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# EXPERIMENTAL INVESTIGANTION ON DURABILITY PARAMETERS OF CONCRETE USING GGBS AND ROBO SAND

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**Abstract—** Concrete performs a very major role in construction field. This present work is much focused to investigate the strength & durability parameters of the M30 grade kind concrete through replacement of natural sand with that of Robosand & the cement with that of GGBS. Different variations in the percentages such as 10%, 20%, 30%, 40% & 50% of sand by Robosand along with cement by GGBS is done in this experimental study to check compressive strength along with the durability parameters. Few tests conducted for durability are resistance to acid, chloride & the sulphate attack lastly test for sorptivity. Above obtained test results are compared with that of results of the normal concrete.

**Keywords—** Cement, Aggregates, GGBS, Robo Sand, concrete.

## I. INTRODUCTION

Concrete is a construction material formed of coarse aggregate Fine Aggregate, Cement and Water. Concrete is the present word derived from Latin word called “concretus” that means hardened or hard. River sand is the most rapidly utilized Fine total as a part of numerous parts of the world. The colossal interest & requirement for cement have made this characteristic asset to get devastated. Extraction of sand from stream in abundance amount has made prominent natural effects over the last few years, environmental and economical issues related to materials used in construction to fulfill specifications. Robosand is one such latest material being considered for use as an alternative material to Natural River Sand. Now days the major problem causing in the field of construction is nothing but the avail of natural sand that is obtained from river or stream. River sand which is one of the major basic material or ingredients in the preparation of concrete.

which becomes present days a much scarce and expensive due to the corresponding increasing demand in construction field and similar to sand, cement also a very most essential ingredients in the preparation of concrete due to much expensive in the cost related matter and other some of the necessity and requirements related during preparation of concrete cement also focused as an scarce and most expensive ingredient. As we know concrete is considered as very strong and very durable material, presently in the modern generation the concrete composed with reinforce is a most popular material which is using for construction around the world. Traditionally the basic ingredients of concrete which includes such as cement, fine aggregate and coarse aggregate, As we know that cement and coarse aggregate is factory made products and their quality and standards may varies according to type of need and company. Water used generally potable water for preparation of concrete. Sand usually obtained from natural sources such river beds or river banks specially. Now days because of various government rules and regulations it have banned the dragging of sand rivers .Hence due to scarcity and much significant increase in the cost of natural sand. As the idea of bond based cement that meets exceptional execution regarding workability, quality and solidness. To make it up prompts look at the admixture to improve the execution with respect concrete. Furthermore, cost of cement of cement ascribed to its fixings which are rare and lavish as a rule to overcome this whole issue

numerous exploration holders furthermore examiners investigated new option substitutions of elements of cement.

There is much urgent need to resolve for this problem hence long term replacement for sand manufactured which is a better alternative to river sand called as Robosand or at some places it is to be called as M-sand and also as result of the examinations and explores, on the idea bond based cement that meets exceptional execution regarding workability, quality and solidness. To set it up prompts look on the admixture to enhance ethe execution with respect to this concrete. Furthermore, ascribed cost of cement to its fixings which is rare and lavish as rule to overcome from this whole issue numerous exploration of holders furthermore examiners investigated a new option substitution of elements of cement.

Hence this my present project focuses on investigating characteristics of M30 concrete with partial replacement of cement with Ground Granulated Blast furnace Slag (GGBS) & sand with Robosand or M-sand. The cubes and the cylinders are tested for compressive strengths and short term Durability parameters such as resistance against acid attack, sulphate attack, chloride attack and sorptivity test and it may be concluded that replacement of cement and san with GGBS and Robosand have improved the strength and resistance against sulphate, acid and chloride attack of the concrete as compared to normal concrete.

## II. LITERATURE SURVEY

In this chapter includes the detail re-examine of literature based on the use of GGBS and Robosand for concrete as partial replacement to that of cement and sand so as to study its mechanical strength of the concrete. Many number of studies have been carried out so far to identify the mechanical properties of GGBS and Robosand.

**A.** The investigation performed out on **"GGBS Based strength & durability characteristics HPC''** by **R.Vijaya sarathy and G.Dhinakaran(2013).** The research worked performed by them is such that in their research work they have made an attempt as to mull over for strudiness & quality attributes of M60 evaluation concrete through partially replacing sand with the Robosand and GGBS with cement. Their experiments are carried out for different variations such as percentage replacements for sand is done by 40%, 60% and 80% with Robosand and 40%, 50% and 60% cement with the GGBS. Finally they observed the specimens with combination of Robosand and GGBS for 40% gave optimum compressive strength and also resistance against sulphate attack and also acid attack as to this results, they have concluded replacement of Robosand with sand and GGBS with that of cement have improved strength and also resistance to sulphate attack and acid attack of the concrete as compared to that of normal concrete.

**B.** The research work performed on **"Strength Properties of High Performance Concrete Using GGBS and Robosand"** by **M.Vijaya Sekhar Reddy, M.Sehalalitha.** In their research work they prepared a High Performance Concrete (HPC). They focused therir experiment much on the mechanical properties of M60 HPC concrete with the partial replacement of the cement by GGBS & fine aggregate by Robosand (crusher dust) along with usage of superplasticizer in their work. The material utilized by them are as follows Zuari cement which confirms to code were utilized in concrete, aggregate i.e. crushed kind granite rock with a 20mm size is utilized as coarse aggregate, fine aggregate obtained from river sand & fineness of modulus for fine aggregate i.e. 3 for fine aggregate& for coarse aggregate it is about 7.18 with that of specific gravity 2.74 for the coarse aggregate & 2.62 for fine aggregate, and norma portable water i.e. tap water was used for mixing & as well as to curing of concrete, GGBS from known industries. Double Sampling Scheme.

**C.** Present paper focused on **"Robosand as replacement material of fine aggregate in normal concrete''** by **Rachana MN & E.Ramesh babu(2014)**. In accordance to their research they have investigated maximum replacement of river sand by the Robosand in varying percentages of 0%, 25%, 50%, 75% & 100% for the M30 & M40 mix designations. They prepared cubes, cylinders & then prisms for each proportion & conducted test for the obtaining compressive strength of concrete and they focused lot on mechanical parameters of the GGBS with replacement of cement usage as used. They have only replaced Robosand with normal sand. They have used proportion for M30, 0%, 25%, 50%, 75% & 100% replacements and for the M40, 0%, 25%, 50%, 75% & 100% replacements of Robosand along with normal sand, after the casting & curing of concrete is done the tests are carried out with each concrete specimen from tests results they concluded as follows.

- Robosand as itself qualifies as river sand to substitution & also with a affordable cost.
- It has been observed that for an economical construction about 100% of Robosand may be adopted for purpose of flexural strength.

**D.** A paper entitiled on **"Experimental analysis to improve strength & durability of cement concrete with GGBS''** by **Kumar Shankar Guruvu, Mk Mv Ratnam, Dr. U RangaRaju**. In their experiment they gave much more importance for improvement of strength and to the durability of the concrete by using various materials such as Flyash, GGBS, silica fume and they also performed chemical analysis on the various addictive concrete with the time period of about 20days and with this they got improvement in strength, durability and also cost reduction concept.

From the results obtained they concluded that

1. As the substitution rate is expanded from 0 to 65% quality is obseved to Increment up to the upgraded worth.
2. Acid utilization will be lessened as the quantity of days of inundation expanded.
3. The GGBS blocks wil provide less weight reduction as contrasted with plain concrete cement blocks in the both 2% and 5% H2SO4.
4. GGBS blocks have been experienced less quality misfortune when contrasted with the plain concrete cement solid shapes in the both 2% and 5% H2SO4.

## III. THE PROPOSED METHOD

The M30 mix propotioning is designed as per guidlines, according to the Indian Standard Recomendad Method IS Codes. procedures used for conducting test in detailed can be shown as follows through various tests conducts such as on slump test (workability), compressive strength and such various tests as on the durability characteristics of the concrete, which is been considered for investigation as per given codes of the practice.

**MIX PROPORTION:**

Grade of Designation = M30.
cement taken = 53 grade OPC.
Admixture being added = conplast SP-430(super plastcizer).
Sp. Gravity of Cement as obtained = 3.10.
Sp. Gravity of FA as taken= 2.62.
Sp. Gravity of CA taken (20mm) = 2.72.
Sp. Gravity of CA taken(10mm) = 2.70.
Minimum Cement utilized (As per IS456:2000) = 300 kg/m3.
Maximum w/c ratio taken (Based on experience) = 0.45.
Exposure condition = Moderate (it's for reinforcing concrete).
Degree of supervision as observed = Good**.**

Maximum cement content may be = 450 kg/m3**.**
Max nominal size of the coarse aggregates is = 20 mm.

The durability characteristics that are tested for different grades of concrete which are for grades M30 at the different partial replacement levels of about (10%, 20%, 30%, 40% and 50%) of Sand by Robosand and the cement by GGBS are as follows. Cubes which have sizes of about 150X150X150mm were casted using the mixes. These specimens will be tested according to as per the code of IS 516 and IS 1199

- Test on Compressive strength
- Durability Test

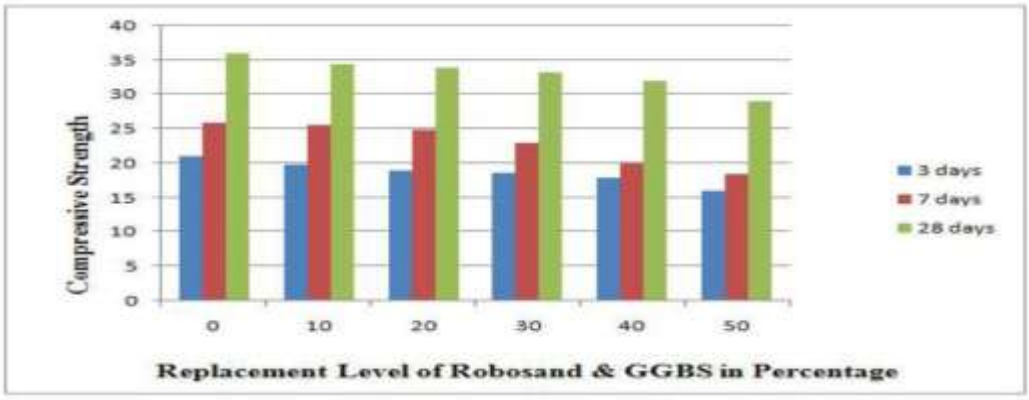
1. Acid immersion Test
2. Sulphate immersion Test
3. Chloride immersion Test

## IV. TEST RESULTS AND DISCUSSIONS

Results of Compressive strength of concrete specimen and various tests based on their Durability characteristics of Concrete specimen are as below

### 4.1.Compressive strength

The Compressive Strength at different levels of replacement of sand by Robosand and cement by GGBS for Concrete is shown in fig below

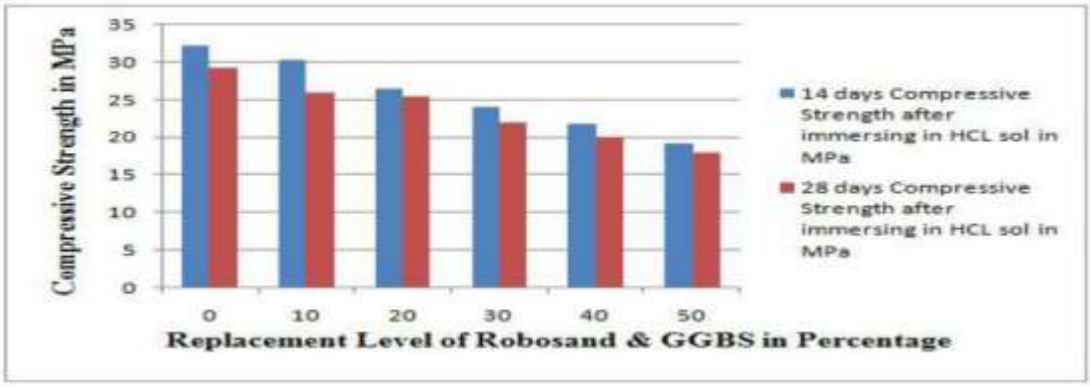



### 4.2.Durability Test

The various tests conducted on durability are as below

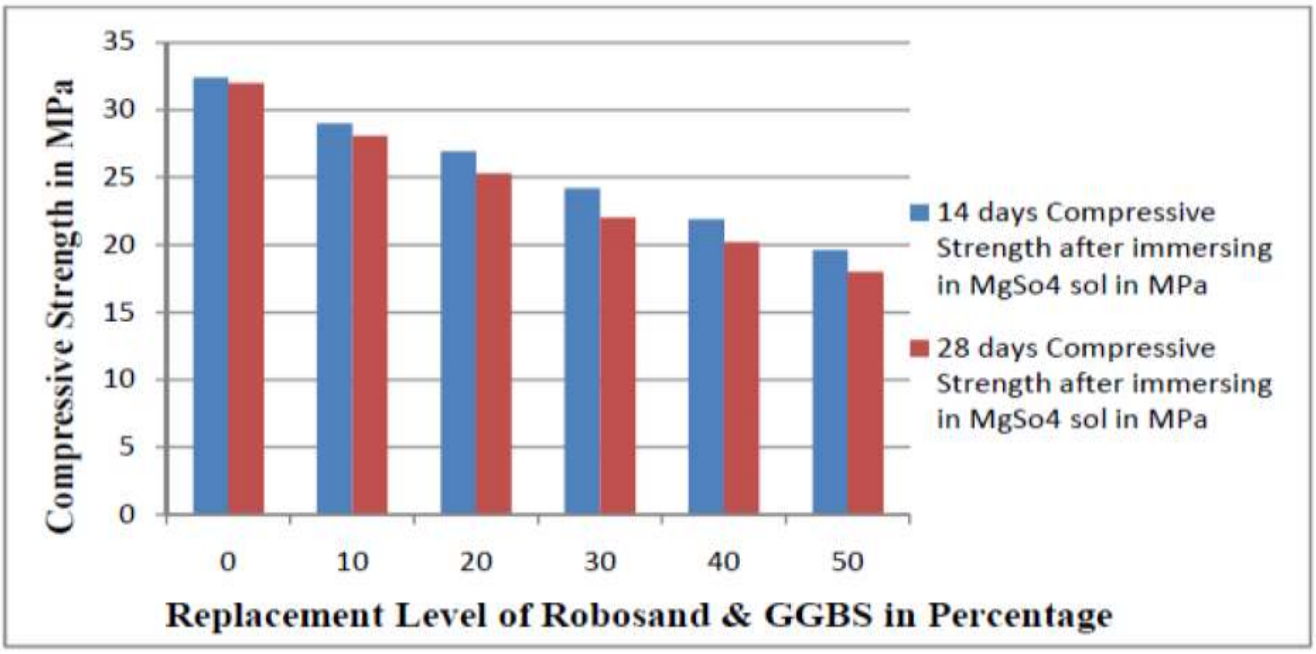
#### 4.2.1.Acid immersion Test

Concrete specimens compressive strength after immersing for 14 & 28 days in HCL solution for different percentage variation replacement of GGBS & Robosand.



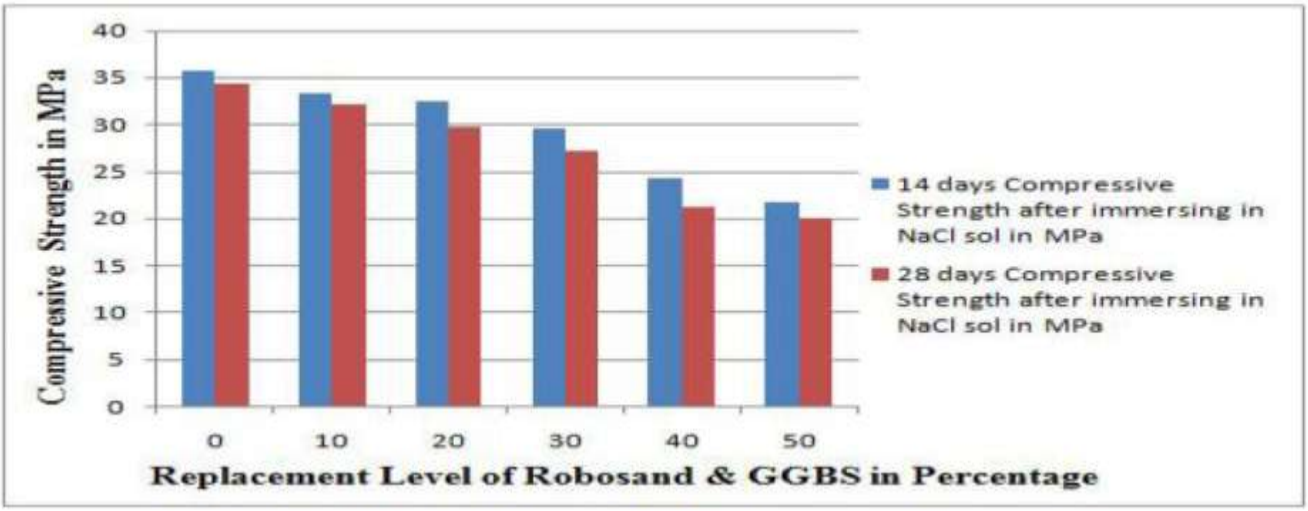
### 4.2.2.Sulphate immersion Test

Concrete specimens compressive strength after immersing for about 14 & 28 days in MgSo4 solution.




### 4.2.3.Chloride immersion Test

Concrete specimens compressive strength after immersing for about 14 & 28 days in NaCl solution for different percentage variation replacement of GGBS & Robosand.




## V. CONCLUSIONS

Based on work as above carried on concrete with the Cementitious Content of about 375 kg/m3 at the replacement levels of (0, 10, 20, 30, 40 and 50) % of Sand By Robosand and cement by the GGBS.

i. Through this investigation results it states that Robosand and GGBS can be used the substitute material to river sand and cement.
ii. The compressive strength will be decreased with that increase in the replacement level of Robosand and the GGBS during the test conducted for this study.
iii. At the level of 30% replacement of sand by Robosand and cement by GGBS the compressive strength is slightly less than that of Normal Concrete which is optimum replacement percentage.
iv. The cubes undergone have less weight loss and less loss in strength compared to normal concrete when these are immersed in chemical solution such as H2SO4, MgSo4 and the salt solution.
v. Results obtained showed very good performance to the durable characteristics for optimum replacement percentages as when compared to normal concrete.
vi. Resistance to acid attack and sulphate attack is shown better by the composite concrete.

## VI. ACKNOWLEDGEMENTS

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