Building Bridges Faster, Safer, Cheaper

SHRP2 advances structures solutions to nationwide implementation

by Matthew J. DeMarco, Federal Highway Administration

The Federal Highway Administration (FHWA), in partnership with the American Association of State Highway and Transportation Officials (AASHTO), is responsible for implementing the tools and products delivered by the Transportation Research Board (TRB) under the Second Strategic Highway Research Program (SHRP2). SHRP2 adheres to the principles of the original SHRP model—a focused, time-constrained, management-driven program designed to complement existing research programs. And like SHRP, with technical product development administered by TRB and national implementation co-administered by FHWA and AASHTO, SHRP2 addresses many of the most pressing needs related to the nation's highway system including

- the high toll taken by highway deaths and injuries,
- an aging infrastructure, and
- congestion stemming from inadequate capacity.

As such, the over-arching goals of the program remain to "Save Time—Save Money—Save Lives."[1]

To expedite adoption of SHRP2 innovations and solutions, the partners launched the *SHRP2 Implementation Assistance Program* (IAP) in early 2013 to provide direct financial and technical support to early adopters of SHRP2 products. The collaborative approach that drove SHRP2 research—including nearly 150 state department-of-transportation-supported research efforts—is being carried through into implementation to ensure the needs of potential users are incorporated into every stage of technology transfer.

Currently in full swing, the assistance program has thus far delivered 34 products through four IAP rounds, engaging all 50 states in over 250 technology deployment projects. Two more assistance offerings in 2015 will deliver 11 new products, as well as additional awards for several products previously offered.

Of the SHRP2 solutions delivered to date, six products under the *Renewal* focus area support improved bridge design, construction, and maintenance, including selection of geoconstruction technologies, bridge design for accelerated and long-life construction, concrete element nondestructive inspection methods, and construction performance specifications. These products are described in more detail in the following sections.

Ground penetrating radar technology being evaluated under the R06A Nondestructive Testing for Concrete Bridge Decks project. Photo: Rutgers University under SHRP2 contract, 2013.

R02—GeoTechTools

GeoTechTools is a comprehensive, web-based application containing information on more than 50 geoconstruction technologies applicable to transportation infrastructure, including bridge foundations, abutments, and approach embankments. The two primary components of this comprehensive toolbox are a *Catalog of Technologies* and a *Technology Selection Assistance System*. GeoTechTools was developed to assist engineers involved in project development, scoping, and/or the execution of highway projects make more informed decisions on geotechnical issues to reduce risk and minimize construction surprises.[2]

R04—Innovative Bridge Designs for Rapid Renewal

The Innovative Bridge Designs for Rapid Renewal: ABC Toolkit includes design standards, examples, and standard drawings for complete prefabricated bridge systems, and proposes specification language for accelerated bridge construction. The R04 focus is on providing accelerated bridge construction (ABC) options for small-to-medium "bread-and-butter"

Recently completed Kittery Overpass Bridge, Kittery, Maine. This ABC project utilized precast concrete cantilevered abutments, precast concrete Northeast Extreme Tee (NEXT) Deck Beams, and precast concrete approach slabs for rapid construction. Photo: Federal Highway Administration.

bridges. It also complements the national goals of the Everyday Counts ABC program for prefabricated bridge element systems (PBES), slide-in bridges, and geosynthetic reinforced soil/integrated bridge systems (GRS-IBS).

To date, R04 IAP demonstration projects have been completed in Missouri, Rhode Island, Maine, Kentucky, California, with work underway in Arizona, Michigan, and Wisconsin. The range of bridge component applications includes integral beam and deck systems, precast concrete piers and abutment walls, slide-in bridge systems, and GRS-IBS component systems.[3]

R06A—Nondestructive Testing for Concrete Bridge Decks

The large number of concrete bridge decks in poor structural condition is one of the biggest problems affecting bridges in the United States. Nondestructive testing (NDT) techniques have the potential to quickly and reliably characterize under-the-surface concrete bridge deck conditions, including delamination above and below reinforcing mats, vertical cracking, concrete deterioration, and reinforcement corrosion. Information on a number of geophysical-based NDT bridge deck evaluation technologies is summarized in the web application NDToolbox, available at www.NDToolbox.org. More detailed information on these and other technologies will soon be available in the new manual to be released by the Turner Fairbank Highway Research Center in early 2015.[3]

R07—Performance Specifications for Rapid Renewal

Thoughtfully developed performance specifications are important for ABC projects, particularly when new structure design and/or construction technologies are being deployed. Performance specifications allow contractors transitioning to new construction methodologies to meet the goals of the new construction methods/components, while at the same time modifying their current practices to fit the needs of the project. To help reach these goals in rapid renewal environments, the R07 project developed a suite of performance specifications for various highway project types and contracting scenarios, as well as implementation guidelines to address project selection, specification development, risk allocation, and the transition from methods to performance specifications.[3]

R19A—Service Life Design for Bridges

As limited resources demand enhancing the operational life of existing and new bridges, designing for service life is gaining importance. To provide procedures for systematically designing for service life, the R19A project developed the *Design Guide for Bridges for Service Life*, which can be used for both new and existing bridges. The guide includes new concepts and approaches that offer improvements to current practice and have the potential to enhance the service life of bridges. Although originally intended for medium-sized, bread-and-butter bridges, the guide is applicable to a broad range of bridge design and material and component selection issues related to an equally expansive array of working environments.[3]

R19B—Service Limit State Design for Bridges

When individual bridge components such as bridge bearings, deck joints, and columns and piles deteriorate at different rates, bridges can be closed for costly repair far too often over the structure's service life. Designing bridge components and systems to service limit states extends the service life of the entire structure, yields significant savings through reduced maintenance, and reduces safety risks for workers and road users. The R19B project[3] developed new design codes, performance measures, and implementation tools to lead to longer and more predictable bridge service life, as well as proposed changes to the *AASHTO LRFD* (Load- and Resistance-Factor Design) *Bridge Design Specifications.*

References

1. Transportation Research Board (TRB). 2014. "Strategic Highway Research Program—SHRP2," www.trb.org/StrategicHighwayResearchProgram2SHRP2/Pages/Overview-168.aspx.
2. Schaefer, V., S. Nichols, M. DeMarco, and R. Berg. 2014. "GeoTechTools—Geotechnical Solutions for Transportation Infrastructure—Implementation," Highway Geology Symposium, Laramie, WY: 16 pp.
3. TRB. 2014. "SHRP2 Renewal Program," www.trb.org/StrategicHighwayResearchProgram2SHRP2/Pages/Renewal_156.aspx.

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EDITOR'S NOTE

For more information on the Innovative Bridge Designs for Rapid Renewal: ABC Toolkit, visit www.trb.org/Main/Blurbs/168046.aspx.