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BEHAVIOUR OF STEEL FIBER REINFORCED CONCRETE

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ABSTRACT

Cement concrete is the most extensively used construction material in the world. The reason for its extensive use is that it provides good workability and can be moulded to any shape. Ordinary cement concrete possesses a very low tensile strength, limited ductility and little resistance to cracking. Internal micro cracks, leading to brittle failure of concrete. In this modern age, civil engineering constructions have their own structural and durability requirements, every structure has its own intended purpose and hence to meet this purpose, modification in traditional cement concrete has become mandatory. It has been found that different type of fibers added in specific percentage to concrete improves the mechanical properties, durability and serviceability of the structure. It is now established that one of the important properties of Steel Fiber Reinforced Concrete (SFRC) is its superior resistance to cracking and crack propagation. In this paper Flexure behaviour of concrete with the Steel fiber is studied in detail.

KEYWORDS: Steel Fiber Concrete, CementFibers, Strength

INTRODUCTION

Concrete is characterized by brittle failure, the nearly complete loss of loading capacity, once failure is initiated. This characteristic, which limits the application of the material, can be overcome by the inclusion of a small amount of short randomly distributed fibers (steel, glass, synthetic and natural) and can be practiced among others that remedy weaknesses of concrete, such as low growth resistance, high shrinkage cracking, low durability, etc. Steel fiber reinforced concrete （SFRC） has the ability of excellent tensile strength, flexural strength, shock resistance, fatigue resistance, ductility and crack arrest. Therefore, it has been applied abroad in various professional fields of construction, irrigation works and architecture. There are currently 300,000 metric tons of fibers used for concrete reinforcement. Steel fiber remains the most used fiber of all (50% of total tonnage used) followed by polypropylene (20%), glass (5%) and other fibers (25%) (Banthia ,2012).

Reinforcement Mechanisms in Fiber Reinforced (FRC): In the hardened state, when fibers are properly bonded, they interact with the matrix at the level of micro-cracks and effectively bridge these cracks thereby providing stress transfer media that delays their coalescence and unstable growth. If the fiber volume fraction is sufficiently high, this may result in an increase in the tensile strength of the matrix. Indeed, for some high volume fraction fiber composite, a notable increase in the tensile flexural strength over and above the plain matrix has been reported. Once the tensile capacity of the composite is reached, and coalescence and conversion of micro-cracks to macro-cracks has occurred, fibers, depending on their length and bonding characteristics continue to restrain crack opening and crack growth by effectively bridging across macro-cracks. This post peak macro-crack bridging is the primary reinforcement mechanisms in majority of commercial fiber reinforced concrete composites.

Effect on workability of steel fiber: Slump tests were carried out to determine the workability and consistency of fresh concrete. The efficiency of all fiber reinforcement is dependent upon achievement of a uniform distribution of the fibers in the concrete, their interaction with the cement matrix, and the ability of the concrete

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to be successfully cast or sprayed. Essentially, each individual fiber needs to be coated with cement paste to provide any benefit in the concrete. Regular users of fiber reinforcement concrete will fully appreciate that adding more fibers into the concrete, particularly of a very small diameter, results in a greater negative effect on workability and the necessity for mix design changes. The slump changed due to the different type of fiber content and form. The reason of lower slump is that adding steel fibers can form a network structure in concrete, which restrain mixture from segregation and flow. Due to the high content and large surface area of fibers, fibers are sure to absorb more cement paste to wrap around and the increase of the viscosity of mixture makes the slump loss.

Effect of steel fiber on compressive, splitting tensile and modulous of rupture of concrete: Presently, a number of laboratory experiments on mechanical properties of SFRC have been done. Investigations conducted uni-axial 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 were 2x2x0.12m, reinforced with hooked end steel fibers and mill cut steel fibers.

Effect of steel fiber on impact capacity and toughness of concrete: Toughness is a measure of the ability of the material to absorb energy during deformation estimated using the area under the stress-strain curves conducted test on the mechanical properties and resistance against impact on steel fiber reinforced high-performance concrete. Five different geometry of fibers included steel-sheet-cut fibers and steel ingot milled fibers with four fiber volume fractions (4%, 6%, 8% and 10%) were applied in to the mix. studied and conducted test for fiber content dosage Vf ranged from 0.0 to 2.0 percent. Steel and Polyolefin fibers were combined in different proportions and their impact on strength and toughness studied. Addition of 2.0 percent by volume of hooked-end steel fibers increases the toughness by about 19.27%, when compared to the plain concrete. When the fibers were used in a hybrid form, the increase in above study parameters was about 31.42%, when compared to the plain concrete.

EXPERIMENTAL WORK

The study on the introduction of effect of steel fibers can be still promising as steel fiber reinforced concrete is used for sustainable and long-lasting concrete structures. Steel fibers are widely used as a fiber reinforced concrete all over the world. Lot of research work had been done on steel fiber reinforced concrete and lot of researchers work prominently over it. This review study tried to focus on the most significant effects of addition of steel fibers to the concrete mixes. The steel fibers are mostly used fiber for fiber reinforced concrete out of available fibers in market. According to many researchers, the addition of steel fiber into concrete creates low workable or inadequate workability to the concrete, therefore to solve this problem of super plasticizer without affecting other properties of concrete may introduce.

However, fibers which are too long tend to ball in the mix and create workability problems. Some recent research indicated that using fibers in concrete has limited effect on the impact resistance of the materials. This finding is very important since traditionally, people think that the ductility increases when concrete is reinforced with fibers. The results also indicated out that the use of micro fibers offers better impact resistance compared with the longer fibers.

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Fig No. 1 Flexure Test For Beam

FLEXURE RESULT

Table No. 4.3 Flexure Result

Sample	S1	S2	S3	S4	S5
Flexure Capacity	0.96	0.87	0.98	0.75	0.67

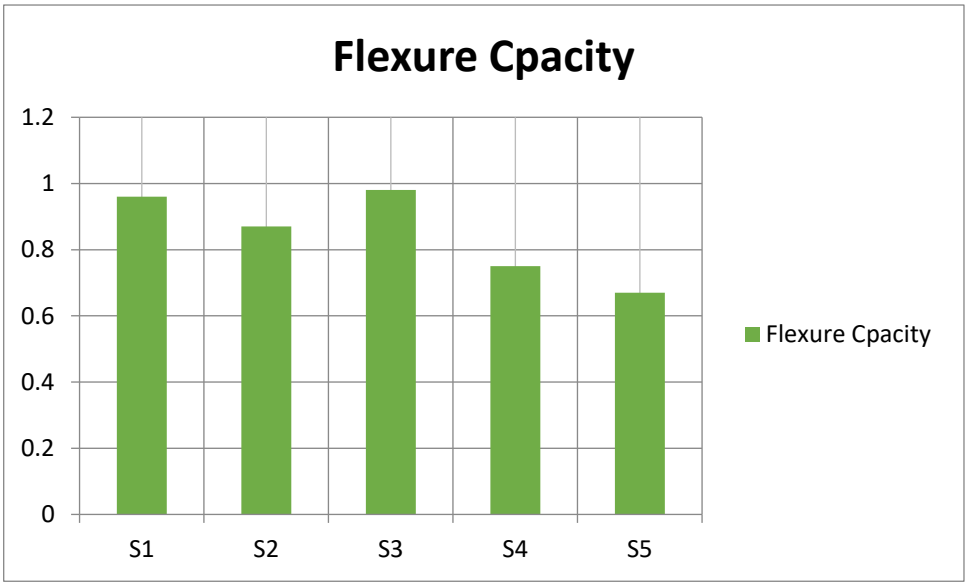

Fig No. 4.5 Flexure Result

FLEXURE RESULT FOR DOOR FRAME

Table No. 4.4 Flexure Result For Door Frame

Sample	S1	S2	S3	S4	S5
Flexure Capacity	1.1	1.6	1.95	1.23	1.56

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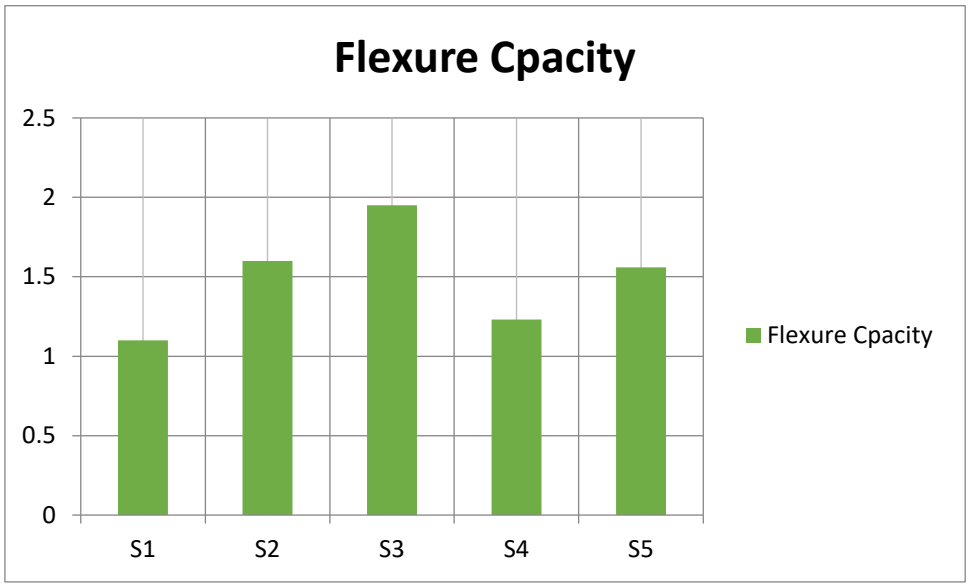

Fig No. 4.6 Flexure Result for Door Frame

Fig No. 4.7 Flexure Result for Door Frame

CONCLUSION

Steel Fiber reinforced concrete (SFRC) is defined as concrete made with hydraulic cement containing Fine and coarse aggregate and discontinuous discrete fiber. In SFRC, thousands of small fibers are dispersed and distributed randomly in the concrete during mixing, and thus improve concrete properties. SFRC is being increasingly used to improve static and dynamic tensile strength, energy absorbing capacity and better fatigue. They concluded that the addition of steel fiber increases the ultimate strength and ductility. The plain structure cracks into two pieces when the structure is subjected to the peak tensile load and cannot withstand further load or deformation.

The experimental is carried out for five different combinations of samples and the results are as discussed below:

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1. It is observed that compressive strength, split tensile strength and flexural strength are on higher side for 3% fiber as compared to that produced from 1%, 1.5%, 2%, and 2.5% fiber .

2. It is observed that Flexure strength increases from 38.85% to 47.17% with addition of steel fiber.

3. It is observed that flexural strength increases from 17.55% with addition of steel fiber.

REFERENCES

[1] Abdul Ghaffar, Amit S. Chavhan, Dr.R.S.Tatwawadi," Steel Fibre Reinforced Concrete", International Journal of Engineering Trends and Technology (IJETT), Vol. 9, 2014.

[2] Ali Amin and Stephen J. Foster, "Shear strength of steel fibre reinforced concrete beams with stirrups", Engineering Structures, Vol. 111, Pp. 323–332, 2016.

[3] A.M. Shende, A.M. Pande, M. Gulfam Pathan," Experimental Study on Steel Fiber Reinforced Concrete for M-40 Grade", International Refereed Journal of Engineering and Science (IRJES), Vol. 1, Pp. 43-48, 2012.

[4] Amit Rana," Some Studies on Steel Fiber Reinforced Concrete", Vol. 3, 2013.

[5] G. Murali, A. S. Santhi and G. Mohan Ganesh," Effect of Crimped and Hooked End Steel Fibres on the Impact Resistance of Concrete", Journal of Applied Science and Engineering, Vol. 17, Pp. 259 - 266, 2014.

[6] Milind V. Mohod," Performance of Steel Fiber Reinforced Concrete", International Journal of Engineering and Science, Vol. 1, Pp. 1-4, 2012.

[7] Patil Shweta and Rupali Kavilkar," Study of Flexural Strength in Steel Fibre Reinforced Concrete", International Journal of Recent Development in Engineering and Technology, Vol.2, 2014.

[8] Rubén Serrano, Alfonso Cobo, María Isabel Prieto and María de las Nieves González," Analysis of fire resistance of concrete with polypropylene or steel fibers", Construction and Building Materials, Vol. 122, Pp. 302–309, 2016.

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