To Enhance Mechanical Properties of Concrete By Adding Basalt Chopped Strand Fiber

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Abstract- *To study the mechanical properties of mixed fibers reinforced concrete. For this research work,M-40 grade concrete was used and tests were conducted by adding for variousProportionsof(ie.,0.1%,0.2%,0.4%,0.6%,0.8%,1.0%,1.2%,1.4%,1.6%,1.8%,2.0%) by weight of cement. After the concrete elements immersion to different types curing on3, 7, 28 days. Finally, to determine the compressive, tensile, flexure strength, pull-out strength were also measured.*

Keywords- basalt chopped strand fibre, high strength concret . Spilt tensile, compressive, flexural strength.

I. INTRODUCTION

Concrete is the most widely used building material in the construction industry. Concrete is mixture of cement, fine aggregates, coarse aggregate, water. By using short discrete fibre in conventional concrete for improve the mechanical properties. The improvement in structural performance depends on the strength characteristics, volume, spacing, dispersion and orientation, shape and the aspect ratio of the fibres. For fibres to be more effective, each fibre needs to be fully embedded in the matrix, thus cement paste requirement is more[5].Several fibres have been used so far to improve the properties of conventional concrete viz: asbestos, steel, glass, carbon, polypropylene, nylon etc. A new advancement in the fibre reinforced concrete is the use of basalt fibre which has shown better results in improving the compressive & flexural strength of concrete composites. Basalt fibre is a new material for improve strengthening.

II. LITERATURE REVIEW

Several experimental investigations have been done in the past to study the behaviour &mechanical properties of basalt fibre reinforced concrete. In this experimental study Fathima Irine I .A(2014)

Investigate and compare the compressive, flexural and splitting tensile strength of basalt fibre reinforced concrete with plain M30 grade concrete. It was observed that, the percentage increase in the strength of basalt reinforced concrete increases with the age of concrete.[8]

The addition of basalt fibres in high strength concrete decreases the 7 and 14 days strength but the strength increases more than the design mix after 28 days [3]. V. Lopresto et.al (2011) conducted an experimental study of the mechanical characterisation of basalt fiber reinforced plastic. Basalt composite showed a 35–42% higher Young's modulus as well as a better compressive strength and flexural behaviour, whereas a higher tensile strength was found for glass material.

III. EXPERIMENTAL PROGRAMME

The material used in the preparation of concrete mixes includes cement, fine aggregates, coarse aggregates, basalt chopped fibres and admixtures. Each material was tested &its physical properties are described below.

A. Cement:

The cement used was Ordinary Portland cement (53Grade) with a specific gravity of 3.15. Initial and final setting times of the cement were 80 min and 175 min, respectively.

Table I.Chemical Composition Of Cement And Basalt Fibre (%)

Oxide	Cement	Basalt Fiber
SiO2	19.71	69.51
Al2O3	5.20	14.18
Fe2O3	3.73	3.92
CaO	62.91	5.62
MgO	2.54	2.41
K2O	0.90	1.01
Na2O3	0.25	2.74

Test on Cement:

Table II. Results Of Tests On Cement

Characteristics	Values obtained	Standard Values
Initial setting time test	80	>30 min.
Final setting time test	175	<600 min.
Fineness test	5%	Not exceed 10%
Specific gravity	3.15	
Compressive strength 7 days	32 N/mm^2	
28 days	57N/mm^2	

Table III. Physical Properties

Filament Diameter(Mm)	7 to 15
Density (kg/m3)	2650
Elastic Modulus (kg/mm2)	10,000 to 11000
Tensile Strength (Mpa)	4185 to 4800
Elongation (%)	3.1

B. Fine Aggregate (Sand):

It is the aggregate most of which passes through a 4.75mm IS sieve and contains only so much coarser material as it permitted by the specification. Sand is generally considered to have a lower size limit of about 0.07 mm. Specific gravity of sand is 2.65.

B. Coarse Aggregate:

The material whose particles are of size as are retained on I.S Sieve No.480 (4.75mm) is termed as coarse aggregate. Specific gravity of coarse aggregates is 2.72.

D. Super plasticizer:

In modern concrete practice, it is essentially impossible to make high performance concrete at adequate workability in the field without the use of super plasticizers. Naphthalene superplasticizer which is characterized by higher water reduction (15%-25%),not cited gas was used for the experimental work.

E. Basalt chopped strands fiber:

Basalt chopped strand fiber is produced by cutting continuous basalt fiber and coating in a silane sizing. Chopped strands are the best way to reinforce thermoplastic resin and reinforce concrete. Basalt chopped strands contain a special silicate which gives it excellent chemical resistance and alkali tolerance. The density of the fiber is 2.75 kg/m3. Basalt fiber chopped strands are there perfect material to take the place of reinforce cement and concrete to improve tensile the stability, low-temperature crack and fatigue resistance. There are many application of basalt chopped strand fiber.

F. Concrete mix proportions:

The mixture proportioning was done according the Indian Standard Recommended Method IS 10262-2009.The target mean strength was 40 MPa for the control mixture, The total mixing time was 5 minutes, the samples were then casted and left for 24 hrs before demoulding They were then placed in the curing tank until the day of testing Cement, sand, Basalt fibre and fine and coarse aggregate were properly mixed together in accordance with IS code before water was added and was properly mixed together to achieve homogenous material. Mix 1 contains 0.1% basalt fiber. Mix 2, 3,4& 5,6,7,8 contains 0.2%, 0.4%, 0.6% & 0.8%, 1%, 1.2%, 1.4%, 1.6%, 1.8%, 2.0% basalt fibre by weight of cement. Superplasticizer was mixed 0.2% by weight of cement in the mix to obtain a workable mix. 150 × 150 × 150mm3 cubes specimens were cured in the tank for 3, 7, 28 days, 500mm × 100 × 100mm3 Beam and 150 mm diameter and 300 mm height Cylinder specimens were cured in the tank for 28 days.

IV. EXPERIMENTAL TEST RESULTS AND DISCUSSIONS

A. Compressive Strength Test:

The compressive strength is the capacity of a material or structure to withstand loads tending to reduce size. It can be measured by plotting applied force against deformation in a testing machine. Compressive strength were measured at 3, 7,28 day of testing.

Compressive Strength Of Basalt Fiber Specimens

Table IV.Compressive Strength Of Concrete

Sr. No	Quantity of basalt chopped strand fiber (%)	Compressive Strength (N/mm²)		
		3 days	7 days	28 days
1.	0	13.7	27	42.2
2.	0.1	15.4	26.31	43
3.	0.2	15.78	26.9	44.3
4.	0.4	15.9	27.4	44.8
5.	0.6	16.88	28.24	45.6
6.	0.8	17.6	29.3	47
7.	1.0	17.65	30.87	47.5
8.	1.2	19.76	32.9	48.1
9.	1.4	21	35.69	50.4
10.	1.6	21.8	35.9	50.9
11.	1.8	22	36.6	52
12.	2.0	23.6	38	52.6

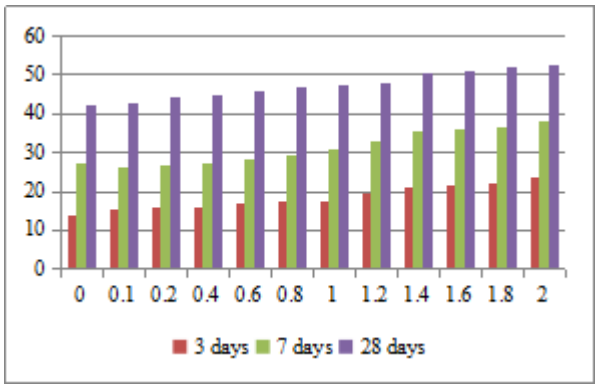

Fig 1. Compressive Strength N/mm²

B. Splitting Tensile Strength Test:

The split tensile strength values of ordinary concrete and basalt fiber concrete mixes are observed at 28 day of testing. The test results are presented below.

Table V. Splitting Strength Of Concrete.

Sr. No	Quantity of basalt chopped strand fiber (%)	Split tensile strength (N/mm²)
1.	0	3.5
2.	0.1	3.4
3.	0.2	3.9
4.	0.4	4.2
5.	0.6	4.65
6.	0.8	5.7
7.	1.0	5.68
8.	1.2	6.8
9.	1.4	7.3
10.	1.6	7.8
11.	1.8	7.89
12.	2.0	8.1

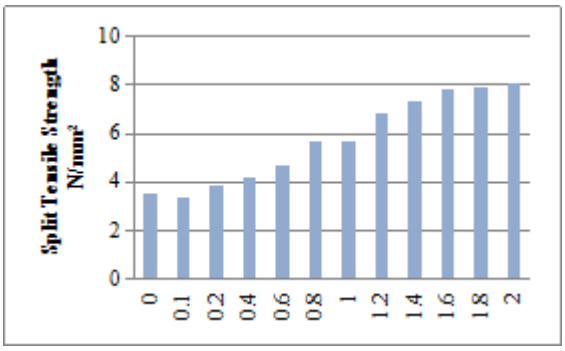

Fig2. Split Tensile Strength N/mm²

C. Flexural Strength of Concrete

The specimen was placed in the machine in such a manner that the load was applied to the

Upper most surface as cast in the mould. The axis of the specimen was carefully aligned with the axis of the loading device. The load was applied through two similar steel rollers. The load was applied with out shock and increasing continuously. The flexural Strength will tested at 28 day of testing for control mix and basalt fiber concrete mixes.

Table VI. flexural Strength Of Concrete.

Sr. No	Quantity of basalt chopped strand fiber (%)	Flexural Strength (N/mm²)
1	0	6.2
2	0.1	10.35
3	0.2	10.67
4	0.4	10.50
5	0.6	12.3
6	0.8	12.8
7	1.0	13.4
8	1.2	14.7
9	1.4	14.9
10	1.6	15.2
11	1.8	15.25
12	2.0	15.8

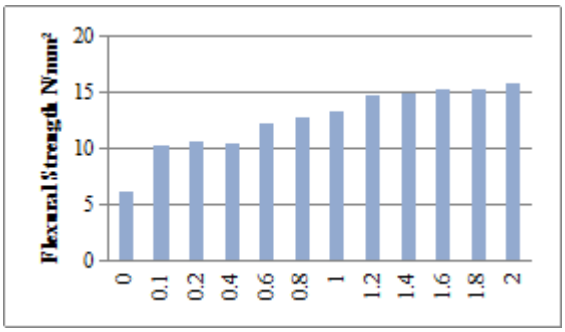

Fig. 3 Flexural Strength N/mm²

D. Pullout test:

For pull-out test cube specimens of 150 mm size were casted. And 12 mm diameter bar are inserted in specimens. The purpose of this test is to know bond stress between concrete and steel.

Table VII .Pullout Strength Of Concrete

Sr. No	Quantity of basalt chopped strand fiber (%)	Pullout strength (N/mm^2)
1	0	8.2
2	0.1	8.0
3	0.2	8.43
4	0.4	8.9
5	0.6	9.27
6	0.8	9.34
7	1.0	9.3
8	1.2	9.49
9	1.4	9.8
10	1.6	10.3
11	1.8	10.7
12	2.0	10.78

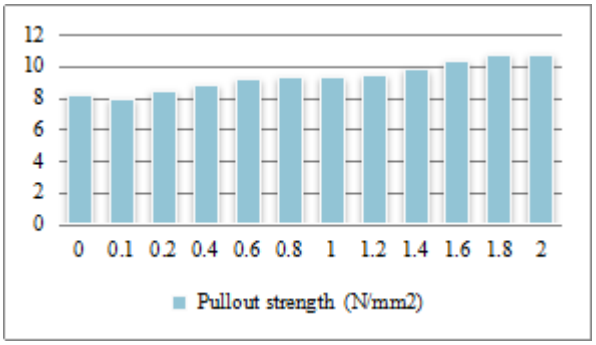

Fig. 4 Pullout Strength N/mm^2

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VI. CONCLUSIONS

- By using basalt chopped strand fibre increase compressive, splitting as well as flexural strength.
- It has been observed that as increasing basalt chopped strand fibre decreasing workability of concrete.
- To achieve workability of concrete, need to use super plasticizers or plasticizers.
- Result shows that fibre is good crack arrestors.
- Basalt rock is available naturally. So basalt fibre is environmentally safe material. It is ideal material for structure.
- It was observed that, the percentage increase in the strength of basalt reinforced concrete increases with the age of concrete.

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