Affordable Housing in Plane Region

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Abstract—Housing is one of the basic need of any human being. In a country like ours with a very large population the need for housing is at its peak. Providing housing which is not compromised on structural front and at the same time is affordable too is an uphill task. Constructing a house with traditional method has become very costly in present times mainly due to increase in prices of raw material such as cement, steel, labour, transportation etc. A large section of population of our country mainly belonging to EWS(Economically Weaker Section), LIG(Low Income Group) still don't have a house of their own because constructing a house of their has gone beyond their affordability. So in order to provide housing facility to these people, we can use various affordable house construction technology that has been developed by CSIR-CBRI. Technology that has to be adopted to build affordable house should suit the people and climatic conditions of that particular region. An affordable house doesn't only mean a very low cost house, instead it should provide safety, security, and comfort to the people who reside in it.

1. INTRODUCTION

Housing is one of the three basic needs of any human being, and in recent times need for housing has increased abruptly. To overcome this problem we need to provide affordable homes to people. But the problem is building an affordable house at present considering various factors is not easy. At present in our country there is an estimated shortage of around 18 million houses, with 99% of these houses are required by EWS(Economically Weaker Sections) of the society. It is present governments dream to provide housing to all and improve its standard too. But before we frame a policy on affordable housing we need to define it first, because what may be affordable for one person might not be for the other person.

We also need to understand the fact that need for affordable housing is driven by many factors in a country like ours, progressive urbanization, growing population which is increasing at a very fast rate. If policies are framed properly housing will have long term effect on our economy. It will not only provide people with homes but will also generate new jobs, and housing sector will have its fair share in GDP.

2. AFFORDABLE HOUSES DEFINITION

It can be defined by simple 30% rule which evolved from the United States National Housing Act of 1937. It says that if the rent a family is paying is or less than 30% of their monthly income it is said to be affordable house, if it is more than 30% of their income the family is considered to be cost burdened and may have difficulty affording necessities such as food, clothing, transportation and medical care.

3. FACTORS WHICH INFLUENCE THE DEVELOPMENT OF AFFORDABLE HOUSES.

There are many factors which provide hindrance in development of affordable housing projects. Few are discussed below.

3.1 Land availability: Land is a fixed asset we all know that. Population of our country is growing at a very fast rate therefore we need to find a way to use this resource to its fullest potential. If we will frame a policy on its usage then only we can use our available land adequately.

3.2 High cost of construction and raw materials: Construction of houses using conventional materials has become very high. Due to increase in prices of raw materials such as cement, steel etc. Apart from increase in prices of raw materials transportation cost also plays an important role as it also has gone up due to increases in prices of fuel.

3.3 Long gestation period: Housing projects in India have a long gestation period, they have to go through numerous stages before they are finalized. Going through multiple approvals to be obtained from multiple authorities consumes around 2-3 years of the project.

3.4 Multiple fees and taxes: Rationalizing the multiple fees and taxes across various project stages can help us to save around 30-35% of the total cost of construction.

4. LOW COST HOUSING MATERIALS

4.1 Brick Panel: Prefabricated Brick Panel system developed by CBRI, Roorkee has been in use in a number of low cost housing projects acroos the country. Main reason for its widespread use is its simple design, ease in adoption and economy. In Brick Panel system concrete is used in the maximum compressive stress zone and bricks are used in less compressive stress zone. Concrete of grade not less than M20 is used for encasing the steel bars in Brick Panel. Dimensions of Brick Panel varies from 900mm-1200mm depending upon the room size, but the width is generally kept around 530mm to provide a gap of 36-40mm for placing reinforcement. After the panels are installed 2-4 cm gap is kept between them and is filled with cement concrete. See Fi.1



Fig. 1: Brick Panel with reinforcement.

4.2 Precast R.C. Plank: Scheme which consists of using R.C. Plank supported over partially precast R.C Joist has been very successful and adopted across numerous residential buildings and industrial sheds (See Fig. 2). To provide Tee-beam effect of the joist the plank is made partly 3cm and partly 6cm thick. To provide strength to the haunched portion of the plank during handling and erection a 10cm wide tapered concrete is provided. Generally plank is made up of M-15 grade concrete reinforced with ms bars. Maximum dimension of R.C. Plank are 1500mm in length and 300mm in width(See Fig.3).



Fig. 2: R.C. Plank resting on R.C. Joist.



Fig. 3: R.C. Plank at Rural Park, CBRI.

4.3 Partially precast Joist: Partially precast joist is usually a square section 15cm wide and 15cm in depth with stirrups projecting out so that the overall depth of the joist with in-situ concrete is 21cm. Joist is designed to work as a Tee-beam with 6cm thick flange comprising of 3cm precast and 3cm in-situ concrete. This particular section is adopted for a span of upto 4m. For spans more than 2.8m, the joist at the supports is to be designed as a doubly reinforced beam which requires welding of the bottom reinforcement of a adjacent joists at the support. Joists help up in cost-cutting for construction of affordable houses. They do not require shuttering and in-situ curing. They can be transported and installed easily. (See Fig.4).



Fig. 4: Precast R.C Joist, Rural Park, CBRI.

4.4 Precast Channel unit: It is a full length precast RCC unit, which is trough shaped in section. Channel units can be used for both flooring and roofing depending upon the requirement, they are supported on suitable structures like brick/stone walls and RCC beams. Good thing is it does not require any intermediate temporary props or supports, since the unit is strong enough to carry the load for which it is designed for. Outer side of the unit are made corrugated and grooved at the ends to provide shear key action between adjacent units(See Fig. 5). The nominal width of the unit is kept 300 or 600mm and the depth is 130mm to 200mm. The length of the unit depends upon the span to be covered and is generally kepy between 2.5m to 4.2m. The minimum flange thickness is 30mm. The channel units shall have a minimum end bearing of 75mm, and a minimum side bearing of 50mm.



Fig. 5: Precast R.C. Channel Unit.

5. RESEARCH PROGRESS ON AFFORDABLE HOUSE

Chowdhury & Roy [1] studied the present work on low-cost and sustainable alternative building materials having advantage in areas such as our own country where cost of steel and concrete housing has become very expensive. There are still many challenges and stereotypes of using these low-cost and sustainable building materials as a structural components for low cost housing. Author has mainly classified the low cost housing materials into two category natural materials and man-made materials.

Natural materials include Bamboo, Life extended Thatch Roofing, Compressed Earth Block, Non-erodable Mud Plaster, Coconut and Wooden Chips Roofing Sheet etc. Man made materials include Fly Ash, Cement Concrete Hollow Blocks, Rice Husk, Ferro-cement. Author also points out that depending upon the availability of these materials, they can be selected to cut down the transportation cost as it consists approximately 30% of the total construction budget.

Shinde & Karankal [2] studied various eco friendly and alternative building materials such as Pozzolona Materials(fly ash/slag) as blending material with cement, author found out that upto 35% of suitable fly ash can be directly be substituted

in place of cement as blending material keeping the structural consideration in mind. It significantly improves the characteristics of the resulting concrete in terms of quality and durability. Author also points out that recycled steel reinforcement can save a huge amount of energy and power and also gives the added advantage of not producing toxic gases.

Taur & Devi T [3] studied about different pre-fabricated building methods. In any building the foundation, walls, doors and windows, floors and roof are most important components. By their individual analysis we can improve the speed of construction and also reduce its cost. Partial prefabrication is such an approach towards the above concerned problem of mass and affordable housing under controlled conditions.

Jain & Paliwal[4] author focuses on the need to adopt the costeffective construction materials. By the use of low-cost housing materials such as light weight cellular concrete, Plank & Joist system, prefabricated brick panels, hollow block construction, RC channel units etc. savings of about10-30% in the cost can be achieved.

Rahman, Wang, Wood & Khoo[5] studied several housing programs introduced in Malaysia, however the success of the programs was reduced due to quality problems. A survey was conducted by authors among 310 rsidents in four different regons of Klang valley. Main defects were pipe leakages, failure of water supply system, cracking in concrete walls and concrete wall dampness. Usage of superior materials and customer oriented supervision may reduce the defects.

Fadairo & Olotuah [6] examined different materials which can be used for construction that are readily available in abundance in Nigeria. Author also suggests the usage of Fired clay bricks and Laterite stabilized blocks over conventional bricks to lower the cost of the affordable house. Author also observed that the laterite materials have desirable qualities for the construction of affordable houses which also suit the climatic conditions of Nigeria because of their thermal properties.

Labin, Che-Ani, Nawi, Mydin[7] explores the proposal for affordable housing measurement with six assessment components, authors studied the factors which affect affordable housing. Six affordable housing components were identified as income ratios, loans and accomodations, facilities and services, safety and comfort, quality management, and Grow Home. Grow Home is an option which can be used as a cost saving to make houses more affordable.

6. CONCLUSION

There are many different ways to built an affordable houses. By using the locally available materials like stone in hilly regions etc. a large sum of construction cost can be saved. There is variety of technological options available for various elements for construction of affordable houses. To use the technology and locally available materials to their maximum extent we need to have their increased understanding. By using materials which are locally available we can save around 30-35% of the total cost of construction. But there is still scope working towards for finding new materials and technologies which can further help us in construction of affordable houses and also ensure that they are safe from structural point of view too.

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