"Effect Of Basalt Fibre On Portland Pozzolana Cement Concrete"

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Abstract: To study the strength properties of concrete containing basalt fibre. The investigation was carried out using basalt fibers as additional material in concrete. For this research work, M-40 grade concrete was used and tests were conducted for various proportions of basalt fibre (i.e. 0.5%, 1.0%, and 1.5%) with locally available material. The concrete specimens were tested for compressive strength. The result shows increment in compressive strength when basalt fibre used 1.0% by weight of cement. When basalt fibre added more than 1.0% the compressive strength decreases.

Keywords– Concrete, basalt fibre, Pozzolana, Compressive Strength.

INTRODUCTION

Basalt is an igneous rock, which means it began in a molten state. For many years, basalt has been used in casting processes to make tiles and slabs for architectural applications. Additionally, cast basalt liners for steel tubing exhibit very high abrasion resistance in industrial applications. In crushed form, basalt also finds use as an aggregate in concrete. More recently, continuous fibers extruded from naturally fire resistant basalt have been investigated as are placement for asbestos fibers, in almost all its applications. In the last decade, basalt has emerged as a contender in the fiber reinforcement of composites.

Basalt is a type of igneous rock formed by the rapid cooling of lava at the surface of a planet. It is the most common rock in the Earth's crust. Basalt rock characteristics vary from the source of lava, cooling rate, and historical exposure to the elements. High quality fibres are made from basalt deposits with uniform chemical makeup. The production of basalt and glass fibers is similar. Crushed basalt rock is the only raw material required for manufacturing the fiber. It is a continuous fiber produced through igneous basalt rock melt at about 2,700° F (1,500° C).Though the temperature required to produce fibers from basalt is higher than glass [1]. It was observed that the use of continuous basalt fibres improved the tensile strength of concrete more than E glass fibres and gave a greater failure strain than the carbon fibres [2]. The use of continuous basalt fibre in concrete was investigated [3]. The results obtained in the research have shown an improvement in the thermal and mechanical properties of concrete. Some researches have studied the effect of using short basalt fibre on the mechanical properties of concrete [4], [5], [6].

Basalt rock can be used to make not only basalt bars but also basalt fabrics, chopped basalt fiber strands, continuous basalt filament wires and basalt mesh. Some of the potential applications of these basalt composites are: plastic polymer reinforcement, soil strengthening, bridges and highways, industrial floors, heat and sound insulation for residential and industrial buildings, bullet proof vests and retrofitting and rehabilitation of structures [7]. Research is based on the investigation of the use of short fibres in structural concrete to enhance the mechanical properties of concrete. The objective of the study was to determine and compare the differences in properties of concrete containing no fibres and concrete with fibres, as well as the comparison on the effects of different type and geometry of fibres to the concrete. This investigation was carried out using several tests, which included workability test, compressive test, indirect tensile test, flexural test and modulus of elasticity test. [8]

MATERIALS

On conducting the experimental studies in the laboratory following materials were used:

1. Cement

PPC (Portland Pozzolana Cement) conforming to IS 1489-1991 part 1 brand name ACC Cement was used in the entire work.

2. Fine aggregate

Fine aggregate locally available river sand were used in work. The fine aggregate was passing through 4.75 mm sieve and retained on 60micron sieve.

3. Coarse aggregate

The aggregates most of which are retained on the 4.75mm IS sieve are termed as coarse aggregates. In these project coarse aggregates of maximum 20mm size is used. These aggregate to be tested on IS-sieve analysis.

4. Basalt chopped fibre

In this experiment basalt fibre having 20mm length was used.

Table:- 1 Chemical composition of Basalt Fibre

S.No.	Chemical Name	Composition Percent (%)
1	SiO_2	51.6% - 59.3%
2	Al_2O_3	14.6% - 18.3%
3	CaO	5.9% - 9.4%
4	MgO	3.0% - 5.3%
5	$Na_2O + K_2O$	3.6% - 5.2%
6	TiO_2	0.8% - 2.25%
7	Fe_2O_3+FeO	9.0% - 14.0%
8	Others	0.09% - 0.13%

Experimental Program

The program was conducted for understanding effectiveness of adding basalt fibers in concrete, the testing carried out on concrete cubes (150mmX150mmX150mm) for compressive strength. Various proportions of basalt fibre were used in mix design 0.5%, 1.0% & 1.5% respectively by weight of cement. M40 mix design was used in the experiment.

TESTING OF THE SPECIMENS

Compressive strength of concrete was tested with and without basalt fiber. Cubes were tested under compressive testing machine. Maximum load taken by specimen was recorded and failure was noted. Three cubes were tested in each category.

Table-2 Specimen details

S.No.	Basalt Fibre	No. of specimens	Specimen size (mm)
B-0	0.0%	3	150mm x 150mm x150mm
B-0.5	0.5%	3	150mm x 150mm x150mm
B-1.0	1.0%	3	150mm x 150mm x150mm
B-1.5	1.5%	3	150mm x 150mm x150mm

Fig.1 Basalt Fiber

Fig.2 testing of cube specimen

S.NO.	Cube Specimen Designation (sets)	No. Of Cube Specimen	Compressive Strength (N/mm2) 28 days
1	B-0	3	50.72
2	B-0.5	3	52.02
3	B-1.0	3	54.78
4	B-1.5	3	50.01

Table-3 Compressive strength of cube specimen

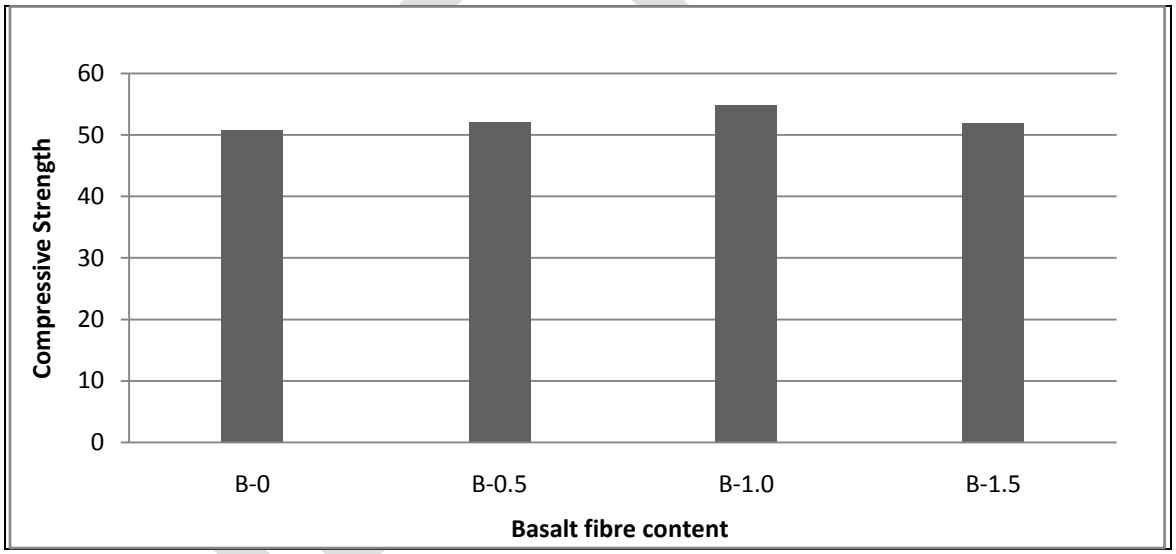

Fig-3 Average Compressive strength on 28 days

IV. ANALYSISAND RESULTS

As per design obtained in accordance to code IS-10262, mix proportion of various materials (viz. Cement, Sand, Aggregate and Water) is calculated for M-40 grade of concrete. Basalt fibre was used in M-40 mix design at 0.5%, 1.0% and 1.5% respectively. The cubes were tested in the laboratory in accordance to code IS 1343-1980.The results of crushing strength of cubes for 28 days of M-40 grades of concrete is given in table-3.It is observed that Basalt fiber concrete has maximum compressive strength for 1.0% at 28 days.

V. RESULTS AND DISCUSSION

The test shows effectiveness of basalt fibre when it used in varying percentage in concrete. It shows that compressive strength of concrete was higher at 1.0% of basalt fibre after that it gets decreased. From these results use of basalt fiber in low cost composites for civil infrastructure provide good mechanical properties at lower cost of basalt fiber. Use of Basalt fiber in concrete is an effective technique to enhance performance of concrete.

VII. COCLUSIONS

The investigation program of concrete of grade M40 with locally available ingredient with different proportion of basalt fibre shows variations in compressive strength of concrete, but at basalt fibre 1.0% in concrete the compressive strength takes maximum of its strength in compression test.

REFERENCES:

[1] By Arivalagan.S, Compressive and Split Tensile Strength Properties of Basalt Fibre Concrete Members

[2] 'Aketoma –Basalt fibrics,tubes,prepregs,rodsetc.http://www.laseroptronix.com

[3] Stephen cater; 'Editorial', Internationalcomposites news,(40)march(2002).

[4] Tengizchantladze; 'Industrial assimilation of the effective type of fibre with multicomponent change', http://www.basaltex.com

[5] Basaltex,the thread of stone',http://www.basaltex.com

[6] Bednar M.,Hajek M., 'Hitzeschutztextilenausneuartigen basaltfilamantgarnen',Technische textilien,43(Nov),252-254(2000).

[7] Ramakrishnan, V., &Panchalan, R. (2005). A new construction Material—Non-corrosive basalt bar reinforced concrete. *Special Publication, 229*, 253-270.

[8] Wang Jun,Zhang Ye 'Use of Short Fibres in Structural Concrete to Enhance Mechanical Properties'.