

Experimental Investigation on Concrete With Replacement of Steel Reinforcement By Bamboo

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Abstract- The Project Report deals with the replacement of Steel reinforcement by Bamboo reinforcement in Concrete. The various Tests like Cement test, Aggregate test are performed to predict the properties of materials used in concrete and also various tests to be done to find properties of fresh and Hardened concrete. The Flexural strength of Bamboo Reinforced Concrete is compared with Conventional Concrete. The strength test results are determined at an age of 3,7,14, and 28 days. The Normal Bamboo materials is modified into diameter of steel and painted with an Epoxy resins. It helps to the Bamboo exhibits a Monolithic property.

Keywords- Bamboo Reinforcement, Steel Reinforcement, Flexural Strength, Concrete RCC Beam

- It is considered to be sustainable and renewable alternative to hardwoods, foremost because it regenerates at exceptionally fast rates.
- It is cost-effective, especially in area where it is cultivated and is readily available. Transporting lightweight bamboo is less costly than transporting its heavier alternatives.
- Bamboo reinforcement technique is used for both main and distribution reinforcement as it was same earlier done for steel reinforcement.
- The energy required in processing bamboo is less than for concrete, wood, and steel.

I. INTRODUCTION

Steel is the most important construction material used to increase the tensile strength of concrete. In steel making process; there's a lot of probability to emission of CO₂ in the atmosphere. It leads to causes for human being and all other lining things. To overcome this, we replace the steel Reinforcement by Bamboo.

The use of Bamboo material has a many advantages. It is a forest resources and Eco-friendly products. It is sustainable Environment without harming our Global Environment. Bamboo is a versatile resource available in the regions of the world. It is fast growing and renewable natural resource. The Bamboo have a less bonding capacity when compared to steel reinforcement. The bonding between Bamboo and surrounding concretes are improved by coated the Bamboo with Epoxy resins.

ADVANTAGES OF BAMBOO

- It is clear from result that this bamboo reinforcement technique is absolutely cheaper than steel reinforcement technique especially for single story structure.



BambooMaterial

II. METHODOLOGY

This project follows the steps given below:

- Collection and study the material properties required for making a concrete.
- Mix proportioning of concrete (M₂₅).
- Investigation of strength parameter like Flexural strength of conventional reinforced concrete V_s Bamboo reinforced concrete.

III. MATERIAL PROPERTIES

A. Cement Tests

The cement used for casting the specimen ordinary Portland cement. The required quantity is produced as single batch, stored in airtight bags are used for the experimental programme. The various properties of cement were determined experimentally and are tabulated.

Table 1

S No	Name of the Test	Test Value
1	Fineness of cement	3%
2	Standard consistency	32%
3	Soundness of cement	8mm
4	Initial setting time	27 mints
5	Final setting time	9 hours 44 mints
6	Specific gravity	3.15

B. Fine Aggregate Tests

The fine aggregate confirms to Zone II and is designated as fine sand. All tests are carried out as per IS: 383-2000.

Table 2

S.No	Name of the Test	Test Value
1	Specific gravity of fine aggregate	2.82
2	Sieve Analysis	3.12

C. Coarse Aggregate Tests

Aggregate are obtained by crushing various types of granites, schist, crystalline and lime stone and good quality sand stones.

Table 3

S. No	Description	Value
1	Crushing value	25.06 %
2	Flakiness Index	15.54%
3	Elongation Index	44.96%
4	Impact value	30%
5	Sieve Analysis of coarse aggregate	3.9

D. Fresh Concrete Tests

Table 4

S. No	Title	Result
1	Slump cone test	125mm
2	Compaction factor	0.96

E. Mix Proportions

Table 5

Grade of Concrete	Cement (Kg/m ³)	Fine aggregate (Kg/m ³)	Coarse aggregate (Kg/m ³)	Water (liter)
M ₂₅	450.53	683.42	1130.66	202.74
	1	1.5	2.5	0.45

IV. EXPERIMENTAL INVESTIGATIONS

A. Flexural Strength of Concrete Beam

To determine the flexural strength of concrete of beam of size 500 x 100 x 100mm were cast with steel & bamboo reinforcement concrete. After 24hours the specimen were remoulded and subjected to water curing. After 3, 7, 14 and 28days of curing, the curing three beams were taken and allowed to dry and tested in UTM.

$$\text{Flexural strength}(F_{ct}) = \frac{3pl}{2bd^2} \text{ (N/mm}^2\text{)}$$

Where,

- P – Ultimate load (N)
- l- Length of specimen (mm)
- b – Width of specimen (mm)
- d – Depth of specimen (mm)

V. RESULTS AND DISCUSSIONS

A. Flexural strength tests

Table 6

S No	Material of reinforcement	Average Flexural Strength (N/mm ²)			
		3 days	7 days	14 days	28 days
1	Steel reinforcement	31.33	32.66	37.43	41.53
2	Bamboo reinforcement	32.15	38.78	40.01	43.30

Table 7

% of replacement	Beam 500X100X100 mm				Total specimens
	3 days	7days	14days	28 days	
Conventional concrete	3	3	3	3	12
Bamboo reinforcement	3	3	3	3	12

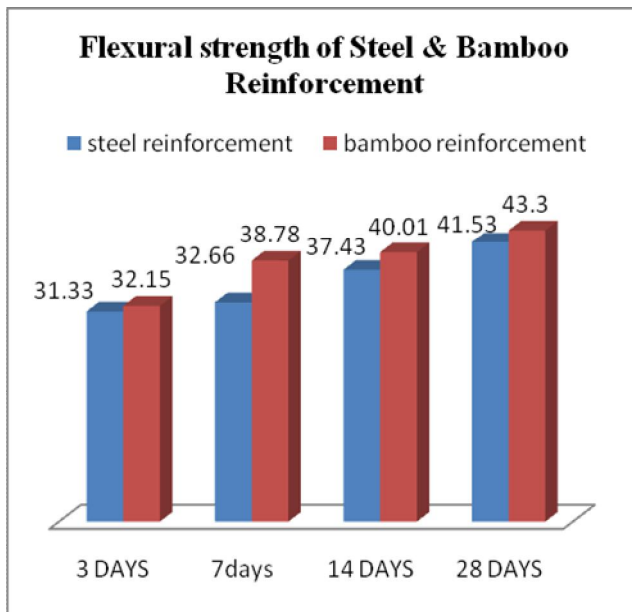


Fig.1 Flexural strength of concrete

VI. CONCLUSION

- This project concludes that the Flexural Strength behaviour of Bamboo Reinforced Concrete (BRC) compared with Normal Reinforced Concrete structure (R.C.C).
- The strength results are compared at an age of 3,7,14 and 28 days.
- At 3Days, The Bamboo Reinforced Concrete gives 1.01% increase in Flexural Strength of Concrete. When Compared to Conventional Concrete.
- At 7Days, The Bamboo Reinforced Concrete gives 1.18% increase in Flexural Strength of Concrete. When Compared to Conventional Concrete.
- At 14Days, The Bamboo Reinforced Concrete gives 1.06% increase in Flexural Strength of Concrete. When Compared to Conventional Concrete.
- At 28Days, The Bamboo Reinforced Concrete gives 1.04% increase in Flexural Strength of Concrete. When Compared to Conventional Concrete.
- Hence, the Overall Strength Results of Bamboo Reinforced Concrete is more than the Reinforced Concrete.
- On the Side of Cost; the Bamboo is less than the Steel.

REFERENCES

- [1] Harish sakaray , N.V. Vamsi Krishna Togati , I.V. Ramana Reddy “ Investigation on properties of Bamboo as Reinforcing Material in Concrete” International Journal of Engineering Research and Application(IJERA) ISSN: 2248-9622 vol. 2, Issue 1 , Jan-Feb 2012, pp.077-083.
- [2] Sanjeev Gill, Dr Rajiv Kumar “ To Experimental Study and use of Bamboo in Civil Structure as Reinforced Concrete” International Journal of Latest research in Science and Technology Volume 5, ISSN (Online): 2278-5299 Issue 2 : Page no. 102-105. March – April 2016
- [3] Dinesh Bhonde , P.B. Nagarnaik , D.K. Parbat , U.P. Waghe “Experimental Investigation of Bamboo Reinforced concrete Slab” American Journal of Engineering Research(AJER) e- ISSN: 2320-8047 p-ISSN: 2320-0936 Volume-03, Issue-01, pp-128-131. 2014.
- [4] Jigar k Sevalia , Nirav B. Siddhpura , ChetanS.Agarwal “Study on Bamboo as Reinforcement in cement concrete” International Journal of Engineering Resarch and Applications (IJERA) ISSN:2248-9622 Vol. 3, Issue 2, March –April 2013, pp.1181-1190.
- [5] Javadian ,Alireza , Hebel, Dirk E. “Bamboo reinforcement – A sustainable Alternative to Steel” Chair of Architecture and Construction, future cities laboratory, Singapore ETH-Centre, Singapore 138602 Octobar 2014.
- [6] Masakazu TERAI & MINANI “Research and development on Bamboo Reinforced Concrete Structure” Fukuyama
- [7] Prem Kumar. V, Vasugi .V “Study on Mechanical Strength of Bamboo Reinforced Concrete Beams” PG Students, Department of Civil Engineering, School of Mechanical and Building Science, VIT University, Chennai Volume 2, Issue -3 July-2014.
- [8] I. K. Khan “ Performance of Bamboo Reinforced Concrete beam” Department of Civil Engineering, Aligarh Muslim University Aligarh – 202002 (U.P) India Volume 3, 2014.
- [9] RanendraNathBhowmik, Joyanta Pal, ParthaPratimSankar “ An Experimental Study on Behaviour of Bamboo reinforced Brick Aggregate Concrete Beam” Assistant Professor, Department of Civil Engineering, National Institute of Technology, Agartala. Volume 9 Apr – May 2017.
- [10] Anuragnayak, Arehant S Bajaj, Abhishek Jain “ Replacement of Steel by Bamboo Reinforcement” Department of Civil Engineering, Sanghvi Institute of Management & Science Behind IIM – indore,pigdambar,453331, Indore, India. Jul – Aug 2013.