Indian J.Sci.Res. 20(2): 122-125, 2018 ISSN: 0976-2876 (Print)
ISSN: 2250-0138(Online)

EFFECT OF SALT WATER BY PARTIAL REPLACEMENT OF GGBS, RHA AND M-SAND IN CONCRETE

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ABSTRACT

Concrete is a mixture of cement, fine aggregate, coarse aggregate and water. Globally concrete is the backbone for the development of infrastructure viz., buildings, industrial structures, bridges and highways etc., leading to utilization of large quantities of concrete. In today's situation concrete needs special performance and uniformity requirements that cannot be always achieved by using conventional constituents and normal mixing. This leads to search for admixtures to improve the performance of the concrete. The construction industry is constantly looking for supplementary of cementitious material with the objective of reducing the solid waste disposal problem. The GGBS, RHA and QS are among the Solid Wastes generated by industry. So we planned to overcome from these problems by Partial replacement of cement with GGBS & RHA and NS with QS is economic alternative. In this research we have to made concrete specimen by using fresh water and salt water for a mix design as per IS 10262 – 1982. We are going to replace 20%, 40% & 60% of GGBS, QS and 2%, 4% & 6% of RHA in three different experiment to find out the maximum strength and compare it with the strength of normal concrete by using the grade of M30 at the ages of 7, 14 and 28days. The results are found to be increasing with the increase in the percentage of GGBS, RHA & QS and it is concluded that the GGBS, RHA & QS can be partially utilized in concrete.

KEYWORDS: Salt water, GGBs, RHA, M-Sand, Mechanical Properties

Today's construction industry, use of concrete is going on increasing rapidly. Cement is major constituent material of the concrete which produced by natural raw material like lime and silica. Once situation may occurs there will be no lime and silica on earth for production of cement. This situation leads to think all people working in construction industry to do research work on cement replacing material and use of it. Industrial wastes like Ground Granulated Blast Furnace Slag (GGBS) and Rice Husk Ash (RHA) show physical and chemical properties are similar to cement. Use of GGBS & RHA as cement replacement will simultaneously reduce cost of concrete and help to reduce rate of cement consumption. The quantity of the water plays an important role in the preparation of concrete. Impurities in water may interfere the setting of the cement and may adversely affect the strength properties. The chemical constituents present in water may participate in the chemical reactions and thus affect the setting, hardening and strength development of mixture. The IS 456 - 2000 code stipulates the water quality standards for mixing and curing. In some arid areas, local drinking water is impure and may contain an excessive amount of salts due to contamination by industrial wastes. When chloride does not exceed 500 ppm, or SO3 does not exceed 1000 PPM, the water is harmless, but water with even higher salt contents has been used satisfactorily. In the present investigation the effects of salt water on compressive strength of concrete are determined. M30 grade of concrete is used to determining the effect of salt water.

OBJECTIVES

- To find out the optimum percentage of partial replacement level of alternative materials at which maximum strength is obtained.
- To use of pozzolanic material such as GGBS and RHA in concrete by partial replacement of cement.
- To increase the corrosion resistance of the concrete by replace of GGBS and RHA
- To reduce the self-weight of concrete by replace of RHA
- To improve the ground water level by using salt water.

SCOPE

- To provide economical construction material.
- Provide safeguard to the environment by utilizing waste property.

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- To provide Eco - friendly structure.
- To provide Superior appearance

METHODOLOGY

Literature collections

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Procurement of materials

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Testing of Materials

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Arriving mix proportions

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Casting specimens

↓

Curing of specimens

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Testing of specimens

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Results and Discussion

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Conclusion

Figure 1: Flow chart of methodology

RESULTS AND DISCUSSION

Slump Test

The apparatus for conducting the slump test essentially consists of a frustum of a cone having the bottom diameter of 20 cm, top diameter of 10 cm and height of 30 cm. For slump test, tamping rod of steel 16 mm in diameter, 0.6 m long and rounded at one end is used for compaction. The internal surface of the slump cone shall be thoroughly cleaned and should be free from any set concrete before commencing the test. The mould should be placed on smooth horizontal, rigid and non – absorbent surface such as carefully leveled metal plate. The mould should be filled in 4 layers each approximately one quarter of the height of mould. Each layer shall be tamped with 25 blows. For the 2nd and subsequent layers tamping rod should penetrate into underlying layer. The bottom layer should be tamped throughout its depth. After the top layer has been rodded the concrete shall be struck off level with trowel or rod. The mould shall be removed from concrete immediately by raising it slowly and carefully in vertical direction. This will allow the concrete to subside and the slump shall be measured immediately by determining the difference between height of mould and that of highest point of slumped concrete specimen.

Sample details	W/C ratio	True Slump Value (mm)
Conventional	**0.375**	**30**
Alternative		
Sample 1	0.150	10
Sample 2	0.200	20
Sample 3	0.250	30

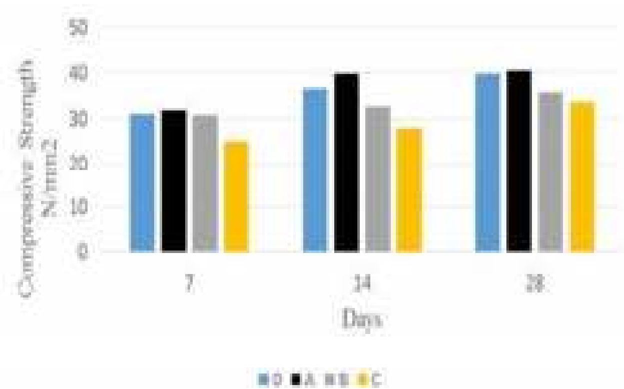
Compaction Factor Test

BS 1881 stated that compacting factor test as one of the test to determine the workability of the concrete. This test is usually being carried out in the lab and in specific condition i.e. construction site. It was a sensitive and more accurate test compared to the slump test and suitable for low workability of concrete mixture. Nevertheless the accuracy of the result will be reduced with the increased of the aggregate size (size exceed 20mm). The sample of concrete is placed in the upper hopper up to the brim in. The trap-door is opened so that the concrete falls into the lower hopper. The trap-door of the lower hopper is opened and the concrete is allowed to fall into the cylinder. The excess concrete remaining above the top level of the cylinder is then cut off with the help of plane blades. The concrete in the cylinder is weighed. This is known as weight of partially compacted concrete. The cylinder is filled with a fresh sample of concrete and vibrated to obtain full compaction. The concrete in the cylinder is weighed again. This weight is known as the weight of fully compacted concrete. It should normally be stated to the nearest second decimal place.

Cube Compressive Strength

For the compression strength test of concrete 100 x 100 mm cubes are used and its tested as per BIS: 516-1959. For each trail mix combination, three cubes were tested at the age of 3, 7, 28, 56 and 90 days of curing using 3000KN capacity AIMIL compression testing machine the specimens shall be tested with the moulded sides in contact with the plates. The load shall be applied without shock and increased continuously at a rate of approximately 140 kg/sq cm/min until the resistance of the specimen to the increasing load breaks down and no greater load can be sustained. The compressive strength is determined by following formula:

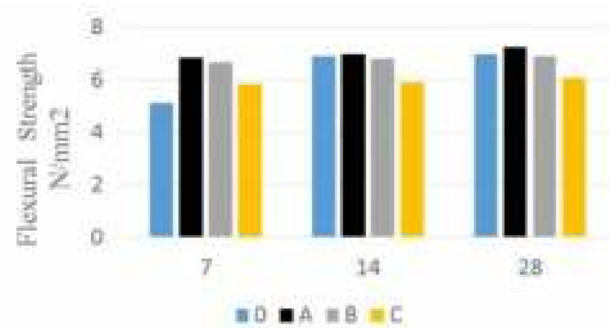
$$Fck = \frac{\text{ultimate load}}{\text{area of specimen}}$$



Flexural Strength Test

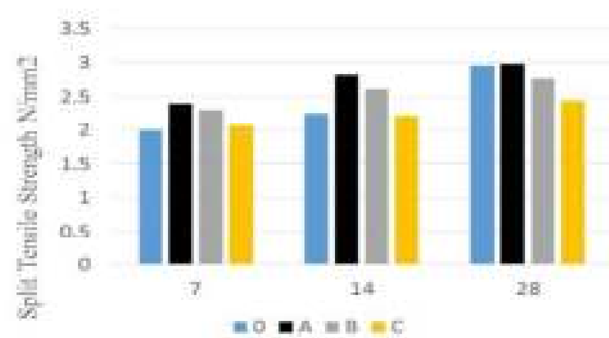
The Flexural strength of concrete is determined as per BIS: 516-1959 at the age of 28 days using 100 x 100 x 500 mm prisms. For each trail mix three prisms were tested to determine the flexural strength of concrete. The bearing surfaces of the supporting and loading rollers shall be wiped clean, and any loose sand or other material removed from the surfaces of the specimen where they are to make contact with the rollers. The specimen shall then be placed in the machine in such a manner that the load shall be applied to the uppermost surface as cast in the mould, along two lines spaced 20.0 or 13.3 cm apart in Figure 5.8. The axis of the specimen shall be carefully aligned with the axis of the loading device. No packing shall be used between the bearing surfaces of the specimen and the rollers. The load shall be applied without shock and increasing continuously at a rate such that the extreme fibre stress increases at approximately 7 kg/sq cm/min, that is, at a rate of loading of 400 kg/min for the 15.0 cm specimens and at a rate of 180 kg/min for the 10.0 cm specimens. The load shall be increased until the specimen fails, and the maximum load applied to the specimen during the test shall be recorded. The appearance of the fractured faces of concrete and any unusual features in the type of failure shall be noted. The flexural strength of the specimen shall be expressed as the modulus of rupture fb, which, if 'a' equals the distance between the line of fracture and the nearer support, measured on the centre line of the tensile side of the specimen, in cm, shall be calculated to the nearest 0.5 kg/sq cm as follows:

$$F_b = \frac{PL}{BD{\wedge}2}$$



Split Tensile Strength

The tensile strength of concrete is one of the basic and important properties. Splitting tensile strength test on concrete cylinder is a method to find out the tensile strength of concrete. By using the universal testing machine (UTM). The size of the specimen is 150mm diameter and 300mm height.



CONCLUSION

From the test results, it is observed that 20% replacement level of cement with GGBS, 2% replacement level of cement with RHA and 20% replacement level of natural sand with Quarry sand gives more strength as conventional concrete. So, it is concluded that optimum replacement level of cement with GGBS as 20%, cement with RHA as 2% and natural sand with Quarry sand as 20%.

Since, this project initiative will give solution to solid waste disposal and also reduces the cement & natural sand exploitation. Hence this attempt towards eco-friendly built environment simultaneously to provide economical construction material are need of hour.

Application:

- To applicable for marine, irrigation construction & underground construction.

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