

RESEARCH SPOTLIGHT

Project Information

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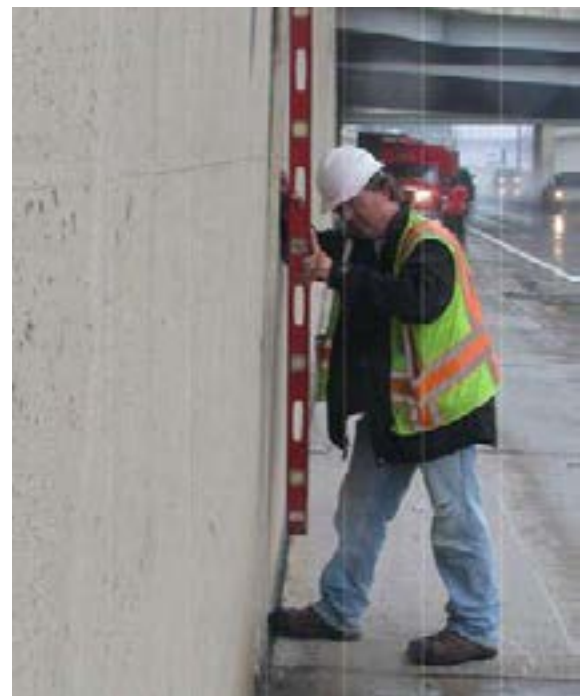
New tools allow proactive management of Michigan's retaining walls

While Michigan's transportation assets are systematically monitored and evaluated, structures like retaining walls have not been managed to the same extent as bridges and pavements. Motivated in part by federal requirements in the Moving Ahead for Progress in the 21st Century Act (MAP-21) of 2012, the Michigan Department of Transportation (MDOT) created a comprehensive strategy to assess and maintain these critical assets. The new procedures are documented in an inspection manual designed to help standardize the process across the state.

PROBLEM

With limited budgets and no shortage of aging infrastructure, transportation agencies across the country have historically focused their resources on roads and bridges. This means that while pavements and structures are regularly repaired or rebuilt, retaining walls and other earth-retaining structures are typically not able to be maintained with the same priority. However, as such structures deteriorate over time – especially those situated along urban freeways – their deterioration can pose safety and mobility concerns for the traveling public.

Without a strategy in place to identify and address structural deterioration at early stages, officials are often forced to respond to



An MDOT worker holds a level against a retaining wall to measure tilt, one of several data points used to gauge the wall's performance.

"We now have the inspection guidelines and tools to track the condition of our retaining walls. These aging structures need to be better understood."

Eric Burns, P.E.
Project Manager

failures after they occur. This reactive approach may be unavoidable after a natural disaster, but in everyday practice it is often more expensive, disruptive to traffic and environmentally consequential than if issues are addressed early on.

Recognizing the seriousness of this issue and in alignment with MAP-21, which calls on states to develop risk-based management plans for their highway assets, MDOT sought to develop a program to strategically address the most at-risk structures before they become compromised. A necessary first step in the process would be to proactively catalog the conditions of the state's vast retaining wall inventory.

RESEARCH

For the purposes of this study, researchers defined a retaining wall as any structure that holds back earth and has an exposed height of 4 feet or greater and a vertical or near-vertical face (with an angle of inclination greater than 45 degrees).

From the outset, researchers identified the need for a comprehensive asset management system for Michigan's retaining walls. To achieve this goal, they first set out to learn how other states manage these assets. While few agencies have programs in place to manage their retaining walls, researchers learned about what best practices these agencies have developed, what data is useful to collect, and how best to use that data to identify at-risk walls.

Next, researchers installed instruments on selected panels of two retaining walls in southeast Michigan to monitor and collect this essential data. Over an 18-month period, researchers measured tilt, strain and surface temperature on the structure. Understanding how the wall panels behaved over multiple seasons helped researchers devise a procedure for assessing risk – a key component of a clearly defined and standardized system for identifying the walls most in need of immediate attention.

RESULTS

The newly developed risk assessment framework provides an objective methodology that MDOT engineers can use to predict when retaining walls will need maintenance or repairs. Using information from design documents and data from visual inspections and monitoring instruments, inspectors can calculate the reliability of a structure in quantified terms. With this information, engineers are better equipped to anticipate which structures will need attention and when. They can then develop a systematic plan to schedule projects strategically and budget for them ahead of time, instead of trying to react to issues after they occur.

To assist engineers in their work in the field, researchers created a retaining wall inspection manual. Since many of the elements of bridge inspection are also used in inspecting retaining walls, researchers opted to design the new manual in a style similar to MDOT's bridge inspection manual. This resource will be a valuable tool for MDOT engineers as they assess the viability of retaining wall structures across the state.

IMPLEMENTATION

The new retaining wall inspection manual will be available on the MDOT website later in 2020. Once it is finalized, retaining walls will be inspected just like any other structure: by inspectors who have met the national inspection safety requirements, using a standardized rating system.

As so few states have inventoried their retaining walls and fewer still have developed an asset management program for these structures, Michigan is a leader in this field. The new tools from this research put MDOT in a position to advance risk-based decision-making for these assets.

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**This final report is available
online at**

<https://www.Michigan.gov/mdot/-/media/Project/Websites/MDOT/Programs/Research-Administration/Final-Reports/SPR-1676-Report.pdf>

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