

# SPR RESEARCH PROGRAM

## SECOND-STAGE PROPOSAL SUMMARY

### PROBLEM NUMBER AND TITLE

**26-09:** Revised Load Rating Practices and Best Management Practices to Support Truck Platooning Across Bridges in Oregon .

### PROBLEM SUMMARY

Truck platooning is currently allowed in the state without restriction. Prior research indicates that heavy trucks travelling closely together can potentially exceed permissible serviceability and strength criteria of bridges of certain configurations. To prevent potential reduction in the lifespan of aging bridges, this research seeks to develop practical tools to accurately determine bridges where truck platooning is feasible based on truck platooning characteristics and bridge configuration.

### ODOT OBJECTIVES

Develop and benchmark an analysis tool to determine if truck platooning practices approach or exceed load rating limits of bridges, and also identify existing bridges in ODOT's highway network that are susceptible to accelerated lifespan reduction if subjected to truck platooning.

### BENEFITS

This research will provide ODOT with evidence-based means to engage effectively with freight mobility partners to advance ODOT's strategic plan and to define regulatory policy. This study directly enhances the structural safety and durability of bridges and promotes fiscal responsibility through improved decision-making on rule-setting, maintenance planning, and asset management.

### SCHEDULE, BUDGET AND AGENCY SUPPORT

**Estimated Project Length:** 24 months.

**Estimated Project Budget:** \$195,000

**ODOT Support:**

Jonathan Rooper - Senior Load Rating Engineer

[jonathan.w.rooper@odot.oregon.gov](mailto:jonathan.w.rooper@odot.oregon.gov) 503-302-6188

Ray Bottenberg – State Bridge Engineer

[Raymond.d.bottenberg@odot.oregon.gov](mailto:Raymond.d.bottenberg@odot.oregon.gov) 503-551-7934

### FOR MORE INFORMATION

For additional detail, please see the complete STAGE 2 RESEARCH PROBLEM STATEMENT online at:

<https://www.oregon.gov/odot/Programs/ResearchDocuments/26-09.pdf>

# SPR RESEARCH PROGRAM

## SECOND-STAGE PROBLEM STATEMENT

### FY 2026

#### PROBLEM NUMBER AND TITLE

**26-09:** Revised Load Rating Practices and Best Management Practices to Support Truck Platooning Across Bridges in Oregon

#### RESEARCH PROBLEM STATEMENT

To support the documented fuel efficiency gained by truck platooning, Oregon HB 4059 Section 40 permits truck platooning without requiring permitting or notification to ODOT. Compared to the design vehicle and truck configurations used for load ratings, permitting heavy trucks to travel close together is known to potentially exceed permissible serviceability and strength criteria. Depending on the combination of axle spacing, truck spacing, number of trucks, and bridge configuration, there is the potential that unregulated truck platooning could reduce the lifespan of Oregon's aging bridge inventory. At the national level, research has primarily focused on new bridge design and superstructure evaluation, with limited consideration for superstructure load rating implications considering AASHTO legal loads. Additional work is needed to understand impacts to the substructure, and to provide practical tools for quickly evaluating existing bridges on interstates and highways where truck platooning is feasible.

#### RESEARCH OBJECTIVES

The goal of the proposed research is to provide ODOT with the necessary information to set policy and regulatory recommendations for freight mobility that will guide management practices of Oregon's aging bridge infrastructure on interstates and highways where truck platooning is feasible. Specific research objectives are:

1. **Examine and Revise Load Rating Procedures:** Conduct a comprehensive analysis of bridges representative of Oregon's inventory via a data driven parametric study to characterize platoon configurations (axle-weights, and headspacings) for load rating purposes and to recommend suitable live load factors for the characterized platoon configurations.
2. **Enhance Asset Management and Decision-making:** Identify existing bridges shown to be vulnerable to truck platooning and document appropriate mitigation measures including increasing headspacings in advance of deficient bridges, implanting weight restrictions, revising inspection schedules, and considering strengthening options.
3. **Support Fiscal Responsibility:** Support mindful allocation of limited state transportation funding to maintain bridge infrastructure.
4. **Support Safe and Reliable Freight Movement:** Investigate the structural safety of Oregon's bridge transportation infrastructure, which is of concern to the traveling public.

#### WORK TASKS, COST ESTIMATE AND DURATION

Using the previously funded ODOT research project (SPR-848) as a starting point, expected project tasks for the proposed research are as follows:

**Task 1: Comprehensive Literature Review [2 months]:** The research team will conduct a literature review to better establish the extent of previous or parallel research on the impacts of truck platooning on existing bridge infrastructure that has occurred since completion of SPR-848.

**Task 2: Superstructure Loading Evaluation [3 months]:** The objective of this task is to review and revise the existing parametric dataset produced using OpenSees as part of SPR-848 to capture additional information gathered during Task 1. In coordination with the TAC, revisions may include consideration of additional bridge span lengths, rating vehicles, and platoon headspacings. The evaluation will include development of lookup

charts or tables for network-level screening of bridges on the freight mobility network. Specifically, the evaluation tool will relate truck platoon configurations, headspacings, and span length to adjust factored internal forces.

**Task 3: Substructure Loading Evaluation [6 months]:** Building off the superstructure load effect dataset produced in Task 2 and a review of substructure types and configurations found in Oregon, OpenSees will be used to assess load effects from truck platoons to the substructure. Based on recommendation from the TAC, specific elements to consider for evaluation may include crossbeams, pile caps, pier caps, and floorbeams. Substructure configurations including material type (concrete and steel), number of supporting elements (columns/piles), skew, and other appropriate parameters will be considered based on prevalence throughout Oregon. In addition to vertical loads from the superstructure, multiple presence will be considered based on TAC input. Multiple presence analysis will include a parametric analysis of multiple platoons, platoon with standard truck configurations with both correlated and uncorrelated gross vehicle weights.

**Task 4: Live Load Factor Calibration [6 months]:** As truck platooning is a new practice, there is a lack of WIM data available to develop reliability index based live load rating factors. Using the procedure in NCHRP Report 454 as a guide, the research team will aim to back-calculate the maximum platooning frequency associated with the current live load factor used for load rating in Oregon such that the current live load factor can still be used without compromising structural reliability. Through parametric analysis, a regression expression could be developed between the required live load factor and the platooning frequency. Using this relationship, future WIM data could be periodically reviewed for actual platooning frequencies to devise/revise headspacing requirements. When deemed necessary, the regression expression can also be leveraged to quickly re-rate critical bridges. At a minimum, concrete superstructures and crossbeams for element geometries typically found in Oregon will be considered. Additional elements, structure types, and multiple presence will be considered based on TAC recommendation.

**Task 5: Rapid Freight Mobility Route Bridge Assessment [4 months]:**

Based on Tasks 1-4 results, all bridges within the range of parameters of the parametric study found on major freight routes will be evaluated for overload due to truck platooning. The quick calibration procedure will be further validated by comparing the revised rating factor with calibrated load factors and the rating factor obtained from re-rating under critical truck platooning configurations. The team will work with TAC to secure access to the most recent load rating documents of bridges under consideration. After validation, bridges identified to be of concern will then be evaluated for remediation options, including strengthening or increase of truck platoon headspacings as required. The effect of remediation options on rating factors will be compared.

**Task 6: Final Analysis, Recommendations, and Reporting [3 months]:** The final task consolidates all research findings, analyses, and recommendations into a comprehensive report. The report will be prepared for review and acceptance by the project's technical advisory committee, with a summary "Research Note" submitted to ODOT Research for publication. Analysis tools and datasets developed as part of the project will be provided to ODOT in a digital format.

**Key Deliverables:** The research will produce the following strategic deliverables: A foundational literature review; an analysis tool for rapidly revising rating factors at a system wide level; and a final report summarizing recommendations for revised load rating practices for both bridge super- and substructures and providing recommendations for best management practices for existing bridges shown to be deficient for truck platooning (either strengthening or increase of headspacings in advance of the deficient bridge).

**Estimated Project Length:** 24 months.

**Estimated Project Budget:** \$195,000.

## IMPLEMENTATION

Implementation of these results within ODOT may include:

- Policy for truck platoon regulation
- New design live load requirements for bridge strengthening projects
- Revised inspection schedules for critical bridges
- Recommendations for live load factors for future load ratings
- Aiding the development of adaptable truck platoon software that avoids bridge restrictions

## POTENTIAL BENEFITS

Assessing Oregon's bridge inventory for potential overload due to unregulated truck platooning will position ODOT as an early adopter of autonomous truck platooning in the United States at a system wide level. Furthermore, the research will provide ODOT with evidence-based means to engage effectively with freight mobility partners to advance ODOT's strategic plan and to define regulatory policy. This study directly enhances the structural safety and durability of bridges, and promotes fiscal responsibility through improved decision-making on rule-setting, maintenance planning, and asset management.

## PEOPLE

### ***ODOT champion(s):***

Jon Rooper    Senior Load Rating Engineer    [jonathan.w.rooper@odot.oregon.gov](mailto:jonathan.w.rooper@odot.oregon.gov) 503-302-6188

### ***Problem Statement Contributors:***

Thomas Schumacher	Professor	PSU	<a href="mailto:thomas.schumacher@pdx.edu">thomas.schumacher@pdx.edu</a>	503-725-4199
David Yang	Assistant Professor	PSU	<a href="mailto:david.yang@pdx.edu">david.yang@pdx.edu</a>	503-725-2870
Mary Ann Triska	PhD Student/Senior Instructor I	PSU	<a href="mailto:mtriska@pdx.edu">mtriska@pdx.edu</a>	503-725-2354

## REFERENCES

The following references were used in the development of this proposal:

- Sayed, S. M., Sunna, H. N., and Moore, P. R. (2020). "Truck platooning impact on bridge preservation." *Journal of Performance of Constructed Facilities*, 34(3).
- Steelman, J. S., Puckett, J. A., Linzell, D. G., and Yang, D. (2021). *Truck platooning effects on girder bridges*, rep., SPR-1(20)M030. Lincoln, NE.: NDOT Research
- Wassef, W. (2021). *Truck platooning impacts on bridges: phase I – structural safety*, rep., Federal Highway Administration, Washington, D.C.
- Moses F. (2001). *NCHRP Report 454: Calibration of Load factors for LRFR Bridge Evaluation*. Washington, DC: National Academy Press.

# STAFF REVIEW PAGE

## LITERATURE CHECK

### TRID&RIP

☒ A review of TRID & RIP databases found no existing research that answers the research question

## ODOT DECISION LENSES

### ***Climate:***

Improvements in the methods used to assess load impact and load rating of bridges are intended to prevent structural damage due to excessive load. A reduction of damage quantity or frequency results in a reduction of repairs needed by these structures. Logically, a reduction of the number of repairs needed will result in a reduction of the carbon footprint of servicing this type of infrastructure by reducing the amount of material used for repairs and its associated transportation impacts.

### ***Equity:***

None

### ***Safety:***

To take full advantage of the fuel economy gained via truck platooning using the latest autonomous vehicle technologies, ODOT must also assess the safety implications for the traveling public as related to the potential overload of Oregon's bridge inventory due to unregulated truck platooning in two ways. First, thoughtfully considering safe operating headspacings of truck platoons involves how passenger vehicles interact with truck platoons. If trucks are spaced optimally from a load rating perspective, passenger vehicles may enter the truck platoon unsafely. While outside the scope of this study, other studies have considered safety in this way. Second, this study is looking directly at the structural safety of bridge transportation infrastructure which is of concern to the traveling public.

## TECHNOLOGY & DATA ASSESSMENT

☒ No Identified T&D output

☒ At the end of this project, the implementing unit(s) within ODOT will need to coordinate the adoption of new technology or data in order to realize the full potential of this research.

## CROSS-AGENCY IMPACTS

- List ODOT partners or impacted units: **ODOT Bridge Engineering**
- Identify any issues of concern raised by an ODOT partners. Note expected mitigation that addresses these concerns: **None**