



# SPR RESEARCH PROGRAM

## SECOND-STAGE PROBLEM STATEMENT

### ODOT FY 2010

ODOT Research Unit  
200 Hawthorne Ave. SE  
Suite B-240  
Salem OR 97301-5192

Phone (503) 986-2700  
Fax (503) 986-2844

#### I. PROBLEM NUMBER

CM-10-11 (Stage 1 Problem Number)

#### II. PROBLEM TITLE

Pavement Marking Investment Optimization

#### III. RESEARCH PROBLEM STATEMENT

Oregon spends considerable sums for pavement markings but has no system to optimize the selection of the varied materials. To more effectively manage this investment which must account for a myriad of variables (weather, volumes, longevity of markings). A systematic approach would be desirable as this would allow a detailed understanding of the issues, more strategic investments, and an explicit link to safety outcomes.

A limited literature review revealed several research projects that have tried to understand and deal with a systematic approach for Pavement Marking Management Systems (PMMS). An Oregon solution would be unique compared to what other states have discovered. Development of an Oregon Pavement Marking System would thus include integration into an asset management approach and a decision management system that explicitly includes data on product performance (retroreflectivity and durability), maintenance schedules, traffic and climactic data, and crash data and crash countermeasures to ensure cost-effective investments are made. Currently, there are 2 research-in-progress related studies. Additionally, the ODOT traffic safety ETG expressed an interest in this topic.

#### IV. RESEARCH OBJECTIVES

The objectives of this research project are as follows:

1. Evaluate management systems and optimization process used in U.S. for pavement markings
2. Complete literature review of safety benefits of pavement markings
3. Evaluate current ODOT pavement marking management process
4. Develop optimization methodology
5. Develop implementation analysis and protocol

#### V. WORK TASKS, COST ESTIMATE AND DURATION

This proposed research effort will include the following tasks:

1. **Literature Review:** The research team will conduct a comprehensive literature review of studies by states to gather information regarding current management systems and optimization of PMMS.  
**Estimated cost:** \$5,000.
2. **Conduct Interviews:** The research team will interview neighboring states to identify their systems and methods to optimize cost and safety aspects with their pavement markings. This will include lessons learned by these agencies. States with similar weather characteristics will also be included in the interview process. If needed, an electronic survey will be developed to supplement the interview process. The results of the survey will serve as input to the approaches considered for recommendation to ODOT. An interim report will summarize the results to task 1 and 2 and presented

to the TAC. **Estimated cost:** \$20,000.

3. **Evaluate ODOT Management Methods:** In task 3 the research team will evaluate ODOT's management and selection process for optimizing pavement markings. This will include interviews with key ODOT personnel to determine the effectiveness and efficiency of selection and application. This task will also evaluate the availability of data sources and prospects of collecting additional data to enhance decision-making (e.g. rainfall and snowfall data, crash data, geometric data). Other aspects to consider will include cost effectiveness and the ability for ODOT crews to undertake any change efforts for suggested PMMS found from task 1 and 2. **Estimated cost:** \$20,000.
4. **Review Pavement Management System types and Analysis:** The research team will review current practices and policies to implement the best choice for PMMS for a select section of roadway designated by ODOT. A cost benefit analysis will be conducted and compared to current ODOT practices. Safety characteristics will be identified and attempted to be quantified given several products. Importantly, the research will include combinations of existing crash data, safety predictive models, and expert judgments to create a system that extends beyond standard asset management programs to explicitly consider pavement marking investment in the context of safety. The PMMS selected will model selection choices over a period of time for evaluation of cost and safety. A comparison of ODOT current selections and practices will then be compared to the system recommended model. **Estimated cost:** \$35,000.
5. **Field Observations:** The research team will implement a 'pilot' system or a stand-alone software for PMMS. This will make recommendations as to what should be used given the location, weather, use/application and terrain. A "test-desk" will be designated for the application of recommended products to determine their effectiveness. Field observations over a winter period will verify the pavement marking management system selection choice was the best choice for ODOT's needs. **Estimated cost:** \$20,000.
6. **Recommendations and Report:** The research team will develop a recommendation for the purchase and installation (including installation guidelines) for a pavement marking management system. These recommendations and guidelines will be informed by the literature review, survey, field experiment, and TAC input. The recommendations will address at least the following aspects: a) The best pavement marking management system practice for ODOT's maintenance program; b) ease of installation, implementation and use given ODOT's infrastructure; c) A matrix of choices, given product performance, location, weather, use/application, etc; and d) Actions(s) to address future research areas within the optimization of pavement markings. **Estimated cost:** \$30,000.

Including ODOT admin costs, the estimate is \$140,000 with duration of 18 months.

## **VI. IMPLEMENTATION**

Key personnel from ODOT will observe the field trials and participate where appropriate in process and selection procedures, data collection and analysis. Input from these personnel will be critical for developing guidance and best practices for pavement marking optimization installation and maintenance of the choices selected. Workshops will be conducted by the project investigators to ensure knowledge transfer to ODOT related to pavement management systems, any recommendations, and data collection and analysis.

## **VII. POTENTIAL BENEFITS**

Better investment decisions; Increased lane miles of pavement markings; Delivery based on critical needs; Support for safety benefits; and Current efficiency of pavement marking choices are unknown.

## **VIII. SUBMITTED BY**

Nick Fortey  
FHWA, Oregon Division  
Tel (503) 587-4721

[Nick.fortey@FHWA.dot.gov](mailto:Nick.fortey@FHWA.dot.gov)

Jon Lazars

ODOT Research Division

Tel (503) 986-2852

[Jon.m.lazarus@odot.state.or.us](mailto:Jon.m.lazarus@odot.state.or.us)