



# SPR RESEARCH PROGRAM SECOND-STAGE PROBLEM STATEMENT FY 2009

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## I. PROBLEM NUMBER

PM-09-03

## II. PROBLEM TITLE

Open Graded Friction Courses for the Pacific Northwest

## III. RESEARCH PROBLEM STATEMENT

The success of open graded wearing courses in the Pacific Northwest has been varied. While Oregon has been placing open graded wearing courses for over twenty years, Washington tried open graded wearing courses similar to Oregon's and discontinued use due to wear problems. Recently, WSDOT placed two open graded wearing course test sections on major highways to investigate wear resistance and potential noise reductions.

In Oregon, some open graded wearing courses last longer than their design life, while several open graded wearing courses are not performing as long as the design life and/or are not providing the splash and spray reductions expected. Most likely, the reduced life/reduced splash and spray can be attributed to wear from studded tires, asphalt binder grade changes, mix design variability and construction practices.

Open graded wearing courses can provide a safety benefit due to reduced splash and spray and tire-pavement noise reduction, however, open-graded mixture performance in the Pacific Northwest is not well understood given the varied performance of traditional mixtures in Oregon and Washington. Additionally, several mix types and binders (originating largely in Arizona and California) are now available that may enhance performance, however, they need to be evaluated in the context of the Pacific Northwest including the resistance to studded tire wear and construction temperature requirements.

## IV. RESEARCH OBJECTIVES

Five areas of interest are proposed to evaluate open graded wearing courses:

- 1) Collect and review relevant literature related to the study objectives and obtain information to determine what types of open graded wearing courses are being used, where they are located, and generally how they are performing.
- 2) Identify Oregon locations where open graded mixes have performed successfully and where they have deteriorated before their design life. Washington data may also be included in this analysis.
- 3) Evaluate mix issues that affect pavement performance including the binder type, aggregate source and actual design. What designs have provided the most successful mixes? What are other states/agencies doing?
- 4) Review construction processes to identify best practices for creating a superior open graded pavement. Also, look at the proper methods to monitor mix quality – should gradation be measured from cold feed samples or are there ways to monitor it behind the paver? Can binder content be accurately measured with the ignition oven? What mixes are harder/easier to construct according to local contractors?

- 5) Determine the best locations for using open graded wearing courses based on a life cycle assessment.

## V. WORK TASKS, COST ESTIMATE AND DURATION

**Task 1: Literature Review:** There is a fair amount of information available that details previous use of open graded wearing courses. A survey may be used to collect specific information from transportation agencies using open graded friction courses. Note that Wisconsin is doing a similar study that we could borrow from. **Estimated Cost: \$10,000 Estimated Time: 7 Months**

**Task 2: Evaluation of open graded wearing course performance in the Pacific Northwest:** Use information from the DOT pavement management system to identify top performers and early failures. What are the commonalities for good pavements versus poor pavements? Investigation may require reviewing construction information to document conditions. May require developing some method of quantifying splash/spray reduction. **Estimated Cost: \$40,000 Estimated Time: 7 Months (concurrent with literature review)**

**Task 3: Laboratory Evaluation:** The lab evaluation would include pulling cores from good performers and poor performers to evaluate at a minimum permeability and asphalt content. The investigation could also include pulling cores from recent projects to determine the impact of construction changes to mix permeability. See Objective 3. Other testing needs would be determined under Task 2. **Estimated Cost: \$30,000 Estimated Time: 4 Months**

**Task 4: Life cycle assessment:** Conduct a life cycle assessment to determine the life cycle cost, energy input and resulting emissions of a typical ODOT open graded surface course. This information, combined with Task 2 information will allow an assessment of the impact of open graded mixtures in Oregon and could lead to recommended use guidelines. **Estimated Cost: \$5,000 Estimated Time: 6 Months**

**Task 5: Construction Monitoring:** Document construction practices on up to three projects placing open graded mixes. Interview two Oregon paving contractors with experience paving ODOT open-graded mixtures. Develop guidelines for best construction practices needed to produce a quality open graded mix. **Estimated Cost: \$30,000 Estimated Time: 3 Months**

**Task 6: Implementation:** This task would include looking at what materials are available to produce a superior open graded mix and evaluating where the wearing course would be cost effective. The task would also provide guidance as to what changes are needed in our mix design process and standard specifications to insure we are getting the quality we desire. **Estimated Cost: \$20,000 Estimated Time: 3 Months**

**Task 7: Documentation:** This task would include preparation of a final report documenting the findings on the use of open graded wearing courses. **Estimated Cost: \$10,000 Estimated Time: 6 Months**

**Task 8:** Project Coordination (research)  
18 month duration, \$10,000

**Total Cost: \$155,000 Total Time: 18 months**

### Matching Funds and Related Studies.

This study is eligible for matching funds from the US DOT Region 10 University Transportation Center

(UTC) at the University of Washington known as TransNow. The intention is to apply for this matching funding in the FY 2010 TransNow cycle (July 2009-June 2010). TransNow selects matching funding proposals yearly on a competitive basis and no guarantee can be made on receiving matching funds.

Additionally, there is a possibility to team this study up with a Washington State Department of Transportation (WSDOT) \$100,000 study recently awarded to the prospective principal investigator concerning hot mix asphalt density and related performance. This teaming possibility could result in using data from both states in each study and giving access to study results to both ODOT and WSDOT. Thus, it may be possible for each DOT to get two study results by only funding one study.

## **VI. IMPLEMENTATION**

Results of the research will be used to modify DOT publications and specifications for the use of open graded wearing courses. In Oregon, the Principal Investigator along with the Pavement Services Engineer will be responsible for making presentations at industry meetings to describe the research findings.

## **VII. POTENTIAL BENEFITS**

Adjustments to our open graded wearing course design process could result in significant value in terms of increased pavement life and/or better splash and spray reduction. With funding projected to decrease over time, we need to be sure we are making cost effective decisions to maintain the overall condition of the state road network.

## **VIII. SUBMITTED BY**

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