Study on Mechanical Properties of Concrete by Partial Replacement of Cement by GGBS

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Abstract - Slag is a waste product from the pyro metallurgical processing of various ores. Slag has been increasing steadily as large volumes, on the order of hundreds of millions of tons, are produced annually worldwide. In general processing of 1 ton of pig iron produces 300 to 400 of BF slag. Metal slag is considered as solid waste and dumped on landfill, this affects the groundwater by releasing toxic elements to water. But we can use this slag as secondary product or partially replacement of cement. By the other side, the increasing demand in the construction industries will lead to the depletion of limestone, we can use the waste iron metal slag as direct replacement for cement. Before this, the metal slag is further treated. This treatment includes quenching of molten metal slag and grinding into fineness required. This grinded slag powder can be directly used as replacement of cement at the time of production of cement or usage of cement during construction. Therefore, this study is to investigate experimentally the properties of concrete made using partial replacement of metal slag by 10%, 20%, 30% for cement.

INTRODUCTION

Concrete is a material composed of coarse granular material embedded in a hard matrix of material that fills the space among the aggregate particles and glues them together. Globally, the ready-mix concrete industry, the largest segment of the concrete market, is projected to exceed $150 billion in revenue by 2017. A large number of retarding admixture products are available in the market. Overdosing of retarders may result in decrease in strength of concrete or failure of structures. Most of the constructions require pumpable and workable concrete. Thus, chemical admixtures are required to be added to the fresh concrete mix.

RELATED WORKS :

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M-S AND:

M-Sand stands for Manufactured Sand. Manufactured sand (M-Sand) is a substitute of river sand for concrete construction. Manufactured Sand: M-Sand was used as partial replacement of fine aggregate. Manufactured sand is produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges, washed and graded to as a more. Manufactured sand is sand produced by crushing rocks, quarry stones or larger aggregates pieces into sized particles. Natural sand, on the other hand is the naturally formed sand extracted from river beds.

Bulk density	1.75kg/m³
Specific gravity	2.73 to 4.66
Slump value	55 mm
Sieve size	150 micron to 4.5 mm
Water absorption	2.2

SLAG:

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LABORATORY TESTING :

COMPRESSIVE STRENGTH TEST

Compressive stress is the stress on materials that leads to a smaller volume. By compressive stress the material is under compression. Compressive stress to bars, columns, etc. leads to shortening. One can increase the compressive stress until compressive strength is reached. Out of many test applied to the concrete, this is the utmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not. Compressive strength of concrete depends on many factors such as water-cement ratio, cement strength, quality of concrete material, quality control during production of concrete etc. Test for compressive strength is carried out either on cube or cylinder. Various standard codes recommend concrete cylinder or concrete cubeas the standard specimen for the test.

SPLIT TENSILE STRENTH TEST:

Split tensile strength was evaluated as per the test procedure given in Indian Standards IS5816-1999.In order to evaluate

the splitting tensile strength of concrete,all the cylinder specimens were subjected to split tensile strength test in a 2000 KN digital compression testing machine .Specimens of 150 mm diameter,300mm height were placed in the machine in a horizontal manner in between the two parallel steel strips one at top and other at the bottom such that the load shall be applied along the 300 mm length .The load was applied without shock and increased continuously at a nominal rate within the range of 1.2 N/mm to 2.4 until the specimen failed .The maximum load applied to the specimen was recorded and the split tensile strength of the specimen was calculated*

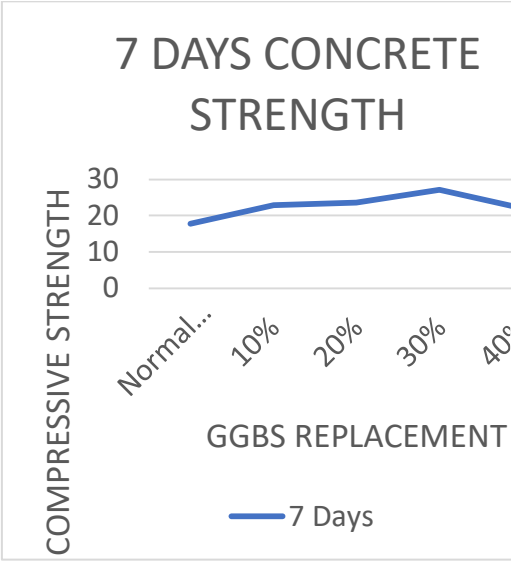
Flexural strength test

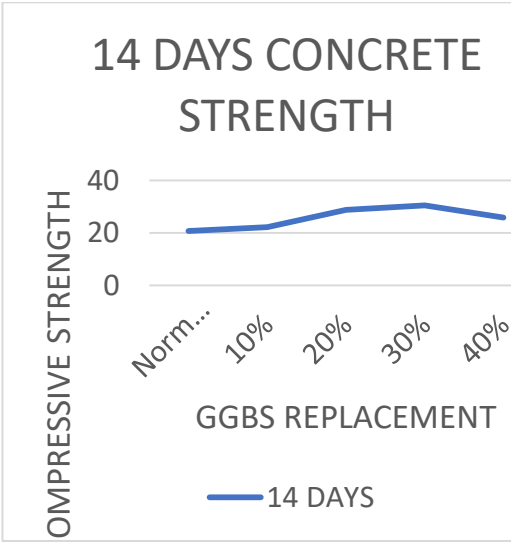
Flexural strength of light weight concrete was determined using prism specimens by subjecting them to single point bending in Universal Testing Machine having a capacity of 400 kN. Specimens of 100 x100x500 mm were placed in the machine in such a manner that the load shall be applied to the uppermost surface .The load was applied without shock and increased continuously at a rate of 1800 N/min until the specimen failed. The maximum load applied to the specimen was recorded and the flexural strength of the specimen was calculated.

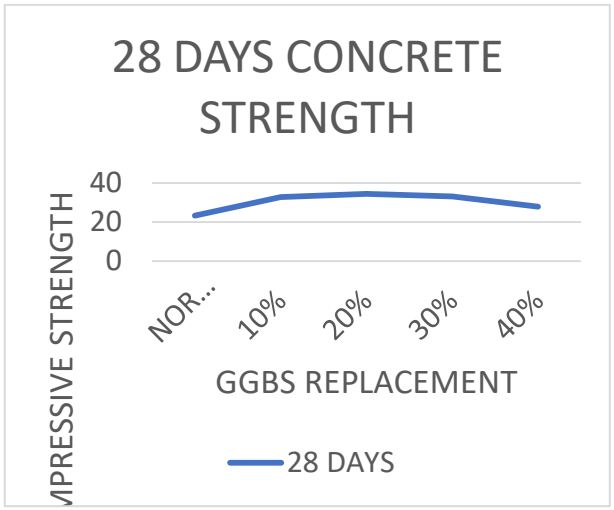
RESULT AND DISCUSSION

COMPRESSIVE STRENGTH TEST

The compressive strength of each concrete is listed .The compressive strength of 10%, 20%, 30% & 40% of slag used concrete is compare with the normal concrete.

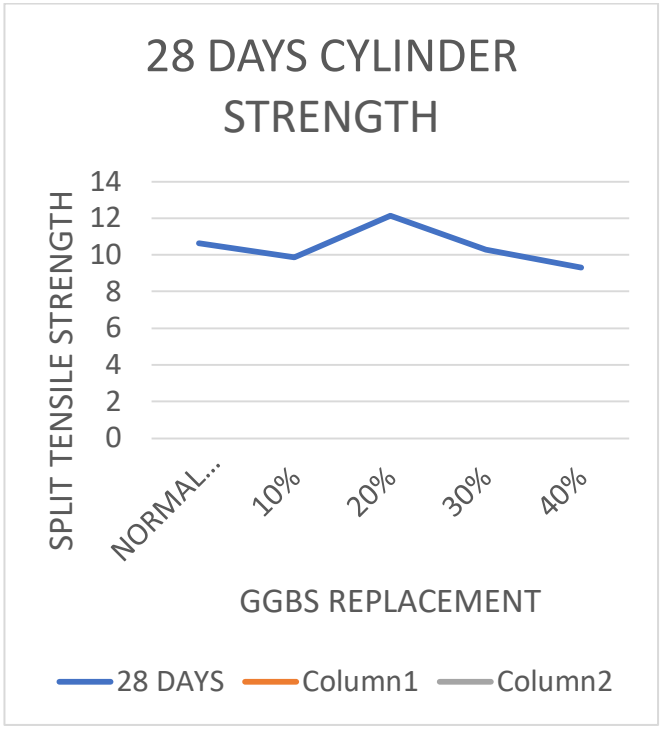




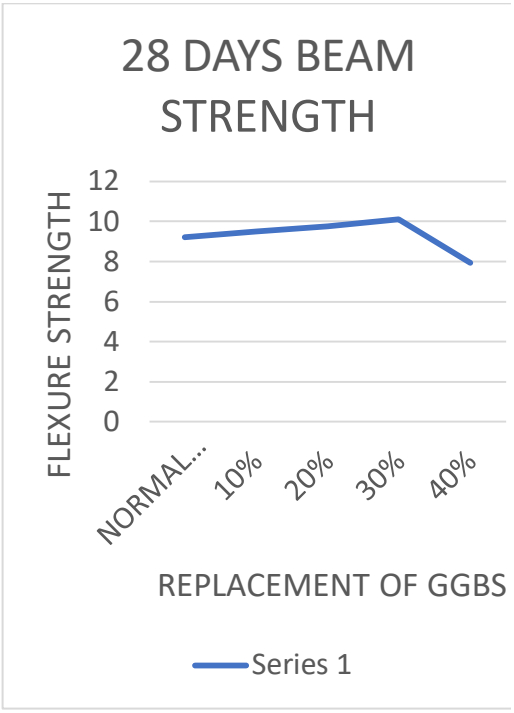


SPLIT TENSILE STRENGTH TEST:

The split tensile of concrete is listed .The split tensile strength of 10%, 20%, 30% &40% of slag used concret is compare with normal concrete



FLEXURAL STRENGTH TEST :



CONCULSION:

The compressive strength, flexural strength and split tensile strength was studied. The GGBS was used as a replacement of cement in concrete. The properties of specification are studied carefully to manufacture the concrete with retarding admixtures. The improvement in strength was also achieved at an appropriate level of using GGBS. The usage of GGBS in concrete gradually increases for each 10%,20%,30% and 40% replacement but 30% is suitable for achieving the required high strength of concrete. By using 40% replacement or more the strength of concrete gradually decreases when compared to 30% replacement. Since we utilize industrial waste it saves lot of natural resources.

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