

Experimental Research in Stability of Basalt Fiber Concrete

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Abstract - This paper represents an experimental research in stability of basalt fiber concrete. The thing this paper is to research and compare the compressive strength of basalt fiber cubes with normal concrete cube of M25 grade. Various sorts of fibers like steel, carbon, glass and polyester are generally used. During this research the effect of inclusion of basalt fiber on the compressive strength of concrete was studied. Supported laboratory experiment on basalt fiber in concrete, cubes specimen are designed with various proportions of basalt fiber at 3, 7 and 28 days.

Basalt fibers offers more characteristics properties like good fire resistance, light weight and good strength. In future it have a really good scope in development industry. During this research trial test for concrete with basalt fiber or without basalt fiber are conducted to point out the difference between compressive strength by cubes. Step by step methodology is given during this paper. The most aim of this organized observation is to review the strength of varied proportions of basalt fibers in concrete. In this paper the basalt fiber having length 12mm are used.

Key Words: Basalt fiber concrete, Moulds, Compressive strength, UTM

1. INTRODUCTION

Construction may be a major part of development plan of developing countries including India. To satisfy the huge demand for infrastructure development, maintenance and life enhancement of structures are very vital. Concrete is that the most generally used man-made construction material. Plain concrete possesses a really low lastingness, limited ductility and tiny resistance to cracking. Conventional concrete doesn't meet many functional requirements like impermeability, resistance to frost adequately. Construction industry is always trying to find new, better and economical material to manufacture new product, which is very beneficial to the construction industry. Today a significant growth is observed in the manufacture of composite material.

With this in mind energy conservation, corrosion risk, the sustainability and environment are important when a product is modified or new product is manufactures. Basalt fiber maybe a high performance non-metallic fiber made up of basalt rock melted at high temperature. Basalt rock can also make basalt rock,

chopped basalt fiber, basalt fabrics and continuous filament wire. Basalt fiber originates from volcanic magma and volcanoes, a very hot fluid or semi fluid material under the earth's crust, solidified in the open air. Basalt is a common term used for a variety of volcanic rock, which are gray dark in colour. The molten rock is then extruded through small nozzles to supply continuous filaments of basalt fiber. The basalt fibers don't contain the opposite additives during a single producing process, which provides additional advantage in cost.

Types of fiber:

1. Basalt fiber. 2. Glass fiber 3. Carbon fiber. 4. Polymer fiber. 5. Asbestos fiber. 6. Nylon Fiber. 7. Steel fiber 8. Synthetic fiber 9. Polypropylene fiber. 10. Acrylic fiber.

Basalt Fiber:

A hard, dense rock which can be found in most countries across the planet, basalt is a rock, which means it began during a molten state. For many years, basalt has been utilized 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 aggregate in concrete. More recently, continuous fibers extruded from naturally fire resistant basalt are investigated as a replacement for asbestos fibers, in most of its applications. In the last decade, basalt has emerged as a contender within the fiber reinforcement of composites. Basalt fiber could also be a singular product derived from basalt rock, a natural material that is found in volcanic rocks originated from frozen lava. The rock itself is extremely hard and it's been used as gravel in construction since past. This rock has excellent strength, durability and thermal properties. The fibers are created by melting the basalt rock between 1500 and 1700 °C and forcing it through in platinum/rhodium crucible bushings. These fibers are manufactured as chopped fibers and continuous fibers. They're very almost like glass fibers, but better in terms of thermal stability, heat and sound insulation properties, vibration resistance, also as durability (more stable in strong alkalis than glasses). Basalt fibers even have good resistance to chemical attack and in seawater environment. For these reasons they're an honest alternative to glass fibers as reinforcing material and combined with the lower cost of basalt, this fiber type could potentially replace glass fibers in various fields; aerospace, automotive, transportation and shipbuilding

as an example . They will be used from very low temperatures (about -200 °C) up to high temperatures within the range of 700-800 °C, which makes them an outstanding economic alternative to other high-temperature-resistant fibers.



Fig-1. Basalt fiber



Fig-2. Basalt fiber mix in concrete.

Table -1. Properties of basalt fiber

Properties	Values
Tensile strength	4.85 Gpa
Elastic modulus	89Gpa
Density	2.7 g/cm ³
Elongation efficiency	3.15%
Specific gravity	6 -21
Temp of application	1450
Colour	Dark brown
Length	12mm
Thickness of BF	0.016mm

1.1 Motivation

- 1: Construction is a major part of development plan of developing countries including India.
- 2: The object of the present work is to study the effect of different proportions of fibers in the concrete and optimum percentage of fibers with maximum strength criteria.
- 3: Based on the literature study, it was found that the

basalt fiber concrete have better toughness and impact strength than the control concrete

1.2 Problem Statement

“Experimental Research In Stability of Basalt Fiber Concrete”

1.3 Objectives

1. To perform laboratory test that are related compressive strength by use of Basalt fiber in concrete.
2. Improve the crack resistance performance of concrete.
3. To review design aspects of BFRC.

2. LITERATURE REVIEW

This paper present the art of knowledge of basalt fiber, it's relatively new material. Basalt fiber could also be a high performance non-metallic fiber made up of basalt rock melted at high heat. Basalt fiber ferroconcrete offers more Characteristics like light weight, good fire resistance and strength. In this thesis specialize in experimental research on fiber ferroconcrete, works were administered on experimental research in stability of basalt fiber concrete. Properties of concrete were checked by testing cubes, cylinders and prisms. The specimens were cast using M25 Grade concrete with locally available materials.

The object of this work is to review the effect of varied proportions of fibers within the concrete and determine optimum percentage of fibers with maximum strength criteria. The specimens like cubes, were cast to see the compressive strength. Concrete specimens with different proportions (2%, 5%, and 10%) of basalt fibers were cast in conjunction with control specimens. Supported the literature study, it had been found that the basalt fiber concrete have better toughness and impact strengths than the control concrete. It had been also found that the addition of basalt fiber in concrete changes the mode of failure from brittle mode of failure to ductile mode of failure when subjected to compression, bending and impact.

3. METHODOLOGY

Selection of Material:- We know that, Concrete is mixture of cement, sand and aggregate. So for our project we select the following materials-

1. Cement, 2. sand, 3. Aggregate, 4. Water

3.1 Mix Design

A study of mix proportions the mixture proportioning was done consistent with the Indian standard recommended method IS 10262:200g. For M25 grade concrete the ratio was taken as 1; 1; 2.

3.2 Preparation of Concrete

According to the IS methods for M25 grade concrete, the cement content was taken as 36 kg/m³, Fine aggregate was taken as 36 kg/m³, coarse aggregate was taken as 72 kg/m³, water content was kept as 0.65 liter and the therefore the main component Basalt fiber was kept as 2%, 5%, and 10%.we considered total mixing time was 5 minutes. The basalt fiber having the length 12mm.

3.3 Preparation of moulds

For our project, 150 ×150×150mm³ cubes molds was prepared. After applying grease moulds was ready for casting, then samples were casted and left for twenty-four hrs. For remolding.

3.4 Curing of moulds

After remolding the samples then they're going to ready for placed in curing tank until the day of Testing. The samples are going to be curried for span of 3, 14 and 28 days.

4. TEST

This paper is represents an experimental research that way carried out to evaluate the characteristics of basalt fiber concrete. The basalt fiber were supplied Nickunjeximp limited Mumbai. The objective of this paper was to determine the strength of basalt fiber in concrete.

4.1 Compressive strength test

compressive strength test were administered and cubes of 150mm×150×150 cube size employing a UTM of 2000 KN capacity as per IS156:1959 The test concluded every 3 days, 14 days and 28days remove the specimen from curing tank and wipe out excess water from surface then put the specimen abroad base plate of the machine rotate the movable portion gently by hand in order that it touches the highest surface of the specimen abroad base plate of the machine. It touches the highest surface of the specimen applied the load gradually and Continuous apply till the specimen fails. Record the ulmost load minimum three specimens should be tested at each selected day.



FIG-3.Universal testing machine

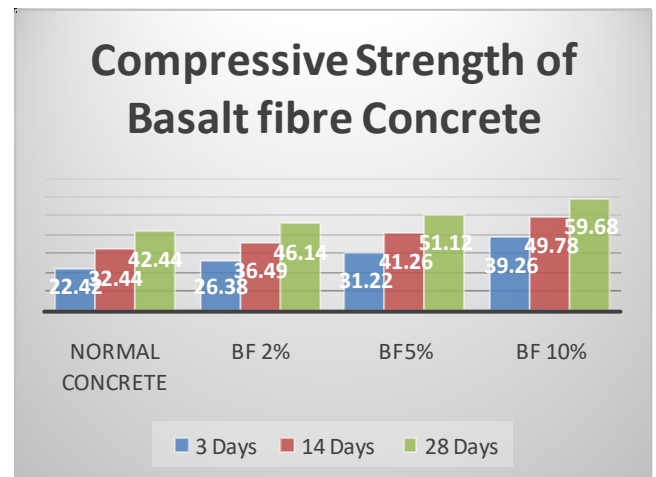


Chart -1: Compressive strength of basalt fiber concrete.

5. COMPARISON

All the test results are going to be checked then strength are going to be increased or decreased is to be checked.

1) Compressive strength normal concrete after 3,14,28 days are respectively 22.42 N/mm², 32.44 N/mm² and 42.44 N/mm²

2) Also compressive strength of two % you look after 3,14 and 28 days are 26.38 N/mm², 36.49 N/mm², 46.14 N/mm²

3) 5% BF compressive strength are 31.22 N/mm², 41.26 N/mm² and 51.12 N/mm²

4) 10% BF compressive strength are 39.26 N/mm², 49.78 N/mm², 59.68 N/mm²

5) We observed that the strength specimen are increasing as adding by BF with 2% ,5% ,10 %.

6) The cracks are more in normal concrete cubes, whereas cracks are less in BF cubes.

7) BF are working as crack resistors.

8) Since, that cost is small bit more as compared to normal concrete cubes.

9) But the strength is just too good as compared to normal concrete.

5.1 Application

1.Basalt fiber is used in civil engineering for varied applications such as bridges, roads, runways, industrial floors, heat and sound insulation for residential and rcc building.

2.Basalt fiber is used withing the bars, pipe fittings, tanks, chimneys, fire and heat protection structures etc because of it's strength.

3.Composite pipes made with basalt fiber can transport the petroleum products, gases and fluids,loose materials etc.

6. CONCLUSIONS

The last procedure is conclusion, in any case the comparisons, the conclusion are going to be discussed.

- 1) supported above mentioned test it's conducted that basalt fibers having great interest for the development industry.
- 2) The share increase of compressive strength of basalt fiber concrete mix compared with 28 days compressive strength of plain concrete is observed as increasing in percentage.
- 3) It had been observed that, the share increase the strength of basalt fiber ferroconcrete increases with the age of concrete.
- 4) Also it had been found that the failure pattern of the specimen, that the formation of crack is more within the case of the concrete without fiber than the basalt fiber concrete.
- 5) It shows that the presence of the concrete act as crack arrestors.
- 6) we conducted that basalt fiber has a plus of high strength, light weight and also non corrosive in nature.
- 7) because the material is made from volcanic eruptions it contains good thermal resistance. Which is a crucial factor for R.C.C structure. Basalt is of course available material therefore there is not any lack of source, which suggest that it'll be economical than the other mineral for instance, carbon fiber.

ACKNOWLEDGEMENT

We express our gratitude to my guide **Prof. A. T. Shingan** for his competent guidance and timely inspiration. It is our luck to finish our Project under his able competent guidance.

We are considerably thankful to **Mr. I. M. Jain**, Head, Department of Civil Engineering, SITS.

It is our luck to finish our Project under his competent guidance. This valuable guidance, suggestions, helpful constructive criticism, keeps interest within the problem during the course of presenting this project successfully.

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