ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

APPROACH TO LOW COST HOUSING

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Abstract:

Adequate housing for all people is one of the pressing challenges faced by the developing countries. India is currently facing a shortage of about 17.6 million houses. The dream of owning a house particularly for low-income and middle-income families 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. The paper presents the material selection criteria and some of the major construction techniques to achieve low cost housing by low income group people.

Keywords: Low cost Housing, Cost, Effectiveness, and Construction.

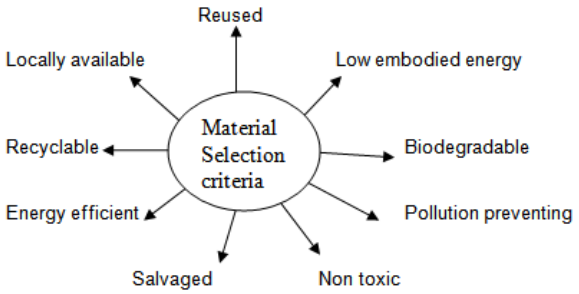
1. Introduction

Affordable housing refers to housing units that are affordable by that section of society whose income is below the median household income. Though different countries have different definitions for affordable housing, but it is largely the same, i.e. affordable housing should address the housing needs of the lower or middle income households. Affordable housing becomes a key issue especially in developing nations where a majority of the population isn't able to buy houses at the market price.

Low Cost Housing is a new concept which deals with effective budgeting and following of techniques which help in reducing the cost construction through the use of locally available materials along with improved skills and technology without sacrificing the strength, performance and life of the structure. There is huge misconception that low cost housing is suitable for only substandard works and they are constructed by utilizing cheap building materials of low quality. The fact is that Low cost housing is done by proper management of resources.

Construction of low cost housing by using the low cost building materials increases the access to buildings by low income group peoples. Low cost housing can be achieved by use of efficient planning and project management, low cost materials, economical construction technologies and use of alternate construction methods available. The profit gained from use of such methods can decrease the cost of construction and make the low cost housing accessible to all.

The use of low cost alternate building materials also prevents the rise of construction cost due to use of scarce building materials which eventually increase the cost of the project.



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2. Selection of Materials for Low Cost Housing

The first step to low cost housing material selection is to select ecofriendly building materials. This also enhances the sustainable design principle. The life cycle of a building is pre-building, building and post-building stages. Each stage of building should be such that they help conserve the energy. These three stages indicate flow of building materials through different stages of a building. Pre-building stage mainly consists of manufacture which is subdivided in processing, packing and transport. The building phase mainly consists of construction, operation and maintenance whilst as the last stage would be disposal where the material can be recycled or reused.

i) In Manufacturing of low cost building materials – Pollution prevention:

Manufacturing of building materials should be environment friendly. Efforts should be made to study and revise the technologies for producing good quality, efficient building materials and should reduce the waste generation during manufacturing. These results in reduction of pollutants to environment.

ii) Recycling of wastes in Manufacturing:

The wastes which are recycled can be used in masonries whilst as wooden wastes can be used in manufacture of plywood or soft boards.

iii) Reducing Energy Consumption and use of Natural materials:

The total energy required to produce a material is called embodied energy. The greater a material's embodied energy, it requires a greater usage of non-renewable sources. It is therefore advantageous to use materials or composite materials prepared from the wastages. The natural materials such as stones, wood, lime, sand and bamboo can be used in ample where ever

possible. The natural materials impact more sustainability to structures as well as they are friendlier to environment.

iv) Use of Local material:

The use of local materials reduces the dependence on transportation whose contribution to the building material cost is high for long distance. Use of locally available building materials not only reduce the construction cost but also are suitable for the local environmental conditions.

v) Energy Efficiency:

Energy efficiency of a building material can be measured through various factors as its
R-value, shading coefficient, luminous efficiency or fuel efficiency. Energy efficient materials must reduce the amount of generated energy.

vi) Use of non-toxic building materials:

Use of toxic building materials can significantly impact the health of construction people and the occupants of the building. Thus it is advisable to use the non-toxic building materials for construction. There are several chemicals including formaldehydes, benzene, ammonia, resins, chemicals in insulations, ply boards which are present in furnishings and building material. The effect on health of these toxic materials must be considered while their selection and they should be used only where-ever required.

Higher air cycling is recommended while installation of materials having volatile organic compound such as several adhesives, paints, sealants, cleaners and so on.

vii) Longitivity, durability and maintenance of building material:

The use of durable construction materials does not only enhance the life of the building but also reduces the cost of maintenance. The lower maintenance costs naturally save a lot of building operating cost. The materials used in buildings determine the long term costs of operation.

viii) Recyclability and reusability of building material:

A material should be available in form which can be recyclable or reusable. Ex – the plastics waste can be used for recycling and producing newer materials. The scrap from steel can be used to manufacture the RCC bars, binding covers and other miscellaneous steel products in building construction.

ix) Bio degradability:

A material should be able to decompose naturally when discarded. Natural materials or organic materials would decompose very easily. It is also a very important consideration whether a material decomposes naturally or produces some toxicgases.

3. Low Cost Construction Techniques:

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From conventional construction practices, areas where cost can be reduced are:-

1) Reduce plinth area by using thinner wall concept.Ex.15 cms thick solid concrete block wall.

2) Use locally available material in an innovative form like soil cement blocks in place of burnt brick.

3) Use an energy efficient material which consumes less energy like concrete block in place of burnt brick.

4) Use environment friendly materials which are substitute for conventional building components like use of R.C.C. Door and window frames in place of wooden frames.

5) Preplan every component of a house and rationalize the design procedure for reducing the size of the component in the building.

6) By planning each and every component of a house the wastage of materials due to demolition of the unplanned component of the house can be avoided.

7) Each component of the house shall be checked whether if it's necessary, or not.

3.1 Foundation:

Normally the foundation cost comes to about 10 to 15% of the total building and usually foundation depth of 3 to 4 ft. is adopted for single or double storeyed building and also the concrete bed of 6″(15 Cms.) is used for the foundation which could be avoided.

It is recommended to adopt a foundation depth of 2 ft.(0.6m) for normal soil like gravely soil, red soils etc., and use the uncoursed rubble masonry with the bond stones and good packing. Similarly the foundation width is rationalized to 2 ft.(0.6m).To avoid cracks formation in foundation the masonry shall be thoroughly packed with cement mortar of 1:8 boulders and bond stones at regular intervals.

It is further suggested to adopt arch foundation in ordinary soil for effecting reduction in construction cost up to 40%.This kind of foundation will help in bridging the loose pockets of soil which occurs along the foundation.

In the case of black cotton and other soft soils it is recommend to use under ream pile foundation which saves about 20 to 25% in cost over the conventional method of construction.

3.2 Plinth:

It is suggested to adopt 1 ft. height above ground level for the plinth and may be constructed with a cement mortar of 1:6. The plinth slab of 4 to 6″ which is normally adopted can be avoided and in its place brick on edge can be used for reducing the cost. By adopting this procedure the cost of plinth foundation can be reduced by about 35 to 50%.It is necessary to take precaution of providing impervious blanket like concrete slabs or stone slabs all-round the building for enabling to reduce erosion of soil and thereby avoiding exposure of foundation surface and crack formation.

3.3 Walling

Wall thickness of 6 to 9″ is recommended for adoption in the construction of walls all-round the building and 4 1/2" for inside walls. It is suggested to use burnt bricks which are immersed in water for 24 hours and then shall be used for the walls

3.3.1 Rat – trap bond wall

It is a cavity wall construction with added advantage of thermal comfort and reduction in the quantity of bricks required for masonry work. By adopting this method of bonding of brick masonry compared to traditional English or Flemish bond masonry, it is possible to reduce in the material cost of bricks by 25% and about 10 to 15% in the masonry cost. By adopting rat-trap bond method one can create aesthetically pleasing wall surface and plastering can be avoided.

3.3.2 Concrete block walling

In view of high energy consumption by burnt brick it is suggested to use concrete block (block hollow and solid) which consumes about only 1/3 of the energy of the burnt bricks in its production. By using concrete block masonry the wall thickness can be reduced from 20 cms to 15 Cms. Concrete block masonry saves mortar consumption, speedy construction of wall resulting in higher output of labour, plastering can be avoided thereby an overall saving of 10 to 25% can be achieved.

3.3.3 Soil cement block technology

It is an alternative method of construction of walls using soil cement blocks in place of burnt bricks masonry. It is an energy efficient method of construction where soil mixed with 5% and above cement and pressed in hand operated machine and cured well and then used in the masonry. This masonry doesn't require plastering on both sides of the wall. The overall economy that could be achieved with the soil cement technology is about 15 to 20% compared to conventional method of construction.

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3.4 Doors and windows

It is suggested not to use wood for doors and windows and in its place concrete or steel section frames shall be used for achieving saving in cost up to 30 to 40%.Similiarly for shutters commercially available block boards, fibre or wooden practical boards etc., shall be used for reducing the cost by about 25%.By adopting brick jelly work and precast components effective ventilation could be provided to the building and also the construction cost could be saved up to 50% over the window components.

3.5 Lintels and Chajjas

The traditional R.C.C. lintels which are costly can be replaced by brick arches for small spans and save construction cost up to 30 to 40% over the traditional method of construction. By adopting arches of different shapes a good architectural pleasing appearance can be given to the external wall surfaces of the brick masonry.

3.6 Roofing

Normally 5″(12.5 cms) thick R.C.C. slabs is used for roofing of residential buildings. By adopting rationally designed insitu construction practices like filler slab and precast elements the construction cost of roofing can be reduced by about 20 to 25%.

3.6.1 Filler slabs

They are normal RCC slabs where bottom half (tension) concrete portions are replaced by filler materials such as bricks, tiles, cellular concrete blocks, etc. These filler materials are so placed as not to compromise structural strength result in replacing unwanted and nonfunctional tension concrete, thus resulting in economy. These are safe, sound and provide aesthetically pleasing pattern ceilings and also need no plastering.

3.6.2 Jack arch roof/floor

They are easy to construct, save on cement and steel, are more appropriate in hot climates. These can be constructed using compressed earth blocks also as alternative to bricks for further economy.

3.6.3 Ferrocement channel/shell unit

These provide an economic solution to RCC slab by providing 30 to 40% cost reduction on floor/roof unit over RCC slabs without compromising the strength. These being precast, construction is speedy, economical due to avoidance of shuttering and facilitates quality control.

3.7 Finishing Work

The cost of finishing items like sanitary, electricity, painting etc., varies depending upon the type and quality of products used in the building and its cost reduction is left to the individual choice and liking.

4.0 Case histories in India

BMTPC has been promoting cost-effective & environment- friendly building materials & construction techniques in different regions of the country. During recent past the council has been laying emphasis on putting up demonstration structures utilising region specific technologies . Such efforts for demonstrating innovative technologies have created a much better impact and helped in building up confidence and acceptability in private & public construction agencies, professional & contractors. Details of the major projects handled by them are given as under:-

4.1 Housing Project at Laggerre, Bangalore, Karnataka.

(Figures 1 & 2)

Project Profile:-

Name of scheme	:	VAMBAY – Ministry of HUPA
Location of site	:	Laggere, Bangalore
No. of Units	:	252 (Ground +2)
Built-up area of a unit	:	275sq.ft
Unit consist of	:	2 rooms 1 kitchen, 1 bath room, 1WC
Cost per unit	:	Rs.60000
Cost per Sqft	:	Rs.218/-
Nodal State Agency	:	Karnataka slum clearance Board

Fig. 1 Floor Plans

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Fig. 2 Elevation View

Name of scheme	:	VAMBAY – Ministry of HUPA
Location of site	:	Dehradun • Ram Kusth Ashram, Ryagi Road{28 Double Units(DUs)} • Rotary club kusthAshram,(BhagatSingh Colony (34DUs) • Shanti Kusth Ashram,Bhagat singh Colony (38DUs)

4.2 Housing Project at Dehradun,Uttarakhand.
(Figures 3&4)

Project Profile:-

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Fig. 3 Floor Plans

Fig. 4 Elevation

No. of Units	:	100
Built-up area of a unit	:	181sq.ft
Unit consist of	:	1room,kitchenspace, 1 bath room, 1WC
Cost per unit	:	Rs.45000
Cost per Sqft	:	Rs.249/-
Nodal State Agency	:	District Urban Development Agency

5.0 Conclusions

The dream of owning a house particularly for low-income and middle-income families is becoming a difficult reality. It is necessary to adopt cost effective, innovative and environment-friendly housing technologies for the construction.

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.

Adoption of any alternative technology on large scale needs a guaranteed market to function and this cannot be established unless the product is effective and economical.

The essence lies in the systematic approach in building methodology and not necessarily particular construction type or design.

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