



# WHRP

## Wisconsin Department of Transportation Wisconsin Highway Research Program

### Request for Proposal

### *Recycled Asphalt Binder Study*

Questions submitted to [research@dot.wi.gov](mailto:research@dot.wi.gov) regarding the  
Content of this RFP are due no later than  
4:30 PM (CST) on December 12, 2017

Responses to questions will be posted to the WisDOT Research and Library  
website <http://wisdotresearch.wi.gov/rfps-and-proposals> by  
4:30 PM (CST) by December 19, 2017

Researchers must submit a PDF version of their proposal by  
4:30 PM (CST) by January 26, 2018  
to: [research@dot.wi.gov](mailto:research@dot.wi.gov)

Researchers will be notified of the proposal review decision by May 1, 2018

For more information regarding this RFP contact the WisDOT Research Program  
at: [research@dot.wi.gov](mailto:research@dot.wi.gov). This RFP is posted to the Internet at:  
<http://wisdotresearch.wi.gov/rfps-and-proposals>

**Wisconsin Highway Research Program  
Request for Proposals  
Flexible Pavement Technical Oversight Committee**

***Recycled Asphalt Binder Study***

**I. Background and Problem Statement**

Recycled materials may detrimentally affect the fatigue and thermal cracking resistance of Hot Mix Asphalt (HMA) if used improperly. New technologies have enabled HMA mixture designers to compensate for some of the negative aspects of recycled asphalt materials (RAM) and provide high performing mixtures with increased concentrations of RAM. In addition, the use of RAM in HMA is favorable due to the decrease in cost, increase in rutting resistance of pavement, and reduction of emissions when green processes are used. However, reasonable limits on content and quality of RAM binder for Wisconsin environments and practices are not fully understood.

The Wisconsin Department of Transportation (WisDOT) maximum allowable binder replacement for fresh asphalt binder is 40% in lower pavement layers and 25% in upper layers. It is also widely accepted that recycled asphalt pavement (RAP) blending in the range of 20-30% by total weight of mix has minimal effects on the long-term pavement performance. The asphalt content of recycled components directly contributes to percent asphalt binder replacement for various quantities of RAM as a percentage of total weight of mix. This research aims to test typical binder replacement limits and better understand blending of RAM and fresh binder for Wisconsin environments and practices.

**II. Research Objectives**

- Understand how quantity and quality of RAM affects the performance of resultant binders.
- Validate resultant binder test results using HMA performance testing methods.
- Draft a binder and/or mixture testing procedure to evaluate the quality of RAM and fresh/virgin asphalt binder blending in Wisconsin.

**III. Scope of Work**

**Phase I (6 months):**

- Performed a detailed literature review. Assess practices and recommendations for the use of RAM in HMA in different States around the country.  
Researchers are recommended to review results of projects:
  - NCHRP 09-58 “The Effects of Recycling Agents on Asphalt Mixtures with High RAS and RAP Binder Ratios”
  - WHP 10-06 “Effect of Recovered Binder from Recycled Shingles and Increased RAP Percentages on Resultant Binder PG.”

- WHRP 12-02 “Development of Guidelines and Specifications for Use of WMA Technology in Delivering HMA Products Inclusive of Non-Conventional Mixtures Such as SMA’s, and Mixtures with High RAP and High RAS Content”
- WHRP 14-06 “Critical Factors Affecting Asphalt Concrete Durability.”
- Evaluate how those practices and recommendations apply to Wisconsin’s environment and practices.
- Find limitations of the practices and recommendations for the use RAM in Wisconsin’s flexible pavements
- Develop testing plan to validate practices and recommendation for the use of RAM in Wisconsin. This plan should include a testing matrix for a virgin mixture design(s) and RAM at various asphalt binder replacement levels, comprised of recycled asphalt shingles (RAS) and/or reclaimed asphalt pavement (RAP).
- Document the findings of Phase I into an interim report. This interim report will be evaluated by the Project Oversight Committee before the start of Phase II. Based on findings of interim report, Project Oversight Committee evaluation may end the research after Phase I.

**Phase II (18 months):**

- Test each mixture type proposed and approve in Phase I for performance properties ranging from rutting to thermal cracking.
- Evaluate technologies expected to improve HMA mixture designs with high RAM contents with selected mixture designs and performance tests.
- Identify effectiveness of technologies or mixture design techniques in compensating for negative aspects of RAM binder.
- Evaluate mixture combinations for resultant binder properties. Properties of particular interest in Wisconsin target thermal cracking and aging characteristics.
- Compare properties of resultant asphalt binder with mixture performance and document any notable compatibility concerns between RAM and fresh asphalt binder.
- Develop testing protocol for WisDOT staff to evaluate allowable RAM binder replacement levels for Wisconsin mixtures. This procedure should include steps to evaluate both quality and content of RAM in HMA. Only binder and/or mixture performance testing methods available to WisDOT staff should be utilized for this procedure.

**IV. Required Testing**

Researchers should include test methods that can be conducted by WisDOT staff. Researchers should not limit testing to the equipment shown below, but consider this list when developing procedures for RAM evaluation. Laboratory equipment or procedures available to WisDOT staff includes:

- Asphalt binder extraction and recovery
- Dynamic shear rheometer
- Bending beam rheometer

- Pressure Aging Vessel (PAV) and Rolling Thin-Film Oven (RTFO) aging
- Hamburg Wheel Tracking Device
- Asphalt Mixture Performance Tester (AMPT)
  - Limited to Dynamic Modulus and Flow Number Test methods
- Semi-circular bend (SCB) tester - Illinois Flexibility Index Test (IFIT)
- Disk-shaped compact tension tester

Researchers may advise modifications or add-ons to this equipment if necessary.

Requirements for Laboratory/Technician Certifications: AASHTO resource accreditation (formally known as AMRL accreditation)

**V. WisDOT/TOC Contribution**

- Aid in collection of materials and guide direction of research.
- Expected level by staff/TOC members: a maximum of 40 hours.
- WisDOT Equipment: The research team will not assume the availability of WisDOT equipment in the proposal. If equipment is donated by WisDOT or another entity, a letter of commitment must be included in the proposal.
- It is not anticipated that any WisDOT equipment will be needed as part of this study.

**VI. Required for Travel to Fulfill TOC Obligations**

This project will require travel to collect materials for researchers. The researchers will be required to give an in-person presentation summarizing the project results, interpretations, and recommendations.

**VII. Specific Results, Findings, Tools, etc. (Deliverables)**

- Submittal and reporting of progress as required by the WHRP and WisDOT
- Presentation Requirements: All projects require the principal investigator (PI) to give a closeout presentation after submittal of the draft final report.
- Reporting Requirements: Six hard copies of the approved report must be delivered to WHRP by the contract end date.

**VIII. Budget and Time Frame**

- Phase I
  - Proposed duration is **6 months**.
  - **Phase I** Budget shall not exceed **\$40,000**.
  - Deadline for Phase I draft final report is February 2019.
  - Deadline for submittal of Phase I Final Report is March 2019.
- Phase II
  - Proposed duration is **18 months**.
  - Deadline for submittal of Phase II draft final report is June 2020.
  - Deadline for submittal of Phase II Final Report is September 2020.
  - **Phase II** Budget shall not exceed **\$160,000**

## **IX. Implementation**

- This research project presentation and report should provide the following, at a minimum:
  - Recommended changes in mix design specifications for recycled asphalt mixtures.
  - Develop a testing protocol for WisDOT staff to evaluate allowable RAM binder replacement levels for Wisconsin mixtures.
  - Provide cost benefit estimates of the proposed recommendations.
  - Impacts and language changes to the Facilities Development Manual, Standard Specifications, Construction and Materials Manual, and any other manuals that may be impacted.
- Draft straw specification, if needed.