

Research Spotlight

Project Information

REPORT NAME: Improving Bridges with Prefabricated Precast Concrete Systems

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RC-1602

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Accelerating bridge construction to minimize traffic disruption

Since 2008, MDOT has been using accelerated bridge construction, which utilizes prefabricated components and structural placements, to minimize traffic disruptions during bridge replacement or rehabilitation. A recent project provided MDOT with a new software tool to help determine when it is most effective to use accelerated methods. The project also provided information about the performance of bridges using prefabricated components and guidance on the best methods and materials for constructing them.

Problem

To reduce traffic delays and minimize the impact of construction during bridge replacement and repair, MDOT uses accelerated bridge construction (ABC). With ABC, bridge components are prefabricated in plants instead of at the bridge construction site and then quickly assembled after being transported to the site. ABC also includes structural placement methods in which workers construct an entire bridge next to an existing one and then quickly slide it into place after rapid demolition of the old bridge. A bridge also can be moved into place using a large platform vehicle called a self-propelled modular transporter.

ABC dramatically reduces the impacts of construction-related traffic disruptions



One method of accelerated bridge construction involves building a new bridge alongside the bridge to be replaced. The new bridge is moved quickly into place after the old one has been demolished.

on safety and the economy. However, the initial costs of bridges constructed using accelerated techniques can be greater than those constructed using traditional methods. MDOT needed a systematic method for determining when the benefits of ABC—which also include longer service lives—outweigh such costs. Research also was needed into the performance of bridges

“ABC doesn’t fit everywhere, but it’s now an important part of our toolbox, and we’re considering it on every bridge rehabilitation and replacement project.”

Dave Juntunen
Project Manager

built using prefabricated elements as well as the best methods and materials for constructing them.

Approach

After reviewing the state of the art in bridge design and construction using prefabricated elements, researchers developed guidance on various prefabricated bridge elements and systems. They also established methods for connecting elements and a procedure for determining when to use ABC over conventional methods.

Research

To begin, researchers conducted a literature review of various precast element bridge systems being implemented with ABC, assessing their durability and how easily they can be repaired and maintained. They also reviewed the constructability of these systems, or how well they avoid delays and other problems during construction. In addition, researchers reviewed state-of-the-art models for deciding when to use ABC over conventional construction methods. Finally, they evaluated the performance of a number of ABC bridges along with challenges encountered and lessons learned related to planning and design, precast element fabrication and construction operations.

Results

Researchers developed the Michigan Accelerated Bridge Construction Decision-Making (Mi-ABCD) tool— software that helps bridge project managers determine which projects are best-suited for ABC and would benefit from being expedited. The tool allows users to account for multiple criteria, including average daily traffic, delay to drivers and the expected dollar value of impacts on the public and commerce.

Researchers also developed recommendations for precast bridge element systems that can be implemented readily in Michigan, information about their benefits and limitations, and details for connections between elements that will be durable in Michigan’s cold climate. The recommendations include guidance on formwork and grouting materials for these connections, and a template for grout selection and application. Researchers also provided guidance on demolition techniques and equipment for precast bridge element systems.

Finally, researchers developed an ABC constructability review checklist to be completed before design to help prevent mistakes and facilitate cost-effective project completion.



The researchers investigated grout type and properties that are suitable for use in precast concrete component connections.

Value

By reducing construction time and traffic disruptions, ABC increases the safety of both travelers and construction workers. ABC also helps reduce construction impacts on the environment and decreases the economic impacts that can occur while bridges are taken out of service. For this reason, ABC is promoted by the Federal Highway Administration’s Every Day Counts initiative and used by more than half of state transportation agencies.

MDOT has used ABC on four bridges since 2008 and is planning to expand its use significantly in the next few years. Currently MDOT is conducting a follow-up project, “Research on Evaluation and Standardization of ABC Techniques,” to investigate various methods of putting prefabricated systems in place and to enhance the Mi-ABCD tool to allow comparison of these placement methods.

Research Administration

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