

ISSUE 5 | WINTER 2018

TRANSPORTATION CONSORTIUM OF SOUTH-CENTRAL STATES (TRAN-SET)

Letter from the Director

Happy Holidays from Tran-SET!

As the holiday season approaches and we begin preparing for travel, home-cooked meals, college football, and spending time with family, I want to sincerely wish everyone a safe and happy holiday! I especially extend this greeting to all Tran-SET staff, Associate Directors, Program Directors, Principal Investigators, and members of the project review committees.

The end of the year is also a time for reflection, reflection of past achievements, successes, personal and professional growth, and of progress. As with each quarterly newsletter, I am proud to report the significant progress that Tran-SET has accomplished. We have finalized and posted the research reports and corresponding datasets for first-cycle projects. We have reviewed, ranked, and selected problem statements for the third cycle of funding, and issued a request for proposal (RFP) for those selected. Third-cycle projects are anticipated to start April 1, 2019.

We have also made great progress in preparing for the **2019 Tran-SET Conference**, including establishing a Steering Committee, Scientific Committee, finalizing the venue, finalizing the hotel accommodations, issuing a call for papers, reviewing the submitted papers, and are currently finalizing the Conference Program and submissions. The Conference is now co-sponsored by the **ASCE Transportation and Development institute (T&DI)**. I am also proud to welcome a new financial sponsor, HVJ Associates. I encourage everyone to visit the Conference **website**; registration is now open!

I also highly encourage you to follow Tran-SET on **LinkedIn, Twitter, and Facebook**. Please also subscribe to our mailing list **here**.

I invite you to read through our Winter 2018 newsletter and learn more about our research, technology transfer, educational, and workforce development activities.

Enjoy!

Marwa Hassan, PhD, PE, M.ASCE
CETF Distinguished Professor; Graduate Coordinator
College of Engineering, Louisiana State University



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About Tran-SET:

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late-November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes."

RESEARCH PROGRAM UPDATES

Research Reports and Datasets for First-Cycle Projects Now Available!

Each Tran-SET project consists of a 12-month technical (research) phase, followed by a 6-month implementation (technology transfer) phase. Tran-SET's first-cycle projects ended their technical phase on May 2018. Their research reports and corresponding datasets have now been finalized and posted! Research reports can be accessed on Tran-SET's **website**. Reports have also been archived, along with the datasets, at **LSU**

Digital Commons. Tran-SET encourages researchers and practitioners alike to view the reports, and perhaps most importantly, to download the publicly available datasets, which can be of long-standing value to the research community.

Tran-SET will continue to disseminate the reports in the upcoming weeks; don't miss a report by subscribing to our mailing list **here!**

Project Highlights for Second-Cycle Projects Coming Soon

Our second-cycle research projects, awarded in March 2018, are beginning to show promising preliminary results. This has spurred Tran-SET to create updated fact sheets, or *Project Highlights*,

for all of our 35 ongoing projects. The *Project Highlights* are currently being finalized and estimated to be posted on Tran-SET's **website** by the end of December.

Selected Problem Statements for Request for Proposal (RFP)

Tran-SET issued a call for problem statements (July 2018) for their third cycle of research projects. A total of 74 problem statements were received from 15 institutions (August 2018). The problem statements have been reviewed and ranked by regional leaders and subject matter experts (October 2018). The most highly ranked problem statements were then chosen to be included in Tran-SET's third-cycle program (November 2018). Submitters of the chosen problem statements were contacted directly for a request for proposal (RFP). One problem statement con-

tains an open RFP **Evaluation of Connections Between Light Rail Link Terminals Between New Orleans and Baton Rouge Public Transportation Systems**. Proposals are due January 31, 2019 with an estimated award date of April 1, 2019. Please "stay tuned" as additional information regarding these projects are forthcoming.

Interested parties can still submit problem statements as Tran-SET holds a year-round, open solicitation. Submitted problem statements will be considered for the fourth cycle. Please see our **website** for more information and to submit.

RESEARCH IN PROGRESS: HIGHLIGHTS



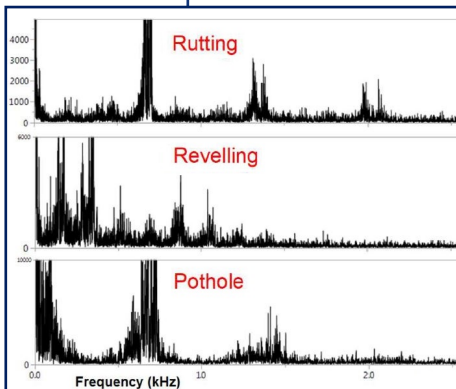
Preserving Existing Transportation Systems

Decision-Making Tool for Road Preventive Maintenance Using Vehicle Vibration Data

Dr. Jing Du - Texas A&M University; Dr. Chao Wang - Louisiana State University

Maintaining America's aging transportation infrastructure is a significant issue, especially due to limited funding. The most cost-effective strategy to improve these conditions is through preventive maintenance. As such, decision makers must be able to identify critical sections of the infrastructure, predict the temporal deterioration of each section, and ultimately distribute limited resources in a holistic way to optimize the long-term performance of the entire system, instead of just at local sections.

To overcome the foreseeable challenges in system-level road pavement preventive maintenance decision-making, this study aims to test a framework that maps pavement surface conditions based on vehicles' vibration data (via sensors built in smartphones) and optimizes the preventive maintenance plans based on the deterioration modeling of the road system. Specific objectives include: (1) understanding the relationships between vehicle vibration (from smartphones) and pavement damage, (2) investigating deterioration modeling of the infrastructure system with vehicle vibration data, and (3) testing algorithms that optimize preventative maintenance plans for the long-term performance of the entire infrastructure system.



Vibration data and pavement condition

RESEARCH IN PROGRESS: HIGHLIGHTS

Please see below for a showcase of select, Tran-SET research projects. *Is our research applicable to your technical area? Beneficial or a potential solution to your local transportation system? Can benefit from your efforts? Interesting?* Please contact us for ways to coordinate, be involved, and engaged! To learn more about the following projects (and the rest of our 35 active research projects), please visit our **website**.



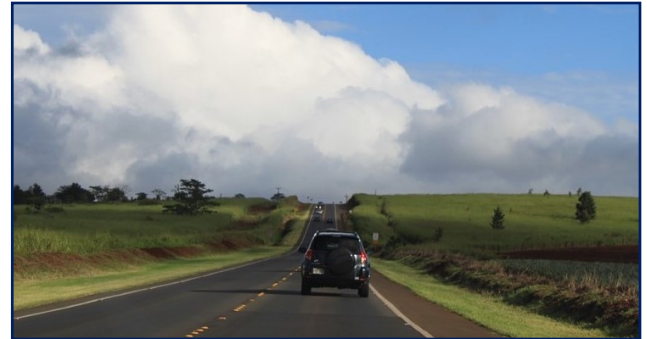
Preserving the Environment

Evaluation and Enhancement of Carbon Sequestration Potential, Bioenergy Production, and Ecosystem Services of Existing Vegetation along Roadsides

Dr. Vikram Kapoor, Dr. Jeffrey Hutchinson, Dr. Samer Dessouky - University of Texas at San Antonio

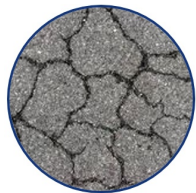
There is a growing realization that anthropogenic greenhouse gas (GHG) emissions contribute to global climate change. With the transportation sector being one of the main sources of GHG emissions, it is incumbent to address such emissions given its direct impact on the environment, health, and climate. Policies and strategies suggest several preventive mitigation options, but have paid little attention to compensatory mitigation through carbon sequestration along highway rights-of-way (ROWs). There has been a growing interest in the potential for roadside vegetation and soils to capture, store, and overall reduce GHG emissions – while at the same time generating revenue by pursuing market-based strategies for trading carbon credit or carbon offsets. In addition, biomass production during carbon storage has the potential to provide biofuel through plantation of bioenergy crops in degraded ROW soils.

This study aims to conduct a baseline assessment of carbon sequestration potential of existing veg-



Example of roadside vegetation along a rural highway

etation along a Texas highway (as a model for other road networks in the south-central U.S.) and evaluate different management techniques to implement remedial measures for improving carbon sequestration along existing roadside infrastructure. The study will result in refinements of additional steps towards establishing simple, reliable, and replicable methodology for assessing the carbon stocks in vegetation along highways.



Enhancing durability and service life of infrastructure

Toward Corrosion-Free and Highly Sustainable Structural Members by Using Emerging Ultra-High-Performance Materials for Transportation Infrastructure

Dr. Shih-Ho Chao - University of Texas at Arlington

Ultra-high-performance fiber-reinforced concrete (UHP-FRC) is a new generation of FRC with ultra-high compressive strength and ductility. However, concrete with only ultra-high compressive strength is not suitable for structural applications, even with mild reinforcing steel, as the brittle nature of the concrete can cause potential issues (e.g., abrupt unpredictable failures and minimum capability of stress redistribution). This study investigates (through

laboratory experiments) a design concept to use UHP-FRC as the ductile element and fiber-reinforced polymer (FRP) as the brittle element. This is the opposite of conventional reinforced concrete where the steel bars are the ductile element and concrete the brittle element. As such, using high-strength FRP bars can reduce reinforcement congestion, while achieving high structural efficiency in the members. FRP bars are also a suitable alternative to steel reinforcing bars when reinforced concrete is exposed to deicing salts, built in or close to seawater, subjected to other corrosive agents, required to maintain low electric conductivity, or required to meet weight limits.



Example of reinforced beam testing

RESEARCH IN PROGRESS: HIGHLIGHTS



Preserving Existing Transportation Systems

Strategies for Prioritizing Needs for Accelerated Construction after Hazard Events

Dr. Vanessa Valentin - University of New Mexico; Dr. Chao Wang - Louisiana State University

There is a need for rapid and responsive infrastructure repair and construction after natural disaster events such as hurricanes, wildfires, and tornadoes. These natural disasters often shut down basic infrastructure systems, including roads, bridges, water supplies, and power supplies, as experienced recently in the south-central U.S. These infrastructure systems are critical and need to be operational as soon as possible. Accelerated construction practices are often used in these situations to speed up the traditional, often slow, project delivery process. However, after a natural disaster, several and varied types of transportation infrastructure components are in need of inspection, rehabilitation, or reconstruction, and transportation agencies are challenged with the task of prioritizing these projects.

Although past studies have investigated accelerated construction and post-disaster project prioritization, these studies do not overlap between accelerated construction, emergency operation, and prioritization at a programmatic level for post-disaster recovery. Also, prior studies have not focused on a diverse portfolio of projects.



Bridge collapse as a result of Hurricane Harvey

There is a need for further research and guidance to assist state DOTs in identifying and prioritizing needs for accelerated construction after hazard events. This study will investigate current practices and institutional barriers to identify and quantify important decision making criteria and to develop a decision making support tool for prioritizing needs for accelerated construction after disaster events, specifically hurricanes and flooding.



Addressing other Region's Transportation Needs

Vehicle Sensing and Communications using LED Headlights to Enhance the Performance of Intelligent Transportation Systems

Dr. Sabit Ekin, Dr. Samir Ahmed - Oklahoma State University

Through the application of sensors, communications, and information technology, intelligent transportation systems (ITS) offer proven solutions and strategies for improving transportation safety, mobility, and environmental sustainability. There have been numerous developments in vehicle sensing and tracking technologies (e.g., Bluetooth, RADAR/LiDAR systems, and vehicle-to-vehicle (V2V) communication technologies). However, all existing vehicle sensing technologies suffer from their own limitations that can degrade the quality of information obtained.

energy efficiency. If LED headlights are switched on and off fast enough (modulation), it is possible to transmit information using the LEDs without a notable effect on the visibility of objects to the human eye. Therefore, LED headlights have great potential for sensing and communication purposes in ITS applications due to their availability in vehicles, unique properties of visible light, operation in unlicensed bands, and inherent safety and security.

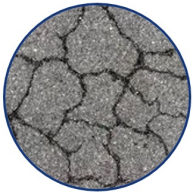
This study will investigate (through field and laboratory proof-of-concept implementations) the use of vehicle LED headlights for improving the accuracy and reliability of traffic data measurements required for developing effective ITS technologies and solutions. Vehicle LED lights will be utilized as a complementary and/or alternative technology to current data acquisition methods.



Example of ITS traffic management solution

Most vehicle manufacturers use light emitting diode (LED) headlights due to their long life and

RESEARCH IN PROGRESS: HIGHLIGHTS



Enhancing durability and service life of infrastructure

Self-Healing Concrete through Microencapsulated Bacterial Spores in a Simulated Hot Subtropical Climate

Dr. Jose Milla, Dr. Tyson Rupnow - Louisiana Transportation Research Center; Dr. Marwa Hassan - Louisiana State University

Concrete is one of the most commonly used construction materials in the world, due to its relatively low cost and high compressive strength. However, its weakness in tension makes it susceptible to cracking and thereby exposes any steel reinforcement to harmful agents that cause corrosion. Several techniques are currently used for crack-sealing but with funding limitations, it is difficult to afford the costly and labor-intensive maintenance and repair services needed to extend a structure's service life.

Bacterial concrete has become one of the most promising self-healing alternatives due to its capability to seal crack widths by reacting directly with the cementitious matrix to form calcium carbonate. It is developed by adding alkali-resistant

bacterial spores, which do not impose hazards to human health, in the concrete mixing process. Bacterial induced calcium carbonate precipitation is directly compatible with Portland cement materials, and promotes economic and environmental benefits by increasing durability and watertightness in concrete.

This study aims to develop an encapsulation procedure that will allow for testing two bacterial strains at varying dosages (by weight of cement) in concrete. Beam specimens will be used to identify the maximum crack-sealing efficiency, while cylinder samples will be used to determine their effects on the intrinsic mechanical properties, as well as its healing over time after inducing damage.

TECHNOLOGY TRANSFER ACTIVITIES

Tran-SET has two objectives that guide its technology transfer (T2) activities: ensure that scientific and technological developments are: (1) accessible, disseminated, and transferred to a wide range of users including state agencies, universities, and industries and (2) have long-term research value and impact to the transportation industry.

Please see below for a showcase of select, T2 activities sponsored by or involving Tran-SET. Please stay up-to-date with our activities by liking us on **Facebook**, following us on **LinkedIn** and **Twitter**, and visiting our **website**! You can also subscribe to our mailing list **here**!



Registration Now Open for the 2019 Tran-SET Conference!

Tran-SET will be hosting the 2019 Tran-SET Conference on **April 11-12, 2019** in San Antonio, TX. It will be held at the beautiful downtown campus of the University of Texas at San Antonio (UTSA). The Conference is co-sponsored by the **ASCE Transportation and Development Institute (T&DI)**.

The purpose of the Conference is to educate, engage, and collaborate with varied stakeholders (academics, industry professionals, state DOTs, and other government agencies) to solve transportation challenges facing the South-Central U.S.

Registration for the Conference is now open! Each registration includes tickets/costs associated with the Gala dinner and social activity. There are no registration

Sep 21, 2018 | Call for Papers Begins

Nov 10, 2018 | Registration Opens
Papers Due (Lectern Presentations and Publication)

Nov 23, 2018 | Abstracts Due (Student Poster Presentations Only)

Apr 1, 2019 | Registration Closes

Apr 11, 2019 | Conference Begins

May 1, 2019 | Proceedings Published

Important Conference dates

fees for attendees from (non-university) public agencies (i.e., City, County, State, or Federal employees). Hotel accommodations have also been finalized.

Please visit the Conference **website** for more information, including to view the Conference Program, the Steering and Scientific Committees, location, venue, and to be a sponsor.



Downtown campus of UTSA

TECHNOLOGY TRANSFER ACTIVITIES



Researcher Hosts "Lunch and Learn" on Flowable Fill Concrete

Dr. Zahid Hossain, Tran-SET Associate Director, arranged a technology transfer event in the form of a "lunch and learn" session on flowable fill concrete (FFC) mixes on November 27, 2018. Dr.

Hossain presented on the feasibility of the use of rice hull ash in FFC and showcased a small field demonstration of the mix at the Razorback Concrete Shop in Jonesboro, AR. There were over 40 attendees, including representatives from local ready-mix plants, admixture suppliers, Arkansas Department of Transportation, and the City of Jonesboro. The event was sponsored by Arkansas Ready Mix Association (ARMCA) and part of Tran-



Dr. Hossain demonstrating FFC mix



Dr. Hossain presenting to "Lunch and Learn" attendees

SET project **Use of Rice Hull Ash (RHA) as a Sustainable Source of Construction Material**. ARMCA, Razorback Concrete, NEAR Concrete, and GCP Applied Technologies were major contributors of the project.



Tran-SET Participates in SEAUPG 2018 Annual Meeting

Dr. Husam Sadek, Tran-SET Research and Technology Transfer Coordinator, represented Tran-SET at the 2018 Annual Meeting and Exhibits of the Southeast Asphalt User/Producer Group (SEAUPG) in Raleigh, NC from November 12-15, 2018. Similar to the mission of Tran-SET, SEAUPG aims to improve the quality and performance of asphalt pavement applications by encouraging the adoption of best practices in all aspects of asphalt technology (materials selection and testing, construction and maintenance, etc.). SEAUPG 2018 provided a great opportunity to meet with industry leaders and form partnerships in order to better transfer Tran-SET's research results/products to practice. SEAUPG 2018 included sessions on the FHWA Asphalt Program, NCAT Research Implementation, and regional updates.



Industry representatives at SEAUPG 2018

More information on SEAUPG 2018 can be found on their **website**.



Sponsored Research to be Used in Public Safety Campaign

Dr. Samer Dessouky, Tran-SET Associate Director, and Dr. Hatim Sharif, Tran-SET Principal Investigator, are collaborating with the UT Health Science Center at San Antonio to create a public campaign on traffic safety for their patients. They will be using research results from Tran-SET project **Relationship between Road Network Characteristics and Traffic Safety**. Another success story on how Tran-SET-sponsored research is being utilized to benefit the communities of Region 6!



TECHNOLOGY TRANSFER ACTIVITIES



Tran-SET Presents and Participates in 2018 Deep South ITE Fall Meeting

Christopher Melson, Tran-SET Program Manager, presented at the 2018 Deep South ITE (DSITE) Fall Meeting held in Baton Rouge, LA during October 25-26, 2018. Mr. Melson presented his research on the **Operational and Safety Attributes of an Alternative Design, Space-Efficient, One-Sided Interchange**. Mr. Melson also led a tour of transportation-related laboratories at the Louisiana State University, including a visit to the Building Simulation and Information Modeling (BIM) Construction Management Studio. The presentation and tour were highlighted in DSITE's Fall Newsletter. For more information regarding DSITE, please visit their [website](#).



Members of DSITE touring the BIM Studio



Success Story: Implementation of Engineered Cementitious Composites (ECC)

The research products from Tran-SET project **Evaluation of the Performance and Cost-Effectiveness of Engineered Cementitious Composites (ECC) Produced from Region 6 Local Materials** were utilized in a sidewalk installation on the campus of Louisiana State University. The installation was featured on a local newscast, university newscast, and in the American Concrete Institute (ACI) Concrete SmartBrief. Check out Tran-SET's [YouTube page](#) for the **newsclip**!

For more information, please see the project **research report** and corresponding **dataset**.



Sidewalk installation utilizing ECC as on the local news



Researcher Presents at GeoMEast 2018 International Congress

Surya Sarat Chandra Congress, a doctoral student under the supervision of Dr. Anand Puppala, Tran-SET Program Director, delivered a Bright Spark Keynote Lecture on the "Application of Unmanned Aerial Vehicles- Close Range Photogrammetry for Monitoring Infrastructure Assets" at the GeoMEast 2018 International Congress and Exhibition. After his keynote lecture, he was presented an award (pictured) by Robin Kemper (current president of ASCE), Norma Jean Mattei (former president of ASCE), Glenn Hewus (current president of the Canadian Society for Civil Engineering), and Dr. Hany Farouk (organizer of GeoMEast 2018). GeoMEast 2018 was held November 24-28, 2018 in Cairo, Egypt. Please visit their [website](#) for more information.



Surya Sarat Chandra Congress receiving Bright Spark Lecture Award

EDUCATIONAL & WORKFORCE DEVELOPMENT ACTIVITIES

Tran-SET has a firm initiative to advance the transportation workforce and to develop its next generation of leaders by: (1) attracting and supporting diverse, promising individuals to the transportation field through internships/research assistantships, (2) providing experiences through education and cutting-edge research to more properly prepare these individuals as they enter the workforce, and (3) incorporating and disseminating knowledge generated from sponsored research into educational and training products/activities.

Please see the next two pages for a showcase of select, educational and workforce development activities sponsored by or involving Tran-SET.

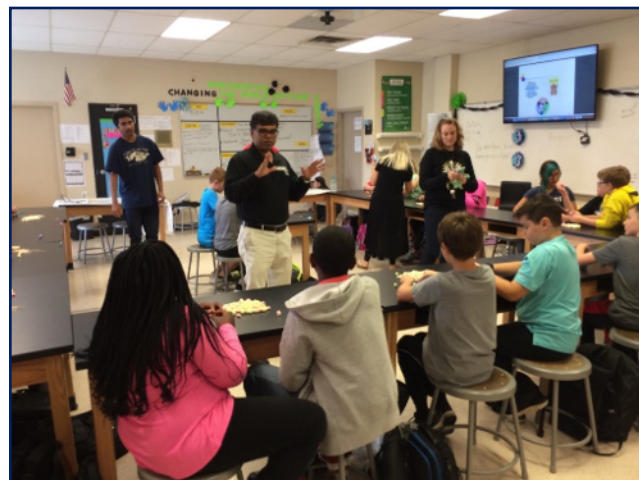


Tran-SET Participates in Nettleton STEAM School Event

Dr. Hossain, Tran-SET Associate Director, and his research team of undergraduate and graduate students delivered lectures to two sixth grade classes at the Nettleton STEAM School. Students were introduced and exposed to the engineering profession, its prospects, and how to become an engineer. The students also engaged in various engineering activities, such as making structures out of marshmallow and toothpicks, and



Dr. Hossain demonstrating hands-on activity



Dr. Hossain lecturing sixth graders

then assessing the stability of these structures in clayey and granular soils (jello and sand) during an earthquake event. Information and pictures from the event are located on the Nettleton STEAM School **website**.



Researchers Participate in Joint Base San Antonio Energy Expo

Two students (Mohammadreza Gholikhani and Ahmid Tahami) from the University of Texas at San Antonio demonstrated a prototype device that harvests energy from the temperature difference in asphalt pavements at the Joint Base San Antonio Energy Expo. The prototype (and related research) is part of Tran-SET project **Development of a Self-powered Structural Health Monitoring System for Transportation Infrastructure**.

The event was hosted and organized by Joint Base San Antonio as part of the U.S. Air Force's "Energy Action Month" as part of their "Protect the Power" initiative. "Protect the Power" calls on airmen and the larger Air Force community to practice smarter, more efficient energy and water consumption behaviors as to enhance readiness and resilience.



Student demonstrating energy harvesting device at JBSA Energy Expo

For more information on the Expo, please visit JBSA's **website**.

EDUCATIONAL & WORKFORCE DEVELOPMENT ACTIVITIES



Sponsored Student Completes Master Thesis

Arkansas State University student, Sumon Roy, is scheduled to defend his master thesis, "Effects of Moisture in Asphalt Pavement: A Nanomechanis-

tic Approach" in December 2018. Mr. Roy was involved and supported by several Tran-SET projects. An (early) congratulations!

Tran-SET Participates in Hector Garcia Middle School "Career Day"

Dr. Samer Dessouky, Tran-SET Associate Director, participated in and presented at the Hector Garcia Middle School "Career Day" on November 30, 2018. Dr. Dessouky presented to sixth and eighth grade students the role of transportation engineers in the community as well as various civil engineering-related fields. He also presented some of his most recent advances in the future of roadway engineering in promoting traffic safety and harvesting energy. A video slideshow of the event is located at the following [link](#).

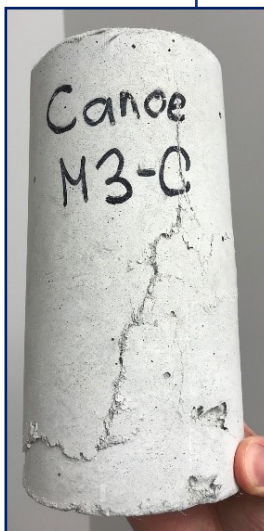


Students participating in "Career Day"

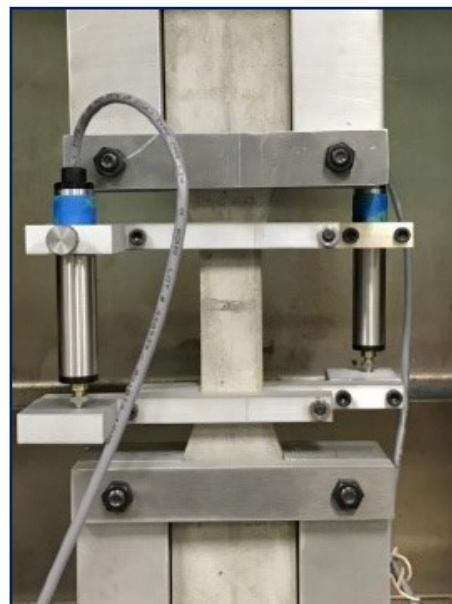


Researcher Helps ASCE Student Chapter with Concrete Canoe

Dr. Gabriel Arce, Tran-SET Research Associate, aided the Louisiana State University student chapter with their concrete mix design for the ASCE Concrete Canoe Competition. Dr. Arce developed a lightweight strain-hardening cementitious composite (SHCC) to be used in their canoe. The purpose of the SHCC is to provide a concrete material with enhanced tensile strength and deformation capacity to allow for the manufacture of a thin canoe and to prevent brittle fracture. Students acquired hands-on experience by producing and testing lightweight SHCC materials in the laboratory. The regional ASCE Concrete Canoe Competition will likely be held in March 2019, and the National Competition will be held in June 2019 in Melbourne, FL.



Lightweight SHCC specimen



Uniaxial tensile test of lightweight SHCC

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