An Experimental Study has been carried out to Evaluate the Behavior of Concrete Elements using Basalt Chopped Strands Fiber

R.singaravadivelan, P.chinnadurai, G.karthikeyan, Dr.K.L.Muthuramu and Dr.N.V.Ramamoorthy

Abstract—To study the mechanical properties of mixed fibers reinforced concrete. This investigation was carried out basalt chopped strands fibers as additional material was used in concrete. For this research work, totally 122 numbers of specimens are carried out, M-20 grade concrete was used and tests were conducted for various proportions of (ie.,0%,0.5%,1.0%,1.5%,2.0%,2.5%) 36cubes, 72cylinders and 24prism specimens. After the concrete elements immersion to different types of curing on 28 days. Finally, to determine the compressive, tensile, flexure strength and slump of concrete were also measured. This strength of the fiber concrete compared to control specimen.

Keywords—Basalt chopped strands fiber, 0.5% dilute Nacl solution, Alkaline water.

I. INTRODUCTION

REINFORCED concrete is preferred for various kinds of structures because of their high tensile and tensile strength, mouldability for desired shapes and dimensions and cheapness. In a large number of structures constructed in the past using the old design codes in different parts of the world are structurally unsafe according to today’s design codes. Replacement of such deficient structures incurs a huge amount of public money and time[1].

A. Basalt fiber

Basalt is a natural material that is found in volcanic rocks. It is mainly used (as crushed rock) in construction, industrial and high way engineering. One can also melt basalt (13000-17000°C) and spin it into fine fibres.[2-3,4-5,6]. Some possible applications of basalt fibres and basalt-based composite are: thermal and sound insulation/ protection, pipes, insulating plastics and frictional materials[2-6].

II. SCOPE OF WORK

This research investigated the effect and its degree on the fundamental mechanical properties of concrete with basalt chopped strands fiber, by changing its dosage ratio and two different kinds of curing to immersion the specimens on 28 days. This scientific evidences and methods for future references of engineering applications.

<table>
<thead>
<tr>
<th>Curing methods</th>
<th>Alkaline water</th>
<th>0.5% of Nacl solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH-value</td>
<td>11</td>
<td>8</td>
</tr>
</tbody>
</table>

III. EXPERIMENTAL INVESTIGATION

A. Materials

Cement: The cement used in all mixtures was commercially available Portland pozzolana cement manufactured by chettinad cement company confirming to IS:12269 was used in this study.

Fine aggregate and coarse aggregate: Locally available river sand passed through 4.75mm IS sieve was used. The specific gravity 2.66, 2.75 and fineness modulus of 2.72, 2.80 were used as fine aggregate and coarse aggregate[9].

Basalt chopped strands fiber: Basalt chopped strands fiber from Shandong shuangyi group co., Ltd, Beijing, China. The fiber diameter 13µ and 25mm length had tensile strength and specific gravity of 2500 Mpa and 2.1 respectively.
TABLE II

PHYSICAL AND MECHANICAL PROPERTIES OF BASALT CHOPPED STRANDS FIBER

<table>
<thead>
<tr>
<th>S.no</th>
<th>Mix Id</th>
<th>Test</th>
<th>Nos</th>
<th>Size(mm)</th>
<th>Cement Kg/m³</th>
<th>F.A Kg/m³</th>
<th>C.A Kg/m³</th>
<th>Water Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cube</td>
<td>Compression</td>
<td>36</td>
<td>150 x 150</td>
<td>361.76</td>
<td>694.054</td>
<td>1094.74</td>
<td>0.545</td>
</tr>
<tr>
<td>2</td>
<td>Cylinder</td>
<td>Split tension</td>
<td>36</td>
<td>300 x 150</td>
<td>361.76</td>
<td>694.054</td>
<td>1094.74</td>
<td>0.545</td>
</tr>
<tr>
<td>3</td>
<td>Cylinder</td>
<td>Compression</td>
<td>36</td>
<td>300 x 150</td>
<td>361.76</td>
<td>694.054</td>
<td>1094.74</td>
<td>0.545</td>
</tr>
<tr>
<td>4</td>
<td>Prism</td>
<td>Flexure</td>
<td>14</td>
<td>700 x 150 x 150</td>
<td>361.76</td>
<td>694.054</td>
<td>1094.74</td>
<td>0.545</td>
</tr>
</tbody>
</table>

C. Test Method

Based on mix proportions, we conduct the tests of compressive strength, split tensile strength, flexural strength of basalt chopped strands fiber in six different contents, according to 0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5% of the cubic content of mixing using different curing methods adopted. All specimens are made under IS code standard laboratory[8-10,11].

A compression testing machine of 2000KN maximum capacity was used for completion of both the compression and indirect tension test for concrete. In each test the crushing load was recorded for the estimation of the compressive and indirect tensile strength.

IV. TEST RESULTS AND DISCUSSIONS

A. Test results and analysis of working properties

The slump of fresh mixed concrete on different fiber cubic content of basalt chopped strands fiber is also tested and the results are shown in fig.3-4,5-6,7-8.
TABLE IV
INFLUENCE OF MIXING FIBER ON FRESH CONCRETE SLUMP

<table>
<thead>
<tr>
<th>Basalt chopped strands fiber(%)</th>
<th>Slump (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>0.5</td>
<td>150</td>
</tr>
<tr>
<td>1.0</td>
<td>70</td>
</tr>
<tr>
<td>1.5</td>
<td>45</td>
</tr>
<tr>
<td>2.0</td>
<td>25</td>
</tr>
<tr>
<td>2.5</td>
<td>20</td>
</tr>
</tbody>
</table>

Test results and analysis of mechanical properties

B. Compressive strength of cubes & cylinder:
The maximum load at failure reading was taken and the average compressive strength is calculated using equation.

\[
\text{Compressive strength (N/mm}^2\text{)} = \frac{\text{Area of cross section (mm}^2\text{)}}{\text{P at failure (N)}}
\]

C. Split tensile strength test:
The maximum load at failure reading was taken and the average split tensile strength is calculated using the equation [12].

\[
\text{Split tensile strength (N/mm}^2\text{)} = \frac{2P}{\pi LD}
\]

Where, 
- \(P\) = Ultimate load at failure (N)
- \(L\) = Length of specimen (mm)
- \(D\) = Diameter of cylindrical specimen (mm)

Fig. 9 Under different water condition curing on concrete specimens on cylinder & cube

Fig.10 Under different water condition curing on cylinder specimens
D. Flexure strength test:

The two point loading test method was used to measure bending tensile properties of tested specimens. The flexural strength data, obtained by following equation

\[
\text{Flexural strength (N/mm}^2\) = \frac{PL}{BD^2}
\]

Where,
- \(P\) = Ultimate load at failure (N)
- \(L\) = Length of specimen (mm)
- \(BD\) = Cross section of the beam (mm²)

![Image of flexure test](image)

Fig. 11 Under different water condition curing on flexure specimens

V. CONCLUSIONS

Working properties of concrete is influenced by basalt chopped strands fiber content; the test results show to increase the fiber content ratio, then decrease the slump value and also strength will be different values to be achieved. So, the applications wise which ratio is best values under different curing process that can be identified.

REFERENCES