Exhibit D

Research Project Requirement Template

Rapid Assessment of Network-Level Pavement Conditions using Novel Tools

Recipient/Grant (Contract) Number: 69A3552348306 (CY1-OU-OSU-TTI-06)

Center Name: Southern Plains Transportation Center (SPTC)

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

Principal Investigator(s): Syed Ashik Ali, University of Oklahoma; Joshua Qiang Li, Oklahoma State University; Garrett Dorsett, Texas A&M Transportation Institute; Kenneth Hobson, University of Oklahoma; Musharraf Zaman, University of Oklahoma

Project Partners: University of Oklahoma, Oklahoma State University and Texas A&M Transportation Institute

Research Project Funding: University of Oklahoma: $60,315 (Match); Oklahoma State University: $75,000 (Federal) and $75,000 (Match)

Proposed Start and End Date: 10/01/2023 to 09/30/2024

Project Description: In this collaborative project, two leading Oklahoma universities – the University of Oklahoma (OU) and Oklahoma State University (OSU) – will work with the Texas A&M Transportation Institute (TTI) to assess network-level pavement conditions rapidly and cost-effectively, using novel tools. Roadway pavements constitute a critical element of surface transportation infrastructure. With a large portion of pavements in poor condition and reaching the end of their service lives, pavement maintenance and rehabilitation are becoming increasingly challenging tasks for many state DOTs, including DOTs in Region 6.

Recent developments have spotlighted the Traffic Speed Deflection (TSD) Device as a valuable technology for measuring surface deflections at short intervals and capturing data on roughness, texture, and rutting at traffic speed. The evaluation of pavement conditions and their rating typically depend on such parameters as deflections, slope deflection indices, structural considerations, and remaining service life. In this context, the potential advantages of deriving network-level pavement condition ratings from TSD data could be enhanced through the implementation of other novel technologies developed by the consortium members collaborating on this project. Lack of access to a TSD device and high cost associated with data collection necessitate the pursuit of innovative in-house technologies, which will not only increase efficiency but reduce costs significantly.

As part of a pooled fund study (TPF-5 (385)) participated by ODOT, pavement conditions data from I-35 and I-40 in Oklahoma were collected recently using a TSD. The proposed study focuses on developing tools for analyzing these TSD data for network-level assessment or rating of the associated pavements. A complementary objective is to collect data from the same pavements using in-house technologies, namely Pave3D 8K available at OSU and an air-coupled Ground Penetrating Radar (GPR) and Fast Falling Weight Deflectometer (FFWD) available at TTI.

For this purpose, with assistance of the Strategic Asset and Performance Management (SAPM) personnel at ODOT, the research team seeks to gain access to the TSD data from I-35 and I-40 and review these data closely. Leveraging different pavement condition indicators, the I-35 and I-40 pavement

sections will be divided into five different categories, namely very poor, poor, fair, good, and excellent. This categorization will facilitate the subsequent selection of experimental sites for an in-depth evaluation, each spanning 3 to 5 miles. The OSU team will employ Pave3D 8K for the acquisition of 2D/3D surface images and detailed pavement roughness and texture data from the evaluation sites. The OSU team will then analyze the Pave3D 8K data and compare them with the TSD data. The results of these comparisons will assist in the establishment of definitive rating thresholds.

FFWD tests will be conducted by TTI at the selected I-35 and I-40 sections. Measured deflections will be used to determine structural conditions and remaining life and to compare with the corresponding TSD results. A subsurface GPR survey will be conducted on the above mentioned I-35 and I-40 sections with the help of TTI. The GPR data will be used to determine layer thicknesses and used to identify areas with subsurface defects.

Based on the pavement conditions, cores will be extracted selectively from distressed locations as well as from some good locations. A visual observation of the extracted cores and limited laboratory test results will be used to validate the pavement rating from the TSD data and Pave3D 8K and FFWD data. The research teams from all three institutions will work together to establish pavement condition thresholds. These thresholds can be used readily by ODOT and other DOTs in Region 6. These thresholds can be adjusted in the future as more network-level data becomes available.

US DOT Priorities: Using advanced technologies, like TSD, Pave3D 8K technology, and other devices, this study aims to change how DOT evaluates and manages infrastructure health on a network level. By improving transportation safety and reliability, the findings could bring about positive changes and help meet the USDOT strategic goal of reducing backlog of pavement repairs and enhancing economic strength. Also, this study will promote the application of in-house technologies for broader application.

Outputs: This study will help develop a data-driven application process for network-level pavement evaluation. Through selecting pertinent parameters and establishing operational thresholds, this study will assist state DOTs to rapidly identify and prioritize pavements in need of maintenance, rehabilitation, and reconstruction. The need for such rapid identification and prioritization becomes particularly important in addressing the impacts of climate change and severe weather. The research team plans to conduct a tech transfer workshop to disseminate the findings and train stakeholders on the use of TSD data and other technologies. The project plans to train at least one graduate student from an underrepresented group to support SPTC's DEI goal.

Outcomes/Impacts: This research will provide valuable insights on the rating of pavements based on their conditions. Pavement condition data will assist transportation agencies in quantifying the impact of extreme weather events such as flooding and intense thermal cycles and undertaking data-driven maintenance and rehabilitation measures. The findings of this project are expected to lead to the development of new technologies by combining the in-house technologies with other technologies the research teams plan to develop using external funding from private, state, or federal sources. The project will help at least one graduate student from an underrepresented group to become a successful transportation professional.

Final Research Report: