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## PERFORMANCE OF CONCRETE BY USING TITANIUMDIOXIDE

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### ABSTRACT

The best construction material is concrete. Additionally, it will adjust to the site's conditions quite effectively. Although cement, fine aggregate, coarse aggregate, and water are all mixed together to make this concrete, it is thought of as a homogeneous material. There are many ways to increase the strength of concrete; one option, while not the best, is to replace some of its constituent parts. nce cement is currently the primary binding agent in concrete, substituting some of the cement with other cementitious materials, such as GGBS and tio2, will produce the best results in increased concrete strength values. In this work, a short trial is conducted to adjust the characteristics of concrete by partially replacing the cement with GGBS at percentages of 10%, 20%, 30%, and 40% and TIO2 at percentages of 0.6%, 0.8%, 1.0%, and 1.250%. Compressive strength and split tensile strength are measured using various tests. Every cube is tested for 7 and 28 days for M<sub>30</sub> Grade of concrete.

**Keywords:** Ground granulated blast furnace slag, Titanium dioxide, compressive strength, split tensile strength.

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### 1. INTRODUCTION

Concrete is the most well-known building material in the world and is utilised for all types of structural development. Concrete will support procedures like post & pre tensioning to get a higher strength at a time with the reduction of concrete. There are many approaches to achieve various necessary conditions, some of which may be of a higher strength than the conventional. Cement serves as a binding agent in concrete, which is a mixture of water, coarse aggregate, and fine aggregate. When cement and water come into contact, an exothermic reaction occurs, which causes the concrete's components to become harder. There are different kinds of concrete that are used for different environmental and strength requirements. Because producing cement produces a lot of CO<sub>2</sub>—about 120 million metric tonnes annually partial replacements like GGBS and TIO<sub>2</sub> can help reduce CO<sub>2</sub> emissions while still enhancing concrete's strength.

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### 2. OBJECTIVES

1. To study the strength properties of ggbs as a partial replacement for cement in concrete.
2. To study the optimize of Titanium dioxide.

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### 3. MATERIALS

#### 3.1 Cement:

A binding agent, cement is a substance used in construction to keep the other building elements together. The main component of concrete is coarse aggregate, whereas fine aggregate is utilised to fill the spaces left by the coarse aggregates. Mortar is simply plain cement combined with fine aggregate and water, whereas concrete is simply cement combined with coarse aggregate.

#### 3.2 GGBS:

The white furnace slag known as GGBS (ground granulated blast furnace slag) is a byproduct of the furnaces used to refine iron ore. Oxides of calcium, silica, aluminium, and magnesium make up the majority of GGBS. In GGBS, calcium oxide typically makes up 40%.

#### 3.3 Titanium dioxide(TIO<sub>2</sub>):

A naturally occurring compound made of titanium and oxygen is known as titanium dioxide. It's an inorganic substance. This substance offers concrete excellent flexural strength and gives it a white hue.

## 4. EXPERIMENTAL RESULTS

### 4.1 COMPRESSIVE STRENGTH

The cube specimens of 150mm x 150mm x 150mm were cast and tested in compression testing machine for 7 and 28 days of curing period for different proportions of concrete mix and presented in table below.

**Table 1.1: Compressive strength of concrete with GGBS as partial replacement of cement in concrete**

Sl.no	GGBS	7 days (N/mm <sup>2</sup> )	28 days (N/mm <sup>2</sup> )
1	0%	27.39	39.25
2	10%	27.71	39.60
3	20%	27.77	39.97
4	30%	27.99	40.05
5	40%	30.68	42.03
6	50%	26.25	38.11

**Table 1.2: Compressive strength of concrete with tio2 as partial replacement of cement in concrete**

Sl.no	TIO <sub>2</sub>	7 days (N/mm <sup>2</sup> )	28 days (N/mm <sup>2</sup> )
1	0%	27.39	39.25
2	0.6%	30.43	44.17
3	0.8%	31.18	45.07
4	1%	32.78	46.17
5	1.2%	29.48	44.14

**Table 1.3: Compressive strength of Concrete with GGBS and Tio<sub>2</sub>**

Sl.no	GGBS +TIO <sub>2</sub>	7 days (N/mm <sup>2</sup> )	28 days (N/mm <sup>2</sup> )
1	0%	27.39	39.25
2	40%GGBS+1%TIO <sub>2</sub>	32.84	47.74

### 4.2 Split tensile strength results

At the age of 7 and 28 days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength.

**Table 1.4: Split tensile strength of concrete with GGBS as partial replacement of cement in concrete**

Sl.no	GGBS	7 days (N/mm <sup>2</sup> )	28 days (N/mm <sup>2</sup> )
1	0%	2.57	3.85
2	10%	2.64	3.89
3	20%	2.76	3.99
4	30%	2.81	4.04
5	40%	3.22	4.58
6	50%	2.65	3.80

**Table 1.5: Split tensile strength of concrete with tio2 as partial replacement of cement in concrete**

Sl.no	TIO <sub>2</sub>	7 days (N/mm <sup>2</sup> )	28 days (N/mm <sup>2</sup> )
1	0%	2.57	3.85
2	0.6%	2.93	4.26
3	0.8%	3.07	4.40
4	1%	3.21	4.66
5	1.2%	3.10	4.36

**Table 1.6: Split tensile strength of concrete with GGBS and to2 as partial replacement of cement in concrete**

Sl.no	GGBS +TIO <sub>2</sub>	7 days (N/mm <sup>2</sup> )	28 days (N/mm <sup>2</sup> )
1	0%	2.57	3.85
2	40%GGBS+1%TIO <sub>2</sub>	3.50	5.02

## 5. CONCLUSION

In this study, the concrete ingredients like cement are partially replaced by GGBS and TIO<sub>2</sub> respectively. GGBS varied different percentages of 10%, 20%, 30%, 40%, 50%.and TIO<sub>2</sub> is varied with different percentages like 0.6%, 0.8%, 1.0%, 1.2%

1. The normal concrete Compressive strength result for 7 and 28 days is 27.39N/mm<sup>2</sup> and 39.25 N/mm<sup>2</sup>.
2. The normal concrete Split tensile strength result for 7 and 28 days is 2.57 N/mm<sup>2</sup> and 3.85 N/mm<sup>2</sup>.
3. At 40% partial replacement of GGBS with cement the compressive strength of concrete at 7 and 28 days are 30.68 and 42.08 N/mm<sup>2</sup>.
4. At 40% partial replacement of GGBS with cement the split tensile strength of concrete at 7 and 28 days are 3.22 and 4.58 N/mm<sup>2</sup>.

5. At 1% partial replacement of titanium dioxide with cement the compressive strength of concrete at 7 and 28 days are 32.78 and 46.17N/mm<sup>2</sup>.
6. At 1% partial replacement of titanium dioxide with cement the split tensile strength of concrete at 7 and 28 days are 3.21 and 4.66 N/mm<sup>2</sup>.
7. By the combination of 40% GGBS +1% TiO<sub>2</sub> with cement the compressive strength of concrete at 7 and 28 days are 32.84 and 47.74 N/mm<sup>2</sup>.
8. By the combination of 40% GGBS +1% TiO<sub>2</sub> with cement the split tensile strength of concrete at 7 and 28 days are 3.50 and 5.02 N/mm<sup>2</sup>.

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