Oregon Department of Transportation

Stage 1 Research Problem Statement

Number*: 25-51*

Proposed Title: Implementation of A Full-Scale Accelerated Pavement Test System for Oregon

1. Concisely describe the **transportation issue** (including problems, improvements, or untested solutions) that Oregon needs to research.

Pavement materials are continuously evolving and improving. Several different types of chemical additives, supplementary cementitious materials, recycled materials, fibers, rubber, plastics, polymers, and several other materials commonly used in today's asphalt and concrete paving mixtures and tack coats (asphaltic emulsions used to bond layers together) are increasing the complexity of the characterization of long-term material performance.

Four major methods have been used in pavement engineering to characterize and predict the long-term performance of complex pavement materials. Those methods are computer modeling, laboratory testing, field performance assessment, and full-scale pavement testing. Although computer modeling (mechanistic-empirical design methods, finite element modeling, layered elastic theory, etc.) is the lowest cost option to determine pavement materials' long-term performance, its predictive capability is generally limited compared to the other three options. While field performance assessment through pavement management systems (PMS) is the most reliable and accurate method, it can take several years to understand the actual performance of a new pavement material, which can significantly slow down the implementation process for different materials and strategies. Although laboratory testing can provide reliable performance estimations, the accuracy and precision of laboratory-predicted material performance should be improved by conducting experiments with larger-scale loading systems (actual heavy truck loads). The connection between field performance and laboratory-predicted material behavior should be created via full-scale testing to be able to better understand the long-term performance and behavior of pavement materials in a reasonable time frame.

Although full-scale test systems can provide more reliable and quicker performance estimates for pavement materials, most accelerated pavement test systems are expensive to purchase and operate (about $4 to $6 million to purchase the system and about $1,000 to $3,000/day to operate). Although experimental test tracks constructed on highways can provide reliable performance estimates, it takes longer (several years) than accelerated pavement tests to obtain results. In addition, the pavement test tracks available across the nation are in regions that have completely different climatic characteristics than Oregon. For these reasons, developing a low-cost accelerated pavement test system to support the current ODOT's mission is critical.

2. Document how this **transportation issue** is important to Oregon and will meet the Oregon Research Advisory Committee Priorities

The accelerated pavement test (APT) system that could be developed in this study has the potential to directly support the *"provide a safe and reliable multimodal transportation system"* mission of ODOT by encouraging the use of the most sustainable and high-performance pavement materials in Oregon (also addressing the second and third items in the ODOT Strategic Business Plan). In addition, the developed system would help ODOT in identifying the impact of several different construction issues on the long-term performance of roadway network in Oregon. Pavement and material performance parameters that will be extracted from the developed APT system would allow ODOT in selecting the most cost-effective, environmentally friendly, and safer material and construction options for Oregon.

The developed APT system is also expected to serve as an educational tool for universities and the public (to address the last item of ODOT's Strategic Business Plan). Tours that will be organized to the APT test sections constructed at the material production plants across Oregon will clearly show the state-of-the-art methods and technologies that are currently being used to encourage sustainable pavement design and construction strategies and solve ODOT's engineering problems.

The only way to attract the attention of younger generations is to show them the innovative and technology-based side of pavement engineering. It is critical to show the students (college and K12 level) and the public that pavement engineering is not just "rocks and dust" but there is also a research and technology development component. Organized tours to the APT test sections are expected to attract the attention of students and encourage them to pursue a career in this field. These students are expected to provide a strong workforce for ODOT and the paving industry in Oregon. This benefit from the APT test system development also addresses the fourth item in the ODOT's strategic business plan, "Attract, retain and develop an outstanding ODOT workforce".

3. What **final product or information** needs to be produced to enable this research to be implemented?

The major products of this research study will be the developed full-scale accelerated pavement test (APT) system and the associated testing procedures. The APT system will be a van equipped with an inertial profiler (for surface profile and rut depth measurements), a stationary profilometer (for accurate rut depth and surface profile measurements), several sensors, strain gauge systems, and several other technologies for pavement response measurement. The cracking resistance of the test sections will also be periodically measured by using the 3D Laser Image Measurement System currently owned by ODOT. The APT system will be used to test several test strips that will be constructed at the material production plants across Oregon. The performance data collected from the tested sections and the corresponding outputs with several recommendations will be shared with ODOT. Standard operating procedures (SOP) and data collection methods and schedules will be documented and shared with ODOT.

4. (Optional) Are there any individuals in Oregon who will be instrumental to the success of implementing any solution that is identified by this research? If so, please list them below.

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5. Other comments:

REFERENCES:

1) ODOT (2018). *Positioned For The Future.* Adopted Strategic Business Plan www.oregon.gov/odot/About/Documents/SBP.pdf

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