

TTI's SEC Lab:
A Quarter Century of
Product-Testing Excellence

TTI Enhances Its Proving
Ground with New Research
Facilities

Visibility Research Laboratory:
One-of-a-Kind Facility Changing
with the Times

TEXAS TRANSPORTATION Researcher

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The World Is Our Laboratory



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ON THE COVER: TTI's facilities bring real-world conditions into controlled laboratory environments to test theories and equipment performance, teach young engineers reliable research techniques, and deliver cost-effective results for sponsors.



3

TTI Facilities Provide Reliable, Real-World Results for Sponsors

4

TTI's SEC Lab: A Quarter Century of Product-Testing Excellence

6

Research in All Kinds of Weather: TTI's Environmental and Emissions Research Facility

8

TTI Upgrades Driving Simulator to Produce More Reliable Results

9

TTI's High-Bay Structural Testing Facility

10

TTI Enhances Its Proving Ground with New Research Facilities

12

McNew Laboratory: Venerable Roadway Material Testing Lab Remains the Go-To Place for Pavement Evaluation

14

Visibility Research Laboratory: One-of-a-Kind Facility Changes with the Times

16

TTI Hosts Accelerate Texas Inaugural Meeting

17

TTI Advisory Council

18

TTI News

20

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TTI Facilities Provide Reliable, Real-World Results for Sponsors



by Dennis Christiansen
Agency Director

A classroom, a roadside, even a cow pasture — you can call any space where a critical thinker tests a theory a laboratory. Any tool, handheld or electronic, can be considered technology when applied to a given task.

But it takes a special kind of laboratory, with the right tools wielded by qualified experts, to conduct critical research. At the Texas A&M Transportation Institute (TTI), we maintain state-of-the-art facilities that cover the spectrum of transportation research. Institute researchers develop and test innovative techniques, as well as new products, technologies and standards. For TTI researchers, providing reliable test results is more than an academic exercise — much more. It's about improving transportation safety for you and your family. It's about achieving greater efficiency in an era of increasingly limited resources.

This issue of the *Texas Transportation Researcher* profiles a number of TTI's research facilities. Our Sediment and Erosion Control Laboratory, as well as our Environmental and Emissions Research Facility, rigorously tests products and technologies to evaluate how they'll perform under realistic conditions. At TTI's nationally certified Proving Ground, we've added to our renowned core competencies for roadside safety research with the capacity to test tolling and connected-vehicle technologies. Our materials and pavements facility — which houses labs accredited by the American Association of State Highway and

For TTI researchers, providing reliable test results is more than an academic exercise — much more. It's about improving transportation safety for you and your family. It's about achieving greater efficiency in an era of increasingly limited resources.

Transportation Officials — provides state-of-the-practice assessments for sponsors. Researchers at TTI's Visibility Research Laboratory objectively test retroreflective technologies and evaluate, subjectively, how humans interact with those technologies in different weather conditions, such as fog and rain. And speaking of human factors, our recently updated driving simulator helps researchers assess driver behavior in an environment that's as close to the real world as simulation can get.

TTI's facilities are living laboratories. Many of our research staff hold teaching appointments with Texas A&M University, while others support graduate and undergraduate student projects. Thanks to TTI's extensive array of labs and equipment, our faculty researchers can supplement the textbook in the classroom with valuable, hands-on experience for

their undergraduate and graduate students. And those students never have to leave campus. Strong relationships with Texas A&M's Dwight Look College of Engineering — which operates TTI's High-Bay Structural Testing Facility, also profiled in this issue — make this possible.

At TTI, we bring the world into the laboratory for both students and sponsors, whether it's by testing how pavement performs under the rigors of a Texas summer sun or determining the safety risks associated with a spring rain obscuring signs along the roadside. Armed with the Institute's research findings, our sponsors can make better decisions about how to improve the transportation system by making it safer, more efficient and more cost effective. That's the value TTI research returns to the real world from the laboratory. ■





TTI's Environment and Planning Program operates the 19-acre, full-scale, indoor/outdoor facility at Texas A&M University's Riverside Campus located in Bryan, Texas.

A Quarter Century of Product-Testing Excellence

SINCE 1989, the Texas A&M Transportation Institute's (TTI's) Sediment and Erosion Control Laboratory (SEC Lab) has generated an Approved Products List (APL) for the Texas Department of Transportation's (TxDOT's) use of erosion-control products. Some 25 years later, the SEC Lab continues to be the nation's premier facility for performance evaluation of roadside environment management.

TTI's Environment and Planning Program operates the 19-acre, full-scale, indoor/outdoor facility at Texas A&M University's Riverside Campus located in Bryan, Texas. Demand for the facility has steadily grown, leading to a 2013 expansion to meet the transportation industry's research needs. The SEC Lab is highly versatile and houses state-of-the-art equipment, including indoor rainfall simulators, a climate-controlled greenhouse, a storm water quality structure, an index testing laboratory and multiple-channel test flumes.

The SEC Lab's research and product performance evaluation programs focus on maintaining environmental quality and meeting regulatory compliance. A commitment to quality drives its reputation of excellence. TxDOT's sediment and erosion-control product evaluation program seeks

"With increased environmental regulations, TxDOT has to ensure that the best products are being used on roadway projects to minimize environmental concerns and to reduce the risk of product failure."

Jett McFalls, TTI SEC Lab manager

to establish and maintain an APL consisting of the best products that meet TxDOT's performance requirements.

"With increased environmental regulations, TxDOT has to ensure that the best products are being used on roadway



The SEC Lab's research and product performance evaluation programs focus on maintaining environmental quality and meeting regulatory compliance.



The SEC Lab is the only facility in the nation doing work on this scale.

projects to minimize environmental concerns and to reduce the risk of product failure,” says TTI Assistant Research Scientist Jett McFalls, the SEC Lab’s manager. “We’re excited about and prepared for the increased use of the different facilities. The SEC Lab is gaining increased recognition not only by Texas industry leaders, but big groups outside the state as well.”

The SEC Lab is the only facility in the nation doing work on this scale, and McFalls and his staff will continue to provide the transportation industry with a timely, uniform and fair method of product performance evaluation. ■



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TTI to Evaluate Sediment Retention Devices for AASHTO

TTI’s SEC Lab has been selected to conduct performance evaluations of sediment retention devices (SRDs) for an American Association of State Highway and Transportation Officials pilot program. Due to TxDOT’s recent inclusion of performance evaluation requirements for SRDs in its *2014 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*, the SEC Lab now includes SRD performance evaluations as part of its APL. Many state departments of transportation have performance evaluation programs in place for erosion-control products or have adopted the standards of the National Transportation Product Evaluation Program (NTPEP) or other testing programs. However, performance evaluation of SRDs is an emerging field, and Texas is ahead of the curve.

“TTI’s SEC Lab has state-of-the-art equipment, facilities and the qualified personnel required for performing all the test methods and procedures for the NTPEP pilot program,” says Jett McFalls, TTI’s research supervisor on the project. “We are only one of two laboratories selected for this program. We plan to begin evaluations in late June 2015.”

RESEARCH IN ALL KINDS OF WEATHER

TTI's Environmental and Emissions Research Facility



"Right now we have a company here testing its laser-cutting machine, which is used by various manufacturers in the transportation field. The machine is very large and weighs 12 tons. The company wants to make sure it continues to operate at extreme temperatures. The chamber is perfect for this type of test."

*Jeremy Johnson,
TTI research specialist*

TRUMPF employees David Krah and Steve Ennis prepare the laser-cutting machine for testing inside TTI's Environmental and Emissions Research Facility.

When researchers at the Texas A&M Transportation Institute (TTI) need a place to test vehicle emissions, they don't have to go far — one of the largest drive-in environmental chambers in the United States is housed at Texas A&M University's Riverside Campus. But the Environmental and Emissions Research Facility (EERF) does more than just emissions testing. Its large size and temperature-controlled environment make possible many other types of research projects as well.

"Right now we have a company here testing its laser-cutting machine, which is used by various manufacturers in the transportation field," says TTI Research Specialist Jeremy Johnson, the facility's manager. "The machine is very large and weighs 12 tons. The company wants to make sure it continues to operate at extreme temperatures. The chamber is perfect for this type of test."

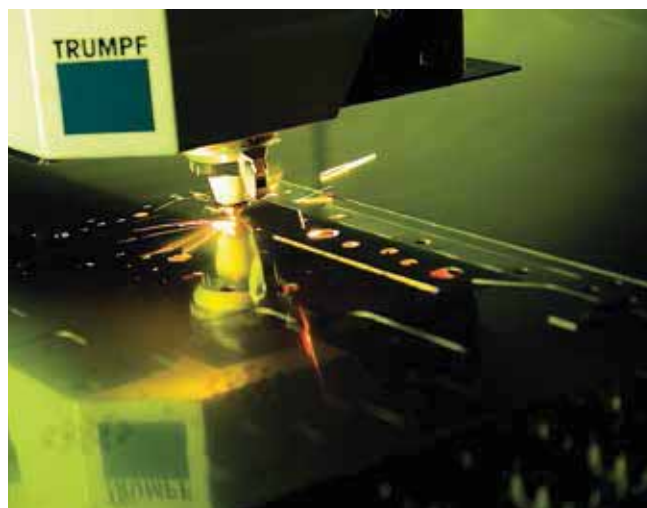
TTI opened the EERF in Bryan, Texas, in January 2010. The development of the facility resulted from competitive grants awarded to TTI from the U.S. Environmental Protection Agency and the Houston Advanced Research Center, with additional funding provided by The Texas A&M University System and TTI.

The 7,500-square-foot facility is the only university-based lab that can conduct tests using a full tractor-trailer rig or a city bus at constant temperatures (ranging from -25°F to +131°F) and a controllable relative humidity of up to 70 percent. Solar loading lights and wind simulator fans help replicate a variety of weather conditions. With the recent addition of a portable dynamometer, tests can simulate various driving speeds and conditions.

"A dynamometer is like a treadmill for a car," says Johnson. "It allows us to test vehicles for emissions — and also battery performance for electric vehicles — as they operate at different ambient conditions."

The lab's temperature-controlled environment has also allowed researchers to test full-size trailers, including refrigerator units. During one test, researchers put 355 temperature probes in a 53-foot trailer to measure how well a manufacturer's product worked under different temperature extremes.

TTI Environment and Air Quality Division Head Joe Zietsman says the facility was envisioned because the U.S. Environmental Protection Agency was interested in evaluating the performance of auxiliary power units used with long-haul trucks. The facility has now proved itself as



The TRUMPF laser-cutting machine, the TruLaser 2030, cuts a test pattern out of a sheet of stainless steel.

the go-to facility for testing a broad range of vehicles and equipment under environmentally controlled conditions.

In August 2014, TTI Associate Research Scientist Laura Higgins used the EERF for her National Cooperative Highway Research Program project on emergency exit tunnels.

"One of our biggest challenges in designing the research study was creating a simulated tunnel emergency without an actual tunnel structure to work with," says Higgins. "The EERF was perfect because of its size and the fact that it has acoustics that are slightly echoing and tunnel-like. Being able to control light conditions and temperature was also very beneficial." ■



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TTI Upgrades Driving Simulator to Produce More Reliable Results



TTI researchers use a simulated driving environment to measure driver reactions behind the wheel.

Researchers these days are using computer simulations rather than actual testing environments to evaluate driving behavior. Why?

For the most part, simulations are more cost effective and safer. However, reliably capturing reality in a simulated environment can be challenging.

In an effort to increase the realism of its driving simulator, the Texas A&M Transportation Institute (TTI) recently upgraded equipment to provide a more realistic simulated testing environment. With the improved simulator, researchers expect to see responses more consistent with real-life driving experiences — without the costs or safety issues associated with actual testing environments.

For a number of years TTI has had a driving simulator that didn't require actually placing participants in a car. However, Mike Manser, manager of TTI's Human Factors Program, said the outdated system looked more like a gaming setup and was unrealistic.

The new simulator more closely resembles the inside of a car and

includes a regular vehicle seat, real pedals and three large monitors mounted on a frame to create a wide field of view for test subjects. With the addition of speakers, as well as a programmable dashboard to relay speedometer statistics and other information, the simulator creates a more realistic driving experience.

Other features include an eye tracker and software that researchers can use to create research scenarios involving automated vehicles. Smaller touch-screen displays complement the larger displays' ability to convey connected vehicle information to drivers.

In the coming year, researchers will assess how effective systems are in providing feedback to drivers under a research grant from KPMG. This is just one of a number of areas TTI is

"When you look at research across the spectrum, you need a variety of tools to answer different kinds of research questions. Our upgraded simulator gives us one of those tools."

*Mike Manser,
TTI senior research scientist and
TTI Human Factors Program manager*

studying to advance our knowledge of human-technology interaction.

"For example, we anticipate using the haptic steering wheel to provide force feedback [vibrations and motion to enhance the simulation]," Manser says. "We can provide unique information and warnings to drivers either through that steering wheel or through the small display screens."

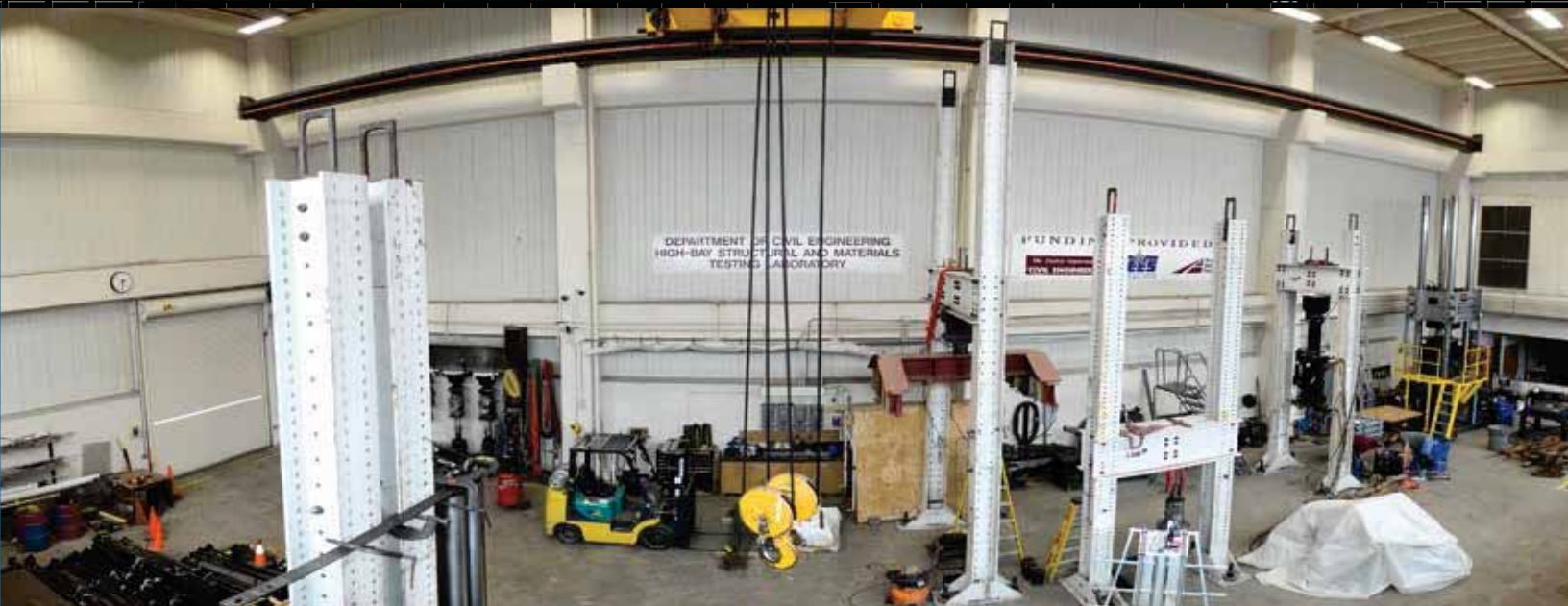
This modernized, more flexible simulator can now adapt to new research efforts to accommodate a wider range of research topics than could the older simulator.

"When you look at research across the spectrum, you need a variety of tools to answer different kinds of research questions," Manser explains. "Our upgraded simulator gives us one of those tools." ■



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TTI's High-Bay Structural Testing Facility Brings Real-World Conditions to a Lab Setting



TTI's High-Bay Lab enables researchers to perform full-scale tests on structural systems using different types of loads that simulate real-world conditions.

Standing outside of the Wisenbaker Engineering Building on the Texas A&M University campus, you'd never guess inside is one of the largest, most modern and best-equipped facilities of its kind — the High-Bay Structural Testing Facility.

The High-Bay Lab enables researchers to perform full-scale tests on structural systems using different types of loads that simulate real-world conditions. With a ceiling height of 40 feet and a heavily reinforced floor, this 4,000-square-foot laboratory accommodates a variety of structural samples simultaneously.

Lab Director Peter Keating explains: "The only way to see the true behavior of structures is to do full-scale tests. That's what this lab allows us to do."

The lab, operated by the Texas A&M University Zachry Department of

Civil Engineering, has a strong floor consisting of three 12-foot-deep box girders covered with a 2-foot-thick heavily reinforced concrete slab for large-scale testing. Tie-down holes throughout the floor are on 3-foot centers. Each tie-down hole can withstand a service load of 100 kips exerted either upward or downward. (A kip is a non-SI unit that equals 1,000 pounds of force.) The area has temperature and humidity controls, and a 20-ton overhead crane.

When Texas A&M Transportation Institute (TTI) Assistant Research Engineer Joe Bracci was looking for

a way to test how bridges with alkali-silica reaction (ASR) cracking would hold up in an overloaded state, the High-Bay Lab was the obvious choice.

"It [ASR] was an issue found in bridges in Texas. We wanted to determine if the bridges were still safe under a failure load — for instance, a hurricane evacuation," said Bracci. "The High-Bay Lab has the capacity for testing those types of loads."

Bridges are just one of many items tested at the facility — pipes, scaffolding and even a Civil War-era ship, the CSS *Georgia*, have been tested there.

"We ran tests to determine how to safely pick up sections of the CSS *Georgia* located in the Savannah River without damaging them," says Keating. "They've been there for 150 years, so they're very fragile." ■

"The only way to see the true behavior of structures is to do full-scale tests. That's what this lab allows us to do."

*Peter Keating,
civil engineering associate professor and High-Bay Lab director*



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TTI Enhances Its Proving Ground with New Research Facilities

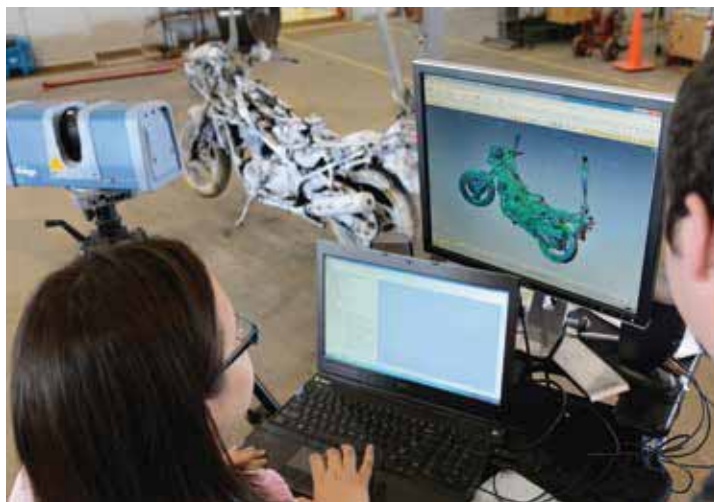
The National Traffic and Motor Vehicle Safety Act of 1966 introduced a new concept to motorist safety: the forgiving roadside. A year before that act was implemented, engineers at the Texas A&M Transportation Institute's (TTI's) Proving Ground Research Facility developed and crash-tested breakaway sign supports — just one example of the new philosophy then being put into practice. The TTI-tested sign supports quickly became a staple along the nation's new Interstate Highway System.

“The breakaway system allowed a post to safely break away from its base when struck, preventing motorists from being killed or seriously injured in many cases,” explains Lance Bullard, head of TTI's Roadside Safety and Physical Security Division. Numerous other safety devices were developed and tested, including crash cushions, concrete

barriers, guardrails and cable barriers. Today, safety devices certified by TTI are on numerous roadways in the nation.

In 2001, TTI began crash-testing and designing bollards and other perimeter security devices for the U.S. State Department for use at embassies, consulates and military bases around the world. And now, researchers are preparing for low-speed bollard crash testing following a recently approved standard designed to improve storefront safety.

Located on 2,000 acres with 3.5 miles of paved runways, the Proving Ground has hosted thousands of full-scale crash tests. The facility is also home to numerous other permanent programs and equipment that, taken together, ensure our nation's roadways will continue to be safer. ■



The Center for Transportation Computational Mechanics

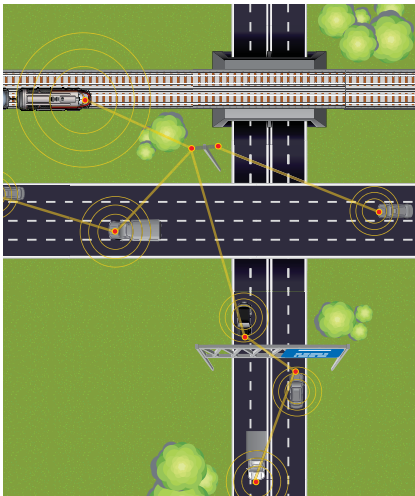
Using sophisticated computer simulation and impact analysis software, researchers can predict the performance of roadside safety and perimeter security devices before an expensive, full-scale crash test is conducted. Researchers use a 3-D scanning device, called a FARO® Edge, to scan each individual vehicle part. “Because of our simulation capabilities, we are able to do a lot more than just crash testing,” Bullard explains. “We can create a virtual connected vehicle and infrastructure test bed without having to actually build it first — which saves money, time and resources.” ■



Toll Gantry

Congress has required that by 2016 the tolling industry develop interoperability standards allowing locally issued toll tags to work anywhere in the nation. “We’re testing a possible solution from two equipment manufacturers,” explains TTI Associate Research Scientist Roberto Macias. “We’re using the radio-frequency identification toll tags from various agencies and determining if the tested products can read them and if the vendors can be tied together.”

TTI conducts its testing by sending vehicles equipped with various toll tags through a toll gantry equipped with the transponders from the manufacturers. Macias says the project is halfway completed, with phase two beginning this summer. ■



Connected Transportation Initiative

TTI’s Connected Transportation Initiative, which covers all modes of transportation, is paving the way toward a future where cars can reliably communicate with each other and the roadside infrastructure.

“We’ve been selected to conduct several large, innovative Texas Department of Transportation [TxDOT] projects, and we’re working on others with Battelle Memorial Institute and the University of Michigan,” says TTI Associate Research Engineer Rajat Rajbhandari, who heads up the connected vehicle test bed.

TTI’s research will examine ways to solve the problem of wrong-way driving, as well as investigate the potential for truck platooning, which enables connected commercial vehicles to safely, efficiently travel close together to save time and energy. Using advanced technologies, researchers are also exploring opportunities to enhance transit, bicycle and pedestrian safety. ■



Vehicle Detection Testing

To improve reliability and accuracy, TTI researchers are testing new vehicle-detection products for use at signalized

intersections. Many of these new products have not been fully vetted, and TTI offers the space to replicate a large, high-speed urban intersection. The new types of vehicle-detection devices are designed to be more accurate, less costly and less intrusive to the motoring public.

“The Proving Ground allows us to test the new products in all kinds of weather conditions, day and night,” says TTI Research Engineer Dan Middleton, who’s conducting the research on behalf of TxDOT. ■



Adaptive Vehicle Control

Individuals with physical disabilities need special equipment to safely operate their vehicles. Working with the Texas Department of Assistive and Rehabilitative Services, TTI makes sure the equipment is installed properly, the vehicle is structurally sound, and safety is not compromised due to modifications of the accelerator, brake and other vehicle components. ■



The Central/Western Field Test Center

Since 1971, TTI has evaluated and calibrated pavement friction trailers (skid rigs) used by 25 state departments of transportation. The center ensures that the skid rigs, which test the friction characteristics of pavements, are working properly and comply with American Society for Testing and Materials standards. ■



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A TTI researcher instruments an asphalt specimen to measure its response under simulated traffic loading.

Venerable Roadway Material Testing Lab Remains the Go-To Place for Pavement Evaluation

The bottom line for the driving public is safer, smoother rides on better roads at a lower cost. The facilities at the Texas A&M Transportation Institute's (TTI's) McNew Laboratory allow sponsors to access some of the most advanced, state-of-the-art equipment to help achieve those goals.

Located behind the Civil Engineering/TTI Building at Texas A&M University, the McNew Lab includes a basement prep area, ground-floor testing facilities and first-floor evaluation area. Recently, the 50+-year-old laboratory was modernized to optimize space and upgrade equipment.

“One of the things I like to promote with our lab is that we’re able to test what’s currently the state of the practice, as well as help develop new test procedures that could become the next industry standards,” says TTI Associate Research Scientist Stephen Sebesta.

The basement of the facility is used for rock-and-dirt sample preparation. Technicians from TTI's Materials and Pavements Division travel to locations around the state to gather samples.

“The basement is referred to as the works-in-progress area and is the least technical of the entire facility,” explains TTI Senior Research Engineer Tom Scullion. Scullion is a Regents Fellow and manages the Flexible Pavement

Program. “It’s used to process bulk materials, and there is some sample preparation for soil and base materials. So it’s kind of where everything begins.”

The ground floor houses 16 environmental chambers that, regardless of the weather outdoors, can condition pavement samples to temperatures as high as 140°F; alternatively, researchers can drop a sample’s core temperature to a bone-chilling -20°F. Researchers can adjust the ambient humidity from a dry 25 percent to a moist 100 percent humidity.

“Basically the idea is that the walk-in chambers can simulate any type of operational environment,” says Sebesta.

The Asphalt Binder Research Laboratory — run by TTI Research Engineer Fujie Zhou — is also located on the ground floor. This lab performs advanced chemistry research on asphalt binders to help determine the binder’s impact on the performance of asphalt mixtures.



Top: Bulk materials processed in the McNew Lab become reconstituted to produce homogenous test specimens.

Bottom: Chemistry and petrography capabilities allow researchers to peer inside pavement materials.

“We can perform tests known as rheological characterization, which tests how the asphalt binder deforms or moves under different environmental conditions and stress states, and we use the chemical analysis to help explain our observations” says Sebesta.

The Bituminous Mixture Molding Laboratory houses several pieces of equipment unique to Texas. One example is a device that makes foamed asphalt samples for testing. Foamed asphalt has shown great promise as a cost-effective alternative for upgrading roadways impacted by energy-sector developments. The lab also houses a linear kneading compactor, which can produce 22-by-22-inch slab samples using a rolling wheel compactor. Researchers can conduct skid resistance assessments and take polishing and sound measurements with the slab samples.

“Our goal is to develop asphalt mixes that optimize friction and decrease roadway noise,” says TTI Research Engineer Cindy Estakhri, who manages TTI’s Recyclable Materials Program. “This equipment allows us to conduct testing in a controlled environment to help us achieve that goal.”

Moving up to the top floor, this area is used for performance tests.

“The top floor is the area where we run advanced performance tests on the samples made on the lower floors. Before recommending samples for field use, they must perform well in the lab,” says Sebesta. “A lot of the performance tests

that we develop become standard in the field with departments of transportation across the country.”

Several performance testing labs are located on this floor, and researchers use a wide variety of testing equipment that includes:

- A Texas overlay tester,
- A Hamburg Wheel Tracker,
- An asphalt pavement analyzer,
- A disk-shaped compact tension and semi-circular bending machine, and
- Universal test machines.

“We’re trying to address some of the major problems the Texas Department of Transportation [TxDOT] is having right now,” states Scullion. “One of them involves the testing and strengthening of rural roadways in areas where energy development has been at its peak. We’re here to support TxDOT’s research program, and the McNew Lab is a very well-equipped, cutting-edge facility to help accomplish that goal.” ■



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Evaluating the use of lasers to assess retroreflective infrastructure condition.

Visibility Research Laboratory

One-of-a-Kind Facility Changes with the Times

IN 2009, when the Texas A&M Transportation Institute (TTI) added a Visibility Research Laboratory (VRL) to its collection of world-class research facilities, TTI Senior Research Engineer Paul Carlson had a vision for what the lab could accomplish.

“Before the lab opened, when we needed to take controlled photometric measurements in order to tie those into human performance, we would do it outside at Texas A&M University’s Riverside Campus between midnight and 4 a.m.,” says Carlson, head of TTI’s Operations and Design Division. “Obviously these weren’t ideal conditions since testing equipment gets exposed to the elements or the weather might not cooperate. We’re able to conduct more

specialized photometric testing with specialized equipment unavailable in the public domain elsewhere in the country, so far as I know.”

The laboratory is located in TTI’s State Headquarters and Research Building and features a 125-foot-long corridor used to test technologies designed to provide nighttime visibility for highway drivers and other road users. The testing started almost exclusively with retroreflective technologies, but now the VRL is testing lighting technologies and other more recent technologies being considered for the transportation industry.

For the last 50 years, TTI researchers have conducted full-scale, closed-course nighttime driving studies at the Riverside Campus. The outdoor facility

allows for static and dynamic visibility and human factors research at speeds up to 70 mph. The VRL complements this full-scale testing facility.

The VRL allows researchers to evaluate existing models related to photometric measurements and standards related to retroreflectivity and lighting. With the capabilities of the VRL, research staff can take existing human factors data related to retroreflective materials collected over the years and compare them to how new materials perform. This allows researchers to more efficiently decide what new materials need to be evaluated in human factors studies. The staff has been able to develop new photometric models related to overhead guide signs with respect to different types of lighting and

retroreflective materials using data collected at the Riverside Campus and evaluated in the VRL.

Carlson and TTI Associate Research Engineer Adam Pike developed American Society for Testing and Materials E-2832 — an improved continuous wetting test method for pavement marking measurements with handheld pavement marking retroreflectometers — using the VRL. During the development of this new method, they designed and tested a portable rain simulator that is becoming an industry standard. This work has helped TTI develop a unique platform in the VRL that Pike and Carlson will use to continue expanding the state of the practice with respect to wet nighttime measurements of pavement markings.

“The lab gives us the ability to test some of our field equipment in a controlled environment to make sure everything is operating properly before being tested in the field,” says Pike. “And because it’s indoors, we don’t have to wait for good weather.”

Since the lab opened, researchers have introduced new testing and measurement equipment, which has increased the scope and types of projects TTI conducts. One recently acquired piece of testing equipment is a remote-sensing technology using light detection and ranging that can sense physical highway infrastructure using 360-degree lasers. The researchers are analyzing the reflected light to determine if it can be used to assess the condition (retroreflectivity) of pavement markings and other retroreflective devices. The equipment will undergo testing in the lab before being used in the field and will be used in a Texas Department of Transportation-sponsored project.

“When the lab first opened, we were doing a lot of quality assurance/quality control tasks, but as we’ve evolved, we’re working more with private industry and public agencies to evaluate and perform research

“The lab gives us the ability to test some of our field equipment in a controlled environment to make sure everything is operating properly before being tested in the field. And because it’s indoors, we don’t have to wait for good weather.”

*Adam Pike,
TTI associate research engineer*

and development for new products,” Carlson explains. “LED technologies have also advanced in the last five years, and we’ve had to adapt to keep up with those changes.”

The Federal Aviation Administration is sponsoring a current project to develop a pavement marking inspection system using a smartphone. The photometric range in the VRL allows researchers to examine the effectiveness of runway pavement markings by simulating different pilot vantage points depending on the type of aircraft they might be flying.

Another ongoing project is testing the photoluminescence of bike lanes coated with skid-resistant material. According to Carlson, the visibility properties of bike lanes are reduced when the lanes are coated with this type of material. The researchers hope to find a happy medium of sorts with skid-resistant bike lanes that also meet visibility standards at night.



Testing new sensors and technologies in the Visibility Research Laboratory.

Researchers are also looking forward to the future by working on advanced pavement marking systems for autonomous vehicles. Autonomous vehicles use pavement marking detection systems to assist vehicles with maintaining their appropriate position on a roadway. Recently, TTI evaluated several different types of pavement markings under wet and dry nighttime conditions to assess whether specific pavement marking properties can improve pavement marking detection by autonomous vehicles. They included nighttime glare conditions and different pavement types.

“This lab has created research opportunities that we may have otherwise not had,” acknowledges Carlson. “It’s been a great asset for our sponsors and the Institute.”

More information about the Visibility Research Laboratory can be found on its website at <http://tti.tamu.edu/group/visibility/>. ■



For more information, contact Paul Carlson at (979) 847-9272 or p-carlson@tti.tamu.edu, or Jeff Miles at (979) 845-9880 or j-miles@tti.tamu.edu, or Adam Pike at (979) 862-4591 or a-pike@tti.tamu.edu.



TTI Hosts Accelerate Texas Inaugural Meeting

The Texas A&M Transportation Institute

(TTI) hosted the inaugural meeting of Accelerate Texas, a center founded by TTI and the Texas Department of Transportation (TxDOT) to focus on economic development to help position Texas as a leader in the commercialization of connected and automated vehicle (CV/AV) technologies.

On March 22 and 23, representatives from 19 private companies and public agencies convened in Austin to discuss issues and opportunities in CV/AV technologies, projects, policies, and the developing CV/AV ecosystem in Texas.

“We want everyone here today to be a part of developing CV/AV technologies in Texas and lead us into this exciting new future,” said Darra Anderson, TxDOT chief strategy and innovation officer, in addressing the meeting participants. “TxDOT is encouraging opportunities for CV/AV infrastructure — both within the state system and regionally.”

“The mission of Accelerate Texas is to research, develop, commercialize and implement CV/AV technologies to enhance the efficiency and safety of our transportation system,” said TTI Associate Agency Director Ed Seymour, who also directs the center. “With our vast transportation infrastructure, we have a unique opportunity to bring

these technologies to Texas and invest in the businesses that are developing them. We appreciate the outstanding contributions of the public- and private-sector participants in the inaugural meeting of Accelerate Texas.”

The meeting participants identified four areas of priority focus and created work groups to make recommendations in the following areas:

- **Communications and data sharing** — defining the data environment and gaps to advance communications and information platforms in Texas for enabling the deployment of CVs/AVs.
- **Procurement** — developing model policies and procedures to guide procurement activities that could expedite the deployment of CV/AV technologies.
- **Road readiness** — assessing transportation agency management and planning strategies for roadway systems and their readiness to support CVs/AVs.
- **Infrastructure standards** — reviewing applicable civil, interoperability and related standards to address the new technologies, devices and materials for deployment in the CV/AV transportation world.

TTI and TxDOT are recruiting additional Accelerate Texas participants as well as opportunities for CV/AV technology development and demonstration/pilot opportunities. ■

Accelerate Texas Inaugural Meeting Participants

BMW
Capital Metropolitan Transit Authority
Central Texas Regional Mobility Authority
City of Austin
Continental
CUBIC
Dallas Area Rapid Transit
Econolite
Harris County Toll Road Authority
Houston METRO
Houston TranStar
Iteris
North Central Texas Council of Governments
North Texas Tollway Authority
NVIDIA
Serco, Inc.
Southwest Research Institute
Texas A&M Transportation Institute
Texas Department of Transportation



For more information, contact **Bob Cuellar** at (512) 407-1132 or r-cuellar@tti.tamu.edu, or **Ed Seymour** at (979) 994-0433 or e-seymour@tti.tamu.edu.

Advancing the Vision

The Texas A&M Transportation Institute (TTI) Advisory Council is comprised of a small group of high-level transportation professionals from across Texas and every sector of the transportation world. The council, which meets annually, offers a tremendous service to the Institute by advising on transportation issues and trends and supporting TTI's research programs and initiatives. TTI profiles several council members in each issue of *Researcher*. ■



Arndt

Jeffrey C. Arndt
President and CEO,
VIA Metropolitan Transit
San Antonio, Texas

Jeffrey Arndt joined VIA in February 2012 as deputy CEO/chief of business support services. His expertise encompasses transit service and capital facility development, training and safety, financial management and planning, labor relations, special event transit/traffic management, and transit operations. He previously served in management positions at First Transit, and Parsons Brinckerhoff and Houston METRO for 25 years, achieving the position of senior vice president of operations/chief operating officer. Arndt also spent five years as a research scientist/research specialist at TTI.

Arndt serves on the American Public Transportation Association Bus Safety Committee and on the Board of Directors for Centro San Antonio, the Texas Diversity Council, the South West Transit Association and the San Antonio Chamber of Commerce. ■



Autenrieth

Robin L. Autenrieth
Department Head, Zachry Department
of Civil Engineering
Texas A&M University
College Station, Texas

Robin Autenrieth has been department head of the Zachry Department of Civil Engineering in the Dwight Look College of Engineering at Texas A&M University since April 2013. She has a joint appointment in both the Department of Civil Engineering and the Department of Environmental and Occupational Health at the Texas A&M Health Science Center School of Public Health. She joined Texas A&M in 1986 as an assistant professor and has served the university in numerous positions, including senior associate dean for academic affairs.

The Zachry Department of Civil Engineering is ranked eighth (undergraduate) and ninth (graduate) among all civil engineering programs at U.S. public institutions. With more than 60 faculty, nearly 1,000 undergraduate students and over 400 graduate students, the department is the largest civil engineering program in the country. ■



Slagel

Gary Slagel
President and CEO,
CapitalSoft, Inc.
Richardson, Texas

Gary Slagel is co-founder of CapitalSoft and has been president and CEO since its inception in 1999. He is responsible for the operations of the company, which is one of the leading providers of enterprise software for efficiently managing capital programs for the public- and private-sector construction markets. For 17 years, Slagel held numerous leadership positions at Texas Instruments in Dallas.

As mayor of Richardson, Texas, from 1991 through 2011, he was instrumental in the development of the Richardson Telecom Corridor, which is home to more than 600 technology companies. He serves on the board of directors for Dallas Area Rapid Transit and on the Regional Transportation Council. He also has served as president of the North Central Texas Council of Governments. ■

Former TTI Research Associate Becomes NTSB Member



Dinh-Zarr

A former TTI research associate has been sworn in as the newest member of the National Transportation Safety Board

(NTSB). T. Bella Dinh-Zarr, who worked at TTI from 1997 to 2000, was sworn in March 23 following her presidential nomination and congressional approval. Dinh-Zarr was then designated as vice chair of NTSB by Pres. Barack Obama.

Following her employment at TTI, Dinh-Zarr — a longtime advocate of transportation safety — worked for the U.S. Centers for Disease Control and Prevention, the National Highway Traffic Safety Administration and the American Automobile Association. Most recently she was the North American director of the Make Roads Safe Campaign for Global Road Safety and the director of road safety at the FIA Foundation.

"I feel privileged to work on this agency's noble mission of keeping people safe in every mode of transportation," Dinh-Zarr said following the NTSB swearing-in ceremony. "Working together and using sound science, we can prevent injuries and deaths, now and for future generations." ■

For more information about TTI News, contact **Rick Davenport** at (979) 862-3763 or r-davenport@tti.tamu.edu.

TTI Receives AAPT's W.J. Emmons Award

Members of TTI's Flexible Pavements Division were honored with a best paper award by the Association of Asphalt Paving Technologists (AAPT) during its annual meeting in March.

TTI Research Engineer Fujie Zhou, Associate Research Engineer Sheng Hu and Senior Research Engineer Tom Scullion received AAPT's W.J. Emmons Award for their paper, "Balanced RAP/RAS Mix Design System for Project-Specific Conditions." The prestigious national award was initiated by AAPT in 1949. The association was founded in 1924 and has 800 members worldwide.

"This is a great honor for me to receive this award, but it's truly a team effort," says Zhou, who presented the paper at the annual meeting. Zhou and his coauthors also received the Emmons Award in 2010. The paper was published, along with the other annual meeting papers, in the *AAPT Annual Journal*. ■



TTI Research Engineer Fujie Zhou (left) receives the W.J. Emmons Award from AAPT President Brian Prowell.

Increased Funding, Greater Reach for TDS Program

As part of its annual summit May 17–19, TTI's Teens in the Driver Seat® (TDS) program announced that an additional \$470,000 in total grant funding from State Farm will help TDS reach 100 new schools (and 100,000 additional teen drivers) in 35 states this year.

"Our unique, shared approach is to positively influence teens to be safer drivers, rather than try to scare compliance into them," explains TDS Program Manager Russell Henk. "Our commitment to this strategy now for more than a decade [with TDS] is consistently producing positive results."

Began in 2002, TDS promotes awareness of the top five dangers of teen driving (e.g., driving at night) and uses positive peer pressure to encourage safer driving behaviors among teens. With the program's resources and staff support, high schools undertake a variety of grassroots outreach activities throughout the year in their schools and communities to help create a traffic safety culture. For the past seven years, State Farm has provided \$100,000 annually to help TDS achieve its goals.

"State Farm and TTI are both national leaders in what they do, and by working together they will continue to make our roadways safer for all drivers and passengers," said Texas A&M University System Chancellor John Sharp. "This partnership exemplifies the commitment to public service that is central to the mission of the A&M System." ■



Texas A&M University System Chancellor John Sharp speaking at the Teens in the Driver Seat Summit in San Antonio.

Kyle Field Gameday Experience Earns State Award

TTI and Texas A&M University Transportation Services recently received the Award of Excellence for Parking Program of the Year from the Texas Parking and Transportation Association for their work on the Texas A&M University Gameday Experience 2014.

With the renovation and expansion of Texas A&M University's Kyle Field stadium and subsequent increase in attendance and traffic, university officials recognized the need for close coordination among local police departments, city and county officials, university departments, the Bryan-College Station Chamber of Commerce, and the Convention and Visitors Bureau.

"Aggie fans deserve the best possible experience when they come out to support our student athletes," says Texas A&M University System Chancellor John Sharp. "Ensuring that great experience in the midst of an unprecedented stadium expansion has been no small task, but this award demonstrates how our team of professionals is exceeding some very high expectations."

Improvements included traffic and bus routing changes, better signalization and contraflow lanes, safer pedestrian paths, pre-paid parking, more efficient entry, and a Destination Aggieland smartphone app to give fans quick access to parking, shuttle and stadium maps and information, traffic conditions, directions to their Kyle Field entry point, and more. ■



TTI Assists DART in Electric Bus Project

Dallas Area Rapid Transit (DART) was recently awarded a \$7.6 million grant for the purchase of seven all-electric Proterra buses and the infrastructure to charge and maintain them. TTI is part of the project team and assisted DART with the grant proposal.

According to TTI Associate Research Scientist John Overman, TTI's role in the project will involve before-and-after analysis of the implementation of the converted fleet and provide an overall picture of how the new electric buses are working, such as how much energy is conserved.

DART was one of 10 agencies selected to receive a total of \$55 million in grants from the Federal Transportation Administration. DART's application was supported by the North Texas congressional delegation. Other project partners include the City of Dallas, Proterra, Cavallo Energy Texas and Downtown Dallas, Inc.

"DART is a leader in converting its fleet to compressed natural gas," says Overman. "This just goes in line with its long-term goals of investing in 21st century transportation solutions like these zero-emission buses." ■

Lukuc Receives SAE Intelligent Transportation Systems Award



Lukuc

Mike Lukuc, manager of TTI's Connected Vehicles and Infrastructure Program, has been honored with the Society of Automotive Engineers (SAE) Delco Electronics Intelligent Transportation Systems Award. The annual award recognizes the impact intelligent transportation systems will have on mobility in the 21st century. Lukuc received the award during the SAE 2015 World Congress held April 21 in Detroit, Mich.

Lukuc has more than 25 years of experience with the automobile industry. While working for the National Highway Traffic Safety Administration, Lukuc managed the \$85 million collaborative crash avoidance research program. ■

TEXAS A&M TRANSPORTATION INSTITUTE

PUBLICATIONS

A full catalog of TTI publications and other products is online at <http://tti.tamu.edu/publications>. You can find the publications by searching for either the title or publication number listed here. Most of these publications are available as free downloads in portable document format (PDF).

Printed, bound versions of these reports are also available through the URL above.

RESEARCH VIDEOS

Access the research topics listed below via the URLs shown.

TTI Enhances Its Proving Ground with New Research Facilities:

<https://vimeo.com/131557369>

Assessing the Effectiveness of Wrong-Way Driving Countermeasures:

<https://vimeo.com/127093778>

TTI's Air Quality Program:

<https://vimeo.com/123978706>

TTI's Flexible Pavements Program:

<https://vimeo.com/118643727>

What Texans Think About Their Transportation System:

<https://vimeo.com/114683447>

Connected Transportation Is Just Up the Road:

<https://vimeo.com/97270483>

TECHNICAL REPORTS

Crash Test and MASH TL-3 Evaluation of the TxDOT Short Radius Guardrail, by Akram Abu-Odeh, **0-6711-1**, April 14, 2015.

Development of Delineator Testing Standard, by Dusty Arrington, **0-6772-1**, March 4, 2015.

Evaluation of Generic and Branded Herbicides: Technical Report, by Jett McFalls, **0-6733-1**, March 31, 2015.

Improving DMS 9210 Requirements for Limestone Rock Asphalt — Final Report, by Cindy Estakhri, **0-6686-2**, March 27, 2015.

Managing the TDM Process: Developing MPO Institutional Capacity — Technical Report, by Karen Lorenzini, **0-6691-1**, April 7, 2015.

Performance of Lap Splices in Large-Scale Column Specimens Affected by ASR and/or DEF — Extension Phase, by Joe Bracci, **0-5722-2**, March 24, 2015.

Rapid Field Detection of Moisture Content for Base and Subgrade: Technical Report, by Stephen Sebesta, **0-6676-2**, March 24, 2015.

Structural Assessment of "D" Regions Affected by Premature Concrete Deterioration: Technical Report, by John Mander, **0-5997-2**, April 10, 2015.

Traffic Control Device Evaluation Program: Technical Report, by Paul Carlson, **9-1001-14-1**, March 31, 2015.

PROJECT SUMMARY REPORTS AND PRODUCTS

Developing a Mixture Based Specification for Flexible Base, by Jon Epps, **0-6621-S**, March 16, 2015.

Evaluation of Design and Construction Issues of Thin HMA Overlays, by Tom Scullion, **0-6742-S**, March 30, 2015.

Improved Nighttime Work Zone Channelization in Confined Urban Projects, by LuAnn Theiss, **0-6781-S**, April 10, 2015.

Lap Splice and Development Length Performance in ASR and/or DEF Damaged Concrete Elements, by Joe Bracci, **0-5722-S**, March 16, 2015.

Project Consistency with Transportation Plans and Air Quality Conformity Workshops: Materials, by Reza Farzaneh, **5-6758-01-P5**, April 8, 2015.

Short Radius MASH TL-3 Guardrail Treatment, by Akram Abu-Odeh, **0-6711-S**, April 7, 2015.

Spread Prestressed Concrete Slab Beam Bridges, by Mary Beth Hueste, **0-6722-S**, April 7, 2015.

Structural Assessment of "D" Regions Affected by Premature Concrete Deterioration, by John Mander, **0-5997-S**, March 30, 2015.

