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## ERRATA

*LTBP Bridge Performance Primer TechBrief*

FHWA Publication No.: FHWA-HRT-14-031

Dear Customer:

An editorial correction was made to this TechBrief after the TechBrief was originally published. The following table shows the modification that was made to the TechBrief.

### Task 1080 - FHWA-HRT-14-031 - TechBrief - FHWA LTBP Industry Day

Location	Correction
Page 4, Bulleted list 1, Bulleted item 2	Change numbering from “2” to “1”
Page 4, Bulleted list 1, Bulleted item 4	Change numbering from “4” to “3”
Page 4, Bulleted list 2, Bulleted item 2	Change word from “(tie for third)” to “(tie for second)”
Page 4, Bulleted list 2, Bulleted item 3	Change numbering from “3” to “2”
Page 4, Bulleted list 2, Bulleted item 3	Change word from “(tie for third)” to “(tie for second)”
Page 4, Bulleted list 2, Bulleted item 4	Change word from “(tie for fifth)” to “(tie for fourth)”
Page 4, Bulleted list 2, Bulleted item 4	Change numbering from “5” to “4”
Page 4, Bulleted list 2, Bulleted item 5	Change word from “(tie for fifth)” to “(tie for fourth)”

# FHWA LTBP Industry Day

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## About LTBP

This research was conducted as part of the Federal Highway Administration's Long-Term Bridge Performance (LTBP) Program. The LTBP Program is a minimum 20-year research effort to collect scientific performance field data, from a representative sample of bridges nationwide, that will help the bridge community better understand bridge deterioration and performance. The products from this program will be a collection of data-driven tools including predictive and forecasting models that will enhance the abilities of bridge owners to optimize their management of bridges.

## Objective

This TechBrief summarizes Long-Term Bridge Performance (LTBP) Industry Day, held July 16, 2012, a public meeting sponsored by the Federal Highway Administration's (FHWA) LTBP Program.

## Introduction

The FHWA Office of Infrastructure Research and Development initiated the LTBP Program in 2008. The LTBP Program is at least a 20-year research effort to collect scientific, performance, and field data from a representative sample of bridges nationwide. This research will help the bridge community better understand bridge deterioration and performance. This program will produce a collection of data-driven tools, including predictive models to optimize management of bridges. Input from state highway agencies and other stakeholders identified a variety of bridge performance issues to be evaluated.

A pilot phase has been completed to validate data collection protocols and a long-term data collection phase on bridges throughout the United States. The LTBP Program will use proven technologies to efficiently obtain the high-quality data needed.

The LTBP Program seeks opportunities to engage and collaborate with industry to learn of existing and innovative tools and technologies, services, or expertise. In November 2011, FHWA issued a Request for Information (RFI) to gain input from non-governmental organizations (e.g., private companies, professional organizations, academia, etc.) who share an interest in improving the health and operational capacity of the Nation's bridges. Responders to the RFI submitted white papers outlining their suggestions for collaboration opportunities.

Subsequently, an Industry Day public meeting was held on July 16, 2012, in Alexandria, VA, to provide an open forum for FHWA and interested representatives from industry to discuss and share ideas. Nearly 60 people attended the event, including attendees from professional organizations, engineering consulting companies, and technology developers and vendors, as well as FHWA and State transportation departments.

The following sections highlight the collaboration opportunities discussed.



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## Poster Session

A poster session was held where FHWA invited all industry responding to the RFI to display information about their products and services in a poster and/or a one-page handout and to discuss how they may be applicable to the LTBP Program. The posters represented a cross-section of the Industry Day attendees.

Firms exhibiting a poster and/or providing attendees with handouts included the following:

- American Galvanizers Association (AGA)—*Hot-Dip Galvanized Steel, Protecting Our Infrastructure for Generations.*
- American Society of Civil Engineers (ASCE)—*Collaborative Efforts that Support the Goals of the FHWA Long-Term Bridge Performance (LTBP) Program.*
- American Society for Non-Destructive Testing (ASNT)—*Overview of the Organization and Potential for Collaboration with LTBP.*
- Cleveland Electric Laboratories' (CEL) Advanced Technologies Group—*Long Term Structural Health Monitoring Using Fiber Optics.*
- Concrete Reinforcing Steel Institute (CRSI) on behalf of the National Concrete Bridge Council (NCBC)—*National Concrete Bridge Council Briefing.*
- Greenman-Pedersen, Inc. (GPI) and Rutgers University—*Evaluation of Deck Rehabilitation Strategies Using Full-Depth Precast Deck Panels and Traditional Cast-in-Place Reinforced Concrete Decks.*
- Intelligent Automation, Inc.—*A Wireless Bridge Structural Health Monitoring System.*
- Intelligent Automation, Inc.—*Bridge Data Management, Summarization, and Knowledge Discovery for Long Term Bridge Performance.*
- Intelligent Engineering/SPS North America—*Evolutionary Bridge Decking Product.*
- Miceli Infrastructure Consulting, LLC—*Effective Technology Transfer to the Bridge Industry.*
- URS Corporation; NEXCO-West USA, Inc.; Optech Inc.; and InspectTech—*Improving Bridge Inspection and Management Systems Through Innovative Imaging Technologies.*

## Professional Organization Presentations

Five professional organizations gave an overview of their expertise and proposed areas for collaboration to assist the LTBP Program.

### NCBC/CRSI Presentation

NCBC represents a range of industry associations (including CRSI), providing shared expertise in materials,

design, construction, and technology. CRSI proposed to use this expertise to support the LTBP Program by offering detailed program review, document review, or other technical input by its staff as requested. CRSI also noted that four ongoing CRSI corrosion research studies may provide potential areas of overlap with LTBP study topics where knowledge and data sharing may be mutually beneficial.

NCBC described how bridge construction, design, and materials have changed over time, and indicated these changes may affect bridge performance. Specifically, NCBC noted cements, reinforcement, and concrete additives have undergone much change since 1990. Additionally, NCBC described how the load and resistance factor design bridge design specifications, empirical deck design, jointless bridges, and increased span lengths have also changed and could affect bridge performance. NCBC also noted that accelerated bridge construction is a new process in bridge construction and may affect bridge performance.

NCBC also discussed different types of bridge deterioration. These included non-corrosion-related cracking and abrasion due to loads and weather and corrosion-related cracking due to deicing salts.

NCBC/CRSI also identified four short-term and six long-term study topics that it suggested could be considered within the LTBP Program.

Short-term study topics included the following:

- Are better construction techniques being employed to ensure better concrete placement and curing?
- What do different States provide in terms of typical annual maintenance of a bridge? Is it documented?
- What are the various States' policies/practices on deicing salt application?
- What are the effects of abutments on bridge performance? Mechanically stabilized earth (MSE) walls? Integral abutments?

Long-term study topics included the following:

- How do bridges age?
  - What is the role of deck cracking in performance?
  - What is the role of concrete permeability?
- What are typical repair schedules, and how do these affect cost and performance?
- Do the American Association of State Highway and Transportation Officials (AASHTO) designs affect performance, such as requirements for shrinkage and temperature steel?
- What are appropriate reinforcing steels, and what are their design lives/corrosion propagation?
- Are dynamic response characteristics of structures

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being captured with the other data? Is there a measurable change in stiffness over time?

- Are the planning models appropriate for bridge design? Is functional obsolescence more likely than structural deficiency for a 100-year service life?

### National Steel Bridge Alliance (NSBA) Presentation

NSBA described their expertise that could support the LTBP Program's research. Specifically, NSBA first described the successful collaboration between FHWA and the steel industry in the development and implementation of high-performance steel. NSBA then recommended five topics/technologies that could be incorporated into the LTBP Program and where NSBA could collaborate as follows:

- Use LTBP bridges to benchmark new proposed criteria to control load-induced deck deterioration.
- Create a database of zinc-coated bridges that could also track first cost and maintenance cost information.
- Create a protocol for conducting site evaluations for the suitability of using weathering steel on a bridge. NSBA proposed using X-ray fluorescence in this protocol because NSBA has expertise with this tool.
- Assess expanded bushings to enhance crack arrest holes for fatigue cracks in older structures. This technology has been used in the aerospace industry, but is new to the bridge industry.
- Support development of performance-based specifications for laser measurement systems to improve the shop fabrication process for steel girders, allowing for virtual assembly and a bridge "birth certificate."

### ASCE Presentation

ASCE's presentation described the state of the Nation's infrastructure and their estimates of the costs to businesses, users, and the Nation if nothing is done to improve the infrastructure. ASCE has eight institutes dedicated to the diverse technical specialties within the civil engineering profession. The Structural Engineering Institute (SEI) is directly related to the needs of the LTBP Program, and their mission statements are complementary. ASCE/SEI identified the following ways it could use its resources to support the LTBP Program:

- ASCE/SEI could host LTBP meetings and conferences at its headquarters in Reston, VA.
- ASCE/SEI journals, conferences, and publications could be used to disseminate LTBP Program findings and information.
- ASCE/SEI could share its knowledge and expertise, especially through its bridge-focused technical committees.

- The LTBP Program could utilize SEI committees to assist in developing standards and guidelines for data collection protocols.

### Advanced Condition Assessment Technologies (ACAT) Group Presentation

The ACAT group represents a host of private companies that provide various technologies and services for bridge monitoring and evaluation. Based on this expertise, the ACAT group made several recommendations for collaborating with the LTBP Program. These ideas included:

- Deploying nondestructive evaluation (NDE) and structural health monitoring tools in the LTBP Program to meet program objectives.
- Working with State highway agencies throughout the duration of the LTBP Program to target typical issues and bridges of concern.
- Striving to address both shorter-term concerns and problems of stakeholders and longer-term objectives of the program.
- Integrating ACAT.

### ASNT Presentation

ASNT is a professional organization for users and practitioners of NDE. ASNT described their specific expertise and their ideas for how their expertise can support the LTBP Program's data collection needs. ASNT suggested several areas of collaboration as follows:

- Provide expertise on developing an NDE testing program for the LTBP based on best practices and designed to result in meaningful, consistent, and repeatable data.
- Disseminate LTBP Program findings and information through ASNT conferences and publications
- Assist in developing NDE personnel qualification requirements, training materials, and certification materials.

### Follow-Up

Following Industry Day, the FHWA attendees and a State transportation department stakeholder met and discussed material presented. The consensus was that the items presented by the industry groups offered much potential for help to the LTBP Program, specifically NSBA, NCBC, the ACAT group, and ASNT.

The questions and issues raised by the industry groups largely confirmed the scope of the 20 performance issues the LTBP Program identified through meetings with State transportation departments and its own research. The input from the industry groups provided valuable insight.

As an immediate follow-up to Industry Day, FHWA requested that NCBC prioritize the questions presented at Industry Day. NCBC provided the following ranking

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of the short-term questions separately and then the long-term questions separately:

Short-term questions include the following:

1. Are better construction techniques being employed to ensure better concrete placement and curing? (Tie for first.)
1. What are the effects of abutments? MSE walls? Integral abutments? (Tie for first.)
3. What do different States provide in terms of typical annual maintenance of a bridge? Is it documented? (Tie for third.)
3. What are the various States' policies/practices on deicing salt application? (Tie for third.)

Long-term questions include the following:

1. What is the role of deck cracking in performance?
2. What is the role of concrete permeability? (Tie for second.)
2. Do the AASHTO designs affect performance, such as requirements for shrinkage and temperature steel? (Tie for second.)
4. Are dynamic response characteristics of structures being captured with the other data? Is there a measurable change in stiffness over time? (Tie for fourth.)
4. What are typical repair schedules, and how do these affect cost and performance? (Tie for fourth.)
6. Are the planning models appropriate for bridge design? Is functional obsolescence more likely than structural deficiency for a 100-year service life?

Since Industry Day, FHWA has met with and discussed possible collaboration with NSBA, NCBC,

and the ACAT group. Plans for meeting with ASNT are underway. Collaborative projects with NSBA and NCBC have begun. Efforts are underway with these industry groups and the FHWA LTBP staff to begin creating national timelines of milestone changes in bridge practices from 1960 to the present. The ACAT group has provided detailed reviews of draft LTBP protocols for long-term instrumentation of bridges.

## Conclusions

Industry Day provided a platform for the LTBP Program to actively engage industry groups and foster collaboration. Attendees exchanged many ideas and identified opportunities to work with and support the LTBP Program. Many different technologies were displayed during the poster session, and the industry/professional associations in attendance presented different ways that they could lend their expertise.

There are many potential mutual benefits to collaboration, including sharing expertise; data sharing to utilize existing data, studies, and data collection or monitoring systems; cost-sharing on specific studies or technology implementation; developing data collection standards, personnel certification, and training materials; and deploying innovative, field-ready technology, which supports LTBP data collection needs and can provide a path to validation for new technology.

The LTBP Program will continue to evaluate the various promising collaboration opportunities discussed and assess how they can help meet the objectives of the program. The LTBP Program looks forward to continuing collaboration with industry partners and working together to improve knowledge and understanding of bridge performance.

**Researchers**—The FHWA LTBP Industry Day was conducted by FHWA Office of Infrastructure Research and Development and Rutgers, the State University of New Jersey. For additional information, contact Susan Lane in the Office of Infrastructure Research and Development, located at 6300 Georgetown Pike, McLean, VA 22101-2296.

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**Key Words**—LTBP Program, bridge performance, performance, long-term bridge performance, Industry Day, industry LTBP collaboration.

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