



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Special Issue 3, May 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Retrofitting of Column by Using Banana Fiber Sheet

Mr. J. P. Choudhari

Assistant Professor, Dept. of Civil, Sinhgad Institute of Technology & Science College, SITS, Pune, India

N. Suryawanshi, K. Shingade, S. Adhore, O. Umade, P. Giri

UG Student, Dept. of Civil, Sinhgad Institute of Technology & Science College, SITS, Pune, India

ABSTRACT: Concrete is the predominant material in the construction industry. To be sustainable, the old Reinforced Concrete (RC) buildings should be retrofitted, and the life of the building should be extended. Experimental study has been attempted to investigate the load carrying capacity of concrete column strengthened with glass fiber and banana fiber mat. The primary aim of this study is to retrofit the RC column specimen to enhance the load carrying capacity. All the columns were casted with the same grade of concrete (M30) and same structural detailing. Two-point symmetrical loading were given to the control columns to obtain load at initial crack and ultimate load. Then the columns other than control columns were loaded till it shows initial crack and then retrofitted with banana fiber and glass fiber bonded externally with resin. The retrofitted columns were tested for ultimate load performance. Load carrying capacity was higher for both retrofitting but the column retrofitter with glass fiber showed significant improvement in the ultimate load carrying capacity.

KEYWORDS: Retrofitting, Reinforced Concrete Column, Glass Fiber, Banana Fiber, Ultimate Load Carrying Capacity

I.INTRODUCTION

Reinforced concrete is one of the most important materials in the construction field. Concrete related structures are to be damaged due to several reasons after their life time. In such cases the damaged portion of the structures is difficult to replace because of financial issues and time duration. The alternative remedy for repairing the damaged structure is retrofitting instead of replacing the structure. Retrofitting is all about the process of strengthening the older buildings, damaged structures such as heritage buildings, bridges etc., It lowers the risk of damage to an existing structure. Retrofitted specimen helps to minimize the further damage of the structure. This paper reports about the strengthening of reinforced concrete column using glass fiber and banana fiber mat. There are various types of glass fiber which differ only in the proportioning of their contents[1]. Synthetic fiber is added to the concrete mix to avoid the shrinkage cracking of plain concrete[2]. Concrete with selfcuring agents would be a new development in the concrete construction industry[3]. Application of carbon fiber brings about very good improvement in strength but the failure is usually explosive in nature[4]. Melt spinning techniques are used in producing E-Glass fibers

In present investigation, M30 concrete grade is used. Mix design was done as per IS 10262: 2009 "Indian Standard Concrete Mix Proportioning – Guideline"[16]. Based on the above practice, a concrete proportion with a characteristics target compressive strength is designed. Experimental investigations have been carried out to find out the enhancement of flexural strength of M30 grade concrete specimen. The tests were conducted as per IS code specifications.

Materials:

Cement, Fine and Coarse aggregate Ordinary Portland Cement (OPC) of grade 53 was used in this study. Fine aggregate which only passes through 4.75mm sieve was sieved and selected. Manufacturing sand (M sand) derived from the granite stone quarry was used instead of natural river sand due to its scarcity. As far as coarse aggregate was concerned, 60 percent 20mm aggregate and 40 percent 12mm aggregate was used.

Banana Fiber-

The Banana used for this work is from the local village, Tamil Nadu region. Uniform length of fiber was obtained by using cutting machine. Salient physical and mechanical properties of Banana were determined in their natural form.

II. LITERATURE SURVEY

(Amgad Elbehiry & Omar Elnawawy, 2020)

This study aims to analyse the performance of using banana fiber bars on the mechanical properties of reinforced concrete columns. In order to achieve this, aim several experimental studies on the utilization of banana fibers to optimize the strength and properties of concrete structures are performed. The experimental studies are conducted based on a group of seven specimens of concrete columns with different aspects to: determine the most critical factors affecting the performance of flexure behaviour of reinforced concrete (RC) columns using banana fiber bars, study the mix design aspects of the banana fiber bar in RC, study the behaviour of banana fiber bars on concrete behaviour, study the effect of banana fiber with different concrete grades. Results show that using banana bars as a reinforcement material can significantly increase the ability to resist cracking and spalling in concrete columns.

(Suresh Kumar, 2019 et.al)

The paper presents an experimental investigation conducted to study the effects of chemically treated banana fiber in concrete. Sustainable development of the built environment in developing countries is a major challenge in the 21st century. The use of local materials in construction of buildings is one of the potential ways to support sustainable development in both urban and rural areas. Banana fibers, which will be the focus of this study. Banana fibers are widely available worldwide as agricultural waste from Banana cultivation. Banana fibers are environmentally friendly and present important attributes, such as low density, light weight, low cost, high tensile strength, as well as being water and fire resistant. This kind of waste has a greater chance of being utilized for different application in construction and building materials. This focused on the use of banana fiber and its effect on the compressive and split tensile strength.

(Prasannan. D 2018 et.al)

This research describes experimental studies on the use of sisal and banana fiber to enhance the strength and applications of concrete. These natural fibers have excellent physical and mechanical properties and can be utilized more effectively. They are economical with no chemicals. The addition of sisal fibers and banana fibers significantly improved many of the engineering properties of the concrete notably compressive strength, tensile strength and flexural strength. The ability to resist cracking and spalling were also enhanced. Thus, it acts as a natural admixture giving additional properties to the ordinary cement concrete. In this project three different percentages of sisal fibers and banana fibers (0.5%, 1%, 1.5%) having 30mm length to be used. M25 grade of ordinary reinforced cement concrete is casted by using Ordinary Portland cement of grade 53. Compressive strength, splitting tensile strength, flexural strength at different ages of ordinary reinforced cement concrete was tested and the sisal fiber and banana fiber reinforced cement concrete to be tested.

(Prof J. Jose 2016 et.al)

Retrofitting is the modification of existing structure which may or may not be damaged to make them more resistant to external forces. The objectives like Upgraded loading requirements; damage by accidents and environmental conditions, rectification of initial design flaws, change of usage can be achieved by retrofitting. The solutions adopted are generally based on successful prior practice. It is necessary to take a decision whether to demolish a distressed structure or to restore the same for effective load carrying system. Many a times, the level of distress is such that with minimum restoration measures the structural component can be brought back to its normalcy and during such times retrofitting is preferred. One of the techniques of strengthening RC structural elements is through confinement with composite enclosure. FRP material, which are available in the form of sheet or laminates are used to enhance the flexural, shear, and axial load carrying capacity of these elements. The proposed technique consists of wrapping Glass Fiber Reinforced Polymer composite mats on the shear and Flexural zones of the RC column and studying their characteristics.

(Nalini Thakre 2014 et.al)

Pervious concrete is a composite material consisting of coarse aggregate, Portland cement, a water. is different from conventional concrete in that it contains no fine sin the initial mixture, recognizing however, that fines are introduced during the compaction process. The aggregate usually consists of a single size and is bonded together at its points of contact by a paste formed by the cement and water. The result is a concrete with a high percentage of interconnected voids that, when function incorrectly, permit the rapid percolation of water through the concrete

III. ACTUAL METHODOLOGY Casting of Columns

Form work of mould and Column casting

A wooden mould of dimension 150mm wide, 250mm deep and 1000mm length was used to cast the column. Generally, concrete's tensile strength is neglected. 2 numbers of 12mm diameter Fe500 steel reinforcement were used in the tension and as well as compression zone. The stirrups will be 8mm diameter provided at 150 mm center to center spacing for the entire length

Curing

The casting of column was done by placing the concrete in to the mould and compacted well for removing the voids. The curing was done for the time period of 28-day in curing tank

Retrofitting of columns

The retrofitting on columns was carried out by pasting the fiber mat with the help of resin. The single layer wrapping technique is followed to retrofit the column. All the column specimens were loaded to get the initial cracks and then the experiment was stopped. Before wrapping the column, the surface should be cleaned to make rough surface so that the resin sticks well in the surface of column. After that the column was coated with polystyrene resin and the fiber mat was wrapped well

Testing of columns

For testing of specimen, loading frame was used. The loading frame consists of steel column, columns, hydraulic jack, linear vertical displacement transducer and supports. The loading frame capacity was 750 kN. The column placed over the two-point roller support leaving 50 mm from the ends of the column. From the column span remaining 900 mm was equally divided and three (Linear Variable Differential Transformer) LVDT were placed to determine the deflection of the column. 2 numbers of LVDT were placed at 1/3rd distance and one LVDT were placed at mid-point. Initially the control columns were tested under two-point loading conditions to obtain the initial crack. then the test was continued to determine the ultimate load carrying capacity of the column and the type of failure occurred in the column

IV. RESULT

Testing of column:

3 Concrete columns of 700mm x 150mm x 150mm were made and tested in the Universal Testing Machine (UTM).

→ 3 columns are used as control columns for comparing results.

→ 3 columns are wrapped with single layer configuration. → 3 columns are wrapped with double layer configuration.



Figure 4.1 Testing Of Normal Column

Testing of normal column:

Table no.4.1 represents the Compressive strengths of the flexural columns without banana fiber

Table 4.1 Result Of Normal Column Testing

Specimen	Dimensions			Load (kN)	Avg.	Compressive strength (N/mm ²)	Avg.
	L	D	W				
CC1	700	150	150	81.69	81.01	21.77	21.59
CC2	700	150	150	79.35		21.15	
CC3	700	150	150	82.00		21.85	

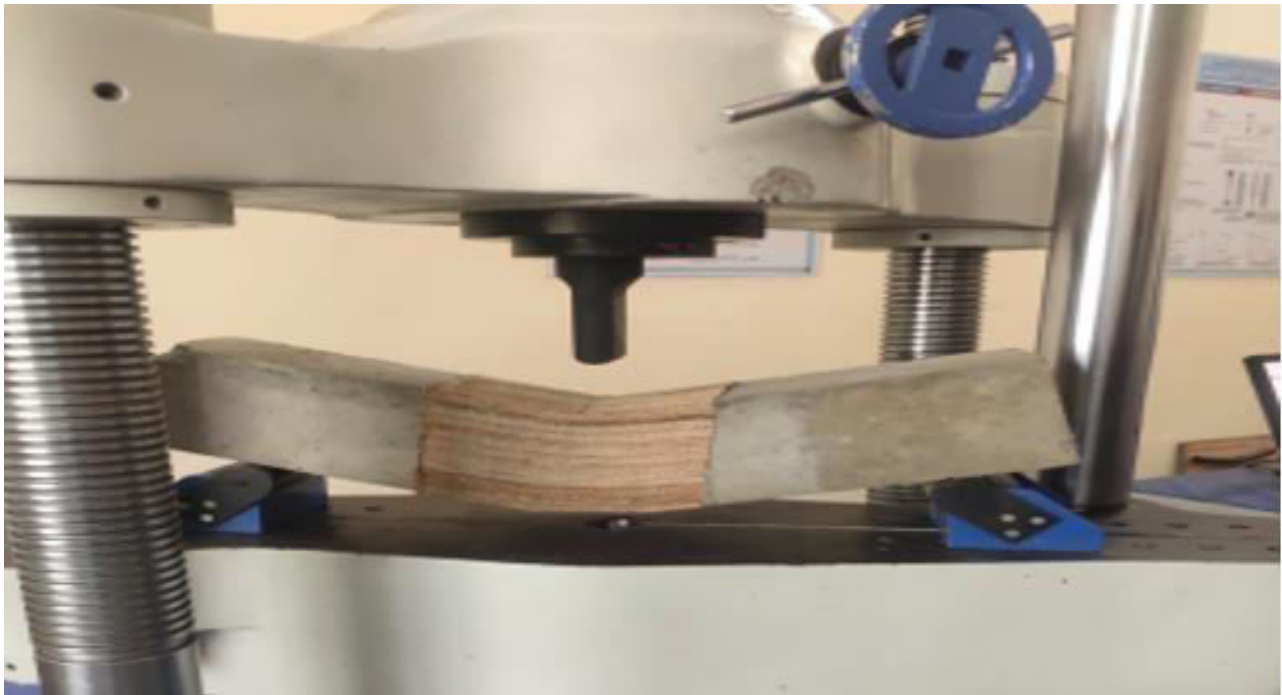


Figure 4.2 Testing Of Single Layer Column

Testing of Single Layer Column:

The Compressive strengths of the flexural columns with single layer banana fiber.

Table 4.2 Result of Single Layer Column

Specimen	D mensions			Load (kN)	Avg.	Compressive strength (N/mm2)	Avg.
	L	D	W				
FSC1	700	150	150	96.86	96.62	25.81	25.74
FSC2	700	150	150	97.33		25.93	
FSC3	700	150	150	95.68		25.49	



Figure 4.3 TESTING OF DOUBLE LAYER FIBER

Testing of Double Layer Column:

Represents the Compressive strengths of flexural columns with double layer banana fiber.

Table 4.3 Result of Double Layer Fiber

Specimen	Dimensions			Load (kN)	Avg.	Compressive strength (N/mm2)	Avg.
	L	D	W				
FDC1	700	150	150	99.93	100.43	26.62	26.75
FDC2	700	150	150	99.81		26.59	
FDC3	700	150	150	101.55		27.06	



Table 4.4 Comparison Of Column Testing

Columns	Avg. Compressive strength (N/mm ²)	Increase in Strength by %
Normal Columns	21.59	0
Single Layer Banana Fiber	25.74	19
Double Layer Banana Fiber	26.75	23

V. CONCLUSION

- The ultimate load was found to be high for columns retrofitted than control column.
- The initial cracks in the strengthened columns appear at a higher load compared to the unstrengthen control column.
- There is an increase of 16% to 22% in compressive strength of blocks retrofitted by single and double layer banana fiber.
- There is an increase of 19 to 23% in flexural strength for columns retrofitted by single and double layer banana fiber.
- There is negligible difference between columns retrofitted with single layer and double layer configuration. So we can conclude that single layer configuration is enough for the column which will save cost of the column.

REFERENCES

1. An experimental study and behaviour of banana fiber in concrete’ by Suresh Kumar S, Akash B M, Kabilan M, Karna H, Navaneethan S, International Journal of Scientific & Engineering Research Volume 10, Issue 3, March-2019 ISSN 2229
2. Comparative Study of Banana and Sisal Fiber Reinforced Concrete with Conventional Concrete, Prasannan. D, Nivin. S, Raj kumar. R, Giridharan. Elavivekan. M, International Journal of Pure and Applied Mathematics, Volume 118 No. 20 2018, 1757-1765
3. Effects of Fiber Geometry and Volume Fraction on the Flexural Behaviour of SteelFiber Reinforced Concrete, D. V. Soulioti, N. M. Barkoula, A. PaiBanana is an T. Matikas, An International Journal for Experimental Mechanics, 2011
4. Effect of banana fibers on the compressive and flexural strength of compressed earth blocks by Marwan Mostafa and Nasim Uddin, Buildings 2015, 5, 282 296; doi:10.3390/buildings5010282.
5. Enhancing the properties of concrete by using banana fiber by Suhas Ritesh Dhoka, International Journal of Advance Engineering and Research Development Volume 5, Issue 06, June -2018.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details