

FHWA R&T Now

A news update of research, technology, and development from the U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA)

January/February 2016

POLICY & PARTNERSHIPS

USDOT Announces Smart City Challenge

The U.S. Department of Transportation (USDOT) has announced the “Beyond Traffic: Smart City Challenge,” a new grant opportunity that encourages mid-sized cities to demonstrate how advanced intelligent transportation systems technologies and applications can be used to reduce congestion, keep travelers safe, and support economic vitality in innovative ways.

In the next few decades, mid-sized cities are expected to experience rapid population increases and rapidly growing demands on their transportation infrastructure. USDOT’s Smart City Challenge is designed to help them begin to address challenges this growth will present.

To show what is possible when communities use technology to connect transportation assets into an interactive network, the Smart City Challenge will concentrate Federal resources into one medium-sized city selected through a nationwide competition. Up to \$40 million in funding will go to one mid-sized city that puts forward bold, data-driven ideas to improve lives by making transportation safer, easier, and more reliable.

Also, the Smart City Challenge will provide the opportunity to highlight the role of public-private partnerships in addressing transportation challenges. USDOT will partner with Vulcan for this competition; Vulcan is offering an additional \$10 million to the winning city to support infrastructure for electric vehicles.

For more information, visit <https://www.transportation.gov/smartcity>, or contact Patricia Readinger, 202-366-9801, patricia.readinger@dot.gov.

ADVANCED RESEARCH

Technical Brief: Novel Alternative Cementitious Materials for Development of the Next Generation of Sustainable Transportation Infrastructure

FHWA’s Exploratory Advanced Research (EAR) Program recently published a technical brief that discusses an EAR project that is being performed by the Georgia Institute of Technology and collaborators from Oklahoma State University, Tourney Consulting, and the U.S. Army Corps of Engineers. Funded by FHWA, the project involves conducting a comprehensive and systematic investigation of novel alternative cementitious materials for applications in sustainable transportation infrastructure.



These cements included calcium aluminate, calcium sulfoaluminate, calcium sulfoaluminate belite, magnesium phosphate, and alkali-activated and carbonate-binder systems that provide potential advantages over traditional portland cement through reductions in embodied energy and greenhouse gases, as well as enhanced performance, which contributes to sustainability. The research includes an evaluation of early-age and long-term material properties in addition to multiscale durability investigations.

The document is available to download at www.fhwa.dot.gov/advancedresearch/pubs/16017/index.cfm.

Fact Sheet: Remotely Monitoring Water Quality Near Highways: A Sustainable Solution

The EAR Program also published a fact sheet about the project, “A Remote, Self-Sustained System for Monitoring Water Quality Near Highways.” The goal of the project was to design a renewable and self-sustaining onsite system. Funded by FHWA, the research was conducted by Montana State University.

This project involved combining remote monitoring capabilities of in situ sensors with renewable and self-sustaining bio-energy generation. Instead of batteries, wireless sensors were powered by microbial fuel cells (MFC) that generated electricity through electrochemical reactions with a type of common and safe bacteria (magnesium oxidizing microorganisms) ubiquitous to streams. Researchers designed MFCs that could function as batteries when there was little microbial activity in the stream but operate as MFCs when significant microbial activity occurred. These MFCs differ from the traditional ones that tend to have low energy generation and limited scalability. Because the energy generated from MFCs can fluctuate, a power management system regulates the voltage to provide a stable and accurate direct current voltage that can power the sensors and support

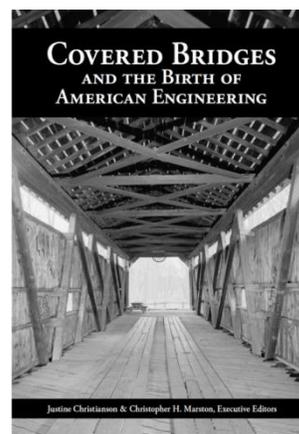
a control system that collects, processes, and transmits real-time water quality data.

The fact sheet presents information about a self-sustained sensing system, field tests, key findings, future work, and the significance of this research to FHWA. The document is available to download at www.fhwa.dot.gov/advancedresearch/pubs/16018/index.cfm.

INFRASTRUCTURE

New Book Released, Features Wood Trusses and Covered Bridge Construction

On January 7, 2016, *Covered Bridges and the Birth of American Engineering* was released at a book event at the historic Silver Spring Baltimore and Ohio Railroad Station in Maryland. Completed through a partnership with the National Park Service–Historic American Engineering Record, the book is one of the products of FHWA’s National Historic Covered Bridge Preservation (NHCBP) Program.



This book describes the importance of covered bridges.

FHWA’s Office of Infrastructure Research and Development and the Historic American Engineering Record (HAER), a division of the National Park Service, Heritage Documentation Programs, have maintained a joint research and technology program for historic covered bridges since 2002. This partnership has included a variety of initiatives, such as documentation for



the HAER collection at the Library of Congress, engineering studies, National Historic Landmark designations, conferences, and a traveling exhibition. These products are the result of cooperative research under FHWA's NHCBP Program.

Covered Bridges and the Birth of American Engineering, edited by Justine Christianson and Christopher H. Marston, examines the development of wood trusses and covered bridge construction, profiles the pioneering craftsmen and engineers involved, explores the function of trusses in covered bridges, and looks at the preservation and future of these distinctly American bridges. The book is generously illustrated and includes photographs and drawings chosen from a vast collection at the Library of Congress. It also includes historic images and engineering diagrams. The book is intended to show a new appreciation for the role that covered bridges played in the development of the Nation and in American bridge engineering.

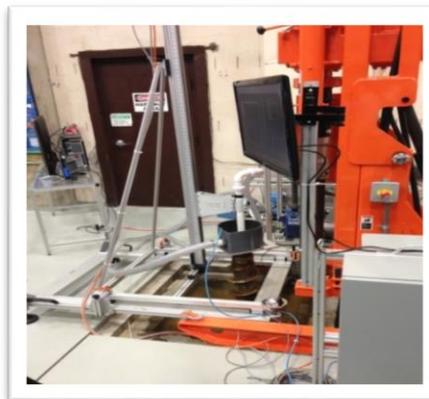
Covered Bridges and the Birth of American Engineering will be distributed to FHWA offices and State departments of transportation. The book is available online at www.nps.gov/hdp/coveredbridges.htm. For more information, contact Christopher Marston, 202-354-2162, christopher_marston@nps.gov, or Sheila Duwadi, 202-493-3106, sheila.duwadi@dot.gov.

ASCE Recognizes FHWA's Hydraulics Research, Engineers Attain Patent for In-Situ Scour Testing Device

The American Society of Civil Engineers will recognize Kornel Kerenyi, a senior hydraulics research engineer in FHWA's Office of Infrastructure Research and Development, at its Outstanding Projects and Leaders Awards Gala on March 17, 2016. Kerenyi will receive the Henry L. Michel Award for Industry Advancement of Research, which acknowledges individuals whose dedication and aggressive vision have provided the cornerstones for

improving the quality of people's lives around the world through research in the design and construction industry.

The U.S. Patent Office recently granted Kerenyi and Bart Bergendahl, a senior hydraulic engineer in FHWA's Resource Center in Lakewood, Colorado, a patent for inventing an in-situ scour testing device which is expected to help in assessing soil erosion resistance at bridge foundation sites. Bergendahl and Kerenyi developed the device to advance bridge scour prediction and help improve hydraulic design decisions on a project-by-project basis. The device can be used to test the erosion and scour potential of a wide range of soil types to depths of 20 meters.



The in-situ scour testing device is part of a new bridge scour design methodology.

More accurate estimates of scour in erosion resistant cohesive, cementitious, and rock-like soils could make foundation construction less expensive. An FHWA Strategic Initiative, the in-situ scour testing device is part of a new bridge scour design methodology that researchers are currently working on in FHWA's J. Sterling Jones Hydraulics Laboratory at Turner-Fairbank Highway Research Center.

For more information contact Kornel Kerenyi, kornel.kerenyi@dot.gov, 202-493-3142, or Bart Bergendahl, bart.bergendahl@dot.gov, 720-963-3754.



Journal Paper Discusses Study on Rebar Bond in UHPC

Jiqiu Yuan and Ben Graybeal, members of FHWA's structural concrete research team, recently published a peer-reviewed manuscript in the ACI Structural Journal, produced by the American Concrete Institute. The manuscript, "Bond of Reinforcement in Ultra-High Performance Concrete," presents results, conclusions, and recommendations from an applied engineering research effort conducted at Turner-Fairbank Highway Research Center. The paper supports FHWA's Every Day Counts Ultra-High Performance Concrete Connections Initiative and is expected to spur further advancement in the field as follow-on research extends the concept to additional reinforced concrete detailing scenarios.

For more information, contact Ben Graybeal, 202-493-3122, benjamin.graybeal@dot.gov.

Pavement Software Features New Traffic Defaults from LTPP

This fall, the American Association of State Highway Transportation Officials (AASHTO) implemented new traffic loading defaults developed by the Long-Term Pavement Performance (LTPP) program in its AASHTOWare® Pavement ME Design Software. In 2012, the LTPP program completed a data analysis project that evaluated the applicability of the existing global traffic loading defaults used in the Mechanistic-Empirical Pavement Design Guide (MEPDG). The project used weigh-in-motion (WIM) data from the LTPP program's Specific Pavement Study experiments to improve the global axle loading values included in the original 2008 defaults.

The MEPDG methodology, which was developed under National Cooperative Highway Research Program Project 1-37A, requires actual traffic inputs. Since the cost to collect these inputs is not possible for the majority of highway agencies, most pavement designs developed using the MEPDG rely on regional, agency-wide, or national traffic loading defaults. Therefore, it

is important for the default values to be representative of the actual truck loadings for a project site.

The original traffic default values used in the MEPDG were based on LTPP traffic data collected by highway agencies prior to 1999. At that time, these data represented the best available and most comprehensive national set of WIM and automated vehicle classification data. Since 1999, the LTPP program has generated high-quality traffic loading information for some of its test sites. These data are being collected using standard protocols for data collection consistency and improved data quality assurance. As a result, these new data provided an opportunity to improve the axle loading traffic defaults in the MEPDG for highway agencies.

For more information, contact Deborah Walker, 202-493-3068, deborah.walker@dot.gov.

LTPP InfoPave™ Has New Web Address

FHWA's Long-Term Pavement Performance (LTPP) InfoPave, which enables users to access pavement performance data and other information available through the LTPP program, has a new Web address: <https://infopave.fhwa.dot.gov>. The new URL fulfills the requirement that Government-owned Web portals have a .GOV address.



LTPP Web page

Security features have been enhanced by applying Secure Sockets Layer (HTTPS) technology, which creates a secure connection between the user and the server. Previous LTPP InfoPave URLs, <http://www.infopave.com> and



<http://infopave.com>, have been configured to automatically redirect users to the .GOV Web site.

By using the latest in computer technology, this Web-centric interface is designed to improve access to LTPP data through user-friendly visualization features. In addition to the pavement performance data from more than 2,500 test sections, the interface provides information, education, and tools to maximize the use of available data. LTPP InfoPave enables users to explore and extract the right data efficiently for analysis to advance the science of pavement engineering and management. In January, an enhanced version of LTPP InfoPave was released to the public at the 95th Transportation Research Board Annual Meeting in Washington, D.C.

For more information, contact Y. Jane Jiang, 202-493-3149, jane.jiang@dot.gov.

OPERATIONS

Saxton Lab Releases Video on Connected Automation

FHWA's Office of Operations Research and Development recently released "Paving the Way to Connected Automation—Cooperative Adaptive Cruise Control," a new video produced at Turner-Fairbank Highway Research Center. The video explains how FHWA and USDOT are developing cutting edge technologies that enable vehicles to communicate and respond to each other in a proactive manner by sharing speed, following distance, and accelerating/decelerating data. Employing connected automation technology, a fleet of Cadillacs successfully conduct a platoon test. This technology, which is essential for improving roadway safety and efficiency, could be a future solution to congestion and traffic incidents as it can prevent unnecessary braking and establish safe and constant speeds with other vehicles.

The video is available at <https://youtu.be/2-WoV8nKQUE>. For more information, contact

Taylor Lochrane, 202-493-3293, taylor.lochrane@dot.gov.

ATTRI Awarded Special Acknowledgement for Poster at Global Summit

At a recent event, the Accessible Transportation Technologies Research Initiative (ATTRI)—a joint USDOT initiative, co-led by FHWA and the Federal Transit Administration, with support from the Intelligent Transportation Systems Joint Program Office—was awarded a Special Acknowledgement for a poster that illustrated the cross-cutting nature and practical aspects of its initiative, which impacts a broad spectrum of mobility changes for future systems.



ATTRI poster

The event, a global summit held November 11–13, 2015 in Cambridge, MA, brought together more than 300 researchers and entrepreneurs, as well as leaders involved in policy, industry, and government. Entitled "Disrupting Mobility," the summit aimed to investigate sustainable futures. ATTRI was represented at a poster session alongside 30 other posters that covered topics from peer-to-peer carsharing to future mobility for seniors.

For more information, contact Mohammed Yousuf, 202-493-3199, mohammed.yousuf@dot.gov.



Workshop on Vehicle Automation and Wireless Connectivity Explores Policy Issues

In coordination with FHWA's Office of Policy, FHWA's Office of Operations Research and Development hosted an all-day workshop at Turner-Fairbank Highway Research Center on December 8, 2015. The purpose of the workshop was to explore policy related issues—especially policy research needs—associated with vehicle automation and wireless connectivity. The workshop brought together representatives from a number of FHWA offices, the National Highway Traffic Safety Administration, and other administrations.

For more information, contact Paul Pisano, 202-366-1301, paul.pisano@dot.gov.

SAFETY

FHWA's Office of Safety R&D Publishes Human-Factors Guidelines Report

FHWA's Office of Safety Research and Development (R&D) recently published a report that describes research offering initial design guidance for vehicle-to-infrastructure (V2I) safety messages and some limited guidance for vehicle-to-vehicle (V2V) systems.



An example of a Cooperative Intersection Collision Avoidance System—Violation Driver Infrastructure Interface

The report, "Multiple Sources of Safety Information from V2V and V2I," uses existing transportation safety research and research from related domains. This information can be used by connected-vehicle system designers and other State transportation department personnel to develop and implement V2I

applications to ensure that these systems work effectively and safely within a larger vehicle-to-infrastructure, vehicle-to-vehicle, and vehicle-to-device environment.

This research project was administered through the National Highway Traffic Safety Administration's Human Factors for Connected Vehicles research program and funded by the USDOT Intelligent Transportation Systems Joint Program Office. Findings are expected to help make the interaction of roadway and vehicle systems safer, reduce the likelihood of crashes and injuries, and improve safety for all roadway users.

The report is available at www.fhwa.dot.gov/publications/research/safety/15007/index.cfm. For more information, contact Brian Philips, 202-493-3468, brian.philips@dot.gov.

RECENT PERIODICALS

Public Roads—January/February 2016

This issue includes: Moving Beyond Traffic; Stop or Go?; The Roads Less Traveled; Commuting in a Post-Baby Boomer World; Digitizing for Better Decisionmaking; and Leveraging a Data-Rich World.

It is available online via www.fhwa.dot.gov/publications/publicroads/16janfeb/index.cfm.

For more information, contact TaMara McCrae, tamara.mccrae@dot.gov.

Innovator: Accelerating Innovation for the American Driving Experience—January/February 2016

This issue includes: Coming Together to Tackle Transportation Issues; Iowa Builds Experience With Accelerated Bridge Construction Project; National STIC Network Advances Innovation Culture; Smarter Work Zone Strategies Promote Safety and Efficiency; Safety Software Helps



Agencies Make Better Project Decisions; FHWA Seeks Innovations for EDC-4; States Innovate!; and Events.

The issue is available online via www.fhwa.dot.gov/hfl/innovator/e-version/issue_52/.

LINKS

Turner-Fairbank Highway Research Center:

www.fhwa.dot.gov/research/

Resource Center:

www.fhwa.dot.gov/resourcecenter/

National Highway Institute:

www.nhi.fhwa.dot.gov/home.aspx

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