good construction management practices etc. However it is necessary that good planning and

design methods shall be adopted by utilizing the services of an experienced engineer or an architect for supervising the work, thereby achieving overall cost effectiveness to the extent of 25% in actual practice.

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