

# **Influence of Glass Fibre on Flexural Behaviour of RCC Beam**

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**ABSTRACT:** Plain cement concrete possess very low tensile strength, limited ductility and have little resistance to cracking. Internal micro cracks are essentially present in concrete and its reduced tensile strength is due to propagation of such micro cracks. Fibres, when added in the concrete, improve the strain properties, cracks resistance, ductility, flexure strength and toughness. In recent years, glass fibres have become popular, which are free from corrosion problem associated with fibres. This present paper outlines the experimental investigation conducted on the structural concrete blended with glass fibre. Cem-fill anti crack, high dispersion, alkali-resistance glass fibre of diameter 30 micron, having aspect ratio of 300 was with used in this project. Compressive strength, split tensile strength and flexural strength were found and test results are compared by conducting tests with 1 and 2 percentages of fibres.

**KEYWORDS:** Glass fibre, compressive vigour, split tensile vigour, flexural vigour.

## **I. INTRODUCTION**

Concrete is a composite textile containing cement, water, coarse aggregate and well aggregate. The resulting material is a solid structure which is formed by the chemical result of the cement and water. This stone like material is a brittle material which is burly in compression but very fragile in tension. This weakness in the concrete makes it to crack under small loads, at the tensile end. These cracks slowly propagate to the firmness end of the member and at last, the member break. The formation of cracks in the concrete may also occur due to the drying shrinkage. These cracks are basically micro cracks. These crack increase in size and magnitude as the time slip away and the determinately makes the material to not succeed. The pattern of cracks is the main reason for the collapse of the concrete. To increase the tensile vigour of concrete many deeds have been made. One of the successful and most commonly used method is providing steel reinforcement. Steel bar, conversely, reinforce concrete adjacent to local tension only. Thus need for multidirectional and closely spaced steel reinforcement arises. That cannot be practically possible. Fibre reinforcement gives the solution for this problem. to add to the tensile strength of concrete a method of preface of fibres in concrete is being use. These fibres act as crack arrestors and stop the spread of the cracks. These fibres are uniformly distributed and at random arranged. This concrete is name as filament unbreakable concrete. The main reasons for adding a fibre to concrete matrix is to improve the post cracking response of the concrete.

## **II. INVESTIGATIONAL PROGRAM**

### **2.1 MATERIALS CHECKING:**

#### **2.1.1 CEMENT:**

Cement act as a binding agent for material. Cement as applied in Civil Engineering Industry is produced by claiming at high temperature. It is a mixture of calcareous, siliceous, aluminous substances and devastating the clinkers to a fine grime. Cement is the most costly material in concrete and it is offered in different form. When cement is mixed among water, a chemical reaction takes place as a effect of which the cement glue sets and hardens to a stone mass. Depending in the lead the chemical composition, setting and harden property.

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## 2.1.2 Aggregate:

Fine aggregate is a substance such as sand, crushed sand or crushed gravel fleeing through 4.75 mm size. nearby available sand is utilized as fine aggregate in the concrete commix. The categorical severity of fine aggregate is 2.71. Material which retained on 4.75 mm size is relegated as coarse aggregate. For most works, 20 mm aggregate is opportune. The locally available 20 mm size of aggregate is utilized. The categorical gravity of coarse aggregate is 2.94.

**Table 1 - properties of materials:**

Sl. No	Property	Test results
Cement	Specific Gravity	2.284
	Initial Setting Time	32min
	Final Setting Time	320min
Coarse Aggregate	Specific Gravity	2.94
	Size	>4.75mm
Fine Aggregate	Specific Gravity	2.71
	Size	4.75mm

## 2.1.3 Glass Fibres:

The glass fibres utilize in concrete underlying the localization of micro crack in to macro cracks hence tensile vigour raise. It ameliorates durability of concrete by incrementing the vigour of concrete. The Glass Fibres are of Cem-FIL Anti - Crack with modulus of elasticity 72 GPa, Filament diameter 14 microns. Concrete Gravity is 2.68, length 12 mm and having the aspect ratio of 300. The number of fibres per 1 kg is 212 million.

## 2.2 Mix Magnitude:

In this study, control commix A was calculated as per IS 10262:1982 to get a target compressive vigour of 20MPa. The glass fibres of 0 %, 1%, 1.5% and 2% by volume fraction of cement were utilized.

## 2.3 preparation and Details of trial Specimens:

In the current experimental research cubes of 150mm x 150mm x 150mm, 150mm diameter cylinder with 300mm length and the beam was 100mmx100mm in cross section with 800mm length of M-20 grade concrete were casted with varying percentage of advisement of 1%, 1.5% and 2% of glass fibre. behind cast, test specimen were demoulded after 24 hours and were kept in the remedying tanks until the time of test.

## 2.4 Tests on Concrete:

Casting and trying of cubical specimens of size 150mmx150mmx150mm designed for compressive vigour, flexural vigour test and split tensile vigour test test was done as per IS:516-1959 designation.

**Table 2 – Result for Compressive strength test:**

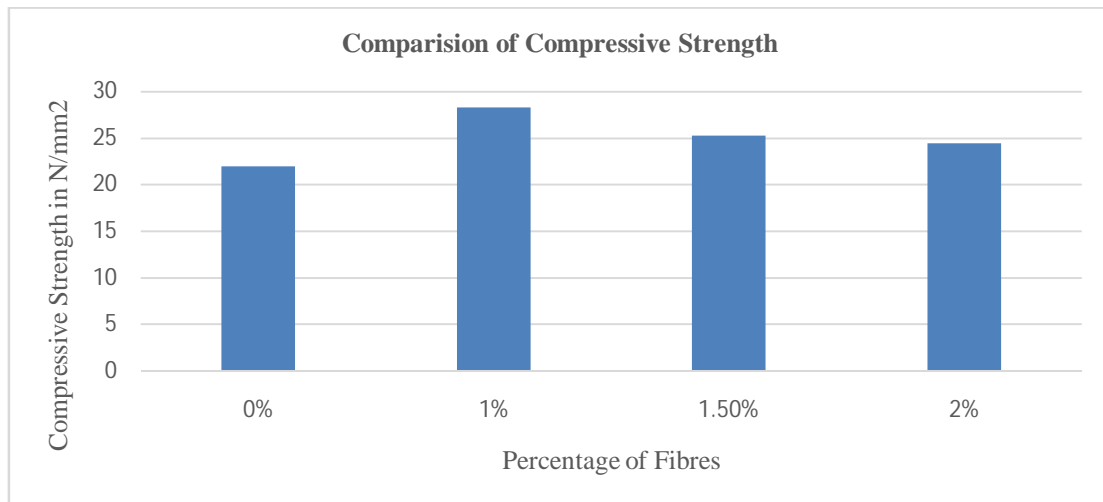
Percentage of Fibre	Compressive Strength for different Curing Periods(N/mm <sup>2</sup> )		
	7Days	14 days	28 days
0%	5.852	12.47	21.98
1%	6.29	13.4	28.29
1.5%	6.112	11.57	25.28
2%	6.87	15.13	24.46

In this below chart shows the compressive strength of the concrete cube after curing 28 days

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**Chart No-1:** Comparison of Compressive Strength

**Table 3 - Result for Splitting Tensile Strength Test:**

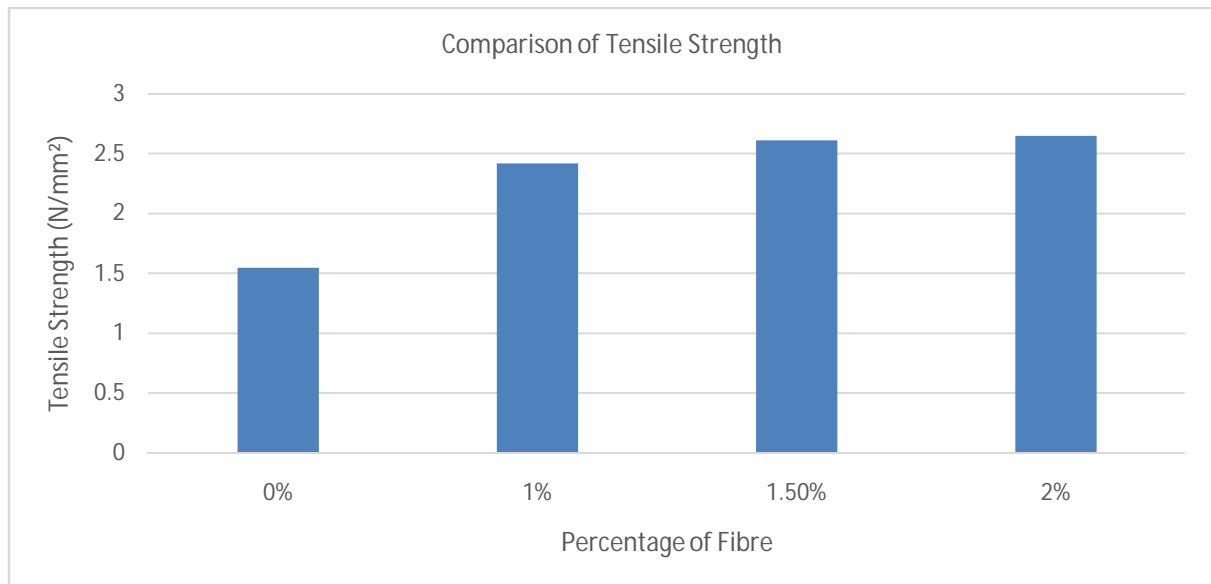
Percentage of Fibre	Tensile Strength for different Curing Periods(N/mm <sup>2</sup> )		
	7Days	14 days	28 days
0%	0.40	0.8	1.55
1%	0.57	1.28	2.42
1.5%	0.63	1.33	2.61
2%	0.64	1.42	2.65

In this below chart shows the tensile strength of the concrete cube after curing 28 days

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**Chart No-2:** Comparison of Tensile Strength

**Table 4 – Result for Flexural strength test:**

Percentage of Fibre	Flexural Strength for different Curing Periods(N/mm <sup>2</sup> )		
	7Days	14 days	28 days
0%	2.62	4.28	8.53
1%	2.83	4.41	8.59
1.5%	3.05	5.02	9.83
2%	2.95	4.96	8.75

In this below chart shows the bending moment resistant capacity of concrete cube after curing 28 days

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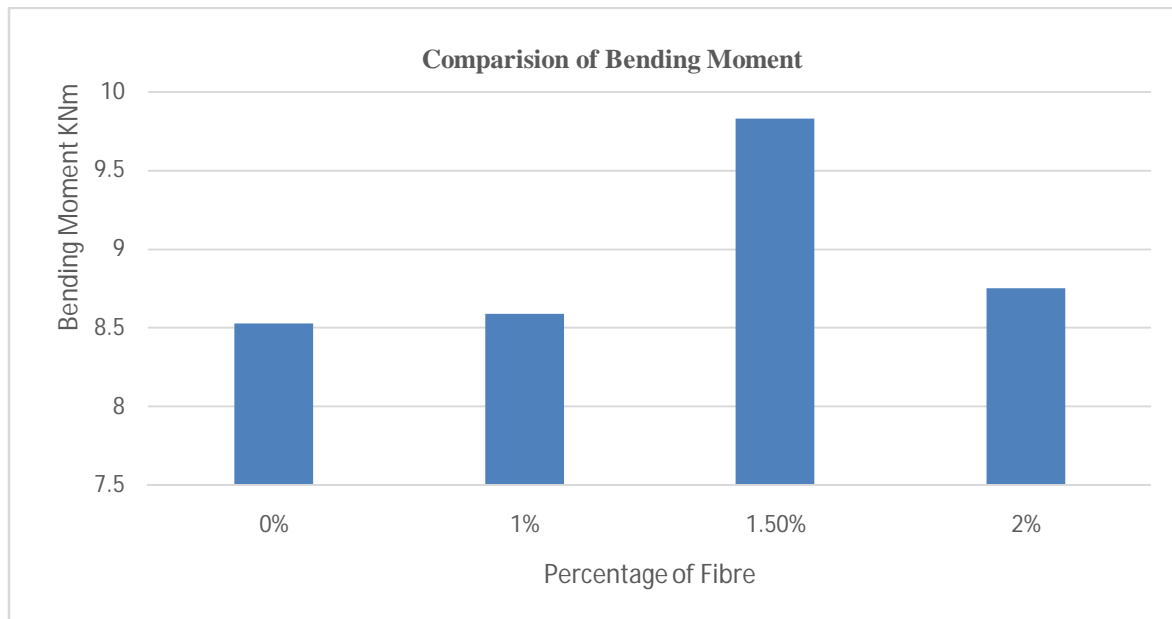


Chart No-3: Comparison Bending Moment.

## III. RESULTS AND DISCUSSIONS

### 3.1 Compressive strength:

Compressive vigour increases with increase in the percentage of glass fibres. It is observed that 28 days compressive vigour is incremented by 28.7% with additament of 1% of glass fibre compared to mundane M-20 concrete. It is observed that 28 days compressive vigour is incremented by 15.00% with integration of 1.5% of glass fibre as compared to mundane M-20 concrete. Additionally it can be observed that 28 days compressive vigour is incremented by 11.2% with additament of 0.1percentage of glass fibre compared to mundane M-20 concrete. When considering the comp. vigour integration of 1%Glass fibre gives the better result.

### 3.2 Split tensile strength:

Tensile vigour increases with increase In the percentage of glass fibres. It can be observed that 28 days Splitting tensile vigour is incremented by 56.13% with additament of 1% of glass fibre compared to mundane M-20 concrete. It is observed that 28 days Splitting tensile vigour is incremented by 68.39%with additament of 1.5% of glass fibre as compared to mundane M-20 concrete. Additionally it can be observed that 28 days Splitting tensile vigour is incremented by 70.97%with additament of 2% of glass fibre compared to mundane M-20 concrete. When considering the tensile vigour additament of 2%Glass fibre gives the better result.

### 3.3 Flexural strength:

Flexural vigour increases with increase in the percentage of glass fibres. It can be observed that 28 days flexural vigour is incremented by 7% with additament of 1% of glass fibre compared to mundane M-20 concrete. It can be observed that 28 days flexural vigour is incremented by 15.26%with additament of 1.5% of glass fibre as compared to mundane M-20 concrete. Withal it can be observed that 28 days flexural vigour is incremented by 6.34% with additament of 2% of glass fibre compared to mundane M-20 concrete. When considering the flexural vigour additament of 1.5%Glass fibre gives the better result.

### 3.4 Conclusions:

The Glass fibres used in this project has shown considerable Improvement in all the properties of concrete when compare to predictable concrete.

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- Compression, Split, Flexural vigour of fibre reinforced concrete is highly appreciable when the percentage of fibre added to concrete is 1.5%
- When percentage of fibre increase, due to balling effect, low workability of concrete and low bonding capacity between concrete and fibre the concrete strength is reduces. Hence the percentage of fibre added to concrete is limited to 1.5%
- The Glass Fibre reinforced concrete is suitable to increase the flexural strength of concrete.

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