Study on the Use of Bamboo Reinforced Concrete (BRC) For Sustainable Green buildings: A Lab Scale Study

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Abstract- *The objective of this paper is to dealing with organic and renewable material called bamboo yet it can be used in only G+1(ground floor +1st floor) building or G+2 so it can reduces the cost of building and play a very important role in our real estate economy. If we look back in history ,buildings constructed with can be found in the regions in which plant grows in abundance, such as South America, Africa and, in particular, in South-East-Asia. Bamboo is one of the oldest construction materials. There has been a furious construction activity in the developing world, especially India and China, for the last one and a half decades. In this paper we made the comparison of compressive strength of steel and bamboo sticks this shows that bamboo sticks cannot be used for multistory structures.*

Keywords- Bamboo reinforced concrete, universal testing machine, curing, moulds.

I. INTRODUCTION

In present era, the inflation rate is increasing day by day and due to which affordable houses are difficult to find. Prices of construction materials such as steel have also 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 needs a high consumption of fossil fuel, so there is need of renewable and economical building material in green buildings.

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 but some species are artificially planted. The plant is fully mature at an age of three to four years.

The world timber demand is increasing at a rapid rate but the timber supply is depleting. It's been found through research that bamboo can suitably replace timber and other materials in construction and other works.

II. METHODOLOGY

- Material: Brown colour and dry bamboo sticks of 20mm width and 120mm long were taken.
- Procedure
  - First of all mould are filling with the m25 grade of concrete in cube (150*150*150)mm
  - Each layer must be 50 mm thick, there will be 3 layer in mould
  - Firstly provide 3 bamboo sticks in one layer of cube mould that is called BRC1
- After those cubes , another cubes of concrete were filled up with concrete and 3 bamboo sticks in first and last layer were provided in mould with each layer of 50 mm concrete thick that is called BRC2.
- Each layer of 50mm thick concrete were stroked 35 times by using tapping rod.
- After 3 hours , dates and location were written on BRC cubes.
- After 24 hours the mould were removed and then were put in clean water for 7 ays and 28 days

Table 1. Tensile strength of Bamboo and steel

STEEL kN /cm²	10mm kN/cm²	12mm kN /cm²	Bamboo kN /cm²	20mm kN /cm²	25mm kN /cm²
Max tensile	22.82	57.36	Max tensile	12.53	18.92
Yield stress	233.15	376.89	Yield stress	50.53	50.63
Breaking	14.56	40.29	Breaking	0.12	4.47

Making process of BRC:

Figure 1.

Figure 2.

Figure 3.

Figure 4.

Two layers of bamboo sticks 20mm width and 120 mm long Compressive strength test machine:

Figure 5.

Figure 6.

Cubes of BRC:

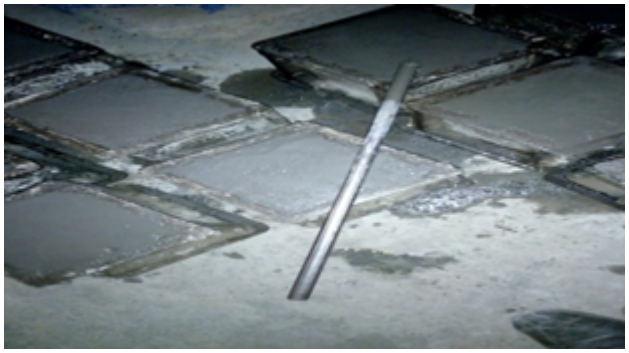

Figure 7

Curing of BRC cubes:

Figure 8.

Figure 9.

After test of BRC1 Cubes(crushed cubes):

Figure 10.

Figure 11.

Tested BRC2 cubes:

Figure 12.

Test results of BRC after 7 days:

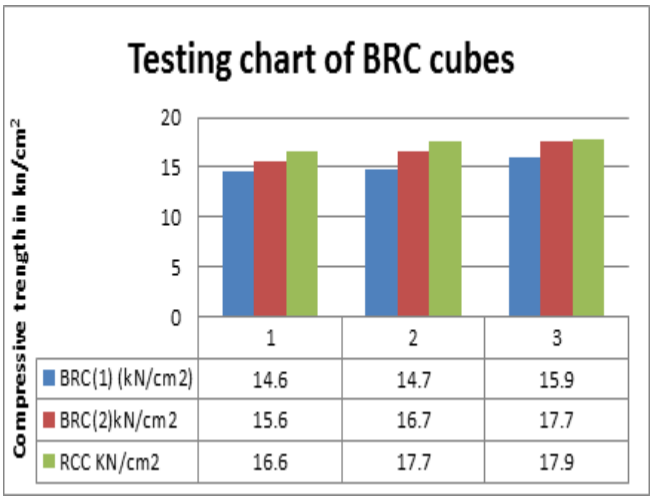

Figure 13.

Test results of BRC cubes after 28 days:

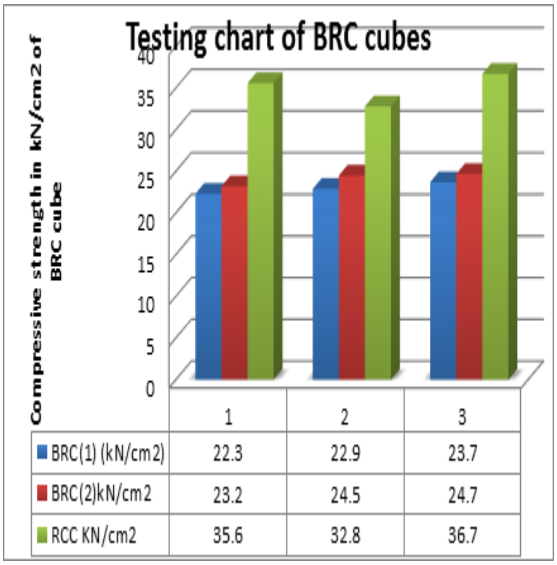

Figure 14.

ECONOMIC ANALYSIS

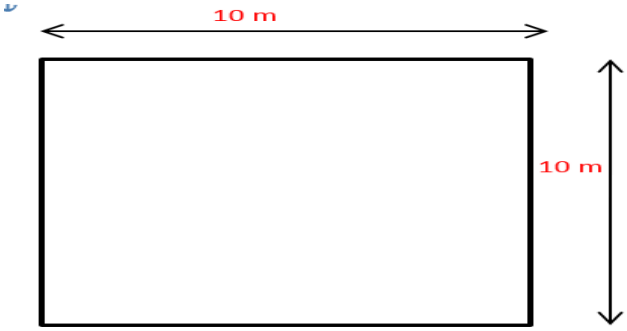

Figure 15.

Total area=100 meter square
No. of bar =length/spacing
No. of =10/0.125
Cross bar =80
Horizontal bar=80
Total bar=160
Using 10 mm dia of reinforcement
Formula $=D^2/162$
So 0.617 kg/m weight of reinforcement
Total cost of bar=3.80*160 =36540
If we use bamboo instead of steel
160/4=40
Total cost of BRC =40*450=18000
* Bamboo dia is greater than 160mm
4 sticks, from 1 bamboo

$$\frac{\text{cost of RCC} - \text{cost of BRC}}{\text{Cost of RCC}} X100$$

Putting the values in above formula we get 50.73 % cost reduction

III. CONCLUSION

- On the basis of strength BRC can be used in horizontal members of buildings like slab, trimix, stiching slab etc.
- It is not recommended for vertical members of buildings like column
- A good potential is present in BRC for the economical building houses and as well as for green buildings also.
- In comparison to steel bamboo is much cheaper.
- Bamboo is an organic and natural material.
- Bamboo is rust free material.
- It is a renewable material , as well as it is not costly.
- Bamboo doesn't decay in the presence of water and resists the rusting or corrosion.
- On the concept of BRC we can make the single storey or double storey houses.
- However BRC can not be used in multistorey buildings.
- It can play a crucial role in housing schemes for middle class and economically weaker section.
- With the help BRC, building construction cost can be brought down.

REFERENCES

[1] Ghavami K. Application of bamboo as a low-cost construction material. In: Proc of Int Bamboo Workshop, Cochin, India, 1988.p. 270–9.

[2] Ghavami K. Ultimate load behaviour of bamboo reinforced lightweight concrete beams. JCement Concrete Compos 1995;17(4):281–8.

[3] Dunkelberg K et al. Bamboo as a building material. Bamboo-IL ISBN 85-88142-01-5, Global Seven Edition, 2000. p. 1–16.

[4] Janssen JA. Bamboo in building structures, PhD thesis, EindhovenUniversity of Technology, Holland, 1981.

[5] Janssen JA. the importance of bamboo as a building material,1992

[6] Bhalla , S., Janssen J.A.J " Design Bamboo As Green Alterative To Concrete And Steel For Moder Structures.1992"

[7] Chariar.V.M., "Fabrication and Testing of Jute Reinforced Engineered Bamboo Structural

Elements1993."

[8] Dutta, B.N. "Estimate & Costing in Civil Engineering.1998"

[9] Francis E. Brink and Paul J. Rush "Bamboo Reinforced Concrete Construction1998."