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Determination of Optimum Usage of Basalt in Strengthening of Concrete

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Abstract: ***Strength is one of the most important properties of concrete and now a days different material are being used to enhance the strength property of concrete. The research aims to study the effect of basalt fibre on strength of concrete. M30 grade of concrete was used in this experiment. Basalt fibre were added in different proportion as 0%, 0.1%, 0.2% and 0.3 % by volume of concrete. Tests were conducted to determine the compressive strength , split tensile strength and bending strength of concrete. A gain in strength of concrete was observed when basalt fibre was used at 0.2% by volume of concrete.***
Keywords: Concrete, Basalt , Basalt fibre, pozzolana, split tensile strength, compressive strength, bending strength.

I. INTRODUCTION

Basalt is an extrusive igneous rock. It is formed from rapid cooling of lava having low viscosity. On earth basalt is found in abundance, around 90% of volcanic rock is basalt. The richness in silica content of basalt is responsible for its low viscosity. Basalt fibre is derived from the fine fibres of basalt which has better physicomechanial properties than other fibres used in construction such as fiberglass. It is much cheaper than other fibres and is also easily available. Crushed basalt rock are melted at 1500^0C and continuous filament of basalt fibres are produced having high specific strength and increased elastic modulus. Out of those fibres, the thicker one is used in the form of chopped strand for reinforcement in concrete. Several researches have been carried out to increase the strength of concrete by addition of different silicious material. The effect of basalt fibre on the strength of concrete was investigated and increase in strength property of concrete is found . The research aims to find the correct proportioning of basalt fibre for its optimum usage for enhancing the strength of concrete.

II. MATERIAL USED

For conducting experimental study following materials has been used :

1) Cement :OPC 53 grade cement was used for experimental purpose.
2) Fine aggregate : Sand conforming to zone II were used , passing from 4.75mm sieve and retained on 60 micron sieve.
3) Coarse aggregate : maximum 20mm size coarse aggregate were used.
4) Basalt fibre : basalt fibre of length 16mm were used for experimental purpose.

Table 1 : Properties of basalt fibre

Length	Density	Break elongation	Modulus of elasticity	Tensile strength	Water absorption
16 mm	2.61 g/cc	3.12 %	84 Gpa	4.25 Mpa	<0.4

Table 2 : Chemical composition of basalt fibre

S.No	Chemical name	Composition
1	Sio_2	50.7 % - 57.8 %
2	Al_2O_3	14 % - 16.9 %
3	CaO	5.6 % - 8.8 %
4	MgO	3.5% - 5.8%
5	$Na_2O + K_2O$	3.9 % - 6.1%
6	TiO_2	0.8% - 2.22%
7	$Fe_2O_3 + FeO$	9.3% - 15.6 %
8	Others	0.09% - 0.23%

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III. SPECIMEN DETAILS

Cubes specimen of standard size were casted for determination of compressive strength and cylinder specimen were casted for the split tensile strength . For determining bending strength molds were casted. Basalt fibre was added in different proportion as 0%, 0.1% , 0.2% and 0.3% by volume of concrete in experimental specimens. Design mix of M30 grade concrete was used and specimen were tested after 28days.

Table 3 : Specimen Detail

S.no	Proportion of basalt fibre	Length of basalt fibre	Specimen quantity	Cube specimen size for compressive strength	Cylindrical specimen size for split tensile strength	Specimen size for bending strength
1	0 %	-	3	150 x 150 x 150 mm	150mm diameter	100 mm x 100 mm x 500mm
2	0.1 %	16 mm	3	150 x 150 x 150 mm	150mm diameter	100 mm x 100 mm x 500mm
3	0.2 %	16 mm	3	150 x 150 x 150 mm	150mm diameter	100 mm x 100 mm x 500mm
4	0.3 %	16 mm	3	150 x 150 x 150 mm	150mm diameter	100 mm x 100 mm x 500mm

IV. EXPERIMENTAL INVESTIGATION

Specimen were casted for different proportions of basalt fibre and test were performed under standard procedure and conditions after 28 days of curing.

Table 4: Compressive strength of cube specimen

S.No	Detail of cube specimen	Number of cube sample	Average Compressive strength
1	BFRCCS 0	3	32.23 Mpa
2	BFRCCS 0.1	3	34.19 Mpa
3	BFRCCS 0.2	3	35.25 Mpa
4	BFRCCS 0.3	3	31.88 Mpa

Table 5: Split Tensile strength of cylindrical specimen

S.No	Detail of cylindrical specimen	Number of cylindrical sample	Average split Tensile strength
1	BFRCTS 0	3	2.83 Mpa
2	BFRCTS 0.1	3	3.21 Mpa
3	BFRCTS 0.2	3	3.95 Mpa
4	BFRCTS 0.3	3	3.15 Mpa

Table 6: Bending strength of concrete specimen

S.No	Detail of specimen	Number of sample	Average bending strength
1	BFRBS 0	3	4.35 Mpa
2	BFRBS 0.1	3	4.72 Mpa
3	BFRBS 0.2	3	4.98 Mpa
4	BFRBS 0.3	3	4.53 Mpa

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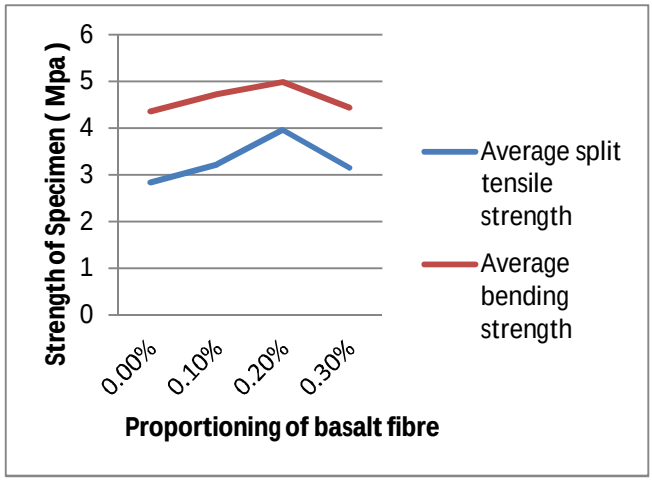

Figure 1 : Compressive strength of concrete

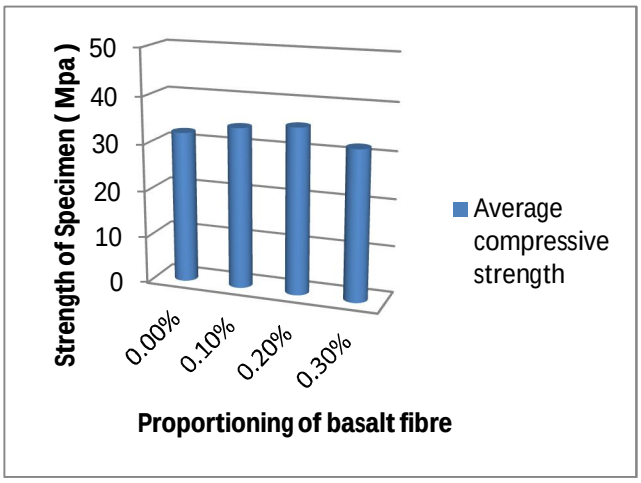

Figure 2 : Split tensile and bending strength of concrete

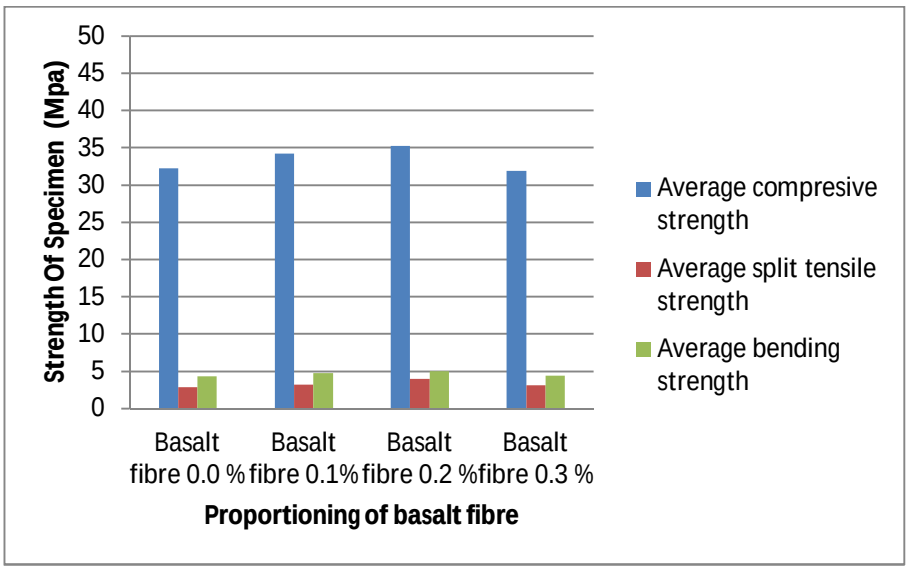

Figure 3 : Comparative analysis for strength of concrete

V. RESULT AND DISCUSSION

There was an increase in strength of concrete specimen on addition of basalt fibre. The addition of basalt fibre of 0.2 % by volume of concrete provides the better result as compared to the conventional mix concrete and it was found that further increase in amount of basalt fibre tends to reduce the strength of concrete. The use of basalt fibre in low composites for concrete construction may provide better strength at lower cost of basalt fibre.

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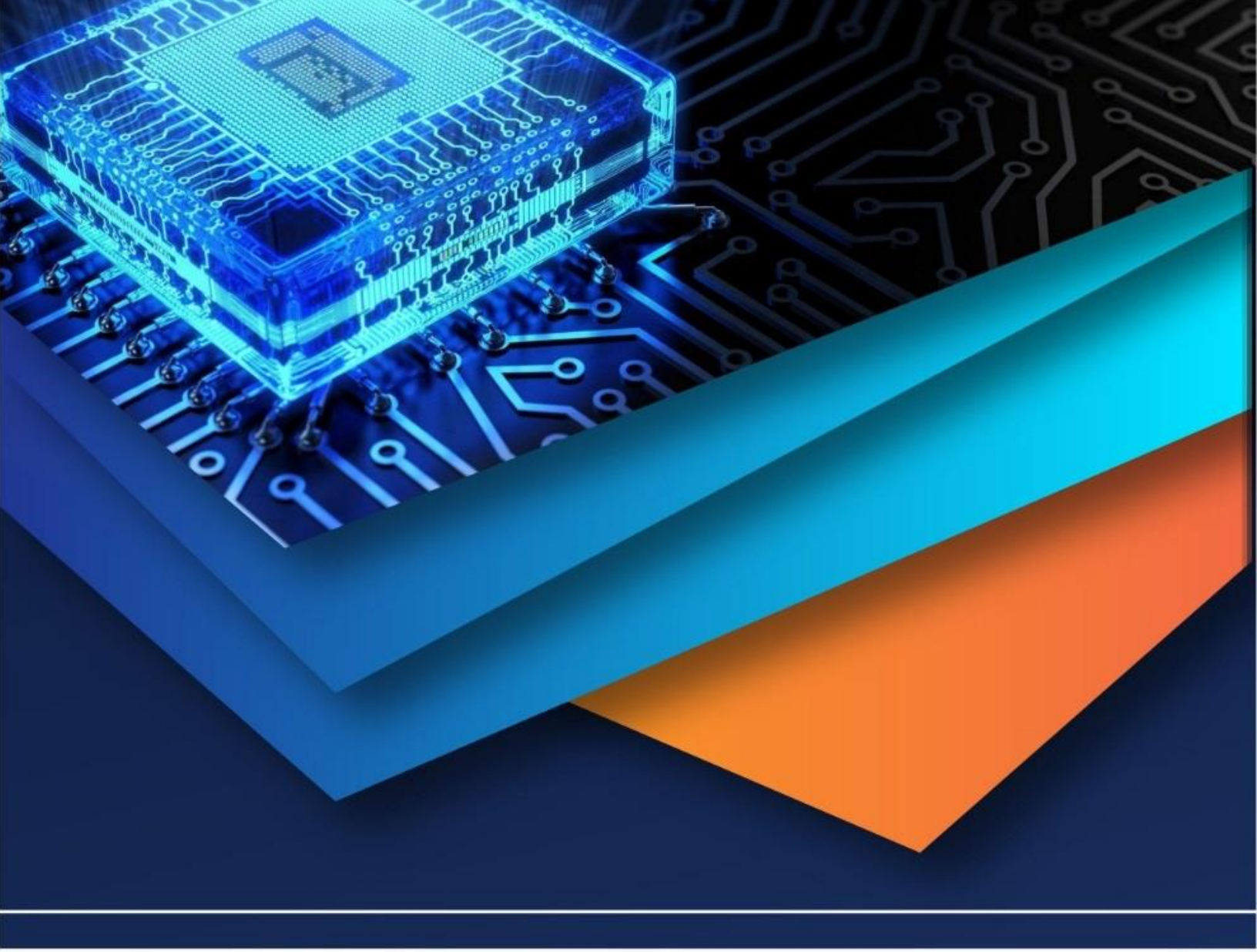

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