



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: 1 Month of publication: January 2019

DOI: <http://doi.org/10.22214/ijraset.2019.1054>

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A Study Effect on Mechanical Properties of Concrete by Partial Replacement of Natural Sand by Iron Slag

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Abstract: *There are a few kinds of mechanical results and waste materials. The usage of such materials in cement makes it practical, as well as aides in diminishing transfer concerns. This trial examination were done to assess the mechanical and solidness properties of M20 evaluations of cement blends, in which common sand was supplanted with waste Steel Slag. Normal sand was supplanted with five rate (0%, 5%, 10%, 15%, 20%) of WSS by weight. An aggregate of five solid blend extents for M20 review of cement with and without WSS were produced. Pressure test, part rigidity test and flexural quality test were completed to assess the quality properties of cement following 7 days and 28 days. Test outcomes demonstrated that there is increment in compressive quality, flexural quality test and incorporation of waste Steel Slag with a specific level of substitution. Nature of cement in term of homogeneity and consistency were additionally moved forward.*

Keyword: *Diminishing, Supplanted, Incorporation, Demonstrated, Consistency.*

I. INTRODUCTION

All through the world there is an expanding center around the need to reuse and to all the more completely use results of assembling forms trying to moderate our limited regular assets. Specialized assessment bolstered by field encounter has demonstrated that a result, for example, press impact heater slag has, in numerous applications, properties appropriate to supplant or enhance and enhance customary materials.

As there are numerous kinds of slag, it ought to be especially noticed that the term slag utilized all through this booklet alludes explicitly to metallurgical slag created in present day press impact heaters, ie; press impact heater slag and not fundamental oxygen steel slag or electric circular segment heater slag which are steel heater slags. As a result in the fabricate of iron, impact heater slag is a sustainable virgin material, for example slag has not been recently utilized but rather has been shaped as a component of the iron making process.

As slag leaves the shoot heater in a liquid frame at 1500°C it is a homogeneous material free from remote issue.

II. OBJECTIVE OF THIS STUDY

In spite of the fact that a framework as quickly talked about above won't yield an ideal control with no variety in item quality, it will guarantee that better-educated choice are made all the more frequently. These frameworks, regardless of how advanced are just comparable to their limit conditions are will ceaselessly require human ability. All metallurgical procedure control frameworks have similar targets and are recorded underneath:

- A. Optimize item quality
- B. Minimize vitality utilization, or by and large streamline ecological execution
- C. Check the mechanical properties of solid blend
- D. Optimize vitality and material stream around the plant so as to streamline by and large plant throughput
- E. Uses of waste material in helpful manne.

III. LITERATURE REVIEW

B G Buddhdev, Dr. H R Varia (2014) states that concrete is the most-used man-made product in the world. Concrete is widely used for making many types of structural components for different civil engineering applications. In this modern era, cement concrete pavements are in demand as compared to bituminous pavements in highway projects.

Manoj Kumar Tiwari et. Al. (2016) studied that current total productions of steel slag in India, are around 12 million tonnes per annum (Indian Minerals Yearbook, May 2016), which is far behind the developed countries. Presently in India, due to limited modes of practices of utilization, huge amount of iron and steel slag dumped in yards of each production unit and engaging of important agricultural land and grave pollution to whole environment.

Mohammed Areeb Qidwai (2015) in their project the experimental investigation is done on geopolymers concrete. The project aim is to use GGBS in place of OPC and compare its properties with the normal concrete. In this project GGBS, sodium hydroxide, sodium silicate, coarse sand and coarse aggregate are used as the ingredient.

Prem Ranjan Kumar, Dr. Pradeep Kumar T.B (2015) in their paper they concluded that construction Industry plays a crucial role in the economic development of any country. In India Construction industry is the second largest after agriculture, contributes about 11% in the GDP. Construction industry is directly related with the consumption of cement in the world. India is the second largest cement producer in the world after China.

P.Sateesh Kumar et. Al. (2015) their aims was to study experimentally, the effect of partial replacement of fine aggregate by steel slag (ss), on the various strength and durability properties of concrete by using the mix designs .the optimum percentage of replacement of fine aggregate by steel slag is found.

IV. MIX DESIGN

Mix design of M-20 is made according to the IS specifications [BIS 10262-1982 and BIS 456-2000]. Moulds are made on the basis of mix design and various tests are done on these moulds in order to check the strength parameters.

Mix Proportion

S. No	Mix designation	%age of GBFS	%age of Natural Sand
1	SS 0 (control)	0	0
2	SS 5	5	95
3	SS 10	10	90
4	SS 15	15	85
5	SS 20	20	80

A. Casting Of Moulds

The ingredients of concrete were mixed in 0.06 m³ capacity mixer. Weighed quantities of cement, sand and Granulated Blast-Furnace Slag (GBFS) dust were dry mixed until uniform colour was obtained without any cluster of cement, sand and Granulated Blast-Furnace Slag (GBFS). All the moulds were oiled before casting the specimens. Cube specimens of size 150 mm x 150 mm x 150 mm of each concrete mixture were cast to determine the compressive strength. Cylindrical specimens of size 150 mm x 300 mm were cast to measure the split tensile of concrete. Concrete specimens of size 500 mm x 100 mm x 100 mm were cast to measure the tensile strength of concrete.

B. Slump Test

The mould was cleaned from inside and was filled in four layers with concrete. Each layer was compacted by twenty-five strokes of the rounded end of 16 mm diameter tamping rod. The strokes were distributed uniformly over the cross section of the mould. The excess mass of concrete was struck off with the help of trowel after tamping the top layer. The mould was removed from concrete immediately by raising it slowly and carefully in a vertical direction.

C. Testing Of Specimens

The following tests have been carried on various specimens:

- 1) Compressive strength test
- 2) Split tensile strength test

3) Flexural strength test

D. Compressive Strength Test

The compressive strength was conducted on various specimens as per the guidelines given in IS 516-1959. Surface water and grit was wiped off and the cube was placed in compression testing machine of 200 tones capacity. The compressive strength of concrete is determined in batching plant laboratories for every batch in order to maintain the desired quality of concrete during casting. The strength of concrete is required to calculate the strength of the members. Concrete specimens are a cast and tested under the action of compressive loads to determine the strength of concrete. In very simple words, compressive strength is calculated by dividing the failure load with the area of application of load.

E. Flexural Strength Test

Although the concrete is not designed to resist tension, the knowledge of tensile strength of concrete is of value in assessing the load at which crack will start appearing in concrete. The absence of cracking is of considerable importance in insuring the better durability of concrete structure and in many cases the prevention of the corrosion of the reinforcement because of the partial difficulties faced in conducting a pure strength, it is preferable to measure the tensile strength of the concrete by subjecting a plain concrete beam to flexural. The flexural test was conducted on various mixes.

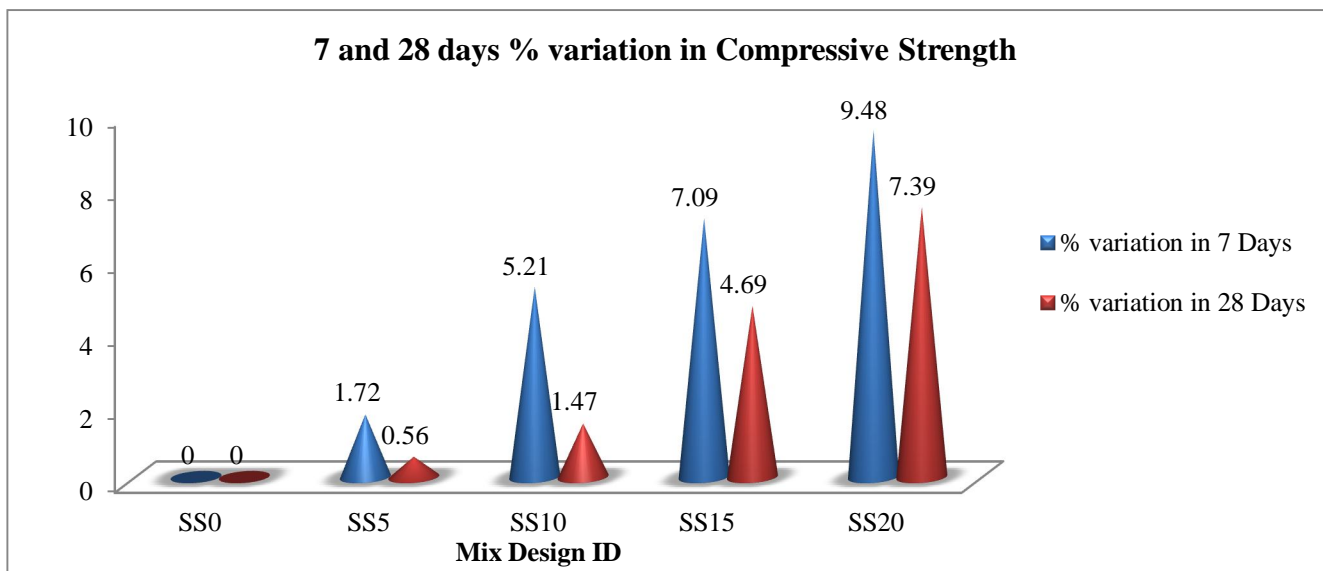
F. Split Tensile Strength Test

The split tensile strength of concrete was conducted on various mixes as per guidelines of IS 516-1970. The cylindrical specimens were tested at the age of 7 days and 28 days after surface drying the same. The test was conducted on compression machine.

V. DISCUSSION OF RESULTS

A. Compressive Strength Test

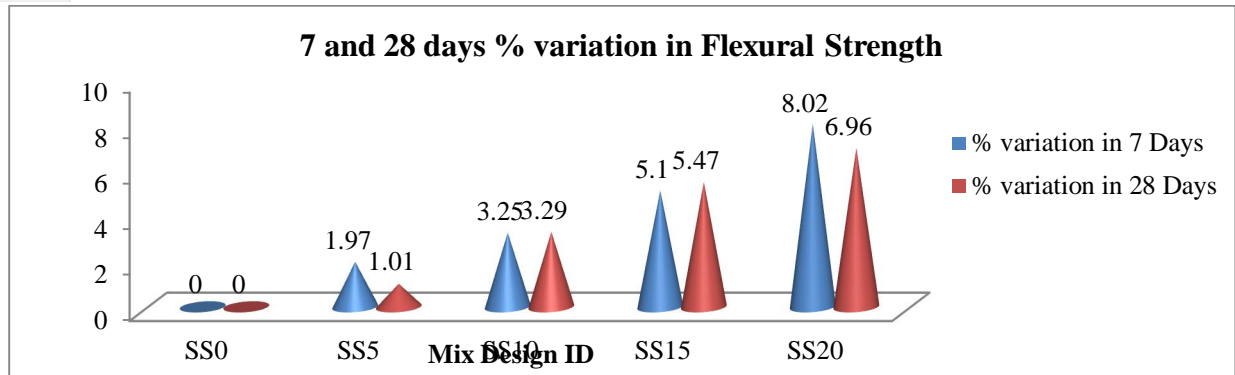
the variation of compressive strength of Slag mixed Concrete due to variation in the replacement levels of Granulated blast furnace slag (GBFS) at the curing ages of 7 and 28 days. The percentage increase in values of compressive strengths with age (from 7 to 28 days) for all the replacement level of Granulated blast furnace slag (GBFS).



Comparison between 7 and 28 days % variation in Compressive Strength

B. Flexural Strength

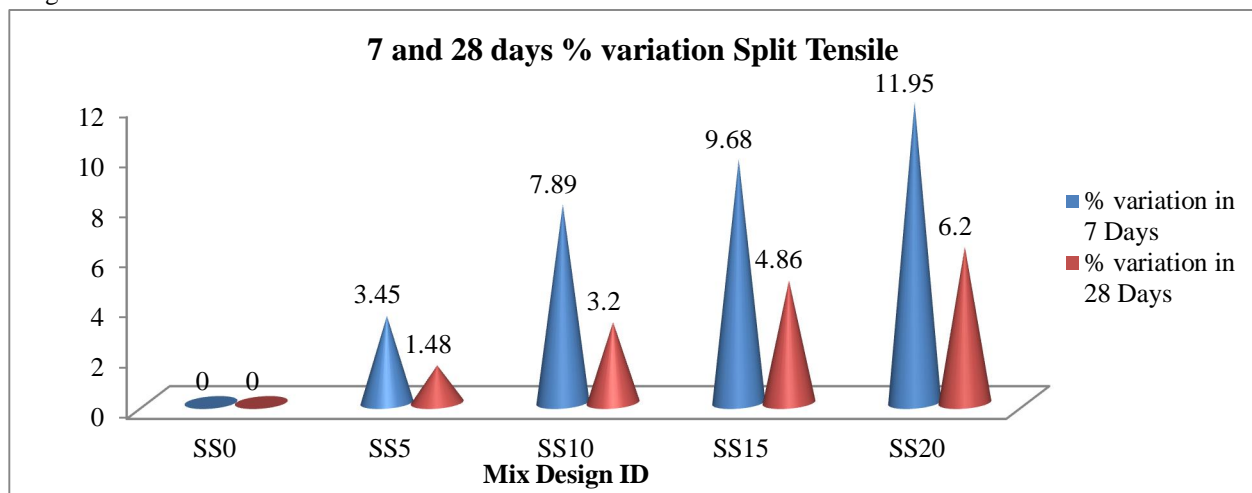
The variation of flexural strength of Slag mixed Concrete due to variation in the replacement levels of Granulated blast furnace slag (GBFS) at the curing ages of 7 and 28 days. The percentage increase in values of flexural strengths with age (from 7 to 28 days) for all the replacement level of Granulated blast furnace slag (GBFS). From the data as presented, it can be seen that the mixes with Granulated blast furnace slag replacement has a higher rate of increase in strength from 7days to 28 days though they have high initial strength.



Comparison between 7 and 28 days % variation in Flexural Strength

C. Split Tensile Strength

The variation of split tensile strength of Slag mixed Concrete due to variation in the replacement levels of Granulated blast furnace slag (GBFS) at the curing ages of 7 and 28 days. The percentage increase in values of split tensile strengths with age (from 7 to 28 days) for all the replacement level of Granulated blast furnace slag (GBFS). From the data as presented, it can be seen that the mixes with Granulated blast furnace slag replacement has a higher rate of increase in strength from 7days to 28 days though they have high initial strength.



Comparison between 7 and 28 days % variation in Split Tensile Strength

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