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EXPERIMENTAL STUDY ON PERFORMANCE OF VARIOUS SIZE OF FIBER IN CONCRETE

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ABSTRACT: *Concrete is strong in compression and weak in tension and also it has brittle character. The concept of using fibers reinforced concrete is to improve the characteristic strength of construction material. Steel Fibre reinforced concrete (SFRC) is defined as concrete made with hydraulic cement containing Fine and coarse aggregate and discontinuous discrete fibre. In Steel Fiber Reinforced Concrete lots of small fibres are discrete on the concrete and randomly distributed in the concrete during mixing and it improves properties of concrete. In recent researches SFRC is being increasingly used fiber to improve the static and dynamic tensile strength, energy absorbing capacity and better fatigue strength. It is observed that one of the important properties of Steel Fiber Reinforced Concrete (SFRC) is its superior resistance to cracking and crack propagation. Thus the concrete is reinforced with the steel fiber in various proportions such as 0%, 1.0%, 2%, and 3% by weight of cement. All the volume proportions were tested with Aspect Ratio 50, 60 and 70. The Compressive and Tensile Strength were analysed as per IS standards on 7th, 14th and 28th day of curing.*

Key Word: Concrete, Steel fiber, Compressive Strength, Split Tensile Strength and crack resistance.

UNIT I INTODUCTION

In this experiment we adopt Steel fiber for increasing the strength of concrete. The SFRC product is compacted and cured by the conventional methods. Segregation or balling is one of the problems in concrete encountered during mixing and compacting SFRC. This should be avoided for uniform distribution of fibers. Use of pan mixer and fiber dispenser to assist in better mixing and to reduce the formation of fiber balls is essential. For the experiment fines and limiting size of aggregates to 20mm occasionally, and cement contents of 350 kg to 550 kg per cubic meter are normally added in concrete mix. Steel fibers are mix to the concrete for change the structural properties of concrete, particularly tensile and flexural strength. The level of upgrading in the reflex properties found with steel fiber reinforced concrete over those of plain concrete depends on several factors, such as specification of fiber like shape, size, volume, percentage and distribution of fibers. Such specification of fibers were found to develop very weak bond and hence low flexural strength.

Properties of straight and deformed steel fibers

	Straight fiber	**Hooked fiber**
Material	Galvanized Steel	Carbon Steel
Length (mm)	53	60
Diameter (mm)	0.71	0.8
Aspect ratio (LID)	75	75
f/MPa)	260	660

ADVANTAGES OF SFRC

Completely eliminate steel fabric reinforcement, saving on both materials and labour

- Reduce slab thickness giving savings in concrete and placement costs.
- Possibilities of wider joint spacing. Save on joint forming costs and joint maintenance
- Simplicity of construction.
- Increase speed of construction. Save time and reduce costs.

UNIT II LITERATURE REVIEW

R. D. Neves and J. C. O. Fernandes de Almeida :Compressive behaviour of steel fibre reinforced concrete: An experimental study to investigate the influence of matrix strength, fibre content and diameter on the compressive behaviour of steel fibre reinforced concrete is presented. Concrete compressive strengths of 35 and 60 MPa, 0,38 and 0,55 mm fibre diameter, and 30 mm fibre length, were considered.

Parviz Soroushian and Cha-Don Lee: Distribution and Orientation of Fibres in Steel Fibre Reinforced Concrete: Measurements were made of the number of fibres per unit cross-sectional area in steel fibre reinforced concrete specimens incorporating various volume fractions of fibres of different types.

From the above research it is shown that the use of steel fibre reinforcement increases the strength. Many researchers had worked in steel fibre reinforced concrete in many proportions but none of them had tested by adding upto 3% of steel fibre in concrete. Thus in this thesis the work has been done by using of steel fibre reinforced concrete of Aspect Ratio 50, 60, 70 in various proportion such as 0%, 1%, 2% and 3%.

UNIT III MATERIAL AND METHODOLOGY

CEMENT: In this experiment we use Cement as a binding material. Ordinary Portland Cement of 43 grade is used for better result.

SAND: As per IS383 for filler material we use sand of Zone II. Sand is a naturally occurring granular material composed of finely divided rock and mineral particles.

AGGREGATE: 20mm graded aggregate of irregular angular shape is used.

Steel fiber: the Steel Fiber is used of various sizes.

For Aspect Ratio 50- 25mm length and diameter of 0.5mm

For Aspect Ratio 60- 30mm length and diameter of 0.5mm

For Aspect Ratio 70- 35mm length and diameter of 0.5mm

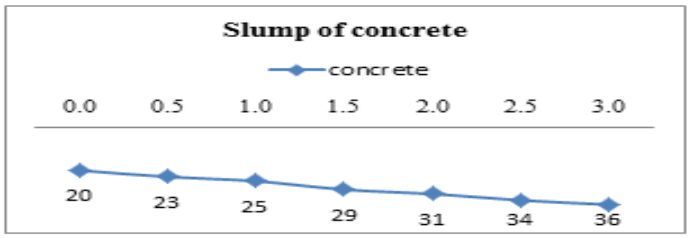
UNIT IV METHODOLOGY:

It is observed that one of the important properties of Steel Fiber Reinforced Concrete (SFRC) is its superior resistance to cracking and crack propagation. Thus the concrete is reinforced with the steel fiber in various proportions such as 0%, 1.0%, 2%, and 3% by weight of cement. All the volume proportions were tested with Aspect Ratio 50, 60 and 70. The Compressive and Tensile Strength were analysed as per IS standards on 7th, 14th and 28th day of curing.

UNIT V RESULT AND ANALYSIS

As shown in Graph 1, the Slump Value of cement replaced with SFRC is decreasing its workability. The pattern of slump was one half of the cone slides down which is called shear slump. It indicates the concrete is non-cohesive and shows characteristic of segregation.

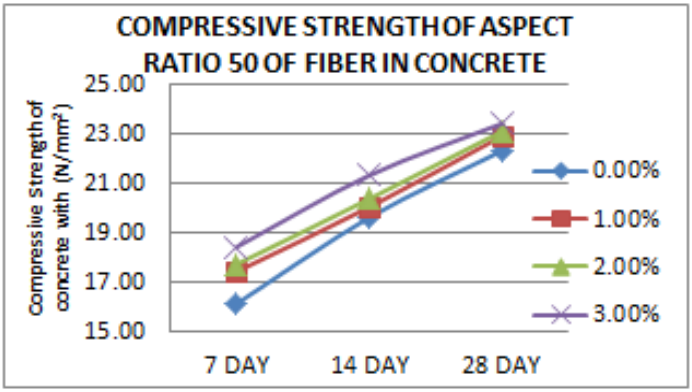
4.5 SLUMP CONE TEST (WORKABILITY TEST):



Graph 1. Slump Value of SFR Concrete

COMPRESSIVE STRENGTH ASPECT RATIO 50 OF SFR IN CONCRETE

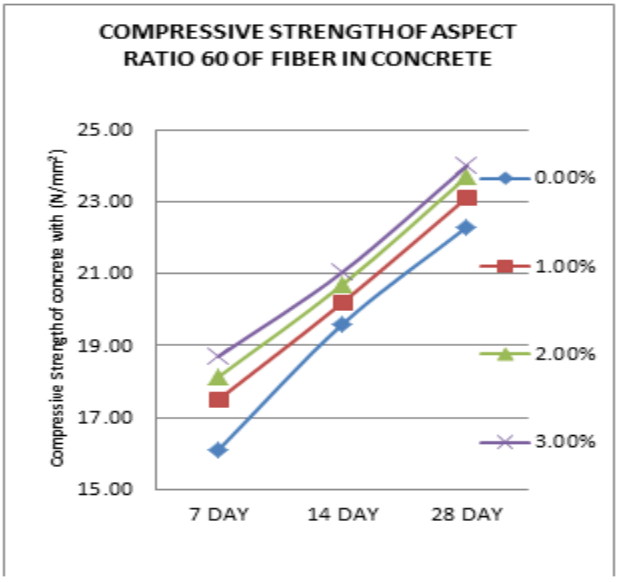
From the results it is observed that by adding steel fibre reinforcement in the concrete will increase in compressive strength. By adding 1%, 2% and 3% of steel fiber to the volume of concrete will give compressive strength of 22.89 MPa, 23.08MPa and 23.40 MPa at 28th day respectively. The compressive strength of M20 grade of concrete should be 20MPa at 28th day of curing. The maximum compressive strength is by adding 3% of fiber in concrete. The strength is increases by 4.47% from normal concrete.



Graph 2: Compressive Strength Of Aspect Ratio 50 Of Fiber In Concrete

COMPRESSIVE STRENGTH ASPECT RATIO 60 OF SFR IN CONCRETE

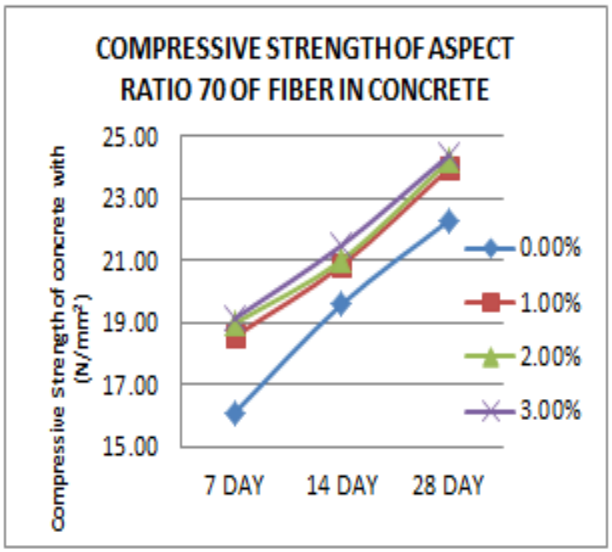
From the results it is observed that by adding steel fibre reinforcement in the concrete will increase in compressive strength. By adding 1%, 2% and 3% of steel fiber to the volume of concrete will give compressive strength of 23.12 MPa, 23.7MPa and 24.0 MPa at 28th day respectively. The compressive strength of M20 grade of concrete should be 20MPa at 28th day of curing. The maximum compressive strength is by adding 3% of fiber in concrete. The strength is increases by 7.05% from normal concrete.



Graph 3: Compressive Strength Of Aspect Ratio 60 Of Fiber In Concrete

COMPRESSIVE STRENGTH ASPECT RATIO 70 OF SFR IN CONCRETE

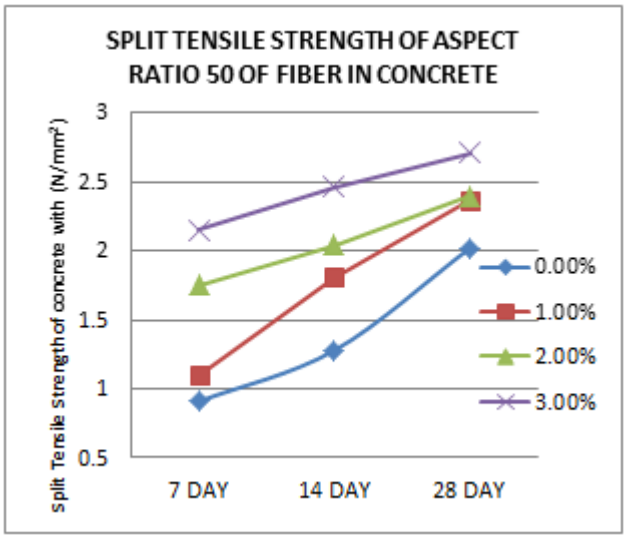
From the results it is observed that by adding steel fibre reinforcement in the concrete will increase in compressive strength. By adding 1%, 2% and 3% of steel fiber to the volume of concrete will give compressive strength of 23.98 MPa, 24.23MPa and 24.4MPa at 28th day respectively. The compressive strength of M20 grade of concrete should be 20MPa at 28th day of curing. The maximum compressive strength is by adding 3% of fiber in concrete. The strength is increases by 8.6% from normal concrete.



Graph 4: Compressive Strength Of Aspect Ratio 70 Of Fiber In Concrete

SPLIT TENSILE STRENGTH ASPECT RATIO 50 OF SFR IN CONCRETE

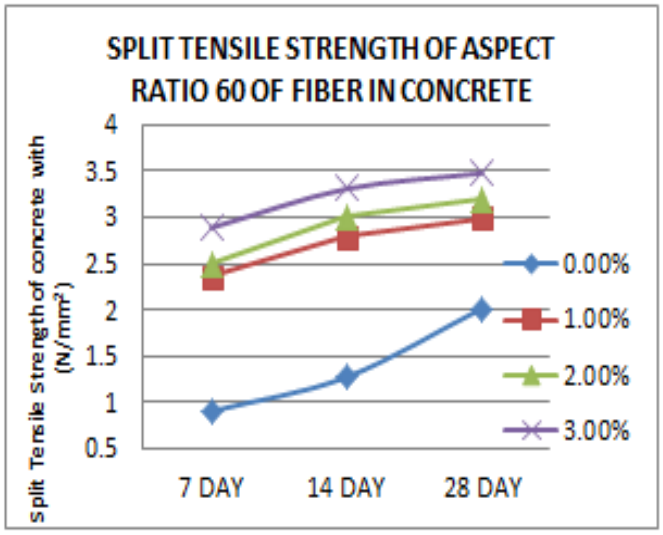
From the results it is observed that by adding steel fibre reinforcement in the concrete will increase in tensile strength. By adding 1%, 2% and 3% of steel fiber to the volume of concrete will give tensile strength of 2.37 MPa, 2.4MPa and 2.71 MPa at 28th day respectively. The tensile strength of M20 grade of concrete should be 20MPa at 28th day of curing. The maximum tensile strength is by adding 3% of fiber in concrete. The strength is increases by 25% from normal concrete.



Graph 5: Split Tensile Strength Of Aspect Ratio 50 Of Fiber In Concrete

SPLIT TENSILE STRENGTH ASPECT RATIO 60 OF SFR IN CONCRETE

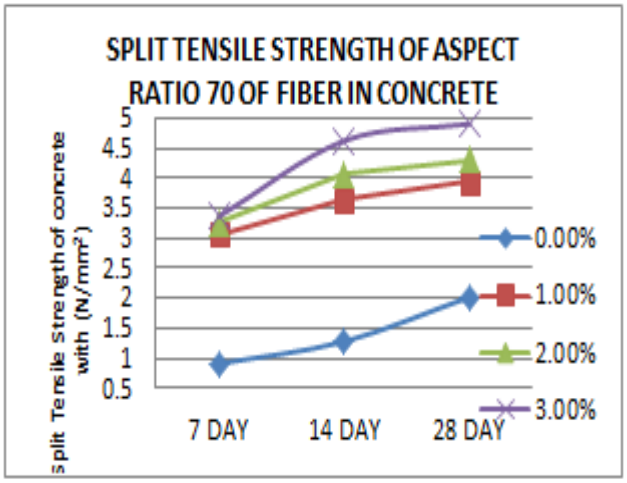
From the results it is observed that by adding steel fibre reinforcement in the concrete will increase in tensile strength. By adding 1%, 2% and 3% of steel fiber to the volume of concrete will give tensile strength of 3.0 MPa, 3.2MPa and 3.48MPa at 28th day respectively. The strength of M20 grade of concrete should be 20MPa at 28th day of curing. The maximum tensile strength is by adding 3% of fiber in concrete. The strength is increases by 41.9% from normal concrete.



Graph 6: Split Tensile Strength Of Aspect Ratio 60 Of Fiber In Concrete

SPLIT TENSILE STRENGTH ASPECT RATIO 70 OF SFR IN CONCRETE

From the results it is observed that by adding steel fibre reinforcement in the concrete will increase in tensile strength. By adding 1%, 2% and 3% of steel fiber to the volume of concrete will give tensile strength of 3.93 MPa, 4.3MPa and 4.9MPa at 28th day respectively. The strength of M20 grade of concrete should be 20MPa at 28th day of curing. The maximum tensile strength is by adding 3% of fiber in concrete. The strength is increases by 58.77% from normal concrete.



Graph 7: Split Tensile Strength Of Aspect Ratio 70 Of Fiber In Concrete

UNIT V CONCLUSION

1. From the result it is observed that the workability of Steel Fibre reinforced concrete decreases as the percentage of steel fibres increases.

2. The Compressive Strength of SFRC (Aspect ratio 50) for proportions of 0%, 0.1%, 2% and 3% are 22.3 MPa, 22.89 MPa, 23.08 MPa and 23.4MPa respectively at 28th day of curing. The Split Tensile strength of SFRC for proportions of 0%, 0.1%, 2% and 3% are 2.02 MPa, 2.37 MPa, 2.4 MPa and 2.71MPa respectively at 28th day of curing.

3. The Compressive Strength of SFRC (Aspect ratio 60) for proportions of 0%, 0.1%, 2% and 3% are 22.30 MPa, 23.12 MPa, 223.7 MPa and 24.0MPa respectively at 28th day of curing. The Split Tensile strength of SFRC for proportions of 0%, 0.1%, 2% and 3% are 2.02 MPa, 3.0MPa, 3.2 MPa and 3.48MPa respectively at 28th day of curing.

4. The Compressive Strength of SFRC (Aspect ratio 70) for proportions of 0%, 0.1%, 2% and 3% are 22.3 MPa, 23.98 MPa, 24.23 MPa and 24.40MPa respectively at 28th day of curing. The Split Tensile strength of SFRC for proportions of 0%, 0.1%, 2% and 3% are 2.02 MPa, 3.93 MPa, 4.3 MPa and 4.9MPa respectively at 28th day of curing.

5. With the use of 3% of steel fibre gives the maximum result in compression as 25.7MPa, 30.05MPa and 33MPa at 7th day, 14th day and 28th day of curing respectively.

6. With the use of 3% of steel fibre gives the maximum result in Compressive Strength as 23.4MPa, 24.00MPa and 24.4MPa at 28th day of curing with aspect ratio 50, 60 and 70 respectively.

7. With the use of 3% of steel fibre gives the maximum result in Split Tensile Strength as 2.71MPa, 3.48MPa and 4.9 MPa at 28th day of curing with aspect ratio 50, 60 and 70 respectively.

8. The addition of Steel Fibre in concrete increases the Tensile properties of concrete and also improves resistance to cracking.

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UNIT V BIOGRAPHIES

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