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PARTIAL REPLACEMENT OF SAND BY FLY ASH WITH SUPER PLASTICIZER

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ABSTRACT

The use of fly ash as replacement of sand is an economical solution for making green and denser concrete. The concrete mix design procedure for partial replacement of sand with fly ash. Present method could produce additional compressive strength for concrete with partial replacement of sand with fly ash over control concrete, with higher slump. Addition of super plasticizer could further improve compressive strength with higher slump over control concrete. Concrete with sand replaced by fly ash was also found to be economical without and with super plasticizer, when cost per N/mm2 was compared. The beneficial effect may be attributed to better packing, pozzolanic activity of fly ash and internal curing by fly ash as partial replacement of sand. Based on experimental results, correlations are developed to predict compressive strength, flexural strength and cost per N/mm2 for percentage sand replacement with fly ash.

Keywords: Fly Ash, Compressive Strength, Internal Curing.

I. INTRODUCTION

It is a pressing need today for the concrete industry to produce concrete with lower environmental impact, the so-called green concrete. This can be achieved in three ways. The first one is by reducing the quantity of sand. Secondly by reducing the use of natural aggregates whose resources are limited and are exhausting very fast. It is also achieved by utilizing maximum possible waste materials like fly ash in concrete. This will reduce the requirement of Landfill area and make system more sustainable. The World Bank has reported that by 2015 disposal of fly ash will require 1000 square kilometer area or one square meter of land per person Also SiO2 and Al2O3 in fly ash react with the free lime available in concrete to form CSH and CAH gel. These gels provide extra cementing material and also fill the pores in concrete making it possible to reduce the quantity of cement. Fly ash is generally used as replacement of sand as an admixture in concrete, and in manufacturing of cement. Concrete containing fly ash as partial replacement of sand poses problems of delayed early strength development. Concrete containing fly ash as partial replacement of fine aggregate will have no delayed early strength development, but rather will enhance its workability and strength. This higher workability and strength achieved gives scope for indirectly reducing the sand quantity in concrete. Earlier investigations in respect of development of strength of cement mortars with fly ash showed the 50% to 80% increase in 91 days' strength. For better packing of concrete more quantity of particle size less than 75 microns is highly desirable. This addition of finer particles will also increase the water requirement of the concrete mix. Addition of fly ash as replacement of sand fulfills this requirement of additional finer particles and improves workability and strength at same water content. Considering present scope of work only workability, cost and strength properties of concrete were studied. In future durability studies are recommended. Fine aggregate occupies about 25% to 40% of total volume of concrete and hence provides great opportunity to utilize about 150 kg per m3 waste materials like fly ash for replacement. The need of fly ash utilization also arises out of the fact that good quality Natural River sand required in concrete and in the cement mortar, is depleting day by day and scarcity of good quality sand is felt by all metro and mega cities in India. Hence this study explores the possibility of replacing part of fine aggregate with fly ash by maximum density method and minimum voids method as a means of incorporating fly ash and reducing the consumption of natural sand. Both methods used in present study for replacing sand with fly ash are the oldest and basic conceptual methods and will provide a simple but effective way of replacing sand with fly ash at site. From the literature reviewed it is clear that in India disposal of fly ash is a big problem. However as reported high volume fly ash concrete lowers compressive strength compared to cement concrete. In all referred literature replacement of sand with fly ash

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has produced higher strength than normal concrete with sand as fine aggregate. It is further observed that water absorbed by fly ash could also be used for internal curing of concrete, which may further reduce cracking.

II. METHODOLOGY

The test performed is

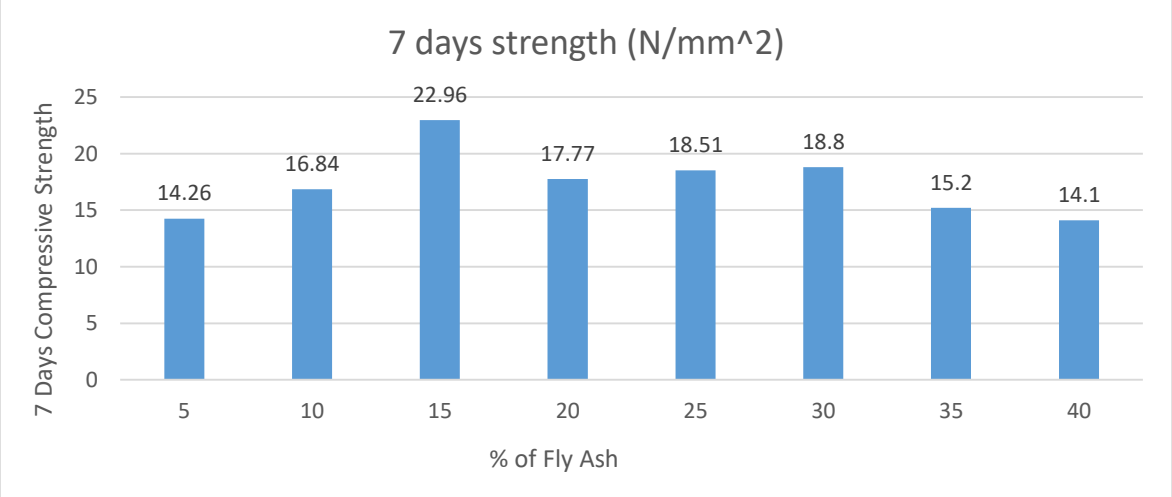
Slump test: The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used an indicator of an improperly mixed batch. The test is popular due to simplicity of apparatus and simple procedure.

Compression test: - the cube specimen was tested for compressive strength at the end of 7 days and 28 days. the specimen was tested after the surface were dried. the load was applied on the smooth sides without shock and increased continuously until the failure of specimen. The maximum load withstand by the specimen is noted, mean compressive strength is determined. Compressive strength of concrete depends on many factors such as water cement ratio, cement strength, quality of concrete material, quality control during production of concrete etc. compressive strength of concrete cube test provides an idea about all the characteristics of concrete. by this single test one can judge that whether concreting has been done properly or not. Concrete compressive strength for general construction varies from 15 Mpa to 30 Mpa and higher in commercial and industrial structures**.**

III. RESULTS

We conduct compressive strength test on block. Then we observed that after 7 days our maximum strength of 7 days is 18.80 N/mm^2 is achieved. After 28 days our strength is 37.58 N/mm^2. We had to try to increase the strength of our concrete block & we determine optimum content of Fly Ash in concrete.

Sr. no	% of sand replacement by Fly Ash	7 days strength (N/mm^2)	28 days strength (N/mm^2)
1.	5	14.26	29.30
2.	10	16.84	32.18
3.	15	22.96	37.58
4.	20	17.77	37.22
5.	25	18.51	33.34
6.	30	18.80	28.17
7.	35	15.20	28.15
8.	40	14.10	23.51



7 Days Compressive Strength

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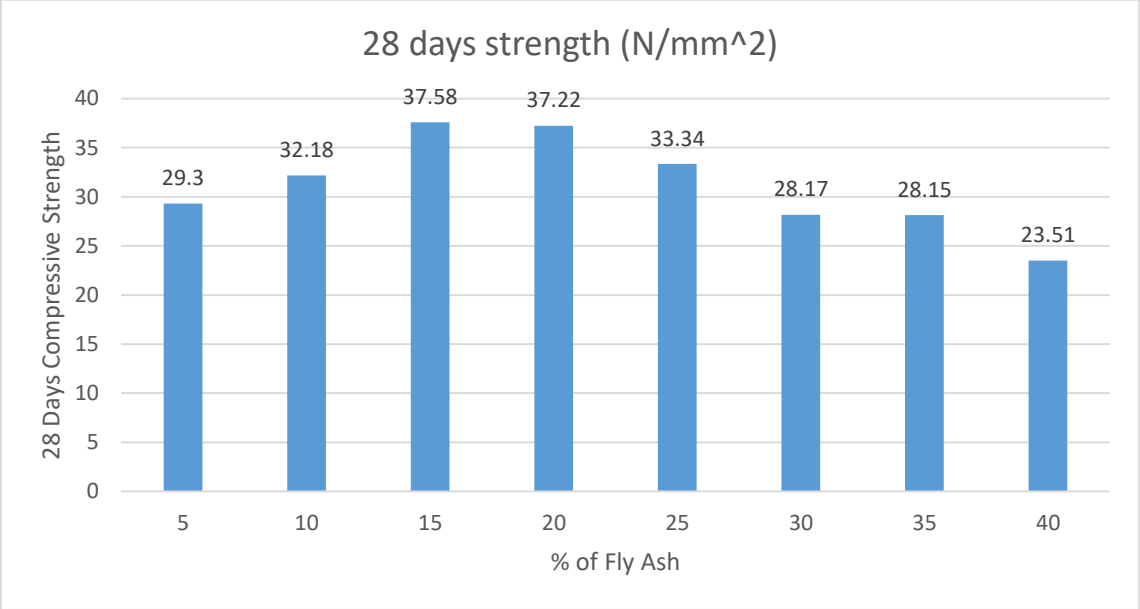

28 Days Compressive Strength

IV. CONCLUSION

- **The following conclusions could be drawn from the present investigation.**

1. Present mix design procedure clearly achieves lesser voids as indicated by higher pulse velocity, compress sieve strength.
2. The compressive strength of concrete mixes with partial replacement of sand by fly ash was found to be 28% higher respectively with super plasticizer.
3. The replacement of sand by fly ash in concrete is help to minimize the void and help to increase the workability of concrete.
4. By using fly ash internal curing of concrete will be increased. 5. It help to reduce digging of sand in river

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