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EFFECT ON STEEL SLAG CONCRETE USING SILICA FUME ALONG WITH FLYASH

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Abstract - *The paper includes different techniques and the related work that has been done for fly ash and silica fume onto the steel slag concrete mixture has shown some extraordinary outcomes in strength and durability. Fly ash, which is largely made up of silicon dioxide and calcium oxide, can be used as a substitute for Portland cement, or as a supplement to it. The materials which make up fly ash are pozzolanic, meaning that they can be used to bind cement materials together. Pozzolanic materials, including fly ash cement, add durability and strength to concrete. Fly ash cement is also known as green concrete. It binds the toxic chemicals that are present in the fly ash in a way that should prevent them from contaminating natural resources. Using fly ash cement in place of or in addition to Portland cement uses less energy, requires less invasive mining, and reduces both resource consumption and CO2 emissions.*

***Key Words*: Silica fume , Steel Slag , Flyash , coarse aggregate , Fine aggregate**

1.INTRODUCTION

Concrete is the most versatile construction material because it can be designed to withstand the harshest environments while taking on the most inspirational forms. Engineers are continually pushing the limits to improve its performance with the help of innovative chemical admixtures and supplementary cementitious materials. Nowadays, most concrete mixture contains supplementary cementitious material which forms part of the cementitious component. These materials are majority byproducts from other processes. The main benefits of SCMs are their ability to replace certain amount of cement and still able to display cementitious property, thus reducing the cost of using Portland cement. The fast growth in instralisation has resulted in tons and tons of byproduct or waste materials, which can be used as SCMs such as fly ash, silica fume, ground granulated blast furnace slag, steel slag etc

1.1 Objectives of the study

To design High Strength concrete good quality aggregates is also required steel slag is industrial by product obtained from steel manufacturing industry this can we used as aggregate in concrete. It is currently used in hot mix asphalt surface application but there is a need of some additional work to determine the feasibility of utilizing industrial by product. More wisely replacement of coarse and fine aggregate with steel slag. .

1.2 Materials

cement is an artificial rock attained by heating limestone added with some raw materials in precise quantities to a very high temperature in an explicitly created forge.

Fly ash, is the by-product acquired through the combustion of coal in thermal power plant. The quality and composition of fly ash depends on the type of coal being burnt. During combustion of coal 75- 80% of ash flies out with the flue gas and thus called fly ash.

Silica fume is a by Product of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolana. Concrete containing silica fume can have very high strength and can be very durable. Silica fume is available from suppliers of concrete admixtures and, when specified, is simply added during concrete production.

2. Methodology

Silica fume is a byproduct of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolana. Concrete containing silica fume can have very high strength and can be very durable. Silica fume is available from suppliers of concrete admixtures and, when specified, is simply added during concrete production.

Table -1: Properties of Fly ash

Cement	Consistency in %	Specific gravity	Initial setting time	Final setting time
Fly ash cement	37.5	3	3 hours 50 min	11 hours 35 min
FC 10	47			
FC 20	55.5			

In order to achieve the objectives, a sequential research methodology has been proposed. The experimental approach to the research methodology can be expressed as,

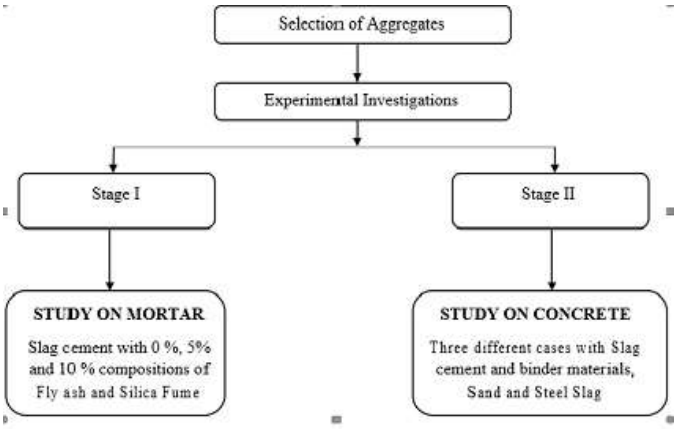

Chart -1: **Framework of the Methodology**

Stage I: The tests were carried out on different combinations of Slag cement and combined action of aggregates of silica fume and fly ash. These components are mixed under different proportions as,

Slag cement with 0 % Fly ash and 0 % Silica Fume

Slag cement with 5 % Fly ash and 0 % Silica Fume

Slag cement with 10 % Fly ash and 0 % Silica Fume

Slag cement with 0 % Fly ash and 5 % Silica Fume

Slag cement with 0 % Fly ash and 10 % Silica Fume

Stage 2: In this stage, the concrete is prepared with three different cases of binder mix along with silica fume and fly ash. The three cases are,

Case 1: In this case, the determination of strength of concrete with proportion mix of 1:1.5:3 using binder mix formed by mixing slag cement and fly ash, sand as fine aggregate and steel slag as coarse aggregate. Here, the proportion of fly ash in the binder mix will be varied at 0%, 5% and 10%.

Case 2: In this case, the concrete mix ratio is maintained the same as in the early case but the change is that, the binder mix is made with slag cement and silica fume instead of the fly ash. Here, the sand is selected as fine aggregate and the steel slag as coarse aggregate. However, in this case, the proportion of silica fume is varied at 0%, 5% and 10% accordingly.

Case 3: In this case of strength determination, the binder mix is formed by mixing slag cement with both fly ash and silica fume. The ratio of mixing is maintained the same as in previous case. The sand was chosen as fine aggregates while the steel slag was the coarse aggregate state.

3. RESULTS AND DISCUSSION

In this research, the concrete cubes were prepared with a ratio of 1:1.5:3 with binder materials along with cement in the proportion of 1 to the sand at proportion of 1.5 to the steel slag as proportion of 3. Various tests were conducted to determine the physical and chemical properties like, Workability, compressive strength, tensile strength, flexural strength, porosity and durability.

From the table, it can be noted that, the water to cement ratio increases with increase in the percentage of replacements added to the binder mix. This is due to the fact that, both silica and fly ash consumes more amount of water. These W/C values can be interpreted graphically as,

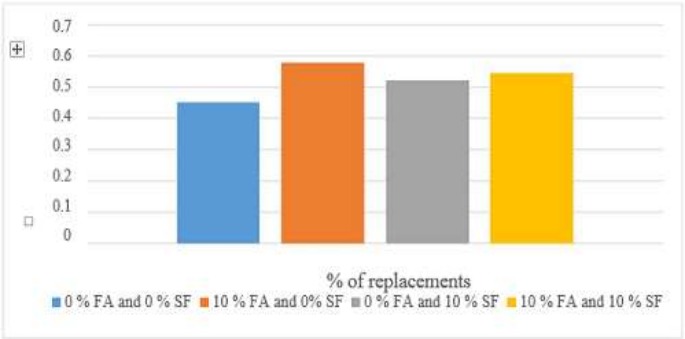

Fig -1: **Water/Cement ratio of the concrete system**

4. CONCLUSIONS

The introduction of fly ash and silica fume onto the steel slag concrete mixture has shown some extraordinary outcomes in strength and durability. The conclusions drawn from this research were summarized as follows.

The more the accumulation of replacements, the denser the binder mix. This, in turn, intensifies the strength of various binder mixes. The inclusion of equal aggregate of fly ash and silica fume has expressed an overall enhancement in the strength of concrete system.

The mixing of silica fume and fly ash to the coarse concentrate of steel slag has suggestively concentrated the compressive strength of the system.

The addition of replacements have gradually condensed the porosity of mortar binding mixes. All the mixes at curing time of 7 days and 28 days have shown the same path of reduced porosity nature. The drop in porosity was usually owing to the establishment of denser matrices by the

replacements i.e. fly ash and silica fume have the tendency to form bonded structures thereby reducing the porosity and capillary action of the mortar mixes.

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