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Study of Strength of Concrete by Using Glass and Steel Fibers

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ABSTRACT

Concrete is the most widely utilized "man-made" material globally for construction in many developing countries in all types of civil engineering works. In addition, concrete is an environmental - friendly material and in areas of growing environment - related awareness that is of prime importance. It is construction material due to its many advantages such as high compressive strength, availability of ingredients at reasonable cost, mould-ability to any shape giving aesthetic appearance and resistance to fire and weathering. Concrete is a material used in civil engineering constructions, consisting of a hard, chemically inert particulate substance, known as an aggregate (usually made from different types of sand and stone), that is bonded together by cement and water.. In this experimental investigation, cement used is Portland Pozzolanic Cement (RAASI GOLD' 53 grade). Concrete is weak in tension and strong in compression. The low tensile strength is due to the propagation of internal micro cracks present even before loading. So, concrete exhibits little fracture. Hence, steel fibers are used to overcome the above disadvantage. The concept of fiber reinforcement is an old as the use of brittle materials as clay, bricks or concrete. The modern use of fiber reinforced concrete started in the 1960s and is used in different areas after investigating different properties of fiber. Steel fibers are the dominating material, but there are many others, such as polymeric fibers, mineral fibers and naturally occurring fibers. In this experimental investigation, fibers of Perma-Fil E Glass Fibers and C**old Drawn Carbon Wire Steel Fibers are used.**

Fiber reinforced concrete is a composite material primarily a combination of conventional concrete or mortar reinforced by oriented, short, continuous and discrete fibers of specific geometry. The fiber is a piece of reinforcing material usually described by aspect ratio. Aspect ratio is the ratio of length to diameter of fiber. The quantity of fiber is specified by volume fraction. These fibers act as crack arrestors, thereby increasing first crack strength and ultimate strength. This chapter tries bringing some basic information on the subject and the objective of the study is reported.

Keywords : Concrete, Compressive strength, Weathering, Aggregate, Portland Pozzolanic Cement, Tension, Compression, Tensile strength , Fiber, Perma-Fil E Glass Fibers.

I. INTRODUCTION

The art and science of construction developed through the pre-historic ages itself. The unending quest for the better building materials and better construction practices lead to the discovery of many building composite. History envisages Romans as the first to recognize the pozzolanic action of certain volcanic ashes. The modern recognition of ash materials as a pozzolana and using various types of fibers in concrete had lead to revolutionary developments in the construction industry and research.

The present work is made to investigate experimentally and the following tests were carried out namely Compressive Strength and Split Tensile Strength. This experimental investigation comprises with the replacement of glass with steel fiber by 0%, 25%, 50% 100% from total content of 0.50, 0.75 and 1.00 percentages by weight have been attempted over the

concrete specimens such as cubes, cylinders and beams respectively. The program consists of casting and testing of specimens for various mixes.

II. METHODS AND MATERIAL

2. Experimental Procedure

2.1. Materials

The properties and specifications of various materials used in the preparation of test specimens are as follows.
(A) Cement
(B) Fine aggregate
(C) Coarse aggregate
(D) Water
(E) Fibers

1.2 Materials Description and Their Properties

1.2.1 Cement

The brand name of the Portland pozzolona cement used for the investigation is 'RASI GOLD' cement (PPC 53 grade) conforming to IS 12269-1987, IS 1489 (Part 1 & 2)-1991, IS 3812-1981 and IS 1344-1981. The cement is fresh and uniform in colour. The cement is free from lumps and foreign matter.

Table 1. Properties of Cement

S. No	TEST	RESULT
1.	Fineness	9%
2.	Specific gravity	3.15
3.	Normal consistency	30%
4.	Initial setting time	150min
5.	Final setting time	480min

1.2.2 Fine Aggregate

The fine aggregate i.e. sand used in the present experimental investigation is river sand conforming to zone-II as per IS : 383-1970 . The sand is clean inert and free from organic matter, silt and clay. The sand is completely dried before use.

Table 2. Properties of Sand

S. No	TEST	RESULT
1.	Specific gravity	2.55
2.	Fineness modulus	3.55

2.2.3 Coarse Aggregate

The coarse aggregate i.e. metal used in the present experimental investigation is natural aggregate conforming to IS: 383-1970. Coarse aggregate consists of particles of maximum size 20mm .The specific gravity is 2.68. The fineness modulus is 6.15. The aggregate is of uniform angularity.

Table 3. Properties of Coarse Aggregate

S. No	TEST	RESULT
1.	Specific gravity	2.68
2.	Fineness modulus	6.15
3.	Shape	Angular

2.2.4 WATER

The water used in the present experimental investigation is clean and free from oils, acids, alkalis, organic materials and other substances as per IS 456-2000. The portable water was used for casting concrete specimens and for curing.

2.2.5 FIBERS

The fibers used in the present concrete mix are Glass and steel.

Table 4. Properties of Glass Fiber

S. No	TEST	RESULT
1.	Physical form	water white to light straw liquid
2.	Molecular weight	248.4
3.	Specific gravity	1.045
4.	Boiling point	255^0 C (491^0 F)
5.	Refractive Index	1.429

The **COLD DRAWN CARBON WIRE STEEL FIBERS of length 50mm and diameter 1mm are used** in this present investigation.

III. RESULTS AND DISCUSSION

3.1. Compressive Strength Test Result

The cube compressive strength results obtained at the age of 28 days are presented in the above table for 0%, 0.5%, 0.75% and 1.00% total fiber content. The glass fiber content is varied from 0% to 100% in the above table and the results compared with that of plain concrete specimens. Likewise, the results of 0.75% total fiber content and the results for 1% total fiber content are compared with that of plain concrete specimens.

Hence the results presented in the above table shows the variation of compressive strength at the end of 28 days with various percentages of glass fibers of 0%, 25%, 50%, 100% by volume used as replacement of steel fiber in total fiber content of 0%,0.5%, 0.75% and 1.0% by volume.

Table 5. Compressive Strength Test Result

Percentages of fibers in concrete specimens		For 0.50% total fiber content Compressive Strength in N/mm2	For 0.75% total fiber content Compressive Strength in N/mm2	For 1.00% total fiber content Compressive Strength in N/mm2
Glass Fiber %	Steel Fiber %			
1	2	3	4	5
0	100	52.44	53.78	56.44
25	75	51.56	52.89	54.67
50	50	47.11	49.33	51.11
75	25	43.56	44.44	47.11
100	0	41.33	43.11	44.89
Conventional Concrete		38.22	38.22	38.22

3.2 Split Tensile Strength Test

Table 6. Split Tensile Strength Test Results

Percentages of fibers in concrete specimens		For 0.50% total fiber content Split Tensile Strength in N/mm2	For 0.75% total fiber content Split Tensile Strength in N/mm2	For 1.00% total fiber content Split Tensile Strength in N/mm2
Glass Fiber %	Steel Fiber %			
2	3	4	5	6
0	100	4.53	4.81	5.09
25	75	4.31	4.53	4.88
50	50	4.17	4.38	4.67
75	25	3.89	4.17	4.31
100	0	3.68	3.89	3.96
Conventional Concrete		3.54	3.54	3.54

Similarly the split tensile strength test results are presented in the above table for 0%, 0.5%, 0.75%, 1.0% total fiber content. The glass fiber content is varied from 0% to 100% in the above table. The variation of split tensile strength at the end of 28 days with various percentage of glass fibers of 0%, 0.5%, 0.75%, 1.0% is also shown in the above table.

IV. CONCLUSION

1. The compressive strength of dual fiber concrete is found to be maximum at 1.0% total fiber content of steel at 28 days compared to plain concrete. Also, with a total of 1.0 % glass fiber by volume the increase of compressive strength at 28 days compared to plain concrete.
2. The split tensile strength of dual fiber concrete is found to be maximum at 1.0 % total steel fiber content at 28 days compared to plain cement concrete. Also, with a total of 1.0 % glass fiber by volume the increase of split tensile strength in 28 Days compared to plain cement concrete.

V. REFERENCES

[1] IS.456-2000, "Indian Standard Code of Practice for Plain and Reinforced Concrete", Indian Standards Institution, Maniac Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi-2.

[2] IS.516-1959, "Methods of Tests for Strength of Concrete", Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi-2.

[3] Satander Kumar (2005), "Alternate Materials for Civil Engineering Construction", Central Road Research Institute, New Delhi.

[4] Sikder, P.K, Gupta, S and Kumar, S. (2004), "Application of Fiber as Secondary Reinforcement in Concrete", NSW & CW, December.

[5] MORTH Specification for Road and Bridge Works (2001), Fourth Revision.

[6] BIS 10269:1987,"Specification for 53 Grade Ordinary Portland Cement", Bureau of Indian Standard, New Delhi.

[7] BIS 2386:1963, "Methods of Test for Aggregates for Concrete", Bureau of Indian Standard, New Delhi.