

# FOCUS

March  
2012

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## The Place to Go for Bridge Preservation

**A** new online toolbox developed by the Federal Highway Administration (FHWA) means that bridge preservation resources are now just a click away.

As State and local transportation departments contend with aging bridge inventories, increases in traffic and congestion, limited funding, and rising costs for labor and materials, adopting strategies for bridge preservation as part of overall management of bridge assets is more vital than ever.

“A successful bridge program seeks a balanced approach that incorporates both preservation and replacement,” said Anwar Ahmad of FHWA. Focusing only on replacing deficient bridges while putting off preservation needs will be inefficient and costly in the long term, as this will allow bridges in good condition to deteriorate. Preservation treatments generally cost much less than major reconstruction and replacement activities.



© VDOT

Work is done on a bearing device to facilitate the proper expansion and contraction of a bridge.

The Bridge Preservation Toolbox ([www.fhwa.dot.gov/bridge/preservation](http://www.fhwa.dot.gov/bridge/preservation)) serves as a compendium of bridge preservation-related information and strategies. The information is structured under four main categories:

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### Sign Up Now to Receive Email Notification for the Online Version of *Focus*

The Federal Highway Administration (FHWA) wants you to receive the latest information on highway infrastructure innovations as quickly as possible. *Focus* is typically posted online up to 2 weeks before the printed copy reaches you in the mail. Please go to the *Focus* Web site at [www.fhwa.dot.gov/publications/focus/index.cfm](http://www.fhwa.dot.gov/publications/focus/index.cfm) to sign up to receive an email notification when each issue of *Focus* is posted online. The email notification will include a short description and a link for each article. It will not include any cumbersome attachments.

FHWA is considering moving the *Focus* newsletter to an online-only distribution. This change would get information to readers faster, reduce costs, and help the environment. An online-only version would continue to provide a printable version for subscribers who prefer to read *Focus* in the traditional eight-page, three-column format.

[www.fhwa.dot.gov/publications/focus/index.cfm](http://www.fhwa.dot.gov/publications/focus/index.cfm)



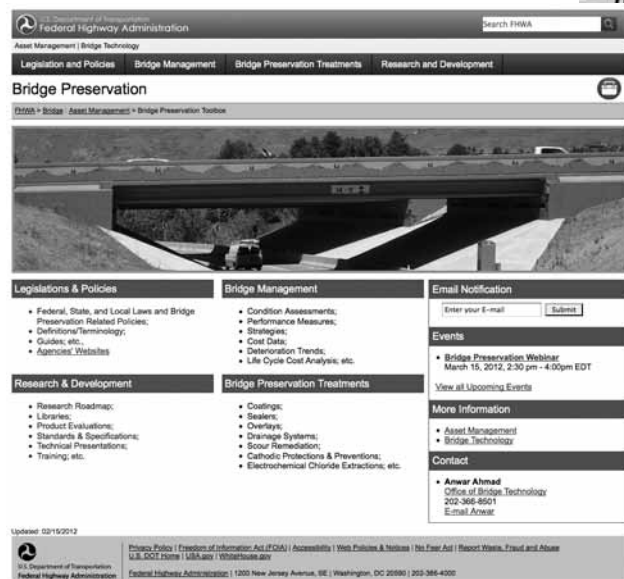
U.S. Department  
of Transportation

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## Bridge Preservation,

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Visit the Bridge Preservation Toolbox at [www.fhwa.dot.gov/bridge/preservation](http://www.fhwa.dot.gov/bridge/preservation) for information on everything from treatments to legislation and policies.



Bridge deck repairs are performed prior to installation of a deck overlay, which can reduce the impact of aging and weathering.

Legislation and Policies, Bridge Management, Bridge Preservation Treatments, and Research and Development.

“The initial content of the Toolbox highlights some of the great work that has been done by the bridge community. We will make every effort to continue to update the contents as new material becomes available,” said Ahmad.

The Bridge Preservation Treatments section features information on preservation and maintenance methods and procedures, including repair methods and protective systems.

Visit the Legislation section to find the latest on Federal, State, and local laws and bridge preservation-related policies. Also featured are background information on bridge preservation terminology and links to State and Federal guides, including FHWA’s *Bridge Preservation Guide* (Pub. No. FHWA-HIF-11-042) (see September 2011 *Focus*). Included in the FHWA guide is a framework for establishing a Systematic Preventive Maintenance (SPM) program for bridges. An SPM program can be implemented at the

network-wide, highway system, area-wide, or regional level. Federal-aid funds may be used for SPM on highway bridges located on public roads regardless of whether a bridge is eligible for replacement or rehabilitation.

Bridge Management resources cover such topics as condition assessments, performance measures, strategies, cost data, deterioration trends, and life-cycle cost analysis. In addition to guidance from FHWA, resources include reports and information from Arizona, Massachusetts, Nebraska, North Carolina, Virginia, and other States.

In the area of Research and Development, users can find technical presentations, details on standards and specifications, National Cooperative Highway Research Program reports, and information on training opportunities.

Visit the Bridge Preservation Toolbox at [www.fhwa.dot.gov/bridge/preservation](http://www.fhwa.dot.gov/bridge/preservation). For more information on bridge preservation resources, contact Anwar Ahmad at FHWA, 202-366-8501 (email: [anwar.ahmad@dot.gov](mailto:anwar.ahmad@dot.gov)). \*

FHWA’s National Highway Institute, in conjunction with the FHWA Highways for LIFE program, will host a Bridge Preservation Webinar on March 15, 2012, from 2:30–4 p.m. (eastern daylight time). The free Webinar will highlight cost-effective preservation practices that can extend the useful life of bridges. For more information or to register, visit [www.nhi.fhwa.dot.gov/resources/webconference/web\\_conf\\_learner\\_reg.aspx?webconfid=24138](http://www.nhi.fhwa.dot.gov/resources/webconference/web_conf_learner_reg.aspx?webconfid=24138). Information is also available by contacting Anwar Ahmad at FHWA, 202-366-8501 (email: [anwar.ahmad@dot.gov](mailto:anwar.ahmad@dot.gov)).

# Updated Course Offers Comprehensive Training on Bridge Safety Inspections

**T**raining on “Safety Inspection of In-Service Bridges” (Course No. FHWA-NHI-130055) is available through a recently updated course offered by the Federal Highway Administration’s (FHWA) National Highway Institute (NHI).

Based on FHWA’s *Bridge Inspector’s Reference Manual*, the course is designed to fulfill the requirements of the National Bridge Inspection Standards for a comprehensive training course.

Successful completion of the course provides participants with the skills to evaluate a variety of bridges and determine the critical areas for inspection, including fatigue-prone details and common points of deterioration and distress. Updates to the 10-day course include an increase in bridge inspection field time from one brief field trip to two longer field trips, new instruction on identifying critical findings and responding to those findings, and coverage of the new American Association of State Highway and Transportation Officials element level condition assessments.

Participants must have completed one of three prerequisite courses with a passing score of 70 percent or better within the last 2 years: Engineering Concepts for Bridge Inspectors (Course No. FHWA-NHI-130054), Introduction to Safety Inspection of In-Service Bridges (Course No. FHWA-NHI-130101), or Prerequisite Assessment for Safety Inspection of In-Service Bridges (Course No. FHWA-NHI-130101A).

Attendees will learn the duties and responsibilities of a bridge inspector, including how to identify, evaluate, and document the various bridge components and deficiencies that can exist. Also covered are design characteristics and field inspection methods for common concrete, steel, and timber structures, as well as non-destructive evaluation methods for basic bridge materials. Identification and evalu-

ation of culvert and waterway deficiencies is another primary topic.

The course provides instruction on inspection equipment needs for various types of bridges and site conditions. Participants will also discuss personal and public safety issues associated with bridge inspections. While this course does not provide indepth coverage of fracture-critical, underwater, or complex bridge inspections, NHI offers specialized training on fracture-critical inspection (Course No. FHWA-NHI-130078) and underwater safety inspection (Course No. FHWA-NHI-130091).

The Safety Inspection course is designed for Federal, State, and local highway agency employees and consultants who inspect bridges or hold bridge inspection management and leadership positions. A background in bridge engineering is strongly recommended. The course fee is \$1,650 per person, with a minimum class size of 20 and a maximum of 30.

For more information on scheduling the course, visit [www.nhi.fhwa.dot.gov](http://www.nhi.fhwa.dot.gov). To learn more about the technical course content, contact Gary Moss at FHWA, 202-366-4654 (email: [gary.moss@dot.gov](mailto:gary.moss@dot.gov)). \*



Top right: A visual inspection of a steel girder bridge is conducted. Middle right: An inspector conducts a visual inspection of a truss structure. Bottom right: An under-bridge inspection vehicle is used on an Interstate bridge. Bottom left: A visual inspection is carried out for a steel substructure unit.

# Don't Barrel Through Work Zones: National Work Zone Awareness Week 2012

States across the country will remind motorists that safer driving means safer work zones as National Work Zone Awareness Week (NWZAW) 2012 kicks off April 23 on Route 141 near St. Louis, Missouri. "Don't Barrel Through Work Zones" is the theme of the 2012 event.

The Missouri Department of Transportation (MoDOT) is reconstructing a 3.2-km (2-mi) stretch of Route 141, upgrading it from a three-lane road with at-grade intersections to a six-lane freeway with multiple interchanges. The upgraded roadway will enhance the flow of traffic through the region, reduce congestion, and generate an estimated \$1 billion in economic activity over the next 20 years.

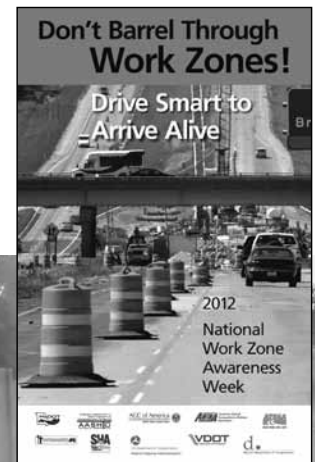
To keep traffic moving safely through the work zone, MoDOT uses a combination of education, enforcement, and engineering practices. Work zone signs have been enhanced, for example, to make them more visible to motorists. An online map with work zone information helps motorists "drive smart" and better plan their trips. And drivers are encouraged to visit MoDOT's Web site at [www.modot.org/workzones/comments.htm](http://www.modot.org/workzones/comments.htm) to rate work zones and offer suggestions on how to improve them.

Missouri and other States such as Kansas, Mississippi, Oregon, Tennessee, and Washington have also sponsored "Go Orange" campaigns where they light public buildings in orange and encourage citizens to wear the color to show support for NWZAW. In Missouri, more than 90 buildings and landmarks throughout the State have participated in Operation Orange.

"These and other work zone safety awareness strategies States are using stress the importance of protecting both workers and motorists," said Chung Eng of the Federal Highway Administration (FHWA). In 2010, 576 workers and motorists were



States across the country will kick off National Work Zone Awareness Week 2012 on April 23. Education and outreach campaigns stress the importance of protecting both workers and motorists.



killed in highway work zones and more than 37,000 were injured. Approximately 85 percent of those killed in work zones are drivers and their passengers.

NWZAW began in 1999 when FHWA, the American Traffic Safety Services Association (ATSSA), and the American Association of State Highway and Transportation Officials (AASHTO) signed a Memorandum of Agreement pledging to increase public awareness of work zone safety issues through a national media campaign. Since then, awareness has continued to grow, with State agencies and other organizations sponsoring high-visibility education and outreach initiatives.

The Arkansas State Highway and Transportation Department, for example, launched a "Know the RED Zones"

campaign to highlight areas with significantly reduced capacity during highway construction projects. The campaign's goal is to encourage motorists to be aware of the RED Zones and consider alternate routes, when available, before they approach the construction area. Travel tips and project information are available on the RED Zones Web site at [www.arkansashighways.com/Roads/roads2.aspx](http://www.arkansashighways.com/Roads/roads2.aspx).

New Jersey will host the 13th Annual New Jersey Work Zone Safety Conference on April 25, 2012, at Rutgers University. Conference topics include traffic control in work zones, maintaining pedestrian access in work zones, and financial implications of work zone accidents. For more information, visit <http://cait>.

rutgers.edu/cait/13th-annual-work-zone-safety-conference.

Work zone safety messages are reaching the youngest passengers as well. The Connecticut Department of Transportation, Connecticut Technology Transfer Center at the University of Connecticut, and Governor's Work Zone Safety Council are sponsoring an "Every Life Counts in Connecticut" roadway safety poster contest for children. Campaign efforts also include outreach to driver training companies, motor transport associations, utility companies, schools, and contractor organizations. To learn more, visit [www.ct.gov/dot/cwp/view.asp?a=1410&q=475476](http://www.ct.gov/dot/cwp/view.asp?a=1410&q=475476).

In addition to ATSSA, AASHTO, FHWA, and individual States, supporters of NWZAW 2012 include the American Road and Transportation Builders Association and the Associated General Contractors of America. More details about NWZAW 2012 and the kick-off event will be posted at [www.atssa.com](http://www.atssa.com) and [www.ops.fhwa.dot.gov/wz/outreach/wz\\_awareness.htm](http://www.ops.fhwa.dot.gov/wz/outreach/wz_awareness.htm) as information becomes available.

New work zone safety resources released by FHWA include a report on *Work Zone Road User Costs—Concepts and Applications* (Pub No. FHWA-HOP-12-005). The report provides an economic basis for quantifying adverse work zone impacts. These data can then be used to make decisions about how to improve work zone mobility and safety, including selecting preferred alternatives to maintain traffic during construction. Step-by-step instructions are provided for key computations. Three real-world case studies from FHWA's Highways for LIFE program are also presented. To download the publication, visit <http://ops.fhwa.dot.gov/wz/resources/publications/fhwahop12005/index.htm>.

Also available is FHWA's *A Primer on Work Zone Safety and Mobility Performance Measurement* (Pub. No. FHWA-HOP-11-033). The primer describes how to better quantify the effects of work zones on travelers, residents, businesses, and the local workforce (see November 2011 *Focus*). To download a copy of the primer, visit [www.ops.fhwa.dot.gov/wz/decision\\_support/performance-development.htm](http://www.ops.fhwa.dot.gov/wz/decision_support/performance-development.htm).

States, contractors, and others can also find guidelines, products, publications, and training resources developed through FHWA's Work Zone Safety Grant program. Since 2006, \$27.8 million in grant funds have been distributed to provide highway work zone safety training and develop guidelines to prevent and reduce work zone injuries and fatalities. To date, a minimum of 50,000 individuals have received grant-supported training. More than 45 guidelines and publications, 40 training modules, and 1 software application are now available. For a complete list, as well as a wealth of other work zone safety resources, visit the National Work Zone Safety Information Clearinghouse at [www.workzonesafety.org/fhwa\\_wz\\_grant](http://www.workzonesafety.org/fhwa_wz_grant).

Another valuable resource is FHWA's Work Zone Safety and Mobility Peer-to-Peer (P2P) program, which matches agencies with experienced transportation professionals who can provide guidance on how to address common challenges in implementing work zone management strategies. To be matched with a peer, call 866-P2P-FHWA (866-727-3492), or send an email to [workzoneP2P@dot.gov](mailto:workzoneP2P@dot.gov). There is no cost to participate in the program.

To learn more about FHWA's work zone safety and mobility resources, visit [www.ops.fhwa.dot.gov/wz](http://www.ops.fhwa.dot.gov/wz). Information is also available by contacting Chung Eng at FHWA, 202-366-8043 (email: [chung.eng@dot.gov](mailto:chung.eng@dot.gov)). \*

## Infrastructure Innovation Webinars

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

### Bridge Preservation

March 15, 2012, 2:30–4 p.m.  
(eastern daylight time)

Based on the Federal Highway Administration's (FHWA) *Bridge Preservation Guide* (Pub. No. FHWA-HIF-11-042), the Webinar looks at how timely and effective bridge preservation assures structural integrity and extends useful life. The session is hosted by FHWA's National Highway Institute, in conjunction with the FHWA Highways for LIFE program. To register, visit [www.nhi.fhwa.dot.gov/resources/webconference/web\\_conf\\_learner\\_reg.aspx?webconfid=24138](http://www.nhi.fhwa.dot.gov/resources/webconference/web_conf_learner_reg.aspx?webconfid=24138). For more information, contact Anwar Ahmad at FHWA, 202-366-8501 (email: [anwar.ahmad@dot.gov](mailto:anwar.ahmad@dot.gov)).

### State-Specific Load and Resistance Factor Rating Load Rating Guidelines

April 19, 2012, 1–3:30 p.m.  
(eastern daylight time)

The Webinar covers fundamental information, lessons learned, and resources available to address State-specific load rating issues such as the application of State legal loads and load calibration based on weigh-in-motion data.

To register, visit <https://connectdot.connectsolutions.com/statespecificlfr/event/registration.html>. For more information, contact Lubin Gao at FHWA, 202-366-4604 (email: [lubin.gao@dot.gov](mailto:lubin.gao@dot.gov)). \*

# A Guide to Conducting an Independent Assurance Program

A new Tech Brief released by the Federal Highway Administration (FHWA) provides guidance State transportation agencies can use in conducting an Independent Assurance (IA) Program to evaluate the sampling and testing procedures they use in their materials and quality assurance (QA) program.

As required by 23 Code of Federal Regulations (C.F.R.) 637 for projects on the National Highway System, an IA Program ensures that materials sampling and testing are performed correctly and that the testing equipment used is operating correctly and remains calibrated. To conduct the IA Program, a separate and distinct schedule of sampling, testing, and observation must be maintained by personnel other than project personnel.

*Independent Assurance Programs* (Pub. No. FHWA-HIF-12-001) discusses best practices for meeting the C.F.R. requirements, including choosing a systems versus project approach. While a project approach covers all projects, a systems approach covers all QA testers. Also addressed is the frequency of IA testing, which may be based on the testing frequency performed for the project's regular QA program or on a specified time interval for a project. Alternatively, a systems approach may be used to base the IA frequency on the number of times that all

personnel who perform testing used in the acceptance decision will have to be reviewed during a year. IA evaluators would then review the work of these personnel at specified intervals. A mix of both of these approaches can also be used. The regulations require States that use the systems approach to submit an annual report to their FHWA division office.

An IA Program ensures that materials sampling and testing are performed correctly and that the testing equipment used is operating correctly and remains calibrated.

Test equipment can be evaluated by using calibration checks, split samples, or proficiency samples, while testing lab personnel can be evaluated through observations and either split samples or proficiency samples. The typical approach for performing IA is to check equipment and personnel at the same time. IA evaluators visit a job site to observe the sampling and testing being performed and to also test a split sample on site with equipment brought by the testers, or to take the sample to a laboratory for testing. If the split samples do not compare, then further analysis is required to determine if the source of the error is in the procedures or equipment.

Other States perform testing on three-way split samples. Using this approach, one split is tested by project personnel, one by the contractor personnel, and one by the IA personnel. This is typically done at the beginning of production to ensure that all testing personnel and equipment are functioning correctly. The Tech Brief also



discusses the way proficiency samples can be used in an IA Program.

As the Tech Brief notes, IA Programs must compare results and detect deficiencies in State or contractor testing procedures in a timely manner. Deviations from established tolerances will require an audit of the respective sampling and testing procedures, as well as the equipment used. The Tech Brief discusses how to establish comparison tolerances and how often to reevaluate these decisions. While some States evaluate their tolerance levels every year, at a minimum the tolerances should be evaluated every 5 years.

To download the Tech Brief, visit [www.fhwa.dot.gov/pavement/materials/hif12001.pdf](http://www.fhwa.dot.gov/pavement/materials/hif12001.pdf). To view the C.F.R. regulation, visit [www.access.gpo.gov/nara/cfr/waisidx\\_03/23cfr637\\_03.html](http://www.access.gpo.gov/nara/cfr/waisidx_03/23cfr637_03.html). For a list of frequently asked questions on the quality assurance regulation, visit [www.fhwa.dot.gov/pavement/materials/qanda637.cfm](http://www.fhwa.dot.gov/pavement/materials/qanda637.cfm). For more information on materials quality assurance, contact Michael Rafalowski at FHWA, 202-366-1571 (email: [michael.rafalowski@dot.gov](mailto:michael.rafalowski@dot.gov)), or Dennis Dvorak at the FHWA Resource Center, 708-283-3542 (email: [dennis.dvorak@dot.gov](mailto:dennis.dvorak@dot.gov)). \*

# Highway Technology Calendar

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

## **Ninth National Conference on Transportation Asset Management: Making Asset Management Work in Your Organization**

April 16–18, 2012, San Diego, CA

Sponsored by the Transportation Research Board (TRB), American Association of State Highway and Transportation Officials (AASHTO), and the Federal Highway Administration (FHWA), conference topics include asset management implementation; pavements and bridges; beyond pavements and bridges (featuring assets such as intelligent transportation systems and signs); and transit state of good repair.

*Contact:* Francine Shaw-Whitson at FHWA, 202-366-8028 (email: francine.shaw-whitson@dot.gov), or visit [www.trb.org/conferences/assetmanagement2012](http://www.trb.org/conferences/assetmanagement2012).

## **North American Steel Construction Conference (NASCC)**

April 18–20, 2012, Grapevine, TX

The conference provides structural engineers, State bridge engineers, steel fabricators, erectors, detailers, architects, and educators with information on the latest design and construction techniques. Participants can attend the Structural Stability Research Council's Annual Stability Conference, which is held in conjunction with the NASCC. Registration also includes admission to the World Steel Bridge Symposium.

*Contact:* Brian Kozy at FHWA, 202-493-0341 (email: brian.kozy@dot.gov), or visit [www.aisc.org/nascc](http://www.aisc.org/nascc).

## **2012 Design-Build in Transportation Conference**

April 25–27, 2012, Phoenix, AZ

Join transportation leaders in discussing lessons learned in the use of the design-

build project delivery method for transportation projects. Discussions will cover choosing the right delivery method, contracting approaches, risk allocation, and performance contracting. The conference is cosponsored by FHWA, AASHTO, and industry groups.

*Contact:* Jerry Yakowenko at FHWA, 202-366-1562 (email: gerald.yakowenko@dot.gov), or visit [www.dbtranspo.com/index.cfm](http://www.dbtranspo.com/index.cfm).

## **2012 International Conference on Winter Maintenance and Surface Transportation Weather**

April 30–May 3, 2012, Coralville, IA

Sponsored by TRB, the Iowa Department of Transportation, AASHTO, and FHWA, the conference will cover both the state-of-the-art and the state-of-the-practice in improving snow removal and ice control operations. Sessions will highlight performance measures, road weather and surface condition data collection, innovative equipment and materials, and large-volume snow control, among other topics.

*Contact:* For more information, contact Roemer Alfelor at FHWA, 202-366-9242 (email: roemer.alfelor@dot.gov), or visit [www.trb.org/Calendar/Blurbs/2012\\_International\\_Conference\\_on\\_Winter\\_Maintenanc\\_164319.aspx](http://www.trb.org/Calendar/Blurbs/2012_International_Conference_on_Winter_Maintenanc_164319.aspx).

## **FHWA Intelligent Compaction (IC) Workshop**

May 3, 2012, Minneapolis, MN

The workshop highlights the fundamentals of IC and discusses the route to successful IC implementation. The training is designed for State agency staff, professionals in the earthwork and paving industries, IC roller vendors, and global positioning system vendors.

*Contact:* George Chang at The Transtec Group, 512-451-6233, ext. 227 (email: gkchang@thetranstecgroup.com), or Lee Gallivan at FHWA, 317-226-7493 (email: victor.gallivan@dot.gov). Registration information is available at [www.IntelligentCompaction.com](http://www.IntelligentCompaction.com).

## **Seventh RILEM International Conference on Cracking in Pavements**

June 20–22, 2012, Delft, Netherlands

Conference topics spotlight the detection, prediction, and mitigation of cracking in pavements; laboratory and field model validation; and accelerated pavement testing. Organized by RILEM (the International Union of Laboratories and Experts in Construction Materials, Systems, and Structures), conference partners include FHWA and AASHTO.

*Contact:* Katherine Petros at FHWA, 202-493-3154 (email: katherine.petros@dot.gov), or visit [www.rilem2012.org](http://www.rilem2012.org).

## **Forty-Ninth Annual Petersen Asphalt Research Conference**

July 9–11, 2012, Laramie, WY

Organized by the Western Research Institute (WRI), the conference will present current research aimed at understanding and improving asphalt performance. Topics covered range from fundamental compositional research to applied field engineering. Attendees are also invited to participate in an open mic discussion.

*Contact:* Steve Salmans at WRI, 307-721-2306 (email: ssalmans@uwyo.edu), or Jack Youtcheff at FHWA, 202-493-3090 (email: jack.youtcheff@dot.gov). Information is also available at [www.petersenasphaltconference.org](http://www.petersenasphaltconference.org).

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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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Publication No. FHWA-HRT-12-011  
HIF-1/03-12(9M)E

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1420 N St., NW, Suite 102, Washington, DC 20005  
fax: 202-347-6938; email: lgpope@woodwardcom.com

## Highway Technology Calendar,

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### 2012 Pavement Performance Prediction Symposium

July 12, 2012, Laramie, WY

Presented by WRI in cooperation with FHWA's Turner-Fairbank Highway Research Center, the symposium will take an in-depth look at a single asphalt-related topic.

*Contact:* Steve Salmans at WRI, 307-721-2306 (email: ssalmans@uwyo.edu), or Jack Youtcheff at FHWA, 202-493-3090 (email: jack.youtcheff@dot.gov). More information on the selected topic will be available at [www.petersenasphaltconference.org](http://www.petersenasphaltconference.org).

### International Conference on Long-Life Concrete Pavements

September 18–21, 2012, Seattle, WA

Organized by FHWA, in partnership with the National Concrete Pavement Technology Center, the conference will address aspects of concrete pavement design, construction, and materials technologies that result in long-life, sustainable concrete pavements. A mini-symposium on concrete paving durability will be held on the final day of the conference.

*Contact:* Shiraz Tayabji at Fugro Consultants, Inc., 410-302-0831 (email: stayabji@aol.com), or Sam Tyson at FHWA, 202-366-1326 (email: sam.tyson@dot.gov). Conference information is also available at [www.fhwa.dot.gov/pavement/concrete/2012conf.cfm](http://www.fhwa.dot.gov/pavement/concrete/2012conf.cfm). \*

Check out FOCUS online at  
[www.fhwa.dot.gov/publications/focus/index.cfm](http://www.fhwa.dot.gov/publications/focus/index.cfm)