

SPR RESEARCH PROGRAM

SECOND-STAGE PROPOSAL SUMMARY

PROBLEM NUMBER AND TITLE

24-14: Driver-Yielding Behavior of an Activated Blank-Out Sign Compared to the Static OR10-15 Sign to Improve Compliance and Pedestrian Safety

PROBLEM SUMMARY

At signalized intersections, sign OR10-15 (MUTCD R10-15) Turning Vehicles Stop for Pedestrians is an optional sign to alert turning vehicles of a possible obscured pedestrian. This sign has also been installed at locations with low right or left turning yielding compliance to pedestrians. ODOT has installed activated blank out versions of OR10-15 but lack guideline to select static or activated OR10-15 signs at complicated intersections.



OR10-15: Static vs. Activated Blank Out

Research is proposed to document and identify the impact to driver yielding behavior, right turning or left turning, with the presence of the static OR10-15 sign compared to an activated blank-out sign for both compliance and pedestrian safety. Both sign

conditions would be compared to a base condition of no sign present. Research proposed would also consider if there were a quantitative difference in motorists yielding rate if 2 or more simultaneous conflict decisions are present (i.e., oncoming traffic, pedestrian, cyclists) versus only just the pedestrian crosswalk. Identify other conditions (e.g., illumination, turning volumes, AADT, intersection locations (such as near a school)) that increase crash risk and lower yielding compliance rates.

ODOT OBJECTIVES

This research proposal addresses ODOT's Mission to Safety, Excellence through innovation and expertise, and Unity by uniting the safety, bike/ped program, maintenance, and local jurisdictions working together towards a common goal. This research proposal directly addresses the Strategic Action Plan (SAP) Modern Transportation System Priority safety goals. The use of this sign is to prevent fatalities or serious injuries involving pedestrians and turning motorists. This proposal specifically supports Strategic Action Plan's Outcomes 5 and 8 related to improved access to active and public transportation, and implementation of transformative technologies.

BENEFITS

This project will be developed to produce a set of evidence-based recommendations for the particular installation of the OR10-15 sign. This research would assist Regions to determine if the extra cost and maintenance of the activated blank out sign would be justified in that it significantly improves driver compliance versus a static sign.

SCHEDULE, BUDGET AND AGENCY SUPPORT

Estimated Project Length: 24 months.

Estimated Project Budget: \$160,000

ODOT Support: Angela Kargel, State Traffic Services Engineer and Unit Manager; Scott Cramer, State Signals Engineer; Christi McDaniel-Wilson, State Traffic Safety Engineer; Marie Kennedy, State Sign Engineer

FOR MORE INFORMATION

For additional detail, please see the complete STAGE 2 RESEARCH PROBLEM STATEMENT online at: <https://www.oregon.gov/odot/Programs/ResearchDocuments/24-14.pdf>

SPR RESEARCH PROGRAM

SECOND-STAGE PROBLEM STATEMENT

FY 2024

PROBLEM NUMBER AND TITLE

24-14: Driver-Yielding Behavior of an Activated Blank-Out Sign Compared to the Static OR10-15 Sign to Improve Compliance and Pedestrian Safety

RESEARCH PROBLEM STATEMENT

At signalized intersections, sign OR10-15 (MUTCD R10-15) Turning Vehicles Stop for Pedestrians is an optional sign to alert turning vehicles of a possible obscured pedestrian. This sign has also been installed at locations with low right or left turning yielding compliance to pedestrians. ODOT has installed activated blank out versions of OR10-15 but lack guideline to select static or activated OR10-15 signs at complicated intersections.



Passive Static OR10-15-Activated Blank Out OR10-15

Of the nearly 9,000 pedestrian crashes that occurred between 2007 and 2017 50% of these crashes were associated with left-turning vehicle movements and another 25% right-turning movements while the pedestrian was in the crosswalk (NCHRP 20-44(13), 2020). Oregon follows a similar trend with roughly 50% of all pedestrian crashes occurring as a result of drivers not yielding the right of way, 33% of which occurred within intersections while the vehicle was making either left or right hand turns between 2018 to 2020 (ODOT 2018-20). As these pedestrian crashes and fatalities are on the rise in Oregon, agencies are considering how to implement existing tools to mitigate these incidents. While there are existing static yield signs, OR10-15 (MUTCD R10-15), that indicate to the driver to yield for pedestrians at intersections, these signs appear to receive limited driver adherence. Agencies are turning to innovative technologies to display the same message in an active manner (versus passively) to bring attention to active pedestrian risks.

Existing active signs, or activated blank out signs, come in an array of configurations and can duplicate existing MUTCD signs such as the R10-15. Vendors include SunriseSESA & SWARCO|McCain that both offer Full Matrix Blank Out Signs that can be programmed to match the proposed R10-15 or other MUTCD compliant signs (128 possible MUTCD symbols preloaded) thus providing an opportunity to test both the left and right turn movements and even the ability to replace the pedestrian with a bicyclist. The advantage of this device is its active capacity; it will illuminate only in the presence of pedestrians attempting to cross the roadway segment, giving drivers an indication that a pedestrian exists in the crosswalk and to use more caution. Having a regulatory sign activated only when the more unexpected need arises (the presence of a pedestrian) may get more compliance than another static sign on a corridor with high sign density. The primary intention of the sign is to reduce crash risk for vulnerable users by focusing drivers on a critical message only when the risk is present.

Research is proposed to document and identify the impact to driver yielding behavior, right turning or left turning, with the presence of the *static* OR10-15 sign compared to an activated blank-out sign for both compliance and pedestrian safety. Both sign conditions would be compared a base condition of no sign present. Research proposed would also consider if there were a quantitative difference in motorists yielding rate if two or more simultaneous conflict decisions are present (i.e. oncoming traffic, pedestrian, cyclists) versus only just the pedestrian crosswalk. Identify other conditions (e.g. illumination, turning volumes, AADT, intersection location (such as near a school)) that increase crash risk and lower yielding compliance rates.

RESEARCH OBJECTIVES

This project will be developed to produce a set of evidence-based recommendations for the particular installation of the OR10-15 sign. This research would assist Regions to determine if the extra cost and maintenance of the activated blank out sign would be justified in that it significantly improves driver compliance versus a static sign.

The research work is proposed to answer the following questions:

- Does the OR10-15, static or activated, improve driver yielding rates over the no-sign baseline condition?
- Is an activated OR10-15 sign more effective than a static OR10-15 sign?
- Does the effectiveness of the static and activated OR10-15 signs change over time?
- Does the performance of these 2 signs differ between permissive left or right turns?

WORK TASKS, COST ESTIMATE AND DURATION

Task 1 — Literature review of deployments of active R10-15 signs and their data collection procedures (2 months): A thorough literature review to summarize all the previous research efforts on OR10-15 (R10-15) signs and identify the knowledge gaps from previous studies; a synthesis on the current state of knowledge on the deployment of active blank-out signs, specifically targeting any deployment of the active R10-15 sign.
Task 1 Deliverable: Synthesis of state of art and practice for active blank-out signs.

Task 2 — Study design and develop the hypothesis for statistical test and design the experiment (2 months): Methodologies on where past studies have tested the static and activated signs and the required external equipment for data collection procedures. The team will design the study, develop data analysis methods and select statistical testing methods to ensure proper data collection methods will make the statistical tests possible.

Task 2 Deliverable: Data collection plan, data analysis methods and the selected statistical analysis methods.

Task 3 — Sites Selection and Data Collection Preparation (2 months):

The team will work with ODOT to identify where to properly test the static OR-15 signs and the activated blank-out signs at specific intersection across Oregon. The team can collect data at more than ten intersections to account for different factors such as illumination, turning volumes, AADT, and intersection locations (such as near a school). The data collection sites will include the situations that two or more simultaneous conflict decisions are present (i.e. oncoming traffic, pedestrian, cyclists) versus only just the pedestrian crosswalk. The team will get the equipment ready for data collection.

Task 3 Deliverable: Data collection sites and data collection preparation including equipment test.

Task 4 — Data collection and analysis - Test static and active R10-15 sign at urban intersections across multiple Oregon districts (12 months): Vehicle to pedestrian yielding data (and other data if needed) will be collected during the baseline condition (no R10-15 sign), during a period when a static R10-15 sign is present, and finally after an active R10-15 sign is installed. The data collection will lead to video-based image processing which can capture near miss situations in combination with the desired yielding behavior. The team will process huge amount of data to get reliable results. Statistical analysis results utilizing the methods developed in Task 2 will inform the guidelines in Task 5 for ODOT to use static and activated OR10-15 signs at complicated intersections.

Task 4 Deliverable: Data collection and post deployment statistical analysis results.

Task 5 — Final Report and guideline on under what conditions should ODOT use activated blank-out OR10-15 signs (3 months): The final report will document the research process undertaken, results of the research tasks and deliverables, and provide recommendations for implementation by ODOT. The final report will also

contain recommendations of where and what existing conditions to implement either the static OR10-15 sign, or the activated R10-15 sign.

Task 5 Deliverable: Final report and implementation guidelines

Key Deliverables:

The key deliverables include (1) an understanding of the state of practice for utilizing both the static and active OR10-15 signs. (2) The testing will capture driver compliance rates and near-miss conflicts for both static and activated signs, combined with the assumptions revolving around intersections with low compliance of yielding for pedestrians. (3) The key deliverables include the impact on yielding behaviors under complicate conditions, such as conflict points, surrounding land use, complexity of the driving task, road users (such as school kids, bikes etc). (4) The key deliverables include recommended guideline for using static and activated OR10-15 signs at complicated intersections.

Estimated Project Length: 24 months.

Estimated Project Budget: \$160,000

IMPLEMENTATION

To be incorporated into pertinent ODOT Traffic-Roadway Section design and operations guidance for appropriate application of tool. Beyond guidance documents, this tool would be included in ARTS as a safety countermeasure and future Intersection Implementation Plans (or similar studies). The research results can be shared with other state and local agencies.

POTENTIAL BENEFITS

This research will provide ODOT with a schema to properly locate both active and static R10-15 signs in order to curb vehicle to vulnerable users' incidents that occur as a result of driver yielding behavior. It will document the characteristics of the intersection and vehicular traffic that exhibit an ideal environment to deploy such equipment. Such information will allow ODOT and its regional counterparts to efficiently mitigate vulnerable user crashes at intersections and promote the safe transport of vulnerable roadway users across Oregon.

PEOPLE

ODOT champion(s): Angela Kargel, ODOT State Traffic Services Engineer and Unit Manager

Problem Statement Contributors: Jamie Schmidt, ODOT Signals Operation Engineer; Xiugang "Joe" Li, ODOT Research Coordinator; Scott Cramer, ODOT State Signals Engineer; Christi McDaniel-Wilson, ODOT State Traffic Safety Engineer; Marie Kennedy, ODOT State Sign Engineer; Gary Obery, ODOT Traffic and Active Modes Engineer; Amanda Salyer, ODOT Traffic Investigations Engineer; and the Oregon State University CCE faculty researchers: Haizhong Wang and Robert L. Bertini; Graduate Research Assistant: Brian Staes.

REFERENCES

NCHRP 20-44(13). (2020). Implementation of NCHRP Research Report 893: The Oregon DOT Statewide Pedestrian and Bicycle Plan.

SunriseSESA. (2023). Transportation Brochure. Full Matrix Blank Out Signs. Retrieved from <https://1952572.fs1.hubspotusercontent-na1.net/hubfs/1952572/SST-Transportation-Brochure-Web.pdf>.

SWARCO. (2023). Blank-Out Signs. Retrieved from <https://www.mccain-inc.com/products/signs/dynamic-message-signs/blank-out-signs>.

Oregon Department of Transportation (ODOT). (2020, 2019, 2018). Oregon Traffic Crash Summary. Retrieved from https://www.oregon.gov/odot/Data/Documents/Crash_Summary_2020.pdf.

STAFF REVIEW PAGE

Literature Check

TRID&RIP

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

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 stakeholders

- List stakeholders or impacted units
 - ODOT Traffic and Roadway Section
 - ODOT Intelligent Transportation System (ITS) Section
 - ODOT Regions' Traffic Units
 - ODOT Pedestrian and Bicycle Program
 - Transportation Safety Office, DMV
- Identify any issues of concern raised by an ODOT stakeholder. Note expected mitigation
No