

Research Stage 1 Problem Statement

PROPOSED TITLE: FIELD IMPLEMENTATION AND PILOT TESTING OF LOW-CARBON PAVEMENT TECHNOLOGIES TO SUPPORT OREGON'S SUSTAINABLE TRANSPORTATION GOALS

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

The FHWA Low-Carbon Transportation Materials (LCTM) program is expected to support the development of various innovations to reduce ODOT's greenhouse gas (GHG) emissions from construction material production. ODOT has been supporting research and innovation for reducing the carbon footprint of construction materials for the past several decades. Some of the major achievements that allowed significant reductions in cost and GHG emissions through various research projects were: i) increased recycled asphalt pavement (RAP) content for asphalt concrete materials, ii) improved pavement performance through performance-based specifications and balanced mix design (BMD), iii) improved service life by reducing delamination related premature failures, iv) quantifying the impact of roadway roughness on vehicle fuel economy and tire wear, and v) investigating the possibility and effectiveness of using renewable fuels for asphalt mixture production for GHG reduction. The funding from the LCTM grant will be used to advance the findings from past research studies and to conduct additional work focused on quantifying GHG emissions, developing and assessing Environmental Product Declarations (EPDs), and improving asphalt mixture production processes at plants to achieve lower emissions. Alternatives with reduced GHG emissions, such as Emulsified Asphalt Concrete (EAC), will also be investigated to identify methods for improving their long-term performance and making them an effective option for ODOT's paving operations.

Although the LCTM program supports the development and advancement of low-carbon strategies, it is not possible to directly implement the findings without pilot section constructions and field trials. The funding for field trials is crucial for ODOT to turn the findings from this critical federal program into products that can be directly implemented and used during construction and material production in Oregon. The unavailability of funding for pilot section construction created a major challenge. The direct implementation of laboratory-level findings in full-scale projects could create significant issues during construction, performance risks, and premature failures.

For all the reasons discussed above, pilot sections play a crucial role in verifying the findings from the laboratory component of research studies, enabling the rapid implementation of major innovations. The pilot sections would be less than a mile long constructions with new technologies, while the rest of the several miles would be constructed by following the current ODOT processes and materials. In this way, the benefits of the new low-carbon materials and processes can be directly quantified by comparing the performance of the pilot sections to their conventional counterparts (called as control). Using the performance data from the pilot sections, ODOT engineers will be able to directly verify the constructability, durability, and overall performance of the new low-carbon materials under Oregon's real-world traffic and climatic conditions. The experience gained from the pilot sections will also allow ODOT to refine specifications, perform practical construction and material production adjustments, and provide hands-on experience for contractors, none of which can be achieved in a laboratory setting.

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

The following research products will be developed in this proposed research study to confidently move the findings and low-carbon products of the LCTM program effort into implementation:

- 1) Design and construction guidelines for a seamless final implementation.
- 2) The quantified durability improvements created by using the low-carbon materials and strategies, based on automated pavement condition surveys (APCS) conducted on the pilot sections and their conventional counterparts (control).
- 3) The reduction in GHG emissions due to the use of low-carbon transportation materials will be quantified by life-cycle assessment and reported.
- 4) The change in material costs due to the use of low-carbon transportation materials will be quantified by conducting cost analyses and reported.
- 5) Revisions to the proposed low-carbon material properties and material production and construction practices based on the experiences from the material production and construction of pilot sections. The observed performance of the pilot sections will also help ODOT understand the required revisions to the low-carbon materials and processes.
- 6) Documentation of suggested practical adjustments for the final implementation.
- 7) Revised specifications and guidelines for the final implementation.
- 8) Training and implementation materials will be developed to achieve a smooth adoption of the new construction and material design and production practices.
- 9) A detailed roadmap for statewide deployment of the developed research products will also be provided.

3. (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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Timothy Earnest	Assist. Materials Engineer	Timothy.Earnest@odot.oregon.gov	(503) 986-3079
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4. Other comments:

5. State of Oregon Decision Making Lenses

State decision making lenses are a part of the state of Oregon's policy structure. State policy and federal policy are not always aligned. The state will prioritize research according to state policy, however ODOT may be required to skip prioritized proposals based on constraints placed on the use of federal funds. If

state funds are available ODOT will attempt to fund prioritized research that is deemed ineligible for federal funding.

Please complete the following three sections. Your answers to these questions will be applied on a programmatic basis to support agency decisions. Answering yes to the questions below is not required. Resolving a narrowly focused technical research problem may meet agency needs without answering yes to any of the following questions. The ODOT Research Section will seek a balanced portfolio some projects will answer yes to one of the three categories below (e.g. climate, equity, and/ or safety) and other projects in a different category.

We are looking for an overall program balance and no one project is expected to balance all categories. Generally, a research problem statement is expected to be able to answer yes with clear and verifiable information in only one of the three categories below, some projects may be able to answer yes in two or even three categories. Some projects (i.e. needs focused on specific elements of infrastructure design), may have no 'yes' answers but may still be a high value research need.

Climate

Oregon recognizes the climate crisis and makes systemic changes to reduce emissions caused by travel. To that end, we seek research that reduces carbon emissions from construction activities and materials, and from maintenance equipment and operations. Oregon envisions a transportation system that is resilient, this means a system that is durable in the face of seismic events and extreme weather to avoid negative impacts, withstand them or bounce back quickly to resume system function. We seek research that improves the ability of the transportation system to adapt or cope with more frequent and extreme weather events. This may include innovations in data and data sharing, construction materials and project design, communication, emergency planning and response, and more. Similarly, we seek research that avoids negative impacts on key habitats and ecosystems that can buffer or reduce damage to infrastructure and improve environmental conditions for wildlife and native vegetation. For definitions and details please review the equity vision, goals, and objectives of the [ODOT Strategic Action Plan](#) and [Oregon Transportation Plan](#).

5a. Will addressing the transportation issue identified as a need in Question 1 develop, or **validate methods for the estimation, measurement, or monitoring** of transportation generated greenhouse gases (GHG)?

☒ Yes

☐ No

☐ Unsure

5b. If climate or GHG is not the focus of this **transportation issue** identified in this problem statement, will the research apply a GHG analysis to transportation infrastructure, planning, operations, maintenance, or materials?

☒ Yes

☐ No

☐ Unsure

5c. Will addressing the **transportation issue** include development or testing of construction practices, methods, or materials to establish potential reductions in greenhouse gas emissions?

☒ Yes

☐ No

☐ Unsure

5d. Will solving the **transportation issue** in question 1 study or support the reduction of vehicle miles traveled and single occupancy vehicle travel or support transition to electric vehicles (or other types of zero emission vehicles) or low-carbon alternative fuels?

☐ Yes

☒ No

☐ Unsure

5e. Will the solving the **transportation issue** in question 1 lead to work that will support, measure, or monitor, transportation system resilience in response to expected climate events, effects, or natural disasters in general?

☐ Yes

☒ No

☐ Unsure

5f. Will solving the **transportation issue** in question 1 lead to work that may result in better environmental conditions for wildlife and native vegetation?

☐ Yes

☒ No

☐ Unsure

5g. If you answered yes to any of the climate questions above or can provide alternative details related to climate, please provide additional information:

Implementation of low-carbon materials for roadway construction is expected to reduce the carbon footprint and GHG emissions of ODOT directly. For this reason, this proposed research project will also directly address the objectives of HB4139, which has the intention to “reduce greenhouse gas (GHG) emissions from the materials and fuels used by the Department of Transportation”.

Equity

Equity can have many dimensions and impacts relating to communities and transportation. It is important that problem statement proposals clearly explain the equity dimensions or impacts being examined. Oregon commits to social equity in the OTP, specifically to *improve access to safe and affordable transportation for all, recognizing the unmet mobility needs of people who have been systemically excluded and underserved. Create an equitable and transparent engagement and communications decision-making structure that builds public trust.* We seek research that studies elements of this goal or applies analysis to specific transportation topics to ensure the resulting research recommendation is consistent with agency equity goals. For definitions and details please review the equity vision, goals, and objectives of the [ODOT Strategic Action Plan](#) and [Oregon Transportation Plan](#).

5h. Is the **transportation issue** identified as a need in Question 1 specifically focused on transportation equity?

☐ Yes

☒ No

☐ Unsure

5i. If the **transportation issue** is not focused on transportation equity, will the primary topic be assessed for equity benefits or impacts within the research project?

☐ Yes

☒ No

☐ Unsure

5j. Is the implementation of potential findings from this research likely to directly involve participation from an identified group that would benefit from an equitable process or outcome?

☐ Yes

☒ No

☐ Unsure

5k. Is the intended final product or information expected to support ODOT's equity efforts (Including but not limited to supporting one of the equity related objectives of the [ODOT's Strategic Action Plan](#) or [Oregon Transportation Plan](#)) ?

☐ Yes

☒ No

☐ Unsure

5l. If you answered yes to any of the equity questions above or can provide alternative details related to equity, please provide additional information:

Safety

Research outcomes may include interventions and countermeasures to prevent or reduce the frequency of crashes or other causes of transportation-related injury or death; or may include measures to reduce severity of injury (including prevention of death) after a crash or other injurious event. For definitions and details please review the equity vision, goals, and objectives of the [ODOT Strategic Action Plan](#), [Oregon Transportation Safety Action Plan](#) and [Oregon Transportation Plan](#).

5m. Will solving the **transportation issue** in question 1 support improving **safety culture** for either transportation workers or the traveling public?

☐ Yes

☒ No

☐ Unsure

5n. Will the solving the **transportation issue** support improving safety through **healthy and livable communities**?

☐ Yes

☒ No

☐ Unsure

5o. Will solving the **transportation issue** support improving safety through using **best available technologies**?

☐ Yes

☒ No

☐ Unsure

5p. Will solving the **transportation issue** support improving safety through **communication and collaboration**?

☐ Yes

☒ No

☐ Unsure

5q. Will solving the **transportation issue** support improving safety through **investing strategically**? 5r. If you answered yes to any of the safety questions above or can provide alternative details related to safety, please provide additional information:

6. Corresponding Submitter's Contact Information:

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7. ODOT Sponsor Contact Information (Required if Submitter is not an ODOT employee)

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This form is not a grant application or contract document. Please do not include proprietary information on this form. Once this form is received ODOT may revise and publish the problem statement. If elected, ODOT will assign investigator(s) of the department's choosing to conduct research.