# Repair and Rehabilitation of RCC Beam using Synthetic Fiber Material

**M.Hemapriya, T.P.Meikandaan, Anitha K**

***Abstract*: Retrofitting is the alteration of existing structures to make them continuously impenetrable to seismic development, ground development, etc. A large number of the current strengthened solid structures all through the world are in pressing need of recovery, fix or reproduction in light of crumbling because of different factors like consumption, absence of itemizing, disappointment of holding between pillar segment joints and so on. Fiber Reinforced Polymer (FRP) composite has been acknowledged in the development business as a promising substitute for fixing and in augmenting the quality of Reinforced concrete structures. This paper exhibits a test study on fortified solid shafts retrofitted with different kinds of filaments remotely. The goal of this examination is to explore the conduct of shafts in the wake of retrofitting utilizing different normal and engineered filaments including steel strands, polypropylene strands, glass filaments, Basalt filaments, carbon filaments and so forth.***

***Keywords – Epoxy bonding agent, glass fiber, basalt fiber, Repair and Rehabilitation***

## I. INTRODUCTION

Structure may not be a savvy arrangement and it is probably going to turn into an expanded monetary weight if updating is a practical other option[1]-[5]. In such events, fix and restoration are most usually utilized arrangements. Support consumption and auxiliary decay in strengthened cement (RC) structures are normal and incited numerous scientists to look for elective materials and restoration methods. In this unique circumstance, fortifying with Fiber Reinforced Polymers (FRP) composite materials as outer support is of incredible enthusiasm to the Civil designing network. The customary fortifying techniques for fortified solid structures endeavor to repay the lost quality by including progressively material around the current segments. In this way retrofitting and restoration of structures can be finished up to be the best other option[6]-[8].

### A. Aim and objective

- To increase the flexural strength of the beam by using Glass Fiber Mat and Basalt Fiber Mat[9]-[15].
- To analyse the strength before and after using Glass Fiber Mat and Basalt Fiber Mat.

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## II. METHODOLOGY

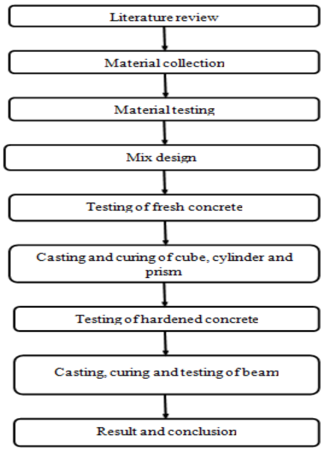


**Figure – 1 Flow Chart**

## III. MATERIAL PROPERTIES

**Table 1 - Properties of Cement**

| Sl. No | Properties of cement | Value |
|---|---|---|
| 1 | Specific Gravity | 3.1 |
| 2 | Normal consistency | 27% |
| 3 | Fineness | 7.18 gm |

**Table 2 - Properties of Aggregate**

| Sl. No | Properties of aggregate | Value |
|---|---|---|
| 1 | Specific Gravity of CA | 2.45 |
| 2 | Fineness modulus of CA | 6.77 |
| 3 | Specific Gravity of FA | 2.56 |
| 4 | Fineness modulus of FA | 2.71 |

**Table 3 - Testing of Fresh Concrete**

| Sl no. | Properties of concrete | Value |
|---|---|---|
| 1 | Slump Value | 145 mm |
| 2 | Compaction factor | 0.82 |

**Table 4 – Mix Proportion of M25 grade concrete**

| Cement ($kg/m^3$) | Fine Aggregate ($kg/m^3$) | Coarse Aggregate ($kg/m^3$) |
|---|---|---|
| 440 | 909.61 | 741.56 |
| 1 | 2.06 | 1.68 |

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## IV. TESTING RESULTS

### Table 5 - Compression Test Results (7 Days)

| S.no | Specimens (mm) | Load (kN) | Compressive strength (N/mm²) | Average compressive strength (N/mm²) |
|---|---|---|---|---|
| 1 | Cube 1 | 298 | 13.24 | |
| 2 | Cube 2 | 261 | 11.6 | 11.59 |
| 3 | Cube 3 | 224 | 9.95 | |

### Table 6 - Split Tensile Test Results (7 Days)

| S.no | Specimens (mm) | Load (KN) | Split tensile strength (N/mm2) | Average split tensile strength (N/mm2) |
|---|---|---|---|---|
| 1 | Cylinder 1 | 78 | 1.1 | |
| 2 | Cylinder 2 | 62 | 0.87 | 0.88 |
| 3 | Cylinder 2 | 49 | 0.69 | |

### Table 7 - Flexural Test Results (7 Days)

| S.no | Specimens | Load (KN) | Flexural strength (N/mm2) | Average flexural strength (N/mm2) |
|---|---|---|---|---|
| 1 | Prism 1 | 3 | 1.5 | |
| 2 | Prism 2 | 2 | 1 | 1.33 |
| 3 | Prism 3 | 3 | 1.5 | |

### Table 8 - Compression Test Results (28 Days)

| S.No | Specimens (mm) | Load (kN) | Compressive strength (N/mm²) | Average Compressive strength (N/mm²) |
|---|---|---|---|---|
| 1 | Cube 4 | 534 | 23.7 | |
| 2 | Cube 5 | 475 | 21.1 | 22.6 |
| 3 | Cube 6 | 524 | 23.2 | |

### Table 9 - Split Tensile Test Results (28 Days)

| S.No | Specimens (mm) | Load (kN) | Compressive strength (N/mm²) | Average Compressive strength (N/mm²) |
|---|---|---|---|---|
| 1 | Cylinder 4 | 107 | 1.51 | |
| 2 | Cylinder 5 | 114 | 1.61 | 1.55 |
| 3 | Cylinder 6 | 110 | 1.55 | |

### Table 10 - Flexural Test Results (28 Days)

| S.No | Specimens (mm) | Load (kN) | Compressive strength (N/mm²) | Average Compressive strength (N/mm²) |
|---|---|---|---|---|
| 1 | Prism 4 | 6 | 3 | |
| 2 | Prism 5 | 4 | 2 | 1.55 |
| 3 | Prism 6 | 3 | 1.5 | |

### A. Conventional Beam Mould Calculation

Volume of the beam = 1 x 0.15 x 0.15 m = 0.0225 m3
Assume load = 50 KN/m
Bending moment = wl2/8 (simply supported) = 6.25 x 106 N/m2
Shear force = wl/2 = 25 KN
Mu = 0.138 x fck x bd2 Mu/ (0.138 fck x b) = d2
d = 115mm
Ast calculation
Mu = 0.87 x fy x Ast x d[(1-Ast x fy) / (bd fck)]
6 x 106 = 0.87 x 415 x Ast x 115[1- 9.6 x 10-4 Ast]
6 x 106 = 41520 Ast – 39.85 Ast2
Ast = 173.35 mm2 Assume 12mm dia bars
ast = πd2 /4
= π x 122 / 4
= 113.09
Ast / ast = 173.35 / 113.09
= 1.53
2 Nos of 12mm dia

### Table 11 - Load deflection test on Conventional Beam 1

| S.NO | Proving Ring Reading | Load (kN) | Deflection (mm) |
|---|---|---|---|
| 1 | 10 | 4 | 0.12 |
| 2 | 20 | 8 | 0.34 |
| 3 | 30 | 12 | 0.49 |
| 4 | 40 | 16 | 0.66 |
| 5 | 50 | 20 | 0.85 |
| 6 | 60 | 24 | 0.98 |
| 7 | 70 | 28 | 1.20 |
| 8 | 80 | 32 | 1.37 |
| 9 | 86 | 34.4 | 1.64 |

### Table 12 - Load deflection test on Conventional Beam 2

| S.No | Proving Ring Reading | Load (kN) | Deflection (mm) |
|---|---|---|---|
| 1 | 10 | 4 | 0.14 |
| 2 | 20 | 8 | 0.25 |
| 3 | 30 | 12 | 0.41 |
| 4 | 40 | 16 | 0.67 |
| 5 | 50 | 20 | 0.88 |
| 6 | 60 | 24 | 1.19 |
| 7 | 70 | 28 | 1.37 |
| 8 | 79 | 31.6 | 1.53 |

### Table 13 - Load deflection test on Conventional Beam 1 after Retrofitting Using Glass Fiber Mat

| S.No | Proving Ring Reading | Load (kN) | Deflection (mm) |
|---|---|---|---|
| 1 | 10 | 4 | 0.04 |
| 2 | 20 | 8 | 0.25 |
| 3 | 30 | 12 | 0.49 |
| 4 | 40 | 16 | 0.78 |
| 5 | 50 | 20 | 0.93 |
| 6 | 60 | 24 | 1.15 |
| 7 | 70 | 28 | 1.28 |
| 8 | 80 | 32 | 1.30 |
| 9 | 90 | 36 | 1.53 |
| 10 | 100 | 40 | 1.65 |
| 11 | 110 | 44 | 1.78 |
| 12 | 118 | 47.2 | 1.81 |

## IV. CONCLUSION

In this preliminary assessment the flexural direct of sustained strong bars remotely fortified by means of carbon, glass, steel, coir and polypropylene sheets are thought about. From the test results and decided quality characteristics, the going with closes are drawn[25]-[29]:
The diversions of the bars are limited because of full folding strategy over all the four sides of the shaft.
The underlying splits in the fortified shafts show up at a higher burden contrasted with the un-reinforced control pillar.
The flexural quality and extreme burden limit of the bars improved because of outer

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fortifying of bars. The fortifying of bars utilizing fiber sheets is seen as progressively compelling in improving the flexural quality and extreme burden limit of bars[31]-[34].

A definitive burden limit of the bars fortified utilizing fiber sheets is expanded when contrasted with that of control pillar.

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