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A Study on Structural Behaviour of Asbestos Fibre on M25 Grade Concrete

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Abstract: ***"Concrete is a perquisite to construction industry". Even though many other materials are used for construction, concrete stand as elite. Therefore based on requirements of capacity of structure in order to further increase its strength, several other materials are added to concrete. Among these asbestos is one of the most abundantly available material which is extracted from naturally occurring mineral asbestos. Due to its physical properties, it has wide range of usage in the construction like roofing material and insulating material etc.***

In this research work, asbestos fibre is used in manufacturing concrete, in order to increase the strength of concrete. In general many artificial fibres like glass, polymers, steel etc., are used in concrete for the purpose of increasing strength. Manufacturing of these fibres leads to pollution in the environment and also they are expensive when compared with naturally occurring materials. Use of naturally occurring materials in concrete, promote in reducing the environmental pollution. asbestos is more abundant available mineral in nature. Due to its wide range of availability it is available at low cost in market.

In this study, influence of asbestos fibre on structural behaviour of concrete is carried out. Therefore in order to carry out this study, normal M25 grade has been chosen. The design of the mix has been carried out for 0% of asbestos fibre. Here the asbestos fibre of 0.2%, 0.4%, 0.6% and 0.8% is added to concrete. Therefore six samples of cubes of size 100 mm x 100 mm x 100 mm are prepared for each percentage of asbestos fibre added and are tested for 7 days and 28 days compressive strength of each three sample cubes of concrete. And also three sample cylinders are prepared to test for 28 days of split tensile strength of concrete.

Keywords: Concrete, Asbestos fibre, compressive strength, split tensile strength

I. INTRODUCTION

Concrete is a most compatible material in the field of construction. It possesses a flexile nature with most of the materials available in nature. Due to its nature and strength characteristics, it is used for any type of construction. The main two parameters that influence the concrete are its strength and durability. In order to increase its strength and durability, several materials are added to concrete in addition to its raw materials (cement, fine aggregate, coarse aggregate and water) during batching of concrete. As the concrete is weak in tension, these additional materials added are in sense to increase this tensile strength as well as compressive strength of concrete. These additional materials are different kinds of fibres, silica, waste materials from industries etc. These materials are either naturally occurring or artificially manufactured. In general naturally occurring fibres are rock fibres, mineral fibres and plant tissues etc. Among these due to their huge availability in nature, rock and mineral fibres are used in strengthening of concrete. Basalt and asbestos are the two main rock and mineral materials mainly used in construction. Asbestos is mainly used in the manufacturing of cement i.e. asbestos cement. This asbestos cement is generally used for making roofing material. According to previous experimental studies, asbestos has been used in the form of fibres in concrete to increase the strength of concrete. Only few researches have been undergone using this asbestos fibre reinforced concrete. It was observed that at 0.33% addition of asbestos fibre in concrete, increase compressive and split tensile strength. In this experimental study, further research has been carried out by increasing the percentage of asbestos fibre at 0.2% interval in concrete and tests are conducted up to 0.8 % addition of fibre. Asbestos fibre due to its strong nature it has shown increase in strength after 28 days of testing.

II. LITERATURE REVIEW

RAHUL CHAUDHARY, SHAHBAZ AHMAD....,(2017), investigated the paper by adding asbestos fibre varying from 0.33%, 0.66%, 1%, 1.33%, 1.66% and 2% to concrete and tested for compressive strength, split tensile strength and flexural strength. They have concluded that at 0.33% of addition of asbestos fibre the compressive strength and split tensile strength has been increased and then it has been decreased gradually.

R BASKAR and C MERLIN RANI (2012) conducted their research on asbestos fibre reinforced concrete and tested for flexural strength of concrete in order to calculate the crack width in beams. Therefore they concluded that 0.75% volume fraction of AFRC beam, there was an increase of 5% of load carrying capacity when compared to control beam.

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III.EXPERIMENTAL METHODOLOGY

1) *Step 1: Literature review*
2) *Step 2: Material collection*
3) *Step 3: Material characterization*
a) *Properties of Cement*
b) *Properties of fine aggregate*
c) *Properties of coarse aggregate*
d) *Properties of asbestos fibre*
e) *Water*
4) *Step 4: Calculation of mix design for M25 grade concrete*
5) *Step 5: Tests on fresh and hardened concrete*

A. *Tests On Materials*

1) *Cement:* The 53 grade ordinary Portland cement confirming to IS 12269:1987 is used in this research work.

Table I
Physical Properties Of Cement

Property	Results obtained	Requirement
Fineness (%)	6%	Maximum of 10%(ordinary portland cement) IS 12269:1987
Normal consistency(%)	30%	22-30% (IS 40311988 part 4)
Initial setting time	35 min	Minimum 30min (IS: 4031 (part 5) -1988)
Specific gravity	3.15	-

2) *Fine Aggregate:* The aggregate used in this research has been extracted from the natural river having sharp angular particles of zone 3.

Table II
Physical Properties Of Fine Aggregate

Property	Results obtained
Fineness modulus	2.97
Specific gravity	2.65
Bulking of sand	11.11%
Bulk density	1620 Kg/m^3

3) *Coarse Aggregate:* The coarse aggregate used in this research is chemically inert and crushed rock aggregate having maximum size of 20 mm. It is tested for aggregate impact value and crushing value to determine the strength of the coarse aggregate. It is also tested for elongation and flakiness index to determine the size and shape of the aggregate.

Table III
Physical Properties Of Coarse Aggregate

Property	Results obtained
Fineness modulus	8.64
Specific gravity	2.7
Elongation index	9%
Flakiness index	7%
Aggregate impact value	19
Aggregate crushing value	20
Bulk density	1680 Kg/m^3

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4) Asbestos Fibre: In this research chrysotile serpentine class of asbestos is used. These are extracted from the ores by crushing of rocks and minerals and extracting asbestos into fibre form.

Table IV
Physical Properties Of Asbestos Fibre

Property	**Results obtained**
Colour	Grey
Size	2 to 5 microns
Density	2.5g/cm^3
Specific gravity	2.5
Coefficient of friction	0.35

5) Water: The water used in concrete should be clean and potable. It should be free from salts and organic matter and the pH of water should be neutral. In this research water free from any acid or alkaline salts and confirming to standard of IS 456:2000 is used.

B. Mix Design

In order to calculate the right proportions of materials that should be used in concrete are calculated using IS 10262 2009. Based on the physical properties of materials the quantity og material is calculated.

Table V
Mix Design Proportions

S.No.	Material	Quantity(kg/m^3)	Proportion
1.	Cement	438	1
2.	Fine aggregate	654.25	1.49
3.	Coarse aggregate	1156.6	2.63
4.	Water	197	0.45
5.	Super plasticizer	0.438	0.1

IV. TEST RESULTS

1) Compressive Strength: The compressive strength test is conducted on hardened concrete at 7 days and 28 days, to calculate the load that is carried by the specimen. Therefore this test is performed on 100 mm x 100 mm x 100 mm cubes that are placed in compressive testing machine and the load applied on the cross section of the member is noted.

Table VI. Compressive Strength Test Results AT 7 DAYS

S.No.	% Addition of asbestos fibre	Compressive strength(N/mm^2)
1.	0	17.16
2.	0.2	18.83
3.	0.4	20.76
4.	0.6	24.50
5.	0.8	23.26

Table VII
Compressive Strength Test Results AT 28 DAYS

S.No.	% Addition of asbestos fibre	Compressive strength(N/mm^2)
1.	0	27.16
2.	0.2	28.43
3.	0.4	30.20
4.	0.6	35.11
5.	0.8	31.16

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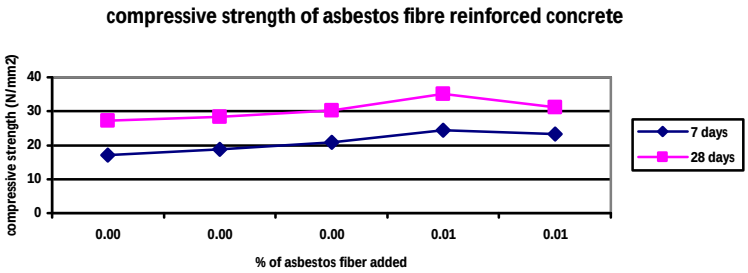

Fig. 1 Compressive strength at an age of 7 days and 28 days

2) Split Tensile Strength: A cylinder of 150 mm diameter and 300 mm height are tested for split tensile strength at 28 days for three specimens and average strength has been calculated

Table VIII
Split Tensile Strength AT 28 DAYS

S.No.	% Addition of asbestos fibre	Split tensile strength (N/mm^2)
1.	0	2.26
2.	0.2	2.48
3.	0.4	2.63
4.	0.6	3.08
5.	0.8	2.51

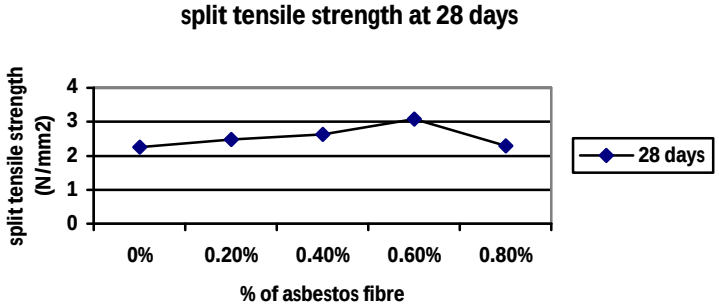

Fig. 2 Split tensile strength at an age of 28 days

V. CONCLUSIONS

Based on the study conducted and the analysis of test results the following conclusions are given:

A. Compressive strength and split tensile strength of concrete in asbestos fiber reinforced concrete has gradually increased with the increase in percentage of fiber. On further increase in percentage of fiber after certain point , the strength got decreased.

B. In this experimental study, the asbestos fiber added at an interval of 0.2% in the concrete, shows gradual increase in its compressive strength and split tensile strength up to 0.6% and decreased at 0.8% in N/mm^2 .

C. The compressive strength and split tensile strength of concrete at 0.6% addition of fiber has increased its strength up to 10%f

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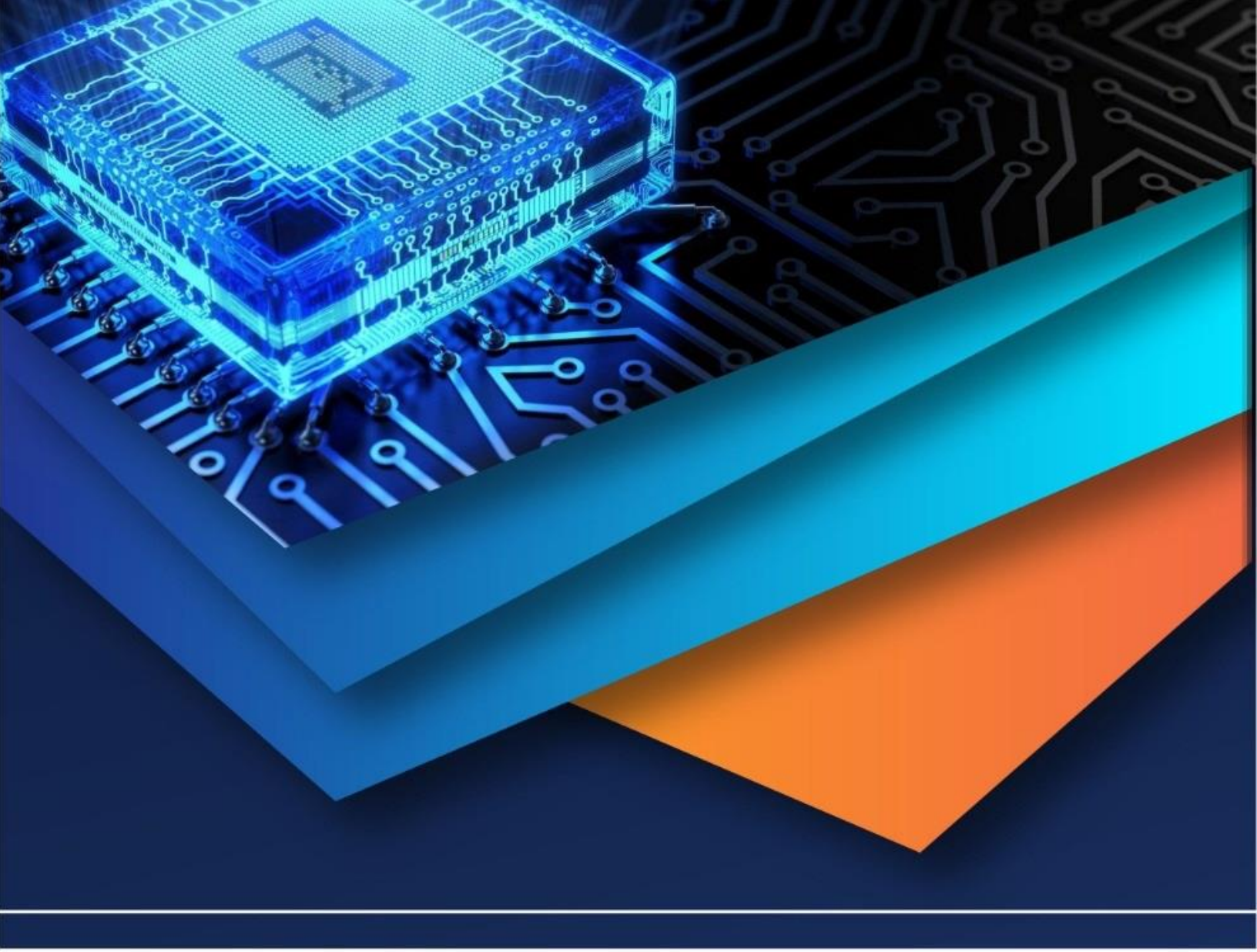

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