

A Study on the Workability and Compressive Strength of Concrete Produced Using All-in Aggregate

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Abstract

Concrete being a versatile and vital construction material widely used for its strength, durability, and adaptability. Reported use of all in aggregate found in Ebute near Oja Odan in Ogun State, Nigeria necessitated the study aimed at evaluating the workability and strength of concrete produced from it. The gradation of the material was determined and compressive strength of concrete cubes made with the material was determined. The result of the compressive strength of 9.33MPa and 10.02MPa is below the required strength of 20MPa for normal concrete.

Introduction

The nature and quality of aggregates used in concrete production significantly affects its performance, as properties such as particle size distribution and density of aggregates impact the concrete's structural integrity. Conventional concrete uses a mixture of fine and coarse aggregate from different sources. The use of all-in-one aggregates for concrete production is an evolving development in the construction industry in search of innovative and sustainable use of materials. It consists of coarse and finer particles in varying sizes obtained from a single source. This study attempts to investigate the effect of its use on some properties of concrete made using it.

Materials and Methods

The study evaluates the workability and compressive strength of concrete produced using all-in-aggregate sourced from Ebute, near Oja-Odan, Ogun State, Nigeria. Other constituent materials used are grade 42.5 portland cement procured from a retail shop in Ilaro and water obtained from the laboratory of Civil Engineering Department, The Federal Polytechnic, Ilaro. Sieve analysis was carried out on the all-in-one aggregate to determine its gradation. Its Specific gravity was also determined before using it to prepare the concrete. Mix ratios of 1:6 and 1:9 (cement to aggregate), and 0.55 water-to-cement ratio were employed for the concrete. For both mixes, slump tests were conducted. Thereafter fifteen concrete cubes were cast for each mix ratio. The concrete cubes were cured and subjected to compression tests to determine the compressive strengths at 7, 14, 21, and 28 days.

Results and Discussions

Results from the sieve analysis indicate an acceptable particle size distribution with only about 1.35% of the material larger than 10mm and a Fineness Modulus of 6.31. The Specific gravity of the material is 2.8 which is within the same range as commonly used aggregates and very much in line with recommended values in the British Standard. The slump test results however point at relatively low workability, with an average height of 5mm for both mixes. As for the Compressive strength tests results, the 1:6 mix has a higher strength of 10.02MPa at 28 days compared to 9.33MPa obtained for the 1:9 mix. The compressive strength of both mix ratios are less than the 20MPa specified for normal concrete.

Conclusions

The study concludes that though the 1:6 mix is stronger, both mixes are viable for light weight concrete production, and that the all-in aggregate has a desirable specific gravity, with its particles graded well enough for producing concrete.

Keywords: Workability, Compressive Strength, Concrete, All-in Aggregate