



SPR RESEARCH PROGRAM

SECOND-STAGE PROBLEM STATEMENT

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

Combination of:

- PM-10-06 – Asphalt Binder Grade Selection for HMAC with Recycled Asphalt Products (in its entirety).
- PM-10-04 – HMAC Incinerator Calibration Factors and Gyratory Compactor Evaluation (excluding the portion concerning the gyratory compactor evaluation).

II. PROBLEM TITLE

Asphalt Binder Grade Selection and Ignition Oven Calibration Factors for HMAC with Recycled Asphalt Products

III. RESEARCH PROBLEM STATEMENT

Oregon currently allows up to 30% recycled asphalt pavement (RAP) to be used in hot mixed asphalt concrete (HMAC). The use of blending charts for RAP proportions greater than 15% is recommended to: a) establish the maximum RAP proportion so that the virgin binder properties are not adversely affected; or b) adjust the grade of the virgin binder so that the blended binder possesses the desired properties. ODOT has also been approached about allowing the use of recycled asphalt shingles (RAS) in HMAC. RAS contains asphalt cement that is substantially stiffer than that used in HMAC in Oregon; hence, inclusion of RAS in HMAC could significantly impact the properties of the blended binder. Research is needed to investigate how the proportion of RAP or RAS impacts the blended binder properties as well as those of mixtures containing varying proportions of RAP or RAS.

A key issue concerning the design, manufacture, and acceptance of HMAC mixtures (with or without RAP or RAS) is accurately determining the content of the asphalt binder in the mixture. ODOT currently uses calibrated ignition ovens (incinerators) for determining asphalt binder content of HMAC for mix design verification purposes as well as for both quality control (QC) and quality assurance (QA) purposes. Binder contents derived from QC/QA testing are used to determine pay quantities, payment for asphalt binder escalation, and price adjustments based on ODOT's statistical analysis processes. Accurate determination of the asphalt binder content (which requires an accurate determination of the calibration factor for a particular mixture and a particular ignition oven) is therefore essential. Over the past few years ODOT has been experiencing an increasing number of issues in validating the contractor's test results for the asphalt binder content of mixtures containing RAP.

IV. RESEARCH OBJECTIVES

The objectives of the research are:

1. Review relevant literature to: a) Determine the state-of-the-practice regarding procedures for selecting virgin asphalt binder grades based on RAP or RAS proportion, to establish how inclusion of RAP or RAS impacts the mix design process, and to determine the state-of-the-practice regarding QC/QA procedures for mixtures containing RAP or RAS; and b) Determine the current state-of-the-practice for calibrating ignition ovens for determining asphalt binder content with emphasis on protocols specific to mixtures containing RAP or RAS.
2. Develop experiment plans and conduct laboratory tests to: a) Gather evidence to justify the need to properly engineer the binder blend for mixtures incorporating RAP or RAS; b) Determine the effect of RAP or RAS content on the calibration factors for ignition ovens; and c) Investigate how the use of RAP or RAS in HMAC mixtures affects the mix design process.
3. Develop recommendations for: a) A virgin asphalt binder grade selection procedure based RAP or RAS proportions; b) Changes or improvements to ODOT's process for determining calibration factors for HMAC containing RAP or RAS; c) A procedure for batching HMAC samples containing RAP or RAS for mix design purposes and ignition oven tests; d) QC/QA test procedures for mixtures incorporating RAP or RAS as well as IA parameters associated with determining asphalt binder content based on incineration; and e) Blending charts for high-RAP or high-RAS mixtures.

V. WORK TASKS, COST ESTIMATE AND DURATION

Task 1 – Literature Review: Review the literature to satisfy Objective 1.

Cost: \$20,000

Time: 3 months

Task 2 – Preliminary Procedures: Based on the findings from the literature review (Task 1), develop a set of preliminary procedures (or modifications to existing ODOT procedures) to initially satisfy Objective 3.
Cost: \$15,000 Time: 1 month

Task 3 – Experiment Plans: Develop experiment plans for laboratory studies to determine: a) asphalt binder grades of binders from RAP and RAS as well as blends of these with virgin asphalt binder; b) the effect RAP and RAS has on ignition oven calibration factors and mix design; and c) batching procedures.
Cost: \$10,000 Time: 1 month

Task 4 – Laboratory Study: Conduct laboratory testing and analysis as per the experiment plans developed under Task 3. It is anticipated that this will entail a substantial amount of the lab work involving binder extractions, rheological testing to determine binder grades (i.e., DSR and BBR testing), tests to determine volumetric properties of mixtures, ignition oven tests, and trials to develop batching procedures.
Cost: \$150,000 Time: 9 months

Task 5 – Develop Recommended Procedures: Modify/finalize the preliminary procedures (and/or develop new procedures) based on the findings from the lab work and format these in the style of ODOT test methods such that they can be readily incorporated into the Manual of Field Testing Procedures.
Cost: \$10,000 Time: 1 month

Task 6 – Report: A final report will be developed to document the efforts undertaken to accomplish Tasks 1-5.
Cost: \$20,000 Time: 3 months

Task 7- Research Administration
Cost: \$10,000

TOTAL PROJECT COST: \$235,000
TIME TO COMPLETION: 18 MONTHS

VI. IMPLEMENTATION

The recommended procedures will be utilized in the design and QC/QA processes for HMAC mixtures that incorporate RAP or RAS. They will also be used to determine more accurate pay quantities and price adjustments.

VII. POTENTIAL BENEFITS

The blending procedure will allow an increase in the percentage of RAP, as well as the introduction of the use of RAS, in HMAC mixtures, reducing the demand for virgin asphalt binder through reuse of a non-renewable resource. With sufficient quantities of RAP or RAS, reduced cost of HMAC is likely. Adopting the new procedures in the mix design process as well as the new procedures for QC/QA testing will ensure that the desired properties of the blended asphalt binders are achieved so as to ensure acceptable long-term performance of HMAC mixtures that incorporate RAP or RAS.

The benefits to be derived from the work involving the ignition oven (incinerator) calibration factors include an improved (more accurate) determination of the binder content and material quality of HMAC mixtures incorporating RAP or RAS. This will allow better decisions in the field regarding mixture adjustments and material quality as well as allow ODOT to more accurately determine pay quantities, adjustments for asphalt binder escalation, and price adjustments based on ODOT's statistical analysis procedures. Implementation of the results could potentially result in savings of millions of dollars to ODOT through reduced payments to contractors for pay quantities and bonuses as well as through savings in maintenance costs by virtue of placing higher quality HMAC mixtures on paving projects.

VIII. SUBMITTED BY

Stage 1 submitters and champions:

PM-10-04: Cole Mullis, Quality Assurance Engineer, ODOT Construction Section

PM-10-06: Larry Ilg, Pavement Quality and Materials Engineer, ODOT Pavement Services

Stage 2 submitter:

Todd V. Scholz, Oregon State University