



# SPR RESEARCH PROGRAM SECOND-STAGE PROBLEM STATEMENT FY 2008-09

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## I. PROBLEM NUMBER

CM-09-06

## II. PROBLEM TITLE

Evaluation of Wet-Weather Retroreflectivity

## III. RESEARCH PROBLEM STATEMENT

Pavement markings are vital to traffic operations and the safe negotiation of drivers through the transportation system. During wet weather conditions a minimum level of retroreflectivity (luminance) is necessary to ensure adequate performance and to meet the needs of older drivers that require higher levels of retroreflectivity. Having pavement marking materials that perform well in wet weather is particularly important in Oregon. Weather data for the Willamette Valley indicates that approximately 40% of the days have some rain.

ODOT requires testing of all pavement marking materials before they can be applied on a state highway. Materials are applied on a two-year test deck where the product and application method are evaluated at least quarterly until a determination can be made regarding the suitability of the marking material. If it is determined that the material is suitable, it is included on the Qualified Products List (QPL). The testing and evaluation on ODOT test desks are limited to measuring the thickness of the marking material; assessing retroreflectivity; and subjective evaluations of appearance, quality, and durability. These tests do not include assessment of wet-weather retroreflectivity or nighttime wet-weather retroreflectivity in particular. Tests are also not carried out in the field unless particular concerns are raised for further investigation.

Research indicates that there is significant variation in the performance of different types of materials, different application methods, and application patterns under wet weather conditions and in the rates of reduction in luminance. Findings are however inconclusive as to whether initial retroreflectivity is necessarily a good indicator of long term performance. Current standards to measure wet-weather nighttime retroreflectivity (such as ASTM E1710) use a 30 m geometry to measure retroreflectivity and use fairly high rainfall intensities that may not be appropriate for prevailing wet-weather conditions.

Because of the increasing older driver population and the impact of wet-weather retroreflectivity on safety, ODOT will benefit from considering the incorporation of the evaluation of wet-weather retroreflectivity as part of the testing procedures of the ODOT pavement marking test deck or quality control processes.

## IV. RESEARCH OBJECTIVES

- To determine how ODOT testing and specifications can be adjusted to accommodate explicit consideration of wet pavement marking retroreflectivity.
- To develop a conceptual framework for the selection of pavement markings (excluding waterborne paints) that incorporates wet pavement marking retroreflectivity.

## V. WORK TASKS, COST ESTIMATE AND DURATION

### Task 1 – Review Current ODOT Practices

Current ODOT pavement marking testing practices will be documented. This includes an assessment of test equipment used; documentation procedures that would support an in-service performance evaluation process; and approaches to the selection of yellow and white pavement markings on different pavement types. 3 months duration, \$10,000 estimated cost.

### Task 2 – Literature Review and Survey

Complete a literature review of available research results and survey of practices of other jurisdictions. The focus of the literature review will be on wet weather retroreflectivity and input that would support a) assessment of existing test deck procedures; b) development of an in-service performance evaluation process, and c) the development of specifications for yellow and white pavement markings. Jurisdictions to be surveyed will include states with snow and those experiencing

extended wet pavement conditions throughout the year. The review will also cover: a) equipment used in wet weather testing and other equipment that is available for performing wet weather retroreflectivity; b) the ASTM wet weather retroreflectivity testing procedures; c) the National Transportation Product Evaluation Program (NTPEP); d) ongoing federal research in this area; and e) considerations for an in-service evaluation program of wet-weather retroreflectivity of pavement markings (with specific consideration of nighttime wet-weather retroreflectivity). 6 months duration, \$20,000 estimated cost.

### **Task 3 – Identify Alternatives**

Identify alternative testing procedures and possible in-service performance evaluation approaches that offer opportunities to improve the current approach to pavement marking specification and selection for ODOT highways to incorporate explicit consideration of wet weather retroreflectivity of pavement marking materials. During this process the focus will be on approaches that will incorporate differences in highway type (such as functional class and posted speed), regional climatic characteristics, rainfall intensity, and snowplow practices in the different regions in Oregon. Input from ODOT personnel will be incorporated into this process. 3 months duration, \$10,000 estimated cost.

### **Task 4 – Limited Field Trials**

Conduct a limited set of field trials (using ODOT facilities and equipment) to allow for a preliminary assessment of the alternative testing procedures identified in Task 2. Where applicable, input from ODOT personnel will be gathered and incorporated into recommended modifications to current testing procedures. Note that the budget for this task includes \$15,000 to purchase measuring equipment, if such equipment is needed. The budget does not include the cost of the application of pavement materials. 9 months duration, \$95,000 estimated cost of which \$10,000 is for ODOT field staff and \$15,000 for equipment.

### **Task 5 – Final Report**

Prepare a final report to document the literature review, findings from the evaluation, and recommendations regarding the explicit consideration of wet weather retroreflectivity for yellow and white pavement markings by ODOT.

Recommendations will include ways to include testing of wet-weather retroreflectivity of pavement marking materials to meet ODOT specific testing needs. 3 months duration, \$5,000 estimated cost.

### **Task 6 – Project Coordination and Management**

ODOT Research Unit staff time to coordinate with the TAC which will be established and other ODOT units. In addition to project management, some field work is included. \$10,000 estimated cost.

**Total Duration: 24 Months      Cost: \$150,000**

## **VI. IMPLEMENTATION**

The research findings will support modifications to ODOT specifications for white and yellow markings (location specific if necessary); procedures used at the ODOT test deck; and recommendations for a possible in-service performance evaluation process that would support continuous assessment of wet weather performance of yellow and white pavement markings.

## **VII. POTENTIAL BENEFITS**

Being able to select pavement marking materials that offer better wet weather visibility will have significant safety and cost saving benefits for ODOT.

## **VIII. SUBMITTED BY**

### **Submitters**

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