



# WHRP

**Wisconsin Department of Transportation**

**Wisconsin Highway Research Program**

Request for Proposal

## **Balanced Mixture Design Implementation Support**

Questions submitted to [research@dot.wi.gov](mailto:research@dot.wi.gov) regarding the content of this RFP are due by **4:30 PM (CST) on January 4, 2019.**

Responses to questions will be posted to the WisDOT Research and Library website (<https://wisconsin.dot.gov/Pages/about-wisdot/research/researchers.aspx>) by **4:30 PM (CST) on January 11, 2019.**

Proposers must submit a PDF version of their proposal to [research@dot.wi.gov](mailto:research@dot.wi.gov) by **4:30 PM (CST) on February 6, 2019.**

Proposers will be notified of the proposal review decision by **May 1, 2019.**

This RFP is posted on the WisDOT Research and Library website (<https://wisconsin.dot.gov/Pages/about-wisdot/research/researchers.aspx>). For more information, contact the WisDOT Research Program at [research@dot.wi.gov](mailto:research@dot.wi.gov).

**Wisconsin Highway Research Program (WHRP)  
Request for Proposals (RFP)  
Flexible Pavement Technical Oversight Committee (TOC)**

***Balanced Mixture Design Implementation Support***

**I. Background and Problem Statement**

The Wisconsin Department of Transportation (WisDOT) is in the process of implementing performance-based testing procedures for Hot Mix Asphalt (HMA) material acceptance. Performance testing allows agencies to test the end product instead of specifying HMA material/volumetric requirements. End-product testing may provide a more accurate way of accepting mixtures for flexible pavements, allow for more innovative mixture designs and increase pavement service life. In past WHRP projects, researchers have identified mixture design factors sensitive to performance properties and recommended test procedures that strongly indicate cracking and rutting resistance (projects 0092-17-06 and 0092-15-04). Despite past success, more information is needed before implementation of promising a performance testing procedures. For that reason, WisDOT does not currently have a draft specification to enforce performance-based acceptance system on WisDOT projects. Furthermore, WisDOT does not have results providing insight regarding practical constraints of performance-based acceptance methodologies.

WisDOT currently provides testing specifications for HMA paving projects that assess quality and design. Quality control tests are conducted throughout the construction and production process to ensure uniformity of construction materials. Design tests are required before construction. Designers submit volumetric test results for approval and, once approved, the mixture design is permitted to be used for WisDOT work. This research project will focus on implementation of design specification requirements. Required design specifications should take into consideration of practical constraints that may affect HMA designs, such as: cost, available materials, construction practices, and others. The goal of a performance-based specification methodology should be to maximize the quality of the end product without adding excessive costs that cannot be recouped during added pavement life.

The prevailing framework for performance-based specifications is typically presented as “Balanced Mixture Design” (BMD) methods. Multiple tests are required to target different levels of performance: rutting, fatigue cracking, thermal cracking and others. Designs that overall improve the specified performance properties are called “balanced” designs. There are three concepts for implementation of the BMD methods:

- Volumetric design with performance testing validation,
- Performance-modified volumetric mix design and
- Performance design.

Researchers will be asked to develop a rational BMD specification that takes into consideration all potential constraints in the mixture design process.

## **II. Research Objectives**

The objective of this research is to assess and test performance-based methodologies with the intent of developing an implementable BMD specification for WisDOT projects. There are multiple factors that contribute to the decision-making process of a mixture design: economics, availability of materials, specification requirements, construction considerations, additives and others must be considered. One question the research team must address during the development of the research project is: How are design considerations prioritized in the BMD process? Researchers are expected to recommend a methodology to set rational performance limits so that available materials can be used without cost prohibitive consequences.

## **III. Scope of Work**

- A. Conduct a comprehensive literature review to determine how existing mixture design specifications use the BMD concept. Comment on the status of state agency BMD implementation and specification limits. Is mixture performance testing being conducted on a design level and/or quality control level? How often are performance testing results reported for a given project or mixture type? Identity any mixture test methods that more accurately indicate field performance than current mixture design parameters.
- B. Interview active HMA mixture designers in Wisconsin and designers who have been part of the BMD implementation process in other states. A minimum of six designers must be interviewed (including three with experience in Wisconsin design and practice). Summarize and analyze key take-aways from the interview process. All interviewees must have their Highway Technician Certification for HMA mixture design (HMA-MD) or an Agency's equivalent certification.
- C. Determine pseudo-performance BMD limitations in coordination with the Project Oversight Committee (POC). BMD performance limitations are expected to include at least two performance test methods and modifications to WisDOT Standard Specification 460 for design of HMA mixtures. Modifications to the standard specification will reduce mixture design requirements and rely on BMD limitations to control material selection.
- D. Collect existing mixture designs and materials from a minimum of four HMA plants based on Wisconsin geology, mixture design type, plant location or other factors. Measure performance properties of existing designs. Modify existing designs to meet requirements of agreed upon BMD specifications. The material collection strategy must be based on Wisconsin geology.
- E. Report BMD strategies used to meet pseudo-performance testing limitations while taking into consideration design factors reported by interviewees. Include an economic analysis of the alternative design methods.

- F. Identify any BMD shortfalls and propose preventive procedures or specifications.
- G. List necessary modifications to the WisDOT standard specification and propose performance testing thresholds to implement the “Balanced Mixture Design” method.

#### **IV. Required Testing**

- A. A minimum of two performance testing procedures.
- B. Recommended procedures for:
  - 1. Rutting: Past research has identified the Hamburg Wheel Tracker, AASHTO T324, as a promising test to indicate HMA rutting resistance.
  - 2. Cracking: Past research has identified the SCB IFIT (AASHTO TP124) and IDEAL CT as promising tests to indicate cracking resistance.
- C. Include the recommended testing procedures or refute the recommended procedures and propose replacements.
- D. Competitive proposals will include a research team member with experience designing mixtures.

#### **V. WisDOT/TOC Contribution**

WisDOT will provide the following support through the POC to support the successful completion of the project.

- A. Typical mixture designs for proposed sampling locations.
- B. Sampling of aggregate stockpiles and asphalt binder. Researchers are responsible for organizing shipping.
- C. The research team will not assume the availability of WisDOT staff or equipment in the proposal. If WisDOT or another entity donates equipment or staff time, a letter of commitment must be included in the proposal.
- D. WisDOT staff/TOC members can be expected to contribute a maximum of 40 hours over the duration of the project. The research team will consult with POC members in the selection of plants and mixtures for testing.
- E. The TOC and POC will coordinate access to WisDOT aggregates used in laboratory test programs. The research team must arrange and cover the cost of the transport of aggregates and materials to their laboratory test facilities as needed.
- F. If field work on or around in-service facilities is anticipated to conduct this research then the researcher shall specify in the proposal the nature and extent of traffic control that will be required for this project including: traffic flagging, signage, barricades, etc., as well as the duration needed (hours/day/location). There also needs to be a discussion in the proposal of the specific traffic control support that is being requested from WisDOT. The researcher will need to coordinate the location of the project fieldwork with the POC chair, WisDOT regional personnel and possibly the county personnel. The researcher should make accommodations in their proposal budget for traffic control and should not assume WisDOT will fund traffic control expenses.

## **VI. Required Travel**

It is expected the principal investigator (PI) will deliver the final presentation in-person in Madison, Wisconsin during the last two months of the project.

## **VII. Deliverables**

- A. Reporting Requirements: A final report delivered to WisDOT by the contract end date. This includes the report, specifications and manual recommendations. Please refer to the Implementation section for further details.
- B. Presentation Requirements: The researcher is required to give a Close-Out presentation to the TOC after submittal of the Before Close-Out Presentation report.
- C. Provide final presentation PowerPoint for training purposes. Training should highlight mixture design changes required to meet new specifications and testing procedures.
- D. Provide a list of WisDOT specification revisions required to implement the Balanced Mixture Design method.

## **VIII. Budget and Schedule**

- A. Project budget shall not exceed **\$150,000**
- B. Proposed project duration is **18 months** starting around **October 1, 2019**.
- C. Deadline for submittal of Before Close-Out Presentation (BCOP) report is three months before contract end date to allow for report review activities.
- D. Deadline for the Close-Out presentation is 4-6 weeks before contract end date.
- E. Deadline submittal for the publication-ready After Close-Out Presentation (ACOP) report is the contract end date.

## **IX. Implementation**

- A. Final report detailing results of the research project. The final report should be as concise as possible (e.g., a maximum of 50 pages plus supporting appendices).
- B. Select [Research Report Preparation](#) for the report preparation instructions. The research team should format the final report such that significant findings are provided at the beginning (e.g., in an extended executive summary). Literature review and summarized interviews may be provided as a separate document or in the Appendices of the report.
- C. Incorporate performance testing into the mixture design process.
- D. The research report and the final presentation document will be used to develop training materials for industry professionals and WisDOT engineers.