isrjournals

International Journal of Advanced Research in Civil,Structural,Environmental and Infrastructure Engineering and Developing

Volume: 3 Issue: 1 Mar,2017,ISSN_NO: 2320-723X

BOND STRENGTH OF CONCRETE INCORPORTING BOTTOM ASH AS PRATIAL REPLACEMENT OF FINE AGGREGATE

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ABSTRACT

Concrete is widely used as a construction material in modern society with the growth in urbanization and industrialization and the demand for concrete is increasing day by day. Therefore, raw materials from natural resources are required in large quantities for concrete production. At the same time, a considerable quantity of industrial wastes mostly from thermal power plants is available in large quantity and the disposal of this material becomes a major issue. Fly ash generated in the power stations is consumed in the cement industry whereas the bottom ash is disposed in the open ground. Hence the bottom ash was used as a substitute for fine aggregate in concrete. This project work aims to study the performance of bond strength of concrete containing bottom ash as a partial substitute for fine aggregate with different water cement ratios of 0.37, 0.38, 0.45 and 0.57. The assessment involves determination of bond strength properties of concrete with 40% bottom ash as partial replacement. The bond strength is proposed to be evaluated as per IS: 2770. Compressive strength, Split tensile strength, flexure strength and bond strength curves were determined compared with concrete containing 0% bottom ash were studied of bottom ash concrete.

Key words- bottom ash, compressive strength, pullout test, bond strength, split tensile strength.

1, INTRODUCTION

Cement and concrete production consumes enormous amounts of natural resources and aggregates, thereby causing substantial energy and environmental losses. This production also contributes significantly to the emission of carbon dioxide, a naturally occurring greenhouse gas. Adjustments and improvements to the present concrete making methods are essential in order to address these environmental and economic issues. This has encouraged researchers in the area of concrete engineering and technology to investigate and identify supplementary by-product materials that can be used as substitutes for constituent materials in concrete production. The beneficial effects of some of these materials on the properties of concrete have further enhanced these efforts. Bottom ash is one of the most preferred sand replacements, especially when the engineering properties and bond strength of the hardened concrete were the primary concern.

In view of this, several other pozzolanic materials are being investigated for similar applications. Bottom ash is a material that can play a similar role to sand fume as a pozzolanic material in concrete. Raw bottom ashes, which are residues from coal thermal power plant, pose an enormous disposal problem and environmental load. Bottom ash is produced from the controlled incineration of cement industry, which is then ground to the required fineness. On average, each unit weight of thermal power plant wastage would yield approximately 40–50% of bottom ash, which can be optimized positively in concrete technology. The beneficial effects of bottom ash on concrete with respect to its mechanical properties and bond strength have been widely discussed. Deduced for high-strength concrete with a compressive strength of 80 MPa can be produced by the combined utilization of bottom ash and super plasticizer from the concrete age of 28 days. Concluded for depending on the rate of addition, bottom ash enhanced the compressive strength of concrete by up to 40% at 42 days and was superior to content in this aspect. Meanwhile found that blended sand containing up to 40% bottom ash can be produced without adversely affecting the strength and bond strength properties of concrete. Addition of bottom ash into concrete also causes significant enhancement to the bond strength properties of concrete. Literature study of 30% to 40% of sand with bottom ash significantly improved the resistance of the concrete to chloride-ion penetrability.

2, REPLACEMENT PROCESS

At a higher proportion of replacement, it was reported that substitution of sand with up to 30% bottom ash resulted in enhanced strength and corrosion resistance, as well as a reduction in the chloride penetration and permeability of concrete. Similarly, stated that the blending of 30% bottom ash with sand resulted in approximately 35% decrease in water permeability, 28% reduction in chloride diffusion, and 75% reduction in chloride permeation of the concrete. The enhancement in the mechanical properties and bond strength of concrete due to the addition of bottom ash is caused by the reaction of sand with bottom ash during the hydration process to form additional super plasticizer. It was confirmed by the findings of bond strength. At temperature around 40℃ and in the presence of water, the amorphous silica contained in bottom ash can react with $Ca(OH)_2$ to form one kind of super plasticizer. On another note, the reduction in the available sources of natural aggregates is also affecting the construction industry. This scenario is further aggravated by the sterilization of valuable aggregate resources by the process of urbanization. slag and bottom ash particles. In the past, residues from quarrying activities have been used for different construction applications such as in the construction of roads and highways, and in the development of building products. However, their application for concreting purposes has been very limited.

3, OBJECTIVE OF THE STUDY

3.1 The main objectives for this research are:

1. To determine the optimum content of bottom ash as substitute for fine aggregate in concrete.
2. To evaluate the mechanical properties here as compressive strength, split tensile strength, flexural strength, of concrete containing bottom ash as partial replacement of sand in concrete.
3. To study the bond Characteristics of concrete containing bottom ash.

3.2 The scope of work is as follows:

1. To evaluate the conditions with different replacement of sand with bottom ash at 0% and 40% to determine the bond strength by conducting the pullout Test of bottom ash concrete.

2. To determine the bond strength properties by conducting pullout test at different water-cement ratio and 40% percentage of bottom ash.
3. The extensive use of bottom ash in concrete production, especially in developing economies, is usually prohibited by its high cost.
4. To study in bond character for 16mm rod in150mm cube containing 40% replacement of bottom ash also conducted in controlled concrete.
5. to analysis the test results and find the suitability of bottom ash use in concrete

4, SCOPE OF FUTURE STUDY

1. To study the strength parameters of bottom ash concrete with more than 40% replacement of fine aggregate. Because the test is satisfy the replacement of bottom ash.

2. To develop a different water cement ratio and various mix proposing for a high volume of bottom ash concrete, by adding admixtures.

3. The ultimate bond strength of glass fiber aggregate concrete under all types of curing conditions was much higher compared to the theoretical bond strength.

4. The ultimate bond strength by evaluating bond strengths in two different concrete mixes, three concrete cover depths and different mass losses of reinforcement bars after corrosion.

5. Investigation carried out to evaluate the mechanical properties of concrete mixtures in which fine aggregate high percentage of partially replaced with bottom ash

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Volume: 3 Issue: 1 Mar,2017,ISSN_NO: 2320-723X

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