

FHWA’s Long-Term Bridge Performance Program—Moving Forward

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The performance of a bridge or bridge component depends on multiple factors, many of which are closely linked. These factors include the original design parameters and specifications, such as

- bridge type;
- materials, geometries, and load capacities;
- initial quality of materials and quality of the as-built construction;
- varying conditions of climate, air quality, and soil properties; and
- corrosion and other deterioration processes.

Other factors that might influence performance include traffic volumes; counts and weights of truck loads and truck live-load impacts; and damage caused by scour, seismic events, wind, and water or ice flow. A critical factor that influences performance is preventive maintenance, including the type, timing, and effectiveness of minor and major rehabilitation actions and, ultimately, the maintenance or replacement actions applied to elements of a bridge.

The Federal Highway Administration (FHWA) initiated its Long-Term Bridge Performance (LTBP) Program to enhance knowledge about why and how bridges deteriorate. The pri-

mary program objectives listed in the following section are expected to improve the understanding of long-term bridge performance and result in more efficient bridge design, construction, rehabilitation, maintenance, preservation, and management.

Primary Objectives

The primary objectives of the LTBP Program are to

- collect, manage, and provide easy access to data;
- perform in-depth data analysis; and
- develop tools and products to aid in understanding bridge performance.

Since the initiation of the LTBP Program’s data collection efforts, many advances have been made in methods and automation for both the collection and processing of various data types. With this in mind, the LTBP Program managers determined that a reassessment of data collection needs was appropriate. FHWA conducted a data collection workshop in 2021 to receive input from subject matter experts from state highway departments, industry, academia, and FHWA

regarding the LTBP Program’s future approach to data collection. A great deal of information was gleaned from the workshop. An analysis of the input received during the workshop and the lessons learned from past LTBP data-collection efforts resulted in the FHWA revising its data-collection strategies. A summary report describes the workshop and the two data-collection strategies developed.¹

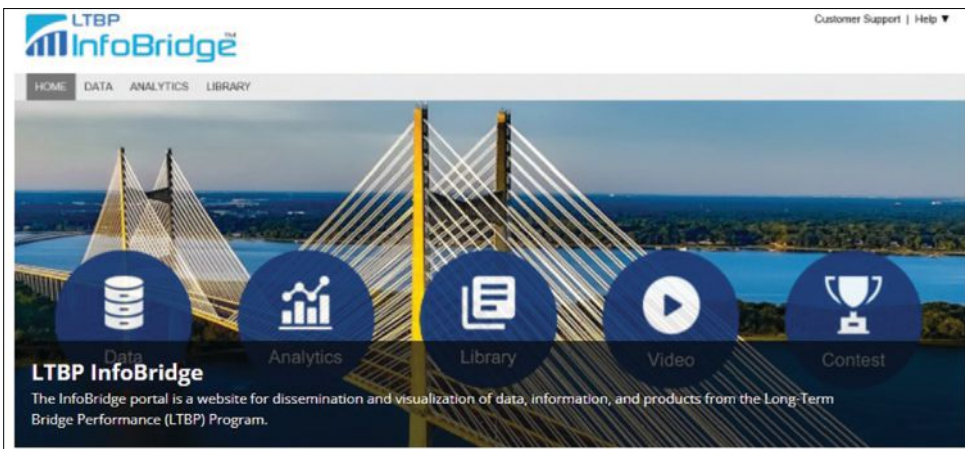
Near-Term Data-Collection Strategies

The first aspect of potential near-term data collection is to perform desk-audit-based data collection. The workshop identified the following potential areas for near-term, desk-audit-based data collection:

- Design and construction data
- Deicing chemical application rates
- Inspection reports
- Maintenance, preservation, and rehabilitation actions
- State policies on deicing chemical application, deck washing, deck and crack sealing, overlays, and other deck treatments
- New bridge construction and deck replacements
- Steel coatings
- Operational information regarding live loads and permit vehicles
- Environmental factors such as precipitation, temperature range, and proximity to the coast
- Joints and bearings

The collection of design and construction data, for instance, would fall into this desk-audit category. Obtaining the documentation from which design and construction data are extracted can be accomplished in an office environment. This desk-audit-based approach will provide context for other data and prove beneficial to the bridge community. Some protocols have been developed already, such as for extracting design and construction data. Additional protocols for this type of desk-audit data will be developed, as needed, to ensure collection of consistent, high-quality data.

Image from the Long-Term Bridge Performance Program webpage, which includes a link to the LTBP InfoBridge portal for dissemination and visualization of data, information, and products from the Long-Term Bridge Performance Program. Figure: Federal Highway Administration.





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The second potential near-term data-collection activity, which was identified during workshop discussions, is to collect field performance-related data by leveraging the efforts of external entities. To accomplish this, the LTBP Program will disseminate protocols to states and researchers to obtain field data from state-sponsored research initiatives that would meet the requirements of the LTBP Program, so the data from these efforts could be included in the database. The data provided to FHWA from LTBP Program projects or state-sponsored research using the LTBP Program data protocols will be made available through InfoBridge, the LTBP Program's data and analysis portal.² (For more information on InfoBridge, see the FHWA articles in the Winter and Spring 2020 issues of *ASPIRE*®.)

The third aspect of potential near-term data collection-related activities identified is to complete the second phase of an accelerated bridge performance testing project, which is currently underway and includes collecting performance data. A four-girder, single-span steel bridge, with both environmental and structural loadings, is currently undergoing accelerated testing at Rutgers University in New Jersey. The primary objective of the testing is to assess the performance of the concrete deck. During the first phase of testing, approximately 2 million load cycles and 85 freezing-and-thawing cycles were applied. A 6% brine solution was also applied to the deck after each heating cycle. After approximately every 200,000 load cycles, nondestructive testing (NDT) data were collected, which resulted in 14 rounds of NDT data during the first testing phase. Additional data are collected with various temperature, strain, and displacement sensors. The second phase of the project involves installing

two overlays (latex-modified concrete and ultra-high-performance concrete), with each placed longitudinally over half of the bridge deck, followed by additional accelerated testing to study the performance of each overlay material.

Long-Term Data Collection


Extensive resources and an optimized strategy are required to collect data to study the long-term performance of bridges. However, the strategy should not consist of gathering all desired data at any cost. It is imperative to determine the value and use of any data collected. The LTBP Program is currently conducting studies to assess the overall value of already-collected data—namely, data collected through the ongoing accelerated testing experiment and field data from earlier LTBP efforts—to help guide the path forward.

Additionally, FHWA has identified three potential long-term data collection activities. The first activity involves data collected by others, as discussed in the previous section. The second potential activity is to conduct additional targeted accelerated testing of different bridge specimens. The third long-term potential data collection activity identified is to target field data collection to be conducted on a limited basis and used primarily for validation purposes. Any of these potential field data collection activities will be subject to the findings of the data utility studies currently underway.

Moving forward, the LTBP Program will continue to develop needed protocols for several of the desk-audit data categories in preparation for a new program technical support contract. Through this new contract, the LTBP Program will initiate near-term data collection activities.

For more information, please contact Dr. Robert Zobel at robert.zobel@dot.gov.

References

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EDITOR'S NOTE

FHWA's Long-Term Bridge Performance (LTBP) website (<https://highways.dot.gov/research/long-term-infrastructure-performance/ltpb/long-term-bridge-performance>) is an excellent resource to learn more about the development and progress of the LTBP Program. The website includes links to the InfoBridge portal and LTBP Program publications, including the Long-Term Bridge Performance Program Protocols,³ which discusses the original data-collection strategies of the program.