LOW-COST CONSTRUCTION MATERIALS: AN INTRODUCTION

Mukul Kumar[1], Somesh Kumar[2], Bharat Phulwari[3], Amit Choudhary[4]

[1] *M.Tech Scholar, Civil Department, Bhagwant University, Rajasthan, India*
[2] *M.Tech Scholars, Civil Department, Bhagwant University, Rajasthan, India*
[3]*Assistant Professor, Civil Department, Bhagwant University, Rajasthan, India*
[4]*Assistant Professor, Civil Department, Bhagwant University, Rajasthan, India*

ABSTRACT

In this paper we are presenting an introduction of low cost construction. Recently, polymer concrete has shown promise for future use as a major construction material. Based on laboratory studies, the strength of polymer concrete is three to four times that of ordinary concrete with very high corrosion resistance and durability. The cost for polymer concrete is about six cents per pound compared with 39 cents per pound of steel, and it is particularly suitable for areas with high corrosion problems, such as locations of offshore structures, sewage pipes, pavement in cold regions, railway ties, nuclear power plants, and numerous other possible applications. Nowadays the various waste products from big industries has been converted into useful building materials which can be used during post earthquake housing construction, solving the problem of disposal on the one hand and providing better construction material at low cost on the other hand. Similarly some agricultural wastes (as rice husk) have also been converted into building materials, which are very much useful during reconstruction phase as low cost building materials. In the present paper few low cost building material, which can be used during post earthquake housing construction has been highlighted.

Keyword: - *Low Cost, Material, Building, Construction, Resistance etc.*

1. INTRODUCTION

A study of the construction methods used by various agencies in the disaster affected areas points to the growing use of local resources and talents in present day relief and reconstruction measures. In case of rural areas, the houses can be constructed by using traditional and locally available raw materials of bamboo, cane, reeds, rattans, willow, timber and leaves of some particular trees, and has been designed to suit the traditional living habits of local people and maintain their socio-cultural heritage. Further there has been a growing feeling amongst the rural peoples that the old bamboo-thatch or leaf houses may be constructed with newer materials of RCC, precast-components etc., using better engineering information and thereby, achieving more durability as well as extra living comfort in the process. Under these growing innovative concept, concrete blocks, cement, wooden frames, and tiles that are locally made are most useful and thereby encouraging many small-scale enterprises in the process. Although there seems to be a strong emphasis on the use of local resources in present day relief aid, the important issue is not just the use of local resources, but how local manpower can be created. In most developing countries, the challenge is to organize and initiate measures that promote talent building. So many new building materials for low cost housing has been developed by various research agencies but so far these new technologies has not been transferred to the community effectively. Local artisans, masons are required to be trained in the use of new low-cost building materials and techniques. Creating better resistance to earthquake today involves access to steel and cement concrete if not to ultra modern aerated concrete blocks. There have been several attempts at local levels to make use of bamboo and mud instead. These attempts have not all stood the test of time; most of them have not got the chance to face further quakes of high magnitudes - but these attempts have always met with criticism by the scientific fraternity. In our rural housing, local materials have to play an important role. Even poor man's materials can be used to provide extra

strength to a dwelling unit with incorporation of a few simple engineering principles. Total safety cannot be assured even by use of high technology - but all dwelling houses, big and small, can be made safer.
The purpose of this paper is to summarize some highlights of studies on relatively low-cost materials for possible use in low-cost housing in developing countries in addition to the polymer, sulfer and fiber concrete currently being studied at Fritz Engineering Laboratory, Lehigh University which are as follows: 1. Stabilized waste-disposal material 2. Polymer-bamboo reinforced concrete 3. Random-straw or coconut fiber stabilized soil.

2. WASTE-MATERIAL

The scope of this study is the further application of waste-disposal material to foundations and highway sub base courses. Laboratory studies have been made on compacted natural waste and stabilized waste disposal material. The compacting method for natural waste material has been developed by the American Solid Waste System Inc. of Minnesota which is three compaction system using pressures in the region of 2000 to 3600 psi with steel baling strips holding the bale together. The stress-strain relationship was analyzed from the tensile and unconfined compression tests. Other tests included wet-dry, freeze and thaw, and hydraulic conductivity 'tests. Since this is a highly non homogeneous material, random statistical techniques and stochastic processes were applied. Based on the preliminary results, it is feasible to use waste-disposal material for future high'" way sub base course.

3. POLYMER-BAMBOO

Utilization of the locally available material especially waste material for developing low-cost material for low-cost housing is important. Using modern geotechnical technology which can improve the strength and durability of much of the existing low-cost material should be encouraged. Other low cost materials such as sulfur treated brick or masonry block are also being studied. The ultimate stress for untreated bricks ranges from 7,540 psi to 12,180 psi as compared with 15,620 to 25,230 psi for treated bricks. Compressive stress and secant modulus also increases significantly. Using the fracture mechanics concept analysis, the fatigue behavior and crack growth of treated and untreated bricks have been evaluated under various loading and environmental conditions.

4. HOLO-PAN SYSYTEM

The holo-pan system can be used only in six standard pre fabricated components and they are
• Wall
• Roofing/floors
• Door/window
• Collar units
• Parapet units
• Partially precast beams

Overall cost of hollow pan system is less and speed of construction is more. A flat can be constructed in 1.5 days time. They are useful for post earthquake reconstruction phase. One crane is required to lay the prefabricated panels at respective positions.

5. TYPES OF BUILDING MATERIALS

The various building materials available can be divided into two types and they are:

- Traditional materials
- Conventional materials
- Improvement of Mud
- Stabilization
- Non-erodable mud plaster
- Terra-cotta skin to mud walls
- Improved Thatch Roof
- Wardha Tumbler Tiles
- Ferro-Cement
- Flyash-sand Lime Bricks
- Gypsum Based Ceiling Tiles, Panel Blocks and Door/Window Shutters
- Precast Stone Blocks

- Clay Red Mud Burnt Bricks

6. FEW REASONS OF FAILURE OF EARTHQUAKE-PROOF HOUSES

It is commonly believed that some houses could be made earthquake proof. The reality however is that by taking up precautions, the earthquake resistance of the house is increased finitely, to make them resist quakes of specific magnitudes. These houses, too, may fail once they face quakes having more intensity than their design took care of. Following are the few reasons why earthquake proof houses may fail:

- Vibrations
- Inertia Force
- Poor Quality of Material
- Dead Load

7. SOLUTIONS TO PREVENT FAILURE OF EARTHQUAKE-PROOF HOUSES

The bamboo construction in North-East India follows this principle of rigid house. Bamboo being light gives added natural advantage. In these houses rigidity is achieved by means of cross bracing and triangulation. All joints are strengthened by means of cross members that can transmit earthquake forces directly to the remaining portions of the house. Reinforced concrete 'frames' are rigid by design and their rigidity can be improved further by small increases in steel used. The 'framework' of such beams and columns can be made to resist earthquakeinduced vibrations of considerable magnitudes. Almost all the multi-storied buildings in towns and cities are framed, thus the structure finds great support. It must be noted here that though the RCC frames take care of major portions of earthquake induced forces, the forces generated in the non-load bearing walls could still lead to damages byway of wall collapses. In places like rural India where concrete technology has little reach, masonry in brick and / or in stone takes major share in the form of lead bearing walls The strength of masonry depends to a great extent on the strength of the mortar joining them to distribute the earthquake-induced forces equally throughout. One modern method 'Foamed Concrete' construction combines principles of structural masonry together with the advantages of lightweight foam concrete. Foam concrete is prepared by aerating the concrete profusely as it is mixed to create a highly fluffy, lightweight substance. Building blocks and units made out of this material lead however to centralization and are subject presently to patent laws. Masonry when properly construct, possesses good resistance to seismic forces. Bad construction, however, means disastrous consequences. Improving the rigidity of load bearing masonry by way of three RCC bands one each at plinth, lintel and roof levels is the most common technique employed in a country's earthquake resistant housing programmes today. These houses, when constructed under supervision can resist earthquakes of moderate intensities quite efficiently.

8. CONCLUSIONS

There are several natural disasters occurring throughout the world round the year and one of them is Earthquake. The severe quakes wreak catastrophic havoc in the human community because of destruction of structures - houses and buildings, bridges, roads, railways and uprooting of transmission towers. Along with death the other distressing factor is collapse of dwelling units. Death and destruction can be prevented or vastly minimized if the houses are structurally sound. In a poor country severe earthquake occurs every now and then, the problem of appropriate 'safe' housing must receive adequate attention from architects, engineer, builders, and owners of property. Nowadays the various waste products from big industries has been converted into useful building materials which can be used during post earthquake housing construction, solving the problem of disposal on the one hand and providing better construction material at low cost on the other hand. Similarly some agricultural wastes (as rice husk) have also been converted into building materials, which are very much useful during reconstruction phase as low cost building materials. In the present paper few low cost building material, which can be used during post earthquake housing construction has been highlighted.

9. REFERENCES

[1]. Broadbent, S.G. and Broadbent, D.M. (2004), "Traditional vs. Modern Construction Practices", Proc. Second International Conference on Post-disaster reconstruction: Planning for Reconstruction, Coventry University, UK

[2]. Central Building Research Institute, "Building Dreams in Mud for Village Wardha (India) - Your own House" Manual, Roorkee, India

[3]. Central Building Research Institute, "Living better with mud and Thatch" Manual, Roorkee, India
[4]. Central Building Research Institute, "Advances in Building materials & construction" Manual, Roorkee, India
[5]. Delaney, Patricia L., Shrader, Elizabeth (2000), "Gender and Post-Disaster Reconstruction : The Case of Hurricane Mitch in Honduras and Nicaragua" Decision Review Draft, LCSPG/LAC Gender Team, The World Bank
[6]. ECLAC & IDB, (2000), "A Matter of Development : How to Reduce Vulnerability in The Face of Natural Disasters", Seminar on Confronting Natural Disasters : A Matter of Development, New Orleans
[7]. Indian Society of Earthquake Technology (2001), "A manual of Earthquake Resistant Non-Engineered Construction", Roorkee, India
[8]. Maharashtra Emergency Earthquake Rehabilitation Programme (1995), "Reconstruction and disaster management plan", Maharastra, India
[9]. Mathur, G.C. (1988), "Low cost Housing in Developing countries", Proceeding of International Seminar on Low cost housing, New Delhi
[10]. Mission, C (1995), Catholic University of London
[11]. Punia, R.D. and Roy, U.N. (2002), "Appropriate technology for Low cost Housing" Journal, Institution of Engineers (India) Calcutta
[12]. Randolph Langenbach (1989), "Bricks, Mortar, and Earthquakes - Historic Preservation Vs. Earthquake Safety", Aptabulletin, The Journal of The Association for Preservation Technology, Volume XXI, No. 3 & 4
[13]. Ranganath, Priya (2000), "Mitigation and the Consequences of International Aid in Postdisaster Reconstruction" Natural Hazards Research Working Paper, McGill University