Oregon Department of Transportation

**Research Stage 1 Problem Statement**

**Number 26-39 – "Addressing Rural and Urban Road Safety Disparities in Oregon: Analyzing Emergency Medical Services and Communication Challenges"**

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

Significant differences in crash outcomes exist between urban and rural areas in Oregon, with rural areas experiencing disproportionately higher fatal crash rates. For example, between 2018 and 2022 in Oregon, the fatality rate per 100K population in rural areas consistently exceeded urban rates, averaging 8.76 in urban areas and 21.91 in rural areas—nearly 2.5 times higher over the last five years (ODOT Crash Data and Oregon Communities Reports). While factors such as higher speeds, unbelted occupants, and outdated roadway designs have been explored to understand the elevated fatality rates, less attention has been given to systemic challenges like delayed Emergency Medical Services (EMS) response times, cell coverage gaps, and less access to higher-level trauma centers. These factors might play a crucial role in worsening the crash outcome, thus leaving rural communities at a disadvantage compared to urban areas. To that extent, this research will adopt a proactive, system-level framework aligned with the Safe System Approach (SSA) to address these rural crash risks. By conducting a detailed spatio-temporal analysis, the study will uncover patterns and disparities, focusing on identifying high-risk zones that combine crash-prone areas with these systemic challenges. The goal is to pinpoint areas with the greatest safety risks, including locations where first responders consistently arrive late due to poor access, communication barriers, or long travel distances. By identifying these critical zones, the research will provide actionable recommendations, such as suggesting safety improvements, improving communication infrastructure, optimizing agency support and enhancing emergency response strategies to improve safety outcomes statewide, particularly in the underserved regions.

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

The final product of this research will be a data-driven tool designed to improve EMS response efficiency and enhance crash outcomes in Oregon. This tool will integrate data on EMS response times, cell coverage gaps, access to trauma centers, distances to medical facilities, roadway infrastructure, environmental factors, and real-time traffic information to identify high-risk zones with delayed EMS responses, poor cell coverage, and significant crash risks.

Using this tool, we will evaluate the effectiveness of various interventions, such as adding visible signage (e.g., emergency pullout signs or location markers) to improve crash reporting accuracy or enhancing roadway infrastructure to facilitate smoother EMS access in critical areas. The tool will also enable an assessment of strategies to address cell phone coverage gaps, such as potential public-private collaboration with telecom providers or the installation of emergency call poles in areas with persistent connectivity issues. Additionally, it will allow a comprehensive understanding of how to best allocate EMS resources under varying conditions to maximize efficiency and save lives. We will be able to evaluate strategies for pre-positioning or dynamic positioning of EMS vehicles to enhance their availability in areas with high demand or elevated crash risk during specific times, such as weekends, holidays, or severe

weather events. By testing scenarios like deploying EMS vehicles closer to crash-prone rural corridors or near regions with limited cell coverage, the tool will offer insights into how different strategies impact response times and crash outcomes. For example, in areas with frequent delays, the tool can simulate the effect of positioning EMS vehicles at intermediate points between existing stations and high-risk zones, or reallocating resources dynamically as demand patterns shift throughout the day. By simulating these scenarios, the tool can identify the most effective solutions for improving emergency response efficiency and reduce the severity and consequences of crashes. Based on the findings, ODOT can collaborate with EMS agencies to implement these strategies, ensuring faster response times and timely access to necessary care based on real-time or predicted demand patterns.

Finally, to complement the data-driven analysis, the team will also engage with rural EMS experts through focus groups or interviews to gain valuable insights into field-level challenges and potential solutions. These discussions will address two key aspects: 1) whether the initial quantitative findings align with their in-field experience, and 2) what solutions they would propose to address some of the validated problems. This approach ensures that the research incorporates practical perspectives, leading to actionable and field-informed recommendations. The findings from these engagements will be incorporated into the final deliverables, providing a comprehensive set of recommendations that address both systemic and operational challenges to improve emergency response and safety outcomes in rural Oregon.

**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 |
|---|---|---|---|
| Christi McDaniel-Wilson | ODOT State Traffic Safety Engineer | Christina.A.MCDANIEL-WILSON@odot.oregon.gov | 503-986-3573 |
| Jiguang Zhao | ODOT Traffic Safety Engineer | Jiguang.ZHAO@odot.oregon.gov | |

**4.** Decision making lenses

**Climate**

4f. 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 gasses (GHG)?

☐Yes ☒No ☐Unsure

4g. 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

4h. Will the 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

4i. Will the 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

4j. Will the solving the **transportation issue** in question 1 lead to work that will support, measure, monitor, transportation system resilience in response to expected climate events, effects, or natural disasters in general?

☐Yes ☒No ☐Unsure

4k. Will the 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

4l. If you answered yes to any of the climate questions above or can provide alternative details related to climate, please provide additional information:

**Equity**

4a Is the **transportation issue** identified as a need in Question 1 specifically focused on transportation equity?

☒Yes ☐No ☐Unsure

4b 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

4c 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

4d 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

4e If you answered yes to any of the equity questions above or can provide alternative details related to equity, please provide additional information:

This research aims to investigate whether factors such as EMS response times, access to trauma centers, and cell coverage gaps are contributing to the disproportionately higher fatality rates in rural areas compared to urban areas. By analyzing these critical elements, the project seeks to uncover patterns and systemic challenges that may exacerbate crash outcomes in underserved regions.

The primary focus of this research is on safety, aiming to improve emergency response efficiency and reduce fatalities. However, it also addresses equity by identifying disparities in emergency services that could contribute to uneven safety outcomes. Through a detailed spatio-temporal analysis, the study will

pinpoint zones with delayed EMS responses and poor cell coverage, targeting these areas for prioritized interventions. Based on the findings, this study will provide actionable recommendations to ensure that all communities have fair and equitable access to life-saving services.

**Safety**

4m. Will solving the **transportation issue** in question 1 support improving **safety culture** for either transportation workers or the traveling public?

☐Yes ☒No ☐Unsure

4n. Will the solving the **transportation issue** support improving safety through **healthy and livable communities**?

☒Yes ☐No ☐Unsure

4o. Will solving the **transportation issue** support improving safety through using **best available technologies**?

☐Yes ☐No ☒Unsure

4p. Will solving the **transportation issue** support improving safety through **communication and collaboration**?

☐Yes ☐No ☒Unsure

4q. Will the solving the **transportation issue** support improving safety through **investing strategically**?

☒Yes ☐No ☐Unsure

4r. If you answered yes to any of the safety questions above or can provide alternative details related to safety, please provide additional information:

This research is closely aligned with ODOT's safety goals by addressing factors that may contribute to delays in emergency response times and higher fatality rates in rural areas. The spatial-temporal analysis will help uncover high-delay zones, understand variations in EMS response across time and locations, and assess whether gaps in communication or infrastructure contribute to increased fatality risks. The project will use this information to develop actionable recommendations, such as improving signage, enhancing communication infrastructure or optimizing agency support. These interventions will help reduce delays, improve emergency response efficiency, and ultimately save lives, particularly in high-risk rural areas. By focusing on proactive and data-driven solutions, this research supports the principles of the Safe System Approach, which emphasizes anticipating and addressing risks to reduce crash severity and prevent fatalities. This alignment ensures that the project contributes meaningfully to ODOT's broader commitment to safety and system-wide resilience.

**5.** Other comments:

The scope of this research is to understand the disparities in crash outcomes between urban and rural areas by digging deeper into factors beyond traditional roadway and traffic elements. The project will include the following key tasks:

**Data Collection and Integration**: Collect and integrate data from EMS response records, cell coverage maps, medical facility and trauma center locations and accessibility, crash data, environmental factors, roadway characteristics and real time traffic data.

**Spatio-Temporal Analysis**: Conduct a detailed spatial and temporal analysis to identify zones with delayed EMS responses, poor cell coverage, and limited access to medical facilities.

**Tool Development**: Develop a user-friendly, data-driven tool to guide decision-making by ODOT and EMS agencies, helping to allocate resources more effectively and reduce emergency response delays.

**Scenario Evaluation**: Simulate various scenarios to evaluate the effectiveness of interventions such as ambulance prepositioning, improved signage, and enhanced communication infrastructure. These simulations will assess the potential to minimize EMS response delays and improve crash reporting accuracy, particularly in areas with significant cell coverage gaps or extended distances to medical facilities.

**Engagement with EMS Experts**: To complement the quantitative analysis, the team will engage with rural EMS experts through focus groups or interviews. These discussions will provide valuable field-level insights into challenges and potential solutions. Specifically, the focus groups will address whether quantitative findings align with field experiences (a process called member checking) and gather proposed solutions from EMS professionals.

**Recommendations**: Provide actionable recommendations based on the analysis, including strategies to improve EMS response efficiency, address identified gaps, and enhance safety outcomes in rural areas. These insights will ensure that the research directly informs practical interventions and policy decisions.

**6.** Corresponding Submitter's Contact Information:


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