

Affordable housing requirements and its possible dimensions in India

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Abstract

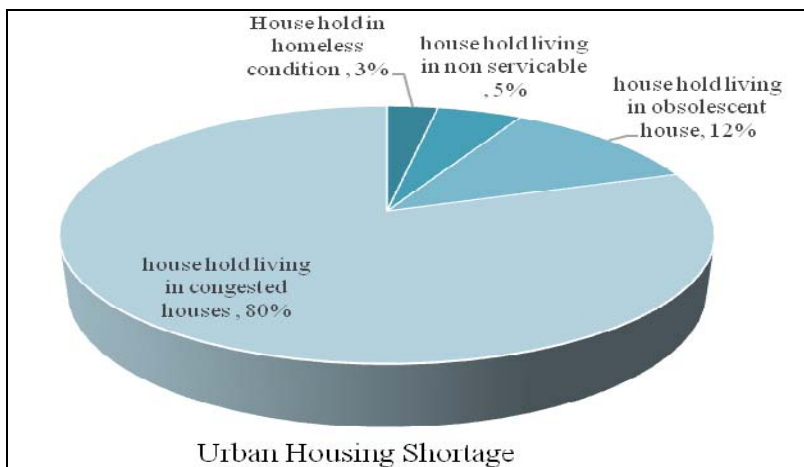
India is facing the challenge of providing adequate shelter to 20.5 million households from 2001 for its citizens. The housing sector in India for several decades faced a number of set-backs, such as an unorganized market, development disparities, a compartmentalized development approach and a deterrent rent control system. In this paper it is investigated, commingle these issues and propose a construction strategy for the Indian housing sector. The criteria to measure sustainability in this paper are cost effectiveness, efficient utilization of resources and environment friendliness. Affordability of a house and availability of building materials for its construction are the main determinants of access to shelter. This demands efficient use of resources at low cost. In this paper it is analyze whether it is possible to reduce cost, reduce emissions and generate employment in house construction. Recent Government policy statements have indicated that an annual supply of two million new houses would be required to meet the current shortage of housing in India. The construction technologies that are evaluated the ‘prefabrication’ construction technologies as well as low-cost techniques.

Keywords: Housing; Low-cost housing; prefabricated house; India

1. Introduction

In India, at the beginning of 21st century, providing adequate houses and sustainable environment are the major pressing challenges. The problem of proper housing will be removed by developing by strategy of low cost housing. Low cost housing can be considered affordable for low and moderate-income earners if household can acquire a housing unit (owned or rented) for an amount up to 30 percent of its household income (Miles, 2000). Cost effective housing is a relative concept and has more to do with budgeting and seeks to reduce construction cost through better management, appropriate use of local materials, skills and technology but without sacrificing the performance and structure life (Tiwari *et al.*, 1999) ^[1, 4]. Low cost housing is a new concept which deals with effective budgeting and following techniques which help reducing

construction cost through the use of locally available materials along with improved skills and technologies without sacrificing the strength, performance and life of the structure (Kumar, 1999; *Civil Engineering Portal, 2008*). Low cost housing technologies aim to reduce construction cost and prefabrication technology reduces the construction on site. It is about the usage of local and indigenous building materials, local skills, energy saver and environment-friendly options. Growing concentration of people in urban areas has resulted in an increase in the number of people living in slums and squatter settlements. Skyrocketing prices of land and real estate in urban areas have induced the poor and the economically weaker sections of the society to occupy the marginal lands typified by poor housing stock, congestion and obsolescence. It is apparent that substantial housing shortage looms in



Urban India and a wide gap exists between the demand and supply of housing, both in terms of quantity and quality.

According to a report submitted by a technical committee to the Ministry of Housing and Urban Poverty Alleviation

(MHUPA), India's urban housing shortage is estimated at nearly 18.78 million households in 2012. Besides those living in obsolescent houses, 80 percent of these households are living in congested houses and are in requirement of new houses. The report also highlights that nearly one million households are living in non-serviceable katcha houses, while over half a million households are in homeless conditions.

2. Affordable Housing Defined

There is no clear-cut definition of the term 'affordable', as it is a relative concept and could have several implied meanings in different contexts.

- According to the RICS Report on Making Urban Housing Work in India, affordability in the context of urban housing means provision of 'adequate shelter' on a sustained basis, ensuring security of tenure within the means of the common urban household. RICS Practice Standard Guidance Notes (GN 59 2010) states that 'affordable housing is that provided to those whose needs are not met by the open market'.
- According to the KPMG Report on 'Affordable Housing – A Key Growth Driver in the Real Estate Sector', affordable housing is defined in terms of three main parameters, namely income level, size of dwelling unit and affordability. Whilst the first two parameters are independent of each other, the third is dependent parameter that can be correlated to income and property prices.
- As per US Department of Housing and Urban Development, the generally accepted definition of housing affordability is 'for a household to pay no more than 30% of its annual income on housing. Families who pay more than 30% of their income for housing are considered cost burdened and may have difficulty affording necessities such as food, clothing, transportation and medical care'.
- According to the Task Force on Affordable Housing set up by the MHUPA in 2008, affordable housing for various segments is defined by size of the dwelling and housing affordability derived by the household income of the population.
- The JNNURM Mission Directorate of MHUPA has also defined affordable housing in its amended Guidelines for Affordable Housing in Partnership released in December 2011.

3. Conventional Construction Methods

Conventional Construction Methods are used are described in the following steps -

- Foundation is the first step of the construction which is provided to distribute loads of superstructure and all others load (dead and live) to the soil thus providing base. Excavation work is first carried out, then earth-work is filled with available earth and ends with watering and compaction in a 6" thick layer.
- After this plain cement concrete is used to form a leveled surface on the excavated soil. The volumetric concrete mix proportion of 1:4:8 (cement: sand: aggregate), with a 6" thick layer for masonry foundation and column footings is used. Plain cement concrete is finished on the excavated soil strata and mixed by manual process.
- Stone masonry for foundation is constructed for outer walls and burnt brick masonry of a 9" thick layer for main

walls and a 4 1/2" thick layer for all internal walls. First class bricks are used for the construction.

- The normal procedure to cast reinforced cement concrete slab is to make shuttering and provide reinforcement and concreting. Formwork is used, with proper cover blocks between bars. Both aggregate and sand used are 3/4" graded.
- Plastering is used for the ceiling, inside and outside walls.
- For the flooring, the earth is properly filled and consolidated in the ratio of 1:4:8 (cement: sand: aggregate) concrete.
- After the plastering the painting process is started, for this surface is prepared with putty and primer

These conventional steps take at least 2 to 3 months; however, the requirement of houses is much higher than the supply chain. There is requirement of some alternate method of the construction techniques.

4. Advantages and disadvantages of Conventional Construction Methods

The design and the construction of the structure are flexible. Depending on house design and the materials specified, construction can be cost effective. It is accepted and understood from designers and builders to lenders, insurers and warranty providers. Materials are readily available from local builder's merchants. Masonry materials are strong, durable and long lasting, spreading their impact (Traditional Housing Bureau) and Good thermal performance. Masonry materials have a high thermal mass, which is their ability to absorb and store heat. In the summer this keeps the building cool and in the winter the heat stored during the day is slowly released back into the house at night leading to a more constant, comfortable environment. When the building has completed of its useful lifespan, bricks and blocks are 100% recyclable (Traditional Housing Bureau).

There are some drawbacks in traditional method of construction which are that progress works can be affected by adverse weather conditions. Materials need to be stored on site and protected from the weather before they are incorporated into the building structure.

5. Prefabrication based Low Cost Construction Technologies

It is found that cost-effective prefabrication construction technologies, which apart from reducing construction cost by the reduction of quantity of building materials through improved and innovative techniques, can play a great role in providing better construction methods and protecting the environment. It should be noted that prefabrication construction technologies do not compromise with safety and security of the buildings. The detail procedures of each step used for the case study are as follow:

1. For the construction of the foundation, the use of available materials such as brick or concrete blocks can be made to resist lateral forces buttresses at the corner. Placement of support piers is very important to distribute the weight correctly and level the structure. Foundation must be constructed in such a manner so as to provide a stable environment.
2. Prefabricated panels are installed on the foundation according to the given plan. These panels are made at construction unit of factory. Steel, cement, wood and

- composite materials are used for the construction of prefabricated panel.
- Prefabricated roofing system is used which based on the principle that for roofs which are simply supported, the upper part of the slab is subjected to compressive forces and the lower part of the slab experience tensile forces. Prefabricated panels are very good in withstanding compressive forces and tensile forces.
 - Flooring is generally made of terracotta tiles or color oxides. Bedding is made out of broken brick bats. Various patterns and designs are used, depending on shape, size of tiles, span of flooring, and client’s personal preference.
 - Plastering can be avoided on the walls
 - Door and window frames are responsible for almost half the cost of timber used, avoiding frames can considerably reduce timber cost. Door planks are screwed together with strap iron hinges to form doors, and this can be carried by ‘holdfast’ carried into the wall. A frameless window consists of a vertical plank of about 10” wide set into two holes, one at the top and one at the bottom. This forms a simple pivotal window. Wide span windows can be partially framed and fixed to walls or can have rows of pivotal planks.

6. Material Used for the Prefabricated Panels

Prefabricated housing technology involves use of factory-manufactured components in buildings. Some commonly used prefabrication materials include steel frames for structures,

panels made of wood, cement, gypsum and other materials for floors, walls and ceilings, factory-made doors, windows and ventilators.

7. Benefits of Using Prefabricated Low Cost Housing Technologies

In prefabrication method self-supporting ready-made components are used in construction, so the need for formwork, shuttering and scaffolding is greatly reduced. In this method, Construction time is reduced and buildings are completed in less time, this reduces the cost of labour. On-site construction and congestion is minimized. Quality control can be easier in a factory assembly line setting than a construction site setting. Prefabrication can be located where skilled labour is more readily available and costs of labour, power, materials, space and overheads are lower. Time spent in bad weather or hazardous environments at the construction site is minimized. Less waste may occur. Advanced materials such as sandwich-structured composite can be easily used, improving thermal and sound insulation and airtightness.

According to the Ministry of Housing and Urban Poverty Alleviation, National Buildings Organisation report there is shortage of 26.53 million houses in 2002. If these houses are made by the conventional construction method then this gap will never cover-up. But if use of pre fabrication method of construction will be applied then this will be so much helpful for the removal of shortage of household.

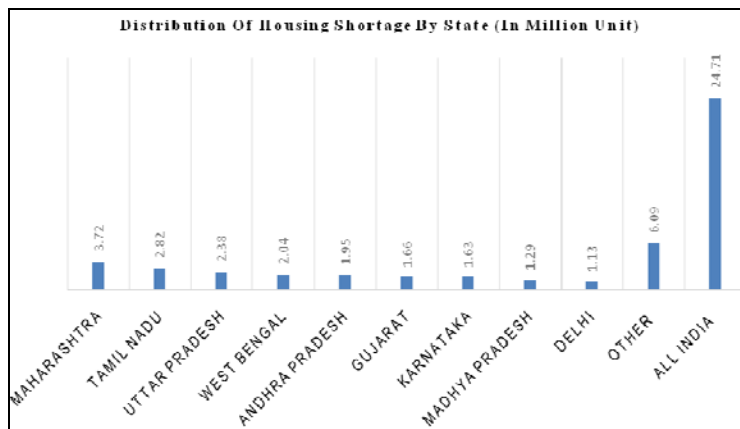


Fig 1: Distribution of Housing Shortage by State (Source: Ministry of Housing and Urban Poverty Alleviation September 2007)

Table 1: comparisons of cost and time of different methods of construction

Method of construction	Conventional Construction Methods	Prefabricated housing method
Cost of construction	Rs 10000 per sq.m#	Rs 4,000 per sq.m*
Time of completion (100 sq. m)	4 months	1 month

*based on Gujarat government report 2007

#based on the CPWD rate calculations

8. Conclusion

To solve the problem of the housing and providing the shelter to the common people particularly for low-income and middle-income families, it is necessary to adopt low cost prefabrication housing technologies for the construction. This paper examined the cost effectiveness of using prefabrication housing technologies in comparison with the traditional construction methods. It was found that about 66.67% saving in construction cost, and one fourth times saved by using the prefabricated construction method. On the basis of this it is

recommended that the prefabrication housing technique should be adopted to remove the shortage of housing in Indian scenario.

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