# Wisconsin Department of Transportation
# Wisconsin Highway Research Program

**Request for Proposal**

## *Timely and Uniform Application of Curing Materials*

Questions submitted to research@dot.wi.gov regarding the content of this RFP are due no later than 04:30 PM (CST) on January 4, 2021

Responses to questions will be posted to the WisDOT Research and Library website https://wisconsindot.gov/Pages/about-wisdot/research/researchers.aspx by 04:30 PM (CST) by January 15, 2021

Proposers must submit a PDF version of their proposal by 4:30 PM (CST) by February 5, 2021 to: research@dot.wi.gov.

Proposal Preparation Guidelines can be found at: Proposal Preparation Guidelines

Researchers will be notified of the proposal review decision by April 30, 2021

For more information regarding this RFP contact the WisDOT Research Program at: research@dot.wi.gov.

This RFP has been posted to the Internet at: https://wisconsindot.gov/Pages/about-wisdot/research/researchers.aspx

# Wisconsin Highway Research Program
# Rigid Pavement Technical Oversight Committee (TOC)
# Request for Proposals

## *Timely and Uniform Application of Curing Materials*

### I. Background and Problem Statement

Excessive early-age concrete surface moisture evaporation causes distress in concrete pavements, including plastic shrinkage cracking, surface scaling and delamination. The timely and uniform use of curing compounds can minimize these problems. Early application will disrupt the hydration in the surface layer and late application will allow rapid drying and fail the full hydration of the cement paste. To achieve the full effectiveness of the curing compounds, the concrete surface should be finished with a uniform coating of curing compound and should be properly inspected.

The WHRP 0092-11-05 study[1] indicated that the presence of bleed water can compromise the effectiveness of the curing compounds. The study also revealed the time of application of the curing compound is dependent on the selected compound and the concrete mix. Wisconsin Construction and Materials Manual (CMM) specifies two principal types of curing compounds, Poly-alpha-methylstyren (PAM) and water based wax curing compound (CMM 419.2 Curing). However, the time of application and the engineering method for the application of the curing compound are not prescribed clearly in the specifications (415.3.12.2 Impervious Coating Method). Moreover, the method to measure/evaluate the uniform coating of the curing compound is not specified. The inconsistent time of application and the unreliable measurement of the coverage tend to leave free water and lead to early distress on concrete pavement surface.

This RFP requests proposers to inspect how and when the curing compound has been applied, and how the time of application and the coverage affect early-age surface moisture evaporation distress in concrete pavements in the field. As part of the research plan, the research team will develop and modify curing compound application guidelines with the goal of reducing early shrinkage cracks and improve the long-term performance of concrete pavements.

### II. Objectives

The research plan includes three main objectives:

1. Observe and record when and how uniformly the curing material(s) are applied by assessing representative concrete pavement projects in Wisconsin;

[1] https://wisconsindot.gov/documents2/research/final-reports-proj-briefs/WisDOT-WHRP-project-0092-11-05-final-report.pdf

2. Document how curing compound application times and coverages relate the development of distress (e.g., shrinkage cracks, scaling or delamination) on concrete pavement in Wisconsin; and
3. Develop a measurable methodology to establish optimal times and assess uniform applications of curing materials to improve the long-term performance of concrete pavements.

## III. Scope of Work

### Task 1: Literature Review

Conduct a comprehensive literature review that includes various state DOTs, the FHWA, ministries of transportation and industries on the:

- commonly applied curing materials for concrete pavement and their application timing window for the optimal performance;
- methodologies to assess optimal timing and uniform application of curing materials;
- short and long-term consequences of concrete pavement performance due to different curing material applications; and
- treatment strategies to mitigate distresses from improperly applied curing materials.

### Task 2: Selection of Representative Concrete Pavement Sections in Wisconsin

Select representative new construction pavement projects in Wisconsin for field visits. In considering various temperatures during construction, projects should be selected in different months. The selection strategy should at a minimum consider aggregate material types (e.g., mixed aggregate in south central, crushed limestone in north central, igneous gravel in north west, igneous quarry material in north central Wisconsin), a diversity of geographic locations, different cement types, various concrete thicknesses and various temperatures (i.e., different construction months). The proposed pavement projects will be presented to the Project Oversight Committee (POC) for comment and approval.

### Task 3: Perform Field Survey

Conduct field visits and record times of curing compound applications, coverage methodologies and coverage areas after placing concrete. Then researchers should monitor and record the presence of any surface moisture evaporation distresses. The research team will visit the field sites and:

- measure the time and temperature when the curing compound material is applied in the field;
- observe and record the curing compound application methods (e.g., the use of devices or measurement to find the optimal time and coverage for applying curing compounds);
- record curing compound application rates and coverage;
- record the construction and material data, including aggregate and cement type,

date and time of curing compound application, environmental condition when the curing compound is applied (i.e., wind speed, ambient temperature, humidity, etc.); and

- observe the early condition of the concrete pavement including early shrinkage and scaling after curing compound has been applied.

**Task 4: Analysis and Interpretation of Field Data**

The research team will analyze and interpret the relationship between the application time and coverage with any noticeable distresses on the concrete surface. The research team will share findings with POC members before developing recommendations.

**Task 5. Develop Recommendation for Timely and Uniform Application of Curing Material**

Based on analyses and interpretations of field data, the research team will propose recommendations and guidelines for the optimal time and measurement method for application coverage of curing compounds. These recommendations and guidelines will then be used to update the current standard specifications for concrete pavements with a measurable methodology aimed at reducing the early shrinkage cracks and improving the long-term concrete pavement performance.

**Task 6. Final Report**

The research team will prepare and submit a draft final report that will include project background, field data analysis and interpretation and recommendations for updated curing material application. As part of this report, the research team will include Excel files with curated testing data for future use, analysis and interpretation.

*Note- The selected research team will negotiate a contract that will include a Data Management Plan (DMP) documenting all field/laboratory data and analyses to ensure accessibility and transparency of research data as required by the USDOT per the Public Access Plan (https://ntl.bts.gov/public-access/creating-data-management-plans-extramural-research). The DMP will include the following items:*

- *The final research data to be produced during the project;*
- *The standards to be used for data and metadata format and content;*
- *Policies for access and sharing the final research data, including provisions for appropriate protection of privacy, confidentiality, security, intellectual property and other rights or requirements;*
- *Policies and provisions for re-use, re-distribution and the production of derivatives; and*
- *Plans for archiving final research data and other research products, and for preservation of access to them.*

*A Data Management Plan is not required as part of the proposal submission.*

## IV. Required Testing

**A.** During field visits, record curing compound application time and environmental condition of the project.

**B.** No laboratory testing is required.

## V. WisDOT/TOC Contribution

WisDOT will provide the following support through the Project Oversight Committee (POC) to support the successful completion of the project:

**A.** Work will be conducted with project oversight by the WisDOT WHRP Rigid Pavements Technical Oversight Committee (TOC).

**B.** 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.

**C.** WisDOT staff/TOC members can be expected to contribute a maximum of 40 hours over the duration of the project.

**D.** The TOC and POC will coordinate access to applicable/available project cross sections.

**E.** 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).

**F.** The proposal will need to discuss 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

**A.** This project will require travel for meetings with the POC to finalize the work plan and the researcher's fieldwork.

**B.** This project will require travel to Madison, WI to deliver the Close-Out Presentation.

## VII. Deliverables

**A.** Quarterly Progress Reports

- **a.** WHRP contracts require quarterly technical progress reports that serve both technical and administrative functions.
- **b.** Detailed information regarding the content of the progress report can be found at: Quarterly Progress Reports Guidelines

**B.** Invoices

- **a.** Invoices shall be submitted quarterly for partial payments on the project for authorized services completed to date. Invoices may be submitted four times per year, one partial invoice for each specified quarter.

**b.** Detailed information regarding invoicing can be found at: Invoicing Requirements

**C.** Before Close-Out Presentation Report

**a.** A Before Close-Out Presentation report is required to be submitted three months before the contract end date to allow time for review, revision and scheduling of the project Close-Out Presentation.

**b.** Reports are expected to have quality technical writing and proper grammar. It is acceptable to dedicate resources from your project for the services of a technical editor to ensure these requirements are met.

**c.** The required elements of the Before Close-Out Presentation report can be found at: Before Close-Out Presentation Requirements

**D.** Project Close-Out Presentation

**a.** The Principal Investigator on the research team is required to give a presentation to the Technical Oversight Committee in-person.

**b.** Presentation and formatting requirements can be found at: Close-Out Presentation Requirements

**E.** After Close-Out Presentation Report

**a.** The After Close-Out Presentation Report is due within three weeks of the Close-Out Presentation for review and comments.

**b.** This report details the results of the research project. The final report should be as concise as possible (e.g., a maximum of 50 pages plus supporting appendices) and follow the report guidelines and submission requirements: After Close-Out Presentation Report Requirements

**c.** After revision(s) and oversight committee chair approval, an electronic copy of the Publication-Ready Report must be delivered to WisDOT by the contract end date.

## VIII. Schedule and Budget

**A.** Project budget shall not exceed $130,000. Matching funds will not be considered in the proposal evaluation process.

**B.** Proposed project duration is 24 months starting around October 1, 2021.

## IX. Implementation

Successful implementation of this research will be achieved through the development of the following items:

**A.** This study will inspect and recommend times of application and coverage of the curing compound. Recommendation should include the measurable method to indicate the curing material application time and any inspection process to confirm the material has been applied at the right time and in right coverage.

**B.** This study will recommend changes to existing concrete pavement construction and maintenance method/specifications and recommendations for use of new method(s), if any, for the future.

**C.** The final research report and presentation will be used to develop training materials for industry professionals and WisDOT engineers.