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Comparative Study of Fly Ash and Pond Ash on Compressive and Flexural Strength of Concrete

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Abstract: **Nowadays concrete is the most commonly used material in the field of construction. Due to the rapid growth of construction industry the demand for concrete is increasing drastically. Fly ash and pond ash are the byproducts formed at the thermal power plants during the combustion of pulverized coal. In this present study fly ash and pond ash are partially replaced for cement and sand respectively. Keeping the fly ash 20% constant the percentage of pond ash is varied from 15% to 20%.Compression test is done for cubes of cross section 150mmx150mmx150mm, Flexural strength test is done on beams of cross section 100mmx100mmx500mm. The curing period for cubes and beams is 28 days and 56 days.**

Keywords: **Compression, Flexural strength, Fly ash, Pond ash.**

1. INTRODUCTION

Now a day's concrete is the most commonly used material in the field of construction. Flexibility, molding ability of concrete material, its high compressive strength and the steel reinforcing and pre-stressing technique in concrete facilitates to improve its strength as against its low tensile strength property and contributed largely for its wide spread use. Many researchers working in the concrete area are trying to understand and modify various concrete properties along with optimizing the cost of concrete. Nowadays concrete is readily prepared for placing at site and is supplied at the site directly from the RMC (Ready Mix Concrete) plant. Chemicals in the form of admixture, polymers and epoxies have been extensively used in concrete mix in order to improve its performance. Use of various fiber materials mixed with concrete is also an option to improve performance of the concrete. Various alternatives of improving performance of concrete are leading towards increasing the cost of concrete. To economize the cost of concrete, use of ground granulated blast furnace slag, rice husk, fly ash etc. have already been tried by many researchers as a partial replacement of cement in concrete mix. Concrete is most widely used construction material worldwide. Cement concrete industry is one of the major users of fly ash in structural concrete, mass concrete construction like highways etc. Fly ash in concrete is used for the purpose of economy and at the same time fly ash contributes in better durability, reduced permeability, reduction in W/C ratio, reduction in expansion due to(AAR) Alkali Aggregate Reaction, and improved long term strength and most importantly reduction in cement content.

2. LITERATURE REVIEW

Arumugam K. et.al. In this paper he has replaced pond ash partially for sand. In this he has considered compressive, flexure, split tensile strength of concrete and he got higher flexural and split tensile strength upto 20% replacement of pond ash for sand.

S.A. Haldive et.al. studied the fly ash and pond ash are obtained as the by product from the thermal power plants and got to the conclusion that this replaced concrete will give higher compressive strength compared to the normal concrete with OPC of 53 grade.

Jay Patel et.al. The objective of this paper is to get a eco friendly and a economical high strength concrete. In this three parameters of hardened concrete are considered such as compressive, flexure and split tensile strength. From this study he concluded that, areas like Goa, Kerala, Mumbai, at where the pond ash is easily available. the partial replacement of sand by pond ash is highly useful and reduces environmental issues.

Prof. P. P. Bhangale et.al. studied the cost analysis and came to conclusion that replacement of fine aggregate with pond ash is acceptable and variation of strength of pond ash concrete in comparison to normal concrete lies within plus or minus 10% up to 28days curing for various mixes.

Abdulhameed Umar Abubakar et.al. The fly ash and coal bottom ash samples were collected from the tanjung bin power plant from this study he concluded that for M35 grade concrete has got a compressive strength of 30N/mm^2 for a curing period of 28 days. By increase in the curing period the strength of this particular concrete gets increased.

3. MATERIALS

Cement:

Ordinary Portland cement of 53 grade confirming to specifications as per IS 12269–1987 is used and Specific Gravity is 3.15.

Fine aggregates:

The sand used for the experimental study is locally procured and was confirming to zone-II. The specific gravity of fine aggregate is found to be 2.44

Coarse aggregate:

By conducting the physical test on coarse aggregate the obtained value of specific gravity is 2.793. The coarse aggregate of 20mm maximum size and retained on IS 4.75mm sieve has been used in the present study.

Water:

Clean potable water available in the laboratory satisfying the requirements of IS 456:2000 is used for concrete mix.

Pond Ash:

Pond Ash from Raichur Thermal Power Station (RTPS) is used for replacement from 15% to 20% for Fine Aggregate. Which contributes to the concrete mix. Specific Gravity of Pond Ash is 2.02.

Fly ash:

Fly Ash from Raichur Thermal Power Station (RTPS) is used as a replacement of 20% for Cement. The specific Gravity of fly Ash is 2.2.

Chemical Admixture:

The Conplast-SP430 super plasticizer manufacture by Fosroc Chemicals (India) Pvt. Ltd, Bangalore is used.

Experimental Investigation:

The experimental investigation is carried out by replacing cement and sand partially with fly ash and pond ash in varying percentages to improve the strength of concrete. The required materials were weighed and mixed manually. The cube specimens of size 150 mm x 150 mm x 150 mm and beam specimens of size 500 mm x 100 mm x 100 mm was casted. The specimens has been de molded after 24 hours from the casting and the specimens were cured at a room temperature in water tank.

4. METHODOLOGY

In this present study partial replacement of cement and sand has done by using fly ash and pond ash. The grade of concrete is $M_{40.}$ In this cube and beam specimens are casted and cured for 28 and 56 days.

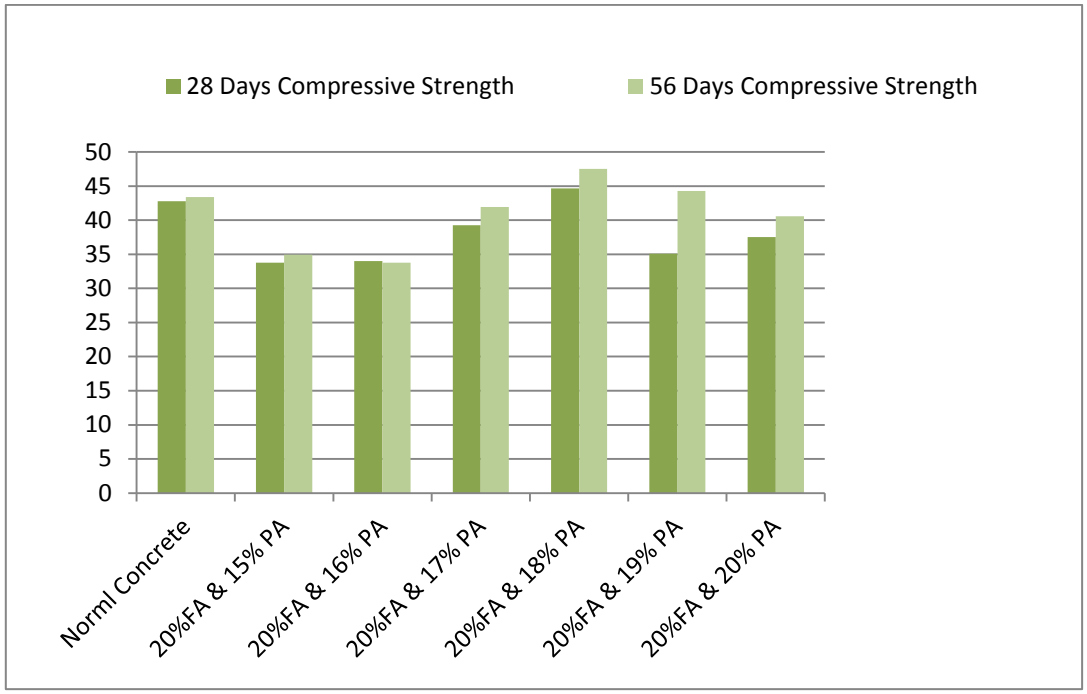
TEST PROCEDURE:

Compressive Strength Test:

The cubes were taken after a curing period of 28 and 56 days from the water tank, surface dried and tested using a compression testing machine. These cubes were loaded on their sides during compression testing such that the load was exerted perpendicularly to the direction of casting. The cubes were placed in the compression testing machine and the

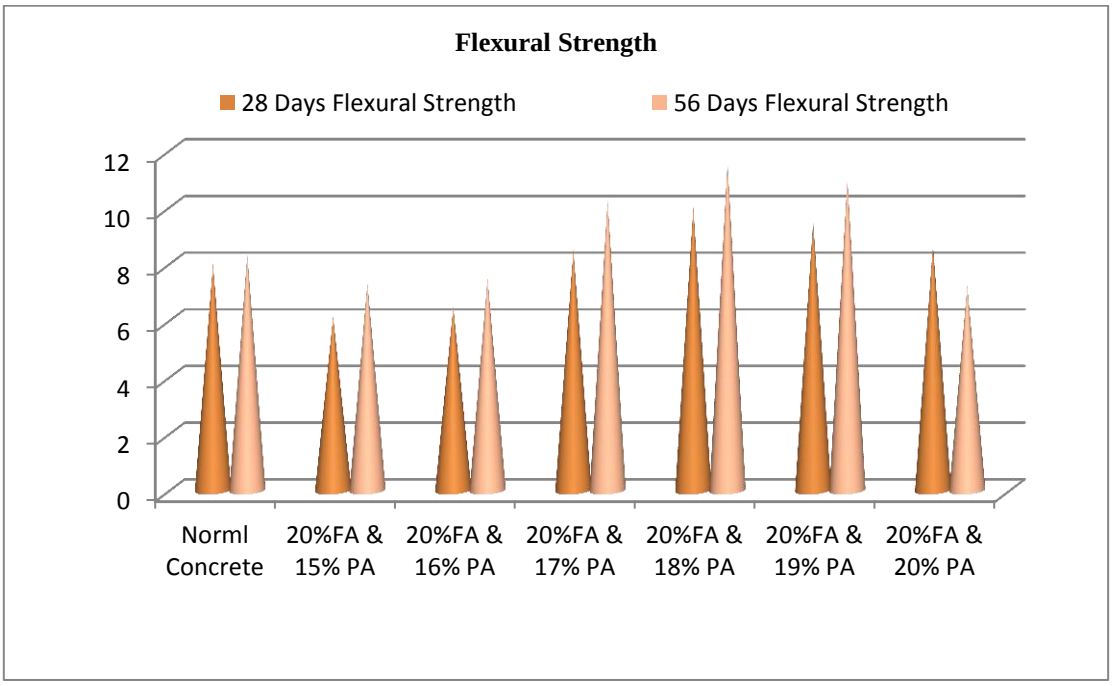
loads are applied gradually at a rate of 14 N/mm^2 /min. The average value of the compression strength of three cubes was taken as the compression strength. The compressive strength of concrete with partial replacement of cement and sand with fly ash and pond ash is shown in the below graph

Test results of concrete cube specimens for M40 grade:



Flexural Strength Test:

The beam specimens of size 500 x 100 x 100 mm were used for the determination of the flexural strength. The bearing surface of the supporting and loading rollers were wiped clean and any other loose fine aggregate or other materials removed from the surface of the specimen where they are to make contact with the rollers. The specimen was then placed in the machine and two point loads was applied. Load was increased until the specimen failed and the load at failure was recorded and the flexural strength was determined. Flexural strength was taken as the average strength of three specimens. The flexural strength of beam for 28 and 56 days comparison is shown in the below graph.



5. CONCLUSION

Compressive strength (Cube 150x150x150 mm):

- The 20%FA,18%PA mix will give a high compressive strength of 44.65 N/mm^2 for 28 days curing period. The 20% FA,15%PA mix will give a low compressive strength of 33.77 N/mm^2.The 20%FA,18%PA mix will give a 4% higher strength compared to normal concrete.

- The 20%FA,18%PA mix will give a high compressive strength of 47.52 N/mm^2 for 56 days curing period. The 20%FA,16%PA mix will give a low compressive strength of 33.77 N/mm^2. The 20%FA,18%PA mix will give 8% of higher strength compared to normal concrete. The 56 days cured concrete of 20%FA,18%PA will give 6% higher strength compared to 28 days cured concrete mixes.

Flexural strength (Beam 100x100x500 mm):

- The 20%FA,18%PA mix will give a high compressive strength of 10N/mm^2 for 28 days curing and 20%FA,15%PA will give a low flexural strength of 6.15 N/mm^2. The 20%FA,18%PA mix will give higher strength compared to normal concrete.

- The 20%FA,18%PA mix will give a high flexural strength of 11.16 N/mm^2 for a curing period of 56 days. The 20%FA,18%PA mix will give 25% higher strength compared to normal concrete. The 56 days cured concrete will give 10% higher strength compared to 28 days cured concrete of other mixes.

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