



A COMPARATIVE STUDY OF THE PHYSICAL AND MECHANICAL PROPERTIES OF COARSE AGGREGATES PRODUCED IN OGUN STATE

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ABSTRACT

This study investigates the compliance of the physical and mechanical properties of granites produced in some parts of Ogun State to relevant codes and standards. The desire to carry out the study was borne by personal on – site experience that single size aggregates produced in some parts of Ogun State do not conform to grading requirements specified in relevant codes and standards. Samples of 9.5mm, 12.5mm, 19mm and 25mm aggregates were collected from four different quarry sites spread across the state. The Samples were tested for their Specific Gravities, Water Absorptions, Moisture Contents, Aggregates Impact Value and Aggregates Crushing Value in accordance to the relevant standards. Test results reveals that all the samples conform to relevant codes and standards. It was therefore concluded that although the aggregates do not conform to grading specification but the physical and mechanical properties of all the aggregates meet the specifications in relevant codes and standards.

Keywords: Evaluation, Physical, Mechanical, Properties, Aggregates and Standards

1. INTRODUCTION

According to [1] aggregates are important constituents containing about 70-80 percent of the volume of concrete. It gives body and strength to the concrete, affects economy and undoubtedly has considerable impact on the properties of concrete. It is therefore very essential to know more about the aggregates which constitutes major volume in concrete so as to know more about concrete and its properties. While in their own opinion, [2] stated that aggregates take about three-quarter of the volume of concrete with the coarse aggregates taking between 50 and 60% of the concrete mix depending on the mix proportion used. This assertion was supported by [3] when it was stated by them that concrete's fresh and hardened state properties, mix proportions, and economy is strongly influenced by the properties of aggregates.

In [4] it was stated that the types, quality and general properties of aggregates determine the quality of concrete because concrete is made up of about seventy five percent of aggregates. While [1] opined that the properties of aggregates like toughness, hardness, shape, size, soundness, density, and specific gravity affect the strength of concrete. Credence was lent to this by [6] when it was stated that the role of coarse

aggregates in the development of strength in concrete is revealed in the high variation in strength between concrete and mortar of the same cement/aggregate proportion. In their own statement, [7] stated that the quality of the concrete is to a great extent determined by the quality of the coarse aggregates and therefore the compressive aggregate strength is an important factor in the selection of aggregate when considering the proportioning of constituent materials of concrete. Aside from these, [8] as well as [9], opined that aggregate moisture content plays a part in concrete workability because if aggregates are too dry, they will absorb (steal) water from the mix. If aggregates are too wet, the excess moisture must be subtracted from the intended mix water quantity. Some properties of aggregates were highlighted to include bond, strength, toughness and hardness [10]. According to [10], the compressive strength of concrete cannot significantly exceed the strength of the major part of the aggregate contained therein which can be determined from the crushing strength of aggregate itself prescribed by [11]. According to [12], maximum economy was achieved when aggregates are used and its use considerably improves the volume, stability and durability of the resulting concrete

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is the highest while that from Papa Adeosun has the least value of 2.68.

3.2 Moisture Content

As can be seen in Figure 2, the moisture content for the different sizes of aggregates varies from one quarry site to another. While for 9.5mm aggregates, the aggregate from Omologede quarry site has the highest and that from Ago - Iwoye has the lowest. In the case of 12.5mm and 19mm aggregates, aggregates from Ago - Iwoye quarry site has the highest and that from Ishara has the lowest. For 25mm aggregates, aggregate from Papa Adeosun quarry site has the highest and that from Ago - Iwoye has the lowest. It can also be observed that the moisture content decreases as the aggregate size reduces for all the quarry sites except for that of Ago Iwoye where that of 12.5mm is higher than that of 9.5mm. However, the values of moisture content for all the coarse aggregate falls within the limits stipulated in previous literatures. In [18] it was stated that the moisture content can range from less than one percent in gravel to up to 40 percent in very porous sandstone and expanded shale. The moisture content of all the aggregates obtained from the various quarry sites fall below the recommended value of 3% as specified in [17].

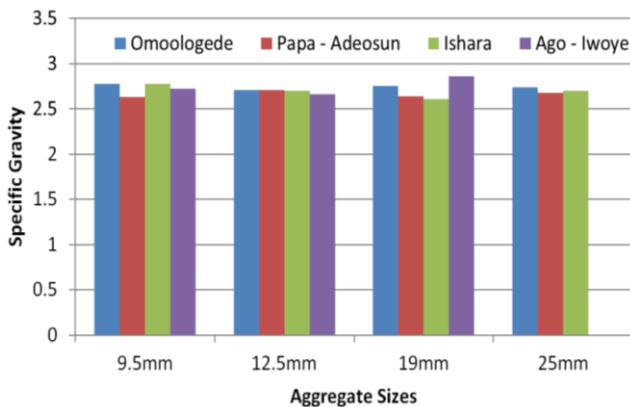


Figure 2: Values of Specific Gravity of different Aggregate Sizes from Various Quarry Sites

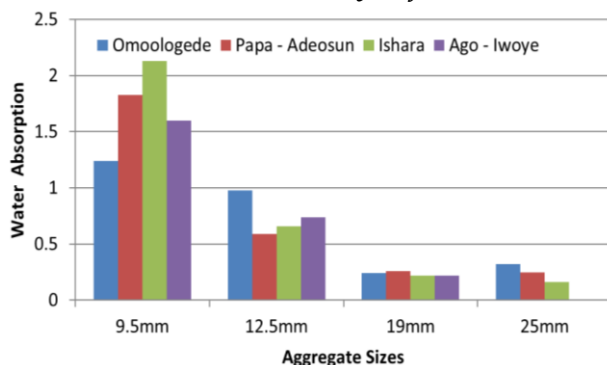


Figure 4: Values of Water Absorption of Different Aggregate Sizes from Various Quarry Sites

3.3 Water Absorption

The values indicated in figure 3 indicates that the water absorption of all the different sizes of aggregates for all quarry sites are within the limits of 1% - 3% stated in literature and British Standards [11, 18 - 21]. It therefore follows that all the aggregates tested have very low water absorption values and hence are very suitable for concreting works. Comparatively, the aggregate from Ishara quarry site has the highest water absorption value and that from Omologede has the lowest value for 9.5mm aggregate sizes. In the case of 12.5mm aggregates, that from Ago - Iwoye quarry site has the highest and that from Ishara has the lowest. For 25mm aggregates, aggregate from Papa Adeosun quarry site has the highest and that from Ago - Iwoye has the lowest.

3.4 Aggregate Impact Value and Aggregate Crushing Value

Values from figure 4 indicates that the Aggregates Impact Value of all the different sizes of aggregates for all quarry sites are lesser than 30% value stated in literature and British Standards [6, 11] and specified in [10].

It therefore follows that Aggregates Impact Value of all the aggregates tested are very suitable for concreting works.

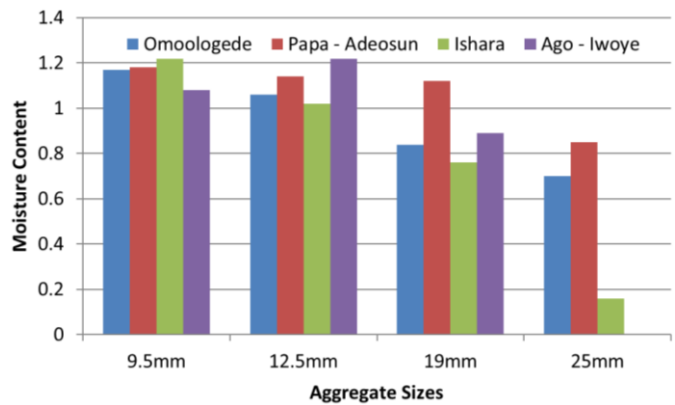


Figure 3: Values of Moisture Content of different Aggregate Sizes from Various Quarry Sites

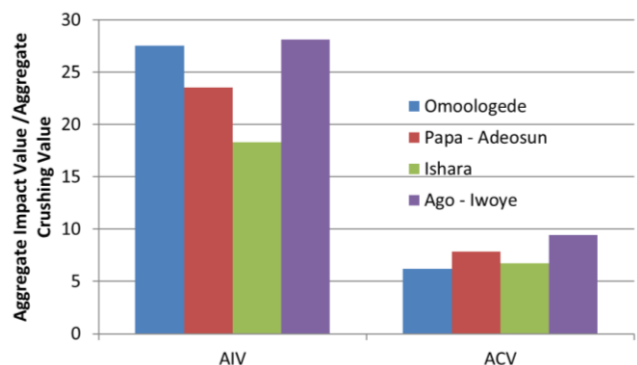


Figure 5: Aggregate Impact and Aggregate Crushing ValueS of different Aggregate Sizes from Various Quarry Sites

As for the Aggregate Crushing Value, all the different sizes of aggregates for all quarry sites has values that are lesser than 35% value allowed for concreting works as stated in literature [11]. The average value of the Aggregate Crushing Value for the coarse aggregates samples considered in this research is between 6.2% and 9.45%. This is considerably lower than stated values in literature therefore, it can be said that the aggregates has a considerable lower value and is therefore very suitable for concreting work. By way of comparison, aggregate from Ago Iwoye has the highest values of 28.12% and 9.45% for impact and crushing values respectively. While aggregate from Ishara has the least value of 18.12% for impact value and that from Omoologede has the least crushing value of 6.21%.

4. CONCLUSION

It can be concluded from the results obtained that there are variations in both the physical and mechanical properties of aggregates varies considerably from location to location. It was also concluded that there are variations between the various sizes of aggregates at each quarry site also varies

5. RECOMMENDATIONS

It is therefore recommended that since the physical and mechanical properties are in conformity with relevant codes and standards, they are suitable for use in concrete work. However for optimum characteristic strength, the various sizes should be combined in appropriate proportions to conform to grading requirements in *relevant codes and standards*.

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