TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Minnesota Department of Transportation

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.

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)*	**Transportation Pooled Fund Program - Report Period:**
TPF 5(443)	☑ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☐ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 1 – December 31)

Project Title:		
Continuous Asphalt Mixture Compaction Assessment using Density Profiling System (DPS)		
Name of Project Manager(s):	**Phone Number:**	**E-Mail**
Kyle Hoegh	507-398-2669	Kyle.Hoegh@state.mn.us
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
		Jan 13, 2020
Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
01/10/2027	01/10/2027	

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	Percentage of Work Completed to Date
$1,136,500	$739,769.98	65%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
3.2%	$36,617.97	65.1%

Project Description:

Background:

It is well known that having adequate and uniform asphalt mixture compaction is critical for pavement life. Multiple studies have estimated that a 1% decrease in density can reduce pavement life by approximately 10%. Currently, a target compaction density is widely used for asphalt mixture compaction acceptance. However, common quality control and acceptance practices for density reply on randomly checking density with nuclear density gauges or cores taken on spot locations. This approach is labor intensive and provide limited information on overall pavement compaction quality, many times missing insufficiently compacted areas. Research conducted by the 2nd Strategic Highway Research Program (SHRP2) R06C has demonstrated a breaking new technology, where a DPS system can be used for routine operation to evaluate density and uniformity of asphalt mixture compaction with continuous pavement coverage of the entire pavement area.

As part of SHRP2 R06C, several state DOTs have evaluated a particular Ground Penetrating-Radar (GPR) DPS system, called the Rolling Density Meter (RDM) with overall, very promising results. A calibration method for the RDM system has been developed and recommended. In addition, a probability histogram of measured dielectric constant is found to be an effective tool for assessing pavement compaction quality and uniformity. Based on this evaluation, state DOTs have found that the system can be used for compaction assessment of essentially the entire pavement area as part of Quality Assurance. However, some additional research and improvements are still needed to use DPS systems for acceptance.

Objectives:

The objective of the proposed pooled-fund project is to establish a research consortium focused on A) further advancing and improving the system based on experience and needs from participants so that the system can effectively and efficiently support their Quality Assurance Programs; B) support communication; C) provide training and technical assistance that includes providing support for specification development and strategies for agency full implementation; and D) conduct technology promotion and marketing for the system. Specific tasks within this multi-year program will be

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

There are references to the workplan throughout this quarterly update. The original workplans and live project update can be downloaded from here: http://www.dot.state.mn.us/materials/dps/workplan.html

Fourteen (14) government agencies have become the pooled fund study members to share their expertise and are learning about the new technology and methods to improve and expand upon transportation systems nationally.

Significant Progress this quarter includes:

1. Task 1 is complete. Continued to respond to requests from others on help they need on DPS system operation and data analysis.

2. An AASHTO specification draft for conversion from dielectric to density using production mix samples was created and submitted for review by the relevant committee chair.

3. Conducted TWG meeting and established purpose and 4 umbrella topics/groups

Purpose: Work as a group of density profiling system users and/or technical experts to identify barriers and work toward solutions for deployment of the DPS method as a QC and/or Density Acceptance tool.

• Top four topics selected for upcoming TWG meetings:

1. Precision, bias and accuracy

a. Champion: Kyle Hoegh

b. Co-champion: NCAT (possible)

Anticipated work next quarter:

The following is expected to be completed for next quarter.

1. Initial work on a specification and new method (using fiberglass material) for checking the consistency of the DPS sensors for field testing will begin

2. Continued work on guidance for field data collection including coverage and safety considerations, protocols for acceptance/rejection of dielectric to density accuracy, and minimum software analysis requirements to ensure the technology allows the user to conveniently make density assessments will be conducted.

2. NCAT will be submitting initial Task 3 report on precision and bias.

3. TWG umbrella group mini-meetings will be conducted to determine scope of the coverage, communicate what the DPS pooled fund has already accomplished related to each subject matter, and identify what still needs to be addressed.

4. UNH will compile the MnDOT master database for a large swath of 2021 construction data, a method of data transfer, compiling, and analysis will be developed using this dataset at the template, and additional data from other States will begin to be added to refine the statistical analysis of the protocols such as how to accept accuracy of the dielectric to density conversion.

5. Work with project engineers and contractors to refine procedures and specifications for 2022 data collection plan including input from contractors. Work with other State Agencies to get data collected following pooled fund protocols.

6. Conduct live training event in May, 2022 including A to Z training of how to operate and analyze DPS data on a project. Training will be conducted at MnROAD.

Significant Results:

The best way to get informed about significant results is to access the Live Workplan Progress Report here: http://www.dot.state.mn.us/materials/dps/workplan.html

Currently this pooled fund is working well for all the members. We have shared results and our experience with each other related to the DPS technology and have discuss a number to topics in the technical teams.

In-place density is a critical factor in ensuring the durability of hot-mix asphalt (HMA) pavement. Currently, a target compaction density is widely used to evaluate asphalt mixture compaction quality. But density is commonly assessed in core samples that are extracted at random locations along a pavement. This approach is not only labor-intensive and destructive, but provides little information about the pavement's overall compaction quality.

DPS is a non-destructive testing technology that can be used to evaluate the density and uniformity of asphalt mixture compaction. It identifies the real-time, in-place compaction level of pavement by measuring the surface dielectric profile, which is dependent on the compaction level. Unlike coring, DPS measures continuously, providing nearly 100% coverage of constructed layers. Therefore, density measurements from DPS can give agency much more confidence than cores in assessing overall pavement construction density, which also can help the agency better predicting pavement performance.

This project has seven specific tasks:

Task 1: Software and Hardware Improvements

Task 2: Development of AASHTO Data Collection and Analysis Specification (Ghost Implementation Protocol)

Task 3: Precision and Bias Testing

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, along with recommended solutions to those problems).

The FHWA was able to secure and transfer $99,000, which has been extremely beneficial in addressing the need for more marketing and communication activities. CTC associates has been able to start addressing these needs by planning for Spring training, and coordinating travel plans, polling, and collecting other information. Additionally, CTC associates has facilitated the initial TWG meeting. Content related to these activities has been posted to the website.

Potential Implementation:

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The results (AASHTO specifications) from this pooled fund study can potentially be used for routine quality control and assurance (QC/QA) process in pavement construction to evaluate density and uniformity of asphalt mixture compaction with continuous pavement coverage. Therefore, the construction process provides a continuous and full coverage assessment method at each stage, from mixture placement to post-construction:

• Mixture placement: Use IR to measure compaction temperature to minimize mixture segregation (QC).
• Mixture compaction: Use IC to ensure compaction uniformity (QC).