

Research Stage 1 Problem Statement

PROPOSED TITLE: Vessel Collision Risk Assessment for ODOT Bridges Using AIS Maritime Shipping Data

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

Oregon has many navigable waterways including the Columbia River, Willamette River, Coos Bay, and Yaquina Bay, among others that enable commercial shipping. Many major highway bridges cross these waterways, including those that have substructures located near vessel navigation. Although vessel-bridge collisions (vessel collisions with stationary objects) do not occur often, the consequences are substantial including loss of life, major bridge damage, extended closures, and economic impacts. The recent Frances Scott Key Bridge collapse has brought vessel-bridge collision risks to national attention, especially as vessel sizes and volume increase and climate influences evolve. Many Oregon bridges were not designed for modern vessel collision, and ODOT lacks a statewide, data-driven understanding of exposure and risks. Modern Automatic Identification System (AIS) data provide high-resolution vessel movement records (speed, class, draft, position), but ODOT has no framework to integrate these data into bridge risk evaluations. Without this, ODOT cannot effectively prioritize which bridges might require detailed assessments or protective measures.

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

ODOT needs a process that can identify the bridges that are most vulnerable to vessel collision. This requires consolidating available shipping data (AIS data), analyzing vessel travel patterns, incorporating waterway environmental and climate influences, identifying bridges with heightened exposure, and establishing criteria for subsequent detailed structural evaluation of the outcomes of the most likely vessel collisions. A statewide screening process will increase safety, improve risk management, and facilitate capital planning.

Research Objective:

- Develop a data-driven screening framework using AIS shipping data to quantify vessel collision risks for ODOT bridges. Specific objectives include:
 - Acquire and filter AIS data (like what we have done previously for WIM data) and other maritime vessel records for Oregon waterways with bridge overcrossings.
 - Analyze vessel traffic patterns (frequency, vessel class, speed, seasonal behavior, navigation paths).
 - Map vessel transit trajectories relative to ODOT bridge substructure locations.
 - Develop risk indicators and exposure scoring methods.
 - Produce a preliminary statewide ranking of bridges based on collision exposure.
 - Recommend priorities and scope for subsequent detailed structural evaluation.

Products to Enable Research to be Implemented:

- Consolidated AIS and maritime vessel data archive for ODOT use.
- GIS-based vessel traffic and density maps for major Oregon waterways with ODOT bridges.

- Exposure index and bridge risk ranking methodology for ODOT bridges.
- Summary report demonstrating methods for ODOT bridges near navigable waterways with commercial vessel traffic.

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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Ray Bottenberg	State Bridge Engineer	Raymond.D.BOTTENBERG@odot.state.or.us	(503) 551-7934

4. Other comments:

This research will:

- Provide the first statewide, data-supported assessment of vessel allision exposure.
- Provide risk-based prioritization of bridges for further evaluation, planning, or protective measures.
- Enhance ODOT's ability to collaborate with USCG, ports, and river pilots on navigational safety issues.
- Position ODOT to comply with the latest FHWA/AASHTO vessel allision guidance.
- Create a foundation for allision modeling and mitigation planning.

Without this research, ODOT may underestimate exposure for vulnerable bridges, resulting in greater risk of allision and the resulting losses. AIS data are available to complete this research, but without the supporting analytical tools ODOT cannot leverage them for risk management.

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:

- For ODOT bridges, the consequences from allision would have dramatic environmental impacts and are directly related to transportation system resilience.

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:

- Quantifying the risks of vessel allision with bridges is directly related to safety and protection of the travelling public. It incorporates using the latest technologies, communicating risks, and collaborating with multiple partners.

6. Corresponding Submitter's Contact Information:

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

Name:	Ray Bottenberg, PE, SE
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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.