WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Experimental Analysis of Strength of Industrial Waste Steel Fibre Reinforced Concrete using M20 Grade

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ABSTRACT:

The project deals with the topic " Industrial Waste Steel Fibre Reinforced concrete "using industrial waste SteelTheinclusionofFibrereinforcedinconcrete,mortarandcementpastecanincreasementofengineeringproperties of the basic materials such as fracture, toughness,flexurestrengthandresistancetofatigue,impact,industrial waste steel fiberreinforcedconcreteisordinaryconcretecontainingdiscontinuous,discreteFibresofshortlength and small diameter In the mixing Percentage of industrial steel fiber is 1%-3% of Weight of the dry material of concrete .Fibre in concrete serve as crack arrestorbyapplyingpinchingforcesatcracktips,thusdelayingthe appearancesofcrakes. Theductilityofthecompositeisincreased many fold, compared to the un-reinforced matrix,with a corresponding increase in strength. Fibre reinforced islikely to be used in preference to conventional reinforced andfor Retrofiting .It basically use as low costing material with great strength

INTRODUCTION

Concrete is the mixture of Fine aggregate ,course aggregate cement and water .the resulting material is pusses property likes stone. this material has more compressive strength but it has low tensile strength .Due to low tensile strength ,cracks are developed in structure Theformation of cracks is the main reason for the failure of theconcrete. To increase the tensile strength of concrete manyattempts have been made .for avoiding the cracks development the industrial waste steel fiber use .and it mixing with other material in concrete, and it is multidirectionalandcloselyspacedsteel. this steel fiber increase the flexural ,tensile strength of the structure .and prevent form the cracks development. The major use of steel fibre for the retrofitting of old beam and columns .

The mixing Percentage of industrial steel fiber is 1%-3% of Weight of the dry material of concrete. For the testing purpse.

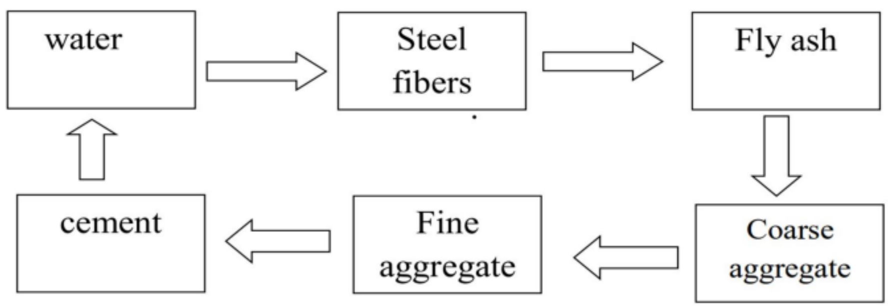
LITERATURE SURVEY:

1.PREVIOUS PREPARATION, PROPERTIES AND MIX DESIGN OF FIBRE REINFORCED CONCRETE: The influence of FIBREs in improving the compressive strength of the matrix depends on whether mortar or concrete (having coarse aggregates) is used and on the magnitude of compressive strength. Studies prior to 1988 including those of Williamson [1974], Naaman et al. [1974] showed that with the addition of FIBREs there is an almost negligible increase in strength for mortar mixes; however, for concrete mixes, strength increases by as much as 23%. Furthermore, Otter and Naaman [1988] showed that use of steel FIBREs in lower strength concretes increases their compressive strength significantly compared to plain un reinforced matrices and is directly related to volume fraction of steel FIBRE used. This increase is more for hooked FIBREs in comparison with straight steel FIBREs, glass or polypropylene FIBREs. Ezeldin and Balaguru [1992] conducted tests to obtain the complete stress-strain curves of steel FIBRE reinforced concrete with compressive strengths ranging from 35 MPa to 84 MPa (5,000 to 12,000 psi). The matrix consisted of concrete rather than mortar. Three volume FIBREs fractions of 50 psi, 75 psi and 100 psi (30 kg/m3, 45 kg/ m3 and 60 kg/m3) and three aspect ratios of 60, 75 and 100 were investigated. It was reported that the addition of hooked-end steel FIBREs to concrete, with or without silica fume, increased marginally the compressive strength and the strain corresponding to peak stress.

2. FLEXURAL BEHAVIOUR OF SFRC AS PER PREVIOUS STUDIES: Shah and Rangan [1971] proposed the following general equation for predicting the ultimate flexural strength of the FIBRE composite: fec-Afm (1-VI) B(VIL/df) Where fee, is the ultimate strength of the FIBRE composite, G is the maximum strength of the plain matrix (mortar or concrete), A and B are constants which can be determined experimentally. For plain concrete, A 1 and B = 0 The constant B accounts for the bond strength of the FIBREs and randomness of FIBRE distribution. Swamy et al. [1974a] established values for the constants A and B as 0.97 and 4.94 for the ultimate flexural strength of steel FIBRE reinforced concrete and 0.843 and 4.25 for its first cracking strength, A comparative evaluation of the static flexural strength for concretes with and without different types of FIBREs: hookedend steel, straight steel, corrugated steel, an polypropylene FIBREs was conducted by Ramakrishnan et al. [1989]. The FIBREs were tested at 0.51.0, 1.5 and 2.0% by volume. It was reported that maximum quantity of hooked-end FIBREs that could be added without causing balling was limited to 1.0 percent by volume. Compared to plain concrete, the addition of FIBREs increased the first cracking strength (15 to 90 percent) and static flexural strength (15 to 129 percent). Compared on equal basis of 1.0 percent by volume, the hooked end steel FIBRE contributed to the highest increase, and the straight FIBREs provided the least appreciable increase in the abovementioned properties. Excising and Lowe [1991] studied the flexural strength properties of rapid-set materials reinforced with steel FIBREs. The primary variables were (a) rapid-set cementing materials, (b) FIBRE type, and (c) FIBRE content. Four Fibre types made of low-carbon steel were Incorporated in this study. Two were hooked and one was crimped at the ends, and one was crimped throughout the length. Steel FIBREs were added in the quantities of 50, 75 and 100 lbs yd3 (30, 45 and 6 kg m). An increase in the flexural strength was observed. The FIBRE efficiency in enhancing the flexural strength is controlled by the FIBRE surface Deformation, aspect ratio, and FIBRE content. The results further indicate that steel FIBREs are very effective in improving the flexural toughness of rapid-set materials. Toughness indexes as high as 4 for 15 and 9 for 110 can be achieved with FIBRE contents of 75 lbs yd3 (45 kg/m3). Johnston and Zemp [1991] investigated the flexural performance under static loads for nine mixtures, using sets of 15 specimens for each mixture. Each set of 102 x 102 x 356 mm (4 x 4 x 14 in.) specimens were prepared from five nominally identical batches and tested under third point loading over a 305 mm (12 in.) span. First crack strengths defined in ASTM C. 108 as the point on the load-deflection curve at which the form of the curve first becomes nonlinear, and ultimate strength based on the maximum flexural load (ASTM C 78) were established for the eight fibrous concretes, with only ultimate strength for the plain concrete control.

3. EFFECT OF STEEL FIBER ON COMPRESSIVE, SPLITTING TENSILE AND MODULOUS OF RUPTURE OF CONCRETE: INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY STEEL FIBER REINFORCED CONCRETE A REVIEW Pramod Kawde, Abhijit Warudka. Presently, a number of laboratory experiments on mechanical properties of SFRC have been done. Investigations conducted uniaxial compression test on fiber reinforced concrete specimens. The results shown the increase in strength of 6% to 17% compressive strength, 18% to 47% split tensile strength, 22% to 63% flexural strength and 8% to 25% modulus of elasticity respectively. The mechanical properties of concrete have been studied, these results shown the increase in strength of 6% to 17% compressive strength, 14% to 49% split tensile strength, 25% to 55% flexural strength and 13% to 27% modulus of elasticity respectively. The strength of 15 steel fibers reinforced and plain concrete ground slabs. The slabs were2x2x0.12m, reinforced with hooked end steel fibers and mill cut steel fibers.

BLOCK DIAGRAM:



RESULT AND CONCLUSION:

Compressive strength:

1. From the camparison charts there is about 20% increase in 28th day compressive strength as compared to the plane cement concrete .

Flexural strength:

1. Fibre reinforcement of concrete upto the full depth or the tension zone was slightly increased the strength and significantly improve the ductility of the concrete under bending stresses.

2. In flexural strength there is about 30% increase on 28th day test as compared to the plane cement concrete.

Tensile strength:

1. The tensile strength of concrete containing steel Fibre increased by adding steel Fibre to concrete.

2. In the tensile strength there is 35% increase on 28th day test as compared to the plane cement concrete.

Sr. No.	% Of Fibre	Comp. Strength N/mm²	tensile Strength N/mm²	flexural Strength N/mm²
1	0	20.1	1.03	6.03
2	1	20.88	1.15	6.06
3	2	22.22	1.35	8.30
4	3	22	1.20	8.15

Future Scope :

Given the variety of Fibre materials, number of mix constituents it is evident that product development is prime research objective. Design methods or modification to the existing design methods and specification are to be made, so that Fibre reinforced concrete can be designed and specified by engineers. Standard test procedure must be established so that quality control can be achieved and independent investigations can reproduce test results and correlate their results with other research program Fundamental research is needed for two purposes:

- To provide more data on physical proportion so that rational design procedure can be established for various types of FRC.
- Fundamental investigation of microscopic and macroscopic details of FRC relevant to mechanical thermal and electrical properties and the effect of environment of environment on the physical properties are needed.
- A better understanding of bond between Fibres and concrete is needed so that Fibres fail and not pulled out. The question of durability of Fibres in alkaline environment of cement and concrete has to be evaluated; further research to verify long term durability of the various Fibres used is needed.
- The test results have shown substantial increase in the various proportion of FRC but some results are not as per expectations. Therefore to confirm he test results more test may be required to perform. Also the various properties of FRC should be investigated some of the properties such as freezing and thawing of FRC, flexural, toughness, static impact test, sudden impact test, shrinkage test, thermal conductivity creep, abrasion resistance friction and skid resistance blast proofing properties are to be evaluated.

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