SPLIT TENSILE STRENGTH OF FIBER REINFORCED CONCRETE USING SILICA FUME & STEEL FIBERS

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ABSTRACT

To determine the split tensile strength of steel fiber reinforced concrete with 7.5% Silica Fume. The tests were carried out according to standard procedures. The splitting test was used to determine the tensile strength of concrete. In this test, compressive line loads are applied along a vertical symmetrical plane setting up tensile stresses normal to the plane, which ultimately causes splitting of specimen. The formula derived using theory of elasticity has been used to calculate the tensile strength of the time of splitting, it is seen that the composite shows maximum results at 7.5% silica fume with 2.5% steel fibers and increase in strength is about 24.10% over the normal concrete at 7 days. It is observed that for 28 days test results, that the 705% silica fume with 2.5% steel fiber gives optimum results and increases strength about 22.49% over normal concrete.

Keywords: Split Tensile Strength, Silica Fume, Steel Fibers.

I. INTRODUCTION

The use of high strength concrete in construction industry has consistently increased over the past years, which enables to design smaller sections. This as a result reduces the dead weight, allowing sufficiently long spans and more usable areas of buildings. Reduction in mass is also important for sake of economical design of earthquake resistant structures. Such advantages often outweigh the higher production cost of high strength concrete associated with careful selection of ingredients, mix proportioning, curing, and quality control too.

II. SILICA FUME

Silica fume is also known as micro silica has been used as a concrete property enhancing material and practically replacement for the Portland cement for over 25 years. Silica Fume itself is a byproduct in production of th silicon metal, silica fume for using in concrete is available in the following forms;

(a) Densified Form
(b) Palletize Form
(c) Slurry Form
(d) Unidentified Form

Silica Fume is very reactive pozzolans when it has been used in concrete because of its very fine particles, having large sufficient area and high silicon dioxide content there are seberal effects on the properties of fresh and hardened concrete silica fume is used. In the fresh concrete, silica fume affects the water demand of slump. The concrete water demands increases with increased amount of silica fume. The fresh concrete whichcontains the silica fume is more cohesive and less prone in segregreation than with other admixtures such as water reducing or high range water reducing admixtures, the slum loss is actually due to change in chemical reactions. Silica Fume is also knwn as to affect the time of setting and bleeding of fresh concrete.

Fire Reinforced concrete (FRC) may be defined as composited material which is made up of cement, aggregate (fine and coarse) and incorporating discrete discontinous fibers is to bridge across the cracks which develop provides some post cracking ductility. If the fibres used is sufficiently strong, strongly bonded with material and per unit FRC to carry significant stresses over a relatively large strain capacity in the post cracking stage.

III. EXPERIMENTAL PROGRAMME

This test is carried out by applying a compressive load in vertical plane analogous to the load in the middle of two opposite faces of a concrete prism of square crossection. Actually, the load is applied over a strip of small width but since the width of the strip is small as compared to dimensions of the prism, its effect may be neglected. The stress normal to the failure plane is tensile stress. The stresses induced in a rectangular block in the transverse direction due to concreted loads applied in vertical plane as shown in fig: 3.2. In the immediate vicinity of these loads, the stress distribution is same as that produced by concentrated load acting normal to the straight edge of semi infinite plate. Hence if small grooves are removed from around the points of application of the loads, the resultant of the stress acting on each groove will consist of a vertical P accompanied by equal and opposite horizontal thrusts. Then across the vertical section of symmetrical passing through the loads, there are set up tensile stresses.

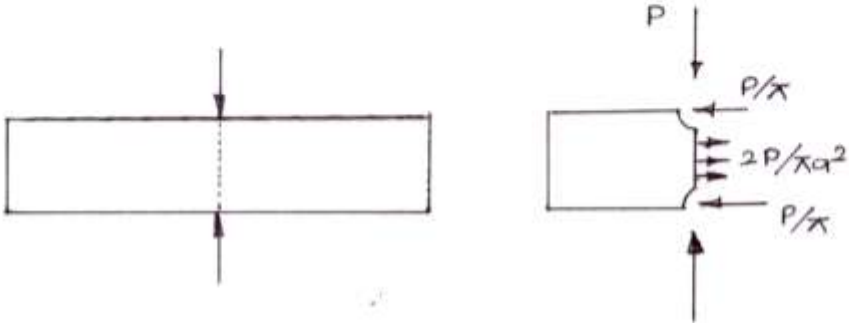

Fig. 1: Split Tensile test on Prism

Stresses induced in a rectangular block subjected to concentrated loads two broken pieces of prism's flexure test were used for split tensile test. This is an indirect test to determine the tensile strength of the concrete. In every case the prism failed in the vertical plane of line loads and splitting failure was observed. The split tensile strength was calculated by the following formula using theory of elasticity:

$$f_t = 2P / \pi a^2 \qquad (1)$$

Where,

a = Side of cube in mm

f_t = Split tensile strength of prism in MPa

P = the load at failure N

An expression for split tensile strength in 3 rd degree polynomial in terms of V_f for 7 days is given by the following equation:

$$F_t = -0.005\,V_f^3 + 0.111V_f^2 - 0.348\,V_f + 4.186 \qquad (2)$$

An expression for split tensile strength in 3 rd degree polynomial in terms of V_f for 28 days is given by the following equation:

$$F_t = -0.006V_f^3 + 0.134\,V_f^2 - 0.430\,V_f + 5.317 \qquad (3)$$

The results of split tensile strength are shown in Table (4.8); the graph is shown in Fig. (2).

Table 4.8: Split Tensile Strength on Prism, MPa

Sr. No.	**Mix. desi.**	**Microsilica Content (%)**	**Fibre Content (V_f)%**	**Split Tensile Strength of Concrete (F_t) (MPa)**		**% variation in Split Tensile Strength**	
				7 days	**28 days**	**7 days**	**28 days**
1	M0	0	0	3.90	4.98	0.00	0.00
2	M1	7.5	0.5	3.95	5.00	1.28	0.40
3	M2	7.5	1.0	4.05	5.12	3.84	2.81
4	M3	7.5	1.5	4.22	5.28	8.20	6.02
5	M4	7.5	2.0	4.35	5.38	11.53	8.03
6	M5	7.5	2.5	4.84	6.12	24.10	22.49
7	M6	7.5	3.0	4.70	6.00	20.51	22.48
8	M7	7.5	3.5	4.58	5.82	17.43	16.86
9	M8	7.5	4.0	4.44	5.58	13.84	14.05
10	M9	7.5	4.5	4.18	5.34	7.17	7.22
11	M10	7.5	5.0	4.10	5.16	5.12	3.61

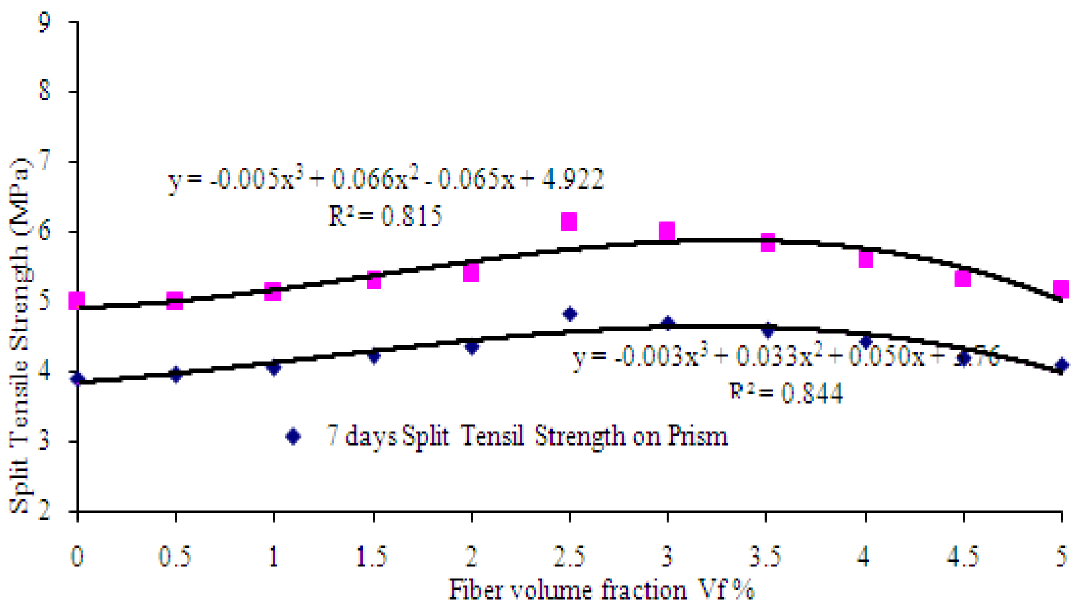

Fig. 4.8 Variation of Split Tensile Strength at the age of 7 & 28 days with respect to fiber content

IV. CONCLUSION

1) While testing silica fume concrete cube spilling of the concrete is observed. However, it is not observed in the case of Silica Fume Fiber Reinforced Concrete due to randomly distributed steel fibers.
2) For all fiber content of silica fume concrete the mode of failure was changed from brittle failure to Ductile failure when subjected to all types of strengths in this study.
3) Split Tensile Strength is found maximum at 7 and 28 days as 4.48 MPa and 6.12 MPa for the fiber content 2.5% and silica fume 7.5% combination.

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