

**TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT**

Lead Agency (FHWA or State DOT): **Wisconsin DOT**

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

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|---|--|---|--|
| Transportation Pooled Fund Program Project # TPF-5(432) | | Transportation Pooled Fund Program - Report Period: <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input checked="" type="checkbox"/> Quarter 4 (October 1 – November 3) | |
| Project Title: Bridge Element Deterioration for Midwest States | | | |
| Name of Project Manager(s): Philip Meinel, Wisconsin DOT (Lead Agency) Richard Boadi (Wood, performing organization) | Phone Number: 608-266-0075 703-477-8367 | E-Mail Philip.Meinel@dot.wi.gov Richard.Boadi@woodplc.com | |
| Lead Agency Project ID: 0092-19-40 | Other Project ID (i.e., contract #): N/A | Project Start Date: December 3, 2019 | |
| Original Project End Date: December 2, 2021 | Current Project End Date: November 3, 2022 | Number of Extensions: 1 | |

Project schedule status:

- On schedule
 On revised schedule
 Ahead of schedule
 Behind schedule

Overall Project Statistics:

| Total Project Budget | Total Cost to Date for Project | Percentage of Work Completed to Date |
|----------------------|--------------------------------|--------------------------------------|
| \$498,017 | \$498,017 | 100% |

Quarterly Project Statistics:

| Total Project Expenses and Percentage This Quarter | Total Amount of Funds Expended This Quarter | Total Percentage of Time Used to Date |
|--|---|---------------------------------------|
| % \$5,417 / 1% | \$ \$5,417 | 100% |

Project Description:

Scope

The objective of this pooled fund research is to have multiple Midwest DOTs pool resources and historic Midwest DOT bridge data related to element-level deterioration, operation practices, maintenance activities, and historic design/construction details. This data will provide the basis for research to determine bridge deterioration curves. A select number of deterioration curves will provide needed utility for the time-dependent deterioration of bridge elements to be used in making estimates of future conditions and work actions. This effort will pool data and through the analysis and research processes create results that will improve the accuracy of various bridge management and asset management applications that the member DOTs use (AASHTO BrM, Agile Assets, and others).

This study is sequenced into three tiers based on the priorities of the DOTs:

Tier 1 National Bridge Elements (NBE) & National Bridge Inventory (NBI) Components:

- Develop element-level deterioration curves for Reinforced Concrete Deck.
- Develop element-level deterioration curves for Reinforced Concrete Slab.
- Develop deterioration curves for NBI component items (i.e. bridge deck, superstructure, and substructure).
- Develop element-level deterioration curves for Reinforced Concrete Deck after a major preservation activity such as mill and overlay with the rigid concrete wearing course.
- Develop predicted improvement in the condition of Reinforced Concrete Deck element after a major preservation activity such as mill and overlay.
- In addition to probabilistic deterioration curves, also develop select deterministic deterioration curves.

Tier 2 Bridge Management Elements (BME) & Remaining NBE Elements

- Develop element-level deterioration curves for each type of wearing surface (bare concrete, sealed concrete, thin polymer overlay, Polyester Polymer Concrete (PPC) overlay, ridged concrete overlay, Polymer Modified Asphalt overlay, and asphalt overlay with membrane).
- Develop element-level deterioration curves for Strip Seal Deck Joints and Modular Deck Joints.
- Determine defect-level deterioration curves that describe defect development and progression (e.g., cracking and delamination).
- Develop deterioration curves for Paint system (protective steel) effectiveness.
- Develop defect-level deterioration curves for Steel Girder corrosion, and correlate to Paint system effectiveness; specifically, how long from new paint to 75% and 50% effective and end of life.
- Develop element-level deterioration curves for substructure elements in harsh environments (e.g., pier caps under expansion joints, pier columns in spray zone from snow plows, etc.).

Tier 3 Similar Agency Defined Elements (ADE) & Inspection Related

- Identify Agency Defined Elements (ADE) that would be of use for other Midwest DOTs to consider adopting.
- Determine what type of inspection information related to Nondestructive Evaluation (NDE) Midwest DOTs have and how it is used that translates into information on element-level defects (Ground Penetrating Radar (GPR), Infrared Thermograph, or other).
- Provide a summary of policy, guidance, and practices that Midwest DOTs employ to relate NDE results to defect reporting (to describe delamination and deterioration) and how DOTs use NDE to make quantifiable inspection and actionable work actions for concrete bridge decks.

Expected Findings and Benefits

The project delivered the following items:

- Literature review which will detail the current state of the practice for bridge deterioration modeling and will include the literature review, a survey, and targeted interviews.
- Data screening procedure. This will allow participating States to help understand the validity of their data and its pros and opportunities for improvement.
- A populated and documented open-source database and analysis engine which the States can use to explore and model their data or data from other States in an easy to use interface.
- Tier 1 models.
- Tier 2 models.
- Tier 3 information.

The activities, tools, practices, policies, or methods in partner States that would be impacted by the research findings include:

- Bridge management practices and policies.
- Deterioration modeling of bridge components.
- Deterioration modeling processes which can be applied to other element level bridge components.
- Development of defensible system performance targets.
- Development of bridge work plans.
- Performance of risk analysis to determine which bridges are more at risk from a condition standpoint.
- This project will provide participating States strengths and opportunities for improvement in their data collection policies, procedures, and methods.

The primary benefit of this project to the participating States is the ability to plug the resultant models into their asset management systems and immediately begin to use the data to make better, data-driven decisions. A secondary benefit of this project is the provision of the online database and analysis engine that will be designed for the participating States to run their own analysis at the NBI level or NBE level using their State's data, a portion of the participating States' data, national data, or some other permutation. This will empower the participating States to explore the data and come up with deterioration models as new data are available or new analysis concepts are uncovered.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Task 1 – Project Management

A progress report was issued, and the project was managed. We responded to email communications regarding the final deliverables. This is the final quarterly progress report.

This task is 100% complete. No problems have been encountered to-date.

Task 2 – Literature Review

This task is 100% complete.

Task 3 – Data Collection

This task is 100% complete.

Task 4 – Develop Data Screening Procedure

This task is 100% complete.

Task 5 – Develop Data Management Policy

This task is 100% complete.

Task 6 – Develop Tier 1 Deterioration Curves

This task is 100% complete.

Task 7 – Develop Tier 2 Deterioration Curves

This task is 100% complete.

Task 8 – Develop Tier 3 Inputs

This task is 100% complete.

Task 9 – Final Project Deliverables

The project team gathered comments on the final report and incorporate them into the final report. The final report, final codes, final raw data, final analysis dataset, and final presentation slides were issued during this period. We delivered a final virtual presentation to close out the project.

This task is 100% complete.

Anticipated Work Next Quarter:

This project is completed. All deliverables were issued to the TAC team. This QPR is the final QPR for this project.

Significant Results:

A significant result is that the project team has delivered all the expected deliverables to the TAC team

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems):

The project is was completed on schedule following the addendum in 2022.

Potential Implementation:

Robust Tier 1 and 2 models ready for implementation in BMSs to enable and support bridge management functions in the DOT.