Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

5-6921-01: Implementation of Laser Scanning System for Classification of Aggregate Texture

Background

The lack of pavement friction causes vehicles to skid and run off the road (ROR). In 2016, single-vehicle ROR crashes resulted in 1,293 deaths on Texas highways. The Texas Department of Transportation (TxDOT) Highway Safety Improvement Program evaluated the cost of one roadway fatality or one incapacitating injury at approximately $3.3 million. If building better skid-resistant pavement surfaces could reduce fatalities by 1 percent, the potential annual reduction in societal cost, given the number of ROR fatalities in 2016, would be significant.

With the goal of improving the measurement of aggregate characteristics and classification, this project undertook the initial implementation of the laser-based system that was developed under TxDOT Project 0-6921 to measure aggregate properties. This laser-based system was adapted to scan ring-shaped specimens specifically prepared to evaluate friction characteristics via the dynamic friction tester (DFT) as part of the Aggregate Quality Monitoring Program. Individual aggregate particles in original state or before micro-Deval (BMD) and after micro-Deval (AMD) abrasion were used to prepare the ring-shaped specimens.

What the Researchers Did

Researchers performed the following to implement the laser scanning system:

- Modified the laser system to scan the surface of ring-shaped specimens prepared with a polyester material in which aggregates before and after micro-Deval abrasion were embedded. Modifications included the hardware and software components of the Aggregate Ring Texturing System (ARTS).
- Prepared the ring-shaped specimens using aggregates from five sources and performed the scans with the ARTS and the DFT system. These activities were performed by TxDOT's Geotechnical, Soils, and Aggregates Branch following the cooperative work plan established for this implementation project.
- Analyzed and summarized the micro-texture (μMPD) and friction data collected with the ARTS and DFT system, respectively, and evaluated the relationship between μMPD and friction.

What They Found

Researchers identified improvements to the ring-shaped specimen preparation, including the distribution of the aggregates, the mold geometry, and the material used to bind the aggregates.

A relationship between DFT friction at 60 km/h (DFT_{60}) and μMPD was developed (Figure 1), which allowed predicting DFT_{60} values based on μMPD measurements, and ranking the various aggregate sources based on these characteristics.

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Based on both predicted and measured friction, researchers concluded:

- The mean DFT_{60} from BMD tests on igneous aggregates was significantly higher than the corresponding value for each of the other aggregate types.
- The mean DFT_{60} values from BMD and AMD tests on dolomite and limestone aggregates were not significantly different.
- The mean DFT_{60} values from AMD tests on dolomite and limestone aggregates were significantly less than the corresponding values for igneous and gravel aggregates.

What This Means

Project 5-6921-01 implemented a laser-based system for laboratory measurement of aggregate μMPD and related the results to friction characteristics of the same specimens. The aggregates were ranked based on their performance, which is a step forward to improving the current TxDOT surface aggregate classification (SAC) system.

To refine TxDOT's SAC system, researchers recommend further compilation of a database of aggregate friction and texture properties and correlation of the results with the skid resistance of mixtures placed on Texas highways.

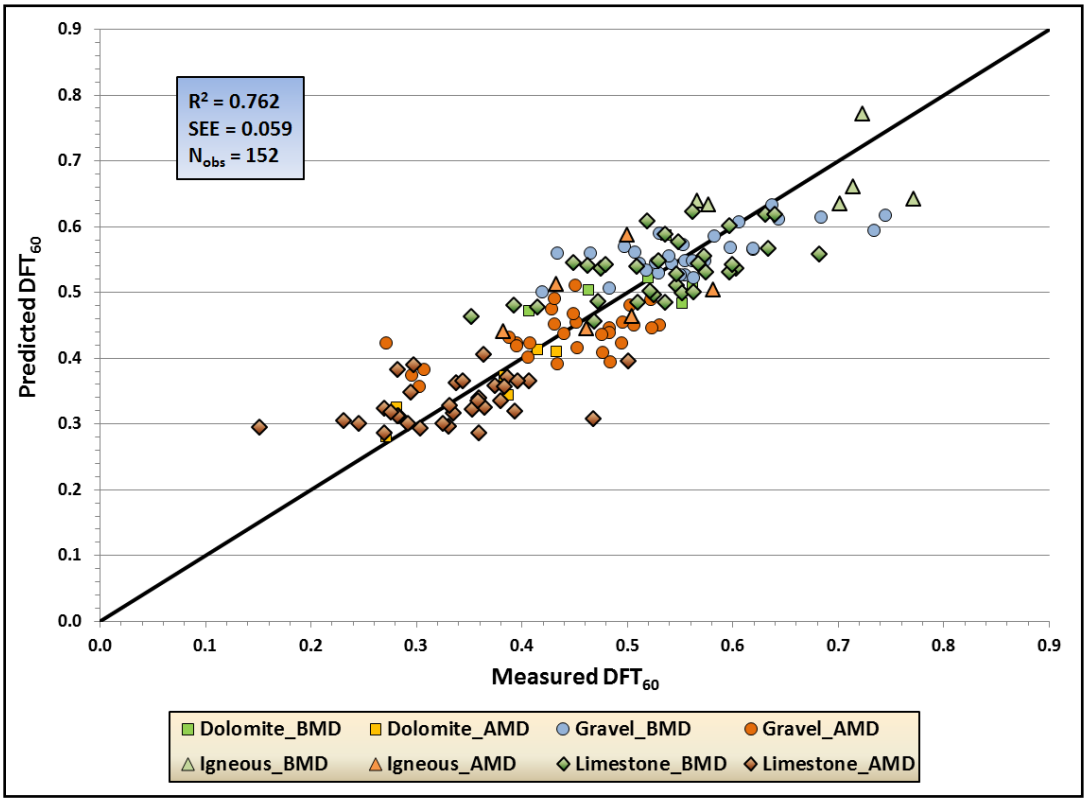

Figure 1. Comparison of Predicted versus Measured DFT_{60}.

For More Information

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