EXPERIMENTAL STUDY ON HYBRID FIBRE REINFORCED CONCRETE

Amsalega.P[1] , Sivanandhini.B[2]

[1] *Assistant Professor, Civil Engineering Department & CK College of Engineering & Technology, Cuddalore*

[2] *Assistant Professor, Civil Engineering Department & CK College of Engineering & Technology, Cuddalore*

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ABSTRACT

This experimental study describes the properties of Hybrid Fibre Reinforced concrete (HFRC). HFRC is prepared by adding any two different types of fibres to the conventional concrete to make it a composite mixture and that derives its individual benefits from each of the added fibre and exhibits significant response. The fibres which are used in the present experimental work is Round crimped steel fibres and polypropylene fibres. Here the polypropylene fibres helps in resists initial cracks and shrinkage and steel fibres helps in increase the strength of concrete

In present study M20 grade of concrete prepared according to the IS 10262:2009. Steel fiber and polypropylene fibres are used as Hybrid fibres. They are used in different proportions as 0.20%, 0.40%, 0.60%, 0.80% and 1% in this study. Specimens are cured for 28 days and tested in the lab for Compressive strength, Split Tensile strength and Flexural strength. From the present study, the strength parameter increases with the percentage of increase in hybrid fibre but the workability decreases while increasing fibre content. As a result the hybrid ratio of 0.8 is concluded as the optimum.

Keywords - Strength, Durability, Polypropylene fiber,steel fibre, concrete.

INTRODUCTION

1.1GENERAL

Concrete is most widely using construction material throughout the world. It is relatively strong in compression but weak in tension and tends to be brittle. Because of the load and environmental changes, a micro crack appears in concrete, which will propogate and leads to failure. The weakness in tension was overcomed by the use of steel fibres. In order to improve the mechanical properties of concrete it is good to mix cement with fibre which have good tensile strength. Adding fibres to concrete greatly increases the toughness of the material. Fibre Reinforced Concrete is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibres that are uniformly distributed and randomly oriented. Examination of fractured specimens of fiber reinforced concrete shows that failure takes place primarily due to fiber pull-out or debonding. Thus unlike plain concrete, a fiber-reinforced concrete specimen does not break immediately after initiation of the first crack. In addition, the character of fibre reinforced concrete changes with varying grade of concrete, fibre materials, geometries, distribution, orientation, and densities. The hybrid fibre reinforced concrete having high durability, strength is greater than conventional concrete , steel reinforcement is protected from corrosion. There are four types of fibers are used concrete: steel fibre, glass fibre, synthetic fibre and natural fibre reinforced concrete.

HYBRID FIBRE REINFORCED CONCRETE (HFRC)

In a hybrid, two or more different types of fibres (different fiber types and/or geometries) are

rationally combined to produce a composite that derives benefits from each of the individual fibres.The hybrid combination of metallic and non-metallic fibres can offer potential advantages in improving concrete properties as well as reducing the overall cost of concrete production

METHODOLOGY

- Literature Reviewing.
- Deciding the grade of concrete and materials required.
- Collecting the materials required.
- Testing the materials.
- Mix Design using IS 10262 : 2009
- Casting of Concrete - Cubes, beams, cylinders
- Testing the Strength of Concrete.
- Comparing Results with Conventional concrete

MIX PROPORTION OF CONCRETE

Proportioning of concrete mixture consists of determination of the respective ingredients necessary to produce concrete having adequate workability, strength, and durability for the particular strength and for various exposure conditions.The mixture proportion for the controlled concrete, Concrete of M20 grade was arrived from the trial mixes as per IS10262 - 2009 Specification and found to be 1:1.65:2.89. (W/C = 0.50). The mixtures were used throughout study.

STEEL SLAG

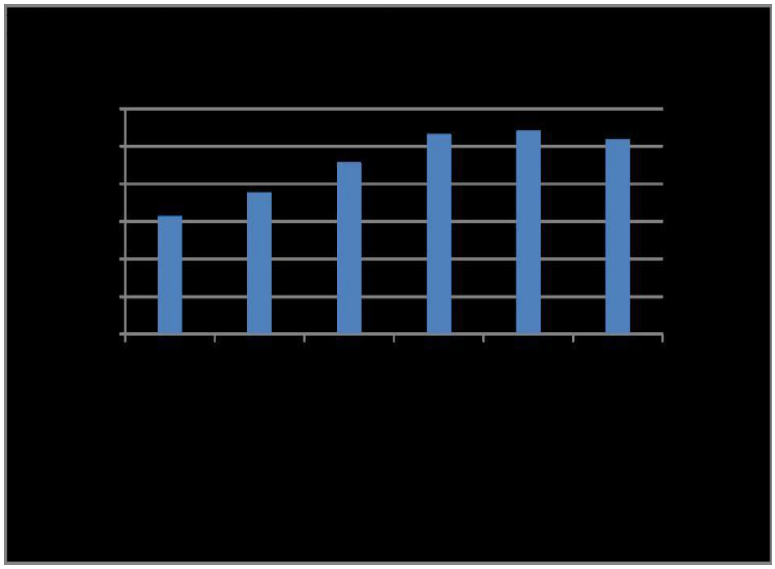
Steel slag is a byproduct obtained either from conversion of iron to steel in a Basic Oxygen Furnace (BOF), or by the melting of scrap to make steel in the Electric Arc Furnace (EAF).

POLYPROPYLENE FIBRES

Polypropylene fibres are new generation chemical fibres. They are manufactured in large scale and have fourth largest volume in production after polyesters, polyamides and acrylics. About 4 million tonnes of polypropylene fibres are produced in the world in a year.

EXPERIMENTAL PROCEDURES

The specimen is prepared with design concrete mix of size 500 × 100 × 100mm.The concrete is filled in three layers and compacted well.The specimen is subjected to curing 28 days. After the curing period the specimen is taken out from the curing tank and wipes it clean.The beam testing machine should be provided with two rollers of 38 mm diameter on which the specimens are placed and the rollers are spaced such that the distance between two rollers should be 400mm.The load applies through two similar rollers mounted at the third points of the supporting span is 133mm center to center.The load shall be applied without shock and increasing continuously at a rate such that the extreme fibre stress increases at approximately 7 kg/sq cm/min, that is, at a rate of



CONCLUSION

From this experimental study, the following conclusions are drawn:

1. There is a significant increase in compressive strength, split tensile and flexural strength of concrete when we add fibres of hybrid ratio 0.80% i.e.0.4% of polypropylene fibres and 0.4% of round crimped steel fibres.
2. The workability of concrete reduces gradually by the addition of fibres.
3. The percentage increase in compressive strength is 32.22 %.
4. The percentage increase in split tensile and flexural strength are 98.23 and 73.80% respectively.

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