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CHARACTERIZATION OF AGGREGATE SHAPE PROPERTIES USING A COMPUTER AUTOMATED SYSTEM

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Shape, texture, and angularity are among the properties of aggregates that have a significant effect on the performance of hot-mix asphalt, hydraulic cement concrete, and unbound base and subbase layers. Consequently, there is a need to develop methods that can quantify aggregate shape properties rapidly and accurately. In this study, an improved version of the Aggregate Imaging System (AIMS) was developed to measure the shape characteristics of both fine and coarse aggregates. Improvements were made in the design of the hardware and software components of AIMS to enhance its operational characteristics, reduce human errors, and enhance the automation of test procedure. AIMS was compared against other test methods that have been used for measuring aggregate shape characteristics. The comparison was conducted based on statistical analysis of the accuracy, repeatability, reproducibility, cost, and operational characteristics (e.g. ease of use and interpretation of the results) of these tests. Aggregates that represent a wide range of geographic locations, rock type, and shape characteristics were used in this evaluation.The comparative analysis among the different test methods was conducted using the Analytical Hierarchy Process (AHP). AHP is a process of developing a numerical score to rank test methods based on how each method meets certain criteria of desirable characteristics. The outcomes of the AHP analysis clearly demonstrated the advantages of AIMS over other test methods as a unified system for measuring the shape characteristics of both fine and coarse aggregates. A new aggregate classification methodology based on the distribution of their shape characteristics was developed in this study. This methodology offers several advantages over current methods used in practice. It is based on the distribution of shape characteristics rather than average indices of these characteristics. The coarse aggregate form is determined based on three-dimensional analysis of particles. The fundamental gradient and wavelet methods are used to quantify angularity and surface texture, respectively. The classification methodology can be used for the development of aggregate shape specifications.