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INFLUENCE OF STEEL FIBRE ON CONCRETE

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ABSTRACT:

Advancements in technology enhances not only human comforts but also damages the environment. Use of steel fibre has become popular and safe now. Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. Hence an attempt has been made in the present investigations to study the influence of crimpled steel fibre concrete at a dosage of 0.8 % volume of concrete. Experimental investigation was done using M20 mix and tests were carried out as per recommended procedures by relevant codes. The study parameters of this investigation included compressive strength, split tensile strength and flexural strength of conventional and fibre reinforced concrete. The results indicated that the compressive, split tensile and flexural strength of fibre reinforced concrete is increased by 32.14%, 52.38%, 12.68% respectively when compared to the conventional concrete.

Keywords: Steel fibre, Strength, Concrete

INTRODUCTION

Use of fibre to concrete has long been experienced since 1900. In the early 1900s, asbestos fibres were used in concrete, and in the 1950s the concept of composite materials came into being and fibre reinforced concrete was one of the focus of interest. Concrete in general weak in tensile strength and strong in compressive strength. The main aim of researchers or concrete technologists is to get better the tensile strength of concrete. The tensile strength of the concrete can be achieved by adding the steel fibre in concrete. G.Murali et al.,[1] investigated the behavior of fibre concrete by using the waste material such as lathe waste, soft drink bottle caps and beverage tin wastes and found that the strength of concrete for all the fibre has been increased significantly than ordinay concrete. Venu Malagavelli et al., (2011), investigated the impact of cement bags waste (High Density Polyethylene (HDPE)) on concrete, and found that when the percentage of fibre in concrete was 3.5% its tensile and compressive strength increased considerably [1]. Zainab et.al., used successfully as partial substitutes for sand in concrete composites [2]. Kandasamy.et.al., (2011) added 0.5% by volume of polythene (domestic waste polythene bags) fibre to concrete and the cube compressive strength, increased by 5.12%,3.84% and 1.63% respectively[3]. In the current investigation the effects on the properties of concrete when added with steel fibres are studied.

MATERIALS USED

Cement concrete having characteristic compressive strength of 20 MPa was used for casting the specimen. River sand is used as fine aggregate. In the present study 60% of the coarse aggregate used is of size 12.5mm and 40% is of size 20mm as per codal provision [5]. Mix proportion of concrete is 1:1.5:3 as per the codal provision [6] with water cement ratio 0.45. FRC beam is casted with Crimpled steel fibre of length 40mm and diameter 0.8mm with aspect ratio 50. Amount of steel fibre added is 0.8% of volume of concrete.

Table 1. Specimen details

Experimental test	Shape	No. of O.C. beams casted	No. of F.R.C. beams casted
Compressive strength test	Cube	4	4
Split tensile strength test	Cylinder	4	4
Flexural strength test	Prism	4	4

Table 2. Quantity of material (4 specimen each)

Specimen (4 numbers each)	Amount Of Concrete (kg)	Amount Of Cement (kg)	Amount Of Sand (kg)	Amount Of Aggregate (kg)	Steel Fibre (kg)
CUBE	38.88	7.04	10.6	21.2	1.02
CYLINDER	61.07	11.10	16.66	33.31	1.6
PRISM	57.92	10.48	15.72	31.4	1.5

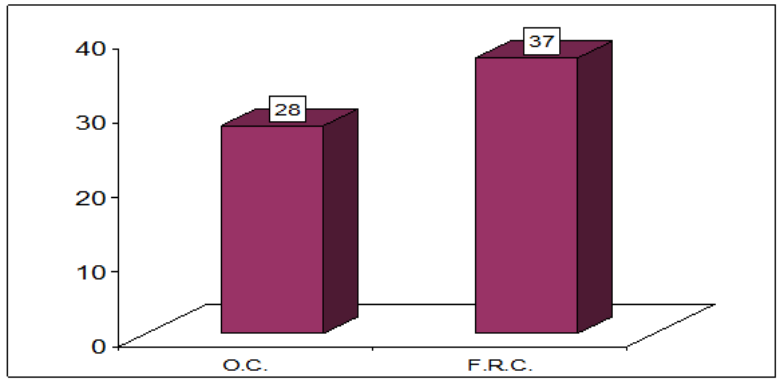

Fig1. Compressive strength of concrete Vs various concrete

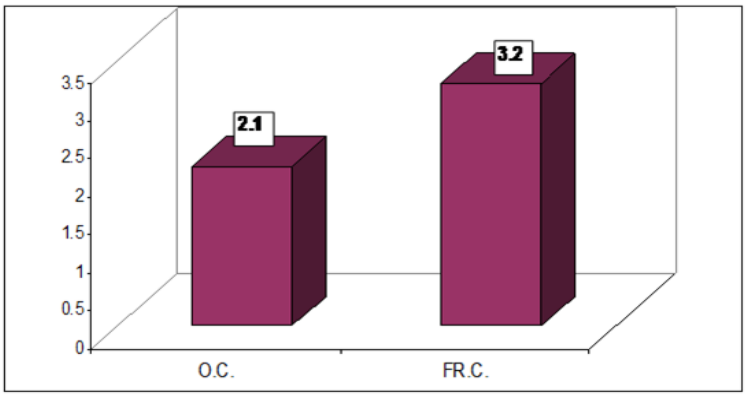

Fig2. Split tensile strength of concrete Vs various concrete

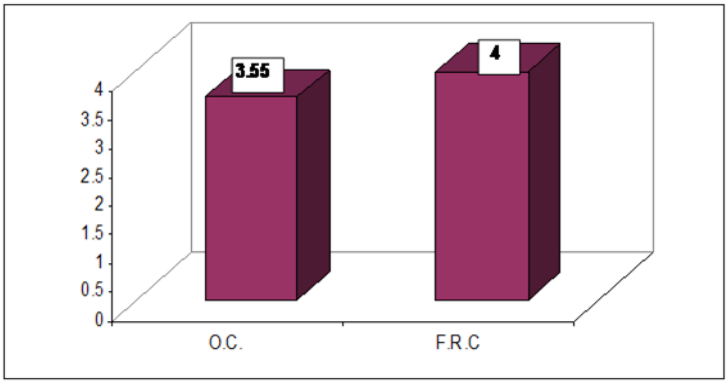

Fig 3. Flexural strength of concrete Vs various concrete

Fig 4. Typical failure patterns

RESULTS AND DISCUSSION

The specimen added with the Crimpled steel fibre have a significant result over the compressive strength. The Compressive strength of fibre reinforced concrete was found to be 32.14% greater than that of the conventional concrete as shown in fig.1. In addition of steel fibre to concrete also have a positive effect on the Split tensile strength. The tensile strength of the fibre concrete was found to be 52.38% greater than that of conventional concrete and is shown in fig.2. Similarly the Flexural strength also has increased due to the addition of steel fibre. The percentage increase of flexural strength of the concrete was found to be 12.68%, as depicted in fig.3.

CONCLUSION

Based on the result obtained from the experimental study, the following conclusions were made.

1) The specimen with steel fibre was found to be excellent in compression which had the Compressive strength of 32.14% more than the conventional concrete.
2) Admirable Split tensile strength was achieved with the addition of steel fibre in concrete. The strength had increased upto 52.38% when compared to that of the conventional concrete.
3) The Flexural strength of fibre concrete was found to be good and increased the flexural strength by 12.68% that of conventional concrete.

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