

## KANSAS DOT RESEARCH PROJECTS QUARTERLY PROGRESS REPORT

Lead Agency (University or Contractor): \_\_\_\_\_ Kansas DOT \_\_\_\_\_

**INSTRUCTIONS:**

*Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.*

<b>KDOT Project Number</b> RE-0617-01	<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 9 (January 1 – March 31, 2015) <input type="checkbox"/> Quarter 10 (April 1 – June 30, 2015) <input type="checkbox"/> Quarter 11 (July 1 – September 30, 2015) <input checked="" type="checkbox"/> Quarter 12 (October 4 – December 31, 2015)	
<b>Project Title:</b> Real-Time Quality Control Monitoring and Characterization of Aggregate Materials in Highway Construction using Laser Induced Breakdown Spectroscopy		
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<b>Lead Agency Project ID:</b> RE-0617-01	<b>Other Project ID (i.e., contract)</b>	<b>Project Start Date:</b> June 1, 2013
<b>Original Project End Date:</b> May 31, 2016	<b>Current Project End Date:</b> May 31, 2016	<b>Number of Extensions:</b> 0

Project schedule status:

- On schedule     
  On revised schedule     
  Ahead of schedule     
  Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Total Percentage of Work Completed
\$975,000	\$724,573.88	74.3%

Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Complete This Quarter
\$975,000	\$83,356.29	8.5%

**Project Description:**

The primary objectives of this research effort is to calibrate laser-spectral models to develop the means to monitor aggregate materials from participating State agencies, and to demonstrate the use of the technology in actual field applications. The overall objective is to transition the technology from a lab-based application to a field based system. Testing of aggregates and the calibration models developed in the NCHRP 150 research effort were accomplished using a laboratory-based laser-optical system. The proposed pooled fund work plan is designed to transition the technology from the laboratory to the field through the calibration, deployment and demonstration of the technology at selected field demonstration site(s). As part of the NCHRP 168 project, a field prototype sampling and laser targeting system field prototype, referred to as the SLT system (Sampling and Laser Targeting System), is under development for use in the pooled funding effort. The SLT system is a bulk sampling and laser-targeting system that is designed to analyze a diverted portion of the bulk material by passing target aggregate material passed a laser that is strategically located to provide for continuous or semi-continuous monitoring of the bulk aggregate stream. Diversion of samples of the bulk material into the SLT system is designed to remove the aggregate from the bulk stream during material transport, such as conveying. This material diversion provides the means to minimize interferences that would be encountered in an in-line monitoring system, without diminishing the effectiveness of the laser monitoring system to obtain large quantities of data necessary to properly characterize the targeted material. It also provides the means to ensure safe operation of the laser by enclosing the entire system in a separate sealed housing disconnected from the main bulk material conveying system, thereby ensuring a contained and safe operation. The SLT can be deployed in a laboratory environment as well where buckets of samples are periodically introduced for analysis or in a continuous or semi-continuous field operation where materials are diverted from a conveying operation to the SLT for analysis.

**Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**

During this period, the research effort focused on an investigation of the differences between averaging multiple shots laser shots associated with aggregate sample and the examination of single shot data. During single shot analysis the data are not averaged. Numerous single shot scans runs were undertaken The SLT was partially modified to accommodate single shot analysis. Selected samples were analyzed using 3000 individual laser shots per sample. Light emission intensity distributions were generated to assess what percentage of the laser shots light were generating high intensity emissions. After the scanning it was concluded that only about 5% of the laser shots were generating high intensity emissions category. The preponderance of laser shots were found to be generating low intensity outputs. This was attributed to the orientation of the aggregate particles relative to the laser beam – a property termed “particle shape heterogeneity. New laser firing procedures and data modeling were initiated to address this issue.

**Anticipated work next quarter:**

SLT software and hardware modifications will be undertaken ad testing initiated to enable further assessment of single laser shot analyses.

**Significant Results:**

Data models are providing predictive results that follow anticipated trends. These findings were based on averaging the results of at least 1500 laser shots per sample. Assessments undertaken indicate too many low intensity shots are included in such an analysis. New laser firing and data modeling procedures are needed to utilize single shot scanning.

**Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, with recommended solutions to those problems).**

Discussions were initiated with participating States and KDOT to expand the TPF 5(278) by initiating plans for Phase II of the laser scanning demo. Phase II would provide the time and resources needed to address the technical and data management issues uncovered in Phase I and to expand participation of additional States and samples.