



WHRP

Wisconsin Department of Transportation Wisconsin Highway Research Program

Request for Proposals

Bridge Deck Thermography Verification and Policy

Questions submitted to research@dot.wi.gov regarding the content of this RFP are due no later than 4:30 PM (CST) on January 3, 2022

Responses to questions will be posted to the WisDOT Research and Library website <https://wisconsindot.gov/Pages/about-wisdot/research/researchers.aspx> by 4:30 PM (CST) on January 14, 2022

Proposers must submit a PDF version of their proposal by 4:30 PM (CST) on February 4, 2022 to research@dot.wi.gov.

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

Proposers will be notified by April 29, 2022

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
Structures Technical Oversight Committee
Request for Proposals for**

Bridge Deck Thermography Verification and Policy

I. Background and Problem Statement

As part of an overall asset management program, Departments of Transportation (DOTs) use non-destructive evaluation techniques, including Infrared Thermography (IRT), to determine the condition of bridge decks, code/enter inspection results, and identify/quantify future work actions like overlays and deck replacements. IRT utilizes reflected electromagnetic waves in the infrared spectrum to discern differences in temperature directly attributed to the presence of voids and delamination in concrete bridge decks. The Wisconsin Department of Transportation (WisDOT) has been utilizing this type of NDE technique for over five years and has recently coordinated a state-wide program to use it on all bridges across the state consistently. The results have been beneficial for the inspection of bridges; however, there are difficulties in interpreting results to quantify needed work actions and plan quantities.

When using IRT, DOTs need to establish the best sensor configurations (e.g., aerial, ground vehicle, or handheld), the most desirable camera/sensor parameters (e.g., pixel density and resolution, sensor vehicle velocity, sensor elevations), and the optimal environmental conditions (e.g., time of day, cloud cover, residual moisture content) to provide the most accurate results. In addition, DOTs need to know at what stage in the life cycle or condition to begin using IR and what configuration of sensor produces the optimal information (e.g., inspection vs. quantifying work actions like types of deck preparation).

Needs for the research

WisDOT is looking for recommendations to refine further the use and implementation of the IRT technique for the inspection of bridge decks, including:

- Optimal IRT parameters based on the required use (e.g., inspection vs. plan production)
- Stationary vs. moving (vehicle and aerial) data collection systems
- Environmental conditions (e.g., temperature, moisture content, humidity, and other) to produce the most accurate results
- Limits of IRT for the detection of crack depths, types of deterioration, etc.
- Estimation of bridge deck life-cycle condition to begin and stop deploying IRT inspections
- IRT data collection frequency



- The anticipated timeframe that the results of the IRT may be considered valid.
- Recommendations for state-wide policy on IRT data collections

II. Objectives

The research team should provide research-driven recommendations to develop:

- A. Specifications related to the equipment type, sensor platform, and environmental parameters for IRT data collection. WisDOT would use these specifications for soliciting and contracting IRT services.
- B. State-wide policies on the bridge deck life-cycle condition to begin and stop using IRT, along with optimal IRT data collection frequencies
- C. Guidelines on the IRT's accuracy compared to the actual condition found in bridges during overlay construction projects (using current WisDOT and other available data). This information should help drive the improvement of asset management estimations and scoping of improvement projects.

These recommendations would translate into the state-wide policy on data collection within the WisDOT Structure Inspection Manual (1-A-2 thru 1-A-5)

<https://wisconsindot.gov/dtsdManuals/strct/inspection/insp-fm-pt1appxa.pdf>.

III. Scope of Work

Task 1:

Conduct a comprehensive literature review of current practices and technologies at various other state DOTs, Canada's Ministries of Transportation, FHWA, industries, and manufacturers. The literature review should also include an assessment of related research conclusions and recommendations. WHRP has completed an initial Literature Search that will be provided to the research team. In addition, the research team should coordinate with the FHWA Long Term Bridge (Infrastructure) Program to include information and developments related to NDE and testing data sets.

Task 2:

Contact at least five state DOTs and other vendors that use IRT on bridge decks and other bridge elements to gather relevant information related to:

- Equipment used
- Camera/sensor parameters (e.g., pixel density and resolution, sensor vehicle velocity, sensor elevations)
- Desirable environmental conditions (e.g., time of day, cloud cover, residual moisture content) that provide the most accurate IRT results.

An emphasis should be placed on state DOTs that use IRT to support bridge inspection reporting/coding and asset management decisions. Summarize this information related to current practices and technologies.

Task 3:

Work with the Project Oversight Committee (POC) to collect and assess Wisconsin-specific policy and data, including:



- Existing deck scanning policy documents
- Current contractual special provisions for contracting these services
- Existing IRT data on file (HSIS Bridge Management System).
- Historic bridge IRT data related to overlay construction project plans and field measurements (including data related to quantities of deck preparation, planned and performed).

This information must be used to compare pre-construction IRT to actual quantiles in the field to assess the accuracy of IRT technology.

Task 4:

Field test bridge decks with IRT equipment and recommended environmental conditions. Compare and validate thermography results with conventional test methods, including chaining, coring, or other appropriate methods. This task should include a **minimum of six bridges** proposed by the research team and agreed to by POC. WisDOT may utilize thermography contractors currently approved for work in Wisconsin to assist the researcher in performing a portion of this in-depth field testing.

Task 5:

Develop recommendations and guidelines in a format consistent with WisDOT contract specifications, Structures Inspection Manual, and Bridge Manual. Please refer to the Implementation section for further details.

Task 6:

The research team 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.

IV. Required Field Testing

- A. Field test bridge decks with IRT equipment and recommended environmental conditions.
- B. Compare and validate IRT results with conventional test methods, including chaining, coring, or other appropriate methods.



- C. These tests should be performed for a **minimum of six bridges** proposed by the research team and agreed to by POC.

There is no laboratory testing anticipated with this project.

V. WisDOT/TOC Contribution

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

- A. Work will be conducted with project oversight by the WisDOT Bureau of Structures and WHRP Structures 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. If field work on or around in-service facilities is anticipated to conduct this research, then the research team 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).
- E. 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 proposed budget for traffic control and not assume WisDOT will fund traffic control expenses.
- F. Researchers should not assume the availability of contractors for sampling and testing.

VI. Required Travel

- A. This project requires meetings with the POC to finalize the work plan and the researcher's fieldwork.
- B. This project requires travel to complete fieldwork.
- C. This project requires the principal investigator to deliver the Close-Out Presentation two months before completing the contract.

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 (BCOP) Report
 - a. A BCOP 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 BCOP report can be found at [Before Close-Out Presentation Requirements](#)
- D. Project Close-Out Presentation
 - a. The Principal Investigator on the research team must give a presentation to the Technical Oversight Committee (TOC).
 - b. Presentation and formatting requirements can be found at [Close-Out Presentation Requirements](#)
- E. After Close-Out Presentation (ACOP) Report
 - a. The ACOP 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 \$150,000. Matching funds will not be considered in the proposal evaluation process.
- B. Proposed project duration is 24 months starting around October 1, 2022.

IX. Implementation

- A. This study will review and recommend guidance on specifications on the equipment type, sensor platform, and environmental parameters for the collection of thermography data to be used in soliciting and contracting for this service.
- B. This study will review and recommend improved policy on the bridge deck life-cycle condition to start using thermography, the optimal frequency of collecting the data, and the point when there is no longer value in collecting the data. This would translate into the state-wide policy on data collection in the Structure Inspection Manual (1-A-2 thru 1-A-5).
- C. This study will provide guidance on the accuracy of the thermography data collected as compared to the actual condition found in the field during overlay



construction projects. This would improve asset management estimations and scoping of improvement projects. This information will also be reflected in the WisDOT Bridge Manual Chapter/Section 42.5.2 Identification of Preservation Needs or related.

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