

Research Stage 1 Problem Statement

PROPOSED TITLE: IMPROVING CALIBRATION ACCURACY OF IGNITION OVENS FOR OREGON AGGREGATES

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

It is essential to accurately determine the asphalt content and aggregate gradation of asphalt mixtures sampled during production. Actual gradation and binder content of the produced asphalt mixtures are measured by using a standard test procedure (AASHTO T 308) and a system called “Ignition Oven”. The system basically burns the asphalt binder around the aggregates, leaving the stripped aggregates. By measuring the weight of the specimen before and after burning, the binder content of the asphalt mixture can be determined. Sieve analysis is also conducted on the aggregates to determine whether ODOT’s gradation requirements from the original mix design (known as the job mix formula, JMF) are met. The accuracy of this measurement process is critical since the binder content and gradation of the mix directly control the long-term performance of the asphalt mixtures. The findings from this test also affect the contractor's pay via a percent within limits (PWL) approach, which has been used by ODOT.

Recent observations by ODOT have revealed significant inconsistencies in aggregate correction factors (needed to account for the expected loss of aggregate pieces at high ignition oven temperatures) and measured gradations that do not conform to the current calibration procedures outlined in AASHTO T 308. A comprehensive national research study ([NCHRP 9-56](#)) has shown that ignition oven type, operating temperatures, and aggregate mineralogy can cause significant bias in determined asphalt and aggregate correction factors. According to ODOT’s local experience, variability can also be a result of the aggregate type and the size of the aggregates in the mixture (coarse or fine gradations). All those potential sources of variability can result in measured asphalt content and gradation errors, creating issues in quality assurance (QA) procedures.

For the reasons outlined in the previous paragraph, the calibration process for ignition ovens needs to be researched and improved by considering Oregon’s specific local materials that are used for asphalt mix production. While national guidance is available through AASHTO specifications and NCHRP research studies, the recommendations from these national assessments do not fully capture the behavior of Pacific Northwest aggregates. Furthermore, the use of the same correction factors for asphalt mixes assessed using different oven brands and for different asphalt mix types may contribute to significant bias, particularly when the aggregates exhibit significant mass loss.

To address the issues outlined above, a local calibration and verification process for the ignition oven should be developed by using the aggregates and materials that are commonly used for roadway construction in Oregon. Through testing and evaluation, the impacts of ignition oven type, its settings, aggregate types, and sample characteristics, as well as their interactions, on the test’s precision and bias must be quantified.

This proposed research study will determine whether separate calibration procedures are required for coarse and fine gradations. The study will also provide recommendations for updating ODOT’s specifications and QA practices. The fundamental goal of the proposed research study is to achieve a high

level of consistency and accuracy in measuring the asphalt content and gradation of ODOT's asphalt mixtures without having any bias related to oven type, mixture constituents, or any other reasons related to the variability in local materials.

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

A clear revised framework for ignition oven measurements will be developed for ODOT by providing revisions to the current national standard method (AASHTO T 308). This revised process will improve the accuracy and precision of measurements across various laboratories with different operators, ovens, and other equipment. The potential outcomes of this proposed research study will be the following:

- 1) A standard calibration and verification process developed for ODOT's materials, potentially with specific requirements for coarse and fine gradations.
- 2) Knowledge of the main factors that control the results of the ignition oven measurement, such as oven type, temperature level, air flow, aggregate properties, etc.
- 3) A detailed process with limits for the acceptable variation of correction factors. The developed process will also include a required frequency and process for ignition oven cross-checks and recalibrations.
- 4) A step-by-step procedure with detailed instructions to follow when calibrating ignition ovens. This process is expected to help achieve statewide consistency in Oregon.

The potential deliverables of the research project would be:

- 1) Updated ODOT specifications and QA guidance documents.
- 2) Training and demonstration materials, including videos and documents describing the changes to the current processes, videos demonstrating the updated ignition oven measurement processes, charts for calibration schedule decision making, and summary documents describing all the proposed changes for a seamless implementation.
- 3) A detailed research report describing the research process and methods followed to update the national standard (AASHTO T 308) and the current processes.

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.

Name	Title	Email	Phone
Larry Ilg	State Quality Assurance Engineer	Larry.D.ILG@odot.oregon.gov	(503) 930-4880

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:

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:

The outcome of this proposed research project will make ODOT's PWL process more consistent and fair. In the current ODOT process, a significant percentage of contractor bonuses is determined by considering errors in asphalt content and aggregate gradations, which are generally due to issues in material production processes. Any bias or precision issues in the use of the ignition oven and the measurement of gradation and asphalt binder content can result in errors in the parameters used for PWL calculations. The elimination of errors in aggregate gradation and binder content measurements is expected to result in equitable pay adjustments for contractors by achieving outputs from the revised process that solely reflect the actual long-term performance of the asphalt mixture.

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)

Name:	Larry Ilg
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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 selected, ODOT will assign investigator(s) of the department's choosing to conduct research.