Wisconsin Department of Transportation
Wisconsin Highway Research Program

Request for Proposal

Field Investigation of Dowel and Tie Bar Placement

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
Request for Proposals

Field Investigation of Dowel and Tie Bar Placement

I. Background and Problem Statement

Dowel and tie bars are essential tools for transferring loads and holding faces of concrete slabs while protecting concrete joints. The improper placement of dowels and tie bars can lead to a reduced load transfer between slabs, and the development of pavement distresses, including faulting and spalling at the joints. Once bars are placed and immersed in the concrete paste, it is difficult to measure the accuracy of placement and extremely hard to fix the misalignment. Moreover, when the pavement is placed by Dowel Bar Inserter (DBI) machine and the insertion process is not set up accurately, it is likely that a shift in the intended location of the steel bars occur. Thus, dowel and tie bars should be appropriately placed to satisfactorily function within the pavement system. Timely detection and correction of misplaced or misaligned bars during construction is essential to avoiding the development of premature failures and costly repairs upon project completion. A 2019 WisDOT internal pilot study revealed that dowel bars were misplaced in several projects, especially when the bars were placed with the DBI machine. For example, there were significant numbers of dowel bars out of allowance horizontally and vertically on STH 441 in Appleton, which required great efforts to repair.

As a result of this research project, WisDOT expects the research team to develop recommendations for appropriate allowance and thresholds for dowel and tie bar placement. The final report is also expected to include recommendations regarding best inspection practices for bar placement in rigid-pavement construction.

II. Objectives

This research plan includes four main objectives:

(1) Investigate and quantify the dowel and tie bar placement from representative concrete pavements in Wisconsin;
(2) Document dowel and tie bar misalignments and relate how these misalignments impact joint performance (i.e., distress and ride quality) of concrete pavements;
(3) Review the acceptable tolerance limits for dowel and tie bar alignments and recommend appropriate thresholds to achieve long-term satisfactory joint performance and practical installation of bars; and
(4) Provide appropriate inspection procedures to confirm proper bar installation in the field.

III. Scope of Work

Task 1: Literature Review

Consult various state DOTs, the FHWA, Ministries of Transportation and industries, and conduct a comprehensive literature review to include:

- Non-destructive inspection methods to assess dowel and tie bar alignments regardless of bar-installation methods.
- Causes for misalignments of dowel and tie bars in concrete-pavement construction.
- Tolerance limits for depth and horizontal and vertical alignment for dowel and tie bars in states with similar weather conditions as Wisconsin.
- Distresses and riding quality issues caused by misaligned dowel and tie bars.
- Applicable mitigation methods for misalignment corrections.
- Contractual incentives or disincentives to address and correct misaligned dowel and tie bars problems.

Task 2: Selection of Concrete Pavement Sections for Field Evaluation

Consult with Project Oversight Committee (POC) members to select representative pavement sections in Wisconsin for field visits. The selection should consider

- Pavement thickness, age and roadway design geometry.
- Pavement transverse and longitudinal joint conditions. The research team should consider using historical pavement survey data to guide the selection.
- Different types of dowel and tie bar installation methods (e.g., dowel basket and dowel bar inserter).

Task 3: Perform Field Survey

Conduct field visits and evaluate the dowel and tie bars for alignment/misalignment determination within current tolerance limits. The research team should recommend appropriate equipment to assess dowel and tie bar alignments regardless of bar installation method. Pavement joint condition should be inspected during the field survey.

Task 4: Analysis and Interpretation of Field Data

Analyze and interpret transverse/longitudinal dowel and tie bars alignment and joint condition data. The research team should generate an interim report for the POC documenting:

- If the scanned dowel and tie bars alignment meet the allowable criteria described in the WisDOT standard specification, Construction and Material Manual (CMM), and Facility Development Manual (FDM).
- The relationship between misalignment and joint condition.

Task 5: Develop Recommendations and Guidance to Update Bar Placement Allowance Criteria and Inspection Process

Recommendation and guidance should be provided in a format consistent with Wisconsin Standard Specifications, Construction and Material Manual (CMM), and

Facility Development Manual (FDM), Highway Maintenance Manual and associated presentation materials for WisDOT practitioners.

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 Bar Placement Allowance Criteria and inspection process. 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. Dowel and tie bar alignment scanning in the field.

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 Rigid Technical Oversight Committee (TOC) and Rigid Project Oversight Committee (POC).

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 and 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. 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

This project will require travel to Madison to deliver the Close-Out Presentation in-person.

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. A detailed review and recommendation of dowel and tie bar placement tolerance limits.

B. Recommendation for future inspection procedures including inspection time, methods and frequency, so that dowel and tie bars in concrete pavement can perform adequately during expected service life.

C. Proposed changes to existing concrete pavement construction and maintenance method/specifications and recommendations for use of new method(s), if any, for the future.

D. A report and a presentation that will be used to develop training materials for industry professionals and WisDOT engineers.