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LOW COST HOUSING

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ABSTRACT

This paper aims to point out 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 here 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.. Low Cost Housing is a different concept which deals with effective costing and following of techniques which help in reducing the cost construction through the use of faraway available materials beside with and technology improved skills without losing the power, performance and life of the structure. There is huge misconception that low cost housing is suitable for only subnormal works and they are built by using cheap building materials of low quality. The fact is that Low cost housing is done by proper management of resources. Economy is also achieved by postponing finishing works or implementing them in phases. Cost of reduction is achieved by selection of more efficient material or by an improved design. Construction of low cost housing by using the low cost construction materials increases the access to buildings by low income group peoples. Advantages of low cost building materials are pollution prevention, Reducing Energy Consumption and use of Natural materials, Use of Local material, Energy Efficiency, Use of non-toxic building materials, Longitivity, durability and maintenance of building material, Recyclability and reusability of building material and Biodegrability. The reviews on various low cost building designs and management are presented in this paper.

Keywords: Prefabrication; Precast RCC 'KULAR' precast joist, Ferro cement product

I.INTRODUCTION

Affordable housing is a term used to describe dwelling units whose total housing cost are deemed "Affordable" to a group of people within a specified income range. (www.wikipedia.com) 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.(P.K.Adlakha and H.C.Puri, 2003). 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. Affordable housing is a general term used to define housing that is affordable to lower or middle income households. Low-cost housing projects are characterized by an increasing demand mainly due to urbanization. To achieve a sustainable housing project is required a balance of environmental, economic and social issues with technical issues. Findings show that up to 60 % of the total cost of a low-income housing project is allocated to engineering project and construction materials. Moreover, walls organize up to 50% of a total cost of resources and up to 45% of total building time. Material source, manufacture techniques and labour requirements all have major impacts on the selection of wall building material. The main objective of this paper is to give detailed review on low cost building design, planning, selecting proper building material and construction.

II.LOGICAL APPROACH FOR OPTIMIZING HOUSING SOLUTIONS

There should be a logical approach for providing appropriate technology based on the availability of options, considering its technical and economical analysis.

1. There should be optimal space in the design considering efficiency of space, minimum circulation space.

2. Economy should be considered in design of individual buildings, layouts, clusters etc.

3. While preparing the specifications it should be kept in mind that, cost effective construction systems are adopted.

4. 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.

5. To develop an effective mechanism for providing appropriate technology based shelter particularly to the vulnerable group and economically weaker section.(R.K.Garg, 2008)

III.PREFABRICATION AS APPLIED TO `LOW COST HOUSING

(P.K.Adlakha and H.C.Puri, 2002) Advantages of prefabrication are:

1. In prefabricated construction, as the components are readymade, self supporting, shuttering and scaffolding is eliminated with a saving in shuttering cost

2. In conventional methods, the shuttering gets damaged due to its repetitive use because of frequent cutting, nailing etc. On the other hand, the mould for the precast components can be used for large number of repetitions thereby reducing the cost of the mould per unit.

3. In prefabricated housing system, time is saved by the use of precast elements which are casted off-site during the course of foundations being laid. The finishes and services can be done below the slab immediately. While in the conventional in-situ RCC slabs, due to props and shuttering, the work cannot be done, till they are removed. Thus, saving of time attributes to saving of money.

4. In precast construction, similar types of components are produced repeatedly, resulting in increased productivity and economy in cost too.

5. Since there is repeated production of similar types of components in precast construction, therefore, it results in faster execution, more productivity and economy.

6. In prefabricated construction, the work at site is reduced to minimum, thereby, enhancing the quality of work, reliability and cleanliness.

7. The execution is much faster than the conventional methods, thereby, reducing the time period of construction which can be beneficial in early returns of the investment.

Concept of prefabrication / partial prefabrication has been adopted for speedier construction, better quality components & saving in material quantities & costs

IV.IN WALLS

In the construction of walls, rammed earth, normal bricks, soil cement blocks, hollow clay blocks, dense concrete blocks, small, medium and room size panels etc of different sizes are used. However, bricks continue to be the backbone of the building industry. In actual construction, the number of the bricks or blocks that are broken into different sizes to fit into position at site is very large. which results in wastage of material poor quality. Increasing the size of wall blocks will prove economical due to greater speed and less mortar consumption, which can be achieved by producing low density bigger size wall blocks using industrial wastes like blast furnace slag and fly ash. Several prefabrication techniques have been developed and executed for walls but these medium and large panel techniques have not proved economical for low rise buildings as compared to traditional brick work. (P.K.Adlakha and H.C.Puri, 2002.

i. Non erodable mud plaster:

The plaster over mud walls gets eroded during rains, which necessitates costly annual repairs. This can be made non erodable by the use of bitumen cutback emulsion containing mixture of hot bitumen and kerosene oil. The mixture is pugged along with mud mortar and wheat/ rice straw. This mortar is applied on mud wall surface in thickness of 12 mm. One or two coats of mud cow dung slurry with cutback are applied after the plaster is dry. The maintenance cost is low due to enhanced durability of mud walls.(R.K.Garg, 2008).

ii. Fly –Ash sand lime bricks:

By mixing of lime and fly ash in the presence of moisture, fly ash sand lime bricks are made. Fly Ash reacts with lime at ordinary temperature and forms a compound possessing cementitious properties. After reactions between lime and fly ash, calcium silicate hydrates are produced which are responsible for the high strength of the compound. Bricks made by mixing lime and fly ash are therefore, chemically bonded bricks. The bricks are manufactured with the help of hydraulic press and are dried in the autoclave. These bricks have various advantages over the clay bricks, It possesses adequate crushing strength, uniform shape, smooth finish and does not require plastering and also are lighter in weight than ordinary clay bricks. (R.K.Garg, 2008).

iii. Solid concrete and stone blocks:

This technique is suitable in areas where stones and aggregates for the blocks are available locally at cheaper rates. Innovative techniques of solid blocks with both lean concrete and stones have been developed for walls. The gang-mould is developed for semi-mechanized faster production of the blocks. In the manual process, single block moulds are used wherein the concrete is compacted with help of a plate vibrator. With the use of a portable power screw driven egg laying type machine, solid concrete blocks are made with higher productivity at low cost. Six blocks of 30 x 20 x 5 cm size are cast in single operation with an output of 120-150/hr. (R.K.Garg, 2008).

Fig. 1. Mud Plastered House

V.IN FLOOR AND ROOF

Structural floors/roofs account for substantial cost of a building in normal situation. Therefore, any savings achieved in floor/roof considerably reduce the cost of building. Traditional Cast-in-situ concrete roof involve the use of temporary Shuttering which adds to the cost of construction and time. Use of standardized and optimized roofing components where shuttering is avoided prove to be economical, fast and better in quality. Some of the prefabricated roofing/flooring components found suitable in many low-cost housing projects are:

i. Precast RC Planks.

ii. Prefabricated Brick Panels

iii. Precast RB Curved Panels.

iv. Precast RC Channel Roofing

v. Precast Hollow Slabs

vi. Precast Concrete Panels

vii. L Panel Roofing

viii. Trapezon Panel Roofing

ix. Un reinforced Pyramidal Brick Roof

i. Precast RC plank roofing system:

This system consists of precast RC planks supported over partially precast joist. RC planks are made with thickness partly varying between 3 cm and 6 cm. There are haunches in the plank which are tapered. When the plank is put in between the joists, the space above 3 cm thickness is filled with in-situ concrete to get tee-beam effect of the joists. A 3 cm wide tapered concrete filling is also provided for strengthening the haunch portion during handling and erection. The planks have 3 numbers 6 mm dia MS main reinforcement and 6 mm dia @ 20 cm centre to centre cross bars. The planks are made in module width of 30 cm with maximum length of 150 cm and the maximum weight of the dry panel is 50 kg (Figure 2). Precast joist is rectangular in shape, 15 cm wide and the precast portion is 15 cm deep (Figure 2). The above portion is casted while laying in-situ concrete over planks. The stirrups remain projected out of the precast joist. Thus, the total depth of the joist becomes 21 cm. The joist is designed as composite Tee-beam with 6 cm thick flange comprising of 3 cm precast and 3 cm in-situ concrete (Figure 3). This section of the joist can be adopted up to a span of 400 cm. For longer spans, the depth of the joist should be more and lifting would require simple chain pulley block. The completely finished slab can be used as intermediate floor for living also In residential buildings, balcony projections can be provided along the partially precast joists, designed with an overhang carrying super imposed loads for balcony as specified in IS: 875-1964, in addition to the self load and the load due to balcony railings. The main reinforcement of the overhang provided at the top in the in-situ concrete attains sufficient strength. The savings achieved in practical implementations compared with conventional RCC slab is about 25%.(P.K.Adlakha and H.C.Puri, 2002).

Fig. 2 Precast R.C. Planks

Fig. 3 R.C. Planks laid over partially precast joists

VI.CONCLUSION

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. Partial prefabrication is an approach towards the above operation under controlled conditions. The essence lies in the systematic approach in building methodology and not necessarily particular construction type or design. The methodology for low cost housing has to be of intermediate type- less sophisticated involving

less capital investment. (P.K.Adlakha and H.C.Puri, 2002). Housing is one of the basic needs of mankind in terms of safety, security, self esteem, social status, cultural identity, satisfaction and achievement. After analyzing various methods for low cost building systems, the best method to adopt is using natural materials, renewable materials, eco friendly building materials used, using locally available materials and minimizing the resource allocation and innovative methods can implemented to reduce the cost and to achieve sustainable and Green building. 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. Partial prefabrication is an approach towards the above operation under controlled conditions. The essence lies in the systematic approach in building methodology and not necessarily particular construction type or design. The methodology for low cost housing has to be of intermediate type- less sophisticated involving less capital investment. (P.K.Adlakha and H.C.Puri, 2002).

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