

CHARACTERISTIC STUDIES OF GROUND GRANULATED BLAST FURNACE SLAG AND FLY ASH WITH BLENDED CONCRETE

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ABSTRACT

The need to reduce the global anthropogenic carbon dioxide has encouraged researchers to search for sustainable building materials. Cement, the second most consumed product in the world, contributes nearly 7% of the global carbon dioxide emission. The use of Ground Granulated Blast Furnace Slag is well established in many cement application where it provides enhanced Durability, including high resistance to chloride penetration, resistance to sulphate attack and production against Alkali Silica Reaction (ASR). The uses of GGBS in soil stabilization is however, still a novel process in The UK although it has been used in South Africa. Additionally, the effect of replacement of fly ash with class C at 30% and GGBS (10-50) % percentage on strength of concrete is also studied. Fly ash and Ground Granulated Burnt Slag (GGBS) are chosen mainly based on the criteria of cost and their durable qualities., Not only this, Environmental pollution can also be decreased to some extent because the emission of harmful gases like carbon monoxide & carbon dioxide are very limited. In this paper our study is mainly confined to evaluation of changes in both compressive strength and weight reduction in five different mixes of M35 Grade namely conventional concrete, concrete made by replacing 30% of cement by Fly Ash in constant, concrete made by replacing 10% replacement of cement by GGBS, concrete made by replacing 20% replacement of cement by GGBS, concrete made by replacing 30% replacement of cement by GGBS, concrete made by replacing 40% replacement of cement by GGBS, concrete made by replacing 50% replacement of cement by GGBS. The testing from 7days, 28days tested.

Keywords : Cement, GGBS, Fly Ash, Concrete, Aggregates.

1. INTRODUCTION

The main focus now a day is on search of waste material or bye product from manufacturing processes, which can be used as partial replacement of cement in concrete, without compromising on its desired strength. The ground granulated blast furnace slag (GGBS) is a waste product from the iron manufacturing industry, which may be used as partial replacement of cement in concrete due to its inherent cementing properties. In the country like India, where the development of the infrastructures projects such as large irrigation, road and building projects are either being constructed or in completion of their planning and design stage, such uses of waste material in cement concrete will not only reduce the emission of greenhouse gases but also will be the sustainable way of management of waste. The Fly ashes (FA), GGBS, are some of the pozzolanic materials which can be used in concrete as partial replacement of cement.

A number of studies are going on in India as well as abroad to study the impact of use of these pozzolanic materials as cement replacements and the results are encouraging. These materials include

fly ash, and ground-granulated blast furnace slag used separately or in combination. The strength, durability and other characteristic of concrete depends on the properties of its ingredients, proportion of mix, method of compaction and other controls during placing and curing.

2. LITERATURE SURVEY

Sundar.J, Manivel.S, et.al, (2015) The production of cement results in emission of many green house gases in atmosphere, which are responsible for global warming. Hence, the researchers are currently focused on use of waste material having cementing properties, which can be added in concrete as partial replacement of cement, without compromising on its strength and durability, which will result in decrease of cement production thus reduction in emission in green house gases, in addition to sustainable management of the waste. The properties of concrete mainly depend on the constituents used in concrete.

Leonard W.Bell., et.al., (2012) In the present that Ground Granulated Blast-Furnace Slag as a Cementitious Constituent in Concrete. Types of slag not produced in the iron-making those derived from the production of copper, lead, the use of ground granulated blast-furnace (GGBF) slag and steel) may differ greatly in composition and performs a cementitious materials.

Ganapati Naidu. P., et.al.,(2011)The present study on Strength Properties of Geo-polymer Concrete with Addition of G.G.B.S and Fly ash based geo-polymer concrete is to reduce the use of OPC in concrete. Geo-polymer is an inorganic aluminohydroxide polymer synthesized from predominantly silicon and aluminium materials of geological origin and by product materials such as fly ash (with low calcium). In this paper an attempt is made to study strength properties of geo-polymer concrete using low calcium fly ash replacing with slag in 5 different percentages.

3. RELATED WORK

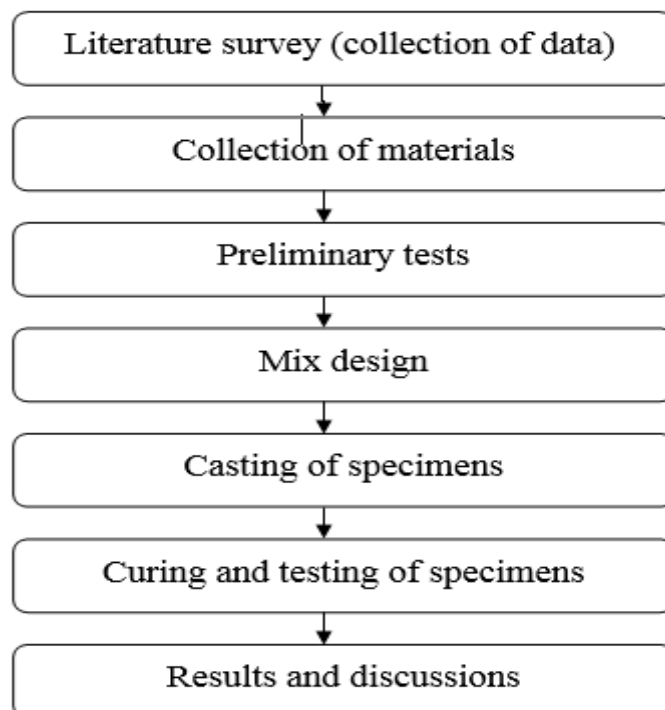


Fig.1.Project Methodology

In the present work, literature survey (collection of data) and detailed study about materials are done. Future work will be mix design with its strength calculation. In the mix design, cement is partially replaced by 70% of ground granulated blast furnace slag and 30% of fly ash. Cement is a fine, grey powder. It is mixed with water and materials such as sand, gravel, and crushed stone to make concrete. Cement and water form a paste that binds the other materials together as the concrete hardens. Portland Pozzolana cement (PPC) is manufactured by the inter-grinding of OPC clinker with 10 to 25 per cent of pozzolanic material. The pozzolanic materials generally used for manufacture of PPC are calcined clay or fly ash.

SIEVE ANALYSIS OF FINE AGGREGATE

The sample shall be brought to an air dry condition by either drying at room temperature or heating at a temperature of 100° C to 110° C. Sample for sieving shall be prepared by either quartering or by means of sample divider. Take proper weight of dries fine aggregate of 1000g. Assemble IS sieves in following order 4.75mm, 2.36mm, 1.16mm, 600 μ , 300 μ , 150 μ , and pan place the aggregates in the top of the sieves and cover with the lid properly secure the sieves in the mechanical shaker and turn on the shaker or shake manually for five minutes. Compute the cumulative percent retained on and the percent passing each sieve



Fig.2 Sieve analysis of fine aggregate

INITIAL AND FINAL SETTING TIME OF CEMENT

Fill the vicat mould completely with the paste prepared as for normal consistency. Fix the specified needle with the rod. Place the mould with the test specimen and release rod quickly. Note the depth of needle penetrate into paste once again for every 5 minutes. The reading is maintained up to 5 minutes. The penetrated depth can be found out.

4. EXPERIMENTAL ANALYSIS

The test conducted for Strength tests are Compression test, Split tensile Strength test Flexural Test, RCPT Test and Sorptivity Test for concrete. The values shown in the tabular column is the average of above tested specimens.



Fig.3.Experimental Setup

According to IS 516-1959, compression test was carried out on cube and cylinder specimens of size 150 mm and 150×150 mm. The strength was recorded at 7, 14 and 28 days. The compressive strength test is carried out in universal testing machine of 1000 KN capacity. According to IS 516-1959, split tensile test was carried out on cylindrical specimens of 70mm diameter and 150mm height at the age of 28 days. Tensile strength is one of the important properties of concrete. The results required for the design of concrete structural elements subject to shear, torsion, and shrinkage and temperature effects. The specimens were tested using universal testing machine of 1000 kN capacity. For each mix 3 cylinders prepared and tested for 28 days.

Another important strength property of concrete is the flexural strength of a concrete. Samples were tested for flexural strength at 28 days of curing.

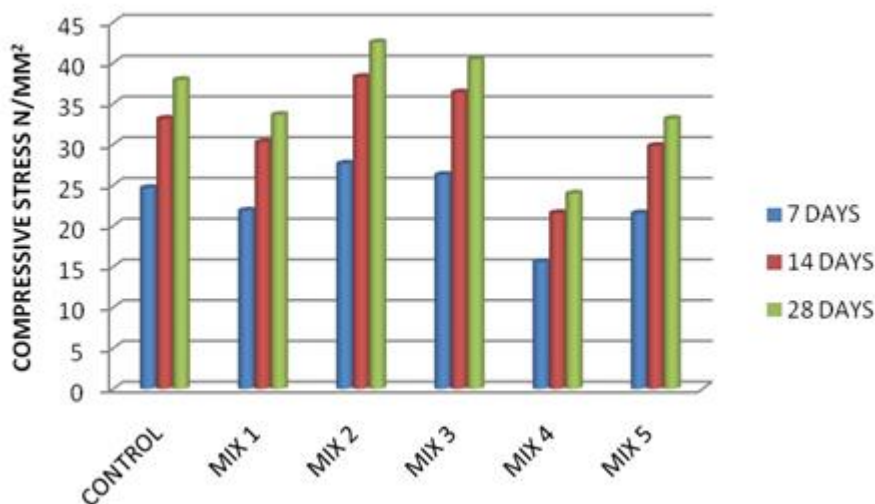


Fig.4.Test Results

The testing machine apparatus used to measure the flexural strength of concrete in this project is operated by hydraulics and has Dial Gauge displays for monitoring the rate of loading and the peak load on the sample at the time of failure. The strain rate was manually controlled by turning a knob either clockwise or counter clockwise. The flexural strength was then calculated using equation. The sorptivity of concrete is a quantity that measures the unsaturated flow of fluids into the concrete.

Sorptivity is a measure of the capillary forces exerted by the pore structure causing fluids to be drawn in to the body of the material. While theoretically possible to consider the flow in any geometry, it is too mathematically complex to be of any practical use except where there are one dimensional flow conditions.



Fig.5.Load setup

The method relies on the results from a test in which electrical current passes through a concrete sample during a six-hour exposure period. The interpretation is that the larger the Coulomb number or the charge transferred during the test, the greater the permeability of the sample. The more permeable the concrete, the higher the coulombs; the less permeable the concrete, the lower the coulombs. The method has shown good correlation with chloride tests. The following formula, based on the trapezoidal rule can be used to calculate the average current flowing through one cell.

CONCLUSION

For first and second phase of this project, a detailed study on literature review was conducted and thereby identifying the drawbacks in them and suggesting a new solutions. Collections of the proposed materials are done. The physical properties of materials used in this project which are necessary for mix design are obtained by experimental means. The materials that are to be used as partial replacement and conventional materials exhibit the properties as specified by the IS are used for the progress of further work in this project. The following works will be carried out such as the mix design. The specimens are casted and the curing for 7, 14 & 28 days. The strength characteristics of the specimen such as compressive test for cube split tensile test for cylinder flexural test for beam sorptivity test and RCPT test shall be tested. Then, finally compare the result with conventional concrete. The results are finally concluded.

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