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Accelerated bridge construction overview: A solution for reducing user costs

With projects completed or underway in 44 states, ABC technologies are changing the way departments of transportation do business. This white paper introduces the innovative bridge repair and replacement approach, explains the reasons for its widespread adoption and points to specific applications.

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In this white paper:

- How ABC minimizes mobility impacts and reduces traffic delays
- Toolkit takes much of the risk out of ABC
- Additional funding available through Every Day Counts and FAST Act

What is ABC?

No one wants to close a bridge for repairs or replacement. But with more than 600,000 bridges in the United States needing to be replaced, widened or rehabbed, more owners will need to do so.

The economic and daily life burdens residents suffer when a bridge is closed for repair or replacement are known as user costs – risks that did not exist when most bridges were built on new alignments 50 or 60 years ago. To tame those risks, owners need solutions that accelerate bridge repair and replacement. And now they have them.

Accelerated bridge construction moves construction away from traffic and builds as much of the new bridge as possible off-line. Activities are performed concurrently, usually in a controlled environment, to quickly and efficiently design, procure, fabricate and erect replacement bridge systems.

The result often is a faster construction schedule. But that is not ABC's primary goal. ABC's mission is to reduce user costs by minimizing mobility impacts and reducing traffic delays through one or more of the following techniques:

- Building prefabricated components off-site and quickly putting them in place once on-site
- Building the entire structure off-line and moving it in place using a self-propelled modular transporter
- Building the bridge off-line/adjacent to the existing bridge and sliding it into place

ABC design concepts are grouped into five classes based on duration of mobility impact:

Tier 1: Projects can be completed in 24 hours.

Tier 2: Projects can be completed within three days.

Tier 3: Projects can be completed within one to two weeks.

Tier 4: Projects can be completed within three months.

Tier 5: The overall project schedule is reduced from years to months.

Each tier dictates the type of ABC technique the owner will use. For example, a Tier 1 project would use a slide-in construction method or an SPMT; whereas a Tier 3 project would require on-site assembly of prefabricated bridge elements and systems.

How did ABC originate?

Though ABC technologies have been deployed in transportation projects for some time, there has been a push for more widespread use of these technologies in recent years. The Transportation Research Board and the American Association of State Highway and Transportation Officials believed user costs could be dramatically reduced if bridges could be constructed faster. In 2006, they initiated the second Strategic Highway Research Program to evolve accelerated bridge construction from an isolated, one-and-done practice to a mainstream renewal method.

Working with TRB and AASHTO, HNTB and a team of subconsultants, including Iowa State University, embarked on a multiyear program to develop a suite of standardized ABC products specifically geared to address national bridge replacement needs. The team reviewed individual ABC standards and specifications from pioneering states, identified best practices and eliminated obstacles to encourage more widespread use of ABC.

In 2012, the Strategic Highway Research Program Report S2-R04-RR-2: Innovative Bridge Designs for Rapid Renewal: ABC Toolkit was published, changing the way the industry views bridge construction.

The ABC Toolkit compiles ABC best practices in design and construction, and guides bridge owners through ABC implementation issues. Users will find descriptions of standardized approaches to designing and constructing complete bridge systems for rapid renewals in addition to:

- Design standards and examples of completed prefabricated bridge systems for routine bridges with span lengths of 40 to 130 feet
- Sample specification language for ABC systems, which adheres to AASHTO's LRFD Bridge Design and Construction Specifications
- Erection concepts for prefabricated bridge systems
- Slide-in construction concepts

To those new to ABC, the toolkit takes much of the risk out of ABC. It was first demonstrated on Iowa's U.S. 6 Bridge over Keg Creek. The Iowa Department of Transportation prefabricated nearly 100 percent of the bridge components and then delivered them to the construction site. In 14 days, the Tier 3 ABC project delivered a new bridge, avoiding a six-month bridge closure and a 14-mile detour.

The second ABC demonstration program took place in late 2013. The New York State Department of Transportation implemented a Tier 1 project, replacing twin three-span, steel composite girder structures on Interstate 84 over Dingle Ridge Road. Using the toolkit's guidance for lateral slide design and construction, each bridge was replaced in a single weekend night.

How does ABC benefit DOTs and taxpayers?

The No. 1 benefit of ABC is its ability to minimize mobility impacts and reduce traffic delays. But ABC also offers several valuable secondary benefits:

- Shorter construction schedules
- Improved productivity and quality
- Reduced environmental impacts
- Improved safety for the traveling public and construction crews by eliminating long-term work zones
- More durable, longer-lasting bridges

Use of ABC also could mean additional federal funding. The Federal Highway Administration's Every Day Counts program is designed to identify and deploy innovation that shortens project delivery, enhances safety and protects the environment. The FHWA has identified ABC as a key technology to minimize traffic disruptions on already congested roads and has provided incentives to several state highway agencies to use ABC on bridge projects.

Another possible funding source can be found in Section 1111 of the FAST Act. According to the new law, states may bundle two or more similar, eligible bridge projects and award a single contract for engineering and design or construction to save time and costs. Bundled bridge projects typically use standardized precast elements and systems for cost and schedule savings. The federal share of funding could be as much as 100 percent when innovative design and construction methods, such as ABC, are used.

How much does ABC cost?

ABC's capital cost can be 20 to 30 percent more than traditional build methods, but it can be the most cost-effective means of construction when total project costs, such as detour or delay, right-of-way acquisition, project administration, maintenance of traffic, environmental mitigation, utility relocation and railroad flagging, are considered.

Where is ABC being used?

Today, ABC projects have been completed successfully, or are underway, in 44 states, with Utah, Texas, Massachusetts, Vermont and Pennsylvania leading the way. More states are developing policies and procedures for considering and implementing ABC in their planning processes.

The best candidates for ABC are:

- Workhorse bridges with high traffic volumes
- Bridges whose closures would require long detours
- Bridges where staged construction may not be viable
- Bridges important to the local economy
- Bridges in environmentally sensitive areas

Although ABC has been used largely for replacing bridges, it also is gaining traction in bridge rehabilitation. ABC has been used successfully to replace bridge decks and portions of substructures and to widen heavily traveled bridges.

The recently completed Franklin Avenue Arch Bridge Rehabilitation project in Minneapolis advances ABC in the rehabilitation arena. The Franklin Avenue Bridge is a five-span, open-spandrel arch bridge over the Mississippi River. The rehab project replaced the deck and the cap beams on top of the columns with precast elements, all of which were fabricated on-site and lifted into place. The ABC solution cut closure of this critical river crossing from two years to four months, minimizing traffic impacts.

Currently, HNTB is working as designer or program manager/owner's engineer on ABC projects in the following states:

1. **Georgia:** State Route 299 Bridge over I-24, SPMT move
2. **Louisiana:** U.S. 90 Bridges over L.A. 14, SPMT move
3. **Maine:** Western Avenue over I-95, rapid deck replacement
4. **Massachusetts:** Route 18 Bridge over MBTA Railroad, slide-in replacement
5. **Michigan:** Detroit I-94 Corridor Improvement, ABC bridge replacements
6. **New Jersey:** Ridge Road Bridge over Route 3 and the Park Avenue and Watchung Avenue bridges, superstructure replacements

7. **Pennsylvania:** Route 30 over Bessemer Avenue, weekend superstructure replacement
8. **West Virginia:** Bridge in Ghent on the West Virginia Turnpike, rapid deck replacement

Implemented by popular demand

The transportation industry is approaching a time when every bridge project with potential traffic impacts will need to consider ABC in the alternative study. Owners will trust it – and the public will demand it – once they experience ABC's ability to reduce mobility impacts and mitigate traffic delays. With greater use of ABC methods, the delta costs on projects will come down as contractors gain greater familiarity with the innovative repair and replacement approach.

Additional resources:

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Federal Highway Administration on FAST Act
http://www.fhwa.dot.gov/fastact/

ABC Toolkit
http://www.trb.org/Main/Blurbs/169082.aspx

Federal Highway Administration's Every Day Counts program
https://www.fhwa.dot.gov/innovation/everydaycounts/about-edc.cfm

HNTB's *Solve* publication, Issue 4, "Accelerated Bridge Construction: Speeding the replacement of workhorse bridges to minimize traffic disruption and user costs," 2015
Available upon request

HNTB's ABC press kit:
http://www.hntb.com/Newsroom/Media-Kits/Accelerated-Bridge-Construction

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