

# Technology Today

Volume 26 Issue 3

Spring 2012

A publication of the Louisiana Transportation Research Center



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## Upcoming Events

**May 17**  
APWA Public Works Week Safety Seminar  
TTEC

**May 23-24**  
Highway Capacity Workshop  
TTEC

**June 26**  
Statewide Traffic Engineers Meeting  
TTEC

To view more events, please visit  
<http://www.ltrc.lsu.edu>.

## New Concrete Mixtures Save State Millions by Turning Waste into Quality Roads

LTRC Concrete Research Manager Tyson Rupnow, Ph.D., P.E., recently completed one of his latest studies for the center, entitled "Evaluation of Ternary Cementitious Combinations," where he discovered a potential annual savings of \$4.8 million for the state's pavements and structures after researching new concrete mixtures that replaced a percentage of Portland cement with industry by-products.

Dr. Rupnow explained, "Our goals for the project were to determine acceptable replacement rates for ternary mixtures for DOTD work. The replacement rates were

selected such that LTRC research engineers could determine at what replacement rate the concrete mixtures became unviable in terms of workability, strength gain characteristics, and durability."

Current Louisiana specifications allow only a maximum 20% fly-ash replacement of Portland cement, which is one of the world's most versatile and most used construction materials, while slag is allowed to replace Portland cement at 50%. However, Dr. Rupnow investigated mixtures incorporating a larger percentage of various supplemental cement combinations that utilized these by-products or "waste

materials" from other industries (such as fly ash and slag) and their performances.

The study indicated that cement mixtures containing up to 70% fly ash and slag exhibited concrete test results that were similar or better than those obtained from control mixtures containing no supplementary cementitious

materials. "It was surprising we were able to go to such an extreme replacement level and still maintain strength in laboratory conditions," he explained.

According to recent cost-benefit

analyses, Dr. Rupnow discovered that by utilizing these waste materials in creating new cement mixtures for local roads and structures, a potential material cost savings around \$25,000 is realized per lane-mile when replacing 70% Portland cement with fly ash and slag. "We have found that by using fly ash and slag with Portland cement, we can make a comparable (or better) product, all while cutting material costs," he said.

To get a better idea of cost savings, Rupnow explained that, in bid year 2007-2008, 191 lane-miles of concrete pavement were let for construction; replacement of 70%



Portland cement, as is allowed by the new DOTD specifications, with fly ash and slag on that quantity of pavement leads to a material cost savings near \$4.8 million per year. “The estimated \$4.8 million figure is a conservative savings to the state because it does not account for any of the structural concrete that is placed in the state in any given year. The savings will probably far exceed \$4.8 million,” he said.

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In addition to benefiting Louisiana by having more cost-effective pavements and structures, the new mixtures also reduce pollution for the state. Dr. Rupnow explained, “Replacing Portland cement with fly ash and slag reduces the carbon footprint during production of the cementitious material. Production for each ton of Portland cement for concrete pavement emits 0.92 tons of carbon dioxide. As by-products of other industries, emissions due to production of fly ash and slag are negligible from the viewpoint of concrete pavement construction.”

Overall, he explained that the transportation community has taken the results with cautious optimism. The research community and private concrete community have taken the results in stride and responded enthusiastically to the results.

**FIND OUT MORE**  
To learn more about LTRC’s report *Evaluation of Ternary Cementitious Combinations*, contact Dr. Tyson Rupnow at [tyson.rupnow@la.gov](mailto:tyson.rupnow@la.gov) or 225-767-9148. You can also view the report in full by clicking on *Final Report 486 (09-4C)* at [http://www.ltrc.lsu.edu/pubs\\_final\\_reports\\_5.html](http://www.ltrc.lsu.edu/pubs_final_reports_5.html) on LTRC’s website.

## LTRC is Member of a Consortium Receiving \$3.5M Award from the U.S. Department of Transportation

As a member of the Mississippi State University-led consortium that was recently awarded a \$3.5 million grant by the U.S. Department of Transportation (USDOT), LTRC will be assisting in establishing the National Center for Intermodal Transportation for Economic Competitiveness (NCITEC).

With this grant, the new center will work to promote the development of an integrated, economically competitive, efficient, safe, secure, and sustainable national intermodal transportation network by integrating all transportation modes both for freight and passenger mobility. The consortium includes, in addition to Mississippi State University and LTRC at LSU, the University of Denver, Hampton University, and the University of Mississippi.

The new center and its members will serve the transportation industry through research, education, workforce development, and technology transfer

activities. The center’s areas of expertise will include intermodal planning, safety and security, public policy, workforce development, and economic competitiveness. The NCITEC will focus on the economics, assessment, design, and development of planning methodologies, operational tools, technology and human resources needed to improve intermodal connectivity and capacity, and to reduce congestion in the nation’s transportation system. The NCITEC will also will seek to improve the transportation workforce’s capacity and capability.

The competition included 46 proposals from universities around the country; of those, 10 were selected because of the importance of their theme and the combined team of experts.

Contact LTRC Director Harold “Skip” Paul at [harold.paul@la.gov](mailto:harold.paul@la.gov) for additional information.

# Local Researchers Present at the 91st Annual Transportation Research Board Meeting

LTRC was represented at the Transportation Research Board's 91st Annual Meeting in Washington, D.C., from January 22-26, 2012. The information-packed program attracted more than 11,000 transportation professionals from around the world and covered all transportation modes, with more than 4,000 presentations in nearly 650 sessions and workshops addressing topics of interest to all attendees—policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions. This year's spotlight theme was *Transportation: Putting Innovation and People to Work*.

The following researchers presented results from LTRC projects at TRB this year:

- 1 **Murad Abu-Farsakh, Ph.D., P.E.**, “Finite Element Analysis to Evaluation Geogrid Base Reinforcement in Flexible Pavement”; “Calibration of Side, Tip, and Total Resistance Factors for Load and Resistance Factor Design of Drilled Shafts”; and Finite Element Analysis of a Full-Scale Lateral Load Test on Batter Pile Group Foundation
- 2 **Somayeh Asadi**, “Development of Photocatalytic Pervious Concrete Pavement for Air and Stormwater Improvements” and “Evaluation of Field Performance of Photocatalytic Asphalt Pavement in Ambient Air Purification”
- 3 **Mostafa Elseifi, Ph.D.**, “Development of Structural Capacity Triangular Model for Pavement Evaluation Using Rolling-Wheel Deflectometer” and “Model to Estimate Pavement Structural Number at the Network Level Using Rolling-Wheel Deflectometer Data”
- 4 **Kevin Gaspard, P.E.**, “Historical Performance of Perdurable Rubblized Jointed Portland Cement Concrete Pavement Overlaid with Asphaltic Concrete in Louisiana”
- 5 **Marwa Hassan**, “Quantification of NO<sub>x</sub> Reduction via Nitrate Accumulation on TiO<sub>2</sub> Photocatalytic Concrete Pavement” and “Field Evaluation of Ability of Photocatalytic Concrete Pavements to Remove Nitrogen Oxides”
- 6 **Patrick Icenogle, E.I.**, “Testing and Characterization of Properties of Concrete” and “Development of Precision Statement for Concrete Surface Resistivity”
- 7 **Md. Sharear Kabir, E.I.**, “Round Robin Evaluation of Automated Testing Equipment for Related Asphalt Materials”
- 8 **Bill King, Jr., P.E.**, “Louisiana’s Experience in Open-graded Friction Course Mixtures” and “Tack Coat Bond Strength as a Specification Parameter”
- 9 **Louay Mohammad, Ph.D.**, “Laboratory Evaluation of Asphaltic Mixtures Containing Titanium Dioxide Photocatalyst,” “Characterization of Fracture Properties of Asphalt Mixtures as Measured by Semicircular Bending Test and Indirect Tension Test,” “Effects of Volumetric and Mechanistic Test Variability on Predicted Performance of Asphalt Pavements Using Mechanistic-Empirical Pavement Design Guide,” and “NCHRP Project 9-40: Importance of Interface Bond Strength through Tack Coat”

(continued)

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**Mark Morvant, P.E.**, “Evaluation of Surface Resistivity Measurements as an Alternate to Rapid Chloride Permeability Test for Quality Assurance and Acceptance”

11

**Ayman Okeil, Ph.D., P.E.**, “Field Monitoring of Positive Moment Continuity Detail in a Skewed Prestressed Concrete Bulb-T Girder Bridge”

12

**Harold R. Paul, P.E.**, “Deploying Asphalt Technology: It’s What’s Important,” “Stakeholder Reactions to Key Observations,” and “Perspective from Louisiana Transportation Research Center”

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**Tyson Rupnow, Ph.D., P.E.**, “Evaluation of Surface Resistivity Measurements as an Alternative to the Rapid Chloride Permeability Test for Quality Assurance and Acceptance,” “Evaluation of the Compressive Strength and Rapid Chloride Permeability of High Replacement Ternary Mixtures,” “Durability of Slag Blended Ternary Concrete,” and “Evaluation of the Compressive Strength and Rapid Chloride Permeability of High Replacement Ternary Mixtures”

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**Xiaoduan Sun, Ph.D., P.E.**, “Crash Modification Factor for Inexpensive Yet Very Cost-Effective Safety Improvement: Converting Undivided Four-Lane Urban Roadways to Five-Lane Roadways”

15

**Chester Wilmot, Ph.D.**, “Evaluating Alternative Pavement Marking Materials” and “Comparison of Time-Dependent Sequential Logit and Nested Logit Models for Hurricane Evacuation Demand”

16

**Zhong Wu, Ph.D., P.E.**, “Development of Design Procedure for Prediction of Asphalt Pavement Skid Resistance”

For more information, please visit TRB’s Annual Meeting webpage at <http://amonline.trb.org/> to read these papers in full.



LTRC Director Skip Paul (middle) presented at this year’s TRB’s *Dialogue with Leaders* session.

Photo credit: Transportation Research Board

# TTEC Hosts National FHWA Broadcast on New Bridge Technology



On February 16, 2012, a total of 38 state and local transportation professionals gathered at the Transportation Training and Education Center and at a remote site, the DOTD District 08 Training facility, to learn about a new bridge construction technology that lowers costs, reduces construction time, and alleviates the age-old problem of the “bump at the end of the bridge.”

As part of the Federal Highway Administration’s Every Day Counts (EDC) initiative, this nationally broadcasted exchange webinar focused on Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS) technology. This system utilizes alternating layers of compacted granular fill material and sheets of geotextile reinforcement to provide support for a bridge, rather than constructing a deep foundation.

GRS-IBS technology offers many advantages over conventional construction, especially for shorter bridges. These advantages include the following:

- Reduced construction time and cost
- Ease of construction and maintenance
- Flexibility of design that allows for easy modification to fit actual field conditions

A GRS-IBS project is scheduled for letting in DOTD District 03 later this year, and a local agency representative who attended the webinar expressed an interest in pursuing the use of this technology on their system of bridges.

To learn more about GRS-IBS technology, you may contact Steve Meunier, DOTD pavement and geotechnical design section administrator, at 225-379-1345 or by e-mail at [steve.meunier@la.gov](mailto:steve.meunier@la.gov).

## About EDC

Every Day Counts was launched by FHWA in 2010 as a way of addressing, with a new sense of urgency, the many challenges faced by today’s transportation industry. EDC is designed to identify and rapidly deploy innovations aimed at shortening project delivery, enhancing the safety of our roadways, and protecting the environment.

A key component of Every Day Counts is a series of nationally broadcasted, facilitated webinars designed to provide opportunities for the exchange of ideas related to specific innovative practices. Future EDC exchange webinars will deal with the following topics:

- In Lieu Fees & Mitigation Banking for Environmental Impacts (scheduled for June 21, 2012)
- Adaptive Signal Control (scheduled for August 16, 2012)

Visit <http://www.fhwa.dot.gov/everydaycounts> for more information about Every Day Counts.



# Recently Published

## Final Report and Technical Summary 427

*In-Place Cement Stabilized Base Reconstruction Techniques Final Report: Construction and Eight Year Evaluation*

Kevin Gaspard, P.E.; Louay Mohammad, Ph.D.; and Zhong Wu, Ph.D., P.E.

## Final Report and Technical Summary 474

*Accelerated Loading Evaluation of Stabilized BCS Layers in Pavement Performance*

Zhong Wu, Ph.D., P.E.; Zhongjie “Doc” Zhang, Ph.D., P.E.; and William M. King, Jr., P.E.

## Final Report and Technical Summary 480

*LADOTD Customer Service Process and Outcome Evaluation*

Sharon Parsons, Ph.D.

## Final Report and Technical Summary 483

*Update LADOTD Policy on Pile Driving Vibration Management*

Mingjiang Tao, Ph.D., P.E., and Mo Zhang

## Final Report and Technical Summary 486

*Evaluation of Ternary Cementitious Combinations*

Tyson D. Rupnow, Ph.D., P.E.

## Final Report and Technical Summary 489

*DOTD GPS Technology Management Plan*

Jeff Barnett, Jennifer Harrison, and Karen Steede-Terry

## Project Capsule 11-6GT

*Quantifying the Key Factors that Create Road Flooding*

Joshua D. Kent, Ph.D.

## Project Capsule 12-1P

*Assessment of Pavement Distresses Caused by Trees on Rural Highways*

Kevin Gaspard, P.E.

## Project Capsule 12-1ST

*Data Collection and Evaluation of Continuity Detail for John James Audubon Bridge #2*

Ayman M. Oeil, Ph.D., P.E.

## Project Capsule 12-2P

*Assessment of Environmental, Seasonal, and Regional Variations in Pavement Base and Subgrade Properties*

Kevin Gaspard, P.E.

## Project Capsule 12-4P

*Development of DARWIN-ME Guidelines for Louisiana Pavement Design*

Zhong Wu, Ph.D., P.E.

## Project Capsule 12-5P

*Evaluation of DOTD Aggregate Friction Rating Table by Field Measurements*

Zhong Wu, Ph.D., P.E.



### FIND OUT MORE

To view a complete list of LTRC publications, visit the website at [www.ltrc.lsu.edu](http://www.ltrc.lsu.edu).

## Staff Updates and Accomplishments

LSU Civil Engineering Professor and EMCRF Manager **Louay Mohammad**, Ph.D., co-authored the paper “Use of Sweep Test for Emulsion and Hot-Asphalt Chip Seals: Laboratory and Field Evaluation,” which was awarded overall runner-up of the Asphalt Materials Section Best Poster Award at TRB’s 91st Annual Meeting. This award is given each year to a poster that is judged to be of the highest quality in terms of presenting information from among all those presented in poster sessions sponsored by the Asphalt Materials Section.

Associate Director of External Programs, **Vijaya (VJ) Gopu**, Ph.D., P.E., served on the NSF site visit teams that reviewed the NEES Equipment Sites at the University of Minnesota in December 2011, and the University of Nevada at Reno in February 2011.

**Dr. Gopu** presented an invited key note lecture at the International Conference on Earthquake Analysis and Design in Coimbatore, India in November 2011. He also presented a lecture titled “Should Engineers Build Tornado Proof Homes” at the 2011 Louisiana Civil Engineering Conference in September 2011.

At the TRB 91st Annual Meeting in January 2012, LTRC Director **Harold “Skip” Paul**, P.E., was an honoree at the Design and Construction Group’s Honorary forum, entitled “Dialogue with Leaders in Design and Construction of Transportation Facilities.” This forum recognizes distinguished experts who have demonstrated career-length participation in the work of the Transportation Research Board and a record of significant research contribution to the transportation research community. Paul presented a career overview within his technical area of expertise and his vision for the future. His presentation was entitled: “Deploying Asphalt Technology: It’s What’s Important.”

Associate Director, Technology Transfer & Training **Sam Cooper, Jr.**, P.E., MSCE, had two technical papers accepted for publication by the *International Journal of Pavement Research and Technology*. The accepted papers were “Parametric Evaluation of Design Input Parameters on the Mechanistic-empirical Pavement Design Guide Predicted Performance” and “Evaluation of the Influence of Variation of Superpave HMA Mixtures Physical Properties on Pavement Performance.”

LTRC would like to welcome **Randell Randolph** as an engineering technician III and **Don George** as an engineering technician I in the Concrete Research Laboratory. Randolph came on board in January, and George was hired from District 61 in February.

**Gisele Landry** is also welcomed by LTRC as she joined TTEC full time in February as a teaching associate for the DOTD Leadership Development Program.

LTRC would also like to congratulate **Samuel B. Cooper**, III, E.I. Cooper was hired on January 3, 2012, as an engineer intern II. He joins the Asphalt Materials Research section and brings a wealth of knowledge in asphalt materials testing. He has his MS degree and is continuing to pursue his Ph.D. degree.

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## Technology Today Publication Statement

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Technology Today is a quarterly publication of the Louisiana Transportation Research Center, administered jointly by the Louisiana Department of Transportation and Development and Louisiana State University.

For additional information on material included in this newsletter, contact the public information director at 225.767.9183.



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