Winter 2020

# LTBP News

## LTBP Rolls Out New Version of InfoBridge™

The Long-Term Bridge Performance (LTBP) Program released a new version of InfoBridge in January at the 99th Transportation Research Board (TRB) Annual Meeting. This latest version has many important features, such as:

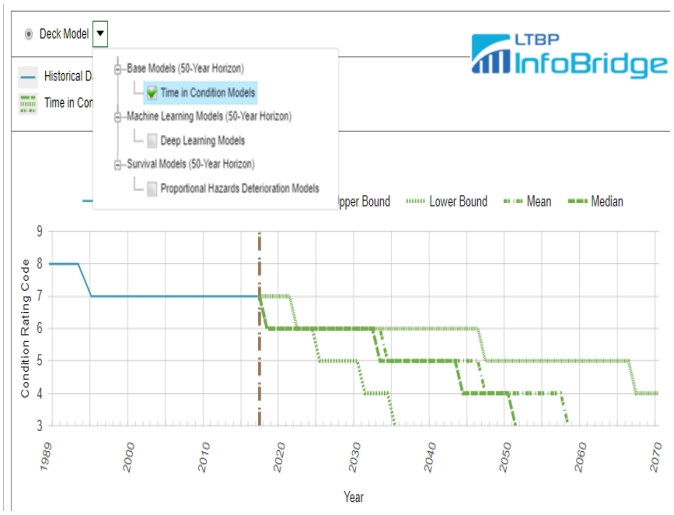
- New searchable bridge tags for *ultra-high performance concrete*, *weathering steel*, and *timber bridges*.
- Bridge searches by metropolitan planning organization boundaries, congressional districts, and State legislative districts.
- Three new bridge deck condition forecast models.
- Additions to historical spec changes.
- Several usability enhancements, such as customizable results table and improved export tools.

In addition to these features, the 2019 National Bridge Inventory (NBI)/National Bridge Element (NBE) and additional LTBP field-collected data are also part of this version.

The new bridge deck condition statistical forecasting models implemented in InfoBridge are *time-in-condition model*, *deep learning model*, and *proportional hazards deterioration model*.

1. The time-in-condition model in the base models category is the simplest of the three models. Base models are deterministic statistical models that are easy to understand and implement. With these models, historical time duration for the condition rating of each deck of selected bridge types is calculated from training subsets of the NBI data. These time durations are applied to bridges of the same type to forecast their deck condition ratings.

2. The deep learning model uses a machine learning technique that enables computational models, composed of multiple processing layers, to learn data representations of a multidimensional and complex dataset. In the context of condition forecasting, data representations can be interpreted as the statistical data interrelationships or data patterns that describe how various factors influence the bridge deck deterioration process. The current model considers 28 factors, including traffic volumes, construction materials, and climate.



Source: FHWA.

*InfoBridge features three new bridge deck condition forecasting models.*

3. The proportional hazards deterioration model is categorized as a survival model. Survival models are multivariable probabilistic bridge deterioration models that combine survival analysis and Markov chain theory. Survival analysis is a statistical approach that analyzes the time until the deck deteriorates to a lower condition rating. The transition probabilities of the Markov chain are calculated from the Cox proportional hazards survival functions and hazard ratios associated with factors influencing deterioration at each condition rating.

The additions to historical spec changes cover standard specifications from 1931 to 2002 for the following:

- Loads.
  - Vehicular Live Load.
  - Pedestrian Live Load.
  - Braking Force.

  - Wind Load.
  - Temperature Load.
  - Water Load.
  - Ice Load.
  - Centrifugal Force.
  - Earth Pressure.
  - Earthquake Load.
- Load Combinations.

The LTBP InfoBridge web portal can be accessed at **https://infobridge.fhwa.dot.gov/.**

## LTBP Program Session at TRB Annual Meeting

Source: FHWA.

*LTBP Session at 2020 TRB Annual Meeting, Washington, DC.*

Hari Kalla, Associate Administrator of FHWA's Office of Infrastructure, welcomed the session attendees and provided introductory remarks.

Jean Nehme, Team Leader for FHWA's Long-Term Infrastructure Performance (LTIP), provided an update of the 2019 LTBP program activities. Other presentations by LTBP staff included an update on the increased data collection, new features in InfoBridge, three bridge deck condition forecasting models in InfoBridge, and a presentation by Professor Başak Bektaş of Minnesota State University on how InfoBridge is being used in research and education.

The session was attended by more than 150 people. The session was sponsored by the TRB Standing Committee on Structures Maintenance (AHD30) and cosponsored by the TRB Standing Committees on Bridge Management (AHD35) and Testing and Evaluation of Transportation Structures (AFF40).

> *"The Long-Term Infrastructure Performance programs, namely LTBP and LTPP, are very important to FHWA, and we fully support them because of their importance to the State DOTs* [departments of transportation] *and other transportation agencies."*
>
> *Hari Kalla*
> *Associate Administrator, Office of Infrastructure*
> *Federal Highway Administration (FHWA)*

## Full-Scale Accelerated Bridge Testing Research

The LTBP Program is conducting an accelerated test on a full-scale steel girder bridge. The program is conducting the test at the Bridge Evaluation and Accelerated Structural Testing (**BEAST**) Lab at the Rutgers Center for Advanced Infrastructure and Transportation.

The main objective is to understand the causes and rates of deterioration of different bridge components. The bridge design (based on specifications from the 1980s) was chosen to represent most of the similar bridge types in operation today. The single-span bridge is 28 ft wide by 50 ft long, and consists of four steel girders supporting an 8-inch concrete deck. The deck is subjected to a rolling (tandem) live load of 60 kip that imposes 17,500 cycles per day. The bridge also is subjected to one freeze–thaw cycle every 16 hours. Additionally, the deck is sprayed


© Rutgers University.

*BEAST Specimen Bridge under Construction.*

with a 6-percent solution of brine every 16 hours. The environmental and live loading frequency is equivalent to approximately 17 years of loading compressed into 1 year.

The bridge is instrumented with strain gages, thermocouples, linear variable differential transformers,

accelerometers, and humidity gages. In addition, visual inspection and several nondestructive evaluation (NDE) measurements are taken on a 1 ft by 1 ft grid after every 14 days of testing. The NDE measurements include electrical resistivity, impact echo, ground-penetrating radar, half-cell potential, ultrasonic shear-wave tomography, ultrasonic surface waves, infrared thermography, and high-definition imaging.

LTBP Program staff will upload all data acquired through this research study onto InfoBridge.

## In Brief

**2020 LTBP State Coordinators' Webinar**
An LTBP Program webinar was presented on Wednesday, March 18, 2020. An LTBP Program progress update was presented in addition to recapping the LTBP session held during the 2020 TRB Annual Meeting. Access the recording: 2020 LTBP State Coordinators' Webinar.

## Publications

**Reports:**

***InfoBridge: Easy Access to the National Bridge Inventory and Much More – Part 1***
Aspire, The Concrete Bridge Magazine, Precast/Prestressed Concrete Institute
Winter 2020 [PDF]

***Truck Platoons and Highway Bridges***
Aspire, The Concrete Bridge Magazine, Precast/Prestressed Concrete Institute
Summer 2019 [**PDF**]

***Advancing Bridge Repair and Preservation Using Ultra-High Performance Concrete***
Aspire, The Concrete Bridge Magazine, Precast/Prestressed Concrete Institute
Spring 2019 [**PDF**]

***Concrete Bridge Deck Service-Life Prediction Tools***
Aspire, The Concrete Bridge Magazine, Precast/Prestressed Concrete Institute
Winter 2019 [**PDF**]

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