

FOCUS

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Post-Tensioning for Bridges: FHWA Manual Presents New State-of-the-Practice

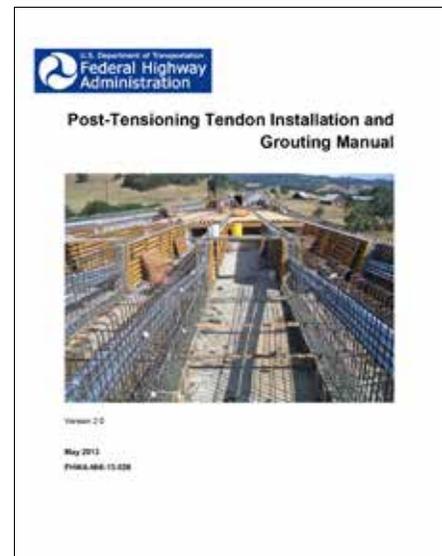
Over the last half of the 20th century, the introduction of prestressed concrete bridges represented a major advancement for bridge construction, offering a range of new engineering solutions and aesthetic possibilities.

The construction of these bridges requires, however, that the concrete be prestressed by using either pretensioning or post-tensioning strategies to reduce cracking and increase durability. The Federal Highway Administration's (FHWA) updated *Post-Tensioning Tendon Installation and Grouting Manual* (Pub. No. FHWA-NHI-13-026) presents guidance on designing, installing, grouting, and inspecting post-tensioning tendons.

"This manual has been a valuable and frequently referenced resource to the bridge community," said Reggie Holt of FHWA. "The updated manual incorporates the many recent changes in the post-tensioning state of practice." Among the manual's highlights are guidance on quality construction procedures, new testing procedures, and recommended post-tensioning detailing.

As the tensile strength of concrete is only about 10 percent of its compressive strength, plain concrete members used in bridge construction are likely to crack when loaded. Prestressing places the concrete structure under compression in areas where traffic loading causes tensile stress. Prestressing steel embedded in the concrete then accepts the tensile stresses, helping to reduce or eliminate cracking.

Using the pretensioning method to prestress the concrete, prestressing steel strands are tensioned against bulkheads before the concrete is



cast. After the concrete has been placed and achieved sufficient strength, the strands are released and their force is transferred to the concrete. With the post-tensioning method, steel tendons are installed in ducts either embedded in or external to the concrete and stressed after the concrete has been placed, hardened, and attained a minimum compressive strength.

The updated FHWA manual covers post-tensioning system materials and components, including steel strands and bars, anchorages and associated hardware, ducts, and grout. Also covered are duct, tendon, and anchor installation, as well as jacks and other necessary stressing equipment and methods.

Highway agencies and contractors will find a range of information on grouting post-

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www.fhwa.dot.gov/publications/focus/index.cfm



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tensioning tendons, including equipment, testing, and inspection. Grouting problems and solutions are also featured, including steps to take when the grout flow is interrupted or the grouting pressure is too high. Manual users can learn from varied examples of grouting procedures.

Corrosion protection of post-tensioning tendons is another key topic. The manual covers the new protection levels established by the Post-Tensioning Institute and American Segmental Bridge Institute. Emphasis areas include sealing inlets and outlets, corrosion protection at anchorages, and temporary protection during construction.

The manual's appendices include definitions for terminology used in post-tensioning work, as well as recommended personnel qualifications for highway agency and contractor staff.

To download the manual, visit www.fhwa.dot.gov/bridge/pt. To view a new FHWA Technical Advisory on Recommendations for Assessing and Managing Long-Term Performance of Post-Tensioned Bridges having Tendons Installed with Grout Containing Elevated Levels of Chloride, visit www.fhwa.dot.gov/bridge/t514033.pdf. FHWA's National Highway Institute (NHI) expects to introduce a new Web-based training course on post-tensioning installation and grouting by summer 2014. To receive email notification when this course is available, visit www.nhi.fhwa.dot.gov/esubscribeinfo.aspx and sign up for NHI updates (select "Structures" under the "Updates by Training Program Area" option).

For more information on the *Post-Tensioning Tendon Installation and Grouting Manual*, contact Reggie Holt at FHWA, 202-366-4596 (email: reggie.holt@dot.gov). *

FHWA Launches Aerodynamics Webinar Series

A new Aerodynamics Webinar series sponsored by the Federal Highway Administration (FHWA) will discuss the unique challenges to bridge engineering presented by the effects of wind load and pressure.

While wind pressure directly adds to bridge structural loads, dynamic effects from winds can also accumulate and become hazardous. Other highway structures can be affected as well, including traffic signs and lighting structures.

The free Webinars will present information on the history of bridge aerodynamics, lessons learned from past cases, current code provisions, available tools for analysis, and mitigation methods.

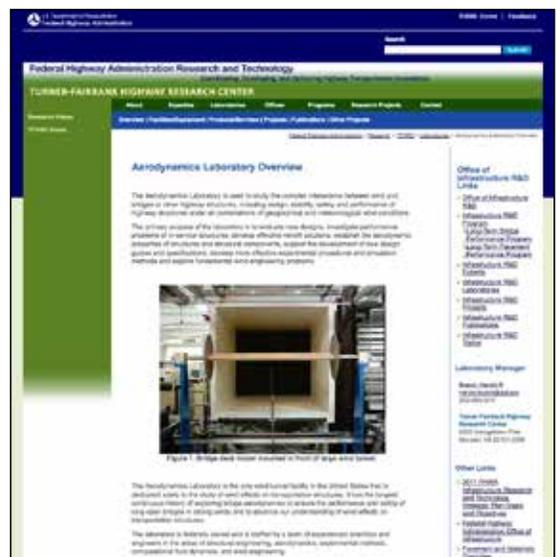
"This series is designed to help bridge engineers recognize potential issues with new designs or on existing bridges, identify countermeasures, and find resources to help address the issues," said Harold Bosch of FHWA.

Webinar topics will range from the daily work performed and decisions made by bridge engineers to cutting edge research initiatives. The series kicked off November 25, 2013, with an overview of the FHWA Aerodynamics Program. Upcoming sessions will feature:

- Introduction to wind hazards in highway engineering—January 2014.
- Wind load and aerodynamic design of bridges—March 2014.
- Wind-induced vibration of bridge cables—May 2014.
- Experimental methods for wind design—June 2014.

- Computational tools for aerodynamics of highway structures—July 2014.
- Coastal wind hazard to bridges: hurricane, surge, waves—August 2014.
- Wind load and aerodynamic design of signs, signals, and lighting structures—September 2014.
- Field monitoring and testing—October 2014.

For additional information on the Aerodynamics Webinar series, contact Harold Bosch at FHWA, 202-493-3031 (email: harold.bosch@dot.gov). *Focus* will announce dates for the upcoming Webinars and registration information when they are available. To learn more about FHWA's Aerodynamics research, visit www.fhwa.dot.gov/research/tfhrc/labs/aerodynamics. *



To learn more about FHWA's Aerodynamics research, visit www.fhwa.dot.gov/research/tfhrc/labs/aerodynamics.

Meet LTPP InfoPave

Participate in a live demonstration of LTPP InfoPave and catch up on other developments from the Federal Highway Administration's (FHWA) Long-Term Pavement Performance (LTPP) program at the Transportation Research Board's (TRB) 93rd Annual Meeting in Washington, DC.

FHWA will introduce LTPP InfoPave at the State Coordinator's Meeting on January 12, 2014. The Web-based program allows users to more easily tap into the wealth of pavement data available through the LTPP initiative. Representatives from the Minnesota and South Carolina departments of transportation will share their experiences in testing the system.

The program will officially debut at the "LTPP InfoPave Public Release" session on January 13. Attendees will learn how to use the system to obtain data for analysis, as well as how the program simplifies access to the LTPP database.

Live demonstrations of the new program will also be held on January 13 and 14 from 8 a.m. to 2 p.m. in the Marriott Wardman Park Tower Meeting Room 8217. To find out more about the technical background of LTPP InfoPave, plan to attend TRB Poster Session 618 on January 14 from 2 p.m. to 3:45 p.m. at the Marriott Wardman Park, Salon 2.

Other developments in the LTPP program, including new warm-mix asphalt projects and an announcement of the 2014 International Data Analysis Contest, will be covered at the State Coordinator's Meeting on January 12. Sponsored by



More details about the LTPP program are available at www.fhwa.dot.gov/research/tfhrc/programs/infrastructure/pavements/ltpptp.

FHWA and the American Society of Civil Engineers, the contest encourages college students, professors, State highway agency staff, industry representatives, and others to get involved in using the LTPP data.

To learn more about the LTPP program, visit the LTPP Exhibit Booth (No. 2111) in the Marriott Wardman Park Exhibit Hall. For additional information on the LTPP sessions at the TRB Annual Meeting, contact the LTPP

Customer Support Service Center at 202-493-3035 (email: ltppinfo@dot.gov). More details about the LTPP program are available at www.fhwa.dot.gov/research/tfhrc/programs/infrastructure/pavements/ltpptp. Online resources include copies of publications, updates on data collection and analysis activities, and links to LTPP products. *

In-Place Recycling Techniques for Asphalt Pavements

Looking for the latest on in-place recycling? The Federal Highway Administration's (FHWA) National Highway Institute (NHI) offers a newly updated "Asphalt Pavement In-Place Recycling Techniques" course (Course No. FHWA-NHI-131050) to help highway agencies implement sustainable and cost-effective alternatives to traditional rehabilitation practices. When using in-place recycling, the existing pavement materials are reused for the new pavement.

Developed in partnership with the Asphalt Recycling and Reclaiming Association, the course combines 2 online training modules with 2 days of instructor-led classroom sessions. Participants will learn how to select the appropriate in-place recycling technique for a given set of conditions, including different traffic levels, pavement conditions, and environments; choose the appropriate materials for the project and develop the mix design; develop suitable specifications, including method specifications and performance specifications; and effectively construct the pavement. Techniques covered are hot-in-place recycling, cold-in-place recycling, and full-depth reclamation.

"This training is a step forward in helping participants better understand the

benefits of in-place recycling technologies for asphalt pavements," said Lee Gallivan of FHWA.

The two online modules introduce pavement evaluation techniques and the three potential recycling techniques, along with the types of equipment commonly used for each. Participants then attend the 2-day classroom session, which focuses on project and technique selection, materials and mix design, construction specifications, and how to address issues that may affect the constructability of a project.

The course is designed for State and local transportation agency engineers and other personnel responsible for asphalt

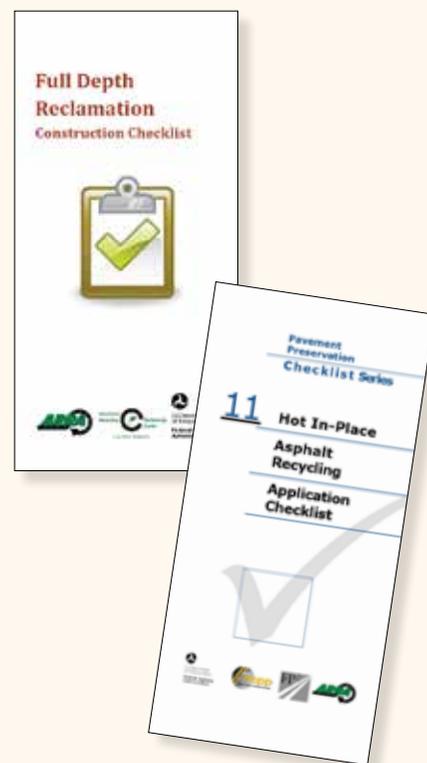
pavement maintenance, resurfacing, rehabilitation, and reconstruction projects. Contractors, consulting engineers, and industry personnel involved in asphalt pavement in-place recycling will also benefit from the training.

For information on scheduling the course, visit www.nhi.fhwa.dot.gov and select "Search for a Course." The course fee is \$400 per person, with a minimum class size of 20 and a maximum of 30. For additional information on the course content, contact Lee Gallivan at FHWA, 317-226-7493 (email: victor.gallivan@dot.gov). *

FHWA offers a newly updated course to help highway agencies implement sustainable and cost-effective alternatives to traditional rehabilitation practices for asphalt pavements.

Checklists for In-Place Recycling

Two new publications from FHWA provide guidance on using in-place recycling techniques. *Hot In-Place Asphalt Recycling Application Checklist* (Pub. No. FHWA-HIF-13-061) examines the three main processes that make up hot in-place asphalt recycling: surface recycling, remixing, and repaving. These three processes are combined with the placement of an overlay of new hot-mix asphalt to reconstruct a pavement.



Full Depth Reclamation Construction Checklist (Pub. No. FHWA-HIF-13-036) offers a handy field guide to using full-depth reclamation (FDR) as an alternative to traditional pavement reconstruction. FDR consists of pulverizing and mixing in place distressed asphalt materials and the underlying pavement materials. Stabilizing agents such as cement, lime, or asphalt may also be added. The resulting material is used as a base for the new pavement.

Topics covered in both checklists include preliminary project tasks such as document review and materials checks, preconstruction inspection responsibilities, weather requirements, mix design, traffic control, and responsibilities for project inspection. Also included are common problems and solutions.

To download the *Hot In-Place Asphalt Recycling Application Checklist*, visit www.fhwa.dot.gov/

[pavement/pub_details.cfm?id=356](http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=356) or www.pavementpreservation.org/fhwa-resources/fhwa-preservation-brochures/. *Full Depth Reclamation Construction Checklist* is available at www.fhwa.dot.gov/pavement/pub_details.cfm?id=896. For more information on the checklists, contact Lee Gallivan at FHWA, 317-226-7493 (email: victor.gallivan@dot.gov).

FHWA's "Asphalt Pavement In-Place Recycling Techniques" course guides highway agencies in recycling existing pavement materials for use in a new pavement.



Infrastructure Innovation Webinars

These free Webinars provide a quick introduction to the latest infrastructure innovations and technologies.

Creating 3D Engineering Models

January 8, 2014, 11 a.m.–12:30 p.m. eastern standard time (EST)

The Webinar will cover the process for creating a 3D model from survey, geographic information system, and design data. Best practices for capturing existing conditions in the model will be discussed, as well as the creation of models using rapid modeling techniques. Presenters will represent both State transportation agencies and private industry.

To register, visit www.nhi.fhwa.dot.gov/resources/webconference/web_conf_learner_reg.aspx?webconfid=27049. For more information, contact Douglas Townes at the Federal Highway Administration (FHWA) Resource Center, 404-562-3914 (email: douglas.townes@dot.gov).

Organizational Approaches and Analytic Tools to Improve Operations Capability

January 8, 2014, 2–3:30 p.m. EST

Sponsored by the Transportation Research Board, this session will explore the new Capability Maturity Model (CMM) developed under the second Strategic Highway Research Program (SHRP2). The CMM is designed to improve transportation systems management and operations. Webinar topics will include State and metropolitan planning organizations' experiences with using CMM. The final 30 minutes of the session are reserved for participant questions.

To register, visit www.trb.org/ElectronicSessions/Blurbs/169944.aspx. For additional information, contact Linda Mason at TRB, 202-334-3241 (email: lmason@nas.edu).

Reshaping Rural Highways for Livability: The Regional Scale

January 21, 2014, 3–4:30 p.m. EST

Presented by FHWA's National Highway Institute, the Webinar will describe how the Virginia Department of Transportation and other stakeholders worked together to develop the Rural Route 50 Traffic Calming Plan. The

plan protects a scenic and historic section of Virginia known as the Mosby Heritage Area, balancing the dual roles of Route 50 as a major highway and the main street for several small towns.

To register, visit www.nhi.fhwa.dot.gov/resources/webconference/web_conf_learner_reg.aspx?webconfid=27083.

Data Needs, Issues, and Governance for Improved Management of Highway Assets

January 22, 2014, 2 p.m. EST

This Webinar will highlight the potential to improve transportation agencies' asset management practices and operational performance through a focus on data and data management. Representatives from State transportation agencies will discuss their agencies' efforts, providing insight into both the challenges encountered and strategies for success.

Visit <http://tam.transportation.org/Pages/Webinars.aspx> to register. For additional information, contact Steve Gaj at FHWA, 202-366-1336 (email: stephen.gaj@dot.gov). *

FHWA Innovations Webinars

For recordings of Webinars presented through FHWA's Innovations Webinar series, visit www.fhwa.dot.gov/hfl/innovations/webinars.cfm. Each 90-minute session focuses on a different technology innovation and includes a panel of speakers from throughout the highway community who have expertise in using the technology. Topics have included alternative contracting methods, fully precast bridge bents for use in seismic regions, road safety audits, bridge preservation, new pavement evaluation tools, and ultra-high performance concrete.

Highway Technology Calendar

The following events provide opportunities to learn more about products and technologies for accelerating infrastructure innovations.

Data Analysis Working Group Forum on Pavement Performance Data Analysis

January 11, 2014, Washington, DC

Sponsored by the Transportation Research Board (TRB), the forum's presentations will focus on techniques for extracting and analyzing pavement performance data. Among the topics will be the Federal Highway Administration's (FHWA) new LTPP InfoPave program for using data collected by the Long-Term Pavement Performance (LTPP) program.

Contact: For information, visit <http://pressamp.trb.org/conferences/programs/default.asp?event=756>.

TRB 93rd Annual Meeting

January 12–16, 2014, Washington, DC

Transportation professionals from around the world will gather to share perspectives on current developments in transportation research, policy, and practice. The conference will feature more than 4,000 presentations in nearly 750 sessions and workshops. The spotlight theme for 2014 is "Celebrating Our Legacy, Anticipating Our Future."

Contact: For information, visit the TRB Web site at www.trb.org (click on "Annual Meeting"). Questions about the meeting can be emailed to trbmeetings@nas.edu.

LTPP InfoPave Public Release Session

January 13, 2014, Washington, DC

FHWA's LTPP program will introduce LTPP InfoPave at this TRB Annual Meeting session. The new Web-based system will allow users to more easily tap into pavement data available from the LTPP program. Participants will learn how to use the system to obtain data for analysis, as well as how the program simplifies the LTPP database.

Contact: LTPP Customer Support Service Center, 202-493-3035 (email: ltppinfo@dot.gov).

2014 Design-Build in Transportation Conference

March 19–21, 2014, San Jose, CA

Join transportation leaders in discussing lessons learned in the use of the design-build project delivery method for transportation projects. Topics will include choosing the right delivery method, contracting approaches, tools and techniques that enhance collaboration, innovative financing solutions, risk allocation, and performance contracting. All modes of transportation will be featured.

Contact: Jerry Yakowenko at FHWA, 202-366-1562 (email: gerald.yakowenko@dot.gov), or visit www.dbtranspo.com.

National Bridge Preservation Partnership Conference 2014

April 21–25, 2014, Orlando, FL

Sessions will cover such topics as best practices; new materials, equipment, technologies, and research; and sustainable long-term performance. Interactive workshops will spotlight bridge preservation tools. Conference sponsors include the American Association of State Highway and Transportation Officials (AASHTO), TRB, the National Center for Pavement Preservation, and FHWA.

Contact: Anwar Ahmad at FHWA, 202-366-8501 (email: anwar.ahmad@dot.gov), or visit www.nbppc2014.org.

Tenth National Conference on Transportation Asset Management

April 28–30, 2014, Miami, FL

The conference is designed for transportation agencies and metropolitan planning organizations in all stages of asset management implementation. Themes will include establishment and monitoring of asset management plans, performance measures for asset management, tools and technology to assist decisionmaking, and adaptation to extreme weather events and climate change, including using risk assessment and vulnerability analysis. Strategies for overcoming barriers to

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FOCUS

Focus (ISSN 1060-6637), which is published monthly by the U.S. Department of Transportation's Federal Highway Administration (FHWA), covers the implementation of innovative technologies in all areas of infrastructure.

Its primary mission is twofold: (1) to serve the providers of highway infrastructure with innovations and support to improve the quality, safety, and service of our roads and bridges; and (2) to help promote and market programs and projects of the various offices of FHWA's Office of Infrastructure.

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Highway Technology Calendar,

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asset management implementation will also be discussed. Organized by TRB, the conference is also supported by FHWA and AASHTO.

Contact: Steve Gaj at FHWA, 202-366-1336 (email: stephen.gaj@dot.gov), or visit www.trb.org/conferences/AssetManagement2014.aspx.

2014 Tools of the Trade Conference July 21–23, 2014, Burlington, VT

Sponsored by TRB, the conference will spotlight practical transportation planning techniques and tools for use by practitioners in small and medium-

sized communities. Researchers, members of academia, and other members of the transportation community are also encouraged to attend. Among the topics are the project programming process, including evaluating and prioritizing projects with performance measures; financial strategies; pedestrian and bike planning; traffic operations and analysis; demand forecasting; and systems analysis. Technology applications, environmental and health issues, and freight logistics will also be featured.

Contact: For additional information, visit www.trbtoolsofthetrade.org/conference/index.html. *