An Experimental Study Strength Properties of Glass Fibre Reinforced Concrete With Partial Replacement of Cement With Silica Fume

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Abstract- *Since advent of civilization various types of cementitous materials have been used for construction practices. The advent of Ordinary Portland Cement (OPC) recast the construction activities completely. From olden days concrete endure from below tensile strength, limited ductility and small defiance to cracking. To overcome these weaknesses a new variety of concrete is desired. Therefore here is an experimental study proposing changes to the conventional concrete to increase fire resistance, increase crack resistance, increase ductility and flexural strength by partial pinch hitter of silica fume to the cement and introducing fibers in the preparation of the concrete for M30 grade of concrete.*

In this connection an experimental in-visitation was carried out to descry the compressive, split tensile and flexural strengths with the use of glass fibres and Silica fume in concrete. The glass fibres were added by 0.5%,1.0%,1.5% and 2.0% by volume and cement was supplant by Silica fume in three different percentages of 5%,7.5%,10%,12.5%,15% and 17.5%.by weight of cement..Glass fibre Reinforced Concrete (GFRC) is tested for Compression, Split tensile and flexural strengths. Therefore The results of this study indicates the improving of compressive strength ,flexural strength and Split tensile strength exhibited the highest enhancement with 10% to 15% silica fume replacement and glass fibres at 1% respectively.

Keywords- Standard concrete, Glass Fibres, Silica Fume, compressive strength, Tensile strength.

I. INTRODUCTION

Concrete is widely used construction material for various types of structures due to its structural stability and strength. Nowadays the world is witnessing the construction of more challenging and difficult Engineering

So the concrete need to possess very high strength and sufficient workability The usage and behavior as well as the durability of concrete structures, built during the last first half of the century with Ordinary Portland Cement (OPC) and plain round bars of mild steel, the ease of procuring the constituent materials (whatever may be their qualities) of concrete and the knowledge that almost all combination of constituents is leads to mass of concrete have bred contempt. Strength was stressed without a thought on the durability of structures. As the consequence of liberties taken, the durability of concrete.

The Ordinary Portland Cement is the main ingredients used for the production of concrete and had no alternative in the civil construction industry. Production of cement involves loose of large amounts of carbon dioxide gas in the atmosphere the major contribution for green house-effect and the global-warming, hence it is inevitable either-to search for another material or partly replace it by some other material. The search for any such material can be used as a alternative or as a supplementary for cement should lead to global sustainable development and lowest-possible environmental impact. Substantial-energy and cost savings can result when industrial by products are used as a partial replacement of cement. Fly ash, Ground Granulated Blast furnace Slag, Rice husk ash, High Reactive Met kaolin, silica fume are some of the pozzolanic materials which has to used in concrete as partial replacement of cement. In study the impact and use of the pozzolanic materials the cement replacements and the results green outraging.

Silica fume is an by-product in the production of silicon alloys of Ferro-chromium, Ferro -manganese, calcium silicon etc. Silica fume which is 10 times finer than cement particles. On pozzolanic materials are incorporated to concrete, the silica has in these materials combine to the calcium-hydroxide released during the hydration of cement and forms additional calcium-silicate-hydrate (C – S – H), which raise the durability and the mechanical properties of concrete. In this book suitability of silica fume has tolled be replacing cement with silica fume at changing percentage and the strength parameters were compared with conventional concrete.

Researchers all over places are urban high performance concrete by placing various fibers, admixtures in different proportions. Various fibers like glass, carbon, Poly- propylene and fibers provide improvement in concrete properties like tensile strength, fatigue characteristic, durability, shrinkage, impact, erosion resistance the serviceability of concrete. Because such characteristics of Fiber Reinforced Concrete is found many applications in civil engineering field. Glass Fiber Reinforced Concrete (GFRC) is a recent introduction in the field of concrete technology. GFRC has advantage of being lightweight, high compressive strength and flexural strength. Fibers lengths 35 mm are used in spray applications and 25 mm length premix applications. Glass fiber has high tensile strength (2-4GPa) and elastic modulus (70-80 GPA), brittle stress strain characteristics and low -creep at room temperature. /Glass fibers are usually round and straight with diameters of 0.005to 0.015mm. They bundled with diameter of 1mm.

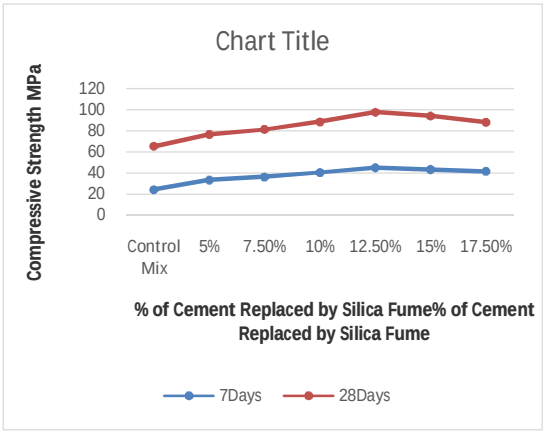
II. METHODOLOGY

The experimental investigation says casting and testing 11 sets along with concrete mix. Each set comprise to 6 cubes, 6 cylinders and 3 beams for determining compressive, tensile and flexural strengths respectively. On taking different percentages of fly ash for find optimum content for the replacement of the cement, then adding steel & Glass-fibers individually for cement accordingly with the different percentages to a weight of cement and finding the optimum percentage of fibers.

III. RESULTS

1. Compressive Strength Results

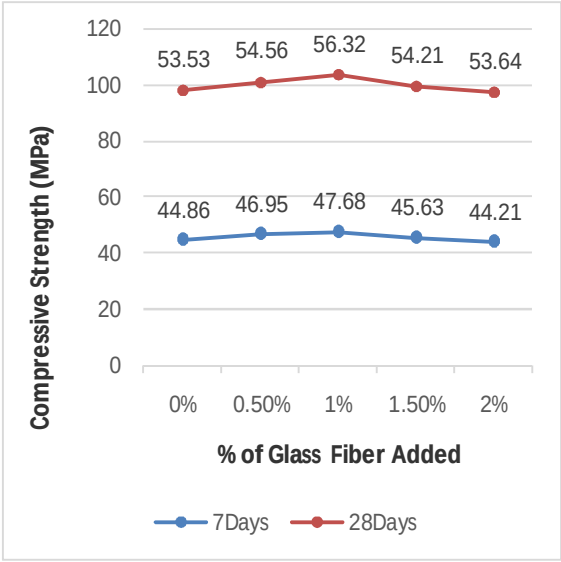
S.No	% of Cement Replaced by Silica Fume	Compressive Strength MPa	
		7Days	28Days
1.	Control Mix	23.98	41.35
2.	5%	33.15	43.51
3.	7.5%	36.12	45.12
4.	10%	40.25	48.21
5.	12.5%	44.85	52.86
6.	15%	43.03	51.23
7.	17.5%	41.26	46.85



Compressive Strength Results

2. Compressive Strength Results of Silica Fume and Glass Fibers

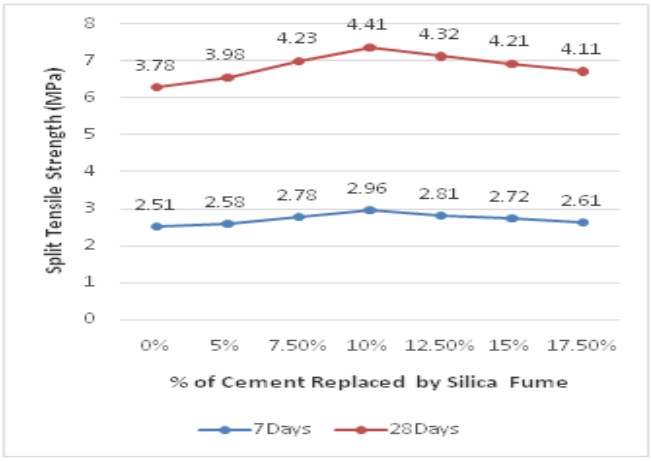
S.No	Optimum Value of Silica Fume(12.5%) + % of Glass Fiber Added	Compressive Strength (MPa)	
		7Days	28Days
1.	0%	44.86	53.53
2.	0.5%	46.95	54.56
3.	1%	47.68	56.32
4.	1.5%	45.63	54.21
5.	2%	44.21	53.64



Compressive Strength Results of Silica Fume and Glass Fibers

3. Split Tensile Strength Results

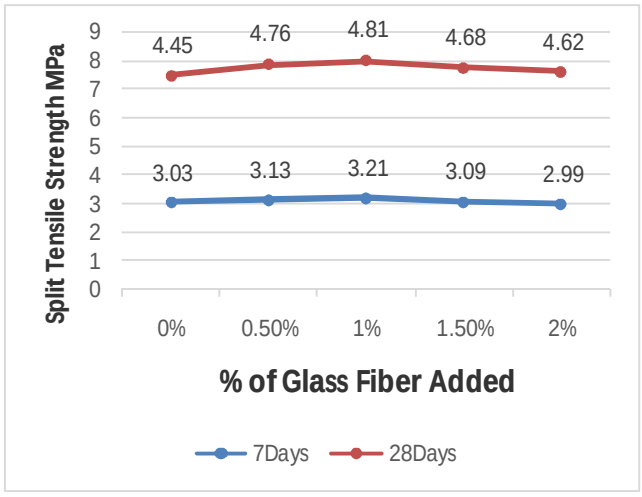
S.No	% of CementReplaced by Silica Fume	Split Tensile Strength (MPa)	
		7Days	28Days
1	0%	2.51	3.78
2	5%	2.58	3.98
3	7.5%	2.78	4.23
4	10%	2.96	4.41
5	12.5%	2.81	4.32
6	15%	2.72	4.21
7	17.5%	2.61	4.11



Split Tensile Strength Results

4. Split Tensile Strength Results Silica Fume and Glass Fibers

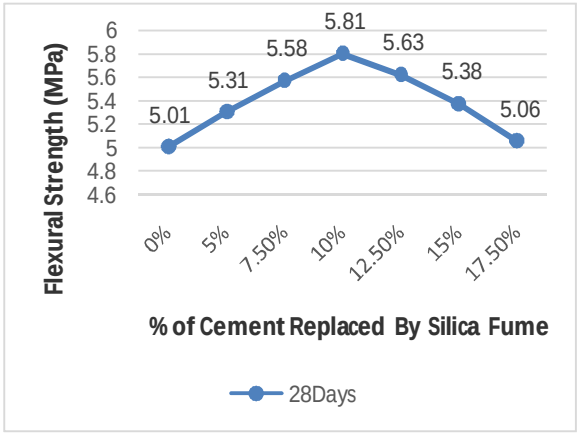
S.No	Optimum Value of Silica Fume(12.5%) + % of Glass Fiber Added	Split Tensile Strength MPa	
		7Days	28Days
1.	0%	3.03	4.45
2.	0.5%	3.13	4.76
3.	1%	3.21	4.81
4.	1.5%	3.09	4.68
5.	2%	2.99	4.62



Split Tensile Strength Results of Silica Fume and Glass Fibres

5. Flexural Strength Results

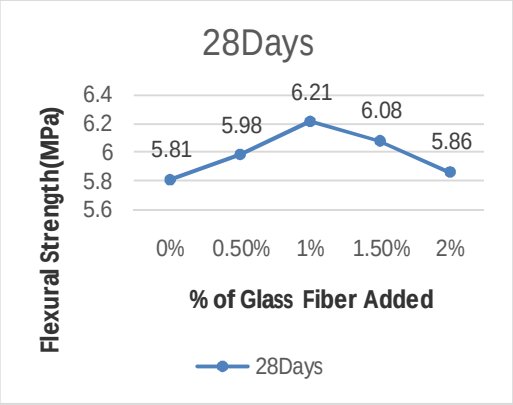
S.No	Optimum Value of Silica Fume(12.5%) + % of Glass Fiber Added	Flexural Strength(MPa)
		28Days
1	0%	5.81
2	0.5%	5.98
3	1%	6.21
4	1.5%	6.08
5	2%	5.86



Flexure Strength Results

6. Flexural Strength Results of Silica Fume and Glass Fibers

S.No	Optimum Value of Silica Fume(12.5%) + % of Glass Fiber Added	Flexural Strength(MPa) 28Days
1	0%	5.81
2	0.5%	5.98
3	1%	6.21
4	1.5%	6.08
5	2%	5.86



Flexural Strength Results of Silica Fume And Glass Fibers

IV. CONCLUSION

From the corollary its terminate the silica fume is a surpass re-placement of cement. The quality of strength rise in silica fume concrete is higher. Later performing all stretchs and analysing their corollary, the following terminates had be derived

1. with the raise in water/cement ratio ratio strength of concrete decreases.
2. Workability of concrete lost as increase with % of silica fume.
3. The optimum grace of compressive strength has gained in 12.5% re-placement of silica fume.
4. The compressive strength is increased 36% for replacement of cement by 12.5% silica fume and accrual of 1% glass fiber.
5. The percentage raised in split tensile and flexural strength's of 27% and 25% at 28days of 1% fiber with 10% silica fume in concrete

At the end some percent of accrual of Glass Fibre gain that gradual lose in strength. Maximum compressive, flexural and split tensile strength is gaining in 1.0%addition of Glass Fibre. Saddling Glass Fibre upto1% only not exceeds the limit. The durability criterion gradual raised based on the gain of Glass Fibre.

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