Building High-Quality Bridges Safer, Faster, and with Less Hassle

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The Second Strategic Highway Research Program 2 (SHRP2) is a partnership between the Federal Highway Administration (FHWA), the Transportation Research Board (TRB), and the American Association of State Highway and Transportation Officials (AASHTO). Under this program, SHRP2 managers facilitate the delivery of financial and technical assistance to state departments of transportation and other qualifying transportation agencies. Participants can access innovative strategies and technologies to construct and manage transportation infrastructure projects more efficiently. These products, based on extensive research, are related to improving traffic safety, identifying and preventing pavement problems, relocating underground utilities, and speeding up the delivery of transportation projects.

One of these products, *Innovative Bridge Designs for Rapid Renewal*, commonly referred to as the ABC Toolkit, includes standards for accelerated bridge construction (ABC) techniques and prefabricated components. This toolkit allows construction teams to build bridges faster and within safer work zones, away from vehicle traffic. This also helps to significantly reduce the travel delays motorists experience during conventional bridge construction projects.

While a previous FHWA article in the Winter 2015 issue of *ASPIRE*™ highlighted the ABC Toolkit and several other SHRP2 products, this current article summarizes and provides lessons learned from several bridge replacement projects funded and coordinated by SHRP2 over the past three years.

IR7 Gila River Bridge—Sacaton, Ariz.

The Gila River Indian Community (GRIC) Department of Transportation (DOT) replaced an aging four-span bridge with a two-span, prestressed concrete girder bridge over the Gila River near Sacaton, Ariz., about 40 miles southwest of Phoenix (see Winter 2016 issue of *ASPIRE*). The project used ABC techniques to shorten road closures from an anticipated 4-month period to 11 days. The construction manager/general contractor (CM/GC) bidding method to allowed the GRIC DOT, the design consultant, and the general contractor to establish a partnership early in the planning and design phases of the project.

Two span bridge slid into place in Arizona using steel on steel with grease for the slide system. All Photos: Finn Hubbard.

New substructure elements were cast-in-place under the existing bridge in preparations to slide into place the new deck and girder superstructure. The new bridge was constructed on the new substructure and partially on temporary support assemblies. This process allowed crews to install one abutment ahead of time, within a two-day weekend closure. Once all parts of the bridge were ready, the road was closed, the new bridge span was slid into place, approach slabs were paved, and the road reopened in 9 days. GRIC DOT officials will continue to consider using ABC methods in their upcoming projects. This bridge was completed in the winter of 2015 with a total construction cost of $2,700,000.

Kittery Overpass Bridge, Route 1—Kittery, Maine

The Maine Department of Transportation (MaineDOT) replaced a concrete rigid frame bridge with a precast concrete beam structure. Route 1 Bridge in Kittery, Maine, located about 60 miles north of Boston, is a backup to Interstate 95 and therefore couldn't be restricted for a long duration. The area is also a tourist destination and local business owners

Simple span NEXT beam in Kittery, Maine.

didn't want to inconvenience customers. A cost-plus-time bidding format, also known as A+B, encouraged the contractor to limit road closures to 29 days instead of the 35 that had been anticipated originally.

Crews used Northeast Extreme Tee (NEXT) beams to take advantage of their low profile and improve the vertical clearance. As a research trial, carbon fiber-reinforced polymer prestressing strands were used in the NEXT beams to avoid corrosion and extend the service life of the bridge. Using ABC methods, MaineDOT officials met crucial shutdown and service-life requirements. This bridge was completed in the summer of 2014 with a total construction cost of $2,560,000.

Bridge A-0087—Columbia, Mo.

The Missouri Department of Transportation (MoDOT) replaced a bridge on Route B over Loop 70 in Columbia. Since the bridge is used by University of Missouri students, replacement was scheduled during the summer months. MoDOT officials provided the contractor two options to build the single-span bridge. The first option used steel girders with a precast concrete deck placed in two modular pieces; the second option used precast, prestressed concrete box beams with a concrete overlay. Both options could be built on geo-synthetic reinforced soil (GRS) abutments without piling. The contractor chose the second option.

Simple span prestressed box sitting on geo-synthetic reinforced soil abutments in Missouri.

During the preconstruction phase it was discovered that the dry-cast modular blocks with tight freezing and thawing requirements for facing the GRS abutments could not be supplied in time. Therefore, officials opted for the use of wet-cast jumbo blocks as an alternative. Crews completed the project with a total construction cost of $395,000 during the summer months and it opened as students returned in the fall of 2014.

Five Bridges on Interstate 39/90 Corridor—near Madison, Wis.

The Wisconsin Department of Transportation replaced five bridges using precast concrete piers. The first bridge project was on Interstate 39/90 south of Madison over a local road. With the construction of this bridge precast concrete pier columns and cap were connected using grouted splice sleeves to minimize the amount of reinforcement projecting from the precast concrete elements. Careful surveying and attention to element alignment was critical. The columns were placed on the cast-in-place footings and all elements came together and fit as planned.

Precast concrete pier cap being placed on precast columns in Wisconsin.

This precast approach saved approximately 3 weeks of construction time per bridge, but the real advantage was in the safety aspects of this process. Construction crews were able to work in the median of the interstate and complete their activities faster than using conventional cast-in-place construction. This reduced the crews' exposure to traffic and travel delays. In this instance, safety became the driving force to using ABC techniques, resulting in a shorter schedule. These five bridges were completed in the summer of 2016 with a total construction cost of $6,897,000.

Seney National Wildlife Refuge, J to H Bridge Replacement—near Seney, Mich.

The FHWA funded the replacement of a single-lane timber bridge in the Seney Wildlife Refuge near Seney, Mich. ABC techniques were used on this project to reduce disturbances to surrounding wetlands. A fully precast concrete option was chosen using precast concrete substructure units with precast, prestressed concrete box beams and precast, prestressed concrete piles to support the structure.

Three span prestressed box bridge built during the winter of 2015 in Upper Michigan.

Building a bridge in the middle of the winter in the upper peninsula of Michigan was no small challenge. But the use of precast concrete allowed for the construction of this bridge in such a cold environment and the old bridge was removed while the wetlands were frozen. The placement of the concrete for the precast concrete connections and the overlays was conducted in a heated enclosure. This bridge was completed in the winter of 2015 with minimal impact to the surrounding habitat and a total construction cost of $1,180,000.

SHRP2 Training Opportunities

FHWA and AASHTO are hosting a series of one-day training sessions for those interested in learning about the ABC Toolkit and to encourage the construction of more bridges using the toolkit.

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EDITOR'S NOTE

Transportation officials interested in hosting a training session should contact AASHTO SHRP2 Implementation Manager Pam Hutton at phutton@aashto.org for details. For additional information on ABC or other SHRP2 strategies please visit: www.fhwa.dot.gov/goshrp2.