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Comparative Studies of Steel, Bamboo and Glass fiber as Reinforcing Bars in Concrete Tensile and Flexural Characteristics

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Abstract: ***This report moderately evaluate the flexural appearance and bend distinctiveness of concrete elements shatterproof with bamboo (Bambusa vulgaris), Glass fiber and the distorted steel rebars. The yield strength (YS), ultimate tensile strength (UTS) and the elongation 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 7, 14 and 28 days were separately reinforced with bamboo, glass fiber and steel bars of same percentage, while the stirrups 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 bonding and load-carrying capacity.***
Keywords: Deformation, concrete beam, reinforcement, Tensile strength, Fiber.

I. INTRODUCTION

Reinforced concrete (RC) structures report for common of the construct conveniences globally and their performance is greatly influenced by the properties of the reinforcing bars. The transfer of stress from concrete to steel is made possible through effective bond between concrete and the reinforcement. Previous studies on the substance, physical and strength uniqueness of steel reinforcing materials exposed the danger of maximize profit at the expenditure of excellence, a condition that pose a major challenge to the structural reliability and durability of buildings and civil infrastructure. even though widespread studies have been approved out on artificial and natural non-ferrous reinforcing materials in the past decades, natural reinforcement still remains a dynamic 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 rattan determined experimentally matches directly with the FEM generate values.Numerous study have been agreed out on likely reinforcing materials such as timber (Andonianet al.), jute (Manzur and Aziz), bamboo (Kankamet al.), raffia palm (Kankam) and palm stalk (Kankam). consideration is frequently been alert on the use of bamboo (Bambusa vulgaris), cane (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).

though widespread literature reproduce on ordinary rebars in reinforced concrete structures, no clear comparative investigations had been done on steel, bamboo and glass fiber under alike geometric and loading conditions to determine the relative capacities and thereby establishing the limits to the applicability of the natural rebars. Hence, this study will present the experimental study to comparatively evaluate the flexural behaviour of concrete beams reinforced with steel, bamboo and Glass fiber. The physical and tensile strength properties of steel, bamboo and Glass fiber were first determined and the flexural capacities of concrete beams reinforced with the individual materials bars were evaluated. The limits of usage of bamboo and Glass fiber bars as reinforcement were established with respect to the steel RC beams.

The primary objective of this paper is to investigate the variation in stability of beams of different reinforcing materials, also
To determine the tensile properties of the three reinforcing material beams.
The elongation of which sample may or may not be ductile.
Methodology Considered:

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A. The physical and tensile strength properties of steel, bamboo and rattan were determined experimentally using a 600 kN capacity universal testing machine (UTM).
B. Ordinary Portland cement was used. The aggregates which comprises river sand and crushed granite of 20 mm maximum nominal size was used.
C. Mixed at a water-cement ratio of 0.45.
D. Twelve 150 × 150 × 900 mm concrete beam specimens were produced and grouped into three.
E. In rebar case 10Φ4 bars and stirrups were 10Φ8 mm steel bars spaced at 100 mm centre and the nominal cover was 25 mm.
F. In Glass fiber case Glass fiber is used as much A.s.t is required and stirrups were 10Φ8 mm steel bars spaced at 100 mm centre and the nominal cover was 25 mm.
G. In Bamboo fiber case Bamboo fiber is used as much A.s.t is required and stirrups were 10Φ8 mm steel bars spaced at 100 mm centre and the nominal cover was 25 mm.
H. In case of mix sample of both 50% of each material is taken as per required Ast%.

II. TEST PREPARATION

The tensile test is conducted on UTM. It is hydraulically operates a pump, oil in oil sump, load dial gauge and middle buttons. The left has upper, middle and lower cross heads i.e; specimen grips (or jaws). Idle cross head can be moved up and down for adjustment. The pipes linking the pinch and right parts are lubricate pipes through which the pumped oil under pressure flows on left parts to more the cross-heads.


Fig:1 Preparation of beams


Fig:2 Testing machine U.T.M.

III. TEST RESULTS

we have to check the flexural strength of beam by using UTM test. In different days.

A. 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	19	33	0.575758	12.1
glass fiber beam	12	18	0.666667	6.4
bamboo beam	7	7.5	0.933333	3.21
Glass & Bamboo fiber mix	9.8	12	.732	5.45

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B. Failure Mode and Crack Characteristics

Beam no.	mode of failure	type of crack at failure	experimental min. crack width
R/f beam	shear	Diagonal	9.1
glass fiber beam	flexural	Vertical	6.4
bamboo beam	shear	Vertical	7.2
Glass & Bamboo fiber mix	Shear	Diagonal	6.10

IV. CONCLUSION

As I have did experimental study on laboratory and prepared a comparative study, it can be concluded that R.C.C. beam is comparatively more stable in load resisting but in comparison we can also prefer glass fibre or Glass fiber and bamboo fiber mix one as depends on load resisting requirements, following are the conclusions mentions below as per results find out in 7 day, 14 day and 28 days sample:

A. The tensile properties of the three reinforcing materials are normally distributed and their stress ratios satisfied the minimum requirement value of 1.08. The strength of Glass fiber and bamboo represented 45% and 17% of that of steel reinforcing bars respectively.

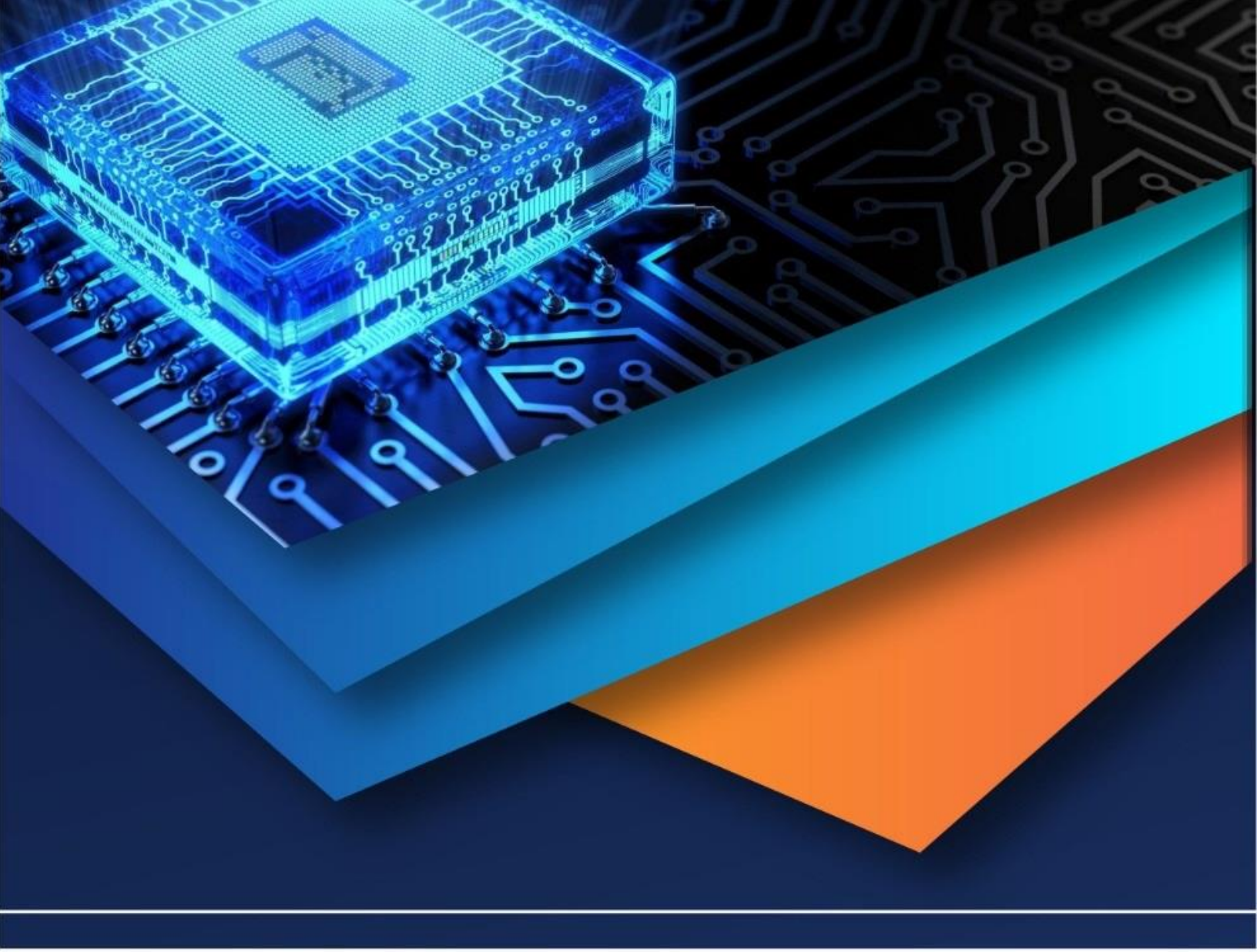
B. The elongation of bamboo did not meet the ductility requirements of 12%, glass fiber marginally satisfied this, but steel rebars fully met the requirements

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

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