Exhibit D

Research Project Requirement Template

Investigation of Hot Mix Asphalt Aging Effect on Mechanical Properties of Mixes Based on Their Binder Performance Results

Recipient/Grant (Contract) Number: 69A3552348306 (CY1-UTEP-02)

Center Name: Southern Plains Transportation Center (SPTC)

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

Principal Investigator(s): Imad Abdallah and Miguel Montoya, The University of Texas at El Paso

Project Partners: The University of Texas at El Paso

Research Project Funding: $65,000 (Federal) and $65,000 (Match)

Proposed Start and End Date: 09/01/2023 to 08/31/2024

Project Description: Because hot mix asphalt (HMA) pavement layers undergo a complex aging process over time that changes their physical and chemical properties, it is important to develop guidelines for designing HMAs with improved resistance to aging. Equally important is to implement such guidelines. This study aims to investigate the effects of HMA aging on the mechanical properties of mixes, including cracking and strength using an overlay tester, indirect tensile test, IDEAL-CT, and performance grades of associated binders. Binders will be extracted and recovered from laboratory-aged HMA specimens prepared as part of a previous UTEP study on HMA aging with varying percentages of reclaimed asphalt pavement (RAP), binder contents, mix types, aggregate sources, and additives. Even though the rutting and cracking performance of these specimens were thoroughly documented in the previous study, no rheological tests were conducted on the binders extracted from them. The present study will help understand the effect of HMA aging on changes in binder performance as a function of RAP percentage, aggregate quality, rejuvenator dosage and type, and asphalt content. The outcome of this project in terms of technology readiness can help with the modification of design guidelines to produce cost-effective and sustainable pavements that should safely last longer. The team will engage students from El Paso Community College and recruit a graduate student to conduct this project.

The following tasks will be pursued to accomplish the aforementioned goals: Task 1 – Determination of rheology of binders extracted and recovered from laboratory-aged HMA specimens previously prepared and preserved under another study; Task 2 – Analysis of impacts of aging on binder performance as a function of mix properties; Task 3 – Evaluation of relationships between properties of extracted binders and traditional binders; Task 4 – Recommendations for the optimization of hot mix asphalt design. Specifically, the impact of aging on the binders' performance grades and volumetric properties of asphalt mixes will be evaluated and used in making recommendations for the DOTs for consideration of aging in mix designs.

US DOT Priorities: This project addresses emerging technologies to enhance durability, resiliency and extend infrastructure life. It addresses the USDOT statutory research priority "D: Improving the Durability and Extending the Life of Transportation Infrastructure" since understanding the aged properties of the hot mix asphalt will lead to improved longevity of the pavement. More specifically it addresses the USDOT strategic goal of "Economic Strength and Global Competitiveness" by extending the life of HMA pavements.

Outputs: The following outputs are anticipated: (1) A final report including preliminary guidelines to help transportation agencies and engineers select appropriate asphalt binders for specific road conditions and environments that could lead to improvement in the development of binder performance grading systems; (2) Technology transfer by disseminating the findings through a conference publication and a publication in a technical journal.

Outcomes/Impacts: This study aims to enhance the understanding of HMA aging and its impact on binder as a function of the mix properties, contributing to the development of more resilient and durable asphalt pavements. Implementable guidelines will be documented in the final report. This research output will help transportation engineers understand how asphalt binders in the mix age over time, which will lead to the development of more durable asphalt mixtures that can withstand the challenges posed by various environmental factors, thereby increasing the lifespan of road pavements. Additionally, it will potentially lead to further, more comprehensive investigations. Webinars and forums to be conducted in this study for students will help equip young and potential engineers and researchers with the skills needed to advance their knowledge in asphalt binder testing by working with students from the El Paso Community College (EPCC). Also, in this study materials for a summer camp will be developed, which will include the following: presentations; hands-on experiments; educational videos; and educational games.

Final Research Report: