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Effect of Different Additives on Properties of Concrete

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ABSTRACT: Concrete is broadly used material for diverse forms of structures because of its structural balance and strength. To reduce cost by using partial replacement of cement by GGBFS, Aggregate by BFS and sand by GBFS it is economically better than normal concrete. And to reduce the volume of waste material from industries. Our aim is to study the properties of concrete by partially replacing cement for M25 grade of concrete This experimental investigation on strength of concrete and optimum percentage of the partial replacement by preparing a mix M25 grade and the same was used to prepare the test samples. In the design mix proportion used in conventional Concrete, cement is replaced by 20%, 40%, 60% of industrial waste like GGBFS, GBFS, BFS. The compressive strength of M25 grade of concrete was mainly studied. Test results shows that, inclusion of GGBFS, BFS and GBFS generally improves the concrete properties up-to certain percentage of replacement in53 grade of cement.

KEYWORDS: Ground Granulated Blast Furnace slag, Granulated Blast Furnace slag, Blast Furnace slag, Workability test, Compressive strength.

I. INTRODUCTION

Concrete is a composite material composed of fine and coarse aggregate bonded collectively with a fluid cement (cement paste) that hardens (healing procedures) over time. Concrete is the second-most-used substance in the international after water, and is the maximum broadly used building material. the cement industry is one of the main sources of carbon dioxide (CO^2). the CO^2 emissions which is where Portland cement is obtained from after its grinding. Therefore, the use of alternative sources for natural aggregates is becoming increasingly important [6].

Over time, waste management becomes one of the biggest challenges in the world. Rapid industrial growth creates a variety of highly hazardous wastes in our area. The use of slags in concrete not only helps to reduce greenhouse gases but also helps to make the environment more environmentally friendly. Our purpose is study is to investigate some properties of concrete mixes with different additives e.g., compression strength, flexural tensile strength, density (as light weight concrete) and their influences on concrete behaviour. Aggregate affect both rheological and mechanical properties of mortars and concrete [4].

II. MATERIAL SPECIFICATIONS

- **Cement:**

Cement is one of the most popular material used for construction. Cement is mixed with sand and water to form a paste, it is termed as mortar. Mortar is used to join bricks or stones, and also for finishing works such as plaster and putty. When cement is mixed with gravel (or crushed stone), sand and water, the composite product is called concrete.

- **GGBFS:**

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Ground Granulated Blast Furnace Slag (GGBFS) is a binder material mainly used for concrete and is a by-product of a blast furnace used for iron manufacturing. GGBFS can replace more than 70% of Portland cement in concrete mixtures. GGBFS is an environmentally friendly product and is made as a by-product of iron production. It is a high-quality low CO^2 material. This is because GGBFS has a low CO^2 content.

- **GBFS:**

Granulated Blast Furnace Slag (GBFS) is produced by quenching molten iron slag (a by-product of steel production) from a blast furnace with water or steam to form a glassy granular material, drying it, and pulverizing it into a fine powder. The use of ground granulated blast furnace slag as a substitute for sand in concrete mixtures.

- **BFS:**

Blast furnace slag is a calcium silicate-based product that is removed from the top of the molten iron in the process of extracting ore from the blast furnace. In this process, the iron ore is reduced to iron and the remaining material forms slag and cools as the liquid melts. Blast furnace slag is a secondary aggregate widely used in construction sites due to its performance and durability.

- **Water:**

According to ACI water used for preparing concrete should be of potable quality [1]. In this investigation ordinary tap water, which is fit for drinking, has been used in preparing all concrete mixes and curing [1].

III. METHODOLOGY OF STUDY

Hand Mix

First, mix the cement and fine aggregate until mixture is combined properly. Then add coarse aggregate and mix until coarse aggregate is evenly distributed. Finally, add water and mix until the concrete is uniform and of the proper consistency. Prepare the mixture as given in the table as followed.

Compressive Strength Test

- Concrete mix is poured into the mould and compacted properly to reduce voids.
- After 24 hours, the mould is removed and the specimen is shifted in water for curing.
- After the specified period of curing (i.e. 28 days) specimens are tested by the CTM (Compression Testing Machine).
- The load is applied gradually until the specimen breaks.
- To calculate compressive strength of concrete divide the load at which cube breaks by the cross-sectional area of specimen.

Fig. No. 1: Compaction of Mould on table vibrator

Fig. No. 2: Casting of Specimen

Fig. No. 3: Curing Cubes

Fig. No. 4: Compressive Strength Test.

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IV. EXPERIMENTAL RESULTS AND DISCUSSION

- **Workability Test**

The concrete workability test or slump test is designed to determine the workability or consistency of a concrete mixture prepared in a laboratory or construction site. The slump value of concrete is only the principle of gravitational flow on the surface of the concrete cone, which indicates the amount of water added, which means how this concrete mixture is in working condition.

Fig.No. 5: Slump Cone Test.

- **Compressive Strength Test**

The compressive strength of specimens after seven and twenty-eight days curing with varying percentage of GGBFS, GBFS, BFS is shown in Table1, Table2, Table3 respectively. Target strength of M25 grade of concrete used for present research experimentation is 25 N/mm^2 approximately.

Sr. No.	Partial Replacement	No. Of Specimen	Ultimate Compressive Strength In N/mm^2
1.	20%	3	25.84
2.	40%	3	26.88
3.	60%	3	18.55

Table1: Ultimate Compressive Strength for GGBFS

It is Observed from the experimental result in Table1 that with increase in percentage of GGBFS, 28 days compressive strength increases and achieves a peak value of 26.88 N/mm^2 at 40% GGBFS replacement to cement. The Specimen with 60% GGBFS replacement to cement achieved compressive strength of 18.55 which lesser than the desired target.

Sr. No.	Partial Replacement	No. Of Specimen	Ultimate Compressive Strength In N/mm^2
1.	20%	3	23.65
2.	40%	3	26.63
3.	60%	3	30.56

Table2: Ultimate Compressive Strength for GBFS

It is Observed from the experimental result in Table2 that with increase in percentage of GBFS, 28 days compressive strength increases. The Specimen with 20% GBFS achieves 23.65 N/mm^2, specimen with 40 % GBFS achieves 26.63 N/mm^2 and specimen with 60% GBFS achieves 30.56 N/mm^2 on replacement to sand respectively.

Sr. No.	Partial Replacement	No. Of Specimen	Ultimate Compressive Strength In N/mm^2
1.	20%	3	30.88
2.	40%	3	32.65
3.	60%	3	39.75

Table3: Ultimate Compressive Strength for BFS

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It is Observed from the experimental result in Table3 that with increase in percentage of BFS, 28 days compressive strength increases. The Specimen with 20% GBFS achieves 30.88 N/mm^2, specimen with 40 % BFS achieves 32.65 N/mm^2 and specimen with 60% GBFS achieves 39.75 N/mm^2 on replacement to aggregate respectively.

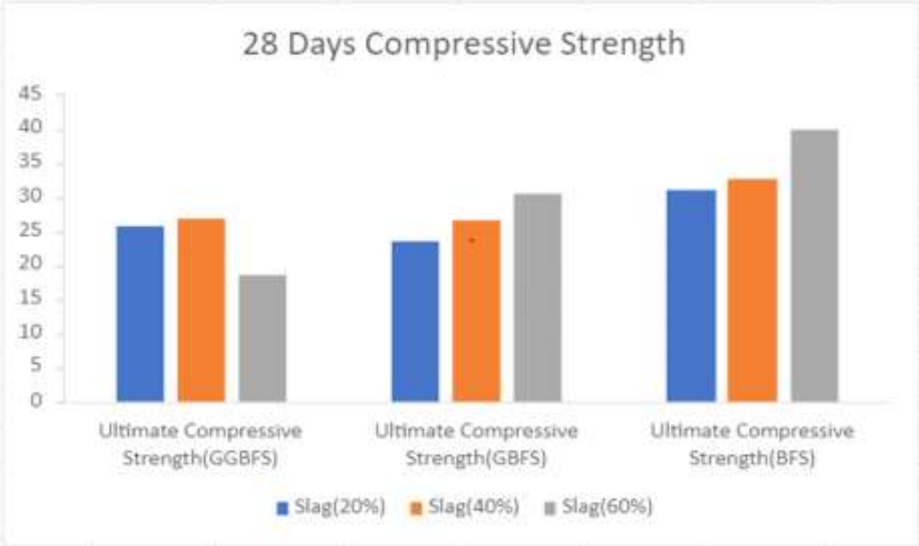

Fig. 1: 28 Days Compressive Strength

V. CONCLUSIONS

The Compressive strength of concrete specimens with GGBFs, GBFS, and BFS has been studied. The results showed that in order to make ecofriendly concrete 40% of GGBFS is replaced with Cement, 40% of GBFS is replaced with sand, 40% BFS is replaced with aggregate respectively. Using these ratios, green concrete can be obtained while reducing construction costs and reducing CO^2 emissions. You can also save river sand by applying this idea. Riverbank conservation can also be achieved by adopting this practice.

REFERENCES

[1]. S. Saran Raj, Dr. K. Chandrasekhar Reddy, 2015, “Effect of Fly Ash and GBFS on Strrength Parameters of Concrete,” IJSR journal, vol-4 issue 5, Paper ID: SUB154249.

[2]. Palash S. Dongre, Mahavir B. Mirkute, Sagar D. Malkhede, 2016, “Comparison of Compressive Strength of Conventional Concrete With GGBFS Concrete,” ICEEOT journal.

[3]. Kiambigi Maina, Gwaya A.O, Koteng D.O, 2018, “Effects of Different Fine Aggregate on Concrete Strength,” IJSCE journal, vol-8 issue 2,

[4]. Abhilash Shivdas Mule, Prof. M. A. Banarase, 2018, “Review on Self compacting Concrete Using GBFS, ” JETIR Journal, vol-5 issue 3, Paper ID: JETIR1803152.

[5]. Ishwar Chandra Thakur, N.Kisku, J.P.Singh, Sheo Kumar, “Properties of Concrete Incoporated with GGBS,” IJRET journal.

[6]. K.G. Hiraskar, Chetan Patil, 2013, “Use of Blast Furnace Slag Aggregate in Concrete, ” IJSER, vol-4 issue 5.