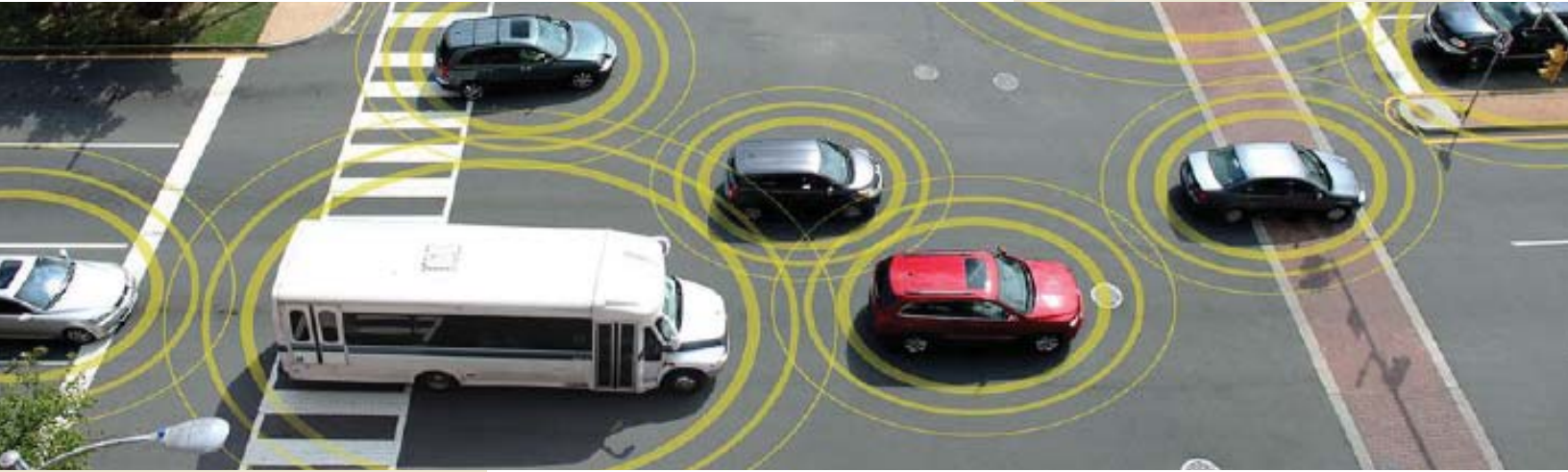




# TECHNOLOGY TODAY

VOLUME 32 ISSUE 2  
WINTER 2018

*A publication of the Louisiana Transportation Research Center*



*Photo source: www.its.dot.gov*

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## UPCOMING EVENTS

### **NHI Course No. 132079 – Subsurface Investigation Qualification**

May 7-9  
TTEC Auditorium – Room 100

### **NHI Course No. 135056 – Culvert Design**

June 26-28  
TTEC Auditorium – Room 100

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

## RESEARCH

# Researchers Create a Test Simulation to Explore Safety of Connected Vehicles

Over the last decade, tremendous interest has grown in a developing technology that allows vehicles to communicate with each other as well as drivers' mobile devices. This fully connected transportation network continues to gain momentum as researchers across the nation are testing how effective the applications will be, what infrastructure is needed, what minimum market penetration is required, and what technological specifications should be adopted in order to address some of the system-wide performance characteristics. Researchers Sherif Ishak, Ph.D., P.E., and Osama A. Osman, Ph.D., are exploring these concerns virtually in their project, "Development of a Simulation Test Bed for Connected Vehicles using the LSU Driving Simulator."

Funded by the Louisiana Transportation Research Center and with the help of the LSU Driving Simulator, researchers were able to create a simulation-based test bed (or platform) to evaluate potential problems and test the integration of equipped vehicles with the connected technology and applications, mobile devices, and highway infrastructure.

The simulation-based test bed included signalized intersections, situations that require vehicles ahead to brake, and other potential incident zones. The three test applications researchers chose included the forward collision warning

*continued on page 2*

*The LSU Driving Simulator, a full-sized passenger car (Ford Fusion), is equipped with state-of-the-art cameras, projectors, and screens, providing a highly realistic virtual driving environment.*



(FCW), blind spot warning (BSW), and do not pass warning (DNPW).

“Some of these applications (e.g., BSW and FCW) are already in recently manufactured vehicles; however, they are radar-based. Connected vehicles, on the other hand, rely on dedicated short range communication, which could provide less problems in harsh weather conditions compared to radar technology,” explained Dr. Osman. “The research team wanted to test these applications specifically, as people may already have the applications in their cars. Hence, people will be able to make sense out of the research results when made available to the public. For the same familiarity reason, DNPW was selected as almost all of us may face problems passing a slow-moving car ahead on a two-lane roadway.”

A group of 150 licensed drivers were recruited for testing various scenarios for the different applications. Dr. Osman explained that for the FCW application the first scenario represented a regular

vehicle when no warning messages were expected to be shown, and the second scenario represented an equipped vehicle that gave warning messages when a potential near crash situation was present (1.5 seconds to collision) or about to be present (3 seconds to collision). Whereas, for the BSW and DNPW applications, four scenarios were tested, each representing a different number of connected vehicles.

Researchers found that headway between vehicles increased as the number of connected vehicles increased. For example, blind spot warnings were only significant at medium and high rates of connected vehicles. Overall, the warning systems did their job of significantly increasing the headway between vehicles before a maneuver took place.

“This increase in headway before maneuvers suggested that drivers were able to remain more conscious of their driving behavior with the assistance of the warning system,” explained Osman. “This was an indication that this connected vehicle application was capable of improving safety during the decision-making process at medium and high penetration rates, which should be taken into consideration by consumers and manufacturers.”

Researchers explained that while there was nothing particularly shocking in the research results, the project further confirmed the significance of having higher degrees of connected vehicles in the market and how that affects the success of the tested connected vehicle applications. Researchers did find that while non-aggressive drivers did not alter their driving behavior, aggressive drivers significantly changed their driving by slowing down more at intersections and increasing their time-to-collision. Additionally, the research team was pleased to demonstrate the ability of the LSU driving simulator to serve as a test bed for the first time in this exploratory research for connected vehicle applications.

In fact, Dr. Osman hopes to use the simulator again for additional research in the area of connected vehicle technology for Louisiana. “There are a few more safety applications that we can now study

with the recent upgrade to the driving simulator. We have already begun working again on the DNPW application to test the impact of the type of vehicle ahead on the effectiveness of and drivers' need for the application," explained Dr. Osman. "The simulator upgrade will also allow us to test driverless cars and user interaction with automation. We have recently started an independent study to explore how people interact with vehicle automation and how getting used to automation affects users' readiness to avoid risky situations, if any."

*To learn more about the simulation project, "Development of a Simulation Test Bed for Connected Vehicles using the LSU Driving Simulator," please contact Dr. Osama Osman at 225-337-2028 or othabe1@lsu.edu.*



## TECH TRANSFER

# LTAP's Tractor Mower Safety Travels Across State

Throughout February and March, Steve Price from International Training Service (ITS) returned to Louisiana to teach LTAP's Tractor Mower and Safety Training Course. The 3-hour course visited 15 Louisiana cities and attracted more than 500 operators, foremen, and supervisors who use industrial and agricultural tractors, as well as mowing equipment, for cutting interstate highways, state roads, and levees.

Price explains, "Tractor mower combinations may be one of the most underestimated and deadliest pieces of equipment used by public works agencies." Providing equipment training to national and international clients for the past 40 years, Price is known for his impressive background with equipment manufacturers and contractors across the globe. He explains that the importance of proper operator training can't

be overstated. His updated course highlighted the importance and benefits of good operator training, common accidents associated with tractor mowers, work zone safety and hazard awareness, operator training tips, and PTO safety awareness, among others.

As well as receiving valuable insight, class participants received a copy of the AEM Safety Training Manual that can be used at any worksite. More than just a class handout, this manual offers several sections dedicated to coming up with a safety program for before and after a job using heavy equipment and different ways you can accomplish performance and maintenance safety. Price believes that training and safety manuals are seldom used or referred to by supervisors, which leads to serious accidents that can be prevented.





## RESEARCH

# LTRC Papers Selected for National Meeting and Publications

Congratulations to the following list of presenters and authors who represented LTRC at this year's TRB annual meeting. A number of papers were also selected for publication in TRB's Journal of the Transportation Research Record. TRB's 97th Annual Meeting took place January 7-11, 2018, at the Walter E. Washington Convention Center, in Washington, D.C. The meeting covered a range of transportation issues, with 5,000 presentations in more than 800 sessions. A number of sessions and workshops focused on the meeting's spotlight theme, *Transportation: Moving the Economy of the Future*. The meeting attracted more than 13,000 transportation professionals from around the world.

### **“A Load Testing Program on Large Diameter Open Ended Instrumented Test Piles to Evaluate the Design Parameters and Pile Setup”\***

Md. Nafiul Haque, Murad Abu-Farsakh, Chris Nickel, and Zhongjie Zhang

### **“Estimation and Incorporation of Pile Setup into LRFD Design Methodology”**

Murad Abu-Farsakh and Md. Nafiul Haque

### **“Numerical Investigation of the Performance of Geosynthetic Reinforced Soil-Integrated Bridge System (GRS-IBS) Subjected to Differential Settlement”**

Murad Abu-Farsakh, Allam Ardah, and George Voyiadjis

### **“Comparison and Challenges of Evaluating the Performance of Geosynthetic Reinforced Flexible Pavements using Different Testing Programs”**

Murad Abu-Farsakh

### **“A Case Study of Overweight Traffic on Pavement Costs: Application of Overweight Permit Database in Analyzing Impact of Shale Gas Development on Louisiana Roadways”**

Xiaohui Sun and Zhong Wu

### **“Performance of BCOA Pavements Under Accelerated Loading in Louisiana Condition”**

Xiaohui Sun, Zhong Wu, and Tyson Rupnow

### **“Self-Healing Evaluation of Shape-Memory Alloys and Steel Reinforced Mortar with Calcium Nitrate Microcapsules under Wet and Dry Cycles”**

Gabriel Arce, Marwa Hassan, Tyson Rupnow, and Louay N. Mohammad

### **“Rheological, Chemical, Micro-Mechanical, and Mechanical Properties of Re-refine Engine Oil Bottoms (REOB) Modified Binders”**

Taesun You, Sreelatha S. Balamurugan, Munir Nazzal, Louay N. Mohammad, Ioan Negulescu, and William Daly

### **“Fatigue Performance of Asphalt Mixture Containing Recycled Materials and Warm-Mix Technologies Under Accelerated Loading and Four Point Bending Beam Test”**

Minkyum Kim, Louay N. Mohammad, Trey Jordan, and Samuel B. Cooper, III

### **“Development and Validation of a Model To Predict Interface Bonding Between Pavement Layers”\***

Ramendra Das, Louay N. Mohammad, Mostafa Elseifi, Wei Cao, and Sam Cooper, Jr.

# “Laboratory Performance of Asphalt Mixtures Containing Re-Refined Engine Oil Bottoms (REOB) Modified Asphalt Binders”\*

Taesun You, Yucheng Shi, Louay N. Mohammad, and Samuel B. Cooper, III

# “Comparison of Asphalt Mixtures Crack Resistance At Intermediate Temperatures Using Advanced Test Methods And Theories”\*

Wei Cao, Louay N. Mohammad, Peyman Barghabany, Samuel B. Cooper, III, and Saman Salari

\*Accepted for both presentation and publication

The following are a list of papers accepted for both publication and presentation at the 93rd AAPT Annual Meeting and Technical Sessions, March 18-21, 2018, Jacksonville, Florida

# “A Direct Shear Approach to Assess the Interface Bonding Performance”

Ramendra Das, Louay N. Mohammad, Mostafa Elseifi, Wei Cao, and Sam Cooper, Jr.

# “Asphalt Mixtures Containing RAS and/or RAP: Relationships amongst Binder Composition Analysis and Mixture Low Temperature Cracking Performance”

Minkyum Kim, Sam Cooper, Jr., Louay N. Mohammad, and Gaylon Baumgardner

# “Long-term Field Performance of Flexible Pavements Using Warm Mix Asphalt Technologies”

Shen, Shen, Weiguang Zhang, Shenghua Wu, Louay N. Mohammad, and Balasingam Muhunthan

# “Impact of Various Crumb Rubber Modifications on Asphalt Binder and Mixture Properties”

Sreelatha S. Balamurugan, Louay N. Mohammad, William Daly, Ioan Negulescu, Samuel B. Cooper, III, Sam Cooper, Jr., and Gaylon Baumgardner

# Roads and Bridges Magazine Features LTRC Research

Research conducted by LTRC’s Pavement & Geotechnical Research Administrator Zhong Wu, Ph.D., P.E., and Associate Director of Research Tyson Rupnow, Ph.D., P.E., was recently featured in Roads and Bridges magazine. The research project focused on determining just how thin roller compacted concrete (RCC) could be paved while also maintaining its strength and integrity. From this project, researchers also tapped into a potential savings of over \$2 million by utilizing this thinner concrete option for low-volume roads across the state.

To learn more, please contact Dr. Zhong Wu at (225) 767-9163 or zhongwu@ltrc.lsu.edu or visit [http://www.ltrc.lsu.edu/pubs\\_final\\_reports.html](http://www.ltrc.lsu.edu/pubs_final_reports.html) and click on Final Report 578 (12-7P) to view the research in its entirety.



# Staff Updates and Accomplishments

Geotechnical Engineering Research Laboratory Manager **Murad Abu-Farsakh, Ph.D., P.E.**, has been approved for Fellow Member by the Membership Applications Renew Committee (MARC).

The Safety Center's Research Manager **Elisabeta Mitran, Ph.D.**, was appointed as a panel member on projects in the new Behavioral Traffic Safety Cooperative Research Program (BTSCRCP), a partnership between the Governors Highway Safety Association (GHSA), the National Highway Traffic Safety Administration (NHTSA), and the Transportation Research Board (TRB) that develops practical solutions to save lives, prevent injuries, and reduce costs of road traffic crashes associated with unsafe behaviors.

Computer Analyst 2 **Adele Lee, M.S.**, GISP, recently completed re-certification as a GIS Professional (GISP) by the GIS Certification Institute (GISCI).

LCTS Safety Initiatives Manager **Rudynah Capone** has been selected as one of the 20 participants of LEAD LSU, a leadership development program for high-performing and emerging leaders at the university.

ITS/Traffic Research Associate **Julius A. Codjoe, Ph.D., P.E.**, was the keynote speaker and awarded at the Engineers Week ceremony at Southern University. LTRC would also like to congratulate him becoming a licensed Professional Engineer.



Special Studies Research Administrator **Kirk Zeringue, P.E.**, was selected by TRB as the chairman of the project panel for NCHRP Project: Enhancing Pedestrian Volume Estimation and Developing HCM Pedestrian Methodologies for Safe and Sustainable Communities.

LSU Professor and EMCRF Manager **Louay N. Mohammad, Ph.D., P.E. (WY)** delivered a presentation titled Evaluation of Various Hamburg Wheel-Tracking Devices and AASHTO T 324 Specification for Rutting Testing of Asphalt Mixtures at the annual meeting of the Southeastern Asphalt User Producer Group in Jacksonville, Florida. He also delivered a presentation titled Assessment of Interface Bonding Performance at Workshop on Balancing Durability and Safe Function in Dense-Graded Asphalt Pavement at the 97th annual meeting of the Transportation Research Board in Washington, D.C.

In March 2018, **Amy Christen**, Teaching Associate 4, earned her Doctorate in Education, Curriculum and Instruction, from Capella University, graduating with honors and a 4.0 grade point average. With this degree, Amy is able to design a curriculum and train participants more effectively and efficiently using research-based instructional methods.

Asphalt Concrete Training Liaison **Patrick Frazier** successfully completed all requirements for the Professional Trainer Certification.

## PUBLICATIONS

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# Recently Published

### **Project Capsule 18-2P**

“Mitigating Joint Reflective Cracks using Stone Interlayers: Case Study on Louisiana Highway 5, Desoto Parish”  
Kevin Gaspard, P.E.

### **Project Capsule 18-4SS**

“ITE Trip Generation Modification Factors for Louisiana”  
Chester Wilmot, Ph.D., P.E.

### **Final Report and Technical Summary 590**

“Assessment of Continuous Deflection Measurement Devices in Louisiana – Rolling Wheel Deflectometer”  
Mostafa A. Elseifi, Ph.D., P.E., and Omar Elbagalati

### **Final Report and Technical Summary 587**

“Evaluation of MIT-SCAN-T2 for Thickness Quality Control for PCC and HMA Pavements”  
Zachary Collier, E.I.; Amar Raghavendra, P.E.; Tyson Rupnow, Ph.D., P.E.; and Patrick Icenogle, P.E.

### **Final Report and Technical Summary 589**

“Reliable Early Opening Strength for Concrete Pavements and Patch Work”  
Zachary Collier, E.I.; Amar Raghavendra, P.E.; and Tyson Rupnow, Ph.D., P.E.

### **Final Report and Technical Summary 577**

“Evaluation of Tack Coat Materials on Longitudinal Joints in Louisiana”  
Samuel B. Cooper, Jr., Ph.D., P.E.; Louay N. Mohammad, Ph.D.; David Mata, E.I.; and Samuel Cooper III, Ph.D., P.E.

### **Final Report and Technical Summary 585**

“Corrosion Map for Metal Pipes in Coastal Louisiana”  
Sanjay Tewari, Ph.D.

### **Final Report and Technical Summary 580**

“Exploring Naturalistic Driving Data for Distracted Driving Measures”  
Sherif Ishak, Ph.D., P.E.; Osama A. Osman, Ph.D.; Julius Codjoe, Ph.D., P.E.; Sydney Jenkins; Sogand Karbalaieali; Matthew Theriot; Peter Bakhit; and Mengqiu Ye

### **Technical Assistance Report 17-01TA-SS**

“Literature Review of the Implications of Differential Speed Limit Implementation”  
Haggai Davis, III; Ravindra Gudishala, Ph.D., P.E.; Kirk Zeringue, P.E.; Chester Wilmot, Ph.D., P.E.; Julius Codjoe, Ph.D., P.E.; and Matthew Roberts



## VIEW ONLINE

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



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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.

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### LTRC Administration and Publications Staff

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**Sam Cooper, Ph.D., P.E.**, Director

**Tyson Rupnow, Ph.D., P.E.**, Associate Director, Research

**Vijaya (VJ) Gopu, Ph.D., P.E.**, Associate Director, External Programs

**Mary Leah Coco, Ph.D.**, Associate Director, Technology Transfer & Training

**Jenny Speights**, Public Information Director

**Emily Wolfe**, Multi-Media Specialist

**Chris Melton**, Multi-Media Producer

**Jenny Gilbert**, Editor/Technical Writer

**Laura Williams**, Editorial Assistant

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