InfoBridge: Easy Access to the National Bridge Inventory and Much More–Part 2

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In January 2019, the Federal Highway Administration (FHWA) released the inaugural version of the Long-Term Bridge Performance (LTBP) InfoBridge—a user-friendly, centralized portal for efficient access to bridge performance-related data and information (https://infobridge.fhwa.dot.gov). InfoBridge includes tools to facilitate bridge data analytics and provides for storage, retrieval, dissemination, analysis, and visualization of data collected through state, national, and LTBP program efforts. In January 2020, the second version of the web portal was released. This article, the second of two about InfoBridge, discusses enhancements implemented in the new release and describes some of the portal's advanced features (see the Winter 2020 issue of *ASPIRE®* for part 1).

Advanced Querying of Bridge Data

InfoBridge users are presented with an intuitive interface that enables querying on almost all data fields available within the portal. For example, the user could query the database for all bridges that have prestressed concrete as their main span material, have a structure length between 150 and 500 ft, and are in poor condition as defined in Chapter 23 of the Code of Federal Regulations (23 CFR 490.409). The query generates a table of results, which the

Figure 1. Queries can be made to form subsets of bridge data based on almost any attribute stored within InfoBridge. All Figures: Federal Highway Administration.
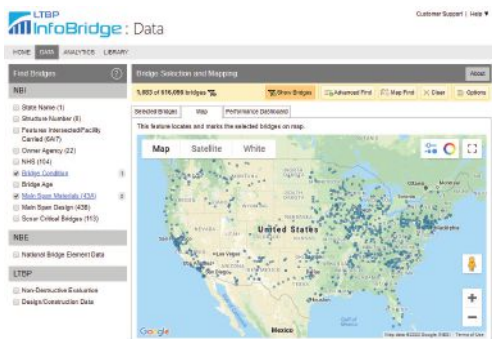
user may customize and export. InfoBridge also displays the results on a map, which may be exported and used in reports or presentations (**Fig. 1**).

New to the second version of InfoBridge is the ability to query on geographical boundaries of metropolitan planning organizations (MPOs) and political districts such as U.S. congressional districts, state senate districts, and state house districts. In addition to MPOs and political districts, this latest version of InfoBridge allows querying based on special projects. Currently, data from three FHWA research projects are included: ultra-high-performance concrete, timber bridges, and weathering steel. More projects will be added in the future.

Historical Changes to Bridge Specifications

InfoBridge allows the user to explore changes to national bridge specifications over the years. This is a crucial feature for researchers investigating the performance of bridge assets. This tool lists specification changes chronologically and allows for searches based on a single keyword or on combinations of keywords. It also lists all pertinent references to each specification.

Currently, the following types of specifications are included:
• Reinforcing steel
• Loads—braking force, centrifugal force, earth pressure, earthquake load, ice load, pedestrian live load, temperature load, vehicular live load, water load, wind load
• Load combinations

In the future, the following types of specifications will be added:
• Minimum and maximum reinforcement
• Shear design of concrete
• Prestressed concrete design
• Lightweight concrete
• Load rating
• Approximate methods of analysis
• Steel bridge design

Figure 2. An InfoBridge two-variable chart displaying the correlation between bridge age and bridge condition.
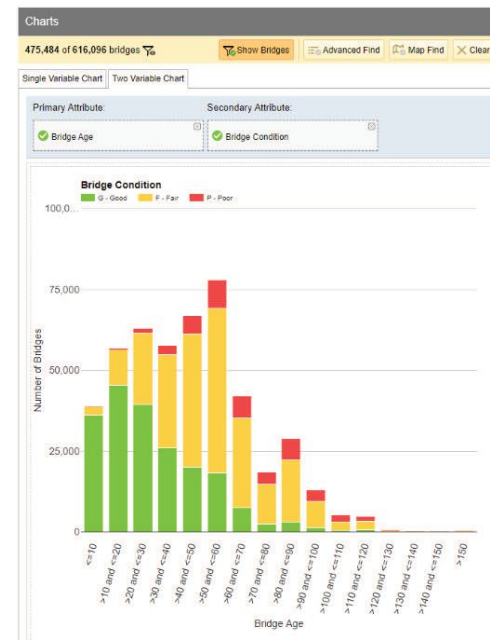
Data Analytics and Visualization

It has been said that a picture is worth a thousand words; therefore, InfoBridge contains multiple tools to transform data and information into graphs, charts, contour plots, dashboards, and maps. All analytics and visualization tools are available on the selection of bridges that results from a user's query. An example of a two-variable chart is provided in **Fig. 2**.

Models for Bridge Deck Condition Forecasting

InfoBridge now includes three newly developed models to forecast bridge deck conditions: (1) time in condition, (2) deep learning, and (3) proportional hazards deterioration models (**Fig. 3**). All three models use historical National Bridge Inventory data in addition to data from other sources, such as the National Aeronautics and Space Administration Modern-Era Retrospective Analysis for Research and Applications,
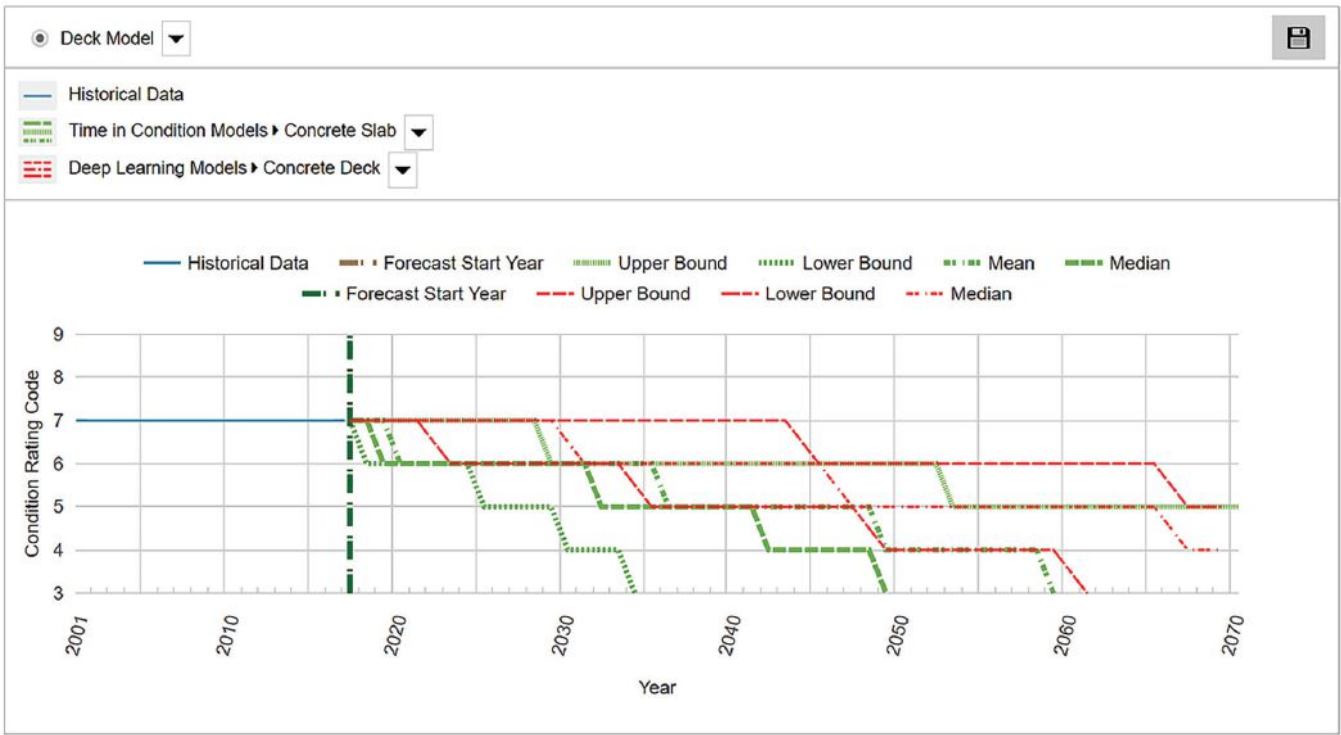
Figure 3. Three new models are now available to forecast bridge deck conditions.

Version 2 climatic data, to forecast bridge deck conditions.

These models are intended to be used for research. Improvements are being planned to increase their forecasting accuracy and will be included in future releases of InfoBridge. Documentation for the models is published in the Library module of InfoBridge. Technical papers describing the models are currently being prepared for publication in peer-reviewed journals.

Design and Construction Data

As-built plans for 1600 bridges have been transposed into searchable data tables (**Fig. 4**). This effort aims to help users better understand the impacts of design and construction practices on bridge performance. Currently, the tables are being restructured to enable more consistent querying and improve the accuracy of research conclusions drawn from InfoBridge design and construction data. A stand-alone interface is being designed to facilitate the inclusion of additional data by bridge owners.

Nondestructive Evaluation Data

InfoBridge has a tabular interface that provides access to downloadable files containing nondestructive evaluation (NDE) bridge data and metadata. In addition, tools for NDE data visualization are included under the *Bridge Information/Graph* tab (**Fig. 5**). Future versions of InfoBridge will include a tool to display the progression of bridge deck deterioration for bridges with multiple rounds of NDE assessments. △

EDITOR'S NOTE

InfoBridge is intended for research, but its data and tools can also be useful to bridge designers. To access InfoBridge, visit https://infobridge.fhwa.dot.gov. *For more information on the portal and the LTBP program, visit* https://highways.dot.gov/long-term-infrastructure-performance/ltbp/long-term-bridge-performance, *or contact Jean Nehme at (202) 493-3042 or jean.nehme@dot.gov.*

Figure 4. Bridge design and construction data for a project in the LTBP database.

Figure 5. Nondestructive evaluation contour plots with dynamic value ranges enable users to adjust the ranges and instantly display the resulting change in values.