

BEHAVIOURAL STUDY OF CONCRETE BEAM WITH BAMBOO REINFORCEMENT AND PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH WASTE PLASTIC

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Abstract - Seldom, steel is used as reinforcement in concrete but because of cost & availability, Replacement of steel with other sustainable material is a major criterion. Bamboo is one of among sustainable material which can fulfill the need of tensile strength for concrete beam. Since bamboo is natural, cheap & also easily available, its replacement will make concrete bamboo beam as an economical one. 12mm diameter bamboos are used in place of steel for M20 grade of concrete. Behavior of beam will be known in the form of flexure strength, compressive strength & consolidation of concrete for 14 & 28 days.

Key Words: Bamboo sticks, Loading frame, flexure strength, loads and displacement.

1. INTRODUCTION

Concrete is a widely used construction material for its various advantages such as low cost, availability, fire resistance etc. But it cannot be used alone everywhere because of its low tensile strength. So, generally steel is used to reinforce the concrete. It is a suitable substitute of this steel with a low cost, environmental friendly and also a less energy consuming one, is a global concern especially for developing country. Bamboo is one of the suitable replacements of reinforcing bar in concrete for low cost constructions. Bamboo is natural, cheap, widely available and most importantly strong in both tension and compression. The tensile strength of bamboo is relatively high and can attain 370 MPa.

1.1 Bamboo as Reinforcement

Bamboo is one of the suitable replacements of reinforcing bar in concrete for low cost constructions. Bamboo is natural, cheap, widely available and most importantly strong in both tension and compression. The tensile strength of bamboo is relatively high and can attain 370 MPa. The bamboo sticks are used as main bars in concrete beam of 12 mm diameter - 4nos. To get maximum strength with low cost.

1.2 Advantages and Disadvantages

- The behavior of bamboo is same as steel bar, It can be used as reinforcement.
- The density of is low so bamboo is light in weight.
- Bamboo can attain the tensile strength up to 370 N/mm².
- Bamboo has 6-8 times more than tensile strength of the steel.
- Bamboo moisture content directly affects the strength.
- Bamboo's strength depends on the age of bamboo. Strength goes decreases as the increase in age.

2. Literature review

Rahul padagannavar, K Arjun conducted experimental study on bamboo reinforced beam where Concrete is the most absorbed construction material in the whole world. Concrete is found to have finest compressive strength however poor in tensile. Steel which is costly, uneconomical and increase in CO2 emission is being used in construction, replacing with bamboo can reduce the effect on environment by using eco-friendly material. His project deals with the value of bamboo as a structural element in flexure. The fresh green bambusa bamboo is treated by broucherie technique making bamboo dry and moisture free, reinforcement crate has been created using steel and bamboo stirrups. The flexure test was carried out on the beams and MOE (modulus of elasticity) has been determined.

3. METHODOLOGY

The following steps were followed to complete this research.

- Calculation of Quantity Materials

For 3 beams:-

Quantity of cement = 23.12*3

= 69.36 kgs.

- Load calculations.
- Calculated ultimate load is 213 KN
- Testing on materials
 - a. Fineness of cement = 5%
 - b. Specific gravity of cement = 3.2
 - c. Bulking of sand = 16.66% @ 2% m/c
 - d. Specific gravity of coarse aggregate=2.7
 - e. Water Absorption of coarse aggregate=1.8
- Preparation of bamboo sticks.
- Mixing and Proportioning
- Casting
- Curing
- Flexure strength test.

4. RESULTS AND DISCUSSIONS

Flexural test evaluates the tensile strength of concrete indirectly. It tests the ability of unreinforced concrete beam or slab to withstand failure in bending. The results of flexural test on concrete expressed as a modulus of rupture which denotes as (MR) in MPa or Psi. The flexural test on concrete can be conducted using three point load test (ASTM C78).

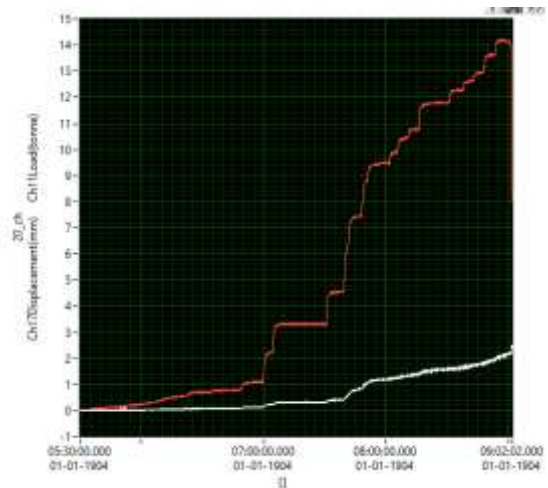
4.1 FLEXURE TESTS ON BEAMS

Table -1: Loads values

Description	Load in (tonnes)		
	Yield	Ultimate	Breaking
Steel Reinforced Beam	3.29	9.48	14.18
Bamboo Reinforced Beam 1	2.81	4.39	21.67
Bamboo Reinforced Beam 3	2.21	4.65	-

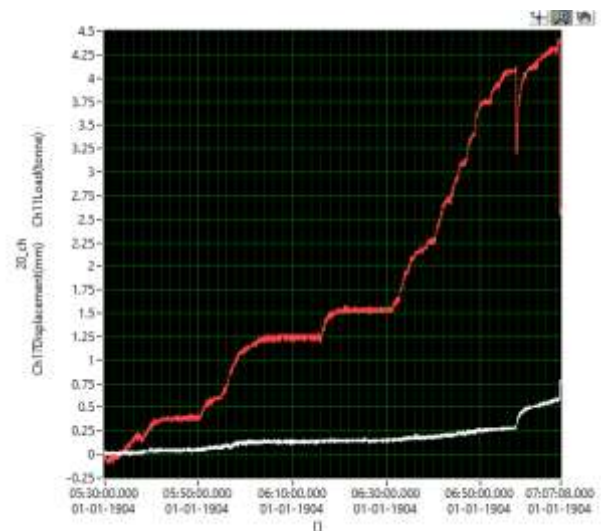
Table -2: Displacement values

Description	Displacement in (mm)		
	Yield	Ultimate	Breaking
Steel Reinforced Beam	0.34	1.23	2.18
Bamboo Reinforced Beam 1	0.18	0.2	0.85
Bamboo Reinforced Beam 3	0.19	0.58	-



Graph -1: Steel reinforced beam

The above graph represent the load and displacement values has 21.67 & 1.23 respectively for Steel Reinforced Beam



Graph -2: Bamboo reinforced beam

The above graph represent the load and displacement values has 14.18 & 0.58 respectively for Steel Reinforced Beam



Fig -1: Three point load

5. CONCLUSIONS

1. Based on the our study it provide assurance that we can use bamboo reinforcement which is most economical and cheaper when compared to conventional steel reinforcement and it is recommended to use in single story building. Considering its credibility, there is a wide scope for designing multi story building using bamboo reinforcement in future.
2. Bamboo can use as a reinforcement in R.C.C. structure as a low cost housing or temporary structure.
3. The behavioral flexure strength of steel reinforced beam is 141.8KN and bamboo reinforced beam is 216.7 KN, by comparing those two values bamboo reinforced beam has more strength than steel beam & we obtain approximately 70-80KN greater strength.
4. By using the bamboo sticks we can construct the building up to the ground level not more than that. Because it doesn't have the elastic property & can't bear the ultimate loads it leads to cracks.



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ACKNOWLEDGEMENT

We also extend our sincere Thanks to **Ms. RASHMI B.R** Project Guide, Dept. of Civil, BITS Narsampet for the support and giving us an opportunity to work on this topic. And we also thank all the teaching and non-teaching staff who directly or indirectly has helped us in order to make this task a success.

REFERENCES

- [1] Amada, S. and Untao, S. 2001. "Fracture Properties of Bamboo," Composites Part B, Vol. 32, pp 451-459.
- [2] James Kariuki et.al "Flexural Strength of Laminated Bamboo Beams" International Journal of Advances in Engineering and Technology, Nov 2014.
- [3] Naznin, F. Chetia, N., "A Study on Bamboo Reinforced Concrete Beams", International Journal of Science and Applied Information Technology (IJSAIT), Vol. 4 , No.3, Pages : 49 – 53, July 2015

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