Oregon Department of Transportation

Stage 1 Research Problem Statement

Number*: 25-44*

Proposed Title: Developing an Online System to Store and Analyze Data from All Stages of the Pavement Life Cycle

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

Roadways are continuously aging and deteriorating due to the increasing traffic volumes, increasing truck weights, and lack of enough funding to periodically maintain and rehabilitate aging roadway infrastructure (Coplantz, 2023). The reductions in funding in previous years have already started to show their effects as a decline in pavement network conditions for all five regions in Oregon (see Figure 9 in the 2022 ODOT Pavement Condition Report). Improving existing asset management practices by developing new tools and strategies has the potential to improve network-level pavement performance and create significant savings for the economy. More efficient maintenance and rehabilitation strategies are also expected to reduce the environmental impact of pavement life cycle stages.

Pavement asset management requires the collection, storage, and processing of datasets from different stages of the pavement life cycle, such as: *i)* pavement design outputs (material and structural design information); *ii)* paving material production and QA information (binder content, gradation, recycled asphalt pavement content, etc.); *iii)* as-built construction data (in-place densities, layer types, thicknesses, etc.); *iv)* pavement condition survey data collected during the use phase of the pavement; and *v)* roadway surface condition data collected by the ODOT's Pavements unit after maintenance activities (paving, chip sealing, etc.). Data from all those stages are needed to be able to identify pavement distress initiation and propagation mechanisms and develop strategies to combat those different distresses. Developing an online geographic information system (GIS) based database that integrates all pavement-related data in one system is crucial in developing a more efficient pavement management system (PMS) in Oregon. Although all the data listed above are collected by the different branches of ODOT at different stages of the pavement life cycle, there is currently no integrated data collection and storage system that can be accessed to store and download all the required historical information about different pavement sections. Connecting all the data in one platform and having an automated data processing system to cross-check the accuracy and validity of the data is crucial. The proposed online system will also have an automated internal statistical analysis platform where the most significant factors controlling the collected pavement performance parameters will be identified at the project and network levels. Using the outputs, the embedded intelligent algorithm will also provide pavement maintenance or rehabilitation suggestions.

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

The GIS-based data processing, storage, and visualization system (integrated into ODOT's current TransGIS) developed in this study will help ODOT improve the current pavement asset management system. The developed system will allow the integration of pavement data collected at different stages of the pavement life cycle. Integration of the pavement design, paving material production, construction, and maintenance data with the current PMS data under one platform will allow ODOT to determine the major reasons for the premature failure of some pavement sections in Oregon. The developed tool will help ODOT understand the most important factors controlling pavement longevity. Based on the findings, current design, construction, material production, maintenance, and pavement management procedures will be improved.

The developed online GIS database will construct the beginnings of a network-level database application that will store all pavement-related data, such as mix design, material production, PMS, ground penetrating radar (GPR), FWD, core, dynamic cone penetrometer (DCP), other laboratory, maintenance, and field test data, etc., for the entire ODOT roadway network. Using the stored pavement information, the total worth of pavement assets and their contributions to the economy can be quantified.

This proposed research study addresses the *"Economic and Community Vitality"* and *"Stewardship of Public Resources"* goals of the Oregon Transportation Plan (OTP). It also directly addresses the *"Process, material, or equipment improvements"*, *"Cost reductions or savings to construction, operations, or asset maintenance"*, and *"Innovative Technologies and Systems"* research focus areas of ODOT.

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

This proposed research study will produce an online GIS-based data processing, storage, and visualization system (integrated into ODOT's current TransGIS) that integrates all data related to the pavements' life cycle under one platform. Using the online database, a user can enter post-miles, traffic directions, and other required highway information (or alternatively coordinates for the location) to access all the data collected for this particular section since the initial construction. The developed online system will also have embedded data visualization tools that will allow users to evaluate the data before downloading. The developed data processing tool with the automated statistical analysis component will also point out the most important factors controlling pavement performance for the selected location. The developed GIS database will also have bridge locations, connectors, ramps, route boundaries, and other important features of the roadway. ODOT personnel will be trained on the use of the developed online database (for future data visualization, processing, and entry).

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.

Name	Title	Email	Phone
Timothy Earnest	Assist. Materials Engineer	Timothy.Earnest@odot.oregon.gov	(503) 986-3079
Sean Parker	QA Training Coordinator	Sean.P.PARKER@odot.oregon.gov	(503) 986-6631
John Coplantz	State Pavement Management Engineer	John.S.COPLANTZ@odot.oregon.gov	(503) 986-3119

5. Other comments:

REFERENCES:

1) Coplantz (2023) 2022 ODOT Pavement Condition Report. www.oregon.gov/odot/Construction/Documents/Pavement/2022_condition_report_maps.pdf

6. Corresponding Submitter's Contact Information: [1 individual]

Name:	Erdem Coleri
Title:	Associate Professor
Affiliation:	Oregon State University
Telephone:	(541) 737-0944
Email:	erdem.coleri@oregonstate.edu