Use Waste Material of Sikka Power Plant- (Mound Ash) in Concrete Replacement as Fine Aggregate

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Abstract— The use of alternative aggregate is a natural step in solving part of depletion of natural aggregates. The investigation on alternative material for concrete making started much before than half a century. Use of hazardous waste in concrete making will lead to green environment & sustainable concrete technology. Concrete made from mound ash (sikka thermal power plant waste) as fine aggregate will be studied for workability, compressive strength, tensile strength and Flexural strength. Further, study of its durability will ensure greater reliability in its usage. So here in my project, I will use mound ash (sikka thermal power plant waste) as replacement of coarse aggregate by different percentage for making concrete of different grade from lower to higher like M-20, and M-30. The percentage replacement will be 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70% 80%, 90% and 100% with natural fine aggregates. I will use OPC-53 grade cement in making concrete with super plasticizer as an admixture to get proper workability for higher strength concrete.

Key words: OPC-53, Concrete Technology, Natural Aggregates

I. INTRODUCTION

Each year thousands of tonnes of wastes are disposed of in landfills which results in the occupation and degradation of valuable land. Depletion of natural resources is a common phenomenon in developed countries like India due to rapid urbanization & industrialization involving construction of infrastructures and other amenities.

Currently waste handling & utilization are burning ecological problems. Therefore intensive investigations are carried out in order to utilize industrial, constructional and domestic waste for concrete mix. The grained rubber of tyres, modified sawdust, crushed ceramic bricks (brick bats), plastic waste and remains of glass (broken glass), fly ash, blast furnace slag, quarry dust, tiles waste, waste aggregates from demolition of structures and ceramic insulator wastes etc. are utilized to produce concrete mixtures.

The reuse of wastes as inputs to other processes would alleviate disposal concerns & reduce the need for virgin resources. There is government as well as community pressure to reduce the volume of the waste by recycling the same.

Following type of ash produced in thermal power plant

A. ESP Dry Fly Ash:
the ash is collected from flue gases by means of electrostatic precipitator (ESP) or bag filters means and is in dry condition

B. Bottom ash (BA):
the ash that is collected bottom of boiler of a thermal power plant

C. Pond ash (PA):
ESP-dry fly ash, bottom ash, air pre-heater ash, bottom ash etc. mixed together transported to ash pond area through water slurry or otherwise and deposited in ash pond in the mix condition is known pond ash.

D. Mound ash:
Which is mixture of fly ash, bottom ash and pond ash etc. mixed to gather, transported to ash deposition area in dry state or moisture condition through convoyer belt or other means and together in the mixed condition in the form of a mound is known as mound ash.

In India major source of power generation is coal based thermal power plants. where 57% of the total power generated is from coal-based thermal power plant. High ash content is found to be in range of 30% to 50% in Indian coal.

II. LITERATURE REVIEW

Cannot available research paper particular on mound ash of I am studied related material pond ash and bottom ash.

A. Effect Of Bottom Ash As Replacement Of Fine Aggregates In Concrete:
P. Aggarwal, Y. Aggarwal, S.M. Gupta. (Civil Engineering Department, National Institute of Technology, Kurukshetra 136119, India)

1) Introduction:
This paper presents the experimental investigation carried out to study the effect of use of bottom ash as a replacement of fine aggregates. Although, flyash is being generally used as replacement of cement, as an admixture in concrete, and in manufacturing of cement, the study on the use of bottom ash (the coarser material, which falls into furnace bottom in modern large thermal power plants and constitute about 20% of total ash content of the coal fed in the boilers) has been very limited.

2) Methodology:
Fresh concrete properties such as compaction factor, unit weight etc. was determined according to an Indian Standard specification. The compressive strength, splitting tensile strength and flexural strength tests were performed at 7, 28, days in accordance with the provisions of the Indian Standard Specification IS: 516-1959. Bottom ash replaced by sand 0%, 10%, 20%, 30%, 40% and 50% in concrete then analysis carried out.

3) Discussion:
The workability of concrete decreased with the increase in bottom ash content due to the increase in water demand.
The density of concrete decreased with the increase in bottom ash content due to the low specific gravity of bottom ash as compared to fine aggregates Compressive strength, splitting tensile strength and Flexural strength of fine aggregate replaced bottom ash concrete continue to increase with age for all the bottom ash contents.
B. Effect on Concrete Properties by Replacement of Sand as Thermal Power Plant Pond Ash:
S M Wysal, P D Dhake1 and M P Kadam.
(Department of Civil Engineering, K.K.Wagh Institute of Engineering Education & Research, Nashik/University of Pune, India.)

1) Introduction:
An effects on concrete by replacement of sand as thermal power plant pond ash on properties such as compressive strength, split tensile strength, flexural strength and Modulus of Elasticity, are studied. The natural sand was replaced with pond ash by 0%, 20%, 40%, 60%, 80%, and 100% by weight, at fixed water-cement ratio 0.48.

2) Methodology:
Mix design was carried out as per IS:10262-2009 concrete mixture with different proportions of pond ash ranging from 0% (for control mix) to 20%, 40%, 60%, 80% and 100 % replacement for sand were considered. The M-25 grade mix design was selected for w/c ratio 0.48 and slump was considered 100 ± 10 mm. For this work testing was carried out at 7 days, and 28 days. cubes specimen, cylindrical specimens and beam specimens were casted and tested for compressive strength, split tensile strength, and flexural strength.

3) Results:
Fig 1: Effect of Pond Ash on Compressive Strength
Fig 2: Effect of Pond Ash on Flexural Strength
Fig 3: Effect of Pond Ash on Split Tensile Strength

4) Discussion:
The compressive strength for 7 and 28 days was increased up to 20% replacement and after that compressive strengths were decreased from 40% to 100% replacement.

The split tensile strength and flexural strength was increased at 7 and 28 days for 40% replacement and after that it was decreased for remaining replacement.

C. Properties of Concrete Using Tanjung Bin Power Plant Coal Bottom Ash And Fly Ash:
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1) Introduction:
Coal bottom ash (CBA) and fly ash were utilized in partial replacement for fine aggregates and cement respectively in the range of 0, 5, 10, 15 & 20% (equal percentages). The results of compressive strength at 7, 28, 56 & 90 days curing are presented because of the pozzolanic reaction; other properties investigated include physical properties, fresh concrete properties and density. The results showed that for a grade 35 concrete with a combination of CBA and fly ash can produce 28 day strength above 30 MPa.

2) Methodology:
A control mix containing OPC, natural sand and crushed rock aggregate was designed for a compressive strength of 35MPa at 28 days with a slump range of 25-75mm non-air entrained concrete using ACI Method of mix design. Natural sand was partially replaced with CBA in the range of 5, 10, 15 & 20%. Similar proportion was used for cement replaced with fly ash.

3) Results:
Fig 4: Graphical Representation of Grain Size Curve.
Fig 5: Result of Compressive Strength for CBA/FA Concrete
4) Discussion:
The result of the grain size analysis indicated that Tanjung Bin coal bottom ash is higher percentage of coarse sand particles.

lower specific gravity of fly ash & bottom ash is as a result of the chemical composition which is lower in lime & alumina content (2.45 & 1.9).

Tanjung Bin bottom ash aggregate absorbed 19% by weight and dry aggregate in contrast to just 2% of normal weight aggregate and it also indicates that there is a direct relationship between the rate of absorption & time.

III. CONCLUSION
- Thermal power plant waste material like pond ash and bottom ash can use in concrete parcel replacement as fine aggregate.
- Workability will decline where increasing percentage of replacement.
- Maximum 30 – 40 % replacement possible in concrete regarding compression, flexural and tensile strength.
- Density of concrete decline where increasing percentage of replacement.

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