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Comparative Study R.C.C. Beam Durability of Bamboo-Glass Fiber Mix Reinforced Polymer Matrix Hybrid Composites System

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Abstract: *In This Paper Bamboo fibers show promising results in terms of concrete strength and avoid unavoidable brittle failure. However, an updated assessment is needed which collects all the relevant important information and provides an easy for the reader to judge the suitability of bamboo fibers. Therefore, this review is carried out on bamboo fiber-reinforced concrete to present past and recent research that was already done by another researcher. The fresh properties, structural properties, performance in elevated temperature, durability, and morphology structure are the main parameters of this review. Results indicate that bamboo fibers decreased the concrete flow like other types of fiber such as steel fiber etc. However, an increase in strength parameters was also detected with the addition of bamboo fibers. Furthermore, bamboo fibers increased the tensile strain which avoids undesirable brittle failure. The review also highlights the optimum addition proportion of bamboo fibers of cement. Finally, the study also recommends potential investigation.*

Keywords: *Fiber reinforcement, Beam Durability, Bamboo-Glass Fiber, Mix Reinforced Polymer Matrix.*

1. Introduction

The general practical monetary development, efficiency, and the 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condition, the constituent materials representing the expanding instances of basic insufficiency and practical outdated nature are recorded in the constructed environment. Weakening in solid structures is a noteworthy test looked by the framework and scaffold ventures around the world. The decay is fundamentally because of natural impacts, which incorporates consumption of steel, progressive loss of quality with maturing, rehashed high force stacking, temperature variation, solidification of defrost cycles, contact with synthetic concoctions and saline water and introduction to ultra-violet radiations. This issue, combined with amendments in basic codes expected to represent the characteristic marvels like seismic tremors or natural weakening powers, requests improvement of fruitful basic retrofit innovations. The auxiliary retrofit issue has two alternatives, repair/retrofit or devastation/remaking. Generally, the pattern inside the US development ventures has been towards the last alternative. This arrangement has turned out to be progressively unsuitable because of changing financial and social states of mind concerning existing structures. This reality prompts the need for advancement of proper auxiliary retrofit/repair frameworks. 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.

2. Beam Strengthening

Early endeavors for understanding the reaction of plain cement subjected to unadulterated torsion uncovered that the material bombs in pressure instead of shear. Structured members curved in design, members from a space outline, capriciously stacked bars, bended box braces in spans, spandrel shafts in structures, and winding stair-cases are average cases of the auxiliary components subjected to torsion minutes and torsion can't be disregarded while planning such individuals. Auxiliary individuals subjected to torsion are of various shapes, for example, T- shape, transformed L– shape, twofold T-shapes and box segments. These distinctive arrangements make the comprehension of torsion in RC individuals from complex errand. Moreover, torsion is typically connected with

bending moments and shearing forces, and the communication among these forces is imperative. In this way, the conduct of solid components in torsion is principally administered by the ductile reaction of the material, especially its pliable breaking qualities. Spandrel pillars, situated at the edge of structures, convey loads from pieces, joists, and shafts from one side of the part as it were. This stacking component produces torsional powers that are exchanged from the spandrel pillars to the segments. Fortified cement (RC) bars have been observed to be lacking in torsional limit and needing reinforcing. These lacks happen for a few reasons, for example, deficient stirrups coming about because of development blunders or insufficient outline, diminishment in the powerful steel zone because of consumption, or expanded request because of an adjustment in inhabitance. Like the flexure and shear reinforcing, the FRP texture is attached to the strain surface of the RC individuals for torsion fortifying. On account of torsion, all sides of the part are subjected to slanting pressure and in this way the FRP sheets ought to be connected to every one of the characteristics of the part cross segment. Be that as it may, it isn't generally conceivable to give outside support to every one of the surfaces of the part cross segment. In instances of distant sides of the cross segment, extra methods for fortifying must be given to set up the sufficient component required to oppose the torsion. The viability of different wrapping setups demonstrated that the completely wrapped shafts performed superior to utilizing FRP in strips. Cement is a fastening material that hardens and hardens and can usually bond additional materials. For this task we will use conventional Portland concrete.

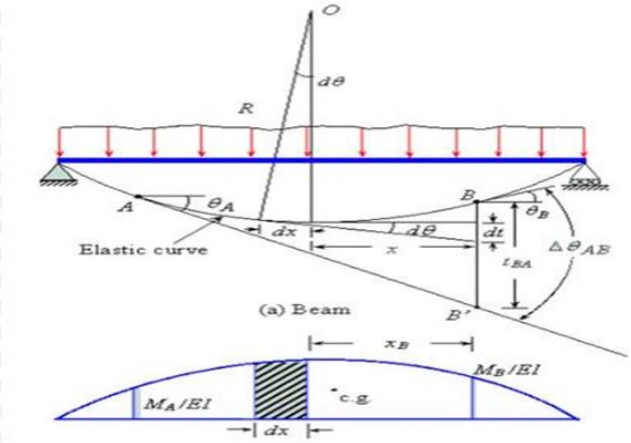

Fig:1. Load distribution

3. 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 fibre strengthened polymer composites have been set up by different assembling innovation and are generally utilized for different applications. At first, antiquated Egyptians made compartments by glass strands drawn from warm diminished glass. Proceeds with glass strands were first produced in the 1930s for high-temperature electrical application. These days, it has been utilized as a part of hardware, avionics and vehicle application and so forth. Glass strands are having phenomenal properties like high quality, adaptability, solidness and protection from chemical harm. It might be as roving's, cleaved strand, yarns, textures and mats. Each sort of glass filaments has one-of-a-kind properties and are utilized for different applications as polymer composites. The mechanical, tribological, warm, water ingestion and vibration properties of different glass fiber strengthened polymer composites.

4. Glass Fiber Properties

Glass fibers are most commonly used fibers. They come in two forms: – Continuous fibers
Discontinuous fibers
Principal advantages:
Low cost High strength Impact resistance Moisture resistance
Good chemical resistance High thermal expansion High bonding strength
Readily processed by thermoplastic

Fig:2 .Glass fiber

5. 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. It is one of the most seasoned building materials utilized by humankind. The bamboo culm, or stem, has been made into a broadened assorted variety of items going from local family items to mechanical applications.

Fig:3. Bamboo fiber

6. 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. The hair breaks created ought to be inside as far as possible.
5. It is a decent heat proof material.
6. When it is new, it can be formed to any coveted shape and size.
7. Durability is very good.
8. R.C.C. structure can be intended to take any heap

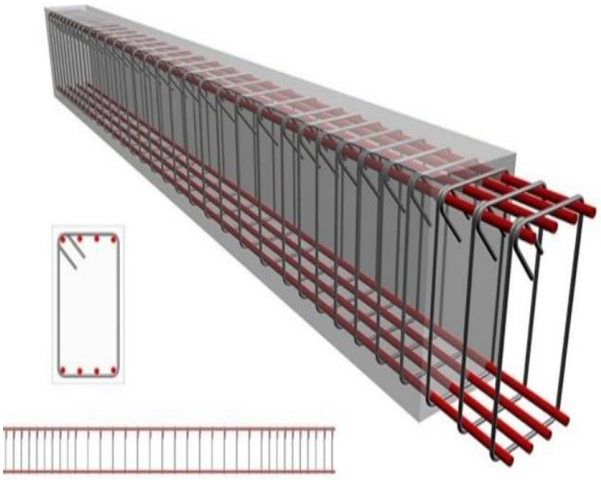

Fig:4. R-C-C Beam

7. Stresses in Beam

Loads acting transversely to the longitudinal pivot the heaps make shear powers and bowing minutes, stresses and strains because of V and M are examined in this section horizontal burdens following up on a bar make the pillar twist, along these lines misshaping the hub of the bar into bend line, this is known as the diversion bend of the bar the shafts are thought to be symmetric about x-y plane, i.e. y-hub is a hub of symmetric of the cross segment, all heaps are accepted to act in the x-y plane, at that point the bowing redirection happens in a similar plane, it is known as the plane of twisting the avoidance of the bar is the relocation of that point from its unique position, estimated in y direction

8. Results

Samples are prepared in a test laboratory, where all materials are mixed in a proper proportion. After wards beams are casted in a 150 × 150 × 900 mm specimens considering stirrups of mild steel fe250 whereas main reinforcement is selected as glass fiber, bamboo fiber, rebar and a composite of glass and bamboo fiber.

EXPERIMENTAL WORK (table for percentage of material added)

Table 1: Percentage of fiber replacing cement

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

Table2.Failure loads for beam

Beam	First crack load, Fc (KN)	Ultimate load failure, Fu (KN)	Fc/Fu	Flexural Strength (N/mm^2)
RCC beam	19	33	0.57	12.1
RCC Beam with Glass fiber	12	18	0.67	6.4
RCC Beam with bamboo	7	7.5	0.933	3.21
RCC Beam with Bamboo & glass fiber mix	9.8	12	.73	5.45

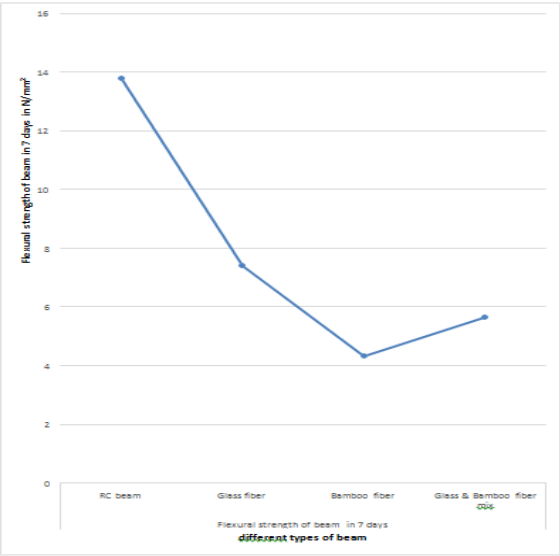

Fig 5. Flexural strength

Determination of Initial Setting time - while placing the test block in the narrow mould and ease off on the non – porous plate, under the rod bearing the niddle
(c), gently lowering the niddle in order to make it in contact with the surface of the test block and release it at the earliest, permitting it to invade inside the test block.
Rehash this system until the needle, when acquired contact with the test square and discharged as portrayed above, neglects to puncture the square past 5.0 ± 0.5 mm estimated from the base of the shape should be the underlying setting time. Performance is strongly influenced by the properties of the reinforcement. The transfer of stress from the Bamboo-Glass Fiber.

9. Conclusion

Comparative Study R.C.C. Beam Durability of Bamboo-Glass Fiber Mix Reinforced Polymer Matrix Hybrid Composites System The following observation we did in laboratory and prepared a comparative study, and concluded that R.C.C. beam is comparatively more stable in load resisting but in comparison we can also prefer glass fiber 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: The hybrid approach of blending more durable glass fiber with bamboo fiber is an effective way to improve the durability of natural fiber composite under environmental aging on the long-term performance of material without actually carrying out long-term test. Temperature
is the key factor for accelerated aging in the processes of water diffusion and chemical degradation. Accelerated test is justifiable if the accelerating parameter does not cause an change in the aging mechanism. To understand the detrimental effects of water on mechanical properties of the composite, it is necessary to study its effect on the constituents of the composite, the fiber, the matrix, and the fiber/matrix interphase region. Because it has been known from previous studies that each of these components are degraded under environmental aging in water.

1) The flexural 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.
2) Bamboo and glass fiber can only be used for lightweight RC structures.
3) we have determined the minimum strength of bamboo and glass fiber beam
4) Bamboo and steel RC beams had 40% residual capacity after the first crack, while glass fiber RC beams had exhausted 75% of its load-carrying capacity after the first crack.

5) The mode of failure for bamboo and steel RC beams was shear, indicated by diagonal cracks because of the short-span specimen adopted and the relatively higher tensile strength than the glass fiber RC beams which failed by flexure (vertical cracks).

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