TECHNOLOGY TODAY

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LAB FEATURE
GEOTECH EDITION

RESEARCH

Digging Deeper: Behind the Scenes of Geotechnical Testing

Ever wonder what goes on behind the scenes in LTRC's geotechnical soil lab? We spoke with Engineering Technician DCL Chris Mertz and Engineering Technician 4 Hend Alyousef to learn more about their day-to-day operations, the specialized equipment they use, and how their work supports research, students, and projects across the state. From early morning routines to field-testing with advanced instruments, they gave us an inside look at the vital role the soil lab serves.

What does a typical day in the soil lab look like?

We'll start by checking samples, lining out what samples need to be tested, and figuring out what tasks need to be completed. We also determine what fieldwork we have scheduled and make sure we have our equipment packed up ready to go.

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EVENTS

LTRC Director Cooper Retires

After more than 40 years of distinguished public service to the Louisiana transportation community, LTRC Director Sam Cooper Jr., Ph.D., P.E., celebrated his retirement this past June.

Dr. Cooper began his DOTD career as an engineer-in-training in the District 08 office in Alexandria in May 1980. After spending two decades in various project and area engineering roles in Alexandria, Leesville, Baton Rouge, and Bridge City, as well as a brief stint in private industry, he came to LTRC in 2003 as a materials researcher. He was named director in 2015, and during his tenure oversaw LTRC's continued development as a leading pioneer in transportation research, technology transfer, and training across the nation. For more information and reflection on the details of Sam's career, see *Technology Today Volume 38, Issue 1.*

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UPCOMING EVENTS

Facilitation Skills for Managers
August 19, TTEC 179

Roads Scholar #11: Road Safety 365
September 30, TTEC 100

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

What types of equipment are used, and what kind of testing is common in the soil lab?

We've got a proctor machine in the back and the material testing system (MTS) we use for unconfined compression testing. We also have nuclear devices that we use for density testing. Our lab is the only one in the state equipped with both a large direct shear as well as a small direct shear. Right now, we are working on a SuperSting R8 resistivity meter, which is more field-oriented.

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

People enjoy the SuperSting R8 because it is a field-oriented device. If the weather is good, we get to enjoy the change of scenery.

Chris

What is something you wish people knew about the soil lab and its capabilities?

Chris: We have a great staff that will go out of their way to help anyone.

What about this field of research interests you?

Hend: I enjoy conducting the tests and discovering something new about the soil. I like helping students with their different projects and research. We meet different people and students. We are always learning something new about the machines, whether it be for research or with the students.

Chris: I enjoy seeing projects come to fruition and how some of these projects will help DOTD in the future.

How have you seen your lab or work benefit research or implementation of research?

Hend

Hend: All our outdoor projects depend on our geotechnical labs, including all the civil engineering buildings, highways, etc. The information we get in this lab is sent to the engineers and designers and then we see it in the outside world.

How are students involved in the soil lab?

For LSU students, if they have a problem or a plan, we help facilitate or resolve their problem. They come into the lab, and we help them with their projects or their research. A lot of the times, they come into the lab to understand some of the basics, and they'll implement those basics into the models they're designing with their modeling software. Whether it is running a conduit for sensors in the field or running a soil test in the lab, they want to learn how to do things to make sure they get the best results that they can.

Ph.D. student Isam Khasib preparing a sample to wet sieve it.

A Leadership Transition in Pavement and Geotechnical Research

Gautreau offers the Governor's Office Fellows a hands-on look at the tools and processes behind pavement and geotechnical research.

LTRC is entering a new chapter as Gavin P. Gautreau, P.E., has officially stepped into the role of Pavement and Geotechnical Research Administrator, succeeding long-time leader Zhongjie "Doc" Zhang, Ph.D., P.E., as he retired in June 2025. Both long-time LTRC employees reflect on their respective journeys that have led them to this next season of transition.

Inspired by Passion and Mentorship

For both men, the road to a career in civil engineering was paved by early inspirations. Gavin recalls a childhood filled with curiosity—taking things apart, building with LEGOs, and summer jobs that introduced him to engineering in the field and lab. His father, Glynn P. Gautreau, P.E., also played a pivotal role in encouraging him to pursue a career as a professional engineer.

Doc's path was influenced by one of his college professors, a former civil engineer who helped him see the vital role geotechnical engineering plays in infrastructure. That spark led him to pursue a Ph.D. at LSU, where his LTRC-funded research planted the seed for what would become a decades-long career with DOTD, with his final stop in Section 19 at LTRC.

Arriving at LTRC

Gavin joined LTRC in 2002, drawn by its national reputation and excellent lab facilities. "LTRC produces great research and I'm proud to be part of the continuing effort," he says. He views his new role as a natural progression—a chance to combine his private-sector and state experience, technical expertise, and communication skills to advance implementable research.

Doc's journey to LTRC began in 1994, when he joined DOTD's planning division. Over the years, he advanced through several roles before being transferred to LTRC by then-Chief Engineer Bill Temple in 2001. He became Research Administrator in 2007, overseeing a bridge between academia and DOTD's real-world challenges.

Reflections and Memories

Both leaders speak fondly of their time at LTRC. For Gavin, one standout memory is sharing an office in the "vintage" building with Doc in his early years. "We had many discussions about work, family, and fun," he recalls. He also values the strong sense of community at LTRC, calling it a "great work family."

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"I knew I wanted to be an engineer as a kid. I loved taking things apart to see how they worked."

—Gavin Gautreau,

Pictured above at his first job after college—G&E Engineering , 1994.

RESEARCH

Evaluating Geophysical Methods to Improve DOTD Soil Investigations

Chris Mertz and Hend Alyousef setting up electrode cables for an electrical resistivity geophysical test.

Louisiana's transportation projects rely on accurate subsurface data to ensure safe, cost-effective design and construction. Currently, DOTD uses conventional methods like soil borings and cone penetrometer tests (CPTs) to evaluate ground conditions. While reliable, these methods provide information only at discrete locations, leading engineers to interpret what lies between test points.

To address these concerns, the research project "Field Evaluation of Geophysical Applications for DOTD," led by Geotechnical Research Engineer Nicholas Ferguson, P.E., is exploring whether geophysical technologies can help fill those gaps and improve how DOTD characterizes subsurface conditions. The study focuses on three non-invasive methods: electrical resistivity, seismic refraction, and cross-hole tomography. These tools have the potential to provide more continuous, site-wide data.

"By utilizing these tools in addition to standard practices, the department can provide a more detailed pre-construction characterization of geotechnical conditions."

—Nick Ferguson

The team will review existing literature, develop testing plans for each method, collect and analyze field data, and assess each approach based on cost, equipment needs, and feasibility. The goal is to determine whether these technologies improve confidence in subsurface assessments and whether they should be implemented in-house or through consultants.

"By utilizing these tools in addition to standard practices," Ferguson explains, "the department can provide a more detailed pre-construction characterization of geotechnical conditions."

Potential benefits include better understanding of the soil between test points, identification of hidden underground features, enhanced quality assurance, improved access in tight areas, and reduced construction risks and costs. The research will conclude with a report recommending the most practical and effective geophysical methods for use in Louisiana.

Read Project Capsule 23-2GT online: *www.ltrc.lsu.edu/publications.html*

RESEARCH

Understanding Site Variability in Geotechnical Engineering

In geotechnical engineering, natural materials like soil and rock vary widely—even within the same site. This variability can stem from geologic processes, testing equipment, operator differences, and how data is interpreted. If not properly considered, it can lead to unsafe underdesign or overly expensive overdesign.

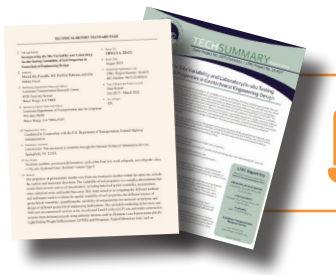
This research, titled "Incorporating the Site Variability and Laboratory/In-situ Testing Variability of Soil Properties in Geotechnical Engineering Design," was led by Murad Abu-Farsakh, Ph.D., P.E., and focused on identifying and measuring sources of soil variability. The team evaluated how equipment and operator differences affect soil property measurements and explored how soil strength and stiffness vary across different sites.

Field tests using tools like the Dynamic Cone Penetrometer (DCP), Light Falling Weight Deflectometer (LFWD), and Plate Load Test (PLT) revealed that even standardized procedures can yield variable results—ranging from 1.6% to over 25% in terms of the coefficient of variation (CoV). Lab tests, including triaxial and CBR, showed CoVs ranging from 0.5% to 30%.

To make sense of this variability, researchers used geostatistical tools like semivariograms and Bayesian analysis. These methods allowed them to map site-specific trends and update predictions for design values such as pile capacity and slope stability. For example, Bayesian techniques combined national data with new test results to refine resistance factors for specific sites.

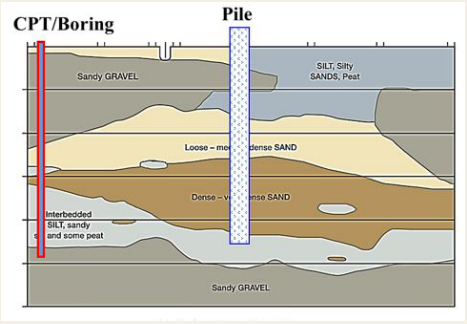
The findings show that when soil variability is clearly understood and integrated into design, engineers can adjust resistance factors more accurately. This leads to safer structures and more efficient use of materials—especially on sites with low variability.

By accounting for how soil properties vary spatially and by test method, engineers can reduce risk and avoid unnecessary costs. This research provides practical tools for doing just that—grounding better design in better data.



Read Final Report or Tech Summary 673 online: *www.ltrc.lsu.edu/publications.html*

Field testing of soil property using LFWD



Spatial variability of soil condition

"Current LRFD guidelines specify constant resistance factors for a project, regardless of the fact that soil properties vary across a project site or along its depth. Research was needed to evaluate site variability, measurement errors, and model transformation bias."

—Dr. Abu-Farsakh

Dr. Cooper's retirement, continued

A broad array of colleagues from LTRC and DOTD Headquarters gathered to remember Dr. Cooper's career and celebrate his retirement on May 28. Friends and partners reflected on Sam's legacy both personally and professionally...

> *When I started working at LTRC, Sam would greet me by name and ask me how I was doing. His gentle and unpretentious way of being in the workplace set a terrific example and a wonderful tone.*

> *I always appreciated Sam's emphasis on surrounding yourself with the right people. That is such an important part of each of our professional journeys.*

> *My favorite memories of Sam aren't tied to any particular grand moments or singular events, but to the quiet consistency of his everyday kindness. His approachable nature and genuine concern for his employees are part of what makes LTRC such a great place to work.*

> *Sam had more than a career; he had a lifetime of showing up, giving his best, and pouring himself into the people around him. He did it all with humility, wisdom, and a quiet strength that didn't ask for recognition, but absolutely deserves it. He gave me a shot- one that changed my life. I say this with every ounce of truth: there is no 'me' today without Sam!*

From the entire team at LTRC, congratulations to Dr. Cooper on a job well done!

Doc reflects on the peaceful work environment and professional relationships he built over the years. He fondly recalls LTRC's holiday parties and team-building events, but what he'll miss most is the meaningful work: "My job was never boring. We helped DOTD solve problems and introduced new tools and technologies with strategic thinking."

Lessons Learned and Advice Given

Gavin plans to build upon the strong connections between LTRC and DOTD Headquarters to align research with the Department's evolving needs. He brings with him a valuable insight: "Some problems work themselves out, but it's better to be proactive to ensure you get the result you want, and it's better for the Department and the taxpayer."

His advice to his younger self? "Hang in there—continue to make good decisions, and good things will develop. Be a sponge and learn more from everything and everyone."

Doc from the early 2000s sitting in his LTRC office.

Doc, reflecting on his career, emphasizes the importance of balance and health. To his younger self, he would advise, "Always improve self-communication skills and build a strong team for better collaboration and implementation."

Looking Ahead

As Gavin settles into his new role, his first big goal is ensuring a smooth transition. "I plan to visit with staff and get updates on current projects so I can help facilitate their success." When asked for one word to describe how he feels about the future, his answer is clear: Prepared. "As an Eagle Scout, I always think about the motto 'Be Prepared,'" he explains.

For Doc, retirement marks a new beginning filled with family time, especially with his grandchildren. His one word to sum up his LTRC experience? Colorful.

As one chapter ends and another begins, LTRC's Pavement and Geotechnical Research team moves forward on a strong foundation. Doc leaves a legacy of problem-solving and innovation, and Gavin steps in ready to build on that momentum with experience, energy, and a clear vision for what's next.

> *"My job was never boring. We helped DOTD solve problems and introduced new tools and technologies with strategic thinking."*
>
> —Doc Zhang

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