Kansas Department of Transportation

TECHNICAL SUMMARY

Real Time Laser Scanning of Aggregate Materials in Highway Construction

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A Transportation Pooled Fund Study - TPF-5(278)

Introduction

The quality and service life of the roadways that make up the highway transportation infrastructure are dependent upon the selection and use of high quality aggregate materials. Five state transportation agencies participated in this Transportation Pooled Fund (TPF) study, which was designed to demonstrate the use of laser scanning as a means to assess, in real-time, the quality of aggregate used in highway construction. Participating states included Kansas, New York, Ohio, Oklahoma, and Pennsylvania.

Project Description

The referenced technology is based on a process referred to as Laser Induced Breakdown Spectroscopy (LIBS). In this process, a high-powered laser pulse is used to excite atoms that make up the aggregate. This excitation results in the emission of light from a range of unique wavelengths (spectrum) that can be thought of as a "fingerprint" of the material. The development of a database of spectra or fingerprints of many aggregate materials with known engineering properties provides the basis for employing numerical techniques (models), similar to "fingerprint matching," to identify the properties of unknown aggregate material.

Scanning data generated in this demonstration show that the technology can differentiate between approved and unapproved aggregate sources. It has the potential to quantify specific test parameters such as acid insoluble residue (AIR), Micro-Deval loss, and specific gravity, as well as to identify the presence of deleterious materials, such as reactive chert, ASR and ACR, and D-cracking susceptible aggregate. It can be used to identify the aggregate source or sources of a stockpile of unknown material(s).

Project Results

A total of 113 aggregates supplied by the participating states were laser-scanned using a field prototype system located in a field materials testing laboratory in South Bethlehem, New York. The analyses in this demonstration focused on specific gravity (bulk and SSD) and absorption, D-cracking, acid insoluble residue, Micro-Deval, and Los Angeles (LA) Abrasion Loss. The results show that laser scanning can successfully predict the properties of aggregate, opening up a whole new way of analyzing aggregate materials. Based on the results presented, recommended future work is outlined, some of which has been initiated and presented herein to refine the scanning and modeling process to enhance data quality.

Project Information

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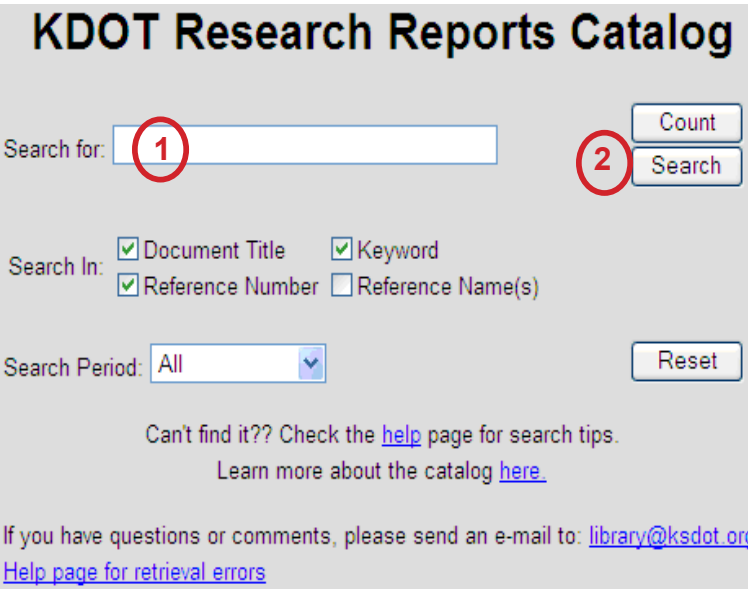

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