IMPACT: International Journal of Research in Engineering & Technology (IMPACT: IJRET)
ISSN(E): 2321-8843; ISSN(P): 2347-4599
Vol. 3, Issue 12, Dec. 2015, 45-48

EXPERIMENTAL STUDIES ON REPLACEMENT OF FINE AGGREGATES BY BOTTOM ASH FOR DEVELOPING HIGH STRENGTH CONCRETE

KIRAN M SANNAKKI & SANJITH J

Department of Civil Engineering, Adichunchanagiri Institute of Technology Chikmagalur, India

ABSTRACT

Present study investigates the effect of coal bottom ash as partial replacement to sand in concrete. The bottom ash was procured from Adani power plant Udupi, and partially replaced with sand. Compressive strength characteristics of M40 grade concrete were studied with of bottom ash varying from 0% (Conventional concrete), 10%, 20%, and 30% replacement and at different curing periods. Analysis of results showed that maximum strength of 49.56 N/mm^2 by replacing 20% of bottom ash as replacement fine aggregate

KEYWORDS: Studies on Replacement, Construction

INTRODUCTION

There is a scarcity and availability of natural aggregates is due to rapid development in construction technology. Nowadays deforestation, extraction of natural aggregates from river beds, lakes and other water bodies have resulted in huge environmental problems. Moreover the filtration of rain water achieved by deposits of natural sand is being lost, thereby causing contamination of water reserves used for human consumption. Hence, to prevent pollution, authorizes are imposing more and more stringent restrictions on the extraction of natural aggregates and its crushing have been banned. The best way to overcome this problem is to find alternative aggregates for construction in place of conventional natural aggregates. In order to overcome these problems bottom ash is used as a partial replacement for fine aggregate.

Bottom ash [normally recognized as coal combustion residues (CCRs) from pulverized fuel power stations] has been categorized as solid garbage. But, CCRs are increasingly being regarded as a useful substitute material resource. They had an appearance similar to dark gray coarse sand, and its particles are clusters of micron sized granules, up to 5mm in diameter (60%-70% smaller than 2 mm. l0-20% smaller than 75 microns).

OBJECTIVE

To determine the optimum content of bottom ash as a substitute for fine aggregate in concrete. To evaluate the fresh and hardened properties of concrete containing bottom ash from power plant as sand replacement in high strength concrete of mix 40.

MATERIALS AND MEHODOLOGY

The different materials used for the bottom ash concrete are

CHATINADU 43 grade ordinary Portland cement of specific gravity 3.14, standard consistency of 32%, initial

setting time of 50minutes, final setting time of 405minutes and fineness of 5 %.Fine aggregate conforming to zone-2 of Table 4 of IS 383- 1970 from Chikmagalur of specific gravity 2.61and water absorption 1.2%. Coarse aggregate crushed granite of 20mm down size, well graded of specific gravity 2.67 and water absorption of .6% and bottom a of specific gravity 2.42 which is used to replace the fine aggregates are brought from Adani power plant Udupi, metakaolin of specific gravity of 2.6 which is replaced to cement to 10% and finally portable water free from alkalinity and acidity is used.

Conventional concrete of M40 grade is adopted and the mix proportion of 1:1.9:3.4 is obtained as per IS method outlined in IS 10262:2009. For bottom ash concrete , bottom ash are replaced at 10%, 20% and 30% to fine aggregate. Test specimen for 7, 14 and 28days cube compressive, split tensile strength is casted in mould size of 150x150x150mm size cube for compressive test strength, cylindrical mould of diameter 100mm. After one day the specimens are cured for 7 days, 14days and 28days and respective compressive strength and split tensile strength of specimens is found out under U.T.M.

RESULTS AND DISCUSSIONS

Table 1: Slump and Compaction Factor for Various Mix

% Replacement Of Bottom Ash	Slump Mm	Compaction Factor
0%(CC)	35	0.9
10	31	0.86
20	28	0.84
30	24	0.82

The table shows the slump value and compaction factor value of various mixes of concrete. As the % replacement of bottom ash to fine aggregate increases workability decreases.

Table 2: Compressive Strength of Various Mix

Replacement of Bottom ash	Compressive strength (N/mm^2)		
	7days	14days	28days
0%(CC)	31.67	39.12	48.77
10	29.67	33.68	42.11
20	31.58	39.648	49.59
30	27.65	34.696	43.37

The table shows the compressive strength of various mixes of concrete for 7 days, 14 days and 28 days. As the % replacement of bottom ash to fine aggregate increases compressive strength increases up to 20% .Thus it is clear that we can replace the fine aggregate by bottom ash up to 20%.

Compressive Strength

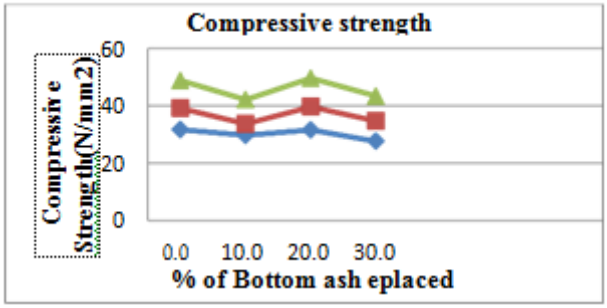

Figure 1: Compressive Strength of Various Mix

Table 3: Split Tensile Strength of Various Mix

% Replacement of coconut shells	Split tensile strength (N/mm^2)		
	7days	14days	28days
0%(CC)	3.5	3.3	5
10	2.92	3.18	4.83
20	3.31	3.41	5.18
30	2.88	3.029	4.59

The table shows the split tensile strength of various mixes of concrete for 7 days, 14 days and 28 days. As the % replacement of bottom ash to fine aggregate increases split tensile strength increases up to 20% .Thus it is clear that we can replace the fine aggregate by bottom ash up to 20%..

Split Tensile Strength

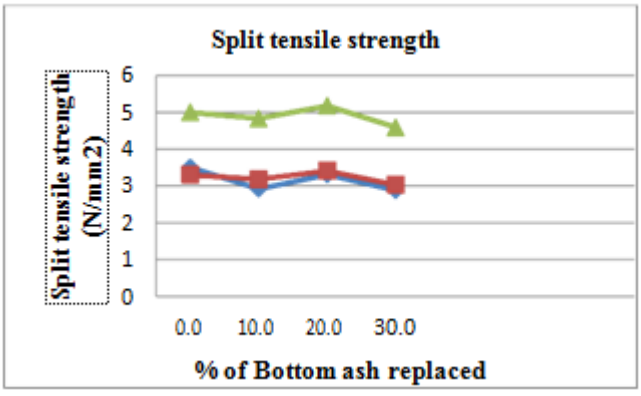

Figure 2: Split Tensile Strength of Various Mix

CONCLUSIONS

- Sand quarrying is done to extract sand for construction purposes. It affects the environment to a great extent. Bottom ash disposal in the environment disturbs the eco-system. Hence, this bottom ash concrete can be used in construction of pavement and buildings. Thus bottom ash is disposed in an eco-friendly way and sand quarrying can be reduced. Thus a greener environment can be build.

- The workability of concrete decreased with the increase in bottom ash content due to the increase in water demand, which is nullified by increasing the content of super plasticizer.
- The compressive strength and Split Tensile strength for 7, 14 and 28 days were increased up to 20% replacement and after that gradually decreased for further replacement.

REFERENCES

1. M.P.Kadam et al (2013) International Journal of Advanced Technology in Civil Engineering, ISSN: 2231 –5721, Volume- 2, Issue-1, 2013
2. Aggarwal P "Effect of bottom ash on replacement of fine aggregate in concrete" Asian journal of civil engineering (building and housing) vol. 8, no. 1 (2007) pages 49-62
3. B Archana "replacement of fine aggregate by bottom ash in concrete" Vol. 3, No. 2, May 2014
4. IS: 8112-1989. Specification for 43grade ordinary Portland cement. Bureau of Indian standards, New Delhi.
5. IS: 383-1997. Specification for coarse and fine aggregates from natural sources for concrete. Bureau of Indian standards, New Delhi.
6. IS: 1199-1959. Indian standard method of sampling and analysis of concrete. Bureau of Indian standards, New Delhi. IS: 10262-2009 "Recommended Guidelines For Concrete Mix Design", 1982. Bureau of Indian standards, New Delhi.