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AN EXPERIMENTAL ANALYSIS OF SILICA FUME AND BLAST FURNACE SLAG WITH PARTIAL REPLACEMENT OF CEMENT AND SAND

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ABSTRACT: Concrete is the basic and essential material used in the construction projects. Rapid growth in urbanization require large amount of construction material such as sand, cement, aggregates and due to high demand of these material their cost day by day increases. So it is very beneficial to replace these materials with some other material whose properties resemble with them. In this research we use silica fume and blast furnace slag with partial replacement of cement and sand. Concrete cubes and beams are prepared and their compressive strength, flexural strength and workability are tested and compared with the concrete have nominal mix. The concrete prepared is M25. The blast furnace slag used in the percentage of 0percent, 10percent, 20percent, 30percent&and silica fume in the percentage of 0percent, 8percent&16percent separately. it is concluded that compressive strength and tensile strength is increases with increase in the percentage of blast furnace slag and silica fume and after that decreases.

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KEYWORDS : SILICA, BLAST FURNANCE SLAG, CEMENT, SAND, M25

[1] INTRODUCTION

The concrete is usually known as for the most part utilized material after water on earth. A few parts of our routine are relying upon concrete specifically or in a roundabout way. The Concrete has been made by the blend of a few constituents, for example, totals, bond, water & so on that are available monetarily. The solid is viewed as unmistakable in a few development materials as it has been produced for specific structural building based ventures particularly. The solid is considered as piece of a few material containing granular materials, for example, coarse totals that are incorporated in a grid. It bound together with fastener or concrete that is filling space among particles & unions them.

The solid is assuming a basic part if there should arise an occurrence of development & plan of country's framework. Normally seventy five percent of volume of cement is considered as sythesis of totals. With a specific end goal to meet worldwide necessity of cement in future, this has turned out to be further testing work keeping in mind the end goal to look better alternatives to normal totals to plan concrete. The Natural totals have been got from normal rocks. These are viewed as idle, filler materials & as per their size they might be dethatched into fine totals & coarse totals. The coarse total part is the thing that held on 4.75 m.m. sifter, when fine totals part is that passing the same.. As indicated by a few gauges after year 2010, worldwide solid industry would require every year 8 to 12 billions metric huge amounts of characteristic totals. Since past a quarter century, generation of pulverized stone has expanded at a normal yearly rate of around 3.3 percent. The sand production & rock has expanded at a yearly rate of less than 1 %. Based on these numbers, by 2020 joined states creation expanded by more than 20%, would be 1.6 billion metric tons, while generation of sand & rock would be just shy of one point one billion metric tons with an expansion of 14 %.

[2] Material utilized

In this segment discourse is done on material utilized as a part of work. Different tests performed on this material are likewise examined.

Cement

Cement is a fine powder which is dark on shading. fundamental piece of concrete is given in 1. Bond is blended with water & materials, for example, rock, pounded stone&sand to make concrete. Bond & water frame a glue that ties different materials together as concrete solidifies. Physical Properties of Cement are shown in Table 1. Cement cube are prepared and tested as shown in Table 2

Sand

Sand has been sieved through 4.75 mm sifter to expel any particles more prominent than 4.75 mm.

Aggregate

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Material that is held on IS strainer no. 4.75 is named as a coarse total. smashed stone is for the most part utilized as a coarse total. Locally accessible coarse total having size of 20 mm are utilized 60percent&10 mm are utilized 40percent in this work.

Table 1 Physical Properties of Cement

Test Conducted	Values Obtained	Standard values
Initial Setting time	45 minutes	Not < 30 minutes
Final Setting time	415 minutes	Not > 600 minutes
Fineness	4.7percent	<10
Specific gravity	3.05	-

Table 2 Compressive strength of cement

Days	Specimen	Compressive Strength (N/mm^2)	Average Compressive Strength (N/mm^2)
3	1	21.545	21.784
	2	22.049	
	3	21.759	
7	1	31.673	32.424
	2	32.455	
	3	33.145	

It could be seen from tables that all outcomes fulfill standard criteria.

[3] RESULT&DISCUSSION

Here consequences of control concrete & cement made with substitution of impact heater slag &bond are talked about. Parameters, for example, workability, Compressive quality, Flexure Strength & Water Absorption are talked about & examinations between different blends are spoken to.

Slump Cone Test

Droop tests were completed to decide workability & consistency of crisp cement. After effects of droop test is arranged in following table and figure

Table 3 Slump value for different mixes

Mix	Slump (mm)
Nominal Mix	98
M-25(10-0)	92
M-25(10-8)	85
M-25(10-16)	78
M-25(20-0)	70
M-25(20-8)	68
M-25(20-16)	60
M-25(30-0)	60
M-25(30-8)	55
M-25(30-16)	54

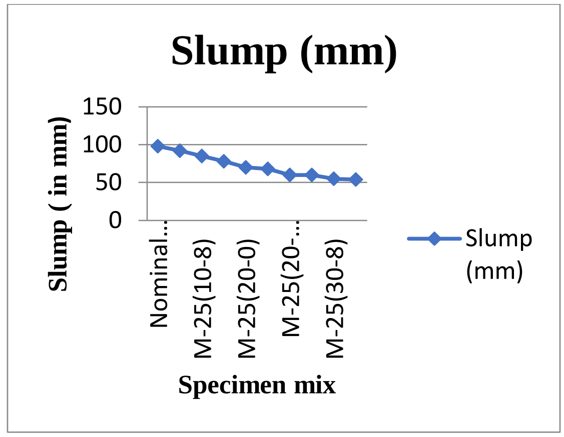

Figure 1 Slump value for all mixes

Diagram 1 Slump test was performed on newly blended cement. It was watched that greatest droop esteem was 98 mm which was for ostensible blend of M-25 review concrete. droop esteem was then seen as diminishing when impact heater slag & silica rage content was expanded from 0 to 30%&0 to 16%.

The Compaction Factor Test

After-effects of Compaction Factor test is arranged in following table and figure.

Table 4 Compaction Factor value for different mixes

Mix	Compaction Factor
Nominal Mix	0.840
M-25(10-0)	0.836
M-25(10-8)	0.849
M-25(10-16)	0.846
M-25(20-0)	0.839
M-25(20-8)	0.841
M-25(20-16)	0.837

M-25(30-0)	0.850
M-25(30-8)	0.846
M-25(30-16)	0.842

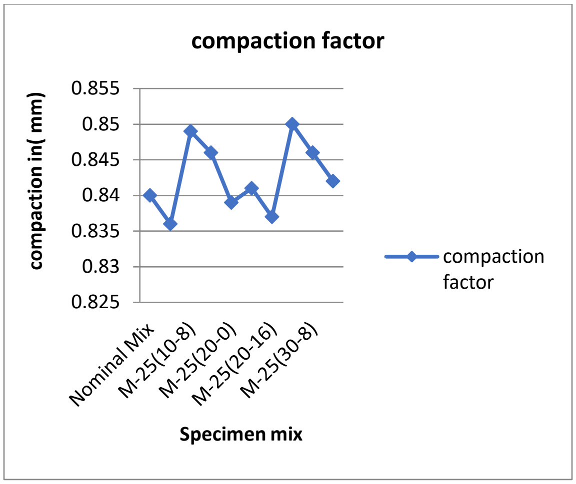

Figure 2 Compaction Factor value for all mixes

Figure 2 Compaction factor test was performed on naturally blended cement. It was watched that compaction factor of mix containing impact heater slag with silica seethe content relatively same as comparing to ostensible blend & greatest esteem was seen as 0.850 which was of blend containing (30-0)% substance.

Compressive Strength Test

Concrete cubes are prepared and their compressive strength are tested at 7 days and 28 days. The blast furnace slag used in the percentage of 0percent, 10percent, 20percent, 30percent&and silica fume in the percentage of 0percent, 8percent&16percent separately.

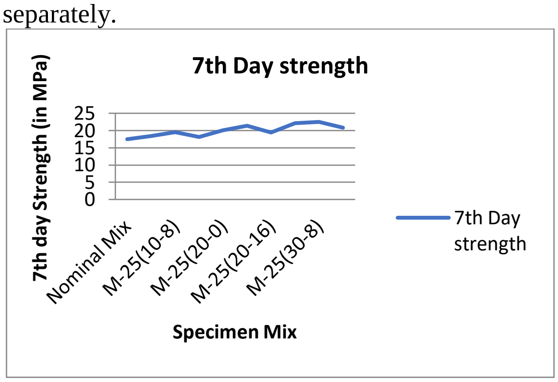

Figure 3. 7 day compressive strength

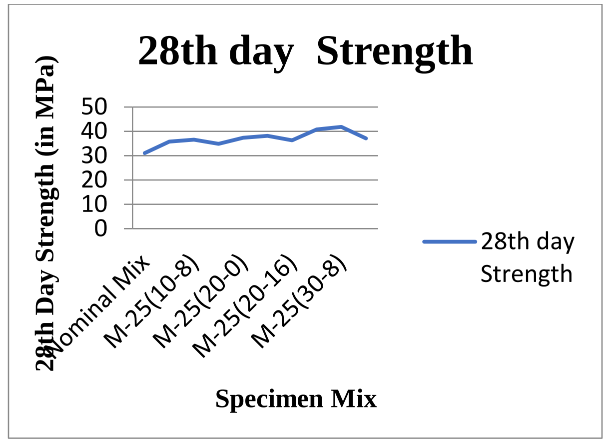

Figure 4. 28 day compressive strength

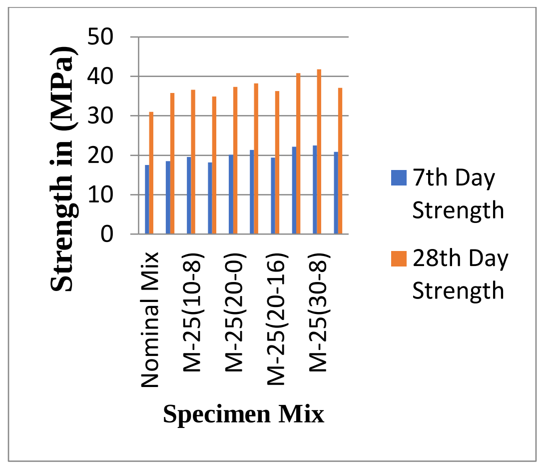

Figure 5 compressive strength of blast furnace slag&silica fume concrete.

figure 5 demonstrates that example blend M-25(10-0) demonstrates an expansion of 5.5% out of 7 day compressive quality&15.3% of every 28 day quality, in any case, example blend M-25(10-8) demonstrates an increment of 11.6% out of 7 day compressive quality&17.8% out of 28 day quality & example blend M-25(10-16) demonstrates an expansion of 3.7% out of 7 day compressive quality&12.41% of every 28 day quality regarding ostensible blend example. example blend M-25(20-0) demonstrates an expansion of 14.8% of every 7 day compressive quality&20.3% out of 28 day quality, be that as it may, example blend M-25(20-8) indicates increment of 22.01% out of 7 day compressive quality&23.05% out of 28 day quality & example blend M-25(20-16) demonstrates an expansion of 10.9% out of 7 day compressive quality&16.85% out of 28 day quality as for ostensible blend example. example blend M-25(30-0) demonstrates an expansion of 26.5% of every 7 day compressive quality&31.55% out of 28 day quality, in any case, example blend M-25(30-8) indicates increment of 28.5% of every 7 day compressive quality&32.76% out of 28 day quality&example blend M-25(30-16) demonstrates an expansion of 19.0% of every 7 day compressive quality&19.45% out of 28 day quality regarding ostensible blend example. Most extreme addition of compressive quality is seen by 32.76 % for mixM-25(30-8) at 28 days as for reference blend.

Flexure Strength Test

Flexure quality examinations were done at age of 7&28 days. Test outcomes are given beneath in table 5. As found in table, these test outcomes are spoken to Figureically underneath.

Table 5 Flexure strength of concrete mix with blast furnace slag&silica fume

Mix	Flexural strength (N/mm^2) (28 days)	Average Flexural strength (N/mm^2)(28 days)
M-25(0-0)	5.04	4.95
	4.95	
	4.85	
M-25(10-0)	4.54	5.37
	5.4	
	5.18	
M-25(10-8)	5.38	5.41
	5.45	
	5.45	
M-25(10-16)	5.32	5.33
	5.35	
	5.3	
M-25(20-0)	6.4	5.7
	5.4	
	5.7	
M-25(20-8)	5.74	5.74
	5.9	
	5.6	
M-25(20-16)	5.65	5.64
	5.6	
	5.65	
M-25(30-0)	6.3	6.1
	6.0	
	6.0	
M-25(30-8)	6.2	5.97
	5.95	
	5.75	
M-25(30-16)	6.0	5.95
	5.95	
	5.9	

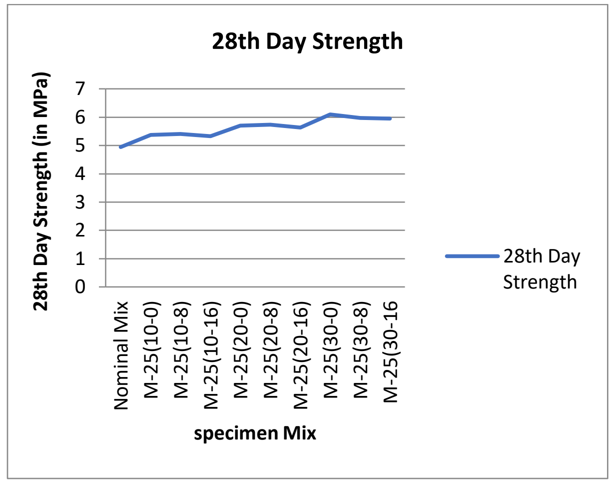

Figure 6 28 day Flexural strength

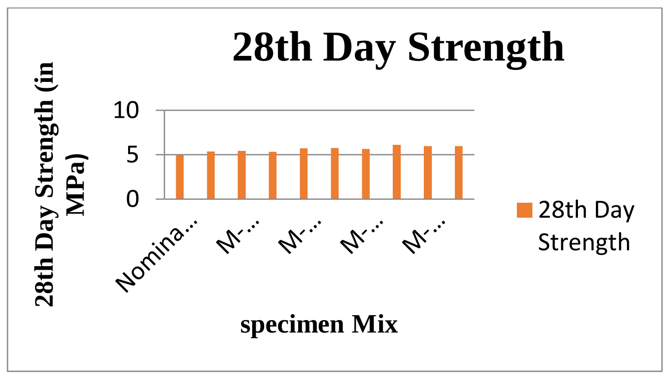

Figure 7 Flexural strength of blast furnace slag&silica fume concrete.

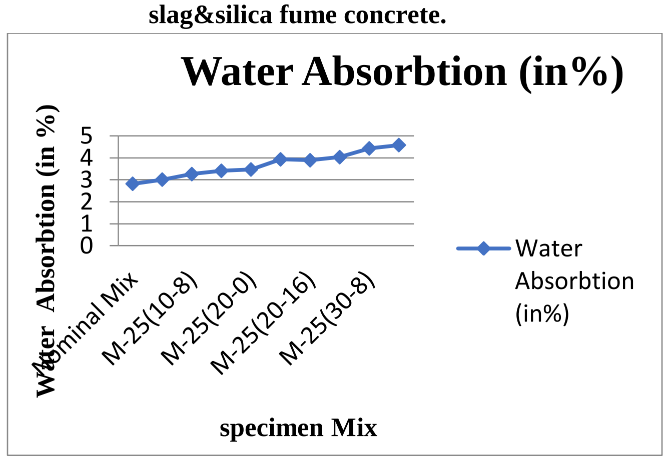

Figure 8 Water absorption of blast furnace slag & silica fume concrete

[4] CONCLUSIONS

1. In M25, as the percentage of blast furnance slag and silica fume increased ,the compressive strength at 7&28 days is increased.
2. When blast furnance slag and silica fume used respectively in (30% & 8%), we obtain high compressive strength.
3. In M25,as the percentage of blast furnance slag and silica fume increased, the flexural strength also increased at the age of 28 days.
4. When blast furnance slag & silica fume used respectively in (30% & 8%),we obtain high flexural strength.
5. In M25, as the percentage of blast furnance slag and silica fume is increased the workability decreases.
6. Maximum workability we obtain at the percentage of blast furnance slag and silica fume used in (10% & 0%).
7. As the percentage of blast furnance slag and silica fume increased, the percentage of water absorption is also increased.
8.At the end of total experimental analysis,the strength of specimens is increased.

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