THOMSON REUTERS
ENDNOTE

[Patel, 3(12): December 2016]
DOI- 10.5281/zenodo.200510

ISSN 2348 – 8034
Impact Factor- 4.022

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

STUDY OF COMPRESSIVE STRENGTH OF CONCRETE WITH GLASS FIBER AND SILICA FUME

Akash Kumar Patel*[1] and Dr.Rajiv Chandak[2]

*[1]Student M.E Structural Engineering, Department Of Civil Engineering Jabalpur Engineering College, Jabalpur (M.P.) India,

[2]Head of Department, Department of Civil Engineering Jabalpur Engineering College Jabalpur (M.P.) India

ABSTRACT

The aim of this paper is to study the behavior of M-35 grade of concrete to determine the compressive strength by partially replacement of cement by mineral admixture such as silica fume and also added Glass fiber. Cement was partially replaced by silica fume in 10% by weight of cement and glass fibers in 1%, 2%, and 3% .The tests were performed according to Bureau of Indian standards. The results thus obtained were compared and examined with respect to the control specimen. It was found that addition of glass fiber in concrete they give variation in strength.

Keywords*: Portland pozzolana cement (ppc), Silica Fume, Glass Fiber, compressive strength, compressive testing machine.*

I. INTRODUCTION

In the world, concrete is most widely used construction material they are made in any form and shape. The strength and durability of concrete can be changed by making appropriate changes in its ingredient like cementation material, aggregate and water and by adding some special ingredient like silica fume and Glass fiber. They are produced better strength in concrete.

The presence of micro cracks in the mortar aggregate produce weakness in concrete they can be removed by inclusion of silica fume with Glass fiber. They are composite material can be introduced into its resist crack growth.

The Glass fiber are resist the axial compressive force in the cube form so they produce better compressive strength in concrete Silica fume is known to produce a high strength concrete and is used in two different ways as a cement replacement, in order to reduce the cement content (usually for economic reasons) and as an additive to improve concrete properties (in both fresh and hardened states).in general, the character and performance of fiber concrete changes with varying concrete formulation as well as the fiber material type.

The fiber can be imagined as an aggregate with an extreme deviation in shape from the rounded smooth aggregate. The fibers interlock and entangle around aggregate particles and considerably reduce the workability, while the mix becomes more cohesive and less prone to segregation. The fibers are dispersed and distributed randomly in the concrete during mixing, and thus improve concrete properties in all direction. Fiber helps to improve the compressive strength.

II. EXPERIMENTAL DETAILS

Material Used

material used in the study were cement (PPC), fine aggregate (river sand passing through 4.75 mm), coarse aggregate (crushed granite stone 60% passing through 20mm and 40% passing through 10mm), Silica Fume, Glass Fiber, and Water. The Table no. 1 and table no. 2 gives the physicals and chemicals properties of silica fume. A brief description of the material used in this research work is presented below.

Cement

For making concrete PPC grade cement (ACC) was used.

[Patel, 3(12): December 2016]
DOI- 10.5281/zenodo.200510
ISSN 2348 – 8034
Impact Factor- 4.022

Fine Aggregates

The fine aggregates used in this investigation is Narmada River sand passing through 4.75 mm sieve with specific gravity of 2.62. The grading zone of fine aggregates is zone II as per Indian standard specification.

Coarse Aggregates

Machine crushed broken stone angular in shape was used as coarse aggregates. There are two fraction of coarse aggregates was used. The size of coarse aggregates 20mm with specific gravity of 2.82, and size of coarse aggregates 10mm of specific gravity 2.82.

Water

Ordinary clean portable water free from suspended particles and chemical substances is used for both mixing and curing of concrete.

Advantages of Glass Fiber:

- Chemical resistance high modulus of elasticity.
- Easy mixing.
- Rust proof.
- Increased durability.
- Greater impact resistance.
- Suitable for both premix and spray.
- Resistance surface cracking.
- It is particularly suited to the preparation of pre-bagged mixes of special mortar or renders.
- It is may also be used in precasting**.**

Table 1 Typical physical properties of silica fume

S.NO.	Main Element	Percentage %
1	Partical size	<1 µm
2	Bulk Density	610
3	Moisture content	0.85
4	Specific Gravity	2.22
5	Fineness M2/kg	17000-20000

Table 2 Typical Chemical properties of silica fume

s.no.	Main Element	Percentage %
1	Silicon (% as SiO2	>85
2	Aluminium (% as Al2O3)	<1
3	Iron (% as Fe2O3)	<1
4	Calcium (% as CaO)	<1
5	Magnesium (% as MgO)	<1
6	Sodium (% as Na2O)	<1
7	Potassium (% as K2O)	<1
8	Chloride (% as Cl)	<0.3
9	Loss on ignition (%)	<3.19
10	Sulfate (% as SO4)	<0.3

[Patel, 3(12): December 2016]
DOI- 10.5281/zenodo.200510
ISSN 2348 – 8034
Impact Factor- 4.022

III. TEST SPECIMEN DETAILS

Experiments were conducted on cubes.The cube specimen of dimensions 150mm x 150mm x150 mm are used. The ingredient used in concrete was PPC (ACC), Local River sand confirming to zone II (specific gravity 2.62) and clean portable water. Design mixes of M-35 were used to prepare the specimens. Cement was partially replaced by 10% of Silica Fume by weight and also added1%, 2%, and 3% of glass Fiber by weight of cement

IV. EXPERIMENTAL RESULTS & DISCUSSIONS

For cube specimen total one set of cubes A (A1 ,A2 ,A3 ,A4) were tested for their compressive strength for different proportion of Glass fiber and constant rate of silica fume such as A set for M35 (0%,1%,2%,3% of steel fiber with replaced 10% silica fume) respectively. It was observed that the specimen set A (A2) has maximum compressive strength in 28 days.

V. RESULTS

The compressive strength values at 7 and 28 days of curing are shown in Table no.3 and Table no.4.There is an increase in compressive strength of sets A. All other concrete mixes containing silica fume and Glass fiber show a variation in strength with the increase in glass fiber content.

Result of Compressive strength testing for 7 days with 10% of silica fume showing in Table no.3

Grade	**M35**		
Days	**28days**		
% of Glass fiber with Silica fume	**Cube sets**	**Compressive Strength (N/mm2)**	**Average Compressive Strength (N/mm2)**
0%	A1	31.5	31.5
		31.1	
		32	
1%	A2	33.78	33.63
		33.33	
		33.78	
2%	A3	32	33.04
		33.78	
		33.33	
3%	A4	33.33	32.27
		32	
		31.5	

[Patel, 3(12): December 2016]
DOI- 10.5281/zenodo.200510

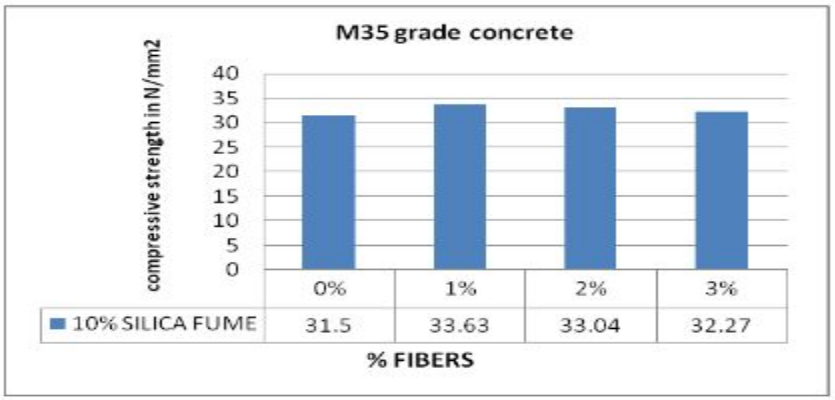
ISSN 2348 – 8034
Impact Factor- 4.022

Compressive strength testing for 28 days with 10% of silica fume showing in Table no.4

Grade	M35		
Days	28days		
% of Glass fiber with Silica fume	Cube sets	Compressive Strength (N/mm2)	Average Compressive Strength (N/mm2)
0%	A1	41.8	43.84
		43.5	
		46.22	
1%	A2	46.22	46.54
		46.7	
		46.7	
2%	A3	45.78	46.22
		46.22	
		46.67	
3%	A4	46.22	45.18
		45.33	
		44	

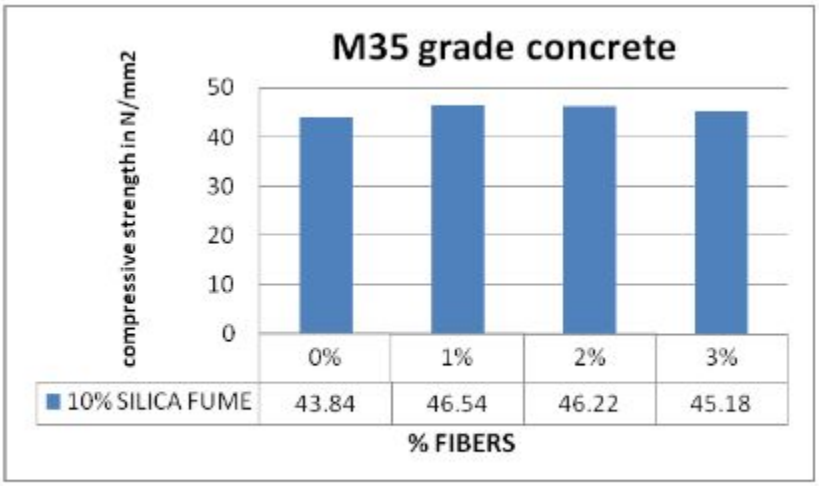
VI. DISCUSSION ON RESULTS

Table shows the results of comprehensive strength experimental investigation on the behavior of axially loaded specimen's i.e. compressive strength specimen strengthened with replacing10 percentage of silica fume and add to different percentage of glass fiber. Form the result for 7 days and 28 days, specimen sets A(A1,A2,A3,A4) are given the effective results compare to conventional method cube for compressive test. The all cube results in graph from in below.



Graph 1 –Showing the variation of the compressive strength in 7 days

ISSN 2348 – 8034
Impact Factor- 4.022



Graph 2 –Showing the variation of the compressive strength in 28 days

VII. CONCLUSIONS

The present study concluded that the addition of glass fiber at 1%, 2%, 3% of cement in additional form the cracks under loading condition.

Compressive Strength Results For 7 Days

- Sets A2 increase the strength 6.76% compare to conventional concrete sets A1.
- Sets A3 increase the strength 4.9% compare to conventional concrete sets A1.
- Sets A4 increase the strength 2.44% compare to conventional concrete sets A1.

Compressive Strength Results For 28 Days

- Sets A2 increase the strength 6.15% compare to conventional concrete sets A1.
- Sets A3 increase the strength 5.42% compare to conventional concrete sets A1.
- Sets A4 increase the strength 3.05% compare to conventional concrete sets A1.

Ti has been observed that the increase in compressive strength for M-35 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 fiber.

The major effects due to Silica fume additions

Improve strength of concrete at all ages at optimum cement replacement levels. The strength development of concretes with silica fumes differently depending on the content of silica fume and on the curing condition, as well as binder characteristics.

- Reduction heat of hydration, and also reduced water permeability of concrete.

Improved sulphate resistance of concrete.

[Patel, 3(12): December 2016]
DOI- 10.5281/zenodo.200510
ISSN 2348 – 8034
Impact Factor- 4.022

REFERENCES

1. *Almusallam, A.A., Beshr, H., Maslehuddin, M., Al-Amoudi, O.S.B.: Effect of silica fume on the mechanical properties of low quality coarse aggregate concrete. Cem. Concr. Compos.26(7), 891–900 (2004)*
2. *Dr. P. Perumal and Dr. J. Maheswaran, "Behavioural study on the effect of AR-Glass Fiber reinforced concrete", NBW & CW October 2006, (pp 174-180).*
3. *Mazloom, M., Ramezanianpour, A.A., Brooks, J.J.: Effect of silica fume on mechanical properties of high strength concrete. Cem. Concr. Compos.26 (4), 347-357 (2004).*
4. *Muthuawamy K.R. and Thirugnanam G.S,(2013), "Mechanical properties of hybrid fibre reinforced high performance concrete", Indian Concrete Journal, Vol 87, No. 4, April, pp. 50-55.*
5. *Naaman. A.E (1997) ," High Performance Fibre Reinforced cement composites distinctive attributes for fibre applications", Fifth International Concrete on Structural Failure, Durability Retrofitting Singapore November 27-28. PP 429 - 439.*
6. *Sudheerjirobe (2015) Experimental investigation and durability properties of hybrid reinforced concrete*
7. *Sinha, D.A, Varma, A.K and, Prakash, K.B, (2013), "Properties of ternary blended steel fibre reinforced concrete", The Indian Concrete Journal, Vol- 87, August, pp. 26-30*
8. *Siddique, R, (1997), "Properties of concrete reinforced with low percentage of synthetic fibres", Fifth International Concrete on Structural Failure, Durability Retrofitting Singapore November 27-28, pp. 448-455.*
9. *U. M. Ghare, "Manufacture of Glass Fibre Reinforced Concrete Products", Unit 1, Division of YOGI group-UAE, August 2008.*