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EXPERIMENTAL STUDY OF PARTIAL REPLACEMENT OF CEMENT BY THERMAL POWERPLANT WASTE AND CORSE AGGREGATE BY LECA (LIGHT EXPANDED CLAY AGGREGATE)

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Abstract

Concrete has been used in various structures all over the world since last two decades. Recently a few infrastructure projects have also seen specific application of concrete. The development of concrete has brought about the essential need for additives both chemical and mineral to improve the performance of concrete. Most of the developments across the work have been supported by continuous improvement of these admixtures. Hence variety of admixtures such as fly ash, rice husk ash, stone dust have been used so for. Also different varieties of fibers have below tried as additions. Hence, an attempt has been made in the present investigation to study the behavior Of Partial Replacement Of Cement With Fly Ash And Sand With Bottom Ash And Glass Used In Concrete. To attain the setout objectives of the present investigation, Partial Replacement Of Cement With Fly Ash And Sand With Bottom Ash And Glass Used In Concrete by 30, 40, and 50 % to produce Concrete. Reinforced Concrete (RC) is tested for Compression, split tension and flexural strengths. The results are quite encouraging for use of Glass in producing Concrete.

Keywords: Experimental, Investigation, Partial Replacement, Cement With Fly Ash, Sand With Bottom Ash And Glass Concrete.

1. INTRODUCTION

Use of waste and by products in concrete will lead to green environment and such concrete can be called as “Green Concrete”. There are various types of waste materials that can be considered for usage in concrete. The disposal of fly ash will be a big challenge to environment, especially when the quantum increases from the present level. Hence worldwide research work was focused to find alternative use of this waste material and its use in concrete industry is one of the effective methods of utilization. Increase in demand and decrease in natural resource of fine aggregate for the production of concrete has resulted in the need of identifying a new source of fine aggregate. The possibility of utilization of thermal power plant byproduct bottom ash as replacement to fine aggregate in concrete is taken into consideration. Presently about 105 million tons flyash is generated every year in India as a by-product of coal consumed in the thermal power plants. The thermal power plant is only the source to produce 65% of the total electricity produced in our country. Investigation on utilization of flyash in cement mortar is carried out by many authors reported in the literature. Several million tons of coal for generating the electricity is being consumed in India out of which 40% of coal is accounted for generating of flyash as a bye product.

The finest flyash is called dry flyash, collected from different electrostatic precipitators (ESP) in dry form. While the ash mixed with water, forming slurry and drained out in ponds is referred as pond flyash. Bottom ash has coarse particle size, higher water absorption and usually no pozzolanic effect. Therefore, it is dumped in land fill sites or discharged in pond in mass quantity and is easily available with free of cost. A previous in literature survey has indicated that, thermal power plant bottom ash would be a potential fine aggregate in concrete. The thermal power plants are the main source of power generation in India. The major obstacle in use of bottom ash in a concrete is that the chemical properties of coal bottom ash are different from place to place and are depends upon the origin of the raw material. All metro and mega cities in India are facing acute shortages of good quality of sand. Waste glass is a major component of the solid waste stream in many countries. It can be found in many forms, including container glass, flat glass such as windows, bulb glass and cathode ray tube glass. At present, although a small proportion of the post consumer glass has been recycled and reused, a significant proportion, which is about 84% of the waste glass generated in India, is sent to landfill. Glass is a 100% recyclable material with high performances and unique aesthetic properties which make it suitable for wide-spread uses.

2. RELATED WORK

Fly Ash is a by-product of the combustion of pulverized coal in electric power generation plants. When the pulverized coal is ignited in the combustion chamber, the carbon and volatile materials are burned off. However, some of the mineral impurities of clay, shale, feldspars, etc., are fused in suspension and carried out of the combustion chamber in the exhaust gases. As the exhaust gases cool, the fused materials solidify into spherical glassy particles called Fly Ash. Due to the fusion-in-suspension these Fly Ash particles are mostly minute solid spheres and hollow ecospheres with some particles even being plerospheres, which are spheres containing smaller spheres.

Fig.1. Fly Ash

The size of the Fly Ash particles varies but tends to be similar to slightly larger than Type I Portland cement. The Fly Ash is collected from the exhaust gases by electrostatic precipitators or bag filters. Chemical makeup of Fly Ash is primarily silicate glass containing silica, alumina, iron and calcium. Color generally ranges from dark grey to yellowish tan for Fly Ash used for concrete. Fly Ash, in addition to having pozzolanic properties, also has some cementitious properties and will have a minimum silica dioxide plus aluminum oxide plus iron oxide content of 50%. Most state and federal specifications allow, and even encourage, the use of Fly Ash; especially, when specific durability requirements are needed. Fly Ash has a long history of use in concrete. Fly Ash is used in about 50%

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Fig.2. Bottom Ash

of ready mixed concrete (PCA 2000). Class C Fly Ash is used at dosages of 15 to 40% by mass of the cementitious materials in the concrete. Class F is generally used at dosages of 15 to 30%. By reducing the permeability of chloride ion egress, corrosion of embedded steel is greatly decreased. Also, chemical resistance is improved by the reduction of permeability and adsorption.

3. ANALYSIS

Within the experimental research program concerning the development of mechanical properties of a partially replacement of cement by flyash, partially replacement of sand by bottom ash and glass is used reference concrete of grade M25 (REF) was considered with the following composition, accordingly. The w/c-ratio is 0.43. Coarse aggregates were chosen, having a particle size mainly varying between 2 mm and 20 mm.

Fig.3. Compression Test

An intensive experimental program is performed to study the effect of internal curing on different types of concrete properties: (i) fresh properties (slump and density); (ii) mechanical properties (compressive strength, flexural strength, splitting tensile strength). During the testing, the beam specimens of size 7000mmx150mmx150mm were used. Specimens were dried in open air after 7 days of curing and subjected to flexural strength test under flexural testing assembly. Apply the load at a rate that constantly increases the maximum stress until rupture occurs. The fracture indicates in the

tension surface within the middle third of span length. At the time of testing, each specimen must keep in compressive testing machine. The maximum load at the breakage of concrete block will be noted. From the noted values, the compressive strength may calculated by using below formula.

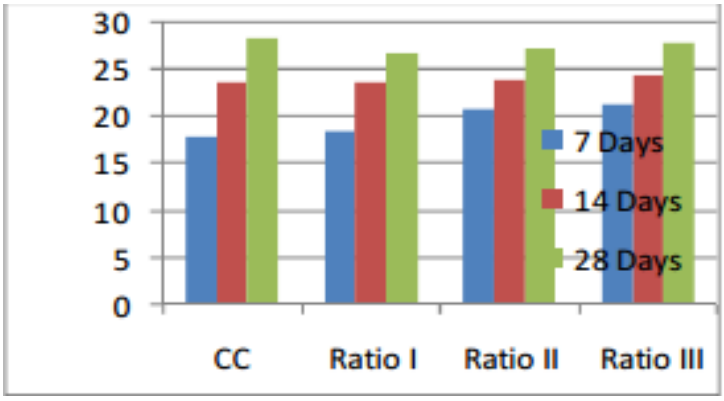

Fig.4. Graph Comparison

CONCLUSION

The study was conducted to evaluate the strength characteristics of concrete with bottom ash and glass and fly ash in concrete . The concrete mix design was done for M30 grade concrete. The following points are concluded from this study. The 7 days cube compressive strength results showed reduced strength of concrete due to slow action. Cement replacement level of 40 % flyash in concrete mixes was found to be the optimum level to obtain higher value of the strength and durability at the age of 28 days. By cost analysis it is found that by 40 % replacement of flyash, cost is reduced up to 45 % on Cement. Also by using bottom ash in this concrete to reduced the fine aggregate cost.

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