The Long-Term Bridge Performance Program

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Various non-destructive evaluation technologies (impact echo, ground-penetrating radar, electrical resistivity, moisture scan, and half-cell potential) were deployed in the first pilot bridge to kick-off the Long-Term Bridge Performance Program. Photo: Federal Highway Administration.

In the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the U.S. Congress directed the Secretary of the U.S. Department of Transportation to establish a 20-year study, develop grants, and enter into cooperative agreements and contracts to

- monitor, material test, and evaluate test bridges;
- analyze the data obtained; and
- prepare products to fulfill study objectives and meet future bridge technology needs.

Accordingly, the Federal Highway Administration (FHWA) initiated a multifaceted research study in 2008 that is strategic in nature with short- and long-term goals. Under this study, referred to as the Long-Term Bridge Performance (LTBP) Program, critical aspects of bridge performance are being examined to better understand the performance of existing and new bridges. The funding for the program has continued through MAP 21-The Moving Ahead for Progress in the 21st Century Act, which is a funding and authorization bill to govern United States federal surface transportation spending.

The Research Team

The LTBP Program's research team consists of a coordinated, collaborative, multi-institutional, and multi-disciplinary group of professionals in government, academia, and industry. FHWA is the lead agency. The primary contractor is Rutgers University, working in partnership with Parsons Brinkerhoff; the Utah State University; the Virginia Center for Transportation Innovation and Research along with the University of Virginia and Virginia Tech; Bridge Diagnostic Inc.; and the technology provider, Advitam.

The research team receives regular input from advisory groups, such as the American Association of State Highway and Transportation Officials, state departments of transportation and the Transportation Research Board, to ensure that the research products are of value to the stakeholders.

Developmental Phase

In the developmental phase, researchers began to synthesize existing information on bridge performance and identified performance issues facing bridge owners in the United States. Based on available resources, researchers developed a short list of high-priority bridge performance topics to be immediately considered for the long-term data collection phase of the LTBP Program. These topics include performance of treated and untreated concrete bridge decks, joints and bearings, coatings for steel superstructure elements, and encapsulated prestressing strand and post-tensioning tendons.

After identifying a prioritized list of questions to be answered, the following steps were taken:

1. Examine the questions to identify the potential for data needs.
2. Design experiments to identify the specific data to be collected.
3. Determine the feasibility and economics of collecting reliable and quantitative data both from legacy sources and from LTBP Program's field monitoring activities.
4. Sort, store, and analyze data through the LTBP Program data portal to address the question from step 1 and close the knowledge creation loop.

Demonstration of the RABIT™ bridge deck assessment tool at the U.S. 15 Bridge over I-66 in Haymarket, Va. Photo: Rutgers University.

Robot components of the RABIT™ bridge deck assessment tool expedites field data collection. Photo: Rutgers University.

Protocols for Data

Protocols for data sampling and collection using inspection techniques and instrumentation, and data quality assurance to carry out these functions were developed to ensure consistent quality. The protocols were documented sufficiently so that any interested party can use them to collect and analyze data. This also allows for proper comparison with data already gathered by the LTBP Program. These protocols are living documents and will be updated frequently.

Sampling Methodology

The LTBP Program's sampling methodology, referred to as the reference bridge/cluster bridges approach, concentrates on small geographic areas and contiguous sections of highways known as corridors. Briefly, this concept involves identifying small groups of similar bridges, or clusters, from FHWA's National Bridge Inventory (NBI) database and studying one or more of the high-priority bridge performance topics using data collected from those bridges. The number of any one cluster will vary, but usually will be about 75 bridges.

Two to four of the bridges within each cluster will be selected as reference bridges and will undergo an optimum periodic inspection and monitoring using visual inspection supplemented with automated bridge deck non-destructive evaluation (NDE), and fiber-optic-based weigh-in-motion systems. The supporting cluster of bridges will only undergo detailed visual inspection and limited NDE or physical testing for reference bridge comparison to ascertain consistency.

Data Management

To manage data collected through the LTBP Program, it was necessary to develop an information technology infrastructure for storing, analyzing, updating, and accessing multiple data models with appropriate security considerations that could be used by a variety of stakeholders. The LTBP Program's Bridge Portal was developed to handle this requirement.

Data Collection Phase

The LTBP Program's long-term data collection phase began in March 2013 in the mid-Atlantic region and will move to other regions of the United States in 2014. The expectation is that up to 1000 bridges will undergo detailed testing, periodic evaluation, and monitoring over the next 20 years. Over 90 test protocols have been developed and are currently being deployed to standardize data collection efforts.

Finally, an automated data collection tool, the RABIT™ bridge deck assessment tool, a product of the LTBP Program, is being deployed to expedite field data collection for the study. The photo on the previous page shows the demonstration of the RABIT™ bridge deck assessment tool for FHWA's administrator, Victor Mendez, on the U.S. 15 Bridge over I-66 in Haymarket, Va.

Moving forward with data collection, researchers will continue to develop refined deterioration and life-cycle cost models and a data-driven bridge condition index. FHWA will continue its outreach efforts to make available a suite of best practices involving bridge design, construction, inspection, maintenance, preservation, and monitoring to assist bridge owners in making better management decisions.

EDITOR'S NOTE

For additional information, please visit FHWA's internet web page at http://www.fhwa.dot.gov/research/tfhrc/programs/infrastructure/structures/ltbp/.