

A Critical Review On Low Cost Housing System In India

SALIMEDA VENKATA CHARY

Student of MBA-Construction Project Management(2016-18),

School of Construction,

Royal Institution of Chartered Surveyors - School of Built Environment (RICS-SBE), Noida, NCR, India.

Abstract : In India, there are only 24.67crore, who are households(*India Census*, 2011).There are still Lakhs and Crores of people in the country, who do not own any house yet. Shelter is the most basic need of a human being and Economically weaker sections in a developing country like India are still facing much problems, as they are not able to own any house. Construction costs are also becoming higher because of high cost of materials and also due to high labour costs. The main aim of low cost housing construction techniques is to reduce the construction cost by following effective processes, methods and by utilising good alternate materials and this paper presents the same. Also this paper talks about the need for low cost housing, challenges to overcome construction of low cost housing and few construction techniques and methods for low cost housing.

Index Terms : Low Cost housing, Construction, Low Cost Materials, Pre cast, Passive design, Modular construction.

I.INTRODUCTION

1.1. Introduction to Low Cost Housing:

For any human being, food, clothes and shelter are the three basic needs, without which anyone cannot survive. Today, because of growing urbanisation, cost of land as well as houses in cities and towns is also rising. Most of the people are not in a situation to afford it and so this paper has been presented which talks about the various construction techniques and few materials that are available for providing shelter through construction of low cost housing units.

Low cost housing is the one in which cost of construction is reduced without any scope of reducing the quality and also ensures good or better performance of the housing units. Cost cuttings are achieved by using various alternate methods of construction and also by use of various alternate materials. There is also a misconception among various people that, low cost housing units are of low quality. However, this is not true and a false assumption. Government of India is also taking many initiatives in developing low cost housing segment and also affordable housing segment.

Low cost houses are especially designed for those people who are economically weaker and are backward in the society. Specifically, these are for the people belonging to Low Income Group (LIG) and Economically Weaker Section (EWS). From the last few years, low income group people are getting much support from the government, as earlier they didn't get much attention for their needs. There have been many changes in the policies and administration system to support the housing for the low income people.

1.2 Need for Low Cost Housing :

Although housing is the basic need for an individual, most individuals will not own a house. Today there is a lot of unsold inventory of the housing units in India, which were developed by various developers. The cost of these unsold inventory costs more than 50 lakhs of rupees each in different urban regions. But still there will be a shortage of many houses which are needed especially by the urban poor and rural poor. The maximum number of people who are not owning a house are the economically weaker sections of various states. If the current needs of housing are not provided, then the shortage of housing units can reach roughly up to 38 Millions by 2030(*Need for low cost housing, 2012*). Hence, there should be a remedy for providing the shelters to the weaker sections of the society.

Cushman & Wakefield had done a survey on demand & supply of housing for various categories of incomes in different cities of India. Bengaluru and Hyderabad have got demand of around 265 and 246 thousands of housing units respectively. But there is no supply for this group of people to satisfy their housing needs.

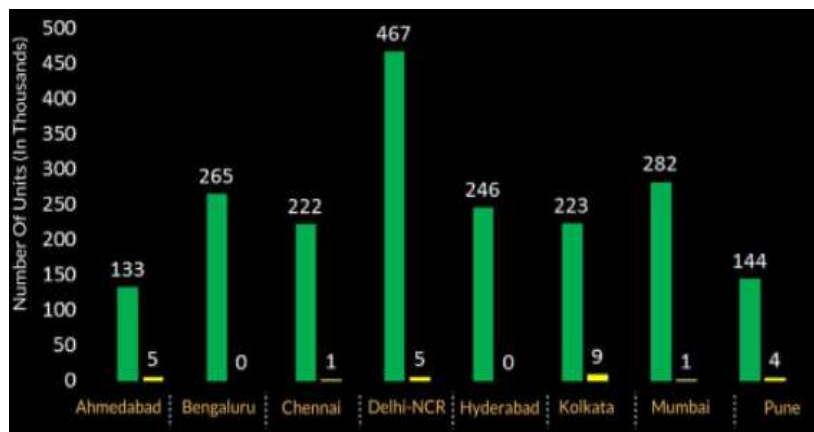


Fig.1: Housing Demand-Supply for Low Income Group

Source: (Cushman&Wakefield report, 2016).

Even though Delhi has a requirement of 450 plus thousands of housing units, the supply is still very low, where only 5 thousand of housing units were supplied for low income group people.

1.3 Transformation of rural regions into urbanization :

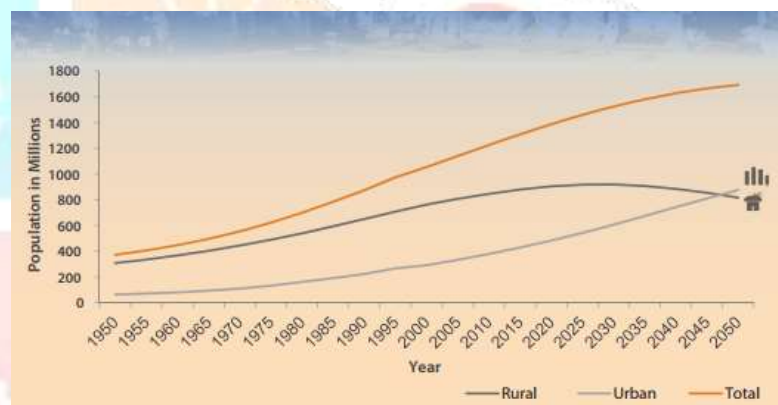


Fig.2: Expected Total Population of India (with rural and urban population).

Source: (India Census, 2011).

From the graph of figure.2, we can see that there has been a tremendous increase in the population of India. It is expected that the population of India will reach somewhere between 1600 Million and 1800 Million by 2050. Urbanisation is creating more jobs and people are moving to the cities in order to undertake more jobs. People belonging to low-income group will face problem with such urbanisation. People of high income and middle income group can afford to build the homes in such areas, so there should be a solution for the people belonging to low income group and to those, who are economically weaker.

II. LITERATURE REVIEW

2.1 Inability to Finance :

From the study of various literature reviews, it has been found that many poor people and poor families belonging to Asia, Africa and Latin America, people are not having any access to loans or mortgages to build a house or to even buy a house. This is mainly due to poverty and also they are unable to access any credit. Poverty is arising due to high rate of unemployment in these countries and even if they are employed, poor wages is the another reason for low availability of funds. Any financial institution or a bank usually favours people who work in an organized sector. Hence as poor people are unable to access the services of formal financial institutions, it is also a reason for not owning any house by them. Tata Housing made a report on customer research by studying the behavior of various customers. Low cost housing basically minimizes the cost of getting a house. Also by innovative construction techniques, project management triangle can be fully achieved, i.e time , cost and quality can't be compromised and can

be achieved. Low cost housing should be delivered without any delays. Because low income people cannot afford delays as it leads to loss for such people.

Tata has partnered with micro housing financing corporation to get funding for the low cost housing. Because many commercial banks are not interested to offer loans for weaker economic people. Now with the help of this micro financing corporation, financing for the projects can be done well(Eberhard and Karlsson, 2013).

By incorporating modern techniques like pre-fabrication and on-site waste reduction techniques, these projects can be delivered on time. It will not take more than 1.5 to 2 years of time. It also reduces cash flow risk, increases speed delivery of the projects and ultimately leads to good sales. Tata housing had said that focus should also be on sustainability. Because this will reduce the energy consumption and also decreases the operations and maintenance costs. Few of the TATA’s projects are IGBC certified and these projects have achieved 30% energy savings. Also they incorporated glazed windows, fluorescent lamps, solar lighting. 30-50% water savings are also achieved through rain water harvesting system.

2.2 Challenges in The Development of Low Cost Housing :

Monitor Deloitte once identified the top three challenges in the development of low cost housing, which are due to rising costs, required approvals and land acquisition. Out of these three, rising costs and approvals remain in the top two, while land acquisition is a third challenge(Agarwal, Jain and Karamchandani, 2013).

The other main challenges also include regulatory, bureaucratic, and financial constraints for developing low cost housing. Land availability or finding the land for low cost housing and affordable houses is also a major problem. It is very costly and is also very lengthy process to obtain land for this low cost housing segment. The approval process takes around 18 months to get approval and another eighteen months to finish the construction with in the time(Jones Lang LaSalle, 2012).So if the government reduces the number of approvals that are required for the development and increases the speed of approval, a developer can develop many low cost houses.

2.2.1 Challenges Related to Approvals:



Source:(KPMG, 2012).

Many estimates have revealed that most of the developers will be required to take approvals from 150 tables of various offices. These include approvals from various state and central bodies including the municipal bodies of respective states. As there exists lot of approvals, many of them are interrelated and delay in such approvals will lead to 25% - 30% of the cost overrun in a project. So if there is good coordination and communication between all these parties, it will lead to quick approvals and encourage developers to undertake such affordable or low cost housing construction projects. Even after the land acquisition is done, it will still take 2-3 years for commencing the construction(KPMG, 2012).

2.2.2 Challenges Related to Financing of Low Cost Houses:

Low cost housing construction does not mean that the finances required for construction are less. Though the cost of construction is less when compared to other segments of housing, it is still hard to develop such projects. Many banks do not offer loans on the lands. They have to look for other lending sources, where the cost of loans come at an interest rate of more than 15%. This creates lot of burden on the borrowers, as the rate of interest is very high. At the outset, developers are selling the units at 10-25% high cost to cover the interest rates (Jones Lang LaSalle, 2012).

2.3 Government support to Economically Weaker Sections and Low Income Group:

Today, Indian government is giving much importance for housing needs of the people of various states. The Housing and Urban Poverty Alleviation Ministry had made a revision to define Economically Weaker Section (EWS). If the annual house hold income of a house hold is Rs.5000 per month or sixty thousand per year, they have been called as Economically Weaker Section. But government has changed the house hold income from Rs.5000-10000/Month or Rs.60000-120000 annually to define them as EWS. Similarly Low Income Group has also been redefined from an annual income of Rs.60000-120000 to Rs. 1 to 2 lacs annually. The changes have been done so that their needs can be satisfied. These two categories of people are extremely important to the nation as they provide various services from agriculture to manufacturing industry. A low cost house could really provide them a strong psychological anchor including some financial security. Also government is developing various schemes like interest subsidy schemes, Pradhan Mantri Awas Yojana scheme and credit linked subsidy, etc. to give better chances for the poor to own a house. Under the PMAY scheme, poor people can get the loan upto 12lacs (*Housing and Urban Poverty Alleviation Ministry*).

III. POSSIBLE TECHNIQUES & METHODOLOGIES FOR LOW COST HOUSING :

1. Planning:

This is the most crucial part in achieving the low cost for a house construction. Most of the projects fail only because of improper planning. All the required financing, resources, construction methodologies and sequence of activities should be properly detailed. No scope of work should be altered in the execution stage. Quality should be considered. It is the primary blue print that will deliver the project effectively and efficiently.

2. Acquiring the land at a low cost:

The major problem for low cost housing or for construction of affordable housing is the acquisition of land. This is a big problem, which is currently being faced by major developers across the nation. One can select a land in those areas, which is in the outskirts of a town, and also which has got high scope of development in the coming future.

3. Modular construction design:

Modular construction is a process in which a building is constructed off-site, under controlled plant conditions, using the same materials and designing to the same codes and standards as conventionally built facilities – but in about half the time. When these modules are put together on site, it reflects the identical design intent and sophisticated specifications. Advantages of this technique are, it is a sustainable practice (green practice), faster and smarter ways of constructing a house.

3.1 Modular construction has the following advantages:

- Weather delays can be eliminated.
- Materials are less wasted.
- Can be reused and has greater flexibility.
- It is the most safest method of constructing a building.
- Construction schedules can be reduced.

4. Passive design techniques:

- Passive design techniques use the naturally available sources of energy like sun and wind for the purposes of heating, cooling, lighting and ventilation.
- This will reduce the energy bills in a building and also the heating load on a building.
- A building can be made comfortable for the people to live in, by naturally reducing the fluctuations in temperature and also it improves the indoor air quality.
- There is no need to incorporate much heavy external loads on a building to keep it cool. Hence it reduces the cost of HVAC systems or cost of air conditioners in a normal building.
- Passive design can be achieved only if a building is oriented properly so that it allows good ventilation and sunlight into the rooms.

5. Load bearing walls:

These walls can be used for the construction of a low rise building. There is no need to construct a framed structure with beams and columns to transfer the loads. Even CPWD in the year-1980, had adopted the load bearing wall systems. Other organisations like ONGC, Delhi Development Authority, Military engineering services have also adopted this system in the construction. In Calcutta, around 50 units of houses, which consists of 5floors each were constructed. Also this had showed a cost reduction of 6%.

This will save the materials cost for steel, cement and also concrete. Even in Tamil Nadu, four hundred 4 storied buildings were constructed which consists of single brick thick wall(A.K.Lal, 1995).

6. Concrete hollow blocks

- These hollow concrete blocks are also costing very less when compared to the conventional red clay bricks.
- These are also utilised in the high rise construction projects as the dead load on the structure will get minimised.
- Also they provide scope for laying of sewer pipes, electrical conduits and even for water pipes. These blocks also require very less plastering.
- These are utilised in all areas of construction markets, like in commercial buildings, industrial buildings and in residential buildings, etc. And so the demand is also very high because of intense requirement.

7. Following materials can be used for various applications as mentioned below:

Table:7.1 Different materials and their applications:

Source	Extracted item	Application for buildings
Rice mills	Rice husk	Can be used as fuel to manufacture materials/products
Coir fibre	Coconut husk	Insulation boards, roofing sheets, wooden panels, lightweight- aggregates can be prepared.
Jute industry	Jute fibre	Door shutters, roof sheets, chip boards
Saw wood	Saw mill waste	Particle boards, wooden chips, wooden blocks, briquettes and insulation boards can be made
Cotton plantation	Cotton stalk	Auto clave cement composite, wall plasterings, etc.
Banana plants	Banana stalk/leaves	Fire resistant boards, building boards can be prepared
Sisal plantation	Sisal fibres	wall plasterings, roof sheets, composite boards, roof tiles, paper manufacturing
Agricultural farm	Rice, Wheat straw	roof parts, wall panels, wall boards
Groundnut mills	Groundnut shell	Building blocks, building panels, particle boards and roof sheets,etc.

8.Precast Techniques:

8.1 Advantages with precast structural elements:

- If many number of houses (mass housing) are constructed with precast elements, then cost reduction can be observed.
- Installation of precast elements is an easy process. While conventional construction takes lot of time for the construction. It requires less movement of materials in the construction site. There is no need to maintain inventory of cement, sand and coarser materials in the site, except for smaller works.
- Also, a conventional construction requires lot of equipments and also lot of labours. But in a precast method of construction, it requires only few skilled personnel to install the various concrete elements.
- Acoustic performance of the precast elements is high as they contain hollow spaces and allows for sound dispersion.
- Flexible designs can be obtained. Even designs with long spans are also possible with the help of precast technology.
- Most of the precast elements are recyclable. Used elements can be crushed in a crusher and can be used again for various purposes like road filling, basement filling, or road bases, etc.
- Even doors and window frames can also be replaced by precast frames which will reduce the cost of material and also cost of maintenance.

8.2 Precast hollow slabs:

- Hollow slabs on an average, costs less than the normal RCC slabs and also provides the same function as like RCC slabs. Hence, these kind of slabs are very helpful for the construction of low cost housing.
- These loads can sustain higher loads and also prevent the slabs from deflection. Also, as the slabs are hollow in nature, it allows for easy traversing of wires and cables from inside. Various layouts are possible with these kind of slabs.
- These slabs reduce the hardware that is required for electrical and mechanical purposes. These kind of slabs have very less vibrations and also they have got good sound insulation properties because of the space between them.
- There is no need of duct work if we use hollow slabs. Because as they provide space for wires and act as ducts, there is no need for extra duct work in the slabs.
- These slabs reduce the height of the building and ultimately saves the cost.

8.3 Pre cast staircase:

- These are used for the faster construction of a staircase in a building.
- The quality of these staircase makes it durable for longer times.
- Also these staircases can reduce the passage of sound through it. In a conventional steel and wood staircases, it is not possible.
- For fire safety purposes, these are very good in nature.
- Speeder construction leads to easy movement for subsequent works in a top portions of a building. Along with the stair cases, one can also install landing areas which are precast

8.4 Pre cast walls:

- These walls can take the loads and also we can use it as partitioning purposes.
- Through design flexibility, one can design most variety of walls.
- Quality of finish on these walls is very good.
- MEP services can be easily incorporated into these walls as they contain hollow spaces.
- Construction speed can be high, as they don't consume much time for installation. Even these walls can resist the fire for longer times

9. Glass Fibre Reinforced Concrete Panel:

- They have much less thickness and these panels do not age and also they are not required to paint periodically.
- These are non-combustible, and even these can be installed by unskilled labours.
- Also these can be installed in any direction, like in horizontal or vertical directions.
- These are fixed with the help of screws to the wooden substructures or else rivets can also be used.
- Young's modulus can be increased by 4.14% for a glass fibre reinforced concrete item, when compared with a conventional concrete item. Also compressive strength can be increased by 37% and flexural strength would be increased by 5.19% (Chawla and Tekwani, 2013).

10. Bamboo products:

India is one of the largest bamboo producers in the world. Hence, bamboo is mostly available and it can be easily assembled at a low cost. After China, our India is the second largest producer of Bamboo. India produces few million tons of bamboo and hence there is a plenty of availability of bamboo.

Bamboo has also got good durability, which will keep the structural elements in a good condition for longer years. Similar to steel, young's modulus of bamboo is around 650 Mpa, while steel is having a young's modulus of 500-1000 MPa (Chowdhury and Roy, 2013). Bamboo has one disadvantage. Due to its circular cross section, it makes difficult for the other bamboo sticks to place on it. Bamboo can be used for partition walls, light weight constructions and in ceilings.

11. Straw

Straw is an agricultural by-product, which is available after removal of grain and chaff. Rice's straw has got high amount of silica and this makes it toughest straw material. Rice straw can create breathing problems, when it is subjected to fire. However, it does not easily catch fire. It is usually fire resistant, thermally insulated, and non-toxic. It also got sound and moisture insulation properties. Also straw bale when used in construction showed a direct cost saving of around 40% in Egypt for a one story building of area 3 X 3 m² (Dessuky, 2009).

12. Gypsum bricks made with Fly Ash :

Many researches have shown the advantages of gypsum bricks mixed with fly ash. It gives good durability and also has a good strength. These can be used as an alternative to the conventional bricks. For conventional clay bricks, lot of clay has to be removed from various lands and it leads to the infertility of the soil and soil won't allow the crops to grow.

When bricks are made with fly ash and gypsum, it provides bricks at a low cost than conventional bricks. These bricks can also act against sulphate attack as they contain gypsum and fly ash. Various tests also have shown the compressive test results which are higher than the I.S. requirement. But the only disadvantage is that these bricks will absorb more than 20% of moisture (Naik, Bahadure and Jejurkar, 2014).

13. Using LED Lights:

By using LED lights, one can reduce the energy costs of a building. Achieving energy efficiency has become a major problem. Many people do not know the advantages of LED lights and also they don't know the information about using the LED lights. Even for a normal house, we can replace the existing halogen bulbs with LED lights which reduces the energy bills. Incandescent or fluorescent bulbs consume lot of energy and are the reasons for major electricity bills.

LED bulbs that are Energy Star rated will consume less energy and also these bulbs will last 25 times longer than the conventional incandescent bulbs. Also incandescent bulbs release nearly 90% of their energy in the heat form, while LEDs dissipate 80% energy as heat, which is less than incandescent bulbs (U.S Dept. of Energy).

IV. Recommendations And Conclusions:

- Low cost mass housing can be constructed by following all the above mentioned techniques or methodologies. Building material selection can play an important role in the faster completion and also in providing the quality.
- If good local materials are available, then they can be used as it reduces the transportation costs and also the energy costs involved in transporting those materials. As transportation of materials is reduced, it will also reduce the pollution.
- Local masons and artisans should be trained to use the above mentioned techniques by incorporating various alternate materials. More study and research must also be conducted on various industrial wastes to check their usage possibility for construction purposes.
- Also, lending loans for real estate sector is seen as insecure by majority of the banks. Hence, if banks change their policies and come forward to finance such low cost housing systems, it would definitely help many people to own a house.
- Providing low cost housing is also a function of building's nature, owner's budget, availability of materials, location and even on availability of experienced engineers. However, by following good planning techniques, it is mostly possible to construct houses at low cost. At least 25% of reduction of cost can be seen by adopting all the above mentioned methods.

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