Study of Bamboo Reinforcement Concrete as a Sustainable Material in Construction

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Abstract – Bamboo belongs low cost, fast growing and broad distribution of growth, is expected to contribute significantly in the developing countries we know from an ancient time bamboo is used as a construction material. The fact about cost optimization steel and bamboo is due to increasing cost of steel and there unavailability it is not possible for peoples to afford it bit by replacing steel as a bamboo we can easily move towards cost optimization. Bamboo is sustainable with steel because due to lack of knowledge regarding bamboo, there bonding and there physical and mechanical properties.no one can understand the fact that bamboo is as sustainable as steel to overcome the remedies of bamboo we have to improve their properties and there bonding strength with concrete for making bamboo as sustainable material as steel.

Keywords: Bamboo, Different Methods to Improve Bonding Strength, Durability, Low Cost.

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1. INTRODUCTION

In recent years, steel prices have soared for developing countries. Steel is difficult to obtain because of expensive prices, and for the construction industry, usage of steel is currently limited heavily. The production of steel has high consumption of fossil fuels, so, the steel discharge in the construction of structures has been presented, showing the possibility of drastic reduction by research institutes. Meanwhile, for developing countries, it is important to make the development of buildings construction; low cost, no requirement of sophisticated technologies and reliable construction methods.

Environmental destruction such as pollution of air and water has been occurring in some regions by rapid development and production of materials like iron, steel, glass, cement and aluminum that use limited mineral resources. On the other hand, plants and fibers are annually reproducible clean resources. Bamboo is a unique group of gigantic grasses the culm of which originates in underground rhizomes. It grows naturally in many parts around the world country but some species are artificially planted. Bamboo forests are found across tropic and sub-tropic zones. The plant is fully mature at an age of three to four years.

Now many researches around the world are begun to explore the use of low-cost and low-energy substitute construction materials. Among the many possibilities for such substitutions, bamboo, which is one of the fastest growing plants, has got a great economic potential. Bamboo has been used in constructions of bridges and houses for thousands of years in Asia. Bamboo takes less energy to harvest and transport. Therefore, bamboo has low manufacturing costs compared with steel, bamboo is widely expected to be possible even in countries and regions that have no advanced manufacturing technology and construction techniques. The use of renewable resources by the construction industry will help to achieve a more sustainable pattern of consumption of building materials.

2. LITERATURE REVIEW:

Ghavami[1] studied bonding and bending with bamboo in lightweight concrete. Most developing countries have several problems, and one of the main problems is housing. The housing problem has been related to the low skill of the scientists, engineers, and designers who need education for finding inexpensive construction and efficient plans. In additional, specialist systems for education,

various information, and vitality of economy are needed.

The values of the test of compression and shear are dependent on the type of bamboo. The tensile strength is higher than the compression strength. In several tests, Bambusa vulgaris shard and Dendrocalamus were researched the highest value of tensile strength & compressive strength.

The bond test considered two types of bamboo, treatment and untreated. The treated specimens were wrapped with steel wire on embedded spacing and cared Negrolin-sand. In this test, treated bamboo, was more effective than untreated bamboo, and with up to 90% improved bond stress.

From the study of previous literature, we come to know that, bamboo is a natural material, eco-friendly, economical and flexible material.

To check the feasibility and reliability of using splint bamboo as reinforced concrete material and to select and prepare the most suitable kind of bamboo specimen to use in concrete as reinforcement.and for pull-out test of bamboo to check bonding properties either concrete The following tests must be performed before using as reinforcement on different bamboo specimens:-

1. Moisture Content
2. Mass density
3. Shrinkage
4. Water Absorption
5. Tensile Strength
6. Compressive Strength
7. Shear Strength
8. Modulus of Rupture
9. Modulus of Elasticity

Concrete recommended by Brazilian Norm Sizing, seasoning, bending, and water proof coatings should be done properly to gain flexural strength of bamboo

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3. EXPERTIMENTAL SETUP:

A: Selection and preparation of bamboo strips

The bamboo culms of locally available Dendrocalamus strictus are procured considering the guidelines such as the samples procured are between 2 and 6 years of age, having brownish appearance and samples which are cut in winter season. Thereafter, bamboo strips of desired size are cut from these bamboo culms.

For the reinforcement, the bamboo samples are treated in five stages. Firstly bamboo specimens are polished by sand paper. Then a coat of paint is applied on the specimen. Then, a coat of bitumen (dry sand) and then bamboo strips binding with Teflon tape and finally binding with steel binding wire applied on the specimen to improve the bonding between the bamboo and concrete.

B: Pull out Test on Bamboo

Pull out test on bamboo is to be carried out by a special apparatus which is sustainable to make a proper grip with bamboo. In this test we calculate and observed deflection (in mm) of bamboo on a given particular load (KN) first we took cubes having standard size 150*150*150 mm and then using proper proportion of cement sand aggregate and water we made an homogenous mixture of concrete and then bamboo strips on which we already perform and improve their physical and mechanical properties are prepared to ready for casting. Bamboo strips cutting should be of 300mm. then we go through first step which includes three samples of plain bamboo which are polished by sand paper. While casting give a cover for bamboo strip and once first layer is casted on cubes then hold the bamboo strip straight in middle of cubes and then cast the cube as per standard procedure. Similarly all the specimen with different coating should be casted each of three samples and after then all cubes are lay down for curing after which we are going to perform test on them after 7,14,28 days and calculate the readings and plot the graph to show the differences in bonding.

Figure 1 Remolding cubes and cured for 28 days

Figure 2 Assembly ready for pull-out test on cubes

4. RESULT:

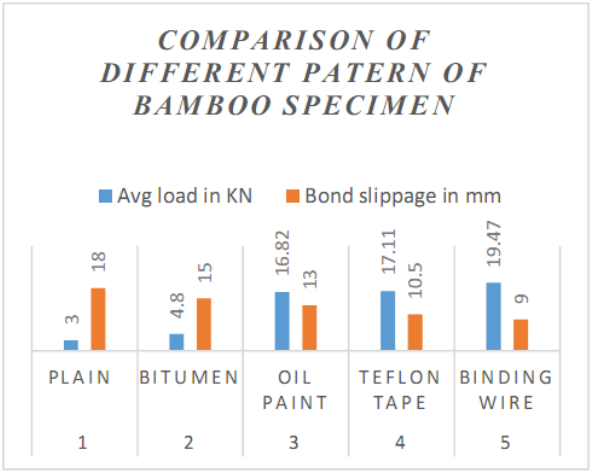

Figure 1 Bond slippage vs Avg Load Graph

5. CONCLUSION:

From the above literature review we come to know that, bamboo is a natural material, eco-friendly, economical and flexibility material. Bamboo can be used as splint bamboo and must be treated before using as reinforcement in concrete. As per study we can conclude that bonding strength of bamboo can be definitely improved by the techniques which we conducted.

REFERENCES:

Chandra. Sabani, Madhuwanti, Latkar and Utpal, Sharma (2013). "Can Bamboo Replace steel as Reinforcement in Concrete, for the key structural Elements in a low cost House, Designed for the Urban Poor?" International journal of chemical, Environmental & Biological Sciences (IJCEBS) Volume1, Issue 2 (2013) ISSN 2320-4087.

Khosrow Ghavami (2005). Bamboo as reinforcement in structural concrete elements, cement & concrete composites 27, pp. 637–649, 4 June 2004.

Leena Khare (2005). Performance evaluation of bamboo reinforced concrete beams, the University of Texas at Arlington December 2005.

Nirav B. Siddhpura, Deep B. Shah, Jai V. Kapadia, Chetan S. Agrawal and Jigar K. Sevalia (2013). "Experimental study on Flexural member using Bamboo as Reinforcement", Civil Engineering Department, Sarvajanik College of Engineering & Technology, Surat, Gujarat, India, Vol.3, No.2 (June 2013).

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