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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 AlkaliSilicaReaction(ASR).TheusesofGGBSinsoilstabilizationishowever,stillanovelprocessin 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 cementbyGGBS,concretemadebyreplacing50%replacementofcementbyGGBS.Thetestingfrom 7days, 28daystested.

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

1. INTRODUCTION

Themainfocusnowadayisonsearchofwastematerialorbyeproductfrommanufacturingprocesses, 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 projectssuchaslargeirrigation,roadandbuildingprojectsareeitherbeingconstructedorincompletion of their planning and design stage, such uses of waste material in cement concrete will not only reduce theemissionofgreenhousegasesbutalsowillbethesustainablewayofmanagementofwaste.TheFly 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. LITERATURESURVEY

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 currentlyfocusedonuseofwastematerialhavingcementingproperties,which can beaded in concrete aspartialreplacementofcement,withoutcompromisingonitsstrengthanddurability,whichwillresult 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 inconcrete.

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 fromtheproductionofcopper,lead,theuseofgroundgranulatedblast-furnace(GGBF)slagandsteel) may differ greatly in composition and performs a cementitiousmaterials.

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 alumino-hydroxide polymer synthesized form predominantly siliconandaluminiummaterialsofgeologicaloriginandbyproductmaterialssuchasflyash(withlow 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 differentpercentages.

3. RELATEDWORK

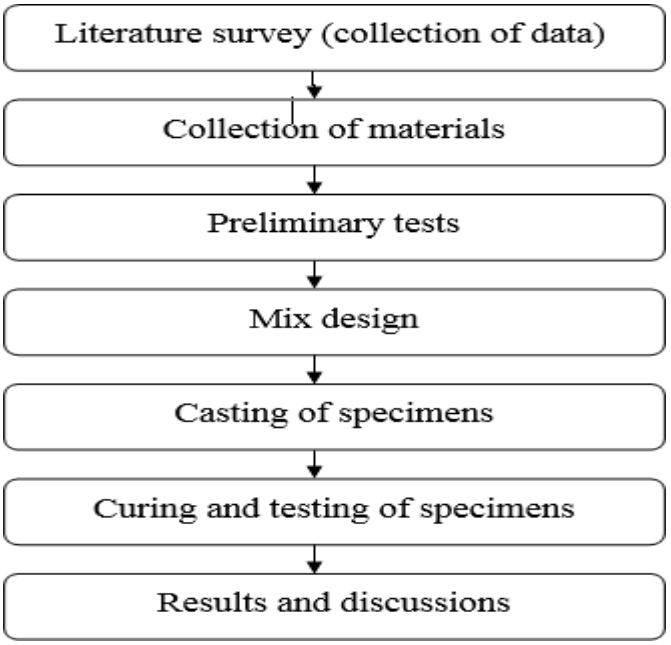

Fig.1.Project Methodology

Inthepresentwork,literaturesurvey(collectionofdata)anddetailedstudyaboutmaterialsaredone.Futurework willbemixdesignwithitsstrengthcalculation.Inthemixdesign,cementispartially replaced by 70% of ground granulated blast furnace slag and 30% of fly ash. Cement is a fine, greypowder.Itismixedwithwaterandmaterialssuchassand,gravel,andcrushedstonetomakeconcrete. Cementandwaterformapastethatbindstheothermaterialstogetherastheconcretehardens.PortlandPozzolan acement(PPC)ismanufacturedbytheinter-grindingofOPCclinkerwith10to25percentof pozzolanic material. The pozzolanic materials generally used for manufacture of PPC are calcined clay or flyash.

SIEVE ANALYSIS OF FINE AGGREGATE

The sample shall be brought to an air dry condition by either drying at room temperature or heating at atemperatureof10℃to11℃.Sampleforsievingshallbepreparedbyeitherquarteringorbymeansofsampledivi der.Takeproperweightofdriesfineaggregateof1000g.AssembleISsievesinfollowingorder4.75mm,2.36m m,1.16mm,600µ,300µ,150µ,andpanplacetheaggregatesinthetopofthesieves 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 eachsieve

Fig.2Sieve 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. EXPRIMENTALANALYSIS

The test conducted for Strength tests are Compression test, Split tensile Strength test Flexural Test,RCPTTestandSorptivityTestforconcrete.Thevaluesshowninthetabularcolumnistheaverage of above testedspecimens.

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Fig.3.Exprimental 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 tensiletestwascarriedoutoncylindricalspecimensof70mmdiameterand150mmheightattheageof 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 28days. Another important strength property of concrete is the flexural strength of a concrete. Samples were tested for flexural strength at 28 days of curing.

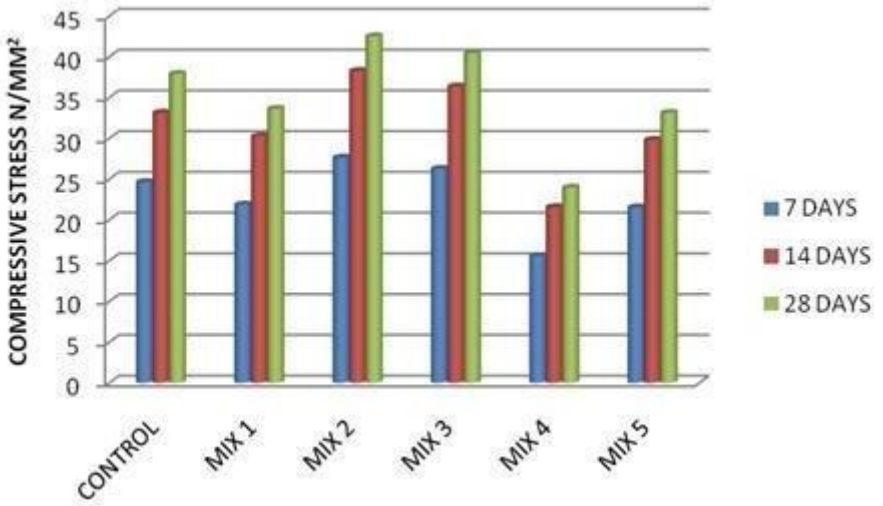

Fig.4.Test Results

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The testing machine apparatus used to measure the flexural strength of concrete in this project is operatedbyhydraulicsandhasDialGaugedisplaysformonitoringtherateofloadingandthepeakload on the sample at the time of failure. The strain rate was manually controlled by turning a knob either clockwiseorcounterclockwise.Theflexuralstrengthwasthencalculatedusingequation.Thesorptivity of concrete is a quantity that measures the unsaturated flow of fluids into theconcrete.

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

Themethodreliesontheresultsfromatestinwhichelectricalcurrentpassesthroughaconcrete 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 methodhasshowngoodcorrelationwithchloridetests.Thefollowingformula,basedonthetrapezoidal rule can be used to calculate the average current flowing through onecell.

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 partialreplacementandconventionalmaterialsexhibitthepropertiesasspecifiedbytheISareusedfor the progress of further work in this project. The following works will be carried out such as the mix design.Thespecimensarecastedandthecuringfor7,14&28days.Thestrengthcharacteristicsofthe specimensuchascompressivetestforcubesplittensiletestforcylinderflexuraltestforbeamsorptivity test and RCPT test shall be tested. Then, finally compare the result with conventional concrete. The results are finallyconcluded.

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