LOW COST HOUSING (BAMBOO)-REVIEW

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Abstract: - Bamboo is one of the oldest building material used by mankind. The bamboo culm, or stem has been made into and extended diversity products ranging from domestic household products to industrial applications. In many overly populated regions of the tropics, certain bamboos supply the one suitable material that is sufficiently cheap and plentiful to meet the extensive need for economical housing. Bamboo shoots are an important source of food, and a delicacy in Asia. Low cost housing is new concept which deals with effective budgeting and applying various technique which help in reducing the cost construction through the use of locally available material along with improved skills and technology without sacrificing the strength performance and life of the structure.

1.0 INTRODUCTION

Bamboo is one of the oldest building material used by mankind. The bamboo culm, or stem has been made into and extended diversity of products ranging from domestic household product to industrial applications. Example of bamboo products are Food containers, skewers, chopsticks, Handicrafts, Toys, Furniture’s Flooring, pulp and Paper, Boats, Charcoal, musical instruments and weapons. In Asia bamboo is quite common for uses, scaffolding and housing, but it is usually a temporary exterior structural material. In many overly populated regions of the tropics, certain bamboos supply the one suitable material that is sufficiently cheap and plentiful to meet the extensive need for economical housing. Bamboo shoots are an important source of food, and a delicacy in Asia. In addition to its more common applications, bamboo has other uses, from skyscraper scaffolding and photograph needles to slide rules, skins of airplanes, and diesel fuels. Extractives from various parts of the plant have been used for hair and skin ointment, medicine for asthma, eyewash, potions for lovers and poison for rivals. Bamboo ashes are used to polish jewels and manufacture electrical batteries. It has been in bicycles, dirigibles, windmills, scales retaining walls, ropes, cables and filament in the first light bulb. Indeed, bamboo has many applications beyond imaginations beyond imagination. Its uses are broad and plentiful. With the advancement of science and technology and the tight supply of timber, new methods are needed for processing of bamboo to make it more durable and more usable in terms of building materials. Studies have been done on the basic properties, and processing bamboo into various kinds of composite products. More studies are needed to aid and promote its application in the modern world.

2.0 Basic Requirements of Bamboo as a construction Material

2.1 Affordability
Foundations are minimized, wall panels are non-load bearing and can be reduced in thickness basic components [bamboo, wire, bolts, chicken mesh, and cement] are inexpensive.

2.2 Sustainability and environmental impact
Bamboo is available in commercial quantities using the established supply system. It is a renewable resource with a short rotation period and can be grown on degraded land. The bamboo is treated using environmentally friendly preservatives. The use of high energy embodied materials [cement, steel] is minimized.

2.3 Cultural acceptability
The system offers traditional materials in a modern engineering context, the result is homely, with the feel of permanence.

2.4 Durability and safety
All bamboo components are treated with safe preservatives to give extended life; the structure is engineered to resist wind and earthquake forces and other imposed lands.

2.5 Improved jointing techniques
Nailing [and therefore splitting] is eliminated; wiring, bolting and strapping provides positive connections.

2.6 Modular construction
Suited to either prefabrication or fabrication in-situ: all components are designed to be prefabricated [e.g. infill grids, roof trusses], or prepared on site.

2.7 Ease of assembly
Only basic carpentry and masonry tools and skills are required to undertake the construction.

3.0 Benefits of bamboo as a construction material

It accumulates a considerable quantity of biomass in short time having low rotation period of 2-5 years it sequesters atmospheric carbon faster than many fast growing trees. Bamboo plantations are known to conserve top-soil. Thus greater use of bamboo and its products as wood alternates, can help preserve tropical forests and curtail the rapid decline of forest areas. The biomass production of bamboo depends on the species, site quality, climate etc. the figures vary between 50 and 100 tons per ha, comprising of culm biomass – 60 to 70%, branches – 10 to 15% and foliage – 15 to 20%. It has been calculated that in Costa Rica a bamboo plantation is able to capture 17 metric tonne of carbon per ha per year. This is due to the rapid growth of bamboo: an annual crop of 30 metric tonne air-dry bamboo per ha per year is easily possible of course any permanent capture of carbon is only valid if the bamboo is used for long-term purposes like housing, i.e. once the bamboo has been burnt, the carbon returns to the atmosphere. In the Philippines, Kenya and the Andes region bamboo is well known for its capacity to control erosion. In Punjab [India] about 62,000 bamboo clumps were stubbed in 1980 in order to stabilize 311 ha of embankments. These clumps started production with five culms per clump in year five, and were expected to attain the full development level of twelve bamboo culms per clump from year ten onwards- yielding an annual profit of as much as US $70,000.

4.0 METHODOLOGY

4.1 Alternative Walling System

The quantity and quality of wood resources from the forest have been decreasing Consequently, the search for substitute material in place of the traditional uses of wood has been renewed by bamboo. In particular, is considered a promising alternate material because of its fast growth rate, short rotation age, and high strength. There is always need of low cost mass housing schemes for people earthquake affected areas emergency structures in different situations. With the aim to utilize strength properties of bamboo in low cost housing research project work is undertaken on Alternative walling system.

4.2 Cement Soil Stabilization

Stabilization of typical earthen plinth can be carried out with a mixture of earth and cement. The proportion of cement to be added depend on the nature of the soil, which can easily tested on site for soil with more than 40% sandy- silty partials, 5% cement additive is adequate. For soil with less sandy content, sand has to added to rise the content above 40% and may require a somewhat a higher proportion of cement additive.

4.3 Cross-Bracing

To increase stability and wind resistance of structure frame of bamboo framed houses, cross bracing with split bamboo section should be done. If houses become weakened at its base due to flood, cross-bracing should be treated with chemical, preservatives so that do not decay easily and loss their strength. Instead of jute or coir rope nylon rope of good quality galvanized wire should be used for tying the elements of the structural frame.

4.4 Treatment Given To Material [Bamboo]

- Bamboo could be impregnated under pressure in autoclave or by boiling.
- Bamboo could be soak in a solution in a open basin for several days [for slats] until one week if bamboo culms.
- Or using the “butcherie” method.

A] Chemical Treatments

1. Treatment with Boric Acid/Borax

However, in all cases, borax/boric acid diffuse better into bamboo when bamboo is moist i.e. in the green condition. The products made with treated bamboo with borax are not toxic. However treated bamboo must not be burned, as the gases of such a fire are toxic, there is a debate either the boric acid/ borax is toxic or not.

Boric acid/ borax has low toxicity to humans through ingestion or inhalation. Median lethal dose [LD50] rating of 2,660 mg/kg body mass for man. Boric acid is poisonous if taken internally or inhaled in large quantities. It is generally considered to be not much more toxic than table salt. Some ethnic groups use it however as a food additive. However in some countries it is requested to farmers and restaurateurs not to use it because of unacceptable risk to consumer health.

In France, the boron content should not exceed 1 milligram per liter according to health standard for drinking water. At high concentrations it is irritating to eyes, skin and respiratory tract where short exposure
but may have effects on the kidney in cases of prolonged or repeated exposure.

2. Boiling in Linseed Oil
The culms or slats of bamboo are soaked in linseed oil heated to between 100 and 120 C. the treatment of bamboo by oleo-thermal process is to our knowledge not developed mainly due to the excessive cost of energy to boil the oil in large basins.

3. Fungi
The originate from very fine, air-borne spores present in fruit bodies, and occur everywhere. They nourish on the nutrients in the bamboo culm. Damage becomes noticeable at an advanced stage, when substantial fungal growth is already underway. Fruit bodies appear subsequently on the outside surface and their removal does not stop the decay process inside the culm wall.

4. White washing
Bamboo culms are painted with slaked lime, thereby prolonging their lifespan by delaying and reducing the absorption of moisture while being a repellent against Insects.

5. Lime washing
To prepare lime water, we mix the lime [slaked lime] with water. It is sparingly soluble, it is necessary to stir the mixture for some time. This step results in a white solution called milk of lime, which is a suspension of calcium hydroxide particles in water. To eliminate the unsolved lime in suspension, we proceed to a decantation of the milk of lime for 24 hours. As a result we obtain the lime water, a clear solution. Lime water is the common name for saturated calcium hydroxide solution \([\text{Ca} \cdot \text{OH} \cdot 2]\) in contact of carbon dioxide \([\text{CO}2]\) it will form calcium carbonate \([\text{CaCo3}]\), which can be seen as a white film on the surface of the lime water.

B] Traditional Treatment
These are ancient methods widely used for centuries by villagers and artisans in countries where bamboo grows, and often the skills are passed on from generation to generation. The most commonly methods used are smoking, whitewashing, storage in water.

1. Leaching
Leaching help removal starch and also chances permeability for future treatment by diffusion and pressure. Mechanical properties are affected for up to 2-3 month of water storage. This method is appropriate for treating any quantity of bamboo. It is also recommended for craft and mat application where pliability is required.

2. Baking over open fire
Baking over fire after applying oil on the surface of green round bamboos. This causes rapid drying of the outer shell and induces partial charring and decomposition of starch and other sugars. This method is very useful for simultaneous straightening of bamboos in round form.

3. Soaking in water
Freshly cut bamboo is stored either in water ponds or running water for 3-4 weeks to leach out starch. This process protects the bamboo against insects. When stored in water basins, water must be changed frequently to avoid fouling. Although traditionally treated bamboo shows increased resistance to insects and fungi attack compare to the freshly cut culms, theses methods do not however provide complete satisfaction in the long term.

4. Smoking
Traditionally culms are stored over the hearth or fireplace. The moisture content in smoked culms is thus reduced so that biological degradation cannot take place. Built up deposits from a protective layer on the culm. Smoke drying also reduced splitting.

C] Thermo-treatment
The principle of the process is to heat the bamboo in an autoclave at a temperature high enough [for bamboo between 150 and 200 C], in anoxic condition and to regularly inject steam to avoid the bamboo to ignite. Bamboo is “cooked” in some way and stabilized while remaining solid. Its ability to absorb water is reduced by half. The technique thermo-treatment of bamboo is an alternative to preservative treatment with use of insecticide and chemicals. However, heating the bamboo at high temperature makes it stable and virtually rot-proof. If thus makes naturally resistant to borers, termites, fungi and moisture. Bamboo products treated by this method can also be used as a structural element of a building. But bamboo from thermo-treated tends to reduce strength and flexibility, and their implementation in structure requires special precautions [such as use of larger section]. They are also ideal for flooring, decks, exterior, siding etc.
5.0 CONCLUSION
The planning and design of low cost house in rural areas. In India almost 30% people of total population cannot build their house for their low income. So we provided bamboo house at low cost. The costing of bamboo house is approximate Rs. 1,20,000/- this is including the bamboo treatment i.e. borax Treatment. After bamboo, the life of structure is more or less 30-35 year. But if we cannot treat the bamboo, the life of structure is more or less Rs 50,500/- and the life of structure is 15-20 years.

6.0 REFERENCES
[6] Positioning Housing Assistance, AHURI.