



**Wisconsin Department of Transportation
Wisconsin Highway Research Program
Request for Proposals**

Vertical and Overhead Concrete Patches

Questions submitted to research@dot.wi.gov regarding the content of this RFP are due no later than 04:30 PM (CST) on January 3, 2023

Responses to questions will be posted to the WisDOT Research and Library website <http://wisdotresearch.wi.gov/rfps-and-proposals> by 04:30 PM (CST) on January 18, 2023

Proposers must submit a PDF version of their proposal by 4:30 PM (CST) on February 8, 2023 to: research@dot.wi.gov.

Proposal Preparation Guidelines can be found at [Proposal Preparation Guidelines](#)

Proposers will be notified by April 28, 2023

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: <http://wisdotresearch.wi.gov/rfps-and-proposals>

Wisconsin Highway Research Program (WHRP)
Structures Technical Oversight Committee (TOC)
Request for Proposals

Vertical and Overhead Concrete Patches

I. Background and Problem Statement

Bridge elements undergo various types of damage throughout their service life. As a result, vertical and overhead concrete patch repairs are necessary to rehabilitate concrete bridge decks and slabs, repair damaged prestressed concrete (PS) girders, and remediate spalls on substructure elements such as piers and abutments. Currently, WisDOT guidance is limited to horizontal concrete surface repairs on concrete pavements and bridge decks. In addition, WisDOT projects mostly rely on the manufacturer's repair recommendations and field engineers' discretion for accepting vertical and overhead concrete surface repairs. Therefore, the development of complete guidance protocols for vertical and overhead concrete patch repairs is required to provide consistency and ensure the durability of concrete patches.

This research study aims at providing repair insights and repair specification recommendations to maximize the service life of vertical and overhead concrete patches. More specifically, minor (≤ 2 -inches deep and not beyond the reinforcing steel) to intermediate surface repairs (>2 -inch, beyond the reinforcing steel, but minor sectional stress affects) located both above traffic and away from traffic will be investigated. Pneumatically applied cementitious materials may also be considered, but they have historically been limited.

Current WisDOT practice for repairs over traffic has typically been coordinated through professional engineers. Details typically include small mechanical anchors and small gauge reinforcement (i.e., tie wire) for containment purposes. For large patches over traffic, patches are typically contained with fiber-reinforced polymer (FRP) wraps.

Patch repair recommendations and specifications must be based on past research, current best practices, and product literature. The research team will also investigate several repair applications to understand their durability performance. We anticipate this study will review literature and contact/survey state agencies, including laboratory testing, and provide recommendations to WisDOT's specifications and for an approved products list. This project would be beneficial to provide specific guidance for vertical and overhead concrete patches to ensure WisDOT delivers longer-lasting repairs.

II. Research Objectives

- A. Investigate and provide material selection guidance and repair strategies for concrete surface repairs in the vertical and overhead positions. Selection guidance should include patches located above traffic. This guidance should include the following strategies: coat damaged area, install patch material without anchorage, install patch material with anchorage, and install patch material confined by FRP.
- B. Develop patch-repair material installation specifications, installation inspection requirements, and acceptance criteria.

- C. Investigate the performance of minor to intermediate patch repairs subjected to several stress tests to evaluate patch durability performance.
- D. Develop recommendations to ensure durable long-term repairs and best practices for patches.

III. Scope of Work

Task 1: Comprehensive literature review

Conduct a comprehensive literature review and assessment of current practices at various state Departments of Transportation (DOTs), Canada's Ministries of Transportation, FHWA, industries, and manufacturers. WHP has completed an initial literature search that will be provided to the research team. Provide a summary of the reviewed information to the Project Oversight Committee (POC).

Task 2: Critical evaluation of vertical and overhead repairs

Evaluate the current use of vertical and overhead repairs for above traffic and away from traffic locations. Consider different patch material types, repair depths, material compatibilities, application methods, repair personnel (contractor vs. local forces), repair procedures, repair durability, and repair reinforcement (e.g., anchors, reinforcement, fibers, etc.). During this task, the research team will work with the POC to establish WisDOT Bureau of Structures staff contacts for discussions and past product acceptance. These discussions should include an evaluation of past repair strategies and soliciting input from Regional Maintenance staff.

Task 3: Repair strategy development

Develop repair strategies for selecting vertical and overhead repairs based on Task 2 outcomes. The proposed guidelines must be consistent with the WisDOT Standard Specifications and Construction and Materials Manual (CMM). In addition, guidelines should include limitations, commentary, and other pertinent factors for accepting repair solutions.

Task 4: Design and Laboratory Investigations

Design and conduct laboratory investigations and experiments that would provide insights into the performance of various patch materials regarding the durability of minor to intermediate vertical and overhead concrete patches. At least four different patch materials/products shall be examined for vertical and overhead conditions. In addition, at least two different concrete substrates representative of a bridge deck and a PS girder should be tested. The experiments should represent current practices with and without anchorage, representative of a typical conventionally reinforced concrete locations (i.e., the underside of bridge decks, vertical faces of substructures, etc.) and a prestressed concrete girder, and be tested to determine the failure mode.

Task 5: Proposed recommendations

The research team will develop recommendations and guidelines in a format consistent with WisDOT Standard Specifications, Bridge Manual, and approved product lists. Please refer to the implementation section for further details.

Task 6: Final report

The research team will prepare and submit a final draft report that will include project background, field data analysis, interpretation, and recommendations for concrete surface repairs. 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-planextramural-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 accessing 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, including preserving data access.*
- *A Data Management Plan is not required as part of the proposal submission.*

IV. Required Testing

- A. Existing Substrates: At least two concrete mixes representing a concrete bridge deck and a PS girder will be considered. Specimens shall be cured for at least 28-days before casting and installing repair materials.
- B. Repair Materials:
 - a. At least four different repair fill materials/products, in addition to WisDOT's standard concrete repair.
 - b. At least one small gauge mechanical anchor and reinforcement concept.

V. WisDOT/TOC Contribution

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

- A. The POC will work with the research team on the shipment of materials. Please budget to cover shipment costs.
- 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 commitment letter must be included in the proposal.
- C. The Technical Oversight Committee (TOC) and POC will coordinate access to WisDOT aggregates used in laboratory test programs. In addition, the research team must arrange and cover the transport of aggregates and materials to their laboratory test facilities as needed.
- D. If fieldwork on or around in-service facilities is anticipated, the proposal will describe the nature and extent of traffic control and support assistance required. The research team will coordinate with WisDOT regional personnel and possibly the county personnel where project fieldwork is being conducted. For WisDOT planning purposes, the research team shall specify in the proposal, as practical, traffic control measures for this project, including traffic flagging, signage, barricades, etc., and the duration (hours/day/location). WisDOT will not fund the traffic control apart from the research project budget.

VI. Required for Travel to Fulfill TOC Obligations

None.

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. Four invoices per year are expected, one partial invoice for each specified quarter.
 - b. Detailed information regarding invoicing can be found at [Invoicing Requirements](#)
- C. Before Closeout Presentation (BCOP) Report
 - a. A BCOP report is required to be submitted three months before the contract end date to allow time for review and revision of the BCOP before the presentation.
 - b. Reports are expected to have quality technical writing and proper grammar. It is acceptable to dedicate funds in the project budget for the services of a technical editor to ensure these requirements are met.
 - c. The required elements of the BCOP report can be found at: [Before Closeout Presentation Requirements](#)
- D. Project Closeout Presentation (COP)
 - a. The Principal Investigator on the research team is required to give a presentation to the TOC.
 - b. Presentation and formatting requirements can be found at [Closeout Presentation Requirements](#)
- E. After Closeout Presentation (ACOP) Report
 - a. The ACOP report is due within three weeks after the Closeout 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 Closeout 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. The project budget shall not exceed \$200,000
- B. The proposed project duration is 24 months, starting around 10/01/2023
- C. The deadline for submittal of the BCOP is three months before the contract end date to allow for report review activities.

IX. Implementation

- A. Summarize the range of available products and applicability for durable vertical and overhead concrete patches located both above traffic and away from traffic.
- B. This study will review and recommend guidance for accepting material/products and installing vertical and overhead concrete patches in a format consistent with the WisDOT Standard Specifications, Bridge Manual, and Approved Product Lists.
- C. The final research report and presentation will be used to develop training materials for industry professionals and WisDOT engineers.