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Cost Reduction through Cost Effective Construction Techniques

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Abstract: ***Low cost housing construction technologies aim to cut down construction cost by using alternatives to conventional methods and Input. "It is effective budgeting and technique which help in reducing cost of construction through use locally available material along with improve skills and technology without sacrificing the strength, performance and life of structure. ''Low cost housing merely satisfies the most bottom and fundamental human needs for shelter and neglects other needs that people aspire home including psychological, social, and aesthetic needs and ultimately, need for self-actualization. This paper examined the cost effectiveness of using low cost housing technologies in comparison with the traditional construction methods. It was found that about 26.11% and 22.68% of the construction cost, including material and labor cost, can be saved by using the low cost housing technologies in comparison with traditional construction methods for walling and roofing respectively.***

Keywords: Cost Effective Construction Techniques

1. Introduction

India is the developing country having only 20% population of higher income group. The reduction in cost is achieved through effective utilization of locally available material and techniques. The material and techniques should be durable, economical, accepted by users and not requiring costly maintained .Economy is also achieved by postponing finishing and implementing low cost housing technology in phases .High efficiency of workers, minimizes waste in design. Studies assessing the conditions of low cost housings have mostly focused on satisfaction levels and subjective perception of quality particularly with regard to the dwelling units or the larger neighbourhood characteristics. However, residents usually react upon their immediate environment to achieve satisfaction and make the surrounding area as their home and apply good management practices can also be achieved ,or all people is one of the challenges faced by developing countries .Housing is a basic sock Adequate shelter for all people is one of the challenges faced by developing countries. India is currently facing shortage of about 17.6 million houses. Also Hon'ble Prime Minister has dreamed to provide everyone shelter by 2020.

Low cost housing can be considered affordable for low and moderate income earner if household can acquires a housing unit for an amount up to 30%of its household income. The low income group in developing country are generally unable to access the housing market .As the three basic needs of people are food, clothes and shelter so main objective is to provide one of the basic need i.e. shelter to low income earners .Low cost housing is a relative concept and has more to do with budgeting and seeks to reduces construction cost trough better management, appropriate use of local materials, skills and technology without sacrificing strength and life of structure. Allwe need where families can have a comfortable living and work in a sustainable environment.

2. Methodology

This study is based on literature and field survey. The focus of the study is to find out issues resulted from low cost house extension projects that affect the construction activities.

The field study is divided into three parts –
On site observation on construction activities to investigate and examine construction activities carried out by the contractors.

Finding new construction techniques to implement them in construction of building.

Study of low cost construction materials from projects under construction and recently completed. After completion of these processes, site observations will carried out to gather primary data.

This data will help to determine the research basis and direction. Reviews of other works from literature survey will become the backbone of this research.

Comparison of low cost building with conventional building.

3. Construction Techniques for Low Cost Housing

1) 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.

2) 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.

3) 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 eg 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.

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 lowcost housing projects are:

a) Precast RC Planks.
b) Prefabricated Brick Panels
c) Precast RB Curved Panels.
d) Precast RC Channel Roofing
e) Precast Hollow Slabs
f) Precast Concrete Panels
g) L Panel Roofing
h) Trapezon Panel Roofing
i) Un reinforced Pyramidal Brick Roof

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 . Precast joist is rectangular in shape, 15 cm wide and the precast portion is 15 cm deep . 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. 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%..

4) Prefabricated brick panel roofing system

The prefabricated brick panel roofing system consists of:

(a) Prefab brick panel Brick panel is made of first class bricks reinforced with two MS bars of 6 mm dia and joints filled with either 1:3 cement sand mortar or M-15 concrete. Panels can be made in any size but generally width is 53 cm and the length between 90 cm to120 cm, depending upon the requirement. The gap between the two panels is about 2 cms and can be increased to 5 cms depending upon the need. A panel of 90 cm length requires 16 bricks and a panel of 120 cm requires 19 bricks

(b) Partially precast joist It is a rectangular shaped joist 13 cm wide and 10 cm to 12.5 cm deep with stirrups projecting out so that the overall depth of joist with in-situ concrete becomes 21 cm to 23.5 cm, it is designed as composite Tee-beam with 3.5 cm thick flange.

Structural design The prefab brick panel for roof as well as for floor of residential buildings has two numbers 6 mm dia MS bars as reinforcement up to a span of 120 cms. The partially precast RC joist, is designed as simply supported Tee-beam with 3.5cm thick flange. The reinforcement in joist is provided as per design requirements depending upon the spacing and span of the joist. An overall economy of 25% has been achieved in actual practice compared to cast-in-situ RCC slab.

Precast curved brick arch panel roofing: This roofing is same as RB panel roofing except that the panels do not have any reinforcement. A panel while casting is given a rise in the centre and thus an arching action is created. An overall economy of 30% has been achieved in single storeyed building and 20% in two or three storeyed buildings

Precast RC channel roofing: Precast channels are trough shaped with the outer sides corrugated and grooved at the ends to provide shear key action and to transfer moments between adjacent units. Nominal width of units is 300 mm or 600 mm with overall depths of 130 mm to 200 mm . The lengths of the units are adjusted to suit the span. The flange thickness is 30 mm to 35 mm. Where balcony is provided, the units are projected out as cantilever by providing

necessary reinforcement for cantilever moment. A saving of 14% has been achieved in actual implementation in various projects.

Case histories in India Demonstrations Construction Using Cost- Effective & Disaster Resistant Technologies – BMTPC's Initiatives 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.

4. Conclusions

The need of the 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. The conventional methods used for housing must be analysed and replaced by new developed construction techniques based on technical experiments and analysis.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 government agencies such as Hudco, Cidco, Mhada must support these techniques to promote the low cost construction techniques by making awareness amongst users and contractors executing the works. 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. If we adopt the right method at the right place by implementing these technique we can succeed in getting solution over costly housing.

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