TPF-5(443) and TPF-5(504) Joint Project Update and Peer Exchange Meeting

Subject: Meeting notes for TPF-5(504) update and peer exchange

Date: Wednesday, November 8th, 2023

Time: 7:45 AM to 5:00 PM (CTS)

Meeting agenda:

Start Time (CT)	Subject	Presenter(s)
7:45 AM to 8:00 AM	Refreshments (Coffee, Bagels, Pastries, etc.)	All
8:00 AM to 8:15 AM	Introduction	Eyoab Zegeye
8:15 AM to 8:30 AM	MnDOT and FHWA welcomes	Jeff Brunner (MnDOT) and Steve Cooper (FHWA)
8:30 AM to 8:50 AM	Background and overview of the TPF-5 (504) Study	Dai Shongtao (MnDOT
8:50 AM to 9:50 AM	TPF-5 (504) project updates	Eyoab Zegeye (MnDOT)
9:50 AM to 10:20 AM	Morning coffee break and tour of the Road Doctor Survey Van (3D-GPR)	
10:20 AM to 12:00 PM	Planning & Coordination of pool fund activities • Update from state members. • Discussion of survey results • MnROAD test construction • Development of analysis tools • Plans for 3DGPR testing in states. • Update on TSD data collection	States members
12:00 to 1:00 PM	Lunch Break (box lunches)	All
1:00 PM to 1:20 PM	Introduction to a next generation Deflectomter (portable) for continuous bearing capacity	Kåre Sloth Jensen (Measure)
1:20 PM to 1:40 PM	IE-SASW method for non-destructive testing of pavements	Monica Jurado (FHWA)
1:40 PM to 2:40 PM	Data collection and processing of 3D-GPR data supported by a case study. New features for automated detection of subsurface defects	Paul Collins (Kontur) Jacopo Sala (Kontur)
2:40 PM to 3:00 PM	Afternoon break	All
3:00 PM to 3:30 PM	Use of 3D-GPR and TSD to evaluate pavements affected by stripping supported by findings from projects in Georgia, Missouri, and Mississippi	Ken Maser (Infrasense)
3:30 PM to 4:00 PM	Research scope of the NRRA awarded project: Effective Use of TSD for Network-based and Project-based Applications	Soheil Nazarian (UTEP)
4:00 PM to 4:30 PM	Open discussions	ALL
4:30 PM to 4:45 PM	Closing statements/ Follow	Eyoab Zegeye (MnDOT)

Participants

In-person	Peter Eakman (FHWA), Shongtao Dai (MnDOT), Steve Cooper (FHWA), Monica Jurado (FHWA), Mattia Zammarchi (AET), Soheil Nazarian (UTEP), Kuznia Mercedes (MnDOT), Jeff Brunner (MnDOT), Paul Collins (Kontur), Ian Rish (GAODT), Jacopo Sala (Kontur), Mike Vrtis (MnDOT),

	Jacob Walker (GADOT), John Siekmeir John (MnDOT), Kean Ashurst (KTC), Jamie Krieg (Kentucky), Tim Jones (KTC), Robbie Cunningham (Georgia), Josh Bragg (GA), Aarons (Braun), Eddie Mccarty (MA), Ryan Bose (Maine), Shaun Gould (Maine), Craig Hebbert (UTDOT), Ken Talbot (UTDOT), Dave Berry (Kontur), Ken Maser (Infrasense); Mike Heitzman (Kontur), Erv Dukatz (Flyereled Consulting),Anh Tran (UNH, Kyler Carlson (WADOT), Robert Miller
On-line	Griffin Sullivan, Kent martin (Kontur), Hung -wen Chung (FDOT); Suyun Ham, Derek Tompkins (Applied Pavements Tech); Kare Sloth Jensen (Measure), Rebecca Embacher (MnDOT), Aaron Dunfee (FDOT); Brad Frazier (Kentucky Transportation); John Garrity(MnDOT); Brian Hill (Illinois DOT); Larry Olson (Olson Engineering), Robert Hinman (FHWA); Greg Johnson(MnDOT); Johnathan Varner (Missouri DOT); Manuel Celeya; Pekka Maijala (Roadscanners); Bob Rae (Nebraska); Rick Miller (Kansas DOT); Timo Saarenketo (Road Scanners); Timo Serenpa (Road Scanners), Guangming Wang (FDOT); Jia Xiaoyang (Tennessee DOT), Tom Yu (FHWA), Hoda Azari (FHWA),

Meeting notes:

- **Welcomes**: The meeting, hosted by MnDOT started with welcomes from Jeff Brunner (MnDOT) and Steve Cooper (FHWA). Jeff provided background on the Road Doctor initiative and acknowledged the contributions of the staff. Steve discussed the SHRP effort, MnDOT's leadership in the pooled fund, and the significance of financial contributions from various agencies.

- **Background**: Dai Shongtao (MnDOT) highlighted the importance of continuous measurements over random cores in pavement analysis, mentioning the SHRP R06D and R06C studies. He emphasized the utility of 3D Radar in identifying defects and the need for stiffness measurements to supplement this. The TPF-5 (504) study was discussed, detailing its tasks, goals, and the integration of Kontur data with TSD sections. Dai further discussed the two pool fund studies, emphasizing their similarities and differences, particularly in GPR technology. The early stage of the current study was noted, with a focus on planning and design. The role of R06D in this study and the successes of the program were also highlighted, including the distribution of technology and findings regarding antenna variation and the reliability of 3D Radar.

- **Project overview and progress:** Eyoab Zegeye (MnDOT) guided participants to the project website and encouraged contributions (technical materials that can be included). He then gave a comprehensive update on the TPF-5 (504) project outlined the study's objectives, progress and budget overview. The survey responses were discussed, with an emphasis on the widespread interest in stripping and NDE technology. The meeting also touched upon the challenges in using NDE technology, such as staffing and training issues, and the lack of clear specifications. He presented states involved in the project, including their equipment and expertise. The discussion covered the variability in stripping types and the need for a broad approach in the pooled fund study. The meeting also reviewed responses from a survey regarding stripping detection and NDT, fostering a discussion on data fusion, thermal segregation, and other factors contributing to pavement stripping. A review of MnDOT's Road Doctor 3DGPR initiatives highlighted advancements in equipment and the need for smarter coring techniques. The potential for machine learning and innovative analysis methods in future developments was also discussed. The construction of AC Stripping Test Sections at MnROAD was detailed, emphasizing the collaborative efforts and the importance of assessing various stripping types and technologies. The transition of the Road Doctor program from research to implementation was highlighted, showcasing the training efforts and collaborations with various agencies and universities. Concluded with a broader discussion on the

motivations and background of the study. The advantages of 3D Radar over traditional GPR in detecting stripping were discussed, along with MnDOT's experience in using these technologies.

Group discussions

- **Development of analysis tools for automated detection of pavement hidden defects**: The development of analysis tools for the detection and rating of stripping in bituminous and composite pavements using 3DGPR and other NDT data was a key topic of discussion. The process for creating the Request for Proposals (RFP) was outlined, emphasizing its collaborative and selective nature:
    - RFP Creation Process: The RFP was developed through a series of closed meetings involving only members, with Task 4 focusing on stated goals and approaches. It was later decided to open the RFP to vendors or qualified interested parties to encourage a broader range of solutions.
    - RFP Posting and Objectives: Scheduled to be posted at the end of November 2023, the RFP aims to develop an analysis tool for automated detection and rating of stripping. The tool should be capable of integrating 3DGPR and other NDT data, with a focus on using data collected from the MnROAD stripping test sections and member states' roads.
    - Approach and Desired Features: The RFP outlines the need for the development, training, verification, and validation of methods using NDT data. It also specifies desired features, delivery formats, and explanations for the proposed solutions.
    - Budget and Allocated Funds: The budget includes a payment of $150,000 to the awarded team. Additionally, indirect contributions are noted, such as $100,000 for the construction of MnROAD stripping test sections and $200,000 for collecting NDT data from state members.
    - Questions and Concerns: A discussion ensued regarding the number of teams to be involved in the RFP. Mike from Kontur inquired whether it would involve one team or multiple, to which Eyoab responded that multiple or different approaches might be considered. Dai suggested the possibility of one contractor with potential sub-contractors. Mike referenced the SHRP2 approach, where each vendor was given funds to develop technology, debating whether to put all resources into one proposal or to recognize 2-3 proposals for broader analysis. Dai mentioned waiting for the proposals before making a decision, while Eyoab highlighted that contractors were interested in the review criteria, emphasizing the need for an end product that is user-friendly and doesn't require expert intervention.

  This summary reflects the strategic planning and collaborative efforts in developing effective analysis tools for pavement assessment, demonstrating a forward-thinking approach in leveraging technology and expertise within the field.

- **Plans for the construction of MnROAD stripping sections**: These discussions focused on the plans for constructing field test sections, covering various aspects of planning, development, construction, and investigation methodologies. Here is a synthesized overview:
    - Planning and Development:
        - Draft Plan: Developed with input from research section experts.
        - Review and Approval: Involved member states and a task force including Ian Rish (GADOT), Xiaoyang Jia (TN), Ruben Carrasco (TX), Thomas Calhoon (MnDOT), and others.
        - Objectives: The primary goal is to build controlled field test sections that mimic pavements affected by asphalt stripping at different depths.
    - Construction Site and Method:

        - Location: MnROAD service road, with 500 feet allocated for the construction of the stripping test section.
        - Surface Inspection: Includes GPR surveys for AC layer thickness and FWD testing.
        - Construction Details: The plan incorporates control sections with highly reflective metal plates, artificially stripped mixture elements (varying in size, thickness, and depth), composite pavement sections, and full-depth bituminous sections.
    - Investigative Approach:
        - Objective: Investigate NDT technologies' capabilities in detecting and mapping asphalt stripping under various conditions.
        - Incorporation of Technology: Use of techniques like GPR and FWD at specific intervals and depths.
    - Questions and Concerns:
        - Ride Quality and Speed Considerations: Addressed by Eyoab and Michael Vertis (MnDOT), focusing on the speed limitations and the need for straight alignment for thermal collection.
        - Data Collection and Analysis Challenges: Discussed by various participants, including Ken Maser and Soheil Nazarian, with emphasis on temperature corrections, data fusion, and the need for accurate GPS.
        - Water Injection and Maintenance: Steve Cooper raised questions about water injection methods, with Michael Vrtis suggesting drilling holes for water tracking. The group also discussed maintenance concerns related to freeze-thaw cycles.
        - Material Selection and Construction Timing: Debates on the type of materials to use, traffic levels, and the timing of construction, with a focus on simulating realistic stripping conditions.
    - Budget and Funding:
        - Construction Costs: Discussed but not detailed in the summary.
        - Funding Allocation: Mentioned the involvement of various states and agencies, along with their respective contributions in terms of equipment and expertise.
    - This meeting highlighted the collaborative efforts and meticulous planning required for constructing test sections that accurately simulate asphalt stripping. The discussions emphasized the importance of precision in both construction and data analysis to ensure reliable and meaningful results.
- **Update from member state:** Several state DOT representative shared their experience with roads affected with stripping and the challenges. Several members states discussed roads that they have identified for this poll fund study and the data has already been collected (GADOT, MODOT, Mississippi DOT)

Afternoon discussions & presentations

The afternoon session covered several critical aspects of the projects and provided updates on innovative NDT technologies for pavement evaluation. The key points were:

- **Development of Analysis Tools and RFP for Software**:
    - Ken's Perspective: He emphasized the need to separate the development of an algorithm for identifying stripping from its packaging into software, stating that the methodology should be proven before integration.
    - Eyoab's Input: He stressed the importance of understanding how the proposed systems work as part of the RFP process. Both can be accomplished within the proposed RFP

    - Dai's Contribution: He mentioned the availability of preliminary data to aid in the proposal development process.
- **Next Generation Deflectometer and Company Overview:** Kare Sloth Jensen (Measure) introduced his company, founded in 2020, specializing in purpose-built laser technology for pavement evaluation. The company's focus is on building high-accuracy, repeatable laser technology that can be integrated into vehicles for pavement analysis. Kare also introduced a portable Traffic Speed Deflectometer (TSD), discussing its high stability, accuracy, and repeatability. The technology is priced at 750,000 Euros and is adaptable to different pavement types.
- **Monica Jurado's Presentation**: She discussed the Impact Echo (IE) and Spectral Analysis of Surface Waves (SASW) methods for non-destructive testing of pavements, highlighting their capabilities and limitations.
- **Paul Collins and Jacopo Sala (Kontur)** provided insights into 3D-GPR technology, emphasizing its use in detecting subsurface defects and the importance of repeated testing over time. They also discussed the new software packages and the workflow involved in GPR data collection and processing.
- **Soheil Nazarian (UTEP)** Discussed the Research Scope of the NRRA Awarded Project:. Soheil outlined the goal of providing guidelines for the use of TSD in both network-based and project-based applications. The research focuses on developing classification guidelines for pavement sections and evaluating the feasibility of using TSD for project-based applications.
- **Questions and Open Discussions:**
    - Various participants raised questions about the methodologies, equipment, and data analysis techniques. Topics included the positioning accuracy of GPS systems, speed and resolution trade-offs in data collection, and the applicability of different technologies for specific pavement conditions.
    - Mike Heitzmann and Timo Saarenketo discussed the nuances of GPR data interpretation, particularly in relation to moisture content and its impact on reflection patterns.

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