

COMPREHENSIVE STUDY ON OPC 53 AND OPC 53 S CEMENT IN M40 GRADE WITH GGBS BLENDED CEMENT CONCRETE

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Abstract

Growing industrial waste have discovered the need to disposal of industrial waste, The waste that have to be disposed can be kept to use in some manner, among the industrial waste processing cementations nature can be replaced as binder matter in concrete to apart . A large volume of production of cement leads to emission of many harm full gases like green house gases in atmosphere, which are tends for global warming. Hence, the researchers are currently focused on waste material having cementing properties, which can be added as partial replacement of cement which reduces cement production then the green house gases emission is also reduced, to sustain-able management of the industrial waste, Some of the Pozzolanic materials like flay ash , Silica fume, Rice Husk ash, Metakoline, Ground Granulated Blast Furnaces Slag (GGBS) are used as cementations materials. Among them the Ground Granulated Blast Furnaces Slag,(GGBS) which waste from, from an iron manufacturing industry, which may be used as substitute of cement in concrete due to its inherent cementing properties. To increase the strength of the concrete some of the special cements are used. Among that OPC 53 S special cement is used in the construction of railway sleepers which gives more compressive strength compared to OPC cements .this special cements is finer than ordinary cements. Due to various codal specifications the binding material replacements of GGBS have been restricted up to 80% in maximum. In accordance with above restrictions the replacement variations in binding material have been decoded in a high strength concrete mixture. The research work have been extensively executed in almost all areas of testing like compressive , spilt tensile, and flexural strength, and also various primary tests like specific gravity , granular gradation etc. have also been excited to achieve high strength concrete. In this project the replacement of GGBS is up to 40% in both OPC and OPCS.

INTRODUCTION

Cement is a material with adhesive and cohesive properties. It is a binder material in concrete, when it is mixed with aggregates and water it turns the particles into a whole compound. Cement is a most important and costliest ingredient of concrete. It is obtained by burning a mixture of the siliceous, argillaceous and calcareous material in definite proportions.

The temperature to which the mixture must be burnt is about 1400 c. The clinker so obtained is cooled and powdered to the required fineness. The product so obtained is cement .It consists of different properties are

obtained by mixing the above components in different proportions along with small percentages of other chemicals. Portlandcement is the most important type of cement which is widely used.

WORKING METHODOLGY

collections of materials:

Cement: the cement of OPC 53 S is used in project it is collected from the railway sleeper plant, OPC 53 OF JPJ cement is used.

Fine aggregate: the sand used for our investigation is collected form Godavari river river sand which is conformingto Zone III as per IandianSpecification 383-1970 codal provisions.

Coarse aggregate: the coarseaggregate of max20mm size with an angularshape which is well graded.

GROUND GRANULATED BLAST FURNACES:GGBS is collected from RIN

(Visakhapatnam Steel Plant)

Physical Properties of Materials:

Cement: The cement,used for this present studyJPJ (OPC 53) grade cement conforming all conditions of IS 8112-1989. It is most recently manufactured, is of uniform colour and also free of lumps. The physical property of the cement isdetermined considering codal provisions. Fineness of cement, normal consistency, specific gravity, setting time, soundness test, and compressive strength of cement, is determined.

Table -3.1 cement physical properties:

Properties	Results	Permissible limits as per IS:12269-1987
Fineness of cement	OPC 53 – 6% OPC 53 S -1%	Shall not be less than 10 %
Normal consistency	32	-
Specific gravity	3.15	-
Setting time Initial		
Final	40 mints 330mints	Should not be less than 30 min Should not be more than 600 min
Soundness of cement	2mm	
Compressive Strength of Cement Motor cubes for		
3 days	29	Should not be less than 23 N/mm2 Should not be
7 days	37.83	less than 33 N/mm2
28 days	53.6	Should not be less than 43 N/mm2

RESULTS AND DISCUSSIONS

COMPRESSIVE STRENGTH:

Result representing the compressive strength values from 3 days curing to 90 days curing at various replacement levels i.e. at 0 % to 40 % replacement of GGBS in both OPC 53 and OPC 53 S cements.

By considering the M 40 mix proportions the different mix are casted the mix details are shown the table

Mix methodology table:

Table – 5.1mix proportions for 1 m³

Mix designations	Cement content	GGB S	F.A content	C.A content	Water
G0	410	0	584	1174	197
G10	369	41	584	1174	197
G20	328	82	584	1174	197
G30	287	123	584	1174	197
G40	246	164	584	1174	197
GS0	410	0	584	1174	197
GS10	369	41	584	1174	197
GS 20	328	82	584	1174	197
GS30	287	123	584	1174	197
GS40	246	164	584	1174	197

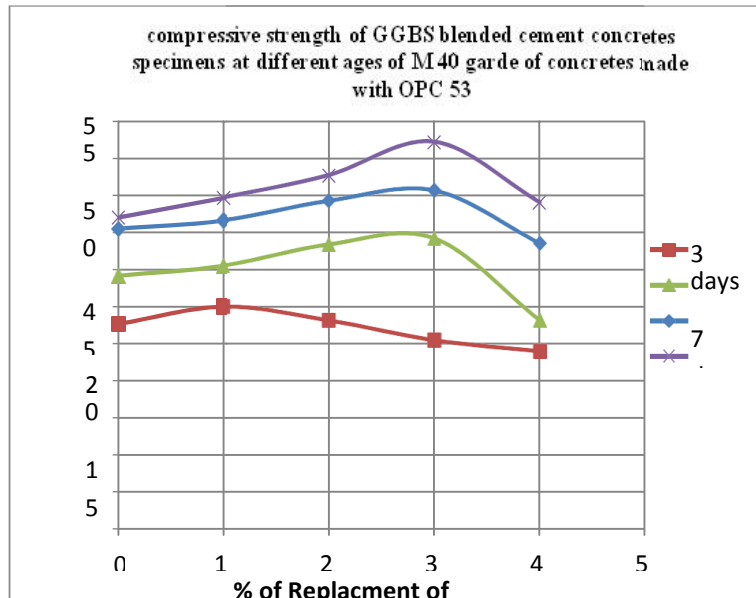
COMPRESSIVE-STRENGTH RESULTS:

The compressive-strength of cubes for 3,7, 14,28,56, 90 days are shown in the below table

Table -5.2 compressive strength for different days N/mm2

MIX DESIGNATION	COMPRESSIVE-STRENGTH N/mm2					
	3	7	14	28	56	90
G0	27.7	34.2	40.5	41	43	45
G10	30	35.5	41.6	44.7	50	53
G20	28.2	38.3	44.2	47.7	54	57
G30	25.5	39.2	45.6	52.2	55	59.5
G40	24	28.2	38.5	44	45	53
GS0	30.66	35.16	43.1	46	48	51
GS10	32.66	37.5	45.7	47.16	50	54
GS20	28.66	38.66	48.1	50.66	56	58
GS 30	28.16	35.16	48.7	54.0	59	62
GS40	26.0	30.16	39.5	48.83	54	59

Graph -1 the compressive strength of G0toG40 mix for 3,7, 14, 28days.

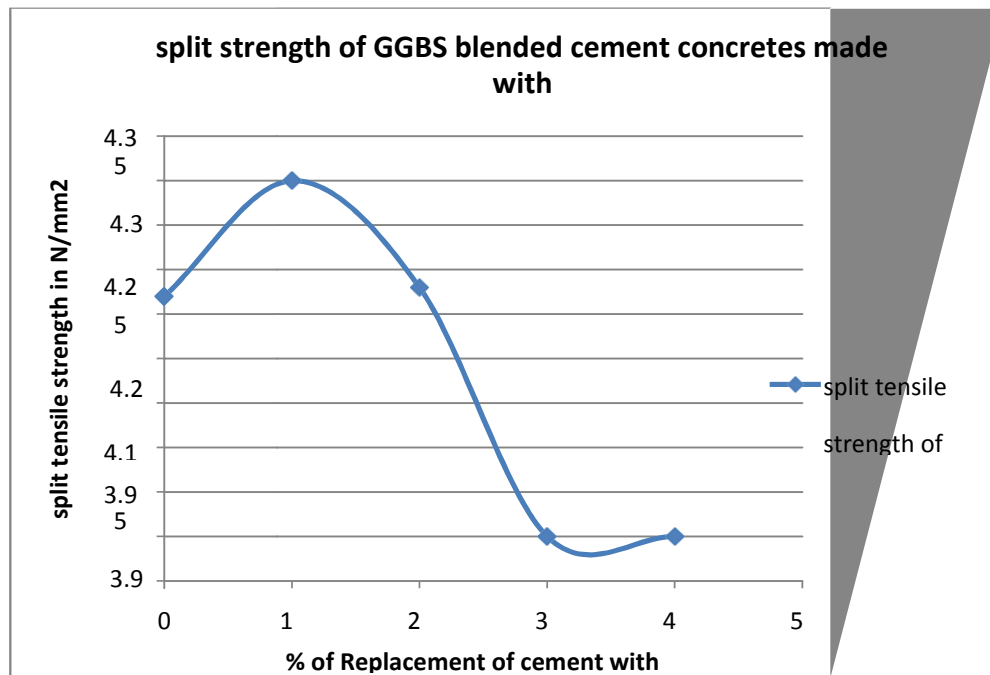


SPLIT TENSILE STRENGTH RESULT:

The standard size of cylinders of 300mm long and 150 mm diameter, cylinders are casted with the designed mix proportions in both OPC 53 and OPC 53 S ,and they are tested the specimens after 28 days curing in normal water.

Table – 5.4split tensile strength results

MIX DESIGNATION	SPLIT TENSILE STRENGTH N/mm2
G0	3.89
G10	4.03
G20	3.72
G30	3.6
G40	3.46
GS0	4.17
GS10	4.3
GS 20	4.18
GS30	3.9
GS40	3.9



CONCLUSIONS:

1. Early strength is compared with GGBS blended cement concrete is slightly lower than conventional aggregate concrete.
2. The compressive strength result of GGBS blended cement concrete when replaced up to 30 % is more than conventional aggregate concrete at the end of 28 days for normal curing
3. The split tensile, flexure strength result of GGBS blended cement concretes when replaced up to 10 % is more than the conventional aggregate concrete at the end of 28 days for normal curing.
4. The degree of workability is normal in GGBS cement concrete up to 40 % level of replacement.
5. An increase of around 27.3 %, 28.8%, 33.3% compressive strength for GGBS blended cement concrete when replaced with 30% of OPC 53 cement at the of 28, 56 90 days normal curing.
6. An increase of around 17.4 %, 31.2%, and 32% of compressive strength is observed for GGBS blended cement concrete when replaced with 30% of OPC 53S cements at the age of 28, 56, 90 days.
7. An increase of about 3.6 % of split tensile strength at 10 % replacement level after 28

- days normal curing when the GGBS is replaced with OPC 53
8. An increase of about 3.1 % of split tensile strength at 10 % replacement level after 28 days normal curing when the GGBS is replaced with OPC 53 S
 9. An increase of about 7.15 % of flexure strength at 10 % replacement level after 28 days normal curing when the GGBS is replaced with OPC 53 grade cement
 10. An increase of about 3.12 % of flexure strength at 10 % replacement level after 28 days normal curing when the GGBS is replaced with OPC 53 S grade cement
 11. GGBS is used as an partial replacement of cement.

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