TECHNOLOGY TODAY

VOLUME 35
ISSUE 4

A publication of the Louisiana Transportation Research Center

LAB FEATURE
CONCRETE EDITION

Meet the Concrete Lab on pg. 3 (left to right: Aaron Brown, Austin Gueho, and Norris Rosser)

IN THIS ISSUE

UPCOMING EVENTS

LTAP Roads Scholar #2: Maintenance of Asphalt Roads
March 28, TTEC 100

National Highway Institute (NHI) Course No. 142045—Pedestrian Facility Design
April 25-26, TTEC 100

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

Editor's note: In a five-part series, LTRC is looking at previous projects to see how past research is actively benefitting today's roads and bridges.

RESEARCH

Lafayette Consolidated Government Sets Standards Using LTRC Concrete Research

Lafayette Consolidated Government (LCG) has longer-lasting bridges after following the standardizing of using concrete mixtures with self-curing capabilities. The idea to implement the concrete mixtures with self-curing capabilities materialized from findings and implications found in LTRC concrete research, "Evaluation of Portland Cement Concrete with Internal Curing Capabilities."

Tyson Rupnow, Ph.D., the lead concrete researcher on the project published in 2016, and his team—Zachary Collier, E.I.; Amar Raghavendra, P.E; and Patrick Icenogle, P.E.— sought to quantify the beneficial use of internally cured concrete (ICC) mixtures using saturated lightweight aggregate fines and find an ICC mixture that would reduce the time needed for water curing, minimize/eliminate cracks, and achieve durability and sustainability in concrete structures.

continued on page 2

This image shows a 150 pcy ICC mixture deck placement the following morning after the construction crew left. This illustrates why ICC is a good option as the absence of cracking in this section indicates that the ICC plays a large role in the future durability of the short non-cured section.

As the research team presented their progress at several industry events, the proposal sparked the interest of Mitchell Wyble, P.E., former LCG city/parish engineer. At the time, Wyble was looking for an innovative way to increase the longevity of concrete bridge projects. "After having a conversation with Tyson, I then reached out to municipalities in the northeast and midwest to see how they were using lightweight aggregate," said Wyble. "After doing external research and talking with other municipalities, I decided it was the right thing to do," said Wyble.

Wyble stated that using ICC significantly reduced cracking, which internally improves the life of bridge structures. Cracking can potentially allow salt, chemicals, and other corrosive materials to seep through the concrete to the steel frames and cause irreparable costly damage.

Though he now serves as promotions and membership director of Concrete & Aggregates Association of Louisiana, Wyble worked with LCG during the time of initial implementation of using concrete mixtures with lightweight aggregate with internal curing capabilities. Currently, the LCG continues to use concrete mixtures with ICC as a standard practice.

According to Wyble, the best monetary benefit from using ICC concrete mixtures is the long-term benefits of the quality of the concrete. Wyble stated that using lightweight aggregate is slightly more costly for the upfront cost, but the savings on repairs and longevity are worth the upfront cost. Wyble estimates that utilizing ICC concrete mixtures extends the longevity of bridge and concrete structure by 50%. Longevity and all costs related to bridge and concrete structures, however, are contingent on regular proper maintenance of structures.

To read more about the original concrete study, please read Final Report 569 or the accompanying technical summary at www.ltrc.lsu.edu/publications.html.

RESEARCH

LTRC Concrete Lab Leading the Way in ICC Research

LTRC's Concrete Laboratory remains a staple for trending research in the industry as researchers recently began a two-year study focusing on the realistic abilities and applications of internal curing concrete (ICC) mixtures.

Currently, ICC is becoming more common in the industry and increasingly implemented on state highways, pavements, and building structures. However, testing of ICC compounds are limited to the standardized AASHTO measures of other typical concrete mixtures. Researchers explain that the implementation of performance-based specifications has prompted research to understand the impact of internal curing on concrete's transport properties.

AASHTO standards require that curing samples be fully saturated in a moist room with 100% relative humidity from the time of molding to testing, despite previous research showing that such curing time is not entirely necessary. Standardized testing measures significantly reduce the impact of internal curing, therefore, making it difficult to assess real applicable benefits.

ICC affects the permeability of concrete, which is a property that determines how liquid and other materials are able to pass through a substance. Concrete that is not properly cured will have poor permeability and be subject to damage and corrosion.

continued on page 6

RESEARCH

Concrete Lab Q+A

Concrete is one of the most versatile materials used at LTRC, and the Concrete Research Laboratory provides a variety of options for faculty and students alike to explore the dynamics of concrete. Engineering Technicians Norris Rosser, Austin Gueho, and Aaron Brown expand upon that notion and give an inside look into the concrete lab and all its capabilities.

What does a day in the concrete lab typically look like?

A typical workday in the concrete lab starts on Monday and extends throughout the week. Every Monday, the entire workload for the week is planned and placed on the lab's whiteboard. Every day, each technician checks the whiteboard to know which task he is assigned, whether roadwork, checking samples, testing materials, etc. Every day is different for each team member as the workload varies from assisting with student projects to working jointly with local and national projects.

What types of equipment are primarily used?

The concrete lab has a plethora of machinery to use for developing and testing concrete. The list of equipment in the concrete lab resembles the everyday kitchen but on a grander and commercial scale. There are aggregate mixes, ovens, refrigerators, freezers, concrete drum mixers, molds, etc.

Is there a favorite piece of equipment that is more popular?

The most recognizable equipment used in the lab is the **concrete drum mixer**. The drum mixers look like giant cake mixers as they are barrel mixers

continued on page 4

Electrical Surface Resistivity Testing

One of the most important pieces of equipment in the concrete lab is the industry-leading surface resistivity equipment, which is used to perform electrical surface resistivity tests. Electric surface resistivity testing is used to examine the quality and durability of concrete samples. The test can be performed in as little as five minutes.

During an electrical surface resistivity test, the equipment sends an electrical current through a concrete sample. As the electric current moves through the pores, the concrete sample attempts to withstand the penetration of the electric current, which indicates levels of resistivity. Resistivity demonstrates the permeability of the concrete sample, which also indicates durability against fluids, specifically corrosive liquids like chloride.

Resist chloride penetration (RCP) testing is a more widespread testing procedure; however, RCP can take up to two days to complete. Electric surface resistivity testing is a more cost-effective option as LTRC concrete researchers previously found in a cost-benefit analysis study in which contractors were estimated to save $1.5 million in quality control costs. *(https://www.fhwa.dot.gov/pavement/concrete/surfacetest.cfm)*

that effectively mix a wide range of different types of aggregate. Different aggregates (such as mortar, cement, and gravel) affect how a concrete mix design needs to be mixed and processed.

Another centerpiece of the concrete lab is the **Test Mark Concrete Compression machine.** The concrete compression machine is very recognizable on the internet as people film various social media videos compressing fruits and other objects. However, the purpose of the compression machine is to ensure that concrete samples meet structural and strength standards.

Overall, what do you enjoy about this aspect of research?

AUSTIN

I enjoy that concrete research is a field that focuses on the structure of a project with integrity from start to finish. Unlike other fields, you do not get to pick or choose data when something is not working. The product shows when something is not right. Also, concrete research is a sacred place in my family as both my dad and grandad worked in the industry.

AARON

I'm enjoying learning how concrete is more flexible than what I initially perceived it to be. Coming from a mechanical background, I enjoy learning how concrete has so many properties and possibilities to build with.

What do you wish people knew about the concrete lab and its capabilities?

NORRIS

I want people to know that the Concrete Research Laboratory can compete with any other lab and still succeed. Our lab is the go-to lab with helping other labs with many concrete projects throughout the entire state. The concrete lab does a lot of heavy lifting, and we are known as being the quick and efficient choice.

Aaron Brown Joins Concrete Lab

LTRC welcomed Aaron Brown to the concrete lab as the new engineering technician 4. A native of Zachary, Louisiana, Brown graduated from Southern University of Baton Rouge (SUBR) in spring 2021 with a mechanical engineering degree. While at SUBR, Brown's research focus was on developing and redesigning a more effective catalytic converter.

Brown joined LTRC because he believes in the progression of Louisiana and sees the potential for the state with the right people in place to push Louisiana in a more progressive and industry-leading direction. Brown sees LTRC as a wonderful opportunity to work in the public sector to help fulfill his goals of giving back to his community.

While at LTRC, Brown's goal is to better himself in the engineering industry. He aims to obtain his engineering intern (E.I.) designation in 2023 and continue working towards his professional engineering license as well. Brown considers himself family-oriented and loves to travel, wanting to go to Phoenix, Oregon, and Colorado Springs.

Why Concrete?

"The versatility is amazing. Concrete makes things more effective for the world. There are endless benefits in homebuilding, roads, and transportation. I love learning new things about concrete every day," Brown said.

Fun Facts

Favorite Color BLUE
Birthday Month JANUARY
Recent Recipe JAMAICAN GOAT CURRY

TRAINING

LTAP's Roads Scholar Class Echoes the Importance of Preventive Bridge Maintenance, Repair Techniques

By Rudynah Entera Capone, MPA

Ferguson (pictured above) once served as public works director for West Feliciana Parish, chief design and construction engineer for City of Baton Rouge, and bridge manager for East Baton Rouge Parish. Recently, he founded the Veteran Inspections and Assessments, LLC, designated as a Louisiana Veteran-Owned Small business. In this venture, he actively performs bridge inspections and assessments where deemed.

With everyone still recuperating from holiday festivities, the Louisiana Local Technical Assistance Program (LTAP) staff were all-hands-on-deck for two of the seven Roads Scholar "RS#14: Bridge Maintenance and Repair" classes, which took place on January 10 in Lafayette and January 24 in New Orleans. The first five classes were successfully offered in Baton Rouge, West Monroe, Bossier City, Alexandria, and Lake Charles between October 26 and December 13, 2022.

This six-hour class is primarily designed for local public agency personnel involved in bridge maintenance and repair of locally owned bridges. However, LTAP welcomes all bridge owners, project consultants, and district/statewide bridge personnel from DOTD to complete the course that credits six professional development hours.

Course instructor Jim Ferguson highlighted how the engineering workforce must be proactive in bridge maintenance in general. One way is by incorporating preventive techniques into an agency's work plans and budgets while achieving better use of resources that help implement best practices accepted by the National Bridge Inspection Standards (NBIS) and DOTD guidelines. In addition to covering the basics of identifying bridge types and components, Ferguson discussed developing programs for routine maintenance and identifying signs of deterioration.

"Preventive maintenance is the most cost-effective strategy, and it starts when the bridge is new. It is encouraged that any maintenance and repair techniques be accepted by DOTD and be able to be inspected post-repair," says Ferguson, who has been in the civil engineering field for over 27 years.

Ferguson also included an interactive portion of the course by dividing the class into groups for a 25-minute exercise. Attendees reviewed three different bridge reports with various deficiencies and were asked to prioritize each bridge for maintenance, repair, or both as well as identify which repair techniques to utilize.

> *"I look at bridges a whole different way after taking the course."*
> —West Monroe attendee

> *"This course complements the bridge inspection class I just attended."*
> —Bossier City attendee

About Roads Scholar Program

The RSP gives local transportation personnel the opportunity to improve their road and bridge maintenance skills. It consists of 15 courses that are four to six hours long. They are offered over a three-year period in convenient locations across the state. Participants who complete the program will have acquired a basic knowledge of road maintenance, work zone safety, and worker safety. A certificate is awarded upon completion of the program. To become a Roads Scholar graduate, a participant must complete all six required courses and a minimum of four elective courses. Participants have the option to attend all nine elective courses. Upcoming classes can be found on www.louisianaltap.org/roads-scholar.html

Concrete lab research continued

In the study, researchers will reduce curing conditions from the standard 28 days to only the first 7 days to simulate realistic conditions. Surface resistivity testing will occur over several points during a 56-day curing period. To verify any results, researchers will also use a bulk diffusion test to further characterize other concrete transport properties. In addition, the use of internal RH sensors will monitor the concrete's degree of hydration over time.

Researchers explain that results on this study will provide a better outlook on the potential benefits of ICC. The results will provide DOTD with further guidance on expanding the use of ICC in structural concrete for increased durability.

STAFF NEWS

Staff Updates and Accomplishments

Ibrahim Elnaml, LTRC and CEE Ph.D. student, participated in the Phi Kappa Phi honor society fall service project in partnership with local non-profit Clean Pelican and other Baton Rouge communities. The Clean Community Event service project was held on Saturday, October 15, 2022, at the Acadian Village shopping center.

Associate Director for External Programs **Vijaya (VJ) Gopu**, Ph.D., P.E., served on an NSF Review Panel for the Civil, Mechanical and Manufacturing Innovation Division in the Directorate of Engineering at the National Science Foundation in October 2022. Dr. Gopu also chaired the Industrial Advisory Board Meeting of the NSF Center for Integration of Composites in Infrastructure held in Miami in December 2022.

Assistant Professor and Research Planning/Intermodal Research Manager **Ruijie "Rebecca" Bian**, Ph.D., and her team were recently selected to present a session to the American Planning Association (APA) Louisiana 2022 Conference. The session title was "Active Transportation Research Roundup: Recent and Ongoing Projects at Louisiana Transportation Research Center." Dr. Bian along with fellow LTRC researchers Tara Tolford (UNO), Hany Hassan (LSU), and Sirisha Gangireddy (LSU) presented ongoing research conducted at LTRC and encouraged planners from different parishes to submit their problem statements to LTRC. This session connected engineers with planners in discussing improving transportation access for communities, while expanding LTRC's research impacts in the state.

LTRC welcomes two of LTAP's recent additions: **Victor Lockwood** as LTAP and LRSP Business Manager and **Haley Ortiz** as LTAP Training Program Manager.

Claire Dixon joins Section 33 as the new Engineering Technician Training Program Manager.

Congratulations to **Emily Wolfe** who recently became LTRC's newest Public Information Director and **Corey Mayeux**, P.E., as he joins Section 33 as the Technology Transfer Engineer.

PUBLICATIONS

Recently Published

Project Capsule 22-3SA
Development of Statewide Design Guidelines for Improving Pedestrian Safety on High-Speed Arterials in Louisiana
Hany Hassan, Ph.D.

Project Capsule 23-1ST
MASH TL-4 Engineering Analyses and Detailing of 36-inch and 42-inch High Median Barriers for DOTD
William Williams, P.E.

Final Report and Technical Summary 669 (21-3SS)
Evaluating Permitted/Protected Versus Protected Left-turn Signals in Louisiana
Raju Thapa, Ph.D., P.E. (TX), Md Asaduzzaman, Kwabena Abedi

Final Report 676 (20-3C)
Feasibility and Advantages of Accepting Concrete Other Than 28 Days
William J. Saunders, E.I.; Jose Milla, Ph.D., P.E.; Tyson Rupnow, Ph.D., P.E.; Samuel Cooper, III, Ph.D., P.E.

Final Report and Technical Summary 668 (21-4SS)
Develop and Evaluate Performance Measures for Intelligent Transportation Systems (ITS) in Louisiana
Raju Thapa, Ph.D., P.E. (TX); Julius Codjoe, Ph.D., P.E.; Kwabena A. Abedi

Final Report and Technical Summary 583 (16-4B)
Evaluation of Non-SBS Modified Binders using the Multiple Stress Creep Recovery Test
David Mata, P.E., and Saman Salari, P.E.

Final Report and Technical Summary 667 (20-4GT)
Feasibility Study on Geophysical Methods to Estimate Geotechnical Properties in Louisiana Nicholas Ferguson, P.E., and Gavin Gautreau, P.E.

VIEW ONLINE

To download a complete list of LTRC publications, visit the website at www.ltrc.lsu.edu.

LOUISIANA TRANSPORTATION RESEARCH CENTER
4101 Gourrier Avenue
Baton Rouge, LA 70808-4443
DOTD Section 33

ADDRESS SERVICE REQUESTED

Pre-Sort Standard
U.S. Postage
PAID
Permit No. 55
Baton Rouge, LA

www.ltrc.lsu.edu

Technology Today Publication Statement

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.

FOLLOW US

Keep up with our latest updates and information at www.twitter.com/LTRC_Updates, and search for us on Facebook and YouTube.

LTRC Administration and Publications Staff

This public document is published at a total cost of $890.00 Eight hundred and fifity copies of the public document were published in this first printing at a cost of $890.00. The total cost of all printings of this document, including reprints, is $890.00 . This document was published by Mele Printing, 11930 South Harrell's Ferry Road, Baton Rouge, to report on the research and training of the Louisiana Transportation Research Center, as required in R.S. 48:105. This material was duplicated in accordance with standards for printing by state agencies, established pursuant to R.S. 43:31. Printing of this material was purchased in accordance with the provisions of Title 43 of the Louisiana Revised Statutes.