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): Kyle Hoegh	**Phone Number:** 507-398-2669	**E-Mail** 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: 01/10/2023	**Current Project End Date:** 12/31/2023	**Number of Extensions:** 1

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
$1,186,500	$815,017.79	75%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
4%	$51,155.79	75% (using revised schedule)

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.):

Progress this quarter

1. Held Fall/Winter 2022 project update and peer exchange hosted in Minnesota. The agenda, including project updates and peer exchange presentations can be found here: https://www.dot.state.mn.us/materials/dps/meetings.html

Fall/Winter 2022 DPS Meeting, Day 2 - 12/01/2022

• 8:15-9:45 - 2022 State Data Collection and Specification Development
o TWG Maine 2022 Data (ppt), Ulrich Amoussou-Guenou
o DPS Research in North Dakota - 2022 Update (ppt), Jon Stork
o DPS 2022 Data Update and Specification Development (ppt), Brendan Rock
o Virginia DOT Initial Use of the DPS (ppt), Brian Diefenderfer
• 10:30-12:00 Vendor Updates and Q&A
o New Developments 2022 (ppt), GSSI
o Updates 2022 (ppt), ESS
• 1:00-1:40 - NCAT Final Report Presentation (ppt), Fabricio Leiva
• 1:40-2:20 - Overview of UNH Research Activities (ppt), Jo Sias
• Meeting Summary Report (ppt)
• Agenda (ppt)

Fall/Winter 2022 DPS Meeting, Day 1 - 11/30/2022

• 8:10-8:30 - Highlights of Major Results (ppt), Shongtao Dai
• 8:30-9:00 - Workplan Update (ppt), Kyle Hoegh
• 9:00-10:00 - TPF TWG Report Outs (ppt), Kyle Hoegh
• 10:15-10:30 - Connecting the Dots (ppt), Transtec Group
• 10:30-11:30 - 2022 Contractor/Consultant Perspective Presentations

Anticipated work next quarter:

The following is expected to be completed for next quarter.

1. Make DPS presentation at the "Mid-Atlantic Asphalt Expo & Conference." in Richmond Virginia.
2. Multiple TPF members present at the 2023 workshop focusing on DPS and PMTP technologies, specifically QC aspects. Work with Erv to develop e-circular, and plan for webinar on the subject.
3. Publish 3rd DPS digest related to use of processes to improve reliability.
4. Work with UNH to merge draft AASHTO specs for measurement of dielectric of gyratory compacted samples and submit to committee for review
5. Start planning for 2023 meetings with CTC and FHWA. Possible TWG meeting in conjunction with the Minnesota Pavement conference, and project update/demonstration/peer exchange meeting in conjunction with Asphalt Stripping TPF. Communicate data and time to the group and start working on meeting agenda.
6. Continue meetings with the FHWA Mobile Asphalt Technology lab focused on their efforts related to the DPS.
7. Hold TWG meeting with Vendors, Contractors, NCHRP project related to use of NDT in construction QA report out, and summary of themes/topics of most interest for DPS from the 2022 menti poll, and 2023 TRB workshop.
8. Work with Contractors from Minnesota and other States to plan data collection for 2023 construction projects using the update protocols, and to try to advance the DPS usage to inform construction process control. Get contractors nationwide more familiar with the technology. Simplify current protocol with focus on acceptable minimum amount of longitudinal joint and mat data and how to handle payment giving flexibility to contractor on how much data is collected.
9. Work with Asphalt Institute on article giving overview of value of DPS.
10. Make DPS presentation at the Mid-Atlantic Quality Assurance Workshop in Charleston, WV
11. Make DPS presentation at the Capri general session focused on improvements in density in Chattenooga, TN
12. Continue to build on precision/bias results using controlled MnROAD experiment and 40 cores, and further investigate effect of changing density with depth using controlled MnROAD experiment and 40 cores sliced to various depths.

Significant Results:

The best way to get informed about significant results is to access the DPS website:
https://www.dot.state.mn.us/materials/dps/index.html

Specifically, the member and friend presentations including project update presentations given here are the best way to stay apprised of the latest significant results:
https://www.dot.state.mn.us/materials/dps/meetings.html

More birds eye view significant DPS topics can be found in the DPS Digest Series located here:
https://www.dot.state.mn.us/materials/dps/digest.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

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).

Both UNH and CTC were granted time-extensions to be able to accomplish their work as part of the larger DPS Pooled Fund workplan. Work is progressing with a new revised end date of December 2023, as indicated in the time extension amendment from UNH. This extension has allowed for use of added additional funds from FHWA and additional State contributions since the original workplan was developed that allows for accommodation of this additional scope of work. Additionally, the data collection costs and travel reimbursement costs originally estimated have been lower than originally estimated. This change in timeline was presented at the Fall/Winter workplan update and peer exchange, and the resulting timeline is reflected in this quarterly report.

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).