

FHWA R&T Now ~ March 2014 ~

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

GENERAL/ADMINISTRATIVE

SHRP2 Implementation Update

FHWA is working closely with the American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Research Board (TRB) to implement the priority products resulting from the Second Strategic Highway Research Program (SHRP2). The centerpiece of the implementation strategy is the SHRP2 Implementation Assistance Program, launched in 2013 to help transportation agencies begin to deploy SHRP2 products. Participants include State departments of transportation, metropolitan planning organizations, tribal agencies, and FHWA Federal Lands Divisions.

Currently, 9 products from the first two rounds of the implementation assistance program are being put into practice on approximately 135 different transportation projects in 38 States and the District of Columbia. The third round participants were set to be announced in March, deploying 5 new SHRP2 products and bringing the total number of States involved to 47. The solicitation period for the fourth round will open in late May, offering opportunities to implement 12 additional SHRP2 products or product bundles.

For more information, contact Carin Michel, 410-962-2530, carin.michel@dot.gov, or visit www.fhwa.dot.gov/goshrp2.

ADVANCED RESEARCH

FHWA to Hold Infravation Web Conference

On March 28, 2014, FHWA will hold a Web conference to make U.S. entities aware of and prepare them for seeking partners for the Infravation Program. Infravation is infrastructure plus innovation. The Infravation Program is the first cooperative research initiative between FHWA and other national road administrations developed from the ground up. The program allows U.S. entities such as academic institutions, State departments of transportation, and businesses to participate in the research along with entities from other countries. Infravation is an important complement to FHWA's national research agenda, including its Exploratory Advanced Research (EAR) Program. It is expected to accelerate the consideration and development of innovations, especially in the areas of advanced systems, materials, and techniques for road infrastructure.

For additional information about the Infravation Program, visit www.fhwa.dot.gov/research/resources/infravation.cfm. For more information about the EAR Program, contact David Kuehn, 202-493-3414, david.kuehn@dot.gov.

FHWA Issues Broad Agency Announcement for EAR Program

FHWA issued a Broad Agency Announcement (BAA) for the EAR Program covering the following topics:

- Virtual Nondestructive Evaluation Laboratory for Highway Structures
- Applications of Massive Data and Data Mining Techniques Relevant to Safety Data
- Behavioral based (or agent based) National Freight Demand Modeling
- Freight Data Development and Enhancement to Support National Freight Transportation Analysis, Modeling, and Forecasting Practices

The BAA will close on April 23, 2014. For a copy of the full notice, please see the announcement posted at www.fbo.gov/index?s=opportunity&mode=form&id=eb2b847a4349c13205a1900dc8c74b1a&tab=core&cvview=0.

FHWA Sponsors Cell Phone Data and Travel Behavior Research Symposium

On February 12, 2014, FHWA's Office of Highway Policy Information, with support from the EAR Program, sponsored the Cell Phone Data and Travel Behavior Research Symposium. The event brought together data providers in private industry, researchers in academic fields, and other professionals from both public agencies and private business and institutes to explore opportunities and challenges using cellular location data for national travel behavior analysis.

Discussions centered on the availability of cellular data and the common types of licensing agreements, applications of cellular data and how it can be leveraged, fusion of cellular data in terms of merging the data with other data sources, and validation of cellular data to determine accurate and meaningful results.

Particular focal points included applications and limitations of land use models and data and using surveys in conjunction with cellular location data to facilitate accuracy and precision. The symposium was sponsored in cooperation with the Transportation Research Board (TRB) Travel Survey Methods Committee, the TRB Special Task Force on Data for Decisions and Performance Measures, and the Task Force on Understanding New Directions for the National Household Travel Survey. FHWA anticipates publishing a summary of the symposium proceedings by summer.

For more information about the symposium, contact Brad Gudzinis, 202-366-5024, brad.gudzinis@dot.gov. For more information about the EAR Program, contact David Kuehn, 202-493-3414, david.kuehn@dot.gov.

EAR Program Opens Window on Transportation Research for Georgia State Students

An EAR Program project examining how driver risk preferences influence choices of route and travel departure times is introducing the next generation of students to the world of transportation research. The study, "Behavioral Sciences Approach to Testing, Validating, and Establishing Best Practices for Alternative Highway Revenue Collection: Experiments on Driving Under Uncertain Congestion Conditions and the Effects on Traffic Networks from Congestion Pricing Initiatives," is funded by the EAR Program, in partnership with the University of Central Florida and Georgia State University (GSU).

Participating in the project opened up a new window on transportation issues for several GSU students, who were drawn from many different backgrounds unrelated to transportation. For more information, visit www.fhwa.dot.gov/research/resources/students_ear_program.cfm.

FHWA Massive Data and Data Mining Convening Workshop

On March 14, 2014, FHWA's Office of Safety Research and Development, with support from the EAR Program, sponsored the workshop, "Massive Data and Data Mining Convening." The panelists and attendees represented academia, Federal government, and professional transportation organizations. The Office of Safety Research and Development sought to understand the advances of domain experts, how to work with large and disparate data sets, and to consider compatible practices that might help explain why crashes occur and suggest innovative means of preventing crashes and roadway deaths and injuries. FHWA anticipates publishing a summary of the workshop by summer.

For more information about the convening panel, contact Ana Maria Eigen, 202-493-3168, ana.eigen@dot.gov. For more information about the EAR Program, contact David Kuehn, 202-493-3414, david.kuehn@dot.gov.

INFRASTRUCTURE

Recruitment Begins for the LTPP Warm-Mix Asphalt Experiment

FHWA has opened the recruiting period for test projects to be included in the newest experiment of the Long-Term Pavement Performance (LTPP) Program. The recruitment period for the new warm mix asphalt test sites runs from now until May 2014. This is an excellent opportunity for highway agencies to learn about the long-term performance of different warm mix technologies available today. FHWA is looking for projects that will be constructed in 2014 and 2015 for this national study. There are numerous benefits for highway agencies that participate in this new experiment.

For further information on the nomination process, site requirements, and highway agency responsibilities, contact Aramis Lopez, 202-493-3145, aramis.lopez@dot.gov.

Participate in the 2014 T&DI/ASCE-LTPP International Data Analysis Contest

The International Data Analysis Contest is a joint effort between FHWA, the LTPP Program, and the Task Committee on the LTPP Contest, which is a subcommittee of the Highway Pavement Committee and part of the American Society of Civil Engineers' (ASCE) Transportation and Development Institute (T&DI).

The contest is designed to encourage university students, professors, and highway agency engineers from around the world to start using the LTPP database. This year's theme is "Use LTPP InfoPave™ to Evaluate a Question or Concern for Your Region or State." Submissions are due by July 31, 2014.

To receive a full copy of the contest guidelines, visit ASCE's Web site at www.asce.org/tdi. Winners will be recognized in January 2015 at TRB's 94th Annual Meeting in Washington, D.C. For more information, contact Aramis Lopez, 202-493-3145, aramis.lopez@dot.gov.

Draft Protocol for Measuring Bridge Approach Transitions using Profilometers

In collaboration with the LTPP Program, the FHWA Geotechnical Engineering Research Team initiated a study to quantify the bump at the end of the bridge. The bump at the end of the bridge has long been studied for highways and railways, yet experts from across the transportation industry continue to identify it as one of the most prevalent substructure factors affecting bridge performance. In the pilot phase, a draft protocol was developed that described the procedure to measure the bump at bridge approach transitions using inertial profilers, which collect longitudinal profile data and have other capabilities. Subsequently, the protocol was used on four Geosynthetic Reinforced Soil Integrated Bridge Systems (GRS-IBS) and four conventional bridge approach transitions to compare the response. Researchers found there was a notable difference. Future work is planned to finalize the protocol for use across the country with the initial data collection focusing on the comparison of new and existing GRS-IBSs with conventional bridge structures in similar areas.

For more information, contact Jennifer Nicks, 202-493-3075, jennifer.nicks@dot.gov; or Jack Springer, 202-493-3144, jack.springer@dot.gov.

Structural Performance of Lightweight Concrete

FHWA's Research and Development effort to facilitate broader use of lightweight concrete through an updating of the structural design provisions in the AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications has reached another milestone. Two reports and their associated technical summaries have been published. They detail the results of hundreds of material-scale tests and 40 full-scale structural tests completed at TFHRC, as well as compiling relevant test results from the past 40 years of research in lightweight concrete. In each report, proposed revisions to the AASHTO LRFD specifications are presented. The proposed revisions have already been brought before the AASHTO Subcommittee on Bridges and Structures (SCOBs) T-10 for consideration as part of their broader rewrite of lightweight concrete provisions.

The technical summary for the report, *Lightweight Concrete: Mechanical Properties* (FHWA-HRT-13-062), is available at: www.fhwa.dot.gov/publications/research/infrastructure/bridge/13061/index.cfm.

The technical summary for the report, *Lightweight Concrete: Development of Mild Steel in Tension* (FHWA-HRT-14-029), is available at: www.fhwa.dot.gov/publications/research/infrastructure/structures/bridge/14030/14030.pdf. For more information, contact Ben Graybeal, benjamin.graybeal@dot.gov, 202-493-3122.

TechBrief: Development of a Family of Ultra-High Performance Pi-Girders

There is a growing desire within the bridge community to develop appropriate structural uses for the advanced properties of ultra-high performance concrete (UHPC). One promising application is to redesign prestressed bridge girders to make optimal use UHPC. In a recently completed study, conducted as part of the FHWA Structural Concrete

Research Program at the Turner-Fairbank Highway Research Center, researchers investigated this topic and developed a family of solutions. The technical brief, *Development of a Family of UHPC Pi-Girders* (Publication Number: FHWA-HRT-14-028), provides details both for researchers interested in extending the research and for designers/owners interested in deploying the concepts.

This document is available at: www.fhwa.dot.gov/publications/research/infrastructure/structures/hpc/14028/index.cfm. For more information, contact Ben Graybeal, benjamin.graybeal@dot.gov, 202-493-3122.

TechBrief: Splice Length of Prestressing Strand in Field-Cast Ultra-High Performance Concrete Connections

Ultra-High Performance Concrete (UHPC), when used in field-cast connections between prefabricated bridge elements, can create robust connections that emulate monolithic components. Connecting adjacent pretensioned structural elements to one another can increase the efficiency of the structural design, accelerate construction, and enhance the structure's serviceability.

Connections engaging prestressing strands extending from the components are rarely designed or implemented due to the need for expensive mechanical connectors or long lengths of strand. The advanced mechanical and durability properties of UHPC create new opportunities for connecting structural elements wherein the connections are simple to construct, easy to maintain, robust, and resilient. The first phase of a research study focused on this topic was recently completed as part of the Structural Concrete Research Program at TFHRC. This intramural pilot project has demonstrated the concept through physical testing and analysis, leading to a full-scale testing phase that will begin this summer.

The results of the pilot phase have been published in the report, *Splice Length of Prestressing Strands in Field-Cast UHPC Connections* (Publication Number: FHWA-HRT-14-047), available through the National Technical Information Service at www.ntis.gov.

This document (Publication Number: FHWA-HRT-14-041) is a technical summary of that report and is available at www.fhwa.dot.gov/publications/research/infrastructure/structures/hpc/14041/index.cfm. For more information, contact Ben Graybeal, benjamin.graybeal@dot.gov, 202-493-3122.

TechBrief: Friction Angles of Open-Graded Aggregates from Large-Scale Direct Shear Testing

This TechBrief summarizes a Geotechnical Laboratory investigation of AASHTO M43 (ASTM D448) designated open-graded aggregates using the large-scale direct shear (LSDS) device at Turner-Fairbank Highway Research Center. Open-graded aggregates, commonly used in road and bridge applications, had not yet been systematically measured for strength before this study. Instead, designers often use a default friction angle of 34-degrees, which is considerably less than the measured strength of these materials, leading to over-conservative and costly designs for bridge foundations and retaining walls. This document (Publication Number: FHWA-HRT-13-068) outlines the testing and results, provides a new approach to determination of strength based on LSDS testing, and recommends a new default friction angle of 39-degrees for these materials in the absence of testing.

The document is available at:

www.fhwa.dot.gov/publications/research/infrastructure/structures/bridge/13068/index.cfm. For more information, contact Jennifer Nicks, 202-493-3075, jennifer.nicks@dot.gov.

Report: Geosynthetic Reinforced Soil Performance Testing – Axial Load Deformation Relationships

This report details the performance testing, or mini-pier experimentation, of 19 geosynthetic reinforced soil (GRS) composites in the Structures Laboratory at Turner-Fairbank Highway Research Center as part of a large parametric study. The primary objectives of this research study were to: (1) build a database of GRS material properties that can be used by designers for GRS abutments and integrated bridge systems; (2) evaluate the relationship between reinforcement strength and spacing; (3) quantify the contribution of the frictionally connected facing elements at the service limit and strength limit states; (4) assess the new internal stability design method proposed by Adams et al. 2011 for GRS; and (5) perform a reliability analysis of the proposed soil-geosynthetic capacity equation for LRFD

calibration.

This document (Publication Number: FHWA-HRT-13-066) is available at www.fhwa.dot.gov/publications/research/infrastructure/structures/13066/. For more information, contact Jennifer Nicks, 202-493-3075, jennifer.nicks@dot.gov.

Report: Composite Behavior of Geosynthetic Reinforced Soil Mass

This report details the results of five plane strain experiments of geosynthetic reinforced soil (GRS) composites conducted in the Structures Laboratory at Turner-Fairbank Highway Research Center. A major finding of this study was the development of a new method to evaluate the bearing resistance and required reinforcement strength within internal stability design. The findings were incorporated by the geotechnical research team in FHWA's *Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide*.

This document (Publication Number: FHWA-HRT-10-077) is available at: www.fhwa.dot.gov/publications/research/infrastructure/10077/index.cfm. For more information, contact Mike Adams, 202-493-3025, mike.adams@dot.gov.

LTPP InfoPave™ Debuts

In January, the LTPP Program introduced InfoPave at TRB's 93rd Annual Meeting. The online system allows users to easily tap into the wealth of pavement data available through FHWA's LTPP Program. LTPP InfoPave is a gateway to data from the LTPP test sections. It offers findings from data analyses and extensive documentation for the many aspects of LTPP experiment design, data acquisition, quality control, and data dissemination.

For more information, contact Aramis Lopez, 202-493-3145, aramis.lopez@dot.gov.

SAFETY

Driving Simulation Videos

The Human Factors Team in the FHWA Office of Safety Research and Development announces three new highway driving simulation videos developed in the Human Factors Laboratory.

[Diverging Diamond Interchange In-Vehicle View With Traffic](#): This video shows a simulation of driving through a Diverging Diamond Interchange (DDI) from a motorist's perspective.

[Diverging Diamond Interchange In-Vehicle View With Traffic and Pedestrians](#): This video shows a simulation of driving through a DDI from a motorist's perspective and includes other motorists and pedestrians in the scenario.

[Driving Safety Enhancements for Rural Curves At Night](#): This video demonstrates various topographical and roadway features being added in layers to create a drivable simulated environment. In this case, the scenario was developed to examine the effects of varying safety countermeasures on driver behavior on rural roadways with horizontal and vertical curvature at night.

These videos are available at: www.fhwa.dot.gov/research/tfhrc/labs/humanfactors/pubs.cfm. For additional information or questions on the simulation videos, please contact either Jim Shurbutt at 202-493 3420, jim.shurbutt@dot.gov, or David Yang at 202-493-3284, david.yang@dot.gov.

Report: Human Factors Assessment of Pedestrian Roadway Crossing Behavior

Pedestrian-vehicle crashes are both common and deadly. The majority of pedestrian fatalities occur outside marked intersection crosswalks. Influences of pedestrian and environmental factors on crossing location choice were examined in this study. Pedestrian crossings at 20 different locations were recorded and analyzed. Data analysis results suggested that the vast majority of crossings (89 percent of the total observed) took place in the marked intersection crosswalks, and that drivers are highly likely to yield to pedestrians in those marked crossing locations. Results also showed that

using strategies such as flowerbeds to separate the sidewalk from the roadway will reduce the proportion of crossings outside the marked crosswalks. A model to predict pedestrian crossing location is provided. The model uses various environmental variables as predicting factors and was shown to successfully predict an average of 90 percent of the crossings.

The full report, *Human Factors Assessment of Pedestrian Roadway Crossing Behavior* (Publication Number: FHWA-HRT-13-098), is available at www.fhwa.dot.gov/publications/research/safety/13098/13098.pdf. For additional information or questions regarding this study, please contact Ann Do, 202-493-3319, Ann.Do@dot.gov, or Jim Shurbutt, 202-493-3420, Jim.Shurbutt@dot.gov.

TechBrief: Where Pedestrians Cross the Roadway

This technical brief describes research on the environmental influences on where and when pedestrians cross the roadway across 20 different sites. The document is a technical summary of the report, *Human Factors Assessment of Pedestrian Roadway Crossing Behavior* (Publication Number: FHWA-HRT-13-098).

Where Pedestrians Cross the Roadway (Publication Number: FHWA-HRT-13-099) can be accessed at www.fhwa.dot.gov/publications/research/safety/13099/index.cfm. For additional information or questions regarding this study, please contact Ann Do, 202-493-3319, Ann.Do@dot.gov, or Jim Shurbutt, 202-493-3420, Jim.Shurbutt@dot.gov.

Report: Safety Effects of Horizontal Curve and Grade Combinations on Rural Two-Lane Highways

This report quantifies the safety effects of five types of horizontal and vertical alignment combinations for rural two-lane highways resulting in a set of safety prediction models for fatal and injury and property damage only crashes. The triad of publications includes a full technical report outlining the underlying concepts, an accompanying calculation tool, and a summary report meant to facilitate the use of the tool.

The full report, *Safety Effects of Horizontal Curve and Grade Combinations on Rural Two-Lane Highways* (Publication Number: FHWA-HRT-13-077), is available at www.fhwa.dot.gov/publications/research/safety/13077/index.cfm. The summary report (Publication Number: FHWA-HRT-13-078) is available at www.fhwa.dot.gov/publications/research/safety/13078/index.cfm, and the calculator tool (Publication Number: HRTM 2130) is available at www.fhwa.dot.gov/publications/research/safety/hrtm2130/index.cfm.

For more information contact Ana Maria Eigen, 202-493-3168, ana.eigen@dot.gov.

RECENT PERIODICALS

***Public Roads*—January/February 2014**

This issue includes: Now Is the Time for Innovation; When Disaster Strikes; Setting the Bar for Excellence; and The Century Challenge.

It is available online via www.fhwa.dot.gov/publications/publicroads/14janfeb/index.cfm. For more information, contact TaMara McCrae, tamara.mccrae@dot.gov.

***FOCUS Newsletter* January/February 2014**

The January/February issue includes: LTPP InfoPave Goes Live: Your Portal to Pavement Data; A Streamlined Introduction to Asset Management Implementation; SHRP2: Apply Now for Round 3 Implementation Assistance; Call for Abstracts: 2014 National Accelerated Bridge Construction Conference; Infrastructure Innovation Webinars; Highway Technology Calendar.

The issue is available online via www.fhwa.dot.gov/publications/focus/14jan/14jan00.cfm. For more information, contact Lisa Pope, lgpope@woodwardcom.com.

***Innovator: Accelerating Innovation for the American Driving Experience*—January/February 2014**

This issue includes: Pennsylvania Group Demonstrates Value to Taxpayers; Agency Staff Learn From Colleagues at Peer Exchanges; States Expand 3-D Modeling Use; GRS Model Helps Deploy Innovation; States Innovate!; Innovator to Go Electronic; Visit Us at TRB; Wyoming Opens Its First Diverging Diamond; and Calendar.

The issue is available online via www.fhwa.dot.gov/hfl/innovator/issue40.cfm. For more information, contact Kathleen Bergeron, kathleen.bergeron@dot.gov.

Links:

Turner-Fairbank Highway Research Center: <http://www.fhwa.dot.gov/research/>

Resource Center: <http://www.fhwa.dot.gov/resourcecenter/>

National Highway Institute: <http://www.nhi.fhwa.dot.gov/home.aspx>

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Suggestions may be submitted to: FHWA_Now@fhwa.dot.gov