

# Research Stage 1 Problem Statement

**PROPOSED TITLE:** Evaluating Transportation Safety using Surrogate Safety Measures from Connected Vehicles

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

In 2022, Oregon recorded over 44,000 roadway crashes, with 41% occurring at intersections, according to the Oregon DOT's Crash Analysis and Reporting Unit. Intersections offer key opportunities for targeted safety improvements that can reduce crashes efficiently when supported by strong data. While crash analysis helps evaluate and refine system safety, using real crash data for new or existing designs is often impractical due to the long data collection periods, typically three or more years which are needed for statistical validity. Tools like the Highway Safety Manual (HSM) have advanced our ability to predict safety performance, but they depend on the availability of calibrated crash modification factors (CMFs) specific to the treatments and local conditions being studied.

Surrogate Safety Measures (SSMs), or leading indicators such as near-miss events, serve as proactive tools to assess safety. As they rely on observable interactions, SSMs can capture a broader range of safety concerns and identify risks not evident in traditional crash data. In the absence of sufficient crash records or calibrated CMFs, these measures offer a valuable approach to detect safety issues proactively and apply countermeasures to prevent fatalities and serious injuries from occurring, thus advancing Oregon's Transportation Safety Action Plan's goal. A current project SPR 888 is exploring the link between crashes and near miss events using field collected conflict/near miss data. There is significant cost associated with the data collection and the automated conflict/near miss analysis.

Recent developments in connected technology have made new datasets available based on ADAS (Advanced Driver Assistance Systems). Some make and models of newer vehicles (2018 and newer) alert drivers when a potential safety concern arises and this data is collected by OEMs (Original Equipment Manufacturers). This dataset identifies near miss instances using events like hard braking, G-force, accelerating, steering, roll, pitch, yaw, speed, make and model. By analyzing these event patterns, agencies can identify high-risk locations and behaviors before crashes occur, providing a valuable early-warning tool for improving roadway design and targeted safety interventions.

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

The availability of the new ADAS dataset which is being provided at no cost to the research team presents an opportunity to evaluate the surrogate safety metrics and explore how they correlate to- a) field observed near miss events collected as part of SPR 888 and b) crashes. This research will provide ODOT with immediate insight into driver behavior and roadway performance. By aligning these datasets, ODOT can better understand how early indicators of driver behavior relate to actual crash risk, helping refine predictive models and identify emerging safety concerns before they escalate into serious incidents.

If validated as useful, this high frequency connected-vehicle data will enhance ODOT's ability to evaluate existing and new safety countermeasures. This approach aligns closely with Oregon's Transportation Safety Action Plan goals by enabling a shift from reactive to proactive safety management, focusing resources on locations most at risk and continuously refining system-wide safety strategies through adaptive, data-driven decision-making.

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**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
Jiguang Zhao	State Traffic Safety Engineer	Jiguang.ZHAO@odot.oregon.gov	971-458-2649

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**4. Other comments:**

The research team currently has access to Compass IOT , a connected vehicle dataset that provides a timely opportunity for evaluation of the near miss metrics with those collected during SPR 888 as well as ODOT crash data.

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**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:

Although this project does not directly impact climate, it does so indirectly. By improving ODOT's ability to proactively detect risk and prevent crashes, the research also enhances system resilience, reducing the frequency and severity of incidents that disrupt mobility during extreme weather events.

## 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:

This project advances equity by enabling ODOT to identify safety risks more precisely, including in communities that have historically experienced higher crash rates but lower levels of investment. By using connected-vehicle surrogate safety data rather than relying solely on reported crashes, which often underrepresent vulnerable or underserved populations, ODOT can proactively target improvements where they are most needed. This data-driven approach supports more equitable allocation of resources and contributes to safer, more reliable transportation options for all Oregonians.

## 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:

Using surrogate safety measures derived from connected vehicle data offers a transformative approach to improving transportation safety by enabling proactive, data-driven decision-making. Instead of waiting for the availability of crash data, agencies can analyze near-miss indicators such as hard braking, rapid acceleration, or sudden steering events in near real time to identify hazardous locations and driving conditions. These surrogate measures act as early warning signals, revealing where roadway design, traffic control, or environmental factors contribute to elevated safety risks. When integrated with roadway and traffic data, they allow transportation agencies to prioritize safety improvements, test countermeasures, and monitor the effectiveness of interventions much faster than traditional crash-based methods. By shifting from a reactive to a preventive safety management model, connected vehicle data can empower agencies like ODOT to reduce serious injuries and fatalities while making smarter, faster, and more efficient infrastructure investments.

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## 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 selected, ODOT will assign investigator(s) of the department's choosing to conduct research.