

Optimizing AASHTO's Bridge Software

Managing bridge inventories is a complex process that most DOTs undertake using AASHTOWare Bridge Management software. NCHRP research was critical to updating this software with new capabilities. The improved tool helps managers better prioritize funds and minimize risk when making decisions about bridge preservation, rehabilitation, and replacement.



Most U.S. transportation agencies use AASHTOWare Bridge Management software to manage their large bridge inventories.

Including Multiple Criteria for Bridge Management

To manage their inventory of bridges, transportation agencies must determine when and how to maintain bridges to keep them safe and performing well even as they age. Bridge managers must establish performance measures and the most cost-effective use of limited funds to meet those measures.

The AASHTOWare Bridge Management software, formerly called Pontis, allows users to track and store bridge maintenance data; model the expected deterioration of bridges; and ultimately make more cost-effective decisions for bridge preservation, rehabilitation, and replacement. The tool also helps agencies comply with the highly detailed inspection regimen required by FHWA.

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Traditionally, this and similar software tools allowed users to make decisions based only on the objective of minimizing long-term costs as bridges deteriorate. However, other objectives are important to bridge agencies, including safety; traffic flow disruption; and vulnerability to scour, fatigue, and other hazards. Accounting for trade-offs between these various performance criteria allows more balanced bridge management decisions.

“The state of the practice in bridge management was based on bridge deterioration,” says Michael Johnson, chief of Caltrans Office of Specialty Investigations and Bridge Management, “yet 40 percent of the money I spend is on vulnerabilities. We needed a way to integrate condition-based objectives with vulnerability criteria.”

Todd Thompson, bridge management engineer for South Dakota DOT, commented further on the need. “Bridge management must consider performance measures beyond life-cycle costs,” Thompson says. “It must optimize multiple objectives to minimize risk.”

The AASHTOWare Bridge Management Task Force proposed a project to update the existing Pontis software. The resulting NCHRP Project 12-67 produced *NCHRP Report 590: Multi-Objective Optimization for Bridge Management Systems* (trb.org/Main/Public/Blurbs/159292.aspx).

Paths to Practice

Collaborating to update AASHTOWare

A key outcome of the NCHRP research was the development of bridge management software modules that allow users to specify multiple performance criteria. This

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software tool also affords visualization of the life cycles of individual bridges and bridge inventories.

According to both Johnson and Thompson, AASHTO is well on its way to implementing this research by updating AASHTOWare Bridge Management software to incorporate multi-objective optimization. “AASHTO has developed an extensive design and has conducted several mini-studies in preparation for software development,” says Thompson, who was a panel member for NCHRP 12-67 and will assist in beta testing of the software.

The role of panel members in implementation via their involvement in AASHTO was critical to implementation, according to Johnson, who was not only a panel member

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Implementation Strategies AT A GLANCE

- Collaboration with AASHTO:** Close ties between research champions and the appropriate AASHTO committee ensured a highly useful research product.
- Communicating Results, Influencing Legislative Change:** Dissemination of results played a role in the signing of MAP-21 legislation, which requires risk-based asset management by states.
- Addressing a Critical Need:** The project was steered from the beginning to address a need that was important to practitioners.

NCHRP—Transportation research that works

Objective national highway research since 1962 • Focused on practical problems of state DOTs • Contract researchers competitively selected • Overseen by balanced panels of technical experts • Reviewed by TRB highway specialists

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and writer of the project proposal, but is the current vice chair of the AASHTOWare Bridge Management committee. “While NCHRP 12-67 was being conducted, this position was held by the project panel’s chair,” Johnson says. Other NCHRP 12-67 panel members were similarly involved in AASHTO.

These overlapping memberships supported implementation, according to Johnson. “It was very easy for the AASHTOWare task force to take over where the NCHRP research panel left off,” he says.

Thompson says the new software will be available in 2015.

Communicating results, influencing legislative change

Beyond their critical overlapping roles in AASHTO, panel members also made presentations at various bridge management conferences and annual meetings.

“The whole project panel has been important,” Johnson says. “They have been positive advocates for a multi-objective approach.” Johnson himself made a presentation to FHWA, and others have gone before AASHTO and TRB committees and facilitated webinars.

This proactive approach to communicating results has had broad consequences. “Our dissemination of results for this project played a role in the signing of federal legislation,” Johnson says. Signed into law in 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21) requires risk-based asset management by states.

“MAP-21 has very broad implications,” Johnson says. “It will change the way bridges are inspected.”

A proactive project panel addresses a critical need

The panel for this project was active not just in communicating results and facilitating the update of AASHTOWare Bridge Management software, but also in steering the project from the beginning to address a critical need.

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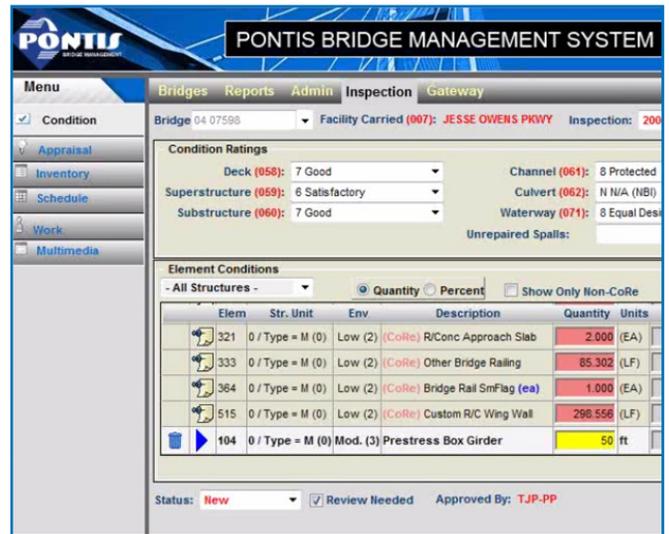
“We had a great panel that contributed a lot to the successful implementation of the project,” Johnson says. “The project was defined in terms of what practitioners needed.”



Deciding when and how to repair bridges can be complex, and it requires prioritizing limited funds. DOTs must take into account not just life-cycle costs but other factors, such as safety, fatigue, and traffic flow disruption.

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Formerly called Pontis, AASHTOWare Bridge Management software is used by most state DOTs to track bridge conditions and make cost-effective decisions.

Thompson notes that 43 of 50 states use AASHTOWare Bridge Management software. “They contribute a license fee,” Thompson says, “so it was important to frame this project to address their needs.”

Johnson adds, “This project was very timely. It addressed a real-life need that a lot of people were struggling with.”

Implementation Success

Ultimately, the improved software will help practitioners make asset management decisions in the most cost-effective ways.

“This project will dramatically improve our method for optimizing bridge projects,” Thompson says.

Moreover, the benefits will go well beyond the transportation industry, according to Johnson.

“The concepts that we were researching in this project are broadly applicable methods for modeling and prioritizing needs,” he says. “The multi-objective optimization framework developed as part of this project has become the current state of the practice in asset management in general, and not just for bridges or the transportation industry.”

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