International Journal of Engineering Research in Current Trends (IJERCT)
ISSN: 2582-5488, Volume-3 Issue-4, July 2021

Strenghtihning of Beam Using Bamboo Fiber and Glass Fiber

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***Abstract*—Concrete is the most utilized material in the construction industry with steel as reinforcements. The present-day situation is seeing a quick change in the building material industry and step by step new innovations are replacing the ordinarily utilized materials. Scientists throughout the world are trying to enhance concrete by the utilization of fibers, pozzolanas and different admixtures. Steel is given in the pressure side fundamentally in order to balance the powerless zone of concrete that is tension. In spite of the fact that it is thought to be the best for this work yet at the same time it gets eroded by the activity of the nature in this way, emerges the point of searching for an option. A standout amongst the most well-known choices is Fiber strengthened polymer rebars (FRP's).**

This study comparatively evaluated the flexural performance and deformation characteristics of concrete elements reinforced with bamboo, Glass fiber and the steel rebars. The yield strength, ultimate tensile strength and the deflection of 9 specimens of the three materials were determined using a universal testing machine. These beams of concrete strength 25 N/mm2 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 observed that out of three material samples mixture of bamboo and glass fiber is suitable rebars for non-load bearing and lightweight RC flexural structures.

***Keywords*—Bamboo Fiber,Flexural,flexural strength, Glass fiber, Tensile strength,UTM.**

I. INTRODUCTION

The general practical monetary development, efficiencY, ANDthe prosperity of a country depend vigorously on the usefulness, unwavering quality, and sturdiness of its built offices. Be that as it may, asIDE THE NATURAL AND OPERATIONAL condition, the constituent materials representing the expanding instances of basic insufficiency and practical outdated nature are recorded in the constructed environment.

Reinforced Concrete (RC) structures represent dominant part of the developed infrastructures universally and their execution is significantly impacted by the properties of the fortifying bars. The exchange of stress from cement to steel is made conceivable through competent bond amongst concrete and the fortification. Past investigations on the substance, physical and quality attributes of steel fortifying materials uncovered the risks of boosting benefit to the detriment of value, a circumstance that represent a noteworthy test to the basic dependability and strength of structures and common framework. Albeit broad examinations have been completed on manufactured and characteristic non-ferrous fortifying materials in the previous decades, common support stillremains a dynamic field of further examination.

Glass Fiber

Glass fiber has generally similar mechanical properties to different strands, for example, polymers and carbon fiber. Despite the fact, it's not as solid or as unbending as carbon fiber, it is considerably less expensive and fundamentally less weak when utilized as a part of composites. Glass strands are consequently utilized as a strengthening specialist for some polymer items; to shape an exceptionally solid and generally lightweight fiber-fortified polymer (FRP) composite material called glass-strengthened plastic (GRP), additionally prominently known as "fiberglass".

Glass fiber

Bamboo fiber

BAMBOO is one of the most seasoned building materials utilized by humanity. The bamboo culm, or stem, has been made into an expanded decent variety of items extending from residential family unit items to mechanical applications. In Asia, bamboo is very basic for extensions, platform and lodging, yet it is generally an impermanent outside basic material. In numerous excessively populated districts of the tropics, certain bamboos supply the one appropriate material that is adequately shabby and abundant to meet the broad requirement for conservative lodging, a report by. With the headway of science and innovation and the great supply of timber, new strategies are required for the preparing of bamboo to make it sturdier and more usable as far as building materials.

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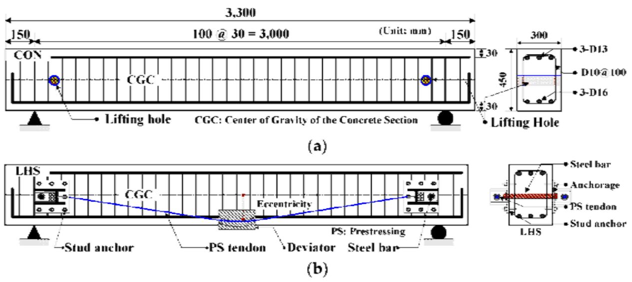
Bamboo fiber

Published By:
International Journal of Engineering Research in Current Trends

RC- Beam

(RC) is a composite material in which concrete moderately low rigidity and flexibility are balanced by the consideration of fortification having higher elasticity or pliability. The support is as a rule, however not really, steel fortifying bars (rebar) and is generally implanted inactively in the solid before the solid sets.

1. It ought to be fit for opposing expected tractable, compressive, bowing and shear forces.
2. It ought not demonstrate exorbitant redirection and ruin usefulness necessity.
3. There ought to be appropriate cover to the fortification, with the goal that the erosion is anticipated.
4. Thehair breaks created ought to be inside as far as possible.
5. Itis adecent heat proof material.When it is new, it can be formed to any coveted shape and size.
6. Durability is very good.
7. R.C.C. structure can be intended to take any heap.



RC Beam

Methodology & Material Selection

Mix design

1. Compute the probable (ft) target strength required from the mix resulting characteristic required compressive strength at 28-day (fck) and the class of quality control.
   f.t. = fck. + 1.65 S
   where, S standards for deviation determined from the Table of approximate contents provided after the mix design.
2. Acquire the water bond proportion for the coveted mean target utilizing the empirical connection between compressive quality and water concrete proportion so picked is checked against the constraining water bond proportion. The water concrete proportion so picked is checked against the constraining water bond proportion for the prerequisites of solidness given in table and receives the lower of the two qualities.
3. Gauge the measure of entangled air for greatest ostensible size of the total from the table.
4. Select the water content, for the required usefulness and most extreme size of totals (for totals in soaked surface dry condition) from table.
5. Decide the level of fine total in all out total by outright volume from table for the solid utilizing smashed coarse total.
6. Alter the estimations of water substance and level of sand as gave in the table to any distinction in functionality, water concrete proportion, reviewing of fine total and for adjusted total the qualities are given in table.
7. Compute the concrete substance shapes the water-bond proportion and the last water content as touched base after alteration. Check the bond against the base concrete substance from the necessities of the solidness, and more prominent of the two qualities is embraced.
8. From the amounts of water and bond per unit volume of cement and the level of sand officially decided in stages 6 and 7 above, figure the substance of coarse and fine totals per unit volume of cement from the accompanying relations:

$$V = \left[W + \frac{C}{S_c} + \frac{1}{p}\frac{f_a}{S_{fa}}\right] \times \frac{1}{1000}$$

$$V = \left[W + \frac{C}{S_c} + \frac{1}{1-p}\frac{C_a}{S_{ca}}\right] \times \frac{1}{1000}$$

where V = total volume of concrete
= Gross vol. ($1m^3$) subtracting the volume of air voids
S_c = specific gravity of cement
W = Mass of water per cubic meter of concrete, kg
C = mass of cement per cubic meter of concrete, kg
p = ratio of fine aggregate to total aggregate by absolute volume
f_a, C_a = total masses of fine and coarse aggregates, per cubic meter of concrete, respectively, kg, and
S_{fa}, S_{ca} = specific gravities of saturated surface dry fine and coarse aggregates, respectively.

Percentage of fiber replacing reinforcement

Percentage of composite material added			
S.no.	**Material**	**% (by weight)**	**Replacing**
1	Glass fiber	5 %	Cement
2	Bamboo fiber	5 %	Cement
3	Glass fiber + Bamboo fiber	2.5% both	Cement

Result and Conclusion:-

Test Results: for 7days

Beam	First crack load, Fc (KN)	Ultimate load failure, Fu (KN)	Fc/Fu	Flexural Strength (N/mm^2)
RCC beam	20	34	0.58	12.6
RCC Beam with Glass fiber	13	19	0.68	6.8
RCC Beam with bamboo	7.5	8.2	0.91	3.29
RCC Beam with Bamboo & glass fiber mix	10	12.2	0.81	5.49

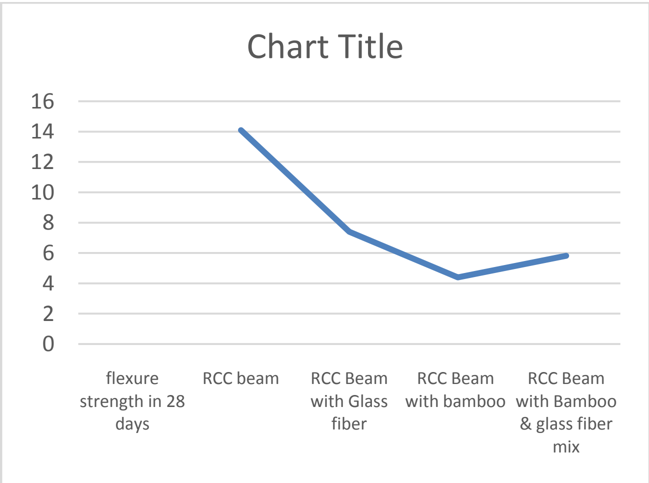
Test Results: for 14days

Beam no.	First crack load, Fc (KN)	Ultimate load failure, Fu (KN)	Fc/Fu	Flexural Strength (N/mm^2)
RCC beam	20.8	34	0.61	12.6
RCC Beam with glass fiber	13.5	19	0.71	7.2

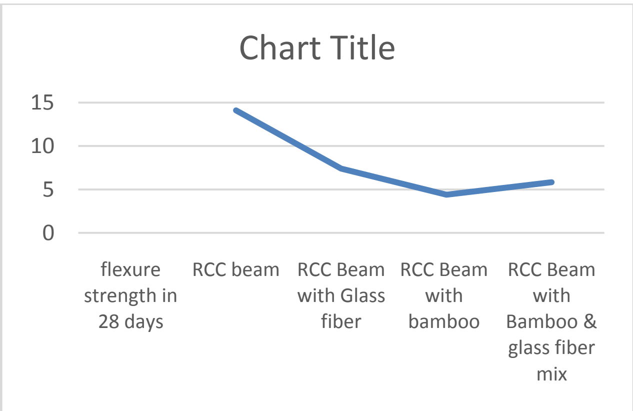
RCC Beam with bamboo	7.9	8.1	0.97	4.6
RCC Beam with Bamboo& fiber mix	11.2	14.1	0.79	5.9

Test Results: for 28days

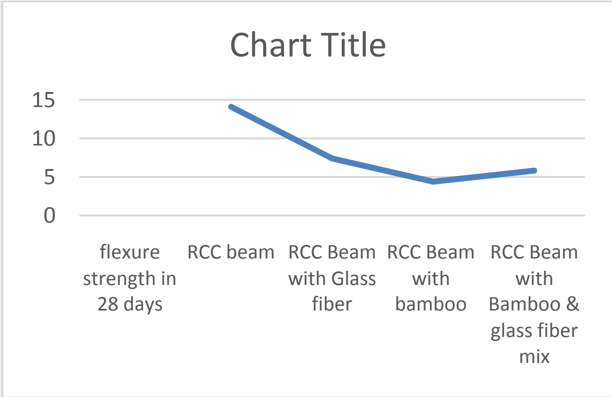
Beam no.	First crack load, Fc (KN)	Ultimate load failure, Fu (KN)	Fc/Fu	Flexural Strength (N/mm^2)
RCC beam	22.8	34.2	0.67	14.1
RCC Beam with glass fiber	14.9	19.5	0.764	7.4
RCC Beam with bamboo	8.9	8.5	1.04	4.39
RCC Beam with Bamboo& fiber mix	11.9	15.6	0.76	5.82



Flexural strength 7 days



Flexural strength 14 days



Flexural strength 28 days

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This Paper is presented in conference
Conference Title : Advances in Mechanical and Civil Engineering
Organised By : Mechanical and Civil Engineering Department, SIRTE Bhopal, M.P.
Date : 25th June - 26th June 2021