INVESTIGATION ON PROPERTIES OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH TITANIUM AND GGBS

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Abstract

Among construction materials, concrete is best. Additionally, it will adjust to the site's conditions quite effectively. Although cement, fine aggregate, coarse aggregate, and water all are mixed together to make this concrete, it is thought of as a homogeneous substance. There are several ways for concrete to profit. strength, changing the concrete's components is another option, however only partially is thought to be ideal. Major now the cement component acts as a binding agent in concrete, therefore by partially substituting the cement with different Cementations ingredients like GGBS and tio2 will produce the best results in increased concrete strength ratings. A modest attempt is conducted in this study to alter the characteristics of concrete by replacing some of the cement with10%, 20%30%,40% and 50%, of GGBS of a percentage and 0.6%,0.8%,1% and 1.2% of titanium dioxide.

Keywords: *- (ground granulated blast furnace slag), (titanium dioxide), compressive strength, split tensile strength.*

I. 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 greater strength at a time with the reduction of concrete. There are many approaches to accomplish 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. An exothermic reaction occurs when cement and water come into contact, which causes the contents of the concrete to harden.There are different kinds of concrete that are used for different environmental and strength requirements. Because producing cement produces a lot of CO2—about 120 million metric tonnes annually—partial replacements like GGBS and TIO2 can help reduce CO2 emissions while still enhancing concrete's strength.

2. Objective

1.To research the strength characteristics of using ggbs in place of certain cement in concrete.

2. To research Titanium dioxide's optimum.

3.Materials

3.1 Cement :A binding agent, cement is a substance used in construction to keep the other building elements together. The major 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 Aggregate: Since aggregates make up around 80% of the volume of concrete, their characteristics have a significant impact on how the material behaves.

3.3 Water: One of the most important materials in construction, water is needed for a variety of tasks like making mortar, mixing cement concrete, and curing work. The strength of the motor and cement concrete in the building project is directly influenced by the quality of the water utilised.

3.4 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 generally makes up 40%.

3.5 TIO_2:A naturally occurring compound made of titanium and oxygen is known as titanium dioxide. It's an inorganic substance. This substance offers concrete excellent strength and gives it a white hue.

4.EXPERIMENTAL RESULTS

4.1 Compressive strength results:

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

Sl.no	% of GGBS	Compressive strength results, N/mm²	
		7 days	28 days
1	0%	34.32	49.82
2	10%	34.78	50.27
3	20%	35.50	50.80
4	30%	35.32	51.12
5	40%	38.39	53.93
6	50%	34.92	51.37

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

Sl.no	% of Tio2	Compressive strength results, N/mm²	
		7 days	28 days
1	0%	34.32	49.82
2	0.6%	38.30	56.67
3	0.8%	39.27	57.33
4	1%	41.60	59.10
5	1.2%	37.59	56.53

Table 1.3: Compressive strength of Concrete with GGBS and TiO2

Sl.no	GGBS+Tio2	Compressive strength results, N/mm²	
		7 days	28 days
1	0%	34.32	49.82
2	40%GGBS+1% Tio2	42.07	61.15

4.2 Split Tensile Strength Results

At the age of 7 and 28days, 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	% of GGBS	Split tensile strength results, N/mm²	
		7 days	28 days
1	0%	3.23	4.83
2	10%	3.34	4.93
3	20%	3.47	5.05
4	30%	3.52	5.10
5	40%	3.87	5.50
6	50%	3.55	5.09

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

Sl.no	% of Tio2	Split tensile strength results, N/mm²	
		7 days	28 days
1	0%	3.23	4.83
2	0.6%	3.74	5.47
3	0.8%	3.86	5.60
4	1%	4.06	5.96
5	1.2%	3.96	5.59

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

Sl.no	GGBS+Tio2	Split tensile strength results, N/mm²	
		7 days	28 days
1	0%	3.23	4.83
2	40%GGBS+1% Tio2	4.39	6.29

5. Conclusion

In this study, the concrete ingredients like cement are partially replaced by GGBS and TIO2 respectively. GGBS varied different percentages of 10%, 20%,30%,40%, 50%.and TIO2 is varied with different percentages like 0.6%, 0.8%, 1.0%, 1.2%

1. At 40% partial replacement of GGBS with cement the compressive strength of concrete at 7 and 28 days are 38.39 and 53.93 N/mm^2.

2. At 40% partial replacement of GGBS with cement the split tensile strength of concrete at 7 and 28 days are 3.87 and 5.50 N/mm^2.

3. At 1% partial replacement of titanium dioxide with cement the compressive strength of concrete at 7 and 28 days are 41.60 and 59.10 N/mm^2.

4. At 1% partial replacement of titanium dioxide with cement the split tensile strength of concrete at 7 and 28 days are4.06 and 5.96 N/mm^2.

5. By the combination of 40% GGBS +1% Tio2 with cement the compressive strength of concrete at 7 and 28 days are 42.07 and 61.15 N/mm^2.

6. By the combination of 40% GGBS +1% Tio2 with cement the split tensile strength of concrete at 7 and 28 days are 4.39 and 6.29 N/mm^2.

6. References

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