Technology Today

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In this Issue

Upcoming Events

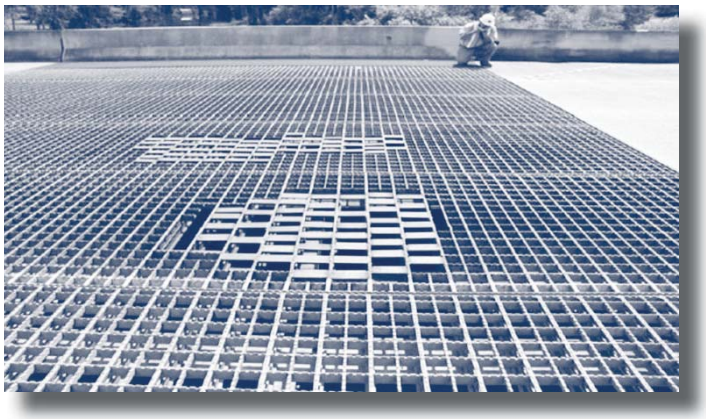
August 16-17
NHI Course No. 131026 - Pavement Subsurface Drainage Design
TTEC

August 22-25, 29-30
SIDRA Solutions Roundabout Training
TTEC

September 14-15
LRSP Regional Peer Exchange
TTEC

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

Researchers Seek Alternatives in Bridge Decks with FRP Strengthened Balsa-Wood



Conventionally, lightweight highway bridge decks in the U.S. are predominantly made of steel grids. Repair and maintenance costs of these bridge decks incurred at the federal and state levels can be quite extensive. However, a very promising alternative is the fiber reinforced polymer (FRP) bridge deck system. Utilizing this alternative, LSU Associate Professor Steve Cai, P.E., Ph.D., developed a four-year LTRC research project (*Development and Performance Assessment of an FRP Strengthened Balsa-Wood Bridge Deck for Accelerated Construction*) with goals to develop, construct, and evaluate a lightweight FRP-wrapped balsa wood bridge deck system in Louisiana. Funded by FHWA's Innovative Bridge Research and Deployment (IBRD) program, researchers' ultimate objective was to take advantage of the promising characteristics of FRP materials to develop a more durable, less maintenance intensive bridge system to save transportation infrastructure system costs for the state.

The LA 70 Bridge in Assumption Parish was built in 1988 with a design load of HS20-44 and an average daily traffic (ADT) of about 6,000. The seven-span, 145-ft. long structure includes a 25-ft. long center steel grid deck span designed to be lifted for river navigation when needed. This corrugated steel grid deck, which was in need of substantial repair, was replaced with the FRB wrapped balsa wood deck.

The new bridge deck consists of pre-fabricated FRP-wrapped balsa wood units bonded on the I-girders. The fabrication sequence of the bridge deck units are illustrated in Fig. 1(a) that shows the balsa wood beam being wrapped with a glass fiber reinforced polymer (GFRP) sheet. In Fig. 1(b), a single panel is being assembled using several of the wrapped balsa wood beams and hardwire layers. The deck was adhesively bonded to the steel girder using customized epoxy [Fig. 1(c)] and a bonded panel is shown in Fig. 1(d).

On LA 70 Bridge, researchers replaced a former steel deck in need of repair with an FRB-wrapped balsa wood deck.

The deck was replaced in only half a day; the new deck is corrosion free and maintenance free, and the smooth surface reduces concern for personal injury to local pedestrians and bikers. In addition, the cost benefit is estimated at $96,000 per bridge.

In addition to installing the new deck, researchers assessed the overall field application of the FRP-wrapped balsa wood bridge from detailed 3-D finite element analysis, laboratory tests, short-term field evaluations, and long-term monitoring measures. More specifically, they examined the performance monitoring integrity of the FRP-wrapped balsa wood bridge deck system, strains in the transverse direction of the deck and the longitudinal direction of the individual girders, and the bridge deck–girder interface bond integrity.

Ideally, this project will help Louisiana develop the required expertise for FRP field applications, be more comfortable in using FRP and balsa wood materials in bridge structures, and identify problem areas, so the advantages of these materials can be fully utilized in future larger scale applications in Louisiana.

To learn more about this project, contact the project's structures research manager Walid Alaywan, Ph.D., P.E., at walid.alaywan@la.gov or 225-767-9106.

Figure 1
Researchers fasten bridge deck units with GFRP sheet and balsa wood beams

State Researcher Selected to Present Findings to AASHTO

Upon completing one of his latest LTRC research projects (*Evaluation of Continuity Detail for Precast Prestressed Girders*), LSU Associate Professor Ayman Okeil, Ph.D., P.E., received an invitation to present his findings to the American Association of State Highway and Transportation Officials (AASHTO). In front of the forum where code provisions are discussed and prepared for voting (AASHTO Committee T-10 on Concrete Bridges), Okeil represented the state on many levels. Okeil explained, "This was the first time presenting in front of AASHTO. A mix of joy, honor, and responsibility came to my mind. After all, Louisiana DOTD (Bridge Design), LTRC, and LSU were being represented, and I did not want to let down the people who entrusted me with the opportunity."

Following his AASHTO presentation, Okeil breaks down his research into the basics, how it was of interest to the concrete bridge community at large, and the influence it may have on future bridge designs for the state.

What did your research focus on and what findings did you present to AASHTO?

The main goal of Project 08-1ST was to evaluate the performance of a new continuity detail for prestressed girder bridges that has never been used before in Louisiana. The detail was the result of an NCHRP research project (12-53) that made recommendations for constructing continuous bridges from simple span girders. The project's recommendations were adopted by the designer of the new John James Audubon (JJA) Design/Build Project. A structural health monitoring (SHM) methodology was adopted to monitor the performance of a three-span segment from Bridge #2 of the JJA Project, which was skewed and was built using Bulb-T girders. Both attributes were not considered in NCHRP Project 12-53. Data collected from over a two-year period revealed that temperature gradients cause restraint moments that need to be accounted for in design.

What about your project did AASHTO find particularly interesting or useful?

From the discussion with Committee T-10 after the presentation, it was clear that the issue needs to be further investigated. One of the committee members also commented favorably on the approach followed in the project and that is to use SHM for newly adopted designs or details to learn from their performance in a real life application, especially for design/build projects like the John James Audubon Bridge project where the designer can divert from local design common practices.

How has your research reached or influenced others since your presentation?

I received several communications from people interested in the details of what we did, including local and out-of-state consultants. Furthermore, the principal investigator for NCHRP Project 12-53 contacted us with some questions about our findings.

How will Louisiana's transportation system benefit from this research?

When the DOTD Bridge Design Section initiated the idea, their goal was to better understand how the new detail would perform as it was never used before in Louisiana. Now that the project findings are available, the new *Louisiana Bridge Design Manual* (currently under development) will incorporate a new detail that is not as susceptible to temperature gradients as the monitored one.

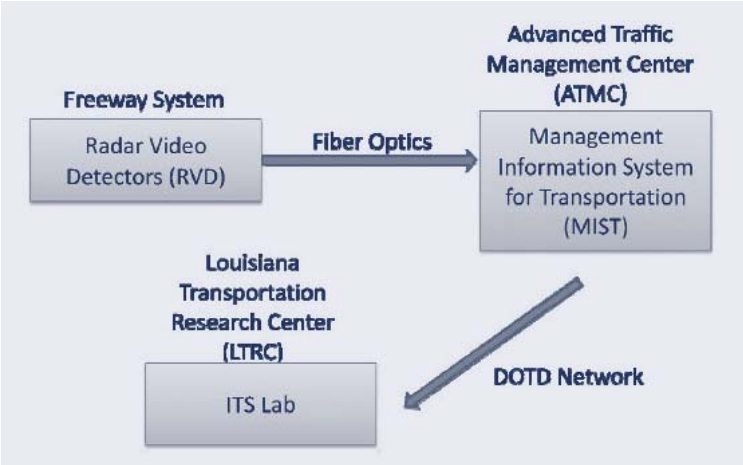
How has this new detail and monitoring affected future bridges in Louisiana?

New Louisiana bridges will have simpler details to avoid the temperature gradient effect while eliminating the problems associated with expansion joints such as leaks, deterioration, debris accumulation, and maintenance.

New LTRC Lab Gathers Research to Address Needs of Travelling Public

Researchers at the Louisiana Transportation Research Center are putting the final touches on their newest lab at the center designed to transform traffic data into useful information that is instrumental to procedures and applications that benefit DOTD, the local government, and the general public. The Intelligent Transportation Systems (ITS) lab has been the result of several years of research where researchers studied equipment possibilities, applications that support ITS data, affiliated costs, ways to properly and securely maintain the lab, and other ITS labs across the country.

Primarily serving the metropolitan and state transportation authorities in their service to the traveling public, the ITS lab is envisioned to evaluate traffic data collected from Louisiana's traffic management centers. The state-of-the-art ITS lab will be a tool for LTRC where data and video will be collected for highway incident detection and management, travel time estimation and prediction, work zone management, ramp metering, crash analysis, new concepts such as managed lanes and congestion pricing, highway breakdown and recovery analysis, traffic signal optimization, calibration of microscopic simulation models, implementation of new pavement design procedures, and others. From there, data and video will be analyzed, reported, and then procedures will be passed on to agencies in order to apply them on a routine basis.



Traffic data flow diagram

This information will assist transportation officials in developing applications that improve their service to the public (e.g., providing current and expected future traffic conditions and developing operational strategies for the existing infrastructure). The lab is also anticipated to retain, recruit, and inspire interest in the field of advanced traffic management systems

for students in Louisiana as well as potential graduate students from outside Louisiana in providing access to raw and processed data of traffic flow.

The short term measure of success of the lab will be reflected by the capability to stream traffic data in real-time from traffic monitoring sites that are connected to the Baton Rouge Traffic Management Center (TMC). Also, the lab will offer technical reporting capabilities that assist users in extracting the most relevant information needed from such data.

For questions concerning the lab's functions or capabilities, please contact Mark Morvant at 225-767-9124 or mark.morvant@la.gov.

FIND OUT MORE

To learn more about this research project, download ***Final Report 456*** *at http://www.ltrc.lsu.edu/pubs_final_reports_5.html*

LTRC Research Study Selected as High Value Research in National Meeting

As reported in the spring edition of *Technology Today*, LTRC researchers recently evaluated a new testing device—a surface resistivity meter—for quality acceptance of precast and cast-in-place concrete. Researchers found that by using this new testing device instead of current devices, DOTD can expect to save about $98,500 in personnel costs within the first year. It is also estimated that contractors will save about $1.5 million in quality control costs.

Surface resistivity meter

In light of this research, fellow transportation researchers from the Southeast region of the Research Advisory Committee (RAC) selected this project (*Evaluation of Surface Resistivity Measurements as an Iternate to Rapid Chloride Permeability Test for Quality Assurance and Acceptance*) as one of the four high value research projects that were presented at the national AASHTO RAC meeting in July. Over 20 projects were submitted for consideration from all the states in the Southeast region, but only four were sent on for consideration at the national level.

In addition to Louisiana, the three other selected projects were from Kentucky [*Shear Repair of P/C Box Beams using Carbon Fiber Reinforced (CFRP) Fabric*], North Carolina (*Precipitation Alert: Ongoing Maintenance of Precipitation Alert and Visualization Tool in Support of NC DOT's' Storm Water Quality Monitoring*), and Georgia [*Development and Evaluation of Devices Designed to Minimize Deer-Vehicle Collisions (Phase II)*].

FIND OUT MORE

To learn more about this research project, download ***Final Report 479*** *at http://www.ltrc.lsu.edu/pubs_final_reports_5.html*

New Seminar Series Announced

LTRC is pleased to announce that the next seminar in its on-going seminar series is now in the works. The theme for this four-session seminar is ***Congestion Management*** and is scheduled for September 13, 2011. All DOTD, academia, and transportation professionals are invited to attend.

As part of a series designed to be a forum for presenting new technology, discussing concerns, and exchanging information on a focused topic, the sessions for *Congestion Management* will include: *Research and Technology, Urban Planning, Public Transit,* and *Congestion Mitigation*.

Registration for the seminar is now open to the public (www.ltrc.lsu.edu) and will feature presentations by a number of transportation professionals spanning from Texas to Florida. Speakers currently scheduled to attend include LSU Associate Professor Sherif Ishak, Yafeng Yin with the University of Florida's Center for Multimodal Solutions for Congestion Mitigation, Brian Wolshon of LSU and the Gulf Coast Research Center for Evacuation and Transportation Resiliency, Tom Haysley with the Regional Planning Commission, LADOTD's Dan Broussard, John Brommelsiek with the Federal Highway Administration, Tim Lomax of the Texas Transportation Institute, and Chad Winchester with DOTD Road Design Section.

The preliminary topics for the seminar range in themes such as *LTRC ITS Lab & LSU Vehicle Simulator, Congestion Pricing, Use of TRANSIMS in Urban Planning, Regional Congestion Management Plan, LADOTD State Transportation Plan, Transportation Management Plan, Rapid Ride Transit Service to Ease Congestion, The CONNECTION - Baton Rouge and New Orleans,* and *The New Orleans Trolley System,* among others.

All those interested in attending will need to register at http://www.ltrc.lsu.edu/congestion_management/ before September 13. For more information about this seminar or the upcoming series, please contact Mark Morvant at 225-767-9124 or mark.morvant@la.gov.

Staff Updates and Accomplishments

Associate Director of Technology Transfer and Training **Sam Cooper,** P.E., MSCE, has been nominated to be a member of the Transportation Research Board (TRB) Committee on Characteristics of Asphalt-Aggregate Combinations to Meet Surface Requirements (AFK40).

On May 20, 2011, LTRC Training Events Program Manager **Mary Leah Coco,** Ph.D., received her Doctor of Philosophy at Louisiana State University. Dr. Coco reported the results of ground-breaking research on the use of Immersive Virtual Learning Environments for the marginalized population of semi-skilled highway workers in her dissertation. Her work has earned accolades at conferences across the nation, including the Interservice/Industry Training, Simulation and Education Conference, the Transportation Research Board, and the Distance Teaching and Learning Conference.

Engineering Materials Characterization Research Facility (EMCRF) Manager and LSU Civil Engineering Professor **Louay Mohammad**, Ph.D., was selected as a member of the International Scientific Committee for the 5th International Conference on Bituminous Mixtures and Pavements that was held on June 2-3, 2011, in Thessalonika, Greece. Dr. Mohammad also co-authored a paper with Khalid Al-Shamsi titled *Estimating Optimum Compaction Level for Dense-Graded Hot-Mix Asphalt Mixtures* that was selected as the distinguished research paper in the *Journal of Engineering Research* for 2010-2011.

Walid Alaywan, Ph.D., P.E., senior structures research engineer, passed his Ph.D. dissertation defense at Louisiana Tech University on June 2, 2011.

Recently Published

Project Capsules

Project Capsule10-3SS
Automatic Enforcement and Highway Safety
Susan Herbel, Ph.D.

Project Capsule 10-6B
Implementation of GPC Characterization of Asphalt Binders at Louisiana Materials Laboratory
William Daly, Ph.D.

Project Capsule 10-6SS
Establishing an Intelligent Transportation System (ITS) Lab at LTRC Phase II
Sherif Ishak

Project Capsule 11-2P
Development of DOTD GPS Technology Management Plan
Jennifer Harrison

Project Capsule 10-2GT
Geotechnical Information Database – Phase II
Scott Deaton, Ph.D.

Reports and Summaries

Technical Assistance Report 11-1TA
Evaluation of the LA 1 Bridge at the Morganza Flood Control Structure
Tyson Rupnow, Ph.D., P.E.

Final Report and Technical Summary 462
A Comparative Analysis of Modified Binders: Original Asphalts and Materials Extracted from Existing Pavements
William Daly, Ph.D.

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Performance of Buried Pipe Installation
Michele Barbato, Ph.D.

Technical Summary 406
Development of Models to Estimate the Subgrade and Subbase Layers' Resilient Modulus from In-situ Devices Test Results for Construction Control
Louay Mohammad, Ph.D.

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Estimating Setup of Driven Piles into Louisiana Clayey Soils
Jay Wang, Ph.D., P.E., Neha Verma, and Eric Steward

Final Report and Technical Summary 458
Implementation of Testing Equipment for Asphalt Materials
William "Bill" King, Jr., P.E., Md Sharear Kabir, E.I., and Louay Mohammad, Ph.D.

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Publication Statement

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

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