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Strength Properties Of Cement Mortar When Cement Partially Replaced With Silica Fume And Fly Ash

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Abstract*: Concrete is one of the important construction material used in the world of all engineering works, including the infrastructure development proved that, it is a cheap material and its constituents are widely available in nature. Due to widespread usage and fast infrastructure development in all over the world, there is a shortage of natural aggregates, Such as fine aggregate and coarse aggregate. These materials are available with high cost, to prevent this the fine aggregate and coarse aggregate can be replaced with waste materials. In this project cement mortar is partially replaced by silica fume and flyash accordingly in the range of 5%, 10%, 20%, & 30% by 1:3 cement mortar. Specific gravity is done for silica fume and flyash. Cement mortars are casted,tested and compared with conventional mortar.These tests were carried out to evaluate the strength properties for 7, and 28 days.*

Key Words: *Fly Ash 1, silica fume2, Compressive Strength*

1. INTRODUCTION

For Past many years construction industry has been making some progress in the utilization of waste materials in concrete. Some of waste products are fly ash, rice husk, saw dust, discarded tires, e-waste, glass, bagasse ash, stone dust, silica fume and ceramic. Proper use of waste products provides viable economy and healthy environment. Each waste product has its specific effect on the properties of fresh and hard concrete. There has been a long-term growing demand for aggregates to produce concrete and this has presented increased problems of supplying of sand and gravel .Previous researches have shown crushed stone dust can be used to replace the natural sand in concrete .Recycle aggregates are also being studied though some loss in workability and mechanical property is reported .The ceramic industry has about 30% to 50% failed products due to improper mixing or heating conditions so ceramic can be used as a coarse aggregates Present study has been done to evaluate the suitability of such waste materials in concrete production.

2. MATERIALS USED

2.1 Cement 1

In this experiment 43 grade ordinary Portland cement is used. The testing of cement is done as per IS …. Code the specific gravity of cement found is 3.10.

2.2 Fine Aggregates 2

In this experiment the locally available sand is used and the specific gravity of fine aggregate is done by using the IS 2720 part 3 code. The specific gravity is found 2.62. The fine aggregates used which passes through the 4.75mm sieve.

2.3 Properties of Silica fume 3

Silica fume also known as micro silica is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. It is an ultrafine powder collected as a byproduct of silicon and production and Ferro -silicon alloy consists of spherical particles with an average particle diameter of 150mm.

Chemical properties of silica fume:

Chemical	Percentage
Sio2	85
Al2o3	1.12
Fe2o3	1.16
Cao`	0.2-0.8
Mgo	0.2-0.8
Na20	0.5-1.2
K2o	0.5-1.2

2.4 Water

The least expensive but the most important ingredient of concrete is water. The water which is used for mixing concrete should be clean and free from harmful impurities such as oil, alkali, acid etc. portable water was used for mixing and curing work.

2.6 Properties of Fly Ash

Fly ash is a byproduct of the combustion of pulverized coal in thermal power plants. it is removed by mechanical collector or electrostatic precipitators as a fine particle residue from the combustion gases. One of the most uses of fly ash is in making cement and concrete.

As fly ash is available almost free of cost, there is considerably saving in making concrete by addition of fly ash. However, each fly ash is different. Its quality depends upon quality of coal used and type of collection. The reactivity of fly ash depends on its chemical composition, fineness and particle shape.

Therefore, before using a particular flyash,research on its cement properties need to be done. IS 3812 specifies the properties of fly ash suitable for use in concrete

Properties of fly ash

Properties of Fly ash Silicon Dioxide (SiO2) 35% Magnesium Oxide (MgO) 5% Alkalis As Sodium oxide 1.50% Sulphur As So3 3%

3. TESTS 3

3.1 Compressive strength 1

The test is done for 28days and the size of the cube 70.6mmx70.6mmx70.6mm. The concrete mix design is carried out for (1:3) mix grade. The cubes are tested on 2000KN capacity universal testing machine. Compression test has been conducted confirming to IS 516-1959(5), on the concrete specimens in the universal testing 200MT. in this text cube is placed with the cast faces not in contact with the platens of testing machine. Load has been applied at a constant rate of stress equal to 15mpa/min according to the relevant IS code and the load at which the specimens failed has been recorded. Thus from the results, the compressive strength is obtained.

4. RESULTS 4

4.1 Compression Test 1

In this study the cubes are prepared with sillca fume and ggbs. Totally 36 cubes are casted and tested for 7days and 28days. Mortars are casted for two different proportions and for 2 different age periods for every age period 3 cubes are casted. The size of cube is 70.6mmX70.6mmX70.6mm. The most and useful parameters is compressive strength because it is a desirable characteristic of cement mortar properties and also quantitatively related to compressive strength.

The replacement of cement with silica fume 5% and Fly Ash 10%,20%,30% strength is increased when compared to normal mortar

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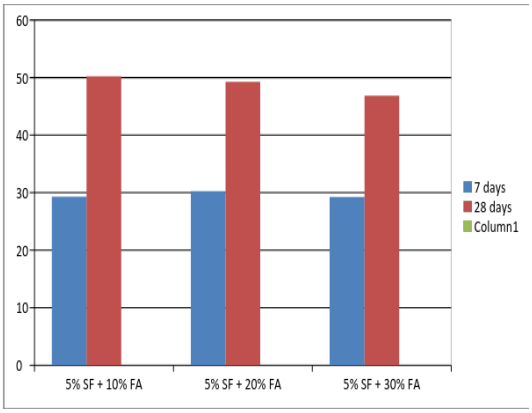
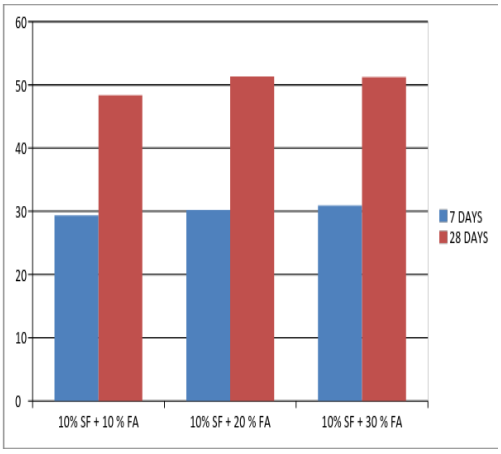
28 days (N/mm^2)	**7 days (N/mm^2)**	**Type of cement mortar**
50.23	29.32	5% silica fume +10% flyash
49.25	30.25	5% silica fume+20% flyash
46.83	29.25	5% silica fume+30% flyash
48.35	29.35	10% silica fume+10% flyash
51.35	30.21	10% silica fume+20% flyash
51.23	30.92	10% silica fume+30% flyash



The compressive strengths are shown in bar charts

Influence of Silica fume 5% and Fly ash 10%,20%,30% Development of Compressive Strength of Cement Mortar (1:3)



Influence of Silica fume 5% and Fly Ash 10%,20%,30% Development of Compressive Strength of Cement Mortar (1:3)

5. CONCLUSIONS 5

A. Based on the present experimental investigation the following conclusion are drawn

- At the Replacement of 10%, 20% GGBS and 5% silica fume with cement got less strength when compared to cement mortar.
- At the Replacement of 10%, 20% GGBS and 10% silica fume with cement got less strength when compared to cement mortar.
- At the Replacement of 30% GGBS and 10% , 5% silica fume with cement got more strength when compared to cement mortar.
- It can be conclude that silca fume can not be replaced alone, when ggbs 30% and silica fume 5% or 10% can be replaced to get more strength.

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