International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

Enhancement in properties of concrete by Silica fumes.

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Abstract – *The usage of pozzolanic materials is a traditional art of concrete construction. Long time age, it was conceded that the suitable pozzolans used in acceptable and suitable quantity, modify certain properties of fresh and hardened mortars and concretes.*

It has been abundantly demonstrated that the simplest pozzolans in optimum proportions mixed with hydraulic cement in order to enhance many qualities of concrete.

- *The low heat of hydration and thermal shrinkage is required and preferred.*
- *Water tightness should be increased;*
- *Diminish the alkali- aggregate reaction;*
- *To attack by sulphate soils and sea water, enhance the resistance;*
- *Enhance extensibility;*
- *Lower susceptibility to dissolution and leaching*
- *Improve workability;*
- *Lower costs.*

Pozzolanic materials are siliceous or siliceous and aluminous materials, which in themselves possess little or no cementitious value, but will, in finely divided form and within the presence of moisture, chemically reacted with lime liberated on hydration, at ordinary temperature, to make compounds, containing cementitious properties.

Key Words: Silica fume; Workability; Split tensile strength; Compressive strength; Flexure strength.

1. INTRODUCTION.

Concrete Beton may be a combination of clay, fine aggregates, coarse aggregates and water. In the plastic process it are often shaped in any shape. The relative number of components tested the wet and hardened stages of the concrete output.Two or three decades ago, in fact, without looking at the future of concrete structures, using OPC to produce concrete for construction can easily get the concrete composition regardless of quality. Nowadays, with recent investigations conducted by engineers and scientists over the past two to thirty years, with the structural stability of the structure, high quality concrete is needed while improving strength, durability and other characteristics. The need for these properties led to the search for complementary cement materials. Look for any suitable material in terms of local replacement of cement in order to achieve global sustainable development and reduce impact on the environment. Concrete cement is the majority of building materials today. It can be said that we live in a concrete era. Beton is straightforward to manufacture, but concrete may be a complex material, actually . It is a matter produced in the field because, because of the usage of other natural materials than cement, its consistency, efficiency because output will significantly improve. Medium standard and lower value cement also are widely used for the accelerated growth of the country's infrastructure. A common usage of agricultural materials will also conserve resources and prices, beyond following environmental protection requirements. The most viable manufacturing component was found to be silica volcanic ash which could be used as a part-alternative to cement in concrete. In India and abroad, many experiments are being undertaken to research the impact of replacing cement with such pozzolan products, and the findings are promising. Adding silica smoke to concrete has numerous benefits, such as strong power, good resilience and decreased production of cement.

2. Blending of silica fume in concrete

Silica fume and fresh concrete-:

Two different results occur: the development becomes more uniform with no leakage from the bottom . Although certain endorsers may find this to form it easier to position and finish the concrete, they're simply benefits for fresh and hardened concrete.

Silica fume and hardened concrete-:

The impact of silica fume on hardened concrete is seen within the chart. Two distinct results are present: improved mechanical properties, including resistance and elasticity board, and decreased permeability, which increases longevity directly. The paragraph addresses of these impacts.

3. WORKING

In cement compounds, silicafume works on two levels, that is the primary one described here may be a reaction called the "pozzolanic" reaction. The hydration (mixing with water) of hydraulic cement produces many compounds, including calcium silicate hydrates (CSH) and lime (CH). The CSH gel is understood to be the source of strength in concrete. When silica fume is added to freshly prepared concrete and it chemically reacted with the CH to produces additional CSH. The advantage of this reaction is 2 fold; increased compressive strength and chemical resistance. The bond between the concrete paste and therefore the coarse aggregate, within the crucial interfacial zone, is greatly increased, leading to compressive strengths which will exceed 100 Mpa. the extra CSH produced by silica fume is more immune to attack from aggressive chemicals then the weaker CH.

Design Mix of concrete with silicafume as per IS specification (IS-15388-2003)

Table -1: Mix Design

MIX DETAILS:								
Grade	Type of Cementitio us Material	Total Cementitious Content		Aggregates			Max. W/C Ratio	Admixture
				Coarse Aggregates		Fine Aggregates		
		Cement	Flyash	MSA 20mm	MSA 10mm			
		Kg/Cum	Kg/Cu m	Kg/cum	Kg/Cum	Kg/Cum		
M40	OPC+F.A	360	105	716	308	722	0.35	0.5%-1.0%
M50	OPC+F.A	430	100	666	359	672	0.31	0.5%-1.0%
M60	OPC+M.Sili ca+F.A	450+25	130	452	452	698	0.27	0.5%-1.0%
M70	OPC+M.Sili ca+F.A	470+40	130	445	445	698	0.26	0.5%-1.0%

Fig -1: Cube Molds.

Fig -2: Cement and Micro Silica

Fig -3: Cube Casting.

Fig -4: Curing Tank

Fig -5: Concrete Cubes.

Fig -6: Compressive Testing Machine.

Fig -7: Cube in CTM.

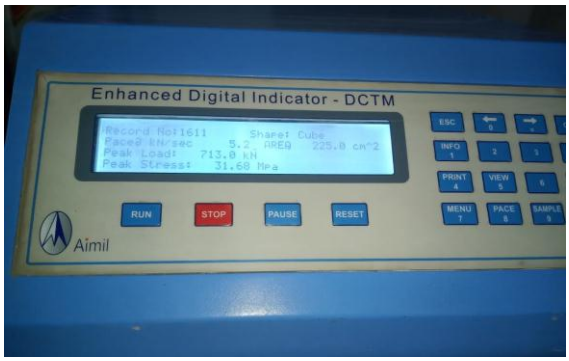


Fig -8: CTM Reading.

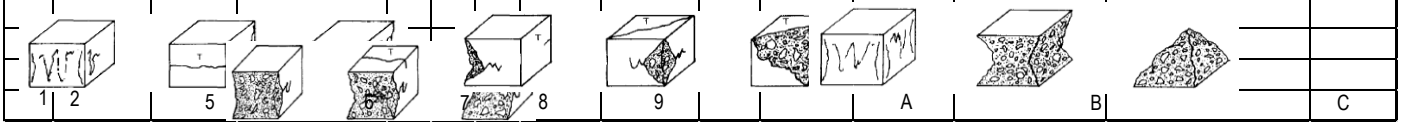
4. METHODOLOGY

Analyzing the compressive strength of concrete blended with silica fume.

Cube Test-:

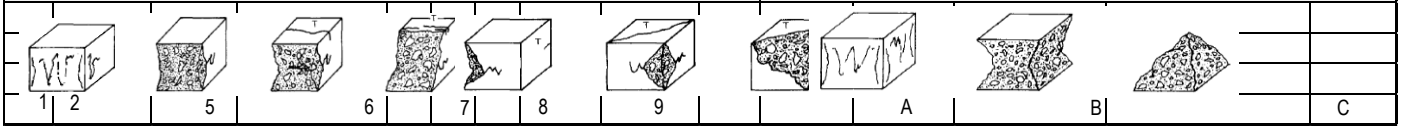
M40

S No	ID Mark	Age at testing	Curing Condition	Size of Concrete Specimen L	B	H	C/S Area	Mass in air	Load	Strength		Average Strength	Specimen Failure Code (See figures)	Remarks
		(Days)		mm	mm	mm	sq.mm	(Kg)	KN	(N/sq.mm)		(N/sq.mm)		Normal / Abnormal
1		7	Good	150	150	150	22500	8.098	710.1	31.56			A	Normal
2	Sample-1	7	Good	150	150	150	22500	8.136	667.1	29.55		**31.09**	B	Normal
3		7	Good	150	150	150	22500	8.284	723.4	32.15			C	Normal
Abnormal Failure of concrete specimen										\				



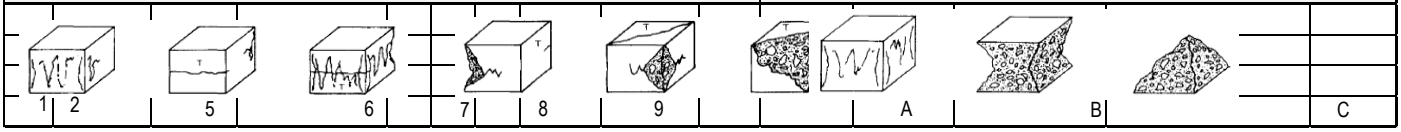
M40

S No	ID Mark	Age at testing	Curing Condition	Size of Concrete Specimen L	B	H	C/S Area	Mass in air	Load	Strength		Average Strength	Specimen Failure Code (See figures)	Remarks
		(Days)		mm	mm	mm	sq.mm	(Kg)	KN	(N/sq.mm)		(N/sq.mm)		Normal / Abnormal
1		28	Good	150	150	150	22500	8.156	1092.2	48.54			A	Normal
2	Sample-1	28	Good	150	150	150	22500	8.246	1034.6	45.98		**47.26**	B	Normal
3		28	Good	150	150	150	22500	8.184	1063.1	47.25			C	Normal
Abnormal Failure of concrete specimen										\				



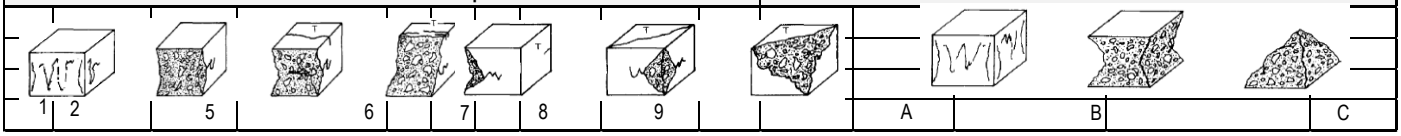
M50

S No	ID Mark	Age at testing	Curing Condition	Size of Concrete Specimen L	B	H	C/S Area	Mass in air	Load	Strength		Average Strength	Specimen Failure Code (See figures)	Remarks
		(Days)		mm	mm	mm	sq.mm	(Kg)	KN	(N/sq.mm)		(N/sq.mm)		Normal / Abnormal
1		7	Good	150	150	150	22500	8.321	987.3	43.88			A	Normal
2	Sample-1	7	Good	150	150	150	22500	8.202	1044.9	46.44		**45.51**	B	Normal
3		7	Good	150	150	150	22500	8.349	1039.5	46.20			C	Normal
Abnormal Failure of concrete specimen										\				



M50

S No	ID Mark	Age at testing	Curing Condition	Size of Concrete Specimen			C/S Area	Mass in air	Load	Strength		Average Strength	Specimen Failure Code (See figures)	Remarks
				L	B	H								
		(Days)		mm	mm	mm	sq.mm	(Kg)	KN	(N/sq.mm)		(N/sq.mm)		Normal / Abnormal
1	Sample-1	28	Good	150	150	150	22500	8.304	1262.7	56.12		55.20	A	Normal
2		28	Good	150	150	150	22500	8.215	1214.6	53.98			B	Normal
3		28	Good	150	150	150	22500	8.260	1248.8	55.50			C	Normal
Abnormal Failure of concrete specimen										\				



5. APPLICATION

New reach Silica fume 900 in used in cement concrete and construction materials. New reach Silica Fume 920 Silica Fume NR920 is a dry powder micro silica admixture for Portland cement concrete and mortars. Used 10 to 15% Silica fumes in heavy structure buildings.

Technical data-:

Parameters	Standard Value
Silicon Dioxide(SiO2)	min 90 %
Loss on Ignition(L.O.I)	max 3 %
Moisture Content(H2O)	max 2.0 %
Percent Retained On 45µm (325sieve)	max 2.0 %

Index items	Standard Value
SiO2(Silicon Dioxide)	Min. 92.0%
Fe2O3 (Iron Oxide)	Max. 0.48%
Al2O3(Aluminum Oxide)	Max. 0.32%
Moisture Content(H2O)	Max. 2.0%
Loss on Ignition(L.O.I)	Max. 3.0%
Percent Retained On 45µm (325sieve)	Max. 2.0%
Bulk Density	250-350kg/m^3 and 600-700kg/m^3

6. CONCLUSIONS

Sample template From Result we can conclude that silica fume is good replacement in concrete.

- ✓ It is more useful to use silica fume used in the higher grade of the concrete
- ✓ As we know that we should not use more than 450 kg of cement as per IS-456, table no.-9; so for increase the strength we use micro silica in the concrete
- ✓ The slump while blending silica fume in concrete is around (80-120 mm)
- ✓ There will be no bleeding or segregation in it.
- ✓ It will fit their all-complete void in it which is left any cement because of the silica fumes is more finer than cement.
- ✓ With increase in W/C ratio strength will decreased.
- ✓ It provide the ultra-high strength to our structure
- ✓ It will used 10-15% of silica will be blended in it
- ✓ It provides approx. 80% of compressive strength in 7 Days.

7. ACKNOWLEDGEMENT

We would like to place on record my deep sense of gratitude to DR. RAJESH KUMAR SHARMA HOD, Department of Civil Engineering, GREATER NOIDA INSTITUTE OF TECHNOLOGY for his generous guidance, help and useful suggestions.

I express my sincere gratitude to MR. Arvind Verma Asst. Prof, and Dept. of Civil Engineering, for his stimulating guidance, continuous encouragement and supervision throughout the course of present work.

I also wish to extend my thanks to every Asst. prof. and other colleagues for attending my project presentation and for their insightful comments and constructive suggestions to improve the quality of this project work.
I am extremely thankful DR. DHEERAJ GUPTA Director, for providing me infrastructural facilities to work in, without which this work would not have been possible.

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