Aggregate Image Measurement System (AIMS2)

Highways for LIFE Technology Partnerships 2009 Award $200,000

U.S. Department of Transportation
Federal Highway Administration
HIGHWAYS FOR LIFE
Accelerating Innovation for the American Driving Experience.

Project Status

The ruggedness testing and Inter-Laboratory Study resulted in procedures and specifications for aggregate shape characterizations using digital imagery. Two AASHTO provisional specifications have been adopted as a result of this work:

TP81 - Standard Method of Test for Determining Aggregate Shape Properties by Means of Digital Image Analysis and *PP64 - Standard Practice for Determining Aggregate Source Shape Values from Digital Image Analysis Shape Properties.* These standard procedures position the platform to standardize the aggregate testing procedure utilizing the imaging technology. The final report and a video is available at www.fhwa.dot.gov/hfl/partnerships/aims.cfm
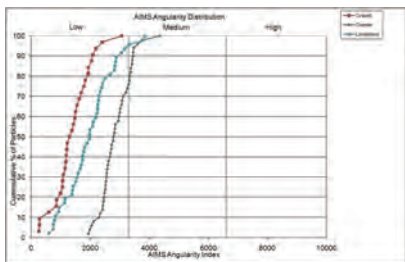
Angularity

The AIMS2 angularity chart provides objective characterization of the material edge characteristics. AIMS2 angularity characterizes the particle edge sharpness characteristics on a scale of 0-10000. The sample chart above reveals the angularity distribution characteristics of river gravel.
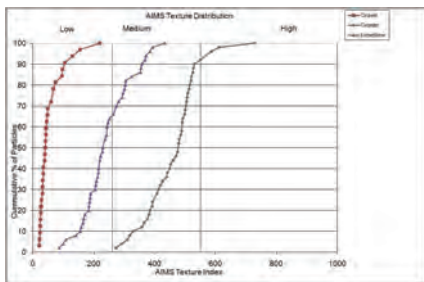

Micro-Texture

The AIMS2 also characterizes surface texture on a scale of 0-1000. The sample texture chart above reveals the smoother texture of a river gravel surface as compared to that of a limestone and crushed granite material.

Need for Innovation

The characteristics of aggregates used in hot-mix asphalt, hydraulic cement concrete, and aggregate pavement layers affect the structural integrity and durability of pavement systems and the skid resistance of pavement surfaces. Those characteristics include shape, (such as round or flat); angularity, (the sharpness of the corners of the aggregate particles); and texture, (the smoothness or roughness of the particle surface). Manual methods now used to measure aggregate characteristics can produce inconsistencies in measurement, quality assurance, and mix design.

Project Overview

Pine Instrument Company refined and developed the Aggregate Image Measurement System (AIMS2) to analyze aggregate properties using digital imaging technology. The AIMS2 combines hardware that captures real-time digital images of paving material samples and the proprietary software that analyzes aggregate characteristics that affect pavement quality and improves the speed and accuracy of testing. In the Inter-Laboratory study, 32 university, commercial, and highway agency laboratories evaluated the reproducibility of the AIMS2 equipment and procedures.
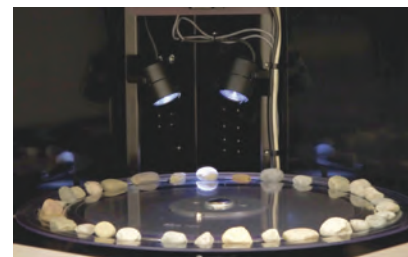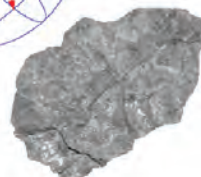

AIMS2 is an integrated hardware/software system that automates the process of measuring the particle angularity, form, and surface texture. The AIMS2 image-based analysis removes operator influence from the characterization while improving productivity and precision.
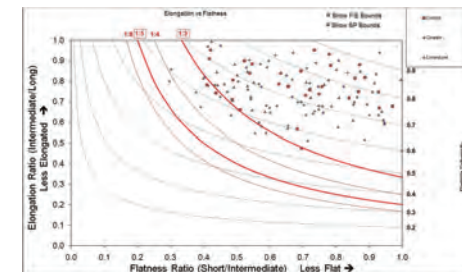
Angularity

Form

The AIMS2 is capable of performing three tests on an aggregate sample size.

Texture

Contact Information

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Particle Shape
(Flat and Elongated)

Existing manual methods for "flat and elongated" analysis can be tedious, labor intensive, and groups particles to a specific range. The AIMS2 captures coarse particle 3D shape data and presents the information in multiple formats.
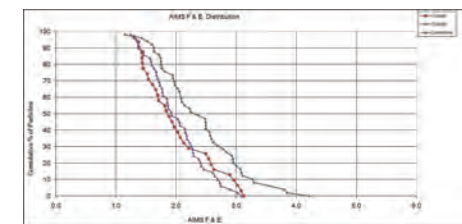
Aggregate Degradation / Skid Resistance

Research has shown a strong relationship of pavement skid resistance to aggregate texture. The AIMS2 can be used to characterize the rate of change of aggregate texture in degradation tests, such as the Micro-Deval. These results can then be used to model frictional characteristics of pavements during the mix design process. The AIMS2 system has also been used to characterize pavement core sample surface characteristics, which relate to in-place pavement frictional properties. These characterizations extend the capabilities of the AIMS2 system beyond aggregate shape analysis into pavement friction applications.

Project Team

Pine Instrument Company
Texas A & M University
32 laboratories