Comparative Study on Fibre Reinforced Concrete

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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 maintain structural requirements and reduce CO_2 emission from cement manufacturers, there is a huge demand for High-Performance Concrete. Fiber-reinforced Concrete is the major hope for HPC. 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.**

Index Terms **- FRC Fiber reinforced concrete, glass fiber, steel fiber, carbon, polypropylene fiber, nylon fiber.**

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. It is obvious that the behavior of HFRC depends on the aspect ratios, orientations, geometrical shapes, distributions and mechanical properties of fibres in concrete mixtures. In 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., of Hybrid Fiber Reinforced Concrete (HFRC) are to be investigated. 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 tensile 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.

In order to achieve less CO_2 emission through lesser use of concrete, High performance concrete is mandate one. With fiber reinforcements , serviceability gets increased with good tensile and compressive strengths. In this project 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

a. To Study and Choose The Best Performed Frc Mixtures And Its Optimal Percentile Blending.

b. To Prepare a High-Performance Fiber Blended Concrete Beams.
c. To Compare the Flexural Strength Results Various Fiber Blended Concrete Beams.

REVIEW ON EARLIER WORKS

[1] Selina ruby G., Geethanjali C., et.al, (2014) The combining of fibers, often called hybridization, is investigated for a M40 grade concrete at a volume fraction of 0.5% in this paper. Control and three hybrid fiber composites were cast using different fiber proportions of steel and polypropylene. Compressive strength, split tensile strength and flexural strength test were performed and results were analyzed to associate with above fiber combinations. The maximum compressive strength reaches in the HFRC S0.75P0.25, i.e., 75% steel fibres and 25% polypropylene fibres because of the high elastic modulus of steel fibre and the low elastic modulus of polypropylene fibre work in perfect combination. The increased fibre availability of PP fibres, combined with the high stiffness of steel fibres, resulted in a significant enhancement of the split tensile strength for this combination.

1. P.S.Song, S,Hwang, B.Sheu, (2004) investigated versus that of the polypropylene-fiber-reinforced concrete, at a fiber content of 0.6 kg/m^3. In this paper, the strength properties and shrinkage cracking control of nylon-fiber-reinforced concrete were under investigation, in comparison with those of the polypropylene-fiber-reinforced concrete counterpart. The nylon fiber-reinforced concrete outperformed its polypropylene companion in the upgrading of compressive and splitting tensile strengths, MOR, and impact resistance. The shrinkage crack reducing potential of the nylon fibers in mortar went moderately ahead of that of the polypropylene fibers.
2. Ahsana Fathima K M and Shibi Varghese., (2014) The main aim of this experiment is to study the strength properties of steel fibre and polypropylene fibre reinforced concrete of M30 grade with 0%, 0.25%, 0.5%, and 0.75% by volume of concrete. This study consisted of compressive strength test and split tensile strength test on hybrid fibre reinforced concrete with 0.5% polypropylene fibres and 0.75% steel fibres. The steel fibre reinforced concrete yield higher compressive strength with addition of 0.75% steel fibre by volume of concrete an also yields higher splitting tensile strength. The polypropylene fibre reinforced concrete yield higher flexural strength with addition of 0.5% polypropylene fibre by volume of concrete.
3. Pravin B.Shinde, Sangita V. Pawar, V. P. Kulkarni, (2015) addresses the compressive strength, split tensile strength, flexure behaviour of hybrid fibre reinforced concrete deep beams. The specimens incorporated steel and polypropylene fibres in the mix proportions of 00-00%, 0-100%, 25-75%, 50-50%, 75-25% and 100-00% by volume at a total volume fraction of 1.0%. Compressive strength of HyFRC after 28 days for 75-25% (steel-polypropylene) hybridization ratio is maximum. Split Tensile Strength of HyFRC Concrete for 28 Days Increases with Increasing Contribution of Steel Fiber in hybridization ratio. Split tensile strength of SFRC (i.e. Hybridization ratio 100-0%) is maximum. Flexural strength of HyFRC for 50-50% & SFRC i.e. 100-0% after 28 days is nearly same.
4. Priyanka Dilip.P, K.Remadevi. (2007) focuses on HFRC system consisting of steel fibers and polyolefin fibers. Steel fiber (80%) and Polyolefin (20%) fibers are different proportions (0.5%, 1%, 1.5% and 2%) are used in the test specimens were cast and tested. Then the results were compared with the control specimen. A hybrid volume fraction of 1% with 80-20 Steel- Polyolefin combine appreciably improve the compressive strength, split tensile strength and flexural strength for the respective specimens. It was found that the 1% HFRC with 80-20 Steel – Polyolefin combination performed better than plain concrete and other HFRC specimens.
5. Casanova and Rossi showed that the replacement of transverse reinforcements in 90 MPa high-strength concrete (HSC) beams with 1.25% steel fibres could obtain equivalent performances of HSC beams with 1.1% conventional transverse reinforcements
6. Sergio F. Brena,et.al, investigated to provide information required for the design of strengthening schemes of existing reinforced concrete bridges using composites.

7. F. Faghih and A.S. Ayoub concluded that 1.0% CNF showed a good effect on the performance of the beam, both in singly reinforced concrete as well as incombination with SF. The experimental investigation carried outshowed that the combination of nano (CNF) and macro size fibers (SF)improved the structural response, both for category 2 beams (Vf = 1.5%) and category 3 beams (Vf = 2.0%), so much that an adequate content of fibers could change the failure mode from shear to flexure-shear.
8. . P. Mahakavi, R. Chithra, R. Gogoi et al, showed that utilization of concrete prepared with flyash, and recycled aggregate is more suitable for sustainable construction & green concrete block production industry beyond economic benefits. It is incorporation of GF up to 1% (by volume) of concrete mixes and FA addition up to 15%,
9. MahdiNematzadeh, et.al.,investigated the mechanical properties and durability of Forta-Ferro fiber-reinforced concrete containing compressed nylon waste were and found that adding a fiber volume fraction of up to 1% to mixtures nylon waste increased the tensile strength by 27%

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.[7]
- 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%[10]
- The glass 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 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]

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