



Exhibit D

Research Project Requirement Template

Integration and Deployment of Novel Tools for Rapid Assessment of Pavement Conditions and Remaining Life

Recipient/Grant (Contract) Number: 69A3552348306 (CY1-TTI-01)

Center Name: Southern Plains Transportation Center (SPTC)

Research Priority: Improving the Durability and Extending the Life of Transportation

Principal Investigator(s): Garrett Dorsett and Tom Scullion, Texas A&M Transportation Institute

Project Partners: Texas A&M Transportation Institute

Research Project Funding: Texas A&M Transportation Institute: \$31,711 (Federal) and \$45,428 (Match)

Proposed Start and End Date: 09/01/2023 to 09/01/2024

Project Description: Extreme heat events from climate change are expected to expose pavements to more intense and prolonged stress. These events, coupled with soil movement from heavy rainfall and drought are also expected to threaten pavement functional and structural life. State and local agencies have benefited from innovative technologies and tools developed to rapidly assess pavement condition, but data has not yet been widely implemented into pavement management systems that provide cohesive and holistic assessments of state roadways. A hybrid approach combining traffic speed deflectometer (TSD) and air-coupled ground penetrating radar (GPR) data is proposed that will allow for large-scale data collection and analysis for use in state-level pavement management systems.

Task 1: TxDOT District TSD Data Collection and Analysis

Researchers will coordinate with TxDOT district offices to collect TSD and GPR data from roadways that are representative of different structural and functional conditions and pose a specific interest to those districts. TSD data have been collected in the Atlanta district and other TxDOT districts interested in TSD testing. The researcher team will work with the TxDOT districts that collect TSD data to identify project sections of interest for closer evaluation. These sections may need maintenance or structural repair, have been recently constructed, or be in good condition. Collected data may be used to assist the district in pavement management activities and/or assess district priorities.

Task 2: Assist Oklahoma Researchers in Oklahoma Testing Program

Oklahoma currently has around 250 miles of TSD data collected on interstate roads. The TTI team will conduct GPR and fast falling weight deflectometer (FFWD) testing at locations of interest identified by the Oklahoma team, based on the analysis of the collected TSD data. Researchers may then assist in data analysis and relay the collected data to Oklahoma.

Task 3: Integration of TSD and GPR Data

A primary motivation of this research is to utilize TSD testing and data collection to provide meaningful, network-level data to TxDOT districts for use within the pavement management system. To accomplish this, the research team will develop a program for TxDOT to integrate the collected TSD and GPR data within a widely used existing program to analyze GPR data. This will allow the participating districts to gain a more holistic understanding of pavement structural data and better understand the impact of



structural anomalies/deficiencies on functional pavement metrics. Increased understanding from this project will lead to more informed decisions within pavement management decision trees.

Task 4: Pavement Structural Analysis and Remaining Life Prediction

Researchers will utilize collected data, along with new and existing mechanics-based modeling tools to develop a process to make determinations of pavement structural condition and predict remaining life that will aid in pavement management decisions. Researchers may utilize AI/ML based tools to optimize the proposed process. The results may be shared with local state and government agencies for verification and develop maintenance/repair strategies, should they be necessary.

US DOT Priorities: This project aligns well with the SPTC priorities in terms of addressing the USDOT goals of (i) Climate and Sustainability and (ii) Economic Strength and Global Competitiveness. The proposed project will assist in incorporating resiliency systems within pavement management programs by producing accurate pavement structural data and remaining life estimations, with consideration of increasingly harsh environmental conditions. For example, extreme heat and prolonged droughts within Texas lead to edge drying of pavement subsurface materials, which can significantly shorten the life of the pavement. The integration of GPR and TSD technologies, along with enhanced remaining life estimates, will allow DOTs to identify issues related to edge drying within the GPR data and assess structural performance through the TSD data before the pavement life is greatly lessened. The research team for this project will be diverse and the results of the project will be available to all interested groups. Greater access to project results may lead to increased engagement with historically lower-income and marginalized communities.

Outputs: Outputs for this project are: (1) Development of a process for large-scale data pavement data collection and analysis for use in state management systems; (2) Assessment of the current pavement management practices used by the participating districts; (3) A program that integrates GPR and TSD data for use by TxDOT in pavement management practices; (4) An optimized process for performing structural and remaining life analysis on pavements.

Outcomes/Impacts: Expected outcomes of this project are: (1) Further validation of TSD data; (2) Rapid and cost-effective assessment of weather impacts on functional performance and life of pavements; and (3) Rapid deployment of hybrid non-destructive test methods and distribution of associated data by teaming with state DOTs and local government agencies. Expected impacts from this project include the following: (1) Rapid and cost-effective assessment of damage from extreme weather events; (2) Measures to return infrastructure to service; (3) Network-level infrastructure health for data-driven decision and resource allocation; and (4) Assistance to rural and marginalized communities. Technical sessions and webinars will be presented to state DOTs (specifically, TxDOT) and local government agencies within the region. These sessions will present findings and best practices to use in pavement management activities.

Final Research Report: