

Research Stage 1 Problem Statement

PROPOSED TITLE: Revisit Guidelines for Tidal Influence on Bridge Scour: A Numerical Modeling Investigation

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

Scour at coastal bridges exposed to waves, tides, storm surge, inlet dynamics, and other coastal processes is more complex than at typical river crossings. In Oregon, most coastal bridges are located in bays, and many are partially shielded from direct wave impact by jetties. As a result, tidal forcing is often the primary driver of scour at these sites. Oregon coast also experiences exceptionally high astronomical tides (king tides) that can intensify scour and threaten bridge safety. Current guidelines (HEC-18 and HEC-25) recommend applying inland river scour equations despite using velocities and depths from a design tidal event, but this practice may be problematic because tidally influenced flows are transient and reversing rather than steady. Therefore, research is needed to reassess and validate scour evaluation methods for tidal environments and to confirm or refine guidance for Oregon's coastal bridges.

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

The ODOT Hydraulics Manual (2014) relies on HEC-18 for scour estimation, and HEC-18 is closely linked to HEC-25 for coastal applications. As noted in Question 1, applying these guidelines to tidally influenced sites is uncertain and needs reassessment. This project will deliver a validated CFD modeling framework for tidal bridge scour, verified with targeted field measurements, physical models, and existing ODOT coastal scour data. The verified model will act as a digital twin to produce high-resolution hydraulic and sediment response datasets across representative tidal conditions. These results will be used to evaluate the applicability of HEC-18 equations to tidal environments and, if needed, to propose revised or new equations. Final products will include recommended updates to ODOT practice and the Hydraulics Manual, technical documentation with example calculations, and an accessible data archive.

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
Greg Wilson	Associate Professor	greg.wilson@oregonstate.edu	(541) 737-4915
Wesley Nickerman	Senior Bridge Hydraulic Engineer	Wesley.A.NICKERMAN@odot.oregon.gov	(541) 239-7068

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:

Coastal bridge piers may be overdesigned to account for uncertainties in current tidal scour guidelines. Reassessing and updating the guidance would reduce uncertainty and help avoid overly conservative designs, lowering material use, construction cost, and construction-related greenhouse gas emissions. The project will deliver validated methods and data to support resilience assessments of tidal bridge scour and to inform the selection and design of efficient countermeasures. Thereby enhancing the resilience of Oregon's coastal bridges to climate-driven hazards.

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:

Coastal structures represent a lifeline for communities that could be isolated as the result of scour related issues. The results of this project will support better asset management and design of new structures along the coast to support a resilient transportation network for coastal communities.

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:	Wesley Nickerman
Title:	Senior Bridge Hydraulic Engineer
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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.