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Effect of Partially Replacement of River Sand, by GBS Sand and Crushed Sand

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ABSTRACT: Nowadays it is very important to make the concrete economical. Therefore the present work has initiated to make the concrete economical by replacing the natural sand by crushed sand and GBS sand in the concrete. The investigations are to be carried out using several test which include workability test, compressive test, flexural test. From our study it is concluded that different Crushed sand gives different results for compressive strength depending on different quarries and from study of different research paper at 40% to 60% replacement of crushed sand the maximum compressive strength is obtained. The concrete with crushed sand performed better than concrete with natural sand as the property of crush sand is better than that of natural sand. The environment problems are very common in India due to generation of industrial by-products. Due to industrialization enormous by-products are produced and to utilize these by-products is the main challenge faced in India. Iron slag is one of the industrial by-products from the iron and steel making industries. In this study, the compressive strength of the iron slag concrete was studied. The results confirm that the use of iron slag overcome the pollution problems in the environment. The results shows that the iron slag added to the concrete had greater strength than the plain concrete.

KEYWORDS: GBS Sand, Crushed Sand, River sand, compressive test, etc.

1. INTRODUCTION

Currently, India is developing country. Now days so many infrastructural projects running. It can be requirement of Globalization. In recent years, concrete technology has made significant advances which have resulted in economical improvements in strength of concrete. This economic development depends upon the intelligent use of locally available materials. One of the important ingredients of conventional concrete is natural sand or river sand, which is one of the constituents used in the production of conventional concrete, has become highly expensive and also scarce. Digging sand, from river bed, in access quantity is hazardous to environment and causing bank slides, loss of vegetation on the bank of rivers.

II. MATERIAL

The different types of materials used for preparation of concrete with various proportions are shown and different material properties are discussed below.

2.1. CEMENT

Basically it is a binding material used in concrete which hardens the concrete. OPC 53 grade cement is adopted.

2.2. GBS SAND

GBS Slag is a by-product generated during manufacturing of pig iron and steel. It is produced by action of various fluxes upon gangue materials within the iron ore during the process of pig iron making in blast furnace and steel manufacturing in steel melting shop. Primarily, the slag consists of calcium, magnesium, manganese and aluminium silicates in various combinations. The cooling process of slag is responsible mainly for generating different types of slags required for various end-use consumers. Although, the chemical composition of slag may remain unchanged, physical properties vary widely with the changing process of cooling.



2.3. CRUSHED SAND

Mankind has been blessed with fairly abundant natural resources. Society has to face the fury of nature, if they are over exploited. Sometimes it may be catastrophic. One such disaster was witnessed in Uttarakhand. Indiscriminate mining of Sand also amounts to overexploitation of the natural resources, adversely impacting the environment in several ways. It is also imperative to keep pace with the growth in construction and sand is one of the vital construction materials. One of the attractive alternatives to Sand is Crushed Sand. It possesses properties similar to that of river sand and is a more sustainable construction material.

2.4. COARSE SAND

Good quality aggregates with angular shape and 20mm size are used.

III. EXPERIMENTAL DESIGN

This experimental design is programmed to evaluate the application of high performance concrete using CS. To study the Material Test of Sieve Analysis, Specific Gravity, Water Absorption and Bulk Density of Sand. To study the compressive strength, flexural strength of concrete on using combination of GBS Sand and Crushed Sand (at 40%, 50%, 60%, and 100%) as partial replacement/ replacement of River Sand. To study the compressive strength, flexural strength on using combination of GBS Sand, Crushed Sand and River Sand (at 40%, 50%, 60%, and 100%) as fully replacement of River Sand.

IV. SPECIMEN DETAILS

Cubes of size 150X150X150mm are casted for all the trial mixes which are shown in (Table 1). Cylinders of size 150X300 mm are casted. There are total 8 trial mixes consisting of conventional concrete and other consist of various mixes of crushed sand, GBS sand, river sand are shown below.

Table -1: Trial mix and their compositions

Trial mix	% River sand	% Crushed sand	% GBS sand
TM1	100	-	-
TM2	-	100	-
TM3	-	-	100
TM4	-	60	40
TM5	-	50	50
TM6	-	40	60
TM7	50	50	-
TM8	50	-	50

Beam of size 150X150X700mm are casted for all the trial mixes which are shown in (Table 2). There are total 3 trial mixes consisting of conventional concrete and other consist of various mixes of crushed sand, GBS sand, river sand are shown below.

Table -2: Trial mix and their compositions

Trial mix	% River sand	% Crushed sand	% GBS sand
TMB	100	-	-
TM1B	-	-	100
TM2B	-	40	60

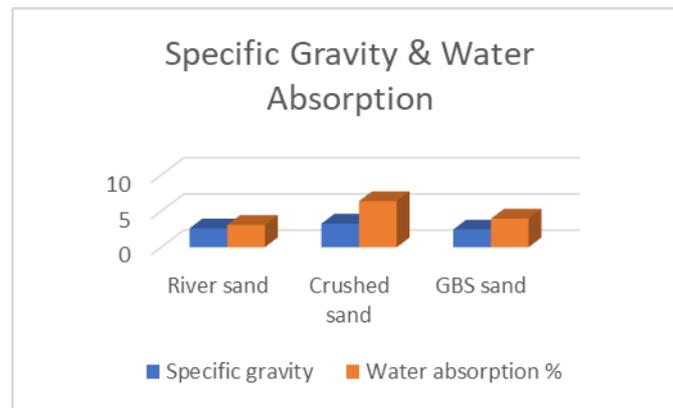


V. RESULTS

5.1. SPECIFIC GRAVITY & WATER ABSORPTION

Table -3: specific gravity & water absorption

	River sand	Crushed sand	GBS sand
Specific gravity	2.61	3.26	2.45
Water absorption %	3.09	6.38	3.95



5.2. SIEVE ANALYSIS

Table -4: sieve analysis for river sand

Sieve size	Wt. Ret	Cum Wt. Ret	Cum % Wt. Ret	Cum % Wt. Passing
10	0	0	0	100
4.75	69	69	6.9	93.1
2.36	79	148	14.8	85.2
1.18	407	555	55.5	44.5
0.60	169	724	72.4	27.6
0.3	184	908	90.8	9.2
0.15	92	1000	100	0
pan	0	-	-	-

Table -5: sieve analysis for crushed sand

Sieve size	Wt. Ret	Cum Wt. Ret	Cum % Wt. Ret	Cum % Wt. Passing
10	0	0	0	100
4.75	3	3	0.3	99.7
2.36	229	232	23.2	76.8



1.18	307	539	53.9	46.1
0.60	106	645	64.5	35.5
0.3	100	745	74.5	25.5
0.15	255	1000	100	0
pan	0	-	-	-

Table -6: sieve analysis for GBS sand

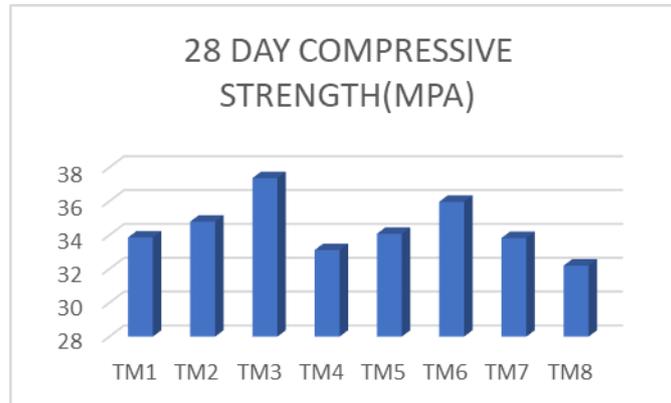
Sieve size	Wt. Ret	Cum Wt. Ret	Cum % Wt. Ret	Cum % Wt. Passing
10	0	0	0	100
4.75	0	0	0	100
2.36	19	19	1.9	98.1
1.18	332	351	35.1	64.9
0.60	287	638	63.8	36.2
0.3	285	923	92.3	7.7
0.15	77	1000	100	0
pan	0	-	-	-

5.3. COMPRESSIVE STRENGTH OF CONCRETE CUBE

Compression test is the most common test conducted on the hardened concrete, partly because it is very easy and simple to perform and partly because many of the desirable properties of concrete are qualitatively related to its compressive strength. Three types of compressive test specimens are used: cube and prisms. Cubes are used in Great Britain, Germany and many other countries in Europe. The size of standard cube specimen is 150mm×150mm×150mm. If the largest nominal size of the aggregate does not exceed 20mm, 100mm×100mm×100mm size cubes may also be used as an alternative.

Table -7: compressive strength of concrete cube

TRIAL MIX	28 DAY COMPRESSIVE STRENGTH(MPA)
TM1	33.86
TM2	34.80
TM3	37.37
TM4	33.12
TM5	34.08
TM6	35.97
TM7	33.83
TM8	32.20

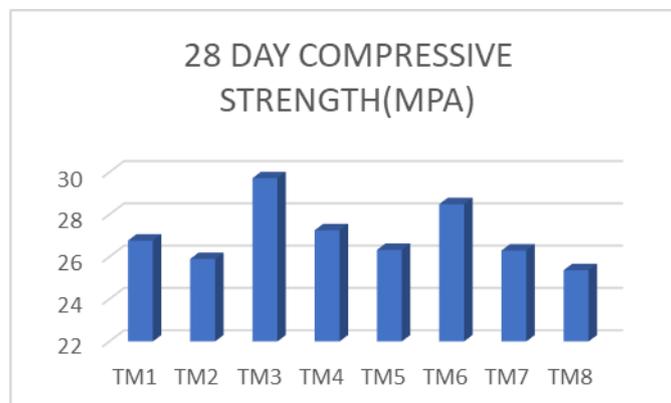


5.4. COMPRESSIVE STRENGTH OF CONCRETE CYLINDER

The Compressive strength of concrete is determined by casting cylinders of size 150 mm X 300 mm. The cylinders were tested by placing them uniformly. Specimens were taken out from curing tank at age of 28 days of moist curing and tested after surface water dipped down from specimens. This test was performed on compression Testing Machine (CTM).

Table -8: compressive strength of concrete cylinder

TRIAL MIX	28 DAY COMPRESSIVE STRENGTH(MPA)
TM1	26.77
TM2	25.90
TM3	29.72
TM4	27.26
TM5	26.33
TM6	28.49
TM7	26.30
TM8	25.37



5.5. FLEXURAL STRENGTH OF CONCRETE BEAM

Flexural strength is the one of the measure of the tensile strength. It is measure of the unreinforced concrete slab or beam to resist the failure in the bending. Flexural strength is also called as the modulus of the rupture. Flexural strength of the

concrete is about 10 to 20 percentage of the compressive strength of the concrete depending on the size, type and the volume of the coarse aggregate. The standard test specimen is beam of 150mm×150mm×700mm size. However the largest nominal size of the aggregate is not exceed 20mm.the specimen should be cured for atleast 28 days.

Table -9:flexural strength of concrete Beam

TRIAL MIX	28 DAY COMPRESSIVE STRENGTH(MPA)
TMB	12.037
TM1B	14.98
TM2B	13.428

VI. CONCLUSIONS

In this study it was investigated the practical use of M25 concrete with various ratios of both Crushed Sand and GBS Sand.

1. It was observed that the partial replacement of fine aggregate by GBS sand, crushed sand increases the compressive strength of concrete. Improvement in strength property was slightly with combinations of CS and GBS sand.
2. It was also observed that the compression strength of concrete cube is more than the compressive strength of concrete cylinder.
3. The compressive strength was higher when replacing fine aggregate fully by GBS sand.
4. At 28 days, compressive strengths of the specimens using Crushed Sand aggregates combining more than 50 % of CS were evaluated lower or similar strength properties to that of a control specimens.
5. There was strong relation between compressive strength and both flexural of concrete in this study. Hence, the empirical equation from this study can be used in prediction of splitting tensile strength and flexural strength of industrial waste materials used as replacement of fine aggregate in concrete production.

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