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EXPERIMENTAL INVESTIGATION ON COMPARISION OF OPC 53 AND OPC 53 S CEMENT WITH GGBS BLENDED CEMENT CONCRETES IN M40 GRADE

M Raveendra[1], Sampathkumar K[2].

1 M.Tech Student, Newton's Institute of Science & Technology, India.*

2 Assistant Professor, Newton's Institute of Science & Technology, India.*

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.

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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 Iandian Specification 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)

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 7 days 28 days	 29 37.83 53.6	 Should not be less than 23 N/mm2 Should not be less than 33 N/mm2 Should not be less than 43 N/mm2

physical properties of OPC-53grade and OPC-53-S grade cements

PROPERTITES	OPC 53	OPC 53-S
Fineness of cement	8%	1%
Standard consistency	32%	35%
Specific gravity	3.15	3.15
Initial setting time	40 minute	22 min
Final setting time	330 minute	150 min
soundness	2mm	2mm

compressive strengths of OPC 53 grade and OPC 53-S grade

S.No	OPC 53 in N/mm^2			OPC 53-S in N/mm^2	
	3 days	7days	28 days	7days	28days
1	29.5	38.8	54.2	42	58
2	28.5	37.2	53.8	38	56
3	29	37.5	53	41	54
average	29	37,83	53.667	40.33	56

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TESTS ON CONCTRETE

Compressive strength:

After 28 days of curing the sample cubes are tested for compressive strength under compressive testing machine. The test samples are taken out from curing tank at least 4 to 5 hours of testing. For one trail at least three specimens are to be tested.

Fig – testing of cubes for compressive strength

TEST FOR SPLIT TENSILE STRNGTH:

The specimens are tested for tensile strength for 28 days on split tensile testing machine. Specimen, preferably from different batches, should batches, should be made for testing for each selected age, specimen are removed from water before 4 to 5 hours of testing.

Fig .testing of specimens for split tensile strength

TEST FOR FLEXURAL STRENGTH:

Flexural strength of the concrete is done using the universal testing machine. The bearing surface of the supporting and loading rollers of the machine should be cleaned. The prism should be placed under the rollers in such a way that the load is applied on theuppermost surface of the casted mould. The prism should be marked at the spacing of 13.3 a part.

Fig – testing of specimens for flexure strength

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 proportions for 1 m^3

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

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COMPRESSIVE-STRENGTH REULTS:

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

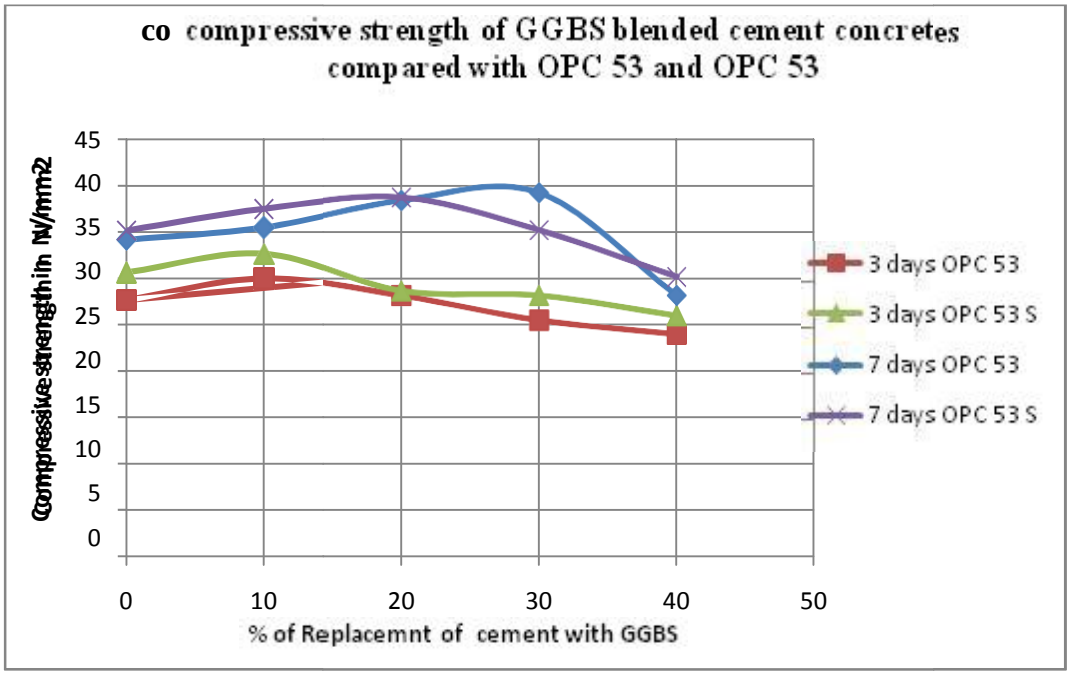
Compressive strength for different days N/mm2

MIX DESINATION	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

% of R eplacemnt of cement with GGBS

Graphs:

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



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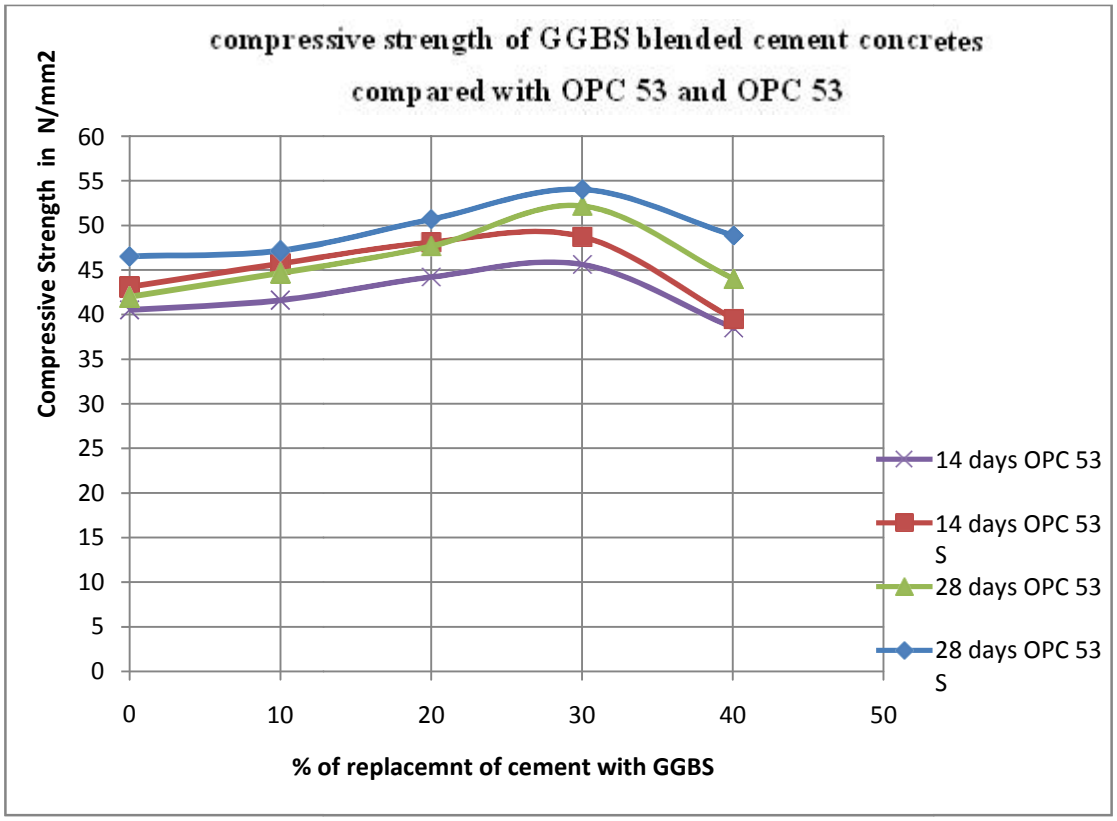
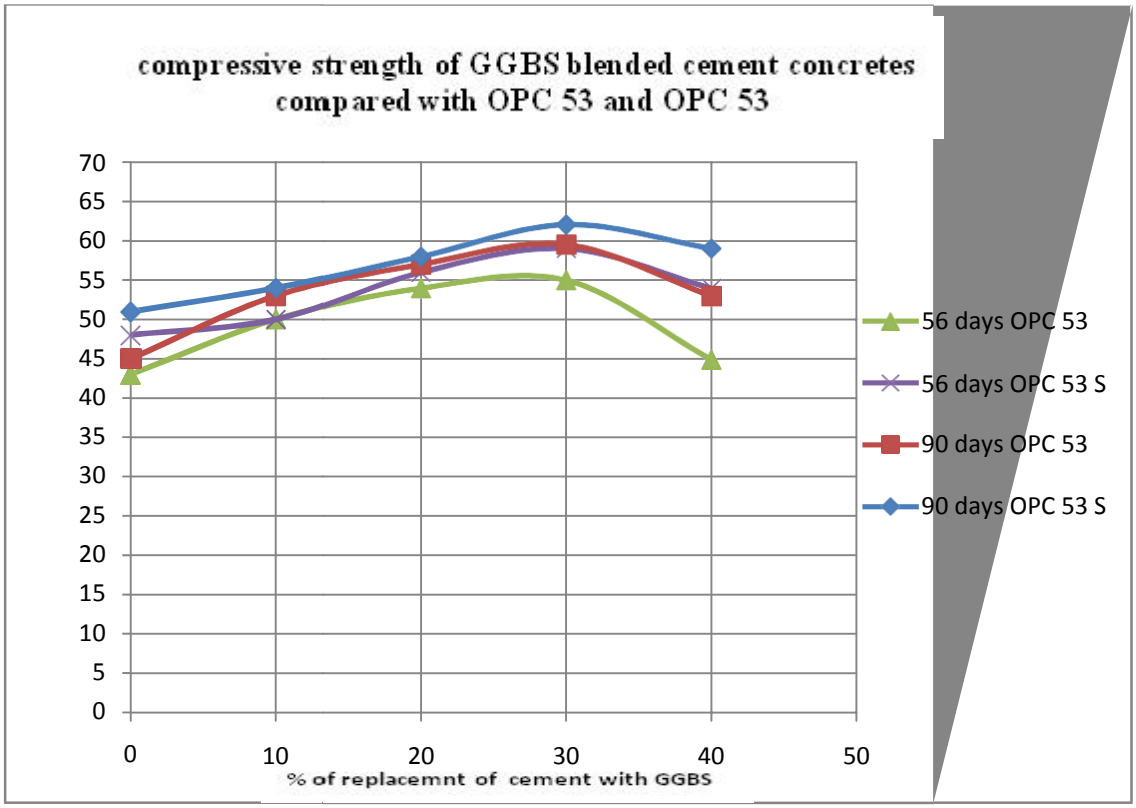


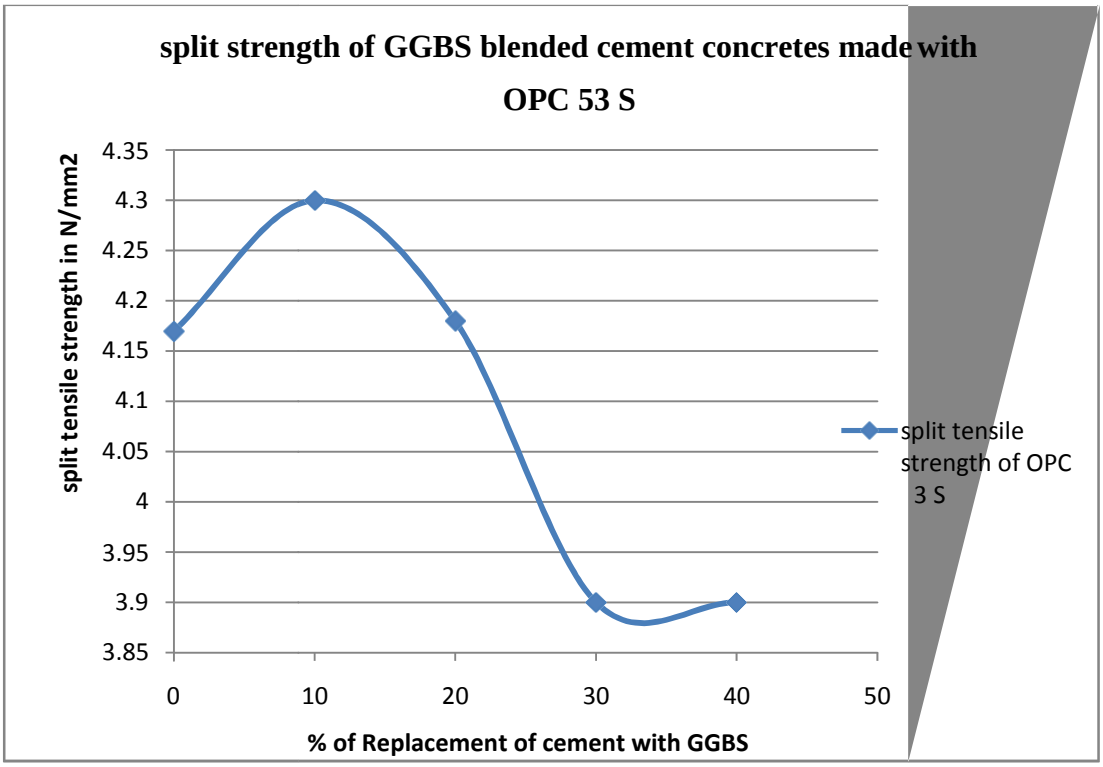


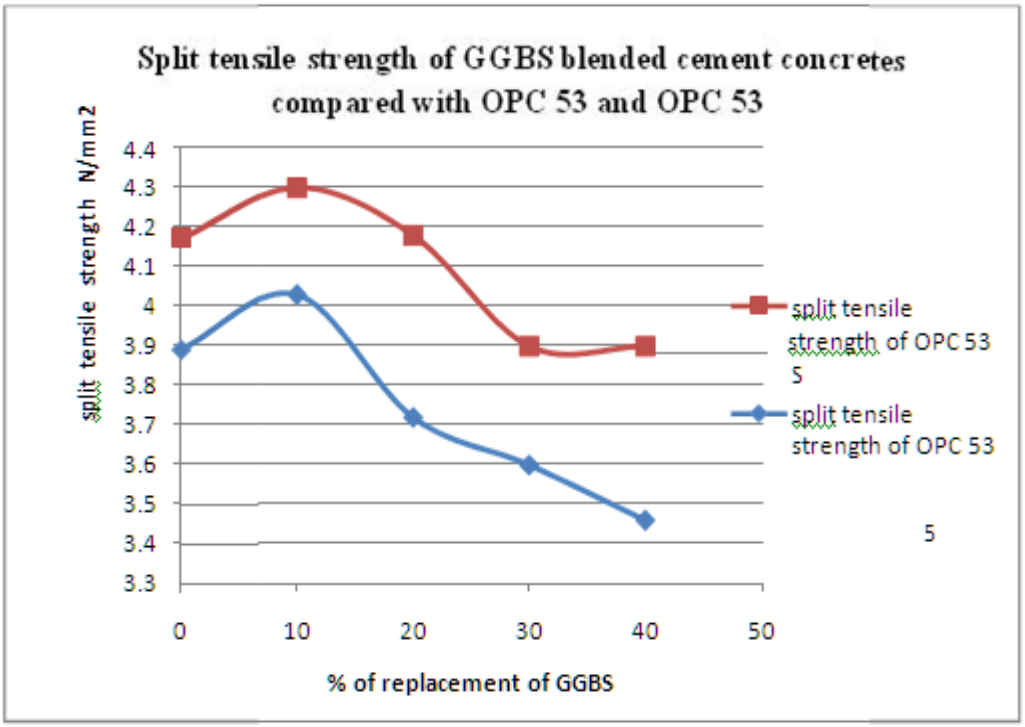
SPLIT TENSILE STRENGTH RESULT:

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.

split tensile strength results

MIX DESIGINATION	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



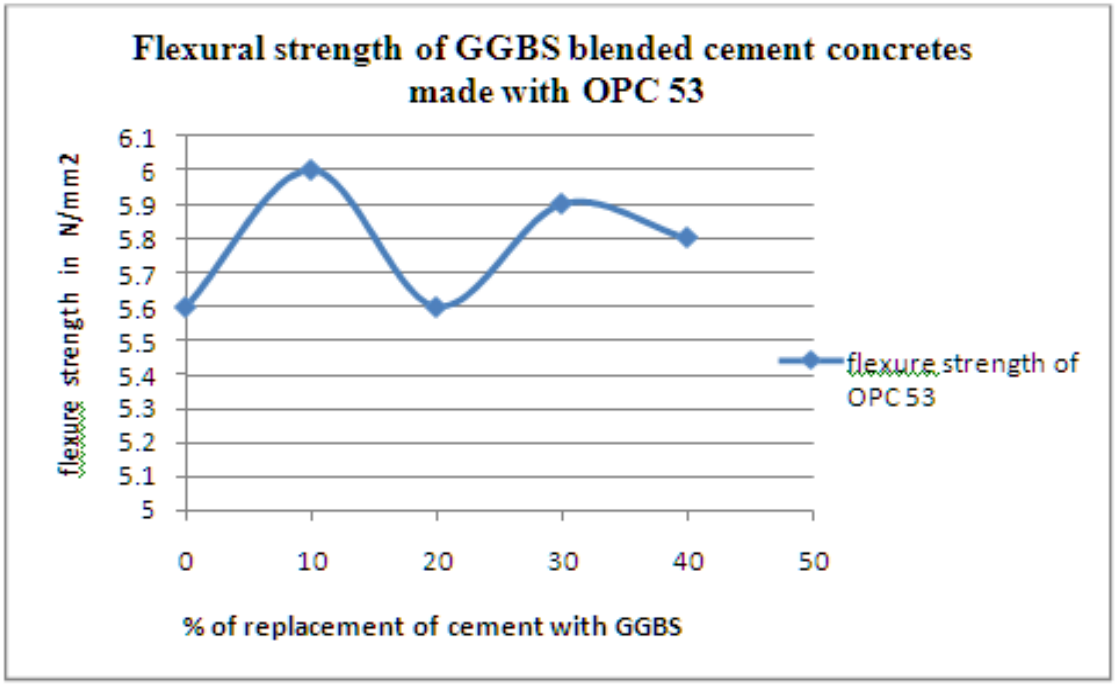


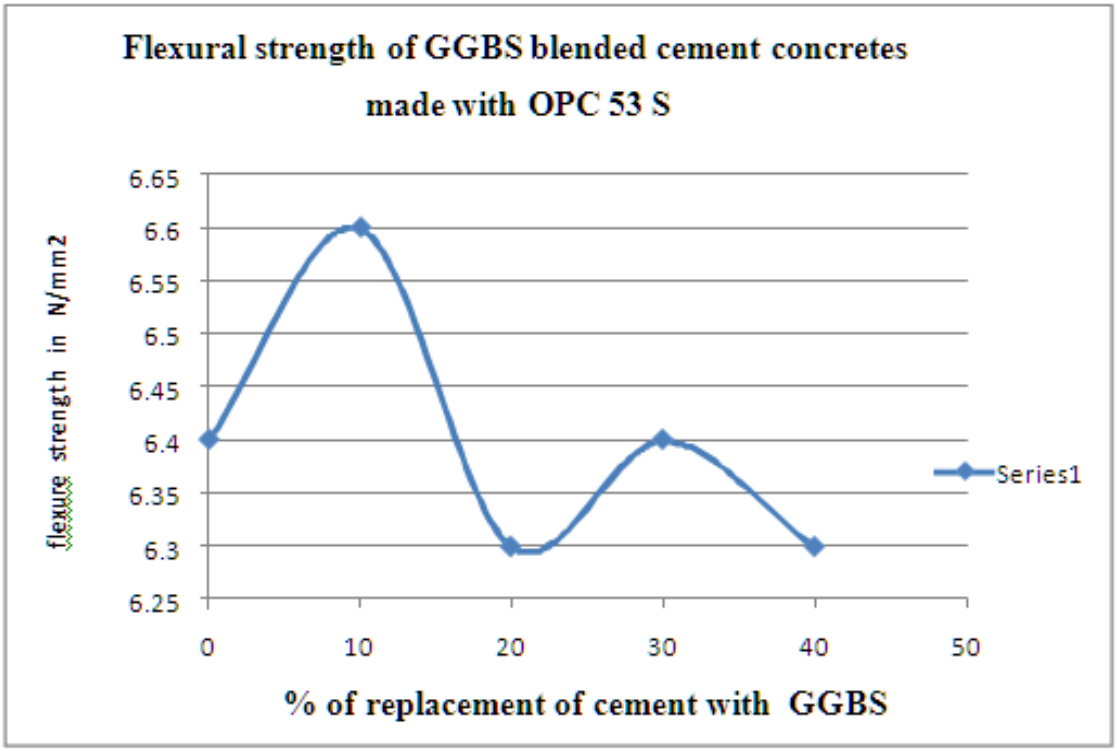
FLEXURE STRENGTH:

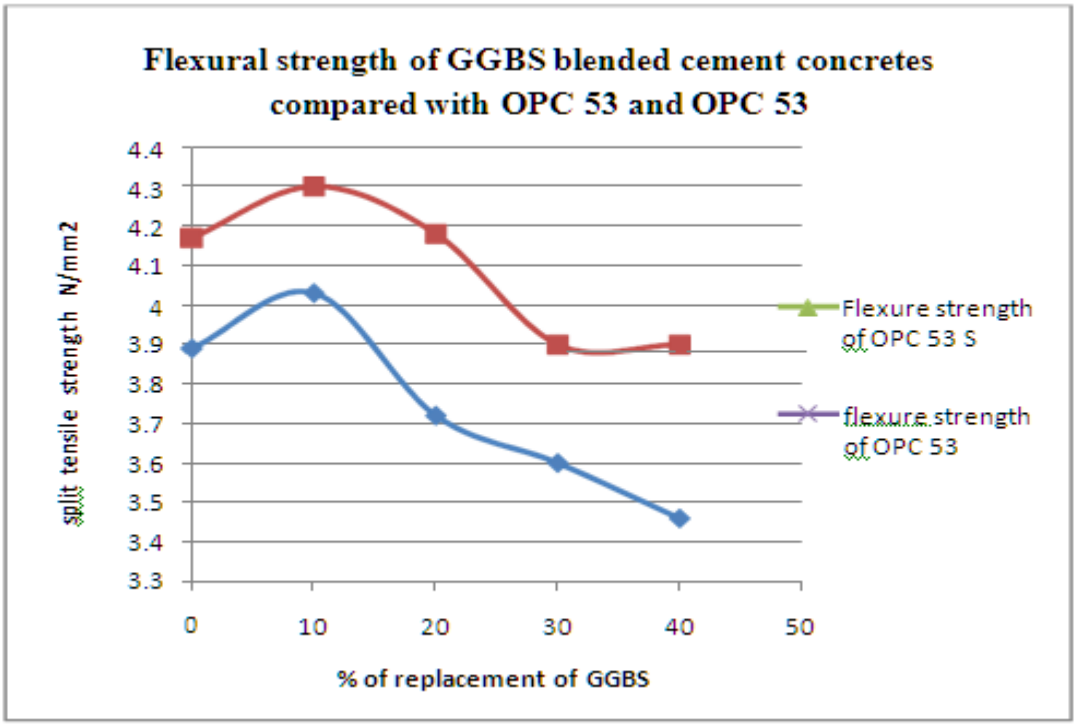
The standard size of prisms of 500mm*100mm*100mm .prisms are casted with the designed mix proportions in both OPC 53 and OPC 53 S, and they are tested the specimens after 28 days curing in normal water.

flexure strength results

MIX DESIGNATION	FLEXURE STRENGTH
G0	5.6
G10	6
G20	5.6
G30	5.9
G40	5.8
GS0	6.4
GS10	6.6
GS 20	6.3
GS 30	6.4
GS 40	6.3


Flexural strength of GGBS blended cement concretes made with OPC 53
flexure strength in N/mm2
6.1
6
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5
0
10
20
30
40
50
% of replacement of cement with GGBS
flexure strength of OPC 53


Flexural strength of GGBS blended cement concretes made with OPC 53 S
flexure strength in N/mm2
6.65
6.6
6.55
6.5
6.45
6.4
6.35
6.3
6.25
0
10
20
30
40
50
% of replacement of cement with GGBS
Series1



CONCLUSIONS:

1. Early strength is compared with GGBS blended cement concrete is slightly lower than conventional aggregate concrete.
2. The compressive strength result of GGBBS 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.

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