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"TO STUDY THE AFFECT OF SILICA FUME AND STEEL FIBER ON STRENGTH OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT"

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Abstract—In this work evaluate the performance of concrete with silica fume and also replace cement by steel fiber. Silica fume use as a mineral admixture in the concrete work for improves the workableproperties and strength properties of concrete in this study use ordinary Portland cement (43 Grade). In this study silica fume has beenreplacedin ordinary Portland cement(43 Grade) cement,which vary2.5% to 10% at an interval of 2.5% by weight of ordinary Portland cement43 Grade and also steel fiberreplaced inordinary Portland cementwhich varies 2.5% to 10% at an interval of 2.5% by weight of OPC cement. A total24 mixes (trial mix, control mix and variation mix) were prepared for M35concrete &M40of concrete. In this study examine the performance of Cube Compressive strength for 7days and 28 days,Beam Flexural strength28 days and Cylinder Splitting tensile strengthfor 28 days respectively. Total numbercubesspecimen140, cylinders 60 and beams60, which were cast for influence of silica fume and steel fiberon concrete. These Concrete cubes, beams, cylinders specimens were cured in waterunder normal atmospheric temperature. On the basis of result thatsilica fume and steel fiberconcrete was found to increase in all strength and durability of variation mix of concrete on all age when compared to normal concrete.Its use should be promoted for better performance as well as for environmental sustainability.

I. INTRODUCTION

Newly, harsh environmental pollution through and system have formed anincrease in the industrial wastes and sub graded by-product which used as Supplementary Cementitious Materiallike asfly ash, micro silica, (GGBS)ground granulated blast furnace slag etc. The use of Supplementary Cementitious Material in concrete constructions work not only prevents these materials to make certain the pollution but also to add to theproperties of concrete in fresh and hydrated states. The Supplementary Cementitious Material can be separated in two kinds based on their type of retort: hydraulic and pozzolanic. Hydraulic materials act in response directly with water to form cementitious compound like Silica fume. Pozzolanic materials do not belong to homeof cementitious property but when used with cement or lime act in response with calcium hydroxide to form products possessing cementitious prosperities. Silica fumeis identified to produce a highstrength concrete and is used as a cement replacement, in arrangement to reduce the cement substanceand as stabilizer to improve concrete properties.

II. LITERATURE REVIEW

J.D.Chaitanyakumar, G.V.S. Abhilash,P.Khasim Khan, G.Manikantasai, V.Taraka ram(2016)
The present study concluded that the addition of glass fibres at 0.5%, 1%, 2% and 3% of cement reduces the cracks under different loading conditions.

- It has been observed that the workability of concrete increases at 1% with the addition of glass fibre.
- The increase in compressive strength, flexural strength, split tensile strength for M-20 grade of concrete at 7 and 28 days are observed to be more at 1%. We can likewise utilize the waste product of glass as fibre.

Jinsong Lei, Zhiping Zhou, ZhangtengSun(2015) Based on the range theory, the suitable mixproportion of steel fiber reinforced concrete is obtainedthrough the orthogonal experiment. Conclusions are asfollows:

- Steel fiber content is mainly influence the flexural strength of steel fiber reinforced concrete. With the increase of dosage of steel fiber, flexural strength of steel fiber reinforced concrete increases. Coarse aggregate gradation mainly affects the compressive strength of steel fiber reinforced concrete.
- Water cement ratio is the main factor influencing the compressive strength of steel fiber reinforced concrete. The strength of steel fiber reinforced concrete with water-cement ratio is inversely proportional to the increase.

C.G. Konapure, V.S Dasari(2015) The following conclusions could be drawn from the present investigation.

- As silica fume content increases the unit weight of concrete decreases. For same % of addition of steel fiber, 15% silica fume gives lower density with 1.5% of chemical admixture. Compaction factor of concrete increases with increase in silica fume content.
- For high grade steel fiber reinforced concrete with silica fume must require more than 1.5% of chemical admixture to achieve homogeneous and workable mix. Increment of silica fume content up to 15% given good result in terms of compressive strength and flexural strength. .

III. EXPERIMENTALPROGRAM:

3.1 MATERIAL CHARACTERISATION

3.1.1 Cement

Portland cement is used in the first series and then pozzolanaportland cement is used to economize the mortar. The quality of cementis judged by doing several tests on cement like consistency test, specific gravity test, initial setting time and final setting time. Initially, our aim was not to replace the cement and used OPC cement but later seeing the positive results OPC is superseded by PPC and a portion of cementations content is replaced by Kota stone slurry. Cement used must be free from any lumps and should be in good condition.(Indian Standard 2000) .

3.1.2 Water

As per IS code 10262:2009 water used for the drinking purpose can be used for the making of concrete and mortar.

3.1.3 Steel fiber

The fiberpower, hardness, and the capacity of the fibers to link with the concrete are mainfiber reinforcement properties. Connection is needy on the aspect ratio of fiber. Steel fiber has a fairly high strength and elasticitymodulus. Steelfibers corroded by alkaline environment. In this study use steel fibers have aspect ratio (50).

3.1.3 Fine Aggregates

Which partials have less than size 4.75mm called Fine aggregate (sand) and Sand shall be fresh hard, hard-wearing, angular, sharp, and free from mica, silts, and alkalis, organic and vegetable matters. It should not contain more than 5% of clay or silt. Sand should be perfectly dry before measured. IS code specification classifying the fine aggregate Zone-1 to Zone-4grade.

3.1.5 Mineral admixtures

Byproductmake concrete mix more economical, shrink permeability, improve strength properties, and improve other concrete properties. Mineral admixtures (byproduct) have an effect on the nature of the concrete hydraulic or Pozzolanicproperties. (Fly ash) and (Silica fume)**Mineral admixtures**. (Fly ash) and (Silica fume) use with Portland cement.

3.2 Control Mix Proportion For M35 with 125mm slump

S.No.	Materials	Weight(Kg)
1	Cement(OPC-43)	404
2	Coarse Aggregate(20mm)	693
3	Coarse Aggregate(10mm)	461
4	Fine Aggregate	702
5	Water	162
6	Admixture @ 1.2% of cement	4.80
7	W/C Ratio	0.40

3.2.1Control Mix Proportion For M40with 135mm slump

S.No	Materials	Weight(Kg)
1	Cement(OPC-43)	453
2	Coarse Aggregate(20mm)	683
3	Coarse Aggregate(10mm)	455
4	Fine Aggregate	664
5	Water	167
6	Admixture @ 1.6% of cement	7.24
7	W/C Ratio	0.37

IV. RESULTS AND ANALYSIS

4.1TESTING OF SPECIMENS

4.1.1 ***Density Test Result***

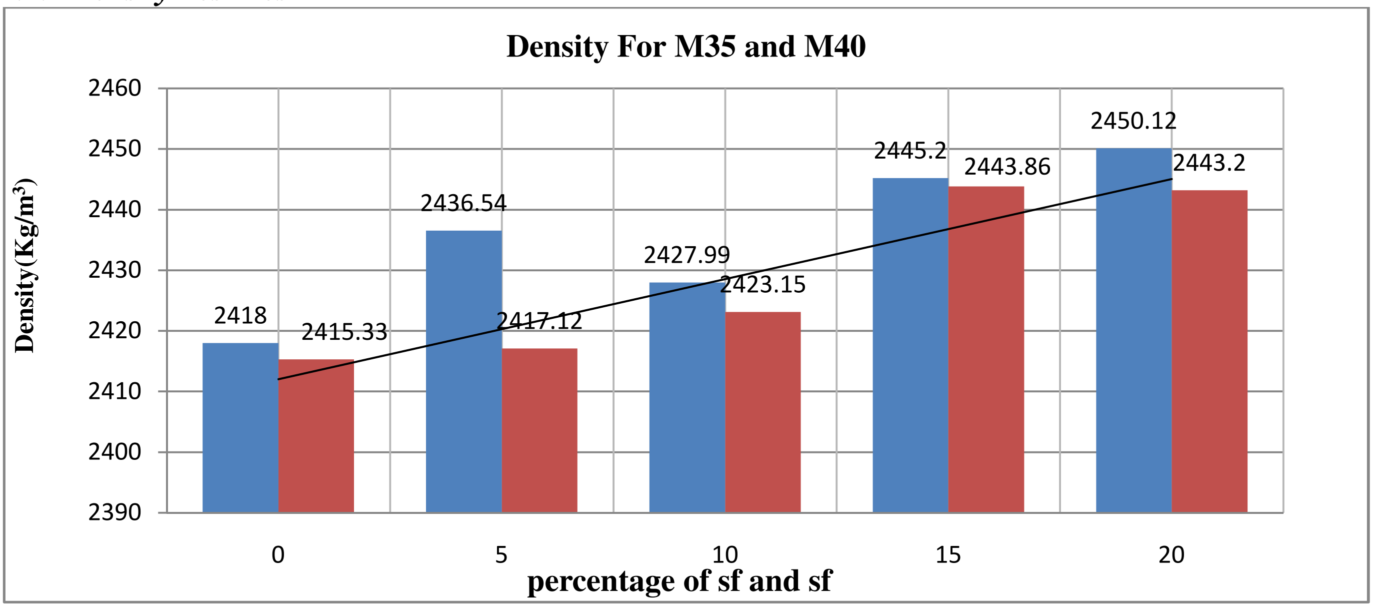

Fig-4.1: Silica fume and steel fiber Effect on Density of Hardened Concrete (M-35 andM-40) on Replace.

4.1.2Compressive strength

Table 4.1Cube Compressive Strength (28 Days) on Replace OPC by Silica fume and steel fiberM35 Grade

S.No	Mix (Cement+Silicafume+steel fiber)	Average	
		Load(N)	Compressive Strength(N/mm^2)
1	OPC+ Silica fume and steel fiber(100+0+0)	974.3	43.30
2	OPC+Silica fume and steel fiber(95+2.5+2.5)	995.6	44.25
3	OPC+Silica fume and steel fiber(90+5+5)	1002.3	44.54
4	OPC+Silica fume and steel fiber(85+7.5+7.5)	1015.6	45.14
5	OPC+Silica fume and steel fiber(80+10+10)	1021.0	45.37

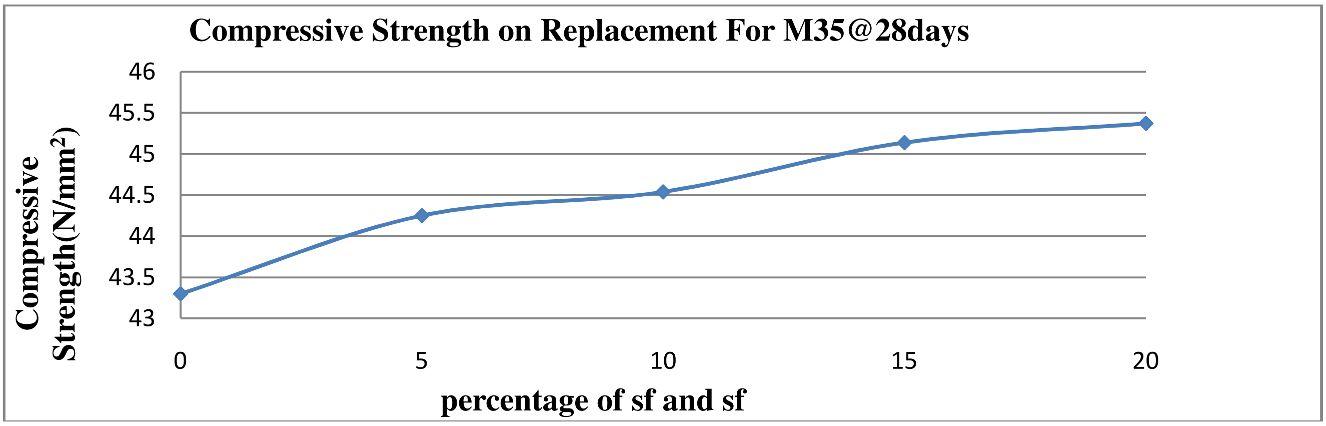

Fig.-4.2Silica fume and steel fiber Effect on M35 Grade on Replacefor 28 Days Cube Compressive Strength

Table 4.2Cube Compressive Strength (28 Days) on Replace OPC by Silica fume and steel fiber for M40Grade

S.No	Mix (Cement+Silicafume+steel fiber)	Average	
		Load(N)	Compressive Strength(N/mm^2)
1	OPC+ Silica fume and steel fiber(100+0+0)	1086.67	48.29
2	OPC+Silica fume and steel fiber(95+2.5+2.5)	1101.00	48.93
3	OPC+Silica fume and steel fiber(90+5+5)	1120.33	49.79
4	OPC+Silica fume and steel fiber(85+7.5+7.5)	1130.33	50.23
5	OPC+Silica fume and steel fiber(80+10+10)	1134.67	50.42

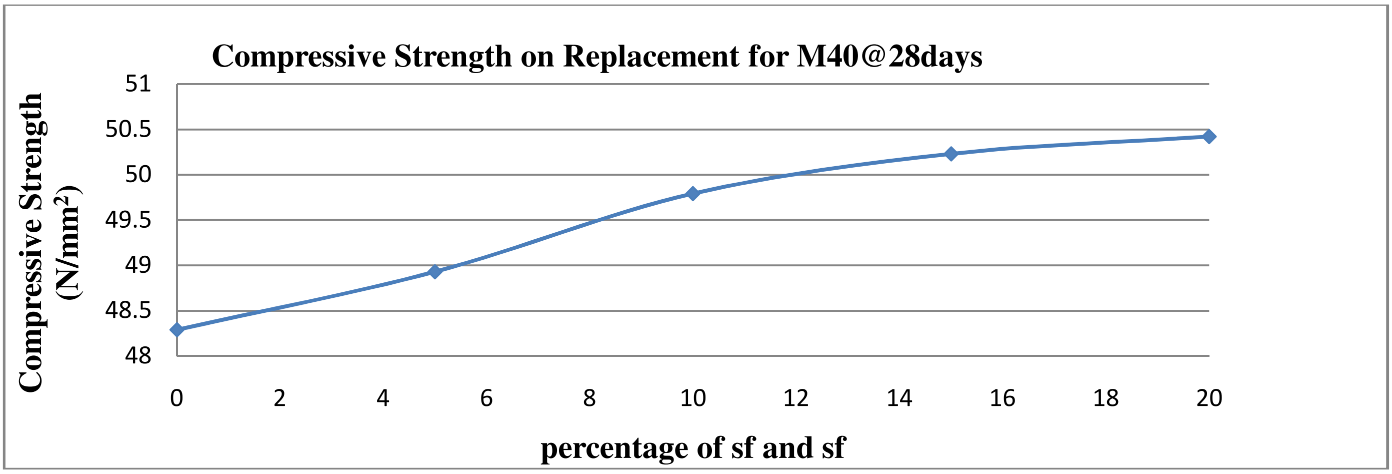

Fig. 4.3 Silica fume and steel fiber Effect on M40 Grade on Replacefor 28 Days Cube Compressive Strength

4.3 Flexural Strength

Table 4.3 beam flexural Strength(28 Days) on Replace OPC by Silica fume and steel fiber For M35 Grade

S.No	Mix (Cement+Silicafume+steel fiber)	Average	
		Load(N)	Flexural Strength(N/mm^2)
1	OPC+ Silica fume and steel fiber(100+0+0)	22.33	5.96
2	OPC+Silica fume and steel fiber(95+2.5+2.5)	24.67	6.58
3	OPC+Silica fume and steel fiber(90+5+5)	25.33	6.76
4	OPC+Silica fume and steel fiber(85+7.5+7.5)	26.67	7.12
5	OPC+Silica fume and steel fiber(80+10+10)	27.33	7.29

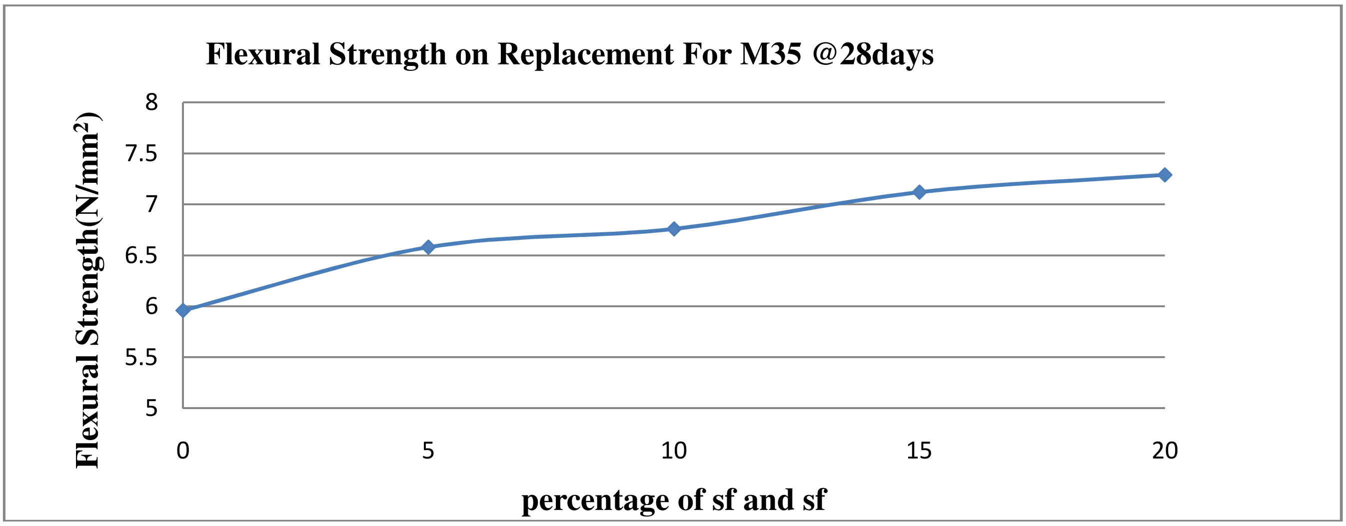

Fig. 4.4Silica fume and steel fiber Effect on M35 Grade on Replacefor 28 Days Beam Flexural Strength

Table 4.4 Beam flexural Strength (28 Days) on Replace OPC by Silica fume and steel fiberFor M40 Grade

S.No	Mix (Cement+Silica fume steel fiber)	Average	
		Load(N)	Flexural Strength(N/mm^2)
1	OPC+ Silica fume and steel fiber(100+0+0)	25.67	6.85
2	OPC+Silica fume and steel fiber(95+2.5+2.5)	28.00	7.47
3	OPC+Silica fume and steel fiber(90+5+5)	29.33	7.83
4	OPC+Silica fume and steel fiber(85+7.5+7.5)	30.10	8.03
5	OPC+Silica fume and steel fiber(80+10+10)	32.67	8.72

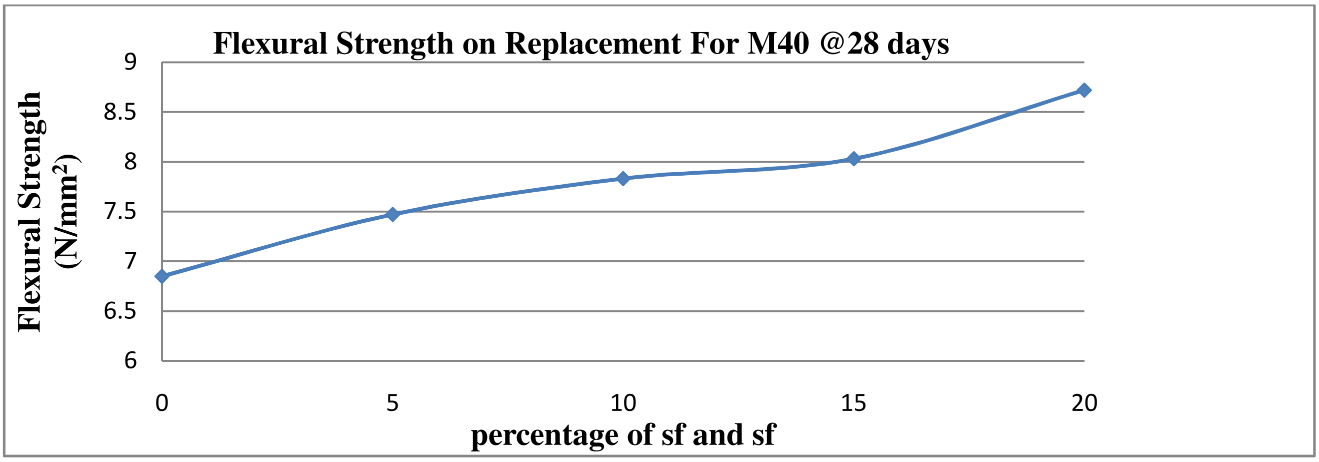

Fig. 4.5 Silica fume and steel fiber Effect on M40 Grade on Replacefor 28 Days Beam Flexural Strength

4.3.4 Splitting Tensile Strength

Table 4.5 Cylinder Splitting Tensile Strength (28 Days) on Replace OPC by Silica fume and steel fiberFor M35 Grade

S.No	Mix (Cement+Silica fume+ steel fiber)	Average	
		Load(N)	Splitting Tensile Strength(N/mm^2)
1	OPC+ Silica fume and steel fiber(100+0+0)	191.67	2.70
2	OPC+Silica fume and steel fiber(95+2.5+2.5)	205.67	2.89
3	OPC+Silica fume and steel fiber(90+5+5)	211.00	2.97
4	OPC+Silica fume and steel fiber(85+7.5+7.5)	214.33	3.02
5	OPC+Silica fume and steel fiber(80+10+10)	227.33	3.20

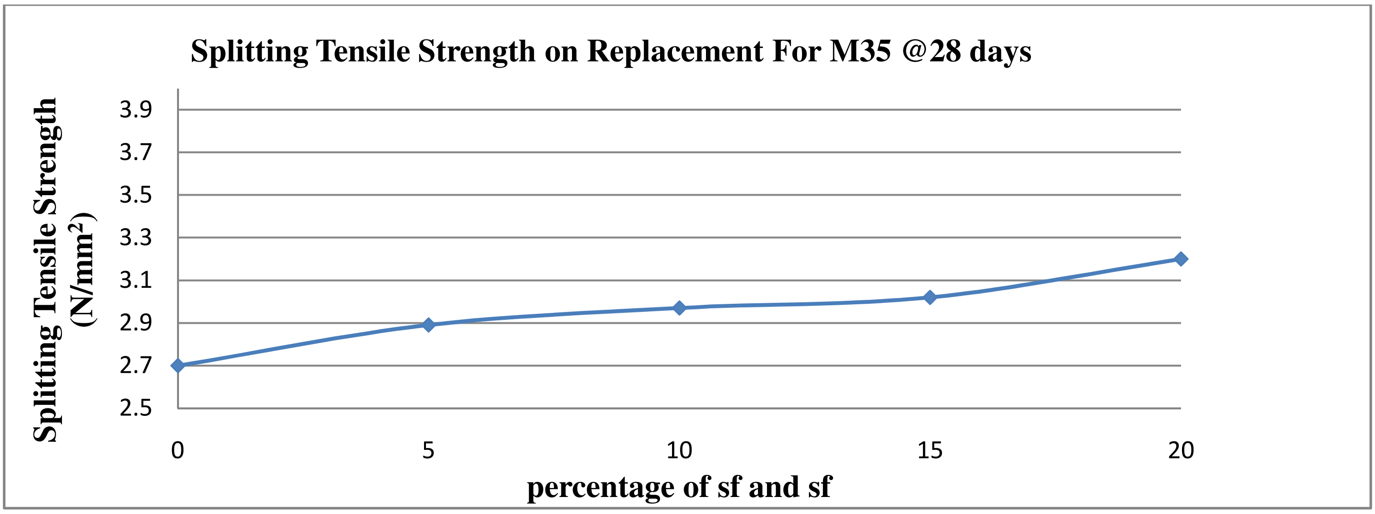

Fig. 4.6 Silica fume and steel fiber Effect on M35 Grade on Replacefor 28 Days Cylinder Splitting Tensile Strength

Table 4.6 Cylinder Splitting Tensile Strength(28 Days) on Replace OPC by Silica fume and steel fiber For M40 Grade

S.No	Mix (Cement+Silica fume+ steel fiber)	Average For Splitting	
		Load(N)	Strength(N/mm^2)
1	OPC+ Silica fume and steel fiber(100+0+0)	211.00	2.97
2	OPC+Silica fume and steel fiber(95+2.5+2.5)	234.67	3.30
3	OPC+Silica fume and steel fiber(90+5+5)	251.67	3.54
4	OPC+Silica fume and steel fiber(85+7.5+7.5)	261.33	3.68
5	OPC+Silica fume and steel fiber(80+10+10)	268.67	3.78

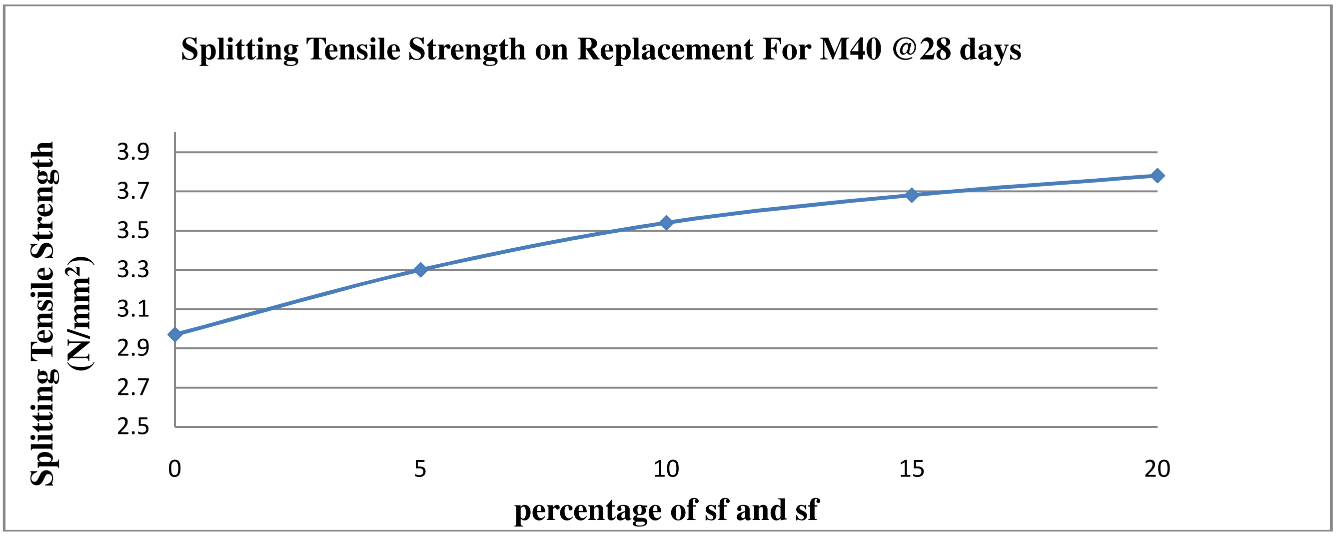

Fig. 4.7 Silica fume and steel fiber Effect on M35 Grade on Replacefor 28 Days Cylinder Splitting Tensile Strength

V. CONCLUSIONS

Evaluate the results of density by hardened concrete specimens, it give conclusions

- Concrete cube compressive strength was better in replace of silica fume and steel fiber(50) in (Grade 43) cement against to control mix. The cube compressive strength replace better than control mix for (M35 Grade) & (M40 Grade).
- In this work partial replace of 20% silica fumeand steel fiber(50) in (Grade 43) cement for M35 grade, this cube compressive strength was 5% better than against to M35 grade concrete control mix. Similarly partial replace of 20% silica fumeand steel fiber(50) in (Grade 43) cement for M40 grade, this cube compressive strength was 5% better than against to M40 grade concrete control mix

Evaluate the results of flexural Strength by beam specimens

- Concrete beamFlexural strength was better in replace of silica fumeand steel fiber(50) in (Grade 43) cement against to control mix. The beamFlexural strength replace better than control mix for (M35 Grade) & (M40 Grade).
- In this work partial replace of 20% silica fumeand steel fiber(50) in (Grade 43) cement for M35 grade, this beamFlexural strength was 22% better than against to M35 grade concrete control mix. Similarly partial replace of 20% silica fume and steel fiber(50) in (Grade 43) cement for M40 grade, this beamFlexural strength was 27% better than against to M40 grade concrete control mix

Evaluate the results of split Tensile Strength by cylinder, it give conclusions

- Concrete cylinderSplit tensile strength was better in replace of silica fume and steel fiber(50) in (Grade 43) cement against to control mix. The cylinderSplit tensile strength better than control mix for (M35 Grade) & (M40 Grade).
- In this work partial replace of 20% silica fume and steel fiber(50) in (Grade 43) cement for M35 grade, this cylinderSplit tensile strength was 18.5% better than against to M35 grade concrete control mix. Similarly partial replace of 20% silica fume and steel fiber(50) in (Grade 43) cement ,Split tensile strength was 27.27% better than against to M40 grade concrete control mix.

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