SPR RESEARCH PROGRAM
SECOND-STAGE PROPOSAL SUMMARY

PROBLEM NUMBER AND TITLE

27-17: Pavement Marking Thickness compared to Durability and Retroreflectivity

PROBLEM SUMMARY

The Pavement Marking Committee (PMC) is seeking a study on non-durable, waterborne paint material thickness vs retroreflectivity. 27-17 will seek new data and use existing data (SPR 886) for cost-savings to discover optimal thickness. ODOT applies paints at a variety of thicknesses, but failure is measured by retroreflectivity. Lines are expected to last for 9-18 months. Crews believe thicker lines last longer (above vendor recommendations) and support an annual re-painting cycle. ODOT has decided to apply thinner lines. Crews are skeptical this will provide the lifespan needed and may result in re-painting after 4-6 months during bad weather. ODOT does not have data to analyze installation versus performance, with other variables (e.g. traffic, product, climate, etc). The PMC has data for installation (Spec-Rite), but relies on inconsistent data to determine failure (e.g. visual inspection, ODOT statewide retro-scan data, converted statewide Lidar scans, etc), leaving the lifespan heavily qualitative. Statewide retro scanning has now been cut. A pilot study showed inconclusive results, due to a small number of cases with the myriad of variables. However, it was discovered that performance data can be obtained from external vendors.

ODOT OBJECTIVES

The research looks to determine optimal thickness that maintains federal standards (≥50 millicandelas) while achieving expected lifespans. An analysis looking at the existing data, performance data, and variables will allow informed decisions for management. The research objectives are:

1) Develop pavement marking performance database comparing multiple sources;
2) Analysis to determine situations for optimal thickness for best lifespan; and
3) Train ODOT staff to use large-data analysis tool and re-analysis for after the study is completed.

Key Deliverables: *Baseline the Spec-Rite (installation) database, Establish performance data and database, Develop analytical methodology, purchase software compatible for ODOT implementation, Training for staff, Results & recommendations from thickness versus lifespan analysis, and final report*.

BENEFITS

Optimal lifespan maximizes materials and reduces staff expense. The outcomes could be targeted for regions, climate, traffic volumes, or similar road geography. Knowing expected lifespan allows for a more proactive approach. The research proposes training, which allows future analysis to be conducted internally. There may be a lost opportunity if ODOT does not proceed. Recent budget reductions are forcing ODOT to try thinner lines. This data, compared with thicker lines, allows for a robust dataset.

SCHEDULE, BUDGET AND AGENCY SUPPORT

Estimated Project Length: 36 months.
Estimated Project Budget: $382,000.00
ODOT Support: Tony Perez, Field Service Coordinator; Rebecca Burrow, Maintenance Services Manager; PMC's #1 choice; Ted Miller, Region 1 Maintenance/Operations Manager

FOR MORE INFORMATION

For additional detail, please see the complete STAGE 2 RESEARCH PROBLEM STATEMENT online at:
https://www.oregon.gov/odot/Programs/ResearchDocuments/27-17.pdf

SPR RESEARCH PROGRAM
SECOND-STAGE PROBLEM STATEMENT
FY 2027

PROBLEM NUMBER AND TITLE

27-17: Pavement Marking Thickness compared to Durability and Retroreflectivity

RESEARCH PROBLEM STATEMENT

The Pavement Marking Committee (PMC) is seeking a research study on non-durable, waterborne paint material thickness versus retroreflectivity. ODOT has a research study underway (SPR 886) to examine lidar scan data files for upcoming federally mandated method(s) reporting. 27-17 will seek additional data and use existing data from SPR 886 to focus on cost-savings.

Construction standards apply non-durable paints at a variety of thicknesses, but failure is measured by millicandelas (retroreflectivity). Retroreflectivity is determined by embedded beads. There are minimum standards of millicandelas when applying non-durables and it is expected to last for 9-18 months. ODOT Maintenance has a federal minimum standard of 50 millicandelas, but has found certain thicknesses last longer and work better with an annual cycle for staffing purposes. ODOT may apply thicker lines that may be greater than vendor recommendations. Due to current budget constraints, ODOT Maintenance will be applying thinner lines for the foreseeable future. Experienced crews are skeptical thinner lines will provide the lifespan needed and would result in re-application after 4-6 months, which would result in more staff time and painting in colder, wetter weather. They are unsure of the optimal thickness for best lifespan.

Currently, ODOT does not have a complete dataset to analyze installation versus performance, understanding there are several other variables to consider (e.g. traffic, product, climate, etc). ODOT relies on vendor recommendations, crew experience, or industry knowledge leaving the lifespan heavily qualitative. The PMC has a database which documents installation information, but relies on a variety of infrequent and inconsistent data to determine failure (e.g. visual inspection, ODOT statewide retro-scan data conducted by interns, statewide Lidar scans converted for retro numbers, etc). Due to cuts, the option for statewide retro-scan data will not be funded.

ODOT conducted a pilot study of select cases to view the relationship between thickness and retroreflectivity. The discovery was inconclusive for both yellow and white paint thickness, in part, due to a small number of data points with the myriad of variables. However, ODOT did discover that statewide performance data on pavement markings can be obtained through external vendors, relatively cheap.

RESEARCH OBJECTIVES

The research looks to determine optimal thickness that maintains federal standards (≥50 millicandelas) while achieving expected lifespans. An analysis looking at the existing data, performance data, and variables will allow informed decisions for management. The research objectives are:

1) Develop pavement marking performance database comparing multiple sources;
2) Analysis to determine situations for optimal thickness for best lifespan; and
3) Train ODOT staff for large-data analysis tool.

This study looks to conduct an analysis on lifespan correlating to thickness utilizing the full ODOT database (Spec Rite) with a focused effort on collection of performance data over multiple years for thinner applications. The combination of prior data from SPR886 and past years will provide a way to have a robust dataset for no extra cost, in hopes to determine how much of a factor thickness contributes to lifespan. In addition, examining performance data will assist ODOT and the PMC to decide which method(s) to capture

and store performance data can be implemented by ODOT. The research will provide valuable guidance on how to setup ongoing analysis for an optimal thickness application as well as help determine life span expectations when thinner applications are needed. The research results will have a large potential for further internal analysis. One example is paint/bead combination. The bead size may influence lifespan and retroreflectivity differently, leading to an analysis of ideal thickness which includes different reflective beads.

WORK TASKS, COST ESTIMATE AND DURATION

Task 1. Literature review: This task will update the existing literature review and result in a comprehensive literature review for the final report. This literature review will focus on similar methods of quality data capture for pavement performance and life spans of various non-durable pavement markings. Further literature topics will include similar techniques to contrast and compare thickness versus performance.

Task 2. Examine/Setup baseline Pavement Marking database (Spec-Rite): The research team will work with ODOT personnel to setup the existing dataset for future analysis for locations in which performance data can be paired for analysis. This includes data from SPR 886.

Task 3. Capture Performance Data: Three Options: The research team will develop the methodology to capture and/or purchase performance data. Specifically, three options: Lidar converted data for retroreflectivity values, purchase statewide vendor data on retroreflectivity, and annual statewide retroreflectivity values (Laserlux). An analysis of each of the datasets and how to combine them for use will be completed. During this process, QA/QC will be conducted to determine if one, or all, are viable for future analysis of pavement marking performance.

Task 4. Develop Analytical Methodology to Compare Variables: The research team will develop the methodology to compare the pavement marking installation data and the performance data. An example of this methodology is regression analysis. It is intended to be analyzed after one, two, and three years of collected data, re-examining the method analysis, the results, and thickness recommendations. During this task, a statistician may be hired to QA/QC the data and advise on COTS software (commercial-off-the-shelf).

Task 5. Data Collection: Three seasons of statewide pavement marking installation and performance data is estimated to produce enough cases (with a myriad of variables) to allow the analysis to determine if there are significant findings.

Task 6. Training and Software Tool Selection: The research team will work with ODOT Maintenance to train them to run and re-run the analysis, select the statistical software tool, and how to produce reports showing thickness, lifespan, and analyze other variables using the proposed methodology.

Task 7. Reporting: A final report will be compiled to document the project in detail.

Key Deliverables: Baseline the Spec-Rite (installation) database; Establish performance data from different sources with storage in new database; Develop analytical methodology from comparing installation and performance data; Analyze performance data collection methods to determine best practice and quality of data; Provide implementation recommendations for performance data storage and future use; Training for staff on how to use analytical tools to re-run optimal thickness for best lifespan given material and staff expense; and Analyze data for results. Recommend an analytical tool to illustrate and report results, preferably using COTS software.

Estimated Project Length: 36 months.

Estimated Project Budget: $382,000

EXPECTED ODOT IMPLEMENTATION ACTIONS

Implementation will consist of developing a performance database of pavement markings. This database will be used for comparison to installation data (already captured and stored), using a research-developed analytical tool. The results of re-running the analysis will provide updated optimal thickness information, per year, per desired variables.

POTENTIAL BENEFITS

ODOT has retroreflectivity standards to maintain by mandate. Optimal lifespan for pavement markings maximizes material purchasing and staff expense. The timing for this study is optimal as ODOT tries to do more with less budget for maintenance. The analytical outcomes could be targeted for regions, climate, traffic volumes, or similar roadway geography. Additionally, knowing expected lifespan for shorter living paint/bead combinations, allows for more proactive planning approach for short-term-fix situations as well as longer term applications. Furthermore, the way in which the research is proposed, future analysis can be conducted internally. There may be an opportunity lost if ODOT does not conduct this research at this time. Recent budget reductions are forcing ODOT to try thinner pavement markings than before. This data, compared with recent data of thicker lines, allows for a robust dataset with a high likelihood of finding an optimal thickness.

PEOPLE

ODOT champion(s): Rebecca Burrow, Maintenance Services Manager

Problem Statement Contributors: Tony Perez, Field Service Coordinator; Jon Lazarus, Research Coordinator; Pavement Marking Committee (various edits);

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STAFF REVIEW PAGE

LITERATURE CHECK

TRID&RIP

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

Please refer to the Draft Preliminary Research Summary conducted by Jon Lazarus on 9/9/2025 for Rebecca Burrows, which examined this topic.

ODOT DECISION LENSES

Climate: This research is not focused on climate and will not include analysis of climate, however, there are three points to consider:

- Addressing the **optimal pavement marking thickness** will include development or testing of construction practices, methods, or materials which could lead to potential reductions in greenhouse gas emissions for both ODOT and supply partners.
- Solving the **optimal pavement marking thickness** will support the optimization of ODOT staff-work and therefore support reduced green house gas emissions.
- Solving the **optimal pavement marking thickness** may lead to work that will support, measure, or monitor, transportation system resilience in response to expected climate events, effects, or natural disasters.

Equity: Although the **optimal pavement marking thickness** is not specifically focused on transportation equity, the study may have equity benefits. The implementation of potential findings from this research will allow analysis of inequitable situations. Lower traveled roads could have a more comparable approach with higher traveled roads addressing any potential inequity

Safety: Solving the **optimal pavement marking thickness** supports:

- improving a **safety culture** for both our transportation workers and the traveling public;
- improving safety through using **best available technologies;**
- improving safety through **communication and collaboration;** and
- improving safety through **investing strategically**.

Safety is a key component of this research proposal. Safety applies to the traveling public as well as ODOT crews. As budgets have declined, it is important to understand which applications still meet minimum safety standards for the traveling public to visibly see the pavement markings. Optimization of the materials means we can evaluate the number of times crews have to apply the pavement markings, as well. This study looks to gain knowledge to still meeting safety standards with optimized material application that allows the product to last for a more predictable lifespan given the variance of the environment it is placed in. This effort will lead to more predictable maintenance schedules, consistent driver expectation, and optimized use of mobile work zones that aims to reduce exposure to ODOT staff and disruptions for 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.

This research project will examine data for performance (and lifespan) of non-durable pavement lines. It is intended to examine different data sources and allow ODOT to choose the best, most implementable, solution for data capture and storage. Additional post-research reviews and approvals may be required to set up a permanent data storage solution.

CROSS-AGENCY IMPACTS

- List ODOT partners or impacted units: ODOT Office of Maintenance; Potentially affect construction vendors who apply pavement markings.

- Identify any issues of concern raised by an ODOT partners. Note expected mitigation that addresses these concerns: None at this time.