iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 9 **Issue:** II **Month of publication:** February 2021

**DOI:** https://doi.org/10.22214/ijraset.2021.33112

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 9 Issue II Feb 2021- Available at www.ijraset.com*

# Study of Reinforcement Beam with Bamboo and Steel

Prof. Sandeep K Shrivastava[1], Sakshi Shrivastava[2]
[1, 2]*Department of Civil Engineering Oriental Institute of Science & Technology, Bhopal*

***Abstract:** This study relatively evaluated the flexural performance and distortion appearances of concrete elements reinforced with bamboo (Bamboos vulgaris), Glass fiber and the twisted steel rebars. The yield strength (YS), eventual tensile strength (UTS) and the extension of 9 specimens of the three materials were determined using a universal testing machine. These beams of concrete strength 25 N/mm$^2$ at age 28 days were together reinforced with bamboo, and steel bars of same proportion, while the loops were essentially mild steel bars. It is Determined that out of three which material sample is suitable rebars for non-load bearing and lightweight RC flexural structures also connection and load-carrying capacity.*
***Keywords:** Distortion, concrete beam, strengthening, Stretchable strength, Fiber.*

## I. INTRODUCTION

Reinforced concrete (RC) structures represent the majority of installations built in the world and their performance is strongly influenced by the properties of the rebar. The transfer of stresses from concrete to steel is made possible by an efficient bond between concrete and reinforcement. Previous studies of the chemical, physical and strength characteristics of steel reinforcing materials have revealed the dangers of maximizing profits at the expense of quality, a situation that pose a major contest to the structural consistency and durability of buildings and civil structure. Although widespread studies have been carried out on synthetic and natural non-ferrous reinforcing ingredients in the past times, natural strengthening still remains a active field of further investigation.

Navin Chand, Mukul Shukla &Manoj Kumar Sharma found that the Tensile strength of bamboo has been experimentally determined parallel and perpendicular to the fibre direction. Different properties are exhibited in two directions in bamboo due to the basic structural difference present in the two directions. Striking differences exist in the distribution of cells within one culm, both horizontally and vertically. Stress and strain values of bamboo under tensile loads are also determined by using the Finite Element Method (FEM) software ABAQUS and the failure load patterns have been generated and analyzed. Flexural strength and deflection in bamboo determined experimentally matches closely with the FEM generated values.Numerous studies have been carried out on natural reinforcing materials such as wood (Andonian*et al.*), jute (Manzur and Aziz), bamboo (Kankam*et al.*), raffia palm (Kankam) and palm stalk (Kankam). Attention is gradually been focused on the use of bamboo (*Bambusa vulgaris*), rattan (*Calamusdeerratus*) and other natural fiber reinforcing materials as alternative reinforcements in concrete especially for low-cost housing for rural communities. In rural communities of Ghana, babadua is used in thatching and its stems are tied into framework of houses before daubing with mud (Schreckenbach and Abenkwa).

Although general literature abound on usual rebars in reinforced concrete structures, no clear comparative investigations had been done on steel, bamboo under alike geometric and loading conditions to determine the relative dimensions and thereby starting the limits to the pertinency of the natural rebars. Hence, this study will present the experimental study to comparatively estimate the flexural behaviour of concrete beams reinforced with steel, bamboo and The physical and tensile strength goods of steel, bamboo and Glass fiber were first determined and the flexural capacities of concrete beams reinforced with the separate materials bars were assessed. The limits of usage of bamboo and Glass fiber bars as reinforcement were reputable with respect to the steel RC beams.

The primary objective of this paper is to investigate the difference in stability of beams of different reinforcing materials, also

To determine the tensile chattels of the three reinforcing material beams.

The extension of which sample may or may not be ductile.

## II. METHODOLOGY CONSIDERED

1) The physical and tensile properties of steel, bamboo and rattan were resolute empirically using a universal testing machine (UTM) with a capacity of 600 Kn
2) Regular Portland cement was used. Aggregates which include river sand and crumpled sandstone with a nominal maximum size of 20mm were used.
3) Mixed at a water-cement ratio of 0.45.
4) Two 200 × 200 × 600 mm concrete beam specimens were produced and grouped into three.

5) In the case of rebar, 10Φ4 bars and stirrups were 10Φ8mm steel bars spaced at the center of 100mm and the nominal cover was 25mm.
6) In the case of fiberglass is used as much A.s.t is needed and the stirrups were 10Φ8mm steel bars spaced at the center of 100mm and the nominal coverage was 25mm.
7) In the bamboo fiber enclosure Bamboo fiber is used as much A.s.t is needed and the stirrups were 10Φ8mm steel bars spaced at the center of 100mm and the nominal coverage was 25mm.

In case of combination sample of equally 50% of each material is taken as per required Ast%.

## III. TEST PREPARATION

The tensile test is conducted on UTM. It is hydraulically operating a pump, oil in oil sump, load dial indicator and central buttons. The leftward has higher, mid and lesser cross heads i.e.; specimen grips (or jaws). Idle irritated head can be stimulated up and miserable for adjustment. The tubes linking the lift and right parts are oil piping through which the driven oil under pressure flows on left parts to more the cross-heads

### *A. Test Results*

Failure loads for beam

| Beam | First crack load, Fc (KN) | Ultimate load failure, Fu (KN) | Fc/Fu | Flexural Strength (N/mm$^2$) |
|---|---|---|---|---|
| R/f beam | 22.4 | 33.8 | 0.662 | 13.8 |
| Glass fiber beam | 12 | 18 | 0.666667 | 6.4 |
| Bamboo beam | 8.4 | 8 | 1.01 | 4.32 |

Failure mode and crack characteristics

| Beam no. | mode of failure | type of crack at failure | experimental min. crack width |
|---|---|---|---|
| R/f beam | shear | Diagonal | 8.1 |
| Bamboo beam | shear | Vertical | 6.8 |

## IV. CONCLUSION AND DISCUSSION

The following observation we made in the laboratory and prepared a comparative study, and concluded that R.C.C. The beam is comparatively more stable in load resistance, but in comparison, we also may prefer bamboo beam and R.c.c beam, according to the load resistance requirement, here are the conclusions mentioned below according to the results to be discovered in a 28-day sample:

*A.* The tensile properties of the three reinforcing materials are normally distributed and their stress ratios meet the minimum requirement value of 1.08. The strength of bamboo was 45% and 17% respectively of that of steel rebar.

*B.* The bamboo elongation did not meet the 12% ductility requirement, the bamboo beam slightly satisfied this, but the steel rebar fully met the requirement.

*C.* Bamboo can only be used for lightweight RC structures. The flexural stiffness of the bamboo RC beams was about 13.5% and 33% respectively of the conventional steel bar RC beams.

*D.* The first cracking loads of bamboo and RC beams were 31% and 55% respectively of conventional RC steel beams. The ultimate experimental failure loads of bamboo and fiberglass RC beams were 21% and 48% of conventional steel RC beams, respectively.

*E.* The RC bamboo and steel beams had 40% residual capacity after the first crack, while the RC fiberglass beams had used up 75% of its load capacity after the first crack.

*F.* The failure mode of the bamboo and steel RC beams was shear, indicated by diagonal cracks due to the short span specimen adopted and the relatively higher tensile strength than the fiber RC beams of glass that are broken by bending (vertical cracks).

## REFERENCES

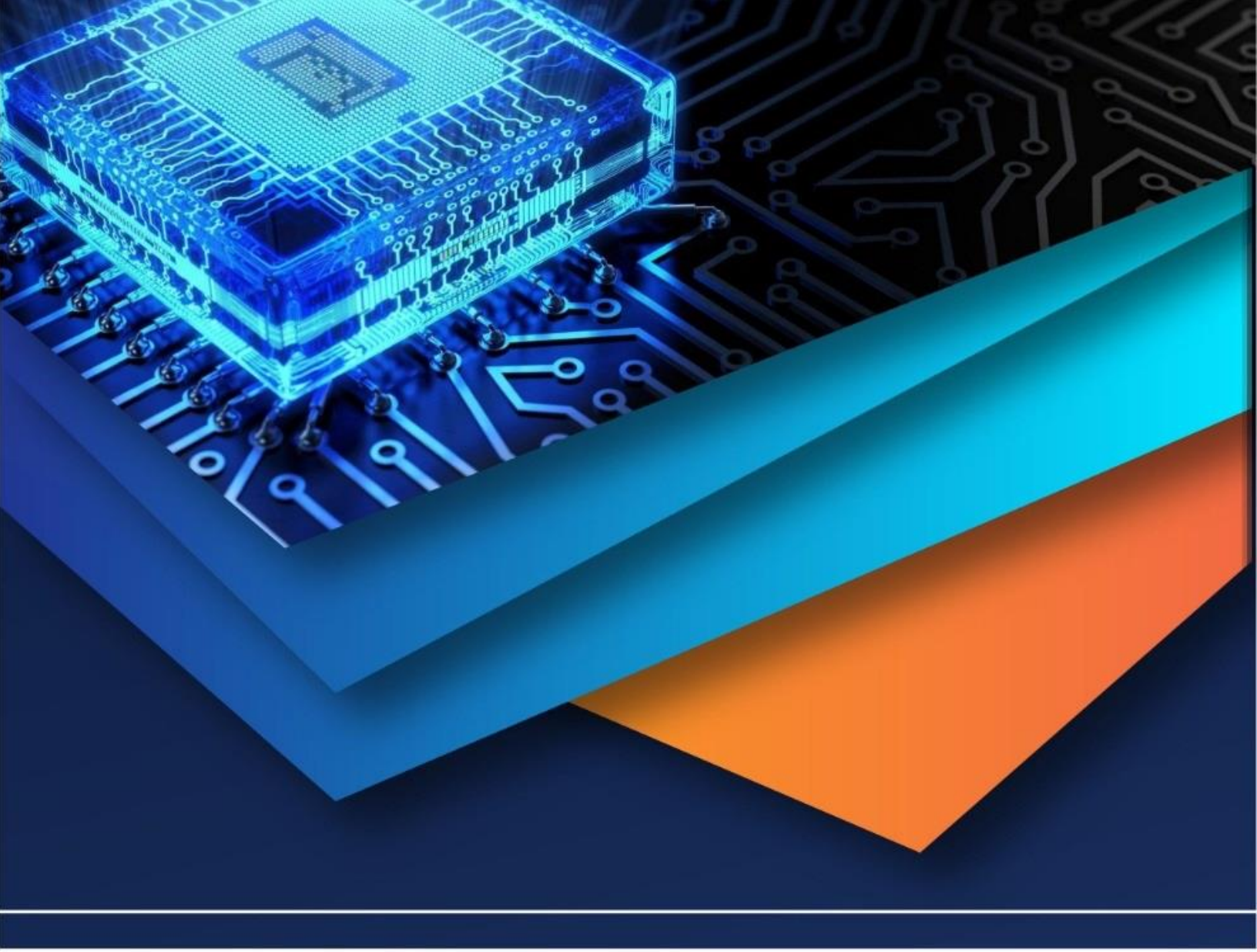
[1] Adewuyi, A.P., Wu, Z.S. and Serker, N.H.M.K. (2009) Assessment of Vibration Based Damage Identification Methods Using Displacement and Distributed Strain Measurements. International Journal of Structural Health Monitoring, 443-461. http://dx.doi.org/10.1177/1475921709340964

[2] Adewuyi, A.P., Wu, Z.S. and Raheem, A.A. (2010) Adaptation of Vibration-Based SHM for Condition Assessment and Damage Detection of Civil Infrastructure Systems. LAUTECH Journal of Engineering & Technology, 1-11.

[3] Adewuyi, A.P. and Wu, Z.S. (2011) Vibration-Based Damage Localization in Flexural Structures Using Normalized Modal Macrostrain Techniques from Limited Measurements. Computer-Aided Civil and Infrastructure Engineering, 154-172. http://dx.doi.org/10.1111/j.1467-8667.2010.00682.x

[4] Neville, A.M. (2004) Properties of Concrete. 4th Edition, Addision Wesley Longman, Edinburgh.

[5] Kosmatka, S.H., Kerkhoff, B. and Panarese, W.C. (2003) Design and Control of Concrete Mixtures. 14th Edition. Portland Cement Association, Skokie.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY