Utilization of Pond Fly Ash as a Partial Replacement in Fine Aggregate with Using Fine Fly Ash and Alccofine in HSC-Fresh Concrete Properties

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Abstract — **India is developing country and it depends upon the thermal power plants for power requirements.75% power generation of India by thermal generation plants and 90 % of it is coal-based generation. Use of coal bring huge amount of ash every year. It was generated around 170 million ton in 2010. Almost generated ash handled in wet form and disposed of in ash ponds.[1] Generated ash ponds are very harmful to environment. Using this fly ash as a replacement of fine aggregates. The main aim of this study is to get the economical and eco-friendly High Strength Concrete(HSC). The fresh concrete test carried out for finding properties of this concrete at fresh stage.**

Index Terms*—Alccofine, Fly ash pond, High Strength Concrete, Replacement of cement (key words)***

I. INTRODUCTION

A fly ash pond is an engineered structure for the disposal of bottom ash and fly ash. The wet method consists of constructing a large "pond" and filling it with fly ash slurry, allowing the water to drain and evaporate from fly ash over time[2].
A pozzolan is siliceous or siliceous and aluminous material which, in itself, possesses little or no cementitious value but which will, in finely divided form and in the presence of water, react chemically with calcium hydroxide at ordinary temperature to form compounds possessing cementitious properties (ASTM C618).[3]

Fig -1 Fly ash pond
(Image Courtesy :Shaila Dewan; Published 6th January, 2009)

Concrete is mostly used artificial material all over the world and has played main role in development of all countries. For higher and higher requirements in last past few years many research has been done on concrete t make it more durable and higher strength. In 1970's compressive strength more than 40 N/mm2 known as high- strength concrete. Later 60-100 N/mm2 compressive strength classified as High-strength concrete.

As per M60 Mix design in this research the Alccofine and fine fly ash partially replaced with cement and pond fly ash as a replacement of fine aggregates. In mix G1, G2 and G3 cement replaced by Alccofine 4% and fine fly ash 26% and pond fly ash varies 10%, 20%,30% as replacement of fine aggregates. Similarly in mix G4, G5 and G6 fine fly ash 24% and pond Fly ash same as 10%, 20% and 30%

II. MATERIALS

Pond fly ash in concrete has been replaced by fine aggregates. Its properties shown in table-1

Table -1 Chemical Composition of Pond Fly Ash

Ingredients	Percentage	Ingredients	Percentage
Cao	0.25	Total Chloride	0.002
Sio_2	73.6	Loss on Ignition	3.7
Al_2O_3	9.1	Fe_2O_3	1.35

MgO	0.05	TiO_2	Nil
SO_3	0.01	P_2O_3	0.0001
NaO_2	0.004	K_2O	0.002

Table – 2 Mix Proportion

M60	**G1**	**G2**	**G3**
CEMENT(kg)	420	420	420
FLY ASH(kg)	156	156	156
ALCCOFINE(kg)	24	24	24
WATER(kg)	198	210	221
F.A.(kg)	676.8	601.6	526.4
P.A.(kg)	75.2	150.4	225.6
C.A.(20 mm)(kg)	672	672	672
C.A.(10 mm)(kg)	448	448	448
ADMIXER(kg)	5.3	5.3	5.3
W/B	0.33	0.35	0.37

M60	**G4**	**G5**	**G6**
CEMENT(kg)	420	420	420
FLY ASH(kg)	144	156	144
ALCCOFINE(kg)	36	36	36
WATER(kg)	198	210	221
F.A.(kg)	676.8	601.6	526.4
P.A.(kg)	75.2	150.4	225.6
C.A.(20 mm)(kg)	672	672	672
C.A.(10 mm)(kg)	448	448	448
ADMIXER(kg)	5.3	5.3	5.3
W/B	0.33	0.35	0.37

III. EXPERIMENTAL PROGRAM

a. Slump Test

To determine the workability of concrete mix by slump test conducted by as per IS 1199-1959. The internal surface of the mould thoroughly cleaned and freed from superfluous moisture than mould placed on a smooth, horizontal, rigid and non-absorbent surface. The mould was filled in four layers, each approximately one-quarter of the height of the mould. Each layer was tamped with twenty-five strokes of the rounded end of the tamping rod. The bottom layer tamped throughout its depth. After the top layer has been rodded, the concrete was struck off level with a trowel or the tamping rod, so that the mould is exactly filled. The mould removed from the concrete immediately by raising it slowly and carefully in a vertical direction. This allows the concrete to subside and the slump shall be measured immediately by determining the difference between the height of the mould and that of the highest point of the specimen being tested. Test results of slump test given in table no-3.

Fig 1 Slump Test

Fig 2 Flow Test

b. Flow Test

To determine the workability of concrete mix by Flow test was conducted as per IS 1199-1959. The mould was placed in centred on the table and filled in two layers, each approximately one-half the volume of the mould. Each layer was rodded with 25 strokes of a straight round metal rod 1.6 cm in diameter and 61 cm long, rounded at the lower tamping end. The stroke was distributed in a uniform manner over, the cross-section of the mould and shall penetrate into the underlying layer. The bottom layer was rodded throughout its depth. After the top layer has been roddd, the surface of the concrete was struck off with a trowel so that the mould is exactly filled. The excess concrete which has overflowed the mould was removed and the area of the table outside the mould again cleaned. The mould was immediately removed from the concrete by a steady upward pull. The table was then be raised and dropped 12.5 m, 15 times in about 15 seconds. The diameter of the spread concrete the average of six symmetrically distributed caliper measurements read.

c. Compacting Factor Test

The concrete was placed gently in upper hopper, using the hand scoop. The hopper was filled level with its brim and trap -door was opened so concrete falls in to lower hopper. Than the trap door of second hopper was opened and concrete was allowed to fall in cylinder. The excess concrete above the top of cylinder was removed by towel. The weight of concrete was measured and compare that with the weight of concrete was fully compacted in same cylinder. And the ratio of both known

Fig 3 Compaction Factor Test

as compaction factor. Result of compacting factor test is given in table no-5

IV. TEST RESULTS

Table – 3 Slump test results

Sr. No.	Mix Proportion	Slump (mm)
1	G1	250
2	G2	230
3	G3	190
4	G4	260
5	G5	210
6	G6	200

Table – 4 Flow Test results

Sr. No.	Mix Proportion	Flow Dia(mm)
1	G1	550
2	G2	600
3	G3	300
4	G4	610
5	G5	510
6	G6	300

Sr. No.	Mix Proportion	C.F.
1	G1	0.98
2	G2	0.98
3	G3	0.98
4	G4	0.98
5	G5	0.98
6	G6	0.98

V. Discussion

The workability measured in terms of compaction factor, decreases with the increase of the replacement level of the fine aggregates with the pond ash. It can be due to extra fineness of pond ash as the replacement level of fine aggregates is increased.

VI. Conclusions

The workability of concrete decreased with the increase in pond fly ash content due to the increase in water demand, which is incorporated by increasing the dosage of super plasticizer.

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