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LOW COST CEMENT CONCRETE PAVEMENT

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ABSTRACT:-*Energy consumption and generation is increasing day by day due to rapid industrialization and urbanization. In this study pond ash is utilized as a partial substitute of cement and waste foundry sand is utilized as a partial substitute of fine aggregate in concrete. The pond ash is added in concrete by partially replacing 20%, 30% and 40% of cement and foundry sand is added in concrete by partially replacing 30%, 40% and 50% of fine aggregate to determine the strength. The casting of cubes is done to determine the compressive strengths respectively for 7 and 28 days of curing. It was observed that as the replacement of foundry sand increases there was increase in compressive strength and curing time. The results obtained by this experimental study were for 30% replacement of natural sand by foundry sand and 20% replacement of cement by pond ash the compressive strength observed were 23.45 MPa and 39.40 MPa for 7 and 28 days respectively.*

INTRODUCTION

A major portion of the energy is generated by thermal power plants by using coal. Pond ash and other by-products from these plants are disposed in large quantities. Pond ash can be effectively used to replace the natural materials. The ash which is fall at the bottom of boiler is mixed with water, and then it is carried away from plant through pipes and finally dumped on open land. After evaporation whatever ash remains is called pond ash. Foundry sand consists primarily of clean, uniformly sized, high-quality silica sand or lake sand that is bonded to form molds for ferrous (iron and steel) and nonferrous (copper, aluminum, brass) metal castings. Although these sands are clean prior to use, after casting they may contain Ferrous (iron and steel) industries account for approximately 85 to 95 percent of foundry sand used for castings.

Foundry sand

Pond ash

MATERIALS AND METHOD

Materials used: Cement, River sand, Pond ash, Foundry sand, coarse aggregates and water.

Properties of Pond ash

Parameters	Pond ash
Specific gravity	2.0
Bulk density	0.95 gram/cm^3
Color	Grey
Fineness test	4%
Fineness modulus	2.80

Properties of Foundry sand

Parameters	Foundry sand
Specific gravity	2.4
Bulk density	2.1 gram/cm^3
Color	Grey
Moisture content	10%
Coefficient of permeability	10^{-4} cm/sec

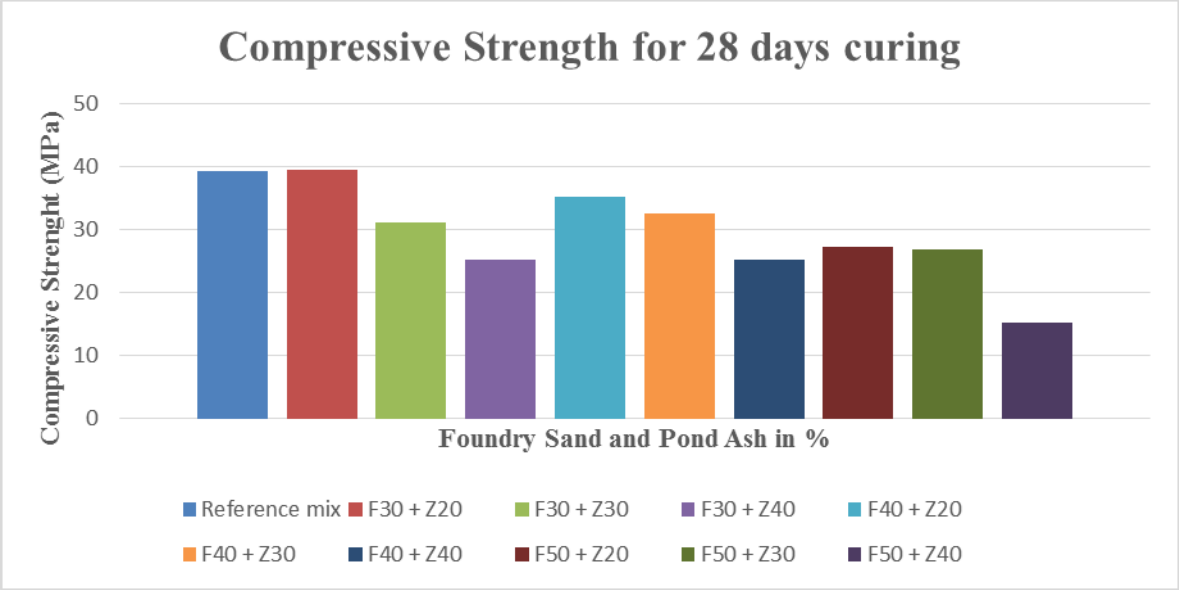
Method:

The experiment was carried out to find the compressive strength of the concrete using compression strength test. The compressive strength of concrete has been evaluated at different ages of concrete. The specimen of standard cube of (150mm x150mm x 150mm) was used to determine the compressive strength of concrete. Specimens were tested for 7 & 28 days with (30%, 40%, 50%) proportion of river sand is replaced by Foundry sand and of Pond ash with (20%, 30%, 40%) by the weight of cement. The constituents were weighed and the materials were mixed by hand mixing. The mixes were compacted using vibrating needle. The specimens were remolded after 24 hours, cured in water for 7 & 28 days, and then tested for its compressive strength as per Indian Standards.

RESULTS AND DISCUSSIONS

Overall compressive strength of concrete cubes with partial replacement of cement by pond ash and partial replacement of natural sand by waste foundry sand in known proportion: - (28 days curing)

Description of the mix	Compressive Strength (MPa)	% increase or decrease of compressive strength with respect to reference mix
Reference mix	39.30	-
$F_{30} + Z_{20}$	39.40	+0.25
$F_{30} + Z_{30}$	31.07	-20.94
$F_{30} + Z_{40}$	25.18	-30.93
$F_{40} + Z_{20}$	35.09	-10.71
$F_{40} + Z_{30}$	32.40	-17.56
$F_{40} + Z_{40}$	25.09	-36.16



RESULTS AND DISCUSSIONS

- The combination of foundry sand with 30% and pond ash with 20% gives higher compressive strength.
- With foundry sand and pond ash, it is possible to produce workable concrete of required strength.
- Foundry sand has a potential to provide alternative natural sand and helps in maintaining the environment as well as economical balance.
- In terms of cost analysis, compared with conventional concrete and modified concrete, modified concrete reduces 10% of total estimated amount.

Cost estimation

Estimation of conventional concrete road
Estimated cost = 3,00,000. Estimation prepared according to PWD circle of year 2015-2016
For Length: 86m, Breadth: 4m,Depth: 0.15m,Quantity: 51.60 =00 cum
Whereas for the same road if we use pond ash with partial replacement of cement by(20%) and foundry sand with partial replacement of sand by (30%) we can save up to 45,000Rs. It means that as compared to conventional about 15% of the total cost is reduced.

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