Experimental Study on Flexural Behaviour on various Fibre Reinforced Concrete Beams

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Abstract

Concrete is a key ingredient that forms a major ingredient for all prestresses and prefabricated structural elements. For all structures are planned with a fine slenderness ratio. To achieve High-Performance Concrete, Fiber-reinforced Concrete is the effective medium to achieve considerable improvement in strength aspects. To compare the best FRC, we are comparing the strength behavior & good composition results of various metallic and synthetic FRCs from works of literature. And the results of FRC with the best composition were taken to find the best FRC with specified strength. Finaly Fibre Reinforced beams are casted, cured and tested for its flexural strength and itsrespective deflections were noted and compared.

Keywords: FRC, Steel fibre, Glass fibre, Nylon Fibre, fibre reinforced concrete beams

I. INTRODUCTION

Concrete is one of the most widely used construction material in the world, it is usually associated with Ordinary Portland Cement (OPC) as the main component for making concrete, also fine aggregate and coarse aggregate. Concrete made with Portland cement has certain characteristics. It is relatively strong in compression but weak in tension and tends to be brittle. These two weaknesses have limited its use. Another fundamental weakness of concrete is that cracks start to form as soon as concrete is placed and before it has properly hardened. These cracks are the main reason for weakness of concrete in various factors and may lead to failure of structure and affects durability factor. These deficiencies may able to overcome by the use of fibers. Extensive research work on FRC during the last two decades has established that combination of two or more types of fibres such as metallic and non-metallic fibers increase overall performances of concrete. IIn Past, a lot of experimental work was carried out on fiber reinforced concrete having different types of fibers to study their improved engineering properties in compressive strength, tensile strength, flexural strength, etc., The fibers are able to prevent surface cracking through bridging action leading to an increased impact resistance of concrete. Most of the fibers used in practice contain one type of fiber or more than one type of fiber. Recent years have seen considerable interest in the fiber hybridization particularly combinations of metallic and non-metallic fibers. For optimal behavior, different types of metallic and non-metallic fibers are to be combined.

The mechanical properties such as compressive strength, flexural strength and flexural toughness etc., And also its being to be achieved using M-Sand instead of River Sand for natural resources conserving concern.

Inclusion of Fibers in concrete improve stensile and compressive strength due to bridging action of fibers.Large amount of studies proved that fiber reinforcement increases the strength significantly.

The direct CO_2 intensity of cement production increased 1.8% per year during 2015-2020. Demand for cement in the construction industry drives production and is thus an important determinant of cement subsector energy consumption and CO2 emissions.

Inorder to achive less CO_2 emission through lesser use of concrete, High performance concrete is mandate one. With fiber reinforcements , serviceablity gets incresed with good tensile and compressive stregnths. In this projec we are going to analyse the strength and composition factors of concrete reinforced with fibres like Steel fiber, Nylon fiber, Glass fiber, and Polypropylene fiber.

Our objectives are

- ✓ To Study And Choose The Best Performed Frc Mixtures And Its Optimal Percentile Blending.
- ✓ To Prepare a High Performance Fiber Blended Concrete Beams.
- ✓ To Compare the Flexural Strength and deflection of various fiber blended concrete beams.

II. THEORETICAL CONCLUSION FROM THE LITERATURE

From the above Literatures, the following conclusions were made.

- ✓ The Literatures proved that fibre reinforcement increases the compressive strength as well as tensile strength of concrete as compared to conventional concrete.[10]
- ✓ The steel fibre reinforcement in concrete increases the compressive strength of concrete & considerably the tensile strength. The fibre

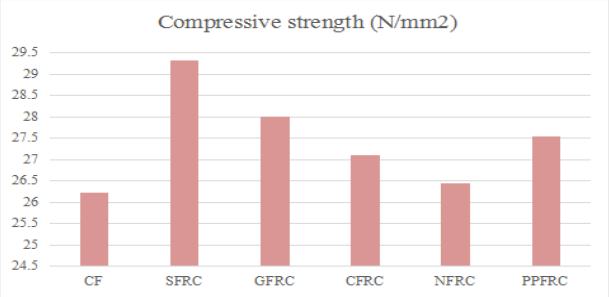
addition of 1.25% to the volume of cement gives the considerable result of increasing the strength.[6]

- ✓ The Polyproylene fibre reinforcement in concrete increases the compressive strength of concrete & considerably the tensile strength. The fibre addition of 0.5% to the volume of concrete yield higher flexural strength[3]
- ✓ The Nylon fibre reinforcement in concrete increases the compressive strength of concrete & considerably the tensile strength. The fibre addition of 1% to the volume of concrete gives the considerable result of increasing the strength about 27%
- ✓ The glass steel fibre reinforcement in concrete increases the compressive strength of concrete & considerably the tensile strength. The fibre addition of 1 % to the volume of concrete gives the considerable result of increasing the strength about 15%
- ✓ The glass steel fibre reinforcement in concrete increases the compressive strength of concrete & considerably the tensile strength. The fibre addition of 1.0 % to the volume of cement gives the considerable result of increasing the strength[8]

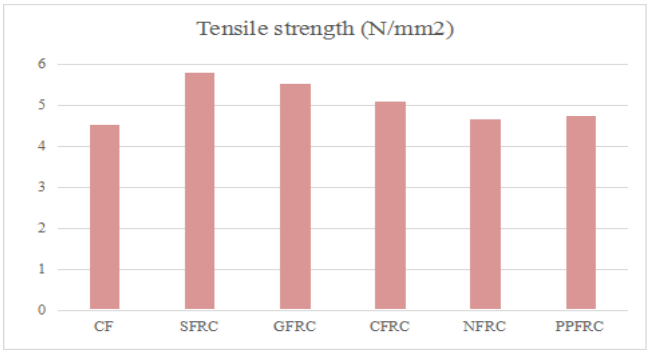
III. SPECIMEN CASTING AND EXPERIMENTAL RESULTS

A total of 18 cubes, 18 prisms and 18 beams were casted and tested, and there compressive strength, split tensile strength and flexural strength results have been taken for M 25 grade design mix.

Compressive Strength for Cubes at 28 days Test for M 25

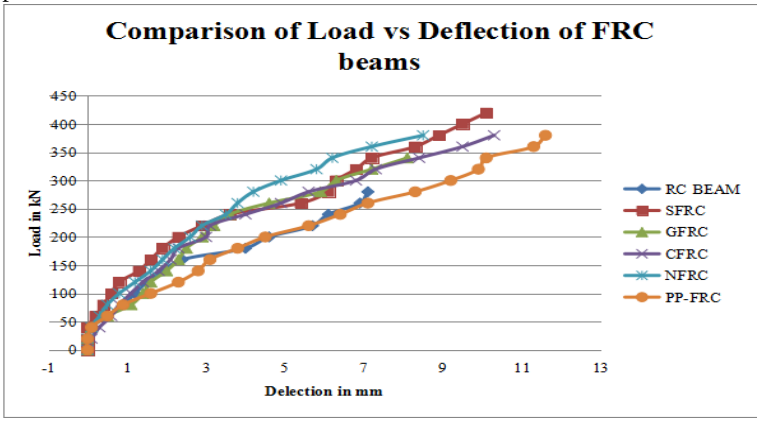


Split Tensile Strength for Cylinders at 28 days test for M 25



FLEXURAL TEST RESULTS ON BEAM SPECIMENS

The deflection of beam was found out by using 100Ton loading frame. The deflection of beam is found out with respect to the load increment. And figure shows the graph plotted for load and deflection for each mix.



Load Vs. Deflection curve comparision for all beam specimens

IV. CONCLUSION

- ✓ The Slump cone test and Compaction factor results showed that thereby no significant changes are known in Conventional Concrete and Fibre Reinforced Concrete except Steel Fiber Reinforced Concrete while using Manufactured Sand as alternative for river sand.
- ✓ The basic properties of Steel, Carbon, Glass, Nylon and Polypropylene fibers was studied.
- ✓ On comparing various Specimens, the mechanical properties of Steel fibre reinforced concrete is increased by 12% in Compression and by 28% Split tensile than the control mix strength.
- ✓ On comparing various Specimens, the mechanical properties of Glass fibre reinforced concrete is increased by 7% in Compression and by 22% Split tensile than the control mix strength.
- ✓ On comparing various Specimens, the mechanical properties of Carbon fibre reinforced concrete is increased by 3% in Compression and by 13% Split tensile than the control mix strength.
- ✓ On comparing various Specimens, the mechanical properties of Nylon fibre reinforced concrete is increased by 1% in Compression and by 3% Split tensile than the control mix strength.

- ✓ On comparing various Specimens, the mechanical properties of Polypropylene fibre reinforced concrete is increased by 5% in Compression and by 5% Split tensile than the control mix strength.
- ✓ The steel fiber reinforced concrete beam shows higher resistance to loads and as well gives maximum deflection when compared to conventional and other fibre reinforced concrete beams
- ✓ It was found that steel fibre reinforced concrete gives us the considerable strength while comparing all other fibre reinforced concrete specimens.

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