Research Stage 1 Problem Statement

Proposed Title: Data-Driven Safety: Recalibrating Oregon's SPFs and Establishing a Guideline for Ongoing Updates.

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

Oregon currently uses Safety Performance Functions (SPFs) that were calibrated using crash data from more than a decade ago. Since then, roadway designs, traffic patterns, and crash reporting practices have changed significantly, which means the older calibration factors may no longer reflect current conditions. Relying on outdated factors can lead to inaccurate crash predictions and may affect how safety projects are prioritized and funded. In addition, there's currently no clear process or guideline within ODOT for when and how these SPFs should be updated. To address this, this research will assess the continued validity of Oregon's existing SPFs and determine whether an update is necessary. It will also evaluate whether more recent crash prediction methods including advanced statistical approaches offer better performance than the default HSM models, while still fitting within ODOT's current workflows. If needed, the study will recommend updated calibration factors and develop clear guidance to help ODOT determine when future updates are warranted, including criteria to distinguish between minor adjustments and more comprehensive revisions. Framed within the Safe System approach, this work will explore moving beyond traditional HSM assumptions to ensure that Oregon's safety analysis tools remain accurate, modern, and aligned with the state's evolving transportation system.

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

This research will produce the following key deliverables to enable implementation:

- **Evaluation Report:** An assessment of the accuracy and relevance of Oregon's current calibration factors for Highway Safety Manual (HSM) predictive methods, including a determination of whether updates are necessary. The report will also evaluate the performance of alternative model forms compared to default HSM SPFs. If updates are warranted, revised calibration factors and SPFs will be developed for applicable facility types.
- **User-Friendly Tool or Template:** A decision-support tool (click here to view the prototype*) to help ODOT staff assess SPF performance over time and trigger update evaluations when needed.
- **Guidance Document:** A practical, implementation-ready guideline that outlines:
    - When updates to SPFs and calibration factors are necessary;
    - How to determine whether an update should be considered a minor revision or a major recalibration;
    - What data and analytical steps are required for each type of update;
    - How to repeat or institutionalize the process over time.
    - If desired, supporting modeling scripts and example workflows to help ODOT update the models in the future as new data becomes available,

All outputs will be designed for direct use by ODOT engineers and planners, with compatibility for integration into existing safety analysis workflows and documentation.

**Please note: This is a prototype version of the tool. The final version will be developed based on ODOT's feedback and requirements. Further, the final prototype can also be delivered as a spreadsheet-based tool or another format that best fits ODOT's existing analysis workflows. If needed, the tool can also be enhanced by adding another interactive tab where users can select facility types and view corresponding locations on a map for better visualization and decision-making support.*

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

4. Other comments:

ODOT maintains high-quality crash, traffic volume (AADT), and roadway inventory data that will serve as the foundation for this research. Using these existing datasets, the study will focus on validating the predictive performance of current calibration factors across various facility types, while exploring newer, more flexible modeling approaches. In particular, the research will test lognormal models and fractional split models—two advanced methodologies identified in national efforts like NCHRP 17-85 and NCHRP 22-49 for inclusion in the forthcoming Highway Safety Manual (2nd Edition). These models offer improved estimation for skewed crash data and allow better disaggregation of crash severity, which is increasingly important for safety programs targeting reductions in fatalities and serious injuries. Further, traditional HSM models rely on a fixed set of input variables, but recent studies have shown that additional factors such as vehicle mix, speed can significantly improve prediction accuracy. Since ODOT already collects variables like truck percentage in its roadway inventory, this research provides a timely opportunity to evaluate their value in enhanced models and determine whether including them leads to more robust and locally sensitive crash prediction tools.

In addition to evaluating model performance, the research will explore how these advanced methods can be integrated into ODOT's current safety analysis tools—such as spreadsheet-based calculators or future AASHTOWare Safety modules without increasing workflow complexity. A key outcome will be the development of a decision-support framework that helps staff identify when updates are necessary, based on criteria like observed prediction bias, significant shifts in crash trends, or procedural changes such as crash reporting thresholds. The framework will provide clear distinctions between routine updates and major recalibrations, along with data and analytical requirements for each.

The study will also identify facility types that currently lack Oregon-calibrated SPF such as freeways, interchanges, or complex urban corridors—and assess the feasibility of expanding local SPF coverage. This will reduce reliance on national default models that may not accurately represent Oregon's unique roadway and safety conditions. By delivering modern, Oregon-specific modeling tools and repeatable

update processes, this research will strengthen ODOT's analytical foundation for prioritizing safety investments. It also supports compliance with evolving federal safety performance requirements under programs like the Highway Safety Improvement Program (HSIP) and advances Oregon's commitment to the Safe System approach.

A related consideration is whether the updated SPF process should connect with ODOT's Safety Investigation Manual worksheet. The worksheet was revised a few years ago, and while its current use varies, it remains part of the safety assessment toolkit. As part of the study, we can review the worksheet to see whether simple alignments such as referencing updated calibration factors or adding light diagnostic checks would be helpful. Any recommendations would be modest and included only if ODOT staff see clear value.

The research will include the following proposed tasks:

- Inventory and review of current SPF applications within ODOT
- Data preparation and integration from internal crashes and roadway databases
- Diagnostic analysis of model performance and bias
- Development and comparison of alternative model forms (including lognormal and fractional split)
- If warranted, generation of revised calibration factors
- Design of a scalable update guideline and implementation workflow
- Development of a lightweight monitoring tool for periodic model assessment

These tasks will directly support ODOT's ability to maintain accurate, up-to-date crash prediction tools aligned with modern safety analysis practices, without requiring a complete overhaul of existing systems.

5. State of Oregon Decision Making Lenses

Climate

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

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:

Although this research does not explicitly focus on transportation equity, its outcomes can support ODOT's broader equity objectives by improving the accuracy of Safety Performance Functions (SPFs) used in project evaluation and funding decisions. Better crash prediction models aligned with current Oregon conditions can lead to more equitable safety investments, especially in communities historically underserved or misrepresented by outdated or non-local data.

The proposed update guideline will help ensure that these tools remain valid over time, reducing the risk of bias that could unintentionally disadvantage lower-income, or rural communities. While equity is not

the central research focus, the work aligns with ODOT's Strategic Action Plan by promoting fairer, data-informed decision-making across the transportation system.

Safety

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:

This research is directly focused on improving transportation safety in Oregon by updating and validating the calibration factors used with Safety Performance Functions (SPFs) under the Highway Safety Manual (HSM). These SPFs are essential tools for estimating crash frequency and identifying cost-effective countermeasures across a range of facility types. By recalibrating these models with recent Oregon crash and exposure data, the project enhances ODOT's ability to make data-driven safety decisions, resulting in better-targeted investments that reduce the frequency and severity of crashes.

As agencies transition toward a Safe System approach which emphasizes proactive, system-wide efforts to prevent fatal and serious injury crashes, there remains a strong need for reliable tools that help identify potential safety issues before crashes occur. Updated and well-calibrated SPFs enable this by providing data-driven estimates of crash risk, even in locations with limited historical crash data. Without such tools, efforts to implement proactive safety strategies may fall short or misallocate resources.

The project also promotes safety through the adoption of enhanced modeling techniques that improve predictive accuracy without requiring major workflow changes. Finally, by developing a clear and repeatable guideline for when and how to update SPFs and calibration factors, the research strengthens cross-unit collaboration within ODOT and ensures strategic, long-term safety planning that benefits communities across Oregon.

6. Corresponding Submitter's Contact Information:

Name:	Tanmoy Bhowmik
Title:	Assistant Professor
Affiliation:	Portland State University
Telephone:	503-725-7096
Email:	tbhowmik@pdx.edu

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

Name:	Greg P. Griffin
Title:	Principal Research Analyst
Crew Number:	
Telephone:	(503) 871-0411
Email:	Greg.GRIFFIN@odot.oregon.gov

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.