International Journal of Scientific Research in Civil Engineering
© 2021 | IJSRCE | Volume 5 | Issue 5 | ISSN : 2456-6667

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

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Article Info
Volume 5, Issue 5
Page Number : 125-129

Publication Issue :
September-October-2021

Article History
Accepted : 15 Sep 2021
Published : 30 Sep 2021

ABSTRACT

This study comparatively evaluated the flexural performance and deformation characteristics of concrete elements reinforced with bamboo (*Bambusa vulgaris*), Glass fiber and the twisted 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. In this paper we are reviewing literatures related to utilization of fibers.

Keywords: Deformation, concrete beam, reinforcement, Tensile strength, Fiber.

I. INTRODUCTION

Reinforced concrete (RC) structures account for majority of the constructed facilities 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 chemical, physical and strength characteristics of steel reinforcing materials revealed the dangers of maximizing profit at the expense of quality, a situation that pose a major challenge to the structural reliability and durability of buildings and civil infrastructure. Although extensive studies have been carried out on synthetic and natural non-ferrous reinforcing materials in the past decades, natural reinforcement still remains a dynamic field of further investigation.

II. Literature Survey

Chand et. al. (2017) Established that the Tensile quality of bamboo has been tentatively decided parallel and opposite to the fiber course. Distinctive properties are shown in two ways in bamboo because of the essential basic contrast introduce in the two bearings. Striking contrasts exist in the appropriation of cells inside one culm, both evenly and vertically. Anxiety estimations of bamboo under elastic burdens are additionally dictated by utilizing the Finite Element Method (FEM) programming ABAQUS and the

disappointment stack designs have been created and analyzed. Flexural quality and redirection in bamboo decided tentatively matches intimately with the FEM produced values.

Nigarwal et. al. (2016) Arranged a relative report between the DC network conduct of bamboo fiber gathered from upper and base part of bamboo, arranged a hypothesis diagram confirmed with the exploratory outcomes.

Akinyele et. al. (2015) Discovered that the interfacial bond qualities of rattan-concrete were in the range 0.082 - 0.598 N/mm2 rely upon the species, concrete grade and other normal conditions. The trial consequences of 0.34 - 0.38 N/mm2 got by fall inside the range. Additionally, Youssef gave 0.56 - 0.68 N/mm2 for some bamboo species fortified with concrete. Every one of the discoveries fall in the vicinity of 3.94 and 28.86% of steel-solid bond quality of 2.07 N/mm2 of practically identical solid review (Neville and Brook). It was discovered that the moduli of flexibility for three types of Rattan were 3396, 516 and 11,106 N/mm2 for C. deerratus, E. macrocarpa and L. secundiflorum separately (Lucas and Dahunsi). The utilization of rattan support in lieu of traditional steel fortifications requires better comprehension under hub stacking and execution conditions. examined the flexural conduct of two-way pieces strengthened with rattan and regular fortifications under pivotal stacking.

Andonianet. al. (2015) Various examinations have been done on normal strengthening materials, for example, wood jute bamboo raffia palmand palm stalk. Consideration is bit by bit been centered around the utilization of bamboo (Bambusa vulgaris), rattan (Calamusdeerratus) and other characteristic fiber fortifying materials as elective fortifications in concrete particularly for minimal effort lodging for rustic networks. In provincial networks of Ghana, babadua is utilized as a part of covering and its stems are integrated with structure of houses before smearing with mud (Schreckenbach and Abenkwa).

Thomas and Shehata (2014) have examined the twisting of cementations materials, for example, Portland concrete, silica smoke, and fly fiery debris. These materials are having noteworthy points of interest over different mixes and surprisingly better upgrades over plain Portland concrete.

Lam et al. [2014] contemplated the impact of fly fiery debris and silica smolder on compressive and break practices of concrete and closed upgrade in quality properties of cement by including distinctive level of fly powder and silica rage.

George et al. (2013) detailed a work on the pre-focused on fiber-reinforced polymer (FRP) reinforcing framework which can be a proficient technique to improve the productivity of FRP materials and the conduct of the fortified individuals under administration conditions. A technique utilizing somewhat impregnated carbon-basalt cross hybrid fiber sheets (CBHFS) was proposed to enhance the malleable limit of dry fiber sheets. The test outcomes showed that the malleable limit of dry fiber sheets can be improved adequately and that it isn't impacted by the example length when fiber hybridization and halfway impregnation are connected together.

Gang et al. (2013) exhibited a trial ponder on the flexural conduct of RC shafts fortified with steel-wire nonstop basalt fiber composite plates. This work investigated a technique for flexurally fortifying reinforced cement (RC) shafts utilizing recently created steel-wire nonstop basalt fiber composite plates (SBFCPs) that comprises of steel wires and persistent basalt-fiber-reinforced polymer (BFRP) composites. The test outcomes

uncovered that the SBFCP reinforced examples performed predominant than the unstrengthened example regarding load limit and part solidness. A parametric report affirmed that the volumetric proportion of steel wires in the SBFCPs impact the heap limit and firmness of examples fortified with SBFCPs. The outcomes likewise demonstrated that harbor by steel plates and jolts enhances the heap limit and pliability of fortified examples.

Obaidat et al. (2011) prepared a test program to think about the flexure and shear conduct of the basically harmed full-scale reinforced cement (RC) pillars retrofitted utilizing CFRP covers. The important parameters considered were inner support proportion, position of retrofitting and the length of CFRP. The test comes about showed that the bars retrofitted utilizing CFRP covers are fundamentally viable and are reestablished to firmness and quality qualities almost equivalent to or more than those of the control shafts. The outcomes likewise uncovered that retrofitting shifts the method of inability to be weak and the viability of the fortifying system utilizing CFRP in flexure diversed relying upon the length.

Kim and Frangopol (2011) introduced an approach to foresee the basic execution of structures through Structural Health Monitoring (SHM). The reasons for SHM have been distinguished as evaluating basic execution, anticipating remaining administration life and giving a choice instrument to ideal upkeep arranging.

Bukhari et al. (2010) assessed the commitment of CFRP sheets on the shear limit of constant fortified solid shafts and explored the current outline rules for shear fortifying of pillars utilizing CFRP sheets and proposed an adjustment to Concrete Society Technical Report TR55. A sum of seven, two traverse ceaseless solid shafts were thrown with rectangular cross-area. Out of these bars one pillar was taken as control bar and the rest of the bars were reinforced utilizing different setups of CFRP sheets. The trial comes about showed that the shear limit of the pillars was substaintially improved by utilizing CFRP sheets and 450 fiber introduction to the pivot of the shaft was observed to be more compelling. Ceroni (2010) explored tentatively on the RC shafts remotely fortified utilizing carbon fiber strengthened plastic (CFRP) overlays and Near Surface Mounted (NSM) bars under monotonic and cyclic burdens.

Martinola et al. (2010) considered the fortifying and repair of RC shafts by utilizing a coat made of fiber reinforced polymer (FRP) with elastic solidifying conduct. For repairing of RC shafts, the bars were at first harmed and after that in the long run repaired. A numerical examination was likewise completed to contemplate the fortification conduct. The trial and numerical outcomes uncovered the viability of the proposed procedure both at extreme and usefulness restrict states.

Pannirselvam et al. (2009) considered the fortifying and repair of RC shafts by utilizing a coat made of fiber reinforced polymer (FRP) with elastic solidifying conduct. For repairing of RC shafts, the bars were at first harmed and after that in the long run repaired. A numerical examination was considered to analyze the behaviour of reinforcement. The examination analysis uncovered the viability of the proposed procedure both at extreme and usefulness restrict states.

Krishnan et. al. (2009) studied the flexural fortifying of RC pillars fortified utilizing carbon fiber reinforced polymer (CFRP) textures. An aggregate of ten number of pillars were thrown, out of which two shafts were dealt with as control examples and the staying eight bars were reinforced utilizing CFRP texture in single and

twofold layers which are parallel to bar hub at the base under virgin condition. Every one of the bars were outlined as under fortified area and tried up to disappointment under monotonic and cyclic burdens. Static and cyclic reactions of the considerable number of shafts were evaluated as far as quality, solidness, malleability proportion, vitality ingestion limit factor, holding between CFRP texture and concrete and the related methods of disappointments. The hypothetical minute ebb and flow relationship and the heap dislodging reactions were anticipated for all the fortified shafts and control bars by utilizing ANSYS programming and contrasted and the exploratory outcomes. The correlation uncovered that the reinforced shafts display upgraded flexural quality and solidness and composite activity until disappointment.

Siddiqui (2009) examined the flexure and shear conduct of RC pillars fortified with remotely reinforced fiber strengthened polymer (FRP) composites. Six RC bars were thrown and separated into two gatherings, each gathering containing three bars. The examples of the main gathering were intended to be frail in flexure and solid in shear; though the examples of the second gatherings were intended to be feeble in shear and solid in flexure. In each gathering out of three shafts one bar was taken as control pillar and remaining bars were reinforced utilizing distinctive CFRP fortifying plans. Test outcomes uncovered that the holding of CFRP sheets with U-shape end harbor clung to the strain side is best in flexural fortifying; while holding of slanted CFRP strips to the side faces RC pillars is extremely effective in upgrading the shear limit of bars.

Esfahani et al. (2007) inspected the impact of reinforcing bar proportion (ρ) on the flexural conduct of reinforced cement (RC) shafts fortified with carbon fiber reinforced polymer (CFRP) sheets. Twelve number of RC pillar examples were thrown, out of which three examples were dealt with as control examples and staying nine examples were fortified in flexure utilizing CFRP sheets. Bar areas with three shifting fortifying proportions, ρ, were utilized as longitudinal ductile support in examples. It was watched that the flexural quality and solidness of the reinforced shafts expanded contrasted with the control examples. The test outcomes presumed that the plan rules of ACI 440.2R-02 and ISIS Canada overestimate the impact of CFRP sheets in improving the flexural quality of bars with little estimation of ρ contrasted with the most extreme esteem (ρmax) determined in the above rules and with the expansion in ρ esteem in the pillars, the proportions of test load to the heap figured utilizing two outline rules likewise expanded.

Saafan (2006) researched tentatively the effectiveness of GFRP composites in fortifying essentially bolstered reinforced cement (RC) bars outlined with inadequacy in shear. Utilizing the hand lay-up method, progressive layers of a woven fiber glass texture were reinforced along the shear traverse to improve the shear limit and to maintain a strategic distance from calamitous untimely disappointment modes. Eighteen number of bars were tried to think about the impact of different shear fortifying plans and variable longitudinal support proportions on the basic conduct of RC shafts. The test outcomes uncovered that by legitimate use of GFRP envelops impressive increment by the shear quality and upgrades in the general auxiliary conduct could be accomplished for the pillars with shear inadequacy.

III. CONCLUSION AND DISCUSSION

- In light of the basic perceptions produced using the study of existing literary works and to accomplish the target illustrated in the past section, the extent of the present research consider is condensed as takes after:
- To examine the shear conduct of rectangular shape section RC, glass fiber and bamboo fiber bars under static stacking condition.
- To inspect the shear conduct and methods of disappointment of RC shear lacking bars remotely fortified with various fiber strengthened polymer.
- To explore the impact of various test parameters, for example, fiber sum and dispersion, reinforced surface, number of layers, fiber introduction and end harbor framework on the shear limit of RC pillars fortified with remotely reinforced composites.

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Cite this article as :

Sukant Sahu, Ravindra Kumar Raj, "Comparative Studies of Steel, Bamboo and Glass Fiber as Reinforcing Bars in Concrete Tensile and Flexural Characteristics A Review", International Journal of Scientific Research in Civil Engineering (IJSRCE), ISSN : 2456-6667, Volume 5 Issue 5, pp. 125-129, September-October 2021.
URL : https://ijsrce.com/IJSRCE215522