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Experimental Investigation on Bottom ash as Partial Replacement for Fine Aggregate

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ABSTRACT: *This project presents the experimental investigation carried out to study the effect of use of bottom ash as a replacement of fine aggregate. Bottom ash is used as concrete aggregate or for several other civil engineering applications where sand, gravel and crushed stone are used. In the present project M_{30} grade of concrete is considered for the experimental investigation. Fine aggregate is partial replaced with 50%, 75%, 100% percentage of bottom ash. Comparative result of compressive strength, split tensile strength, flexural strength of conventional concrete cube, cylinder, prism and bottom ash added concrete cube, cylinder, prism are investigated.*

Key words: Bottom ash, Concrete, Fine aggregate, Replacement

INTRODUCTION

Concrete is the mostly used composite material in construction today. The function of fine aggregate is to assist in production workability and uniformity in the mixture. It has emerged as the dominant construction material for the infrastructure needs of the twenty-first century. The challenge for the civil engineering community in the near future is to realize projects in harmony with the concept of sustainable development and this involves the use of high performance materials. Over 70% of electricity generated in India, is by combustion of fossil fuels. In which nearly 61% is produced by coal-fired plants. Most of the ash has to be disposed off either dry or wet to an open area.

BOTTOM ASH

It is the coarser material, which drops into the bottom of the furnace in latest large thermal power plants and constitute about 20% of gross ash content of the coal fed in the boilers. It consists of non-combustible materials. Bottom ash is formed when ash adheres as hot particles to the boiler walls, agglomerates and then falls to the base of the furnace at a temperature around 1200^0C. Bottom ash obtained from thermal power plant at Neyveli in India was used in the investigation.

USE OF BOTTOM ASH

In comparison to sand, an elementary raw material, the black sandy material obtained is a subsidiary raw material. Using this material is more endurable and environmentally amicable and eludes the use of natural resources such as sand and gravel. Bottom ash is used in following activities

- Road construction
- Foundation material
- Aggregate

MATERIAL USED

- Cement
- Coarse aggregate
- Fine aggregate (M-sand, Bottom ash)
- Water

EXPERIMENTAL STUDIES

M_{30} grade of concrete is considered for the experimental investigation. Fine aggregate partial replaced with 50%, 75%, 100% percentage of bottom ash. Comparative result of compressive strength, spilt tensile strength, flexural strength of conventional concrete cube, cylinder, prism and bottom ash added concrete cube, cylinder, prism are reported.

COMPRESSIVE STRENGTH, SPLIT TENSILE STRENGTH, FLEXURAL STRENGTH

The specimen of standard cube of (150mm x 150mm x 150mm), cylinder (150mm x 300mm),prism(500mm x 100mm x 100mm) was used to determine the compressive strength, split tensile strength, flexural strength of concrete respectively . Two specimens were tested for 7, 14, 28 days with varying proportion of bottom ash replacement. The constituents were weighted and the materials were mixed in a mixer. The mixes were compacted with the help of tamping rod. The specimens were de-molded after 24h, cured in water for 7, 14, 28 days and then tested for its compressive strength as per Indian standards. The compressive strength test on cubes in the CTM machine is conducted.

COMPRESSIVE STRENGTH

Age	0% bottom ash N/mm²	50% bottom ash N/mm²	75% bottom ash N/mm²	100% bottom ash N/mm²
7 days	25.11	23.55	26.22	26.66
14 days	27.10	25.77	28.40	29.33
28 days	29.00	27.77	30.88	31.99

SPLIT TENSILE STRENGTH

Age	0% bottom ash N/mm²	50% bottom ash N/mm²	75% bottom ash N/mm²	100% bottom ash N/mm²
7 days	3.81	4.14	4.45	4.77
14 days	4.13	4.61	5.09	5.41
28 days	5.09	4.77	5.72	6.04

FLEXURAL STRENGTH

Age	0% bottom ash N/mm²	50% bottom ash N/mm²	75% bottom ash N/mm²	100% bottom ash N/mm²
7 days	6.50	7.25	7.75	8.50
14 days	8.00	7.50	8.25	8.75
28 days	10.0	8.25	9.25	10.25

CONCLUSIONS

From the results it is concluded that the bottom ash can be used as a replacement for fine aggregate. The results prove that the replacement of 100% of fine aggregate by bottom ash induced higher compressive strength. To save the natural resource. It is economical compare with river sand. It controls environmental effects by the usage of bottom ash.

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