REVIEW PAPER ON LOW COST AND EFFECTIVE CONSTRUCTION TECHNIQUES

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ABSTRACT

Low-Cost Housing is a new concept which deals with effective budgeting and following of techniques which help in reducing the cost construction through the use of locally available materials along with improved skills and technology without sacrificing the strength, performance and life of the structure. There is huge misconception that low-cost housing is suitable for only sub-standard works and they are constructed by utilizing 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.

Energy efficiency and sustainability are the basic needs of modern era. In order to achieve this there are several building construction techniques and environment friendly materials have been introduced. But there is a need to use these techniques and material in a proper combination so that they could be adoptable and economical and play a vital role in the improvement of energy efficiency and sustainability. Green building and sustainable architecture are new techniques for addressing the environmental and energy crises. Some of the techniques are discussed in this paper that are

1. Trombe wall construction technology.
2. Rammed earth wall construction technology.
3. Rat trap bond construction technology.
4. Mud flooring.

INTRODUCTION

Low-Cost Housing is a new concept which deals with effective budgeting and following of techniques which help in reducing the cost construction through the use of locally available materials along with improved skills and technology without sacrificing the strength, performance and life of the structure. There is huge misconception that low-cost housing is suitable for only sub-standard works and they are constructed by utilizing 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.

Objective of the project:

- The important need and everyone's dream to have their own home with individual needs.
- To propose cost effective technique is more suitable for low – income groups and compare the costs with conventional techniques.
- The main objective is to suggest that the cost-effective techniques is more suitable for low – income groups. The implementation of cost-effective technique for low – income group projects will be more profitable.

Significance of the study:

The goal of low-cost housing is to save money while also maintaining buildings quality. Following Properties Reduces Cost of Construction. Locally available materials, Improved skills and technology. Without sacrificing the strength, performance and life of the structure. There is a need for the adoption of strong, durable, environment friendly, ecologically appropriate, energy efficient and yet cost-effective materials and appropriate technologies in construction.

Methodology:

1.<u>Trombe wall construction technology:</u>

A Trombe wall is a massive Equator-facing wall that is painted a dark color in order to absorb thermal energy from incident sunlight and covered with a glass on the outside with an insulating air-gap between the wall and the glaze. A Trombe wall is a passive solar building design strategy that adopts the concept of indirect-gain, where sunlight first strikes a solar energy collection surface which covers thermal mass located between the Sun and the space. The sunlight absorbed by the mass is converted to thermal energy (heat) and then transferred into the living space

2.<u>Rammed earth wall construction technology:</u>

As the name implies, rammed earth construction involves the use of compressed earth. A mixture of earth consisting of the right amount of sand, gravel and clay is poured into a mould or formwork. This earth mixture is rammed until it becomes rock solid. When properly constructed, rammed earth walls can resist the various onslaughts of nature for a very long time.

3.Rat trap bond construction technology:

Rat trap bond is a brick masonry method of wall construction, in which bricks are placed in vertical position instead of conventional horizontal position and thus creating a cavity (hollow space) within the wall. Architect Laurie Baker introduced it in Kerala in the 1970s and used it extensively for its lower construction cost, reduced material requirement and better thermal efficiency than conventional masonry wall, without compromising strength
of the wall.

The bricks are placed in vertical position, so that 110 mm face is seen from front elevation, instead of the 75mm face (considering brick of standard size 230 X 110 X 75 mm). Since width of wall remains 230mm, an internal cavity is created. This is where approximately 30% Material (brick and mortar) is saved and thus overall construction cost is reduced. Cavity provides effective thermal and sound insulation. This makes rat trap bond energy and cost-efficient building technology.

4.Mud flooring:

Mud flooring is one type of flooring that is most commonly used in rural areas even today. In modern times it is known as earthen floor. It is laid on concrete sub-surface. It consists of raw earth, sand, finely chopped straw and clay mixed to form paste. This paste is applied on the sub-surface (i.e., of concrete) with a trowel. Once it dries, it is saturated with several treatments of a drying oil. Mud flooring being the environmentally friendly material, it is used in even today with alterations.

It has following advantages:

- Mud flooring is cheap and hard.
- Easy to construct. It does not require skilled labour.
- It has good thermal insulation property. It remains cool in summers and warm in winters.
- It is environmentally friendly flooring.
- It is fire resistant.
- It is noiseless.
- The only disadvantage of mud flooring is that it is not moisture resistant.

LITERATURE REVIEW

Trombe walls have been integrated into the envelope of a recently completed Visitor Center at Zion National Park and a SEB at NREL's Wind site. A Trombe wall can enable a building envelope to go from a net-loss feature to a net-gain feature. The Trombe wall provides passive solar heating without introducing light and glare into theses commercial spaces. Overhangs are necessary to minimize the summer gains; however, additional means would be helpful to minimize summer cooling impacts. In both walls, edge effects were minimized with appropriate ground insulation.

The Trombe walls in both the Visitor Center and the SEB provide significant heating to the buildings. In the Visitor Center, 20% of the annual heating was supplied by the Trombe wall, and the SEB afternoon and evening heating loads are typically met by the Trombe wall. The annual net effect of the wall has to be considered when designing a Trombe wall, as the additional cooling loads can affect the cooling system performance.

Historical Overview—Earthen building systems have been used throughout the world for thousands of years. Adobe construction dates back to the walls of Jericho which was built around 8300 B.C. Many extant earthen structures have been functioning for hundreds of years. However, with the development of newer building materials, earthen building systems have fallen into disfavour in parts of the world where they were once commonly used. At the same time, earthen construction is experiencing a revival in the industrialized world, driven by a number of factors.

Sustainability—As world population continues to rise and people continue to address basic shelter requirements, it E2392/E2392M − 10´1 3 Copyright by ASTM Int'l (all rights reserved); Fri Aug 1 16:53:53 EDT 2014 Downloaded/printed by Patrick Donaldson (communicator) pursuant to License Agreement. No further reproductions authorized. Becomes increasingly necessary to promote construction techniques with less life cycle impact on the earth. Earthen building systems are one type of technique that may have a favourable life cycle impact.

Building Code Impact—Earthen building systems have historically not been engineered, but as of the late 20th Century it is for the first time in history possible to reliably apply rational structural design methods to earthen construction. A large number of earthen building codes, guidelines and standards have appeared around the world over the past few decades, based upon a considerable amount of research and field observations regarding the seismic, thermal and moisture durability performance of earthen structures. Some of those standards are: Australian Earth Building Handbook California Historical Building Code Chinese Building Standards Ecuadorian Earthen Building Standards German Earthen Building Standards Indian Earthen Building Standards International Building Code / provisions for adobe construction New Mexico Earthen Building Materials Code New Zealand Earthen Building Standards Peruvian Earthen Building Standards This guide draws from those documents and the global experience to date in providing guidance on earthen construction to engineers, building officials, and regulatory agencies.

Audience—There are two primary and sometimes overlapping markets for earthen construction and for this guide.

1.Areas with Historical or Indigenous Earthen Building Traditions—In places where earthen architecture is embedded in the culture, or there is little practical or economical access to other building systems, this guide can set a framework for increasing life safety and building durability. **2.Areas with a Nascent or Reviving Interest in Earthen Architecture**—In places where earth is sometimes chosen over other options as the primary structural material, this guide provides a framework for codification and engineering design.

In this investigation an attempt has been made to simulate the out-of-plane failure of box-type rat-trap bond masonry building as those observed in the event ofa strong earthquake. Shock Table tests of (1/3) scale rat-trap bond masonry building models were carried out to simulate such failure. It can be seen that the total energy imparted to the model without roof slab is 3581.56 Nm before its total collapse. The model with roof slab was capable of withstanding a total energy of 4069.09 Nm before its total collapse. Thus, the energy capacity of model with roof slab is greater than that of the model without roof slab. It was observed in this experimental investigation that the damages in the case of model without roof slab are more severe and extensive than that with roof slab. The onset of damage is much earlier in the case of model without slab than that with slab. The integrity of walls was ensured by the provision of the roof slab. This shows that the sustainability of model with roof slab under base shock excitation is better than that without roof slab. This reveals that design of roof plays an important role in design of masonry systemsubjected to base shock excitation.

Stabilized mud blocks (SMBs) are manufactured by compacting a wetted mixture of soil, sand, and stabilizer in a machine into a high-density block. Such blocks are used for the construction of load-bearing masonry. Cement soil mortar is commonly used for SMB masonry. This paper presents the results of an experimental investigation in characterizing the properties of SMB masonry using cement-soil mortars. The compressive strength, stress-strain relationships, and elastic properties of SMB masonry using three types of SMBs and cement-soil mortars are discussed. The influence of a cement-soil mortar's composition and strength on masonry characteristics is examined. The results of masonry using cement-soil mortars are compared with those using conventional mortars (cement mortar and cement-lime mortar). Some of the major findings are: (1) SMB masonry strength is sensitive to block strength and increases with increase in block strength; (2) the strength of SMB masonry using cement-soil mortars is more sensitive to the cement content of the mortar than to the clay fraction of the mortar mix; (3) the masonry modulus increases as the block strength increases; and (4) SMB masonry with cement-soil mortars shows higher modulus than the masonry using cement mortar and cement-lime mortar.

CONCLUSION

Housing is one of the basic needs of mankind in terms of safety, security, self-esteem, social status, cultural identity, satisfaction and achievement. After analysing 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.

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