

ISSUE 4 | FALL 2018

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

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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."

Letter from the Director

Wishing You All a Wonderful Autumn!

As seasons change, I am happy to report the significant progress that Tran-SET has accomplished. Our first-cycle projects have completed their research activities. I have been impressed with their overall quality; many promising research products (technology) have been developed, enhanced, and moved toward implementation – and have made progress in accomplishing Tran-SET's **Vision** to "address the accelerated deterioration of transportation infrastructure". Tran-SET is currently finalizing the respective research reports and will begin disseminating them shortly. I want to personally thank all Tran-SET staff, Associate Directors, Principal Investigators, and members of each project review committee on the successful projects and reports.

Tran-SET has established a Steering Committee, Scientific Committee, and are currently finalizing arrangements for the **2019 Tran-SET Conference**. The annual Conference will be held in San Antonio, TX on April 11-12, 2019. Please mark your calendars! We have already announced a **Call for Papers** for presentation and publication, which are due **October 31, 2018**. Registration will open October 31, 2018. The Conference is a great opportunity to learn how Tran-SET-sponsored research is solving regional transportation needs and to network, collaborate, and engage with professionals in a wide-range of transportation fields. Please visit the Conference **website** for details.

As part of our initiative to improve the quality and effectiveness of our social media, Tran-SET has established a **LinkedIn page**. I highly encourage you to follow us on LinkedIn – as well as our **Facebook** and Twitter pages. You may also subscribe to our mailing list **here**.

I invite you to read through our Fall 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

RESEARCH PROGRAM UPDATES

Tran-SET Welcomes Dr. Husam Sadek to the Team



Dr. Husam Sadek

In early August 2018, Tran-SET welcomed the newest addition to their team: Dr. Husam Sadek. Dr. Sadek will serve as Tran-SET's *Research and Technology Transfer Program Coordinator* – aiding in the administration of technical deliverables and coordination of the Center's technology transfer activities. Dr. Sadek previously worked for the Modified Asphalt Research Center (MARC) at the University of

Wisconsin-Madison. He has more than 10 years of academic and industry experience. His research interests include: pavement engineering, advanced materials characterization, accelerated pavement testing, and infrastructure sustainability.

Please welcome him to the Tran-SET team!

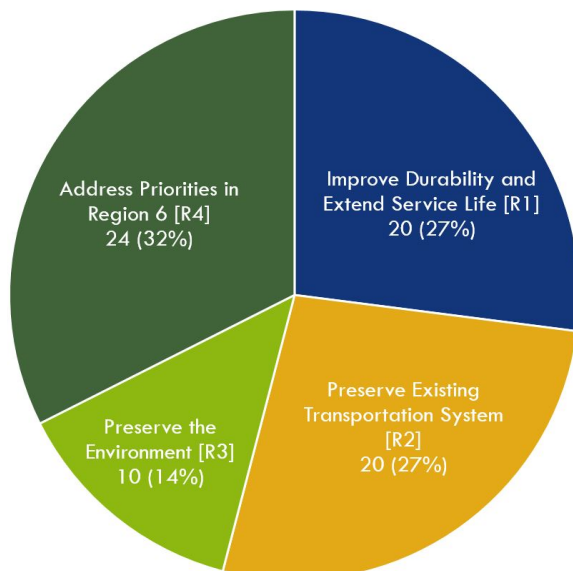
Research Reports for First-Cycle Projects Coming Soon

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 and have completed their research reports. The reports are currently in review and will be finalized shortly.

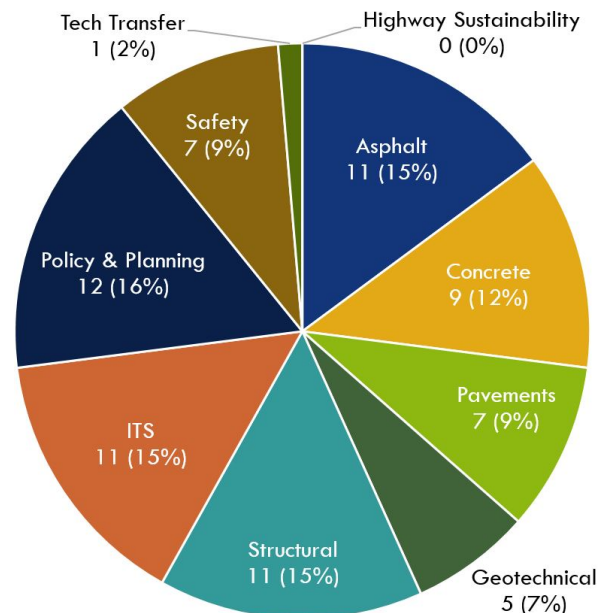
Please "stay tuned" as Tran-SET will be disseminating these reports in the next coming weeks and months. Don't miss a report by subscribing to our mailing list [here!](#)

Received Problem Statements for Third-Cycle Projects

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), including four submitted by Tran-SET's Center Advisory Board. 17 problem statements were collaborative in nature, involving multiple partnering institutions. Submitted problem statements are categorized below, by Tran-SET's research themes and transportation topical areas, respectively.



Problem statements categorized by Tran-SET research theme



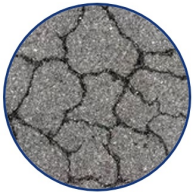
Problem statements categorized by transportation topical area

Problem statements are currently in review. A request for proposal will be solicited for the top-ranked statements in the next several weeks. 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

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 70 active research projects), please visit our **website**.



Enhancing durability and service life of infrastructure

Ultra-High Performance Concrete (UHPC) Shear Keys in Concrete Bridge Superstructures

Dr. Craig Newton, Dr. Brad Weldon - New Mexico State University

Shear keys are used between bridge elements to provide load transfer from one girder to an adjacent girder. Shear keys are produced by forming recessed keys into the sides of precast girders, such that the recessed area in adjacent girders align to form a void that can be grouted to achieve interlock. In service, shear keys often deteriorate through the loss of bond between the grout and superstructure elements. Repairs involve chipping open portions of the shear key and removal of the original grouting material. New grout should then be introduced to successfully re-seal the joint and establish a strong bond with the girders.

While rehabilitation generally utilizes non-shrink grout mixtures, this study investigates the use of ultra-high performance concrete (UHPC) produced with local materials to fill shear keys between girders. UHPC has been shown to have exceptional durability and strength having the po-



Example of bridge shear keys with dowels

tential to greatly extend the service life of shear keys in bridge superstructures. This study consists of a literature review to identify successful bonding practices (between the UHPC and substrate), laboratory experiments to verify the effectiveness of these identified practices, and design recommendations for field implementation of the technology.

The Impact of Hurricane Harvey on Pavement Structures in Southeast Texas and Southwest Louisiana

Dr. Stefan Romanoschi - University of Texas at Arlington

Hurricane Harvey was the wettest tropical cyclone in the continental U.S. In a four-day period, areas received more than 40 inches of rain causing catastrophic flooding. This resulted in inundation of thousand of homes, displacement of 30,000 peo-

ple, and prompted 17,000 rescues. Hurricane Harvey also induced major damage to the transportation infrastructure. Pavements were damaged by the flood, weakening and softening foundation layers, which were further intensified by increased heavy truck traffic by the recovery effort and surrounding oil and gas developments.

This study evaluates the damage caused by Hurricane Harvey to road structures in Texas and Louisiana by comparing strength of pavement structures before and after Hurricane Harvey, as reflected by material properties and surface deflections. Damage evaluation will provide a quantitative estimate of increased maintenance and rehabilitation costs for pavement structures and indicate pavement configurations/materials most affected by the flooding. This study will aid authorities in flood-prone areas in estimating maintenance and rehabilitation costs and in designing more resilient infrastructure.



Preserving Existing Transportation Systems



Devastating floods from Hurricane Harvey

RESEARCH IN PROGRESS: HIGHLIGHTS



Addressing other Region 6 Transportation Needs

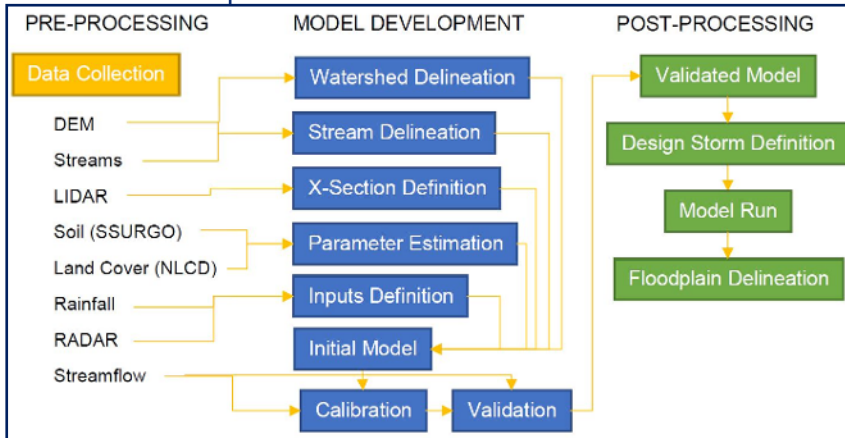
Assessing the Impacts of Super Storm Flooding to Transportation Infrastructure - Case Study: San Antonio, Texas

Dr. Marcio Giacomoni - University of Texas at San Antonio; Dr. Francisco Olivera - Texas A&M University

Data from governmental agencies shows exponential growth in fatalities, damage, and recovery costs due to extreme weather events in the U.S. Most critical infrastructure built in urban areas,

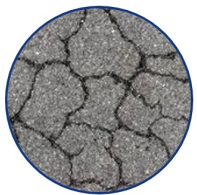
are likely to become more frequent and severe due to climate change, there is a pressing research need to: (1) develop and test new modeling frameworks that can assess the impacts of flooding on the built environment and to (2) identify mitigation and adaptation strategies that protect critical infrastructure in urban areas against flooding.

The use of two-dimensional (2D) models for floodplain mapping has not been sufficiently tested for super storms; the suitability of existing modeling capabilities to accurately represent super storms requires further investigation. This study develops and applies a computational framework capable of predicting the impacts of super storms in the transportation infrastructure and evaluating flood protection strategies that alleviate some of the impacts in highly populated urban areas. The study will include the development of state-of-the-art simulation models and a training workshop to engage varying agencies impacted by floods.



Flow chart of proposed modeling framework

including that for transportation and flood protection, are designed to handle a design storm with 100 years of return period. "Super storms" are defined as rainfall events with return periods greater than 100 years, which have recently occurred frequently in the U.S. Since super storms



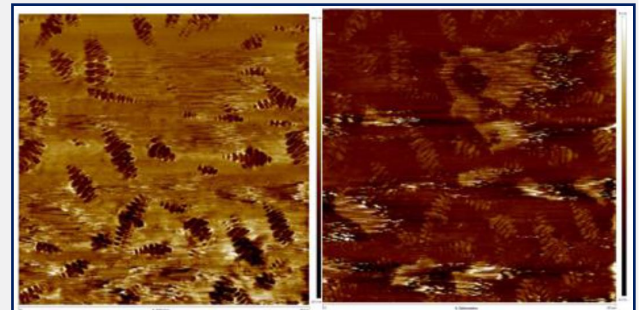
Enhancing durability and service life of infrastructure

Use of Nanoclays as Alternatives of Polymers toward Improving Performance of Asphalt Binders

Dr. Zahid Hossain, Dr. Ashraf Elsayed - Arkansas State University

Manufacturers have investigated several asphalt modifiers to increase resistance to asphalt rutting and thermal cracking. Styrene-butadiene-styrene (SBS) and styrene-butadiene-rubber (SBR) are among the most commonly used asphalt modifiers. However, a significant portion of polymer-modified binders can be (potentially) replaced with nanoclay-modified binders. This in turn, can result in significant reduction in cost of asphalt binders. Nanoclay is economical, naturally abundant, and possesses an extraordinary potential to improve the performance of asphalt due to interaction of nanoscale phenomena (e.g., quantum effects, high surface energy, spatial confinement, and large fraction of surface atoms).

This study assesses the feasibility of using nanoclays as an alternative to SBS and SBR polymers to modify performance grade (PG) binders. To evaluate the effects of nanoclays on the mecha-



Atomic force microscopy analysis

nistic performance and rheological properties of asphalt binders, laboratory tests using rotational viscosity, dynamic shear rheometer, atomic force microscopy, and chemical analysis will be conducted. Rolling thin film oven and pressure aging vessel will be used to simulate short-term aging and long-term aging of the binders. Furthermore, bending beam rheometer (BBR), sessile drop (SD), Texas boiling test, tensile strength ratio (TSR), and creep resistance at low temperatures will also be performed to characterize the performance of the blended nanoclay-modified asphalt binders.



High shear mixer used in laboratory tests

RESEARCH IN PROGRESS: HIGHLIGHTS



Preserving Existing Transportation Systems

Prediction and Rehabilitation of Highway Embankment Slope Failures in Changing Climate

Dr. Navid Jafari - Louisiana State University; Dr. Anand Puppala - University of Texas at Arlington

Resilience of transportation infrastructure, such as highway embankments, is critical in avoiding commuter delays and costly repairs. The majority of highway embankments across the U.S. are in marginal condition as high-plasticity clays used during construction soften over time and lower in strength. Infiltrating rainfall increases pore-water pressure in these areas and ultimately leads to slope instability. As a result, these failures require periodic maintenance to ensure proper highway safety, requiring significant up-keep costs.

This study investigates the impact, over time, that a wide-range of environmental factors (e.g., climate, partially saturated flow, etc.) have on shear strength of compacted embankments. To predict the progression of decreasing strength, this study characterizes and models the effect of wetting and drying cycles of high-plasticity soil embankments in Louisiana and Texas. Comprehensive inverse analyses of embankment failures, in conjunction with laboratory testing of Louisiana and Texas soil samples, will be conducted. Main outcomes include: (1) a methodology to predict loca-



Tension cracks along embankment slope at Texas site

tions of high-failure probability areas and (2) cost-effective rehabilitation techniques. The review of past failures and continuous field monitoring will be used to develop guidelines for rehabilitating failed slopes so that the likelihood for subsequent slides is significantly reduced.



Preserving the Environment

Development of Geopolymers Based Cement and Soil Stabilizers for Transportation Infrastructure

Dr. Miladin Radovic - Texas A&M University; Dr. Anand Puppala - University of Texas at Arlington

Ordinary Portland Cement (OPC) is a key material for transportation infrastructure and is widely used for stabilization of base and subgrade materials. However, production of OPC consumes a

large amount of energy and releases carbon dioxide. Geopolymer cement (GPC) has been substituted for OPC in several engineering applications due to its high strength. It has also received attention as an ecofriendly and sustainable alternative to OPC, since it can be inexpensively processed at room temperature from waste materials (e.g., fly ash) or other natural sources (e.g., clay). GPC has been investigated as an alternative to OPC for soil stabilization to prevent failures as a result of the reaction between OPC with clay and sulfate mineral in the soil, causing significant swelling.

This study investigates the durability of GPC concrete as stabilized base and subgrade materials under extreme service conditions typical for the southcentral U.S., including large water uptake during flooding and rainfalls. This study will: (1) conduct leachability studies to investigate the volume of leachate generated and its chemical composition and (2) provide guidance for the optimum composition of GPCs for extended durability of concrete structures and stabilized soil.



Geopolymer concrete being place

large amount of energy and releases carbon dioxide. Geopolymer cement (GPC) has been substituted for OPC in several engineering applications

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**!



Tran-SET to Host 2019 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. 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. The Conference is an opportunity to inform stakeholders of Tran-SET's research, education, workforce development, and technology transfer activities. This includes showcasing our technical contributions in a wide-range of transportation fields.

The Conference theme is: ***Developing, evaluating, and implementing cutting-edge technologies, novel materials, and innovative construction management processes to enhance the durability and service of transportation infrastructure***

Papers and student abstracts from national and international participants are welcomed. Please visit the Conference **website** for more information and to submit.

Sep 21, 2018 | Call for Papers Begins

Oct 31, 2018 | Registration Opens

Oct 31, 2018 | Papers Due (Lectern Presentations and Publication)

Nov 16, 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

Registration will open **October 31, 2018**. Please considering attending as to:

- Learn how Tran-SET-sponsored research is solving transportation needs in the South-Central region;
- Network, collaborate, and engage with other professionals in a wide-range of transportation fields and from varied backgrounds;
- Earn as many as 12 professional development hours (PDHs); and
- Enjoy the beautiful and unique sites of San Antonio.

Tran-SET is also proudly welcoming a wide-array of **sponsors** to participate. Sponsorship is a great opportunity to showcase novel materials, advanced equipment, and market services to a diverse, professional audience. The Conference will provide a unique, friendly, and collaborative environment.

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



San Antonio river walk near Conference venue

Tran-SET has announced their **Call for Papers** for presentation and publication. Draft papers are due **October 31, 2018**. A Student Poster Competition will also be held at the Conference. Student abstracts are due November 16, 2018.

TECHNOLOGY TRANSFER ACTIVITIES



Tran-SET Researcher Participates in GeoChina 2018

Dr. Zahid Hossain, Tran-SET Associate Director, presented and moderated at the *5th GeoChina International Conference*. The Conference was held on July 23-25, 2018 at HangZhou, China and was hosted by Zhejiang University. The Conference provided a showcase of recent developments and advancements in design, construction, and inspection of transportation infrastructure. Specific Conference topics included bridge, pavement, geotechnical, tunnel, railway, and emerging techniques for safety inspection.

Dr. Hossain was also a lead editor of the Conference proceedings and publication of "Solving Pavement and Construction Material Problems with Innovative and Cutting-Edge Technologies". To order and view the Conference proceedings, please visit the Springer [website](#).



Proceedings of the 5th GeoChina International Conference



Tran-SET Hosts Second Webinar in Series

Tran-SET hosted the second webinar in their *Joint Tran-SET Webinar Series* on September 19, 2018. The Webinar covered "Transportation Infrastructure Resilience to Extreme Weather Events" and was jointly hosted by the *University Transportation Research Center* (UTRC). The Webinar included a diverse lineup of presenters, including researchers of Tran-SET- and UTRC-sponsored projects and practitioners from the Colorado DOT and FHWA.

The Webinar attracted a wide audience, with over 70 in attendance from academia, government agencies, and industry – including over 20 local, county, and state DOTs. A video recording of the Webinar, along with the presentation slides are located on Tran-SET's [website](#).



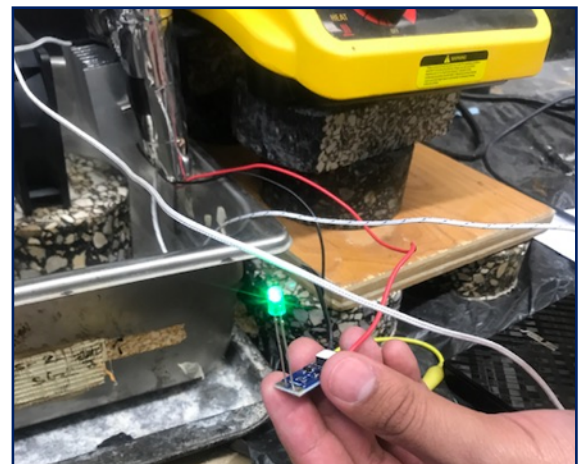
Damage to bridge caused by Hurricane Katrina

Tran-SET is currently planning their next webinar slated for early December. Please feel free to contact us if you would like to jointly host, collaborate, or present!



Tran-SET Researcher Presents at MESAT

Dr. Samer Dessouky, Tran-SET Associate Director, presented at the *4th Conference of the Middle East Society of Asphalt Technologists* (MESAT) on July 4-6, 2018 in Beirut, Lebanon. The Conference included sessions on asphalt binders, rubber modified asphalt, and pavement performance, among others. Dr. Dessouky presented on "Experimental and Assessment of Thermoelectric Energy Harvesting from Asphalt Pavements" – which included work from the Tran-SET-sponsored project, "**Development of a Self-Powered Structural Health Monitoring System for Transportation Infrastructure**".



Thermoelectric energy harvester prototype powering LED light

TECHNOLOGY TRANSFER ACTIVITIES



Tran-SET Researcher Director of the Center for Infrastructure Renewal (CIR)

Focusing on research, innovation, and technology transfer, the Center for Infrastructure Renewal (CIR) is the national leader in the development of transformative infrastructure solutions. CIR is a joint center between Texas A&M Engineering Experiment Station and Texas A&M Transportation Institute. CIR labs are innovating new materials, technologies, and processes to create solutions for transportation infrastructure that last longer, have lower costs, and can be built in less time. CIR houses 10 laboratories, including the Advanced Characterization of Infrastructure Materials Lab, Advanced Infrastructure Materials and Manufacturing Lab, Concrete Innovation Lab, and the National Corrosion and Materials Reliability Lab.

The Director of CIR is **Dr. Zachary Grasley**, Principal Investigator of Tran-SET's **"Modeling Sulfate Attack in Modern Concrete for Building Sus-**



A look inside the Structural and Materials Testing Lab

tainable and Resilient Infrastructure" project.

For more information, please visit the CIR [web-site](#).



Tran-SET Researcher Presents at SASHTO

Dr. Anand Puppala, Tran-SET Program Director, delivered a lecture on the "Evaluation of Initial Applications of Unmanned Aerial Vehicles (UAVs) for Monitoring Infrastructure Assets" at the 2018 SASHTO Annual Meeting. The presentation highlighted the recent work by Dr. Puppala and his research team on UAVs and close-range photogrammetry for inspecting pavements, bridges, and railway tracks/corridors.

The Southern Association of State Highway and Transportation Officials (SASHTO) comprises of state DOTs from Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Texas, Virginia and West Virginia.

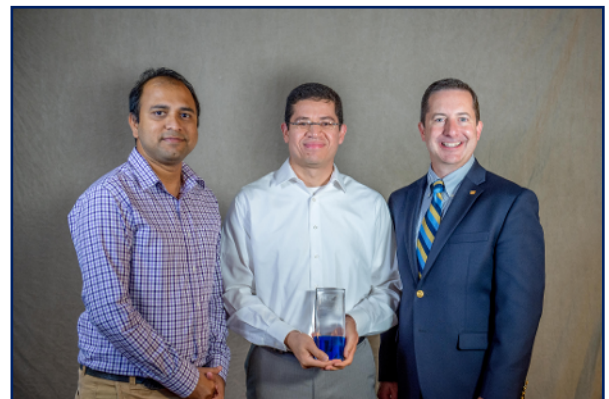


Audience at the 2018 SASHTO Annual Meeting



Tran-SET Researcher Receives Transportation Achievement Award for Design

Each year, the Institute of Transportation Engineers (ITE) sponsors an awards program to honor outstanding achievement in transportation engineering and service. Awards are presented in the categories of planning, design, operations, and safety. **Dr. Samer Dessouky**, Tran-SET Associate Director, was awarded the Transportation Achievement Award for Design for his "Highway Integrated Sensing and Energy Conversion Module (HI-SEM)". He received his award at the 2018 ITE Annual Meeting, held August 20-23, in Minneapolis, MN.



Dr. Dessouky receiving ITE's Transportation Achievement Award for Design

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 Sponsors Outreach Event at Prairie View A&M University

As a planned outreach activity in Tran-SET's **"Recruiting, Retaining, and Promoting for Careers at Transportation Agencies"** project, Prairie View A&M University's Center for Energy and Environmental Sustainability sponsored an event to expose and educate incoming freshmen to the field of transportation. **Dr. Doeun Choe**, Tran-SET Principal Investigator, organized and supervised the event on July 20, 2018, which included over 70 students. Dr. Choe assessed the students' knowledge and interest in transportation-related careers and conducted fun activities using magnets and plastic cups to illustrate how Maglev (magnetic levitation) trains operate.



Students discuss careers in transportation



Students learn about Maglev trains



Tran-SET Researchers Participate at the @UNM Summer Transportation Institute

Dr. Greg Rowangould, **Dr. Vanessa Valentin**, and **Dr. Su Zhang** (Tran-SET Principal Investigators) engaged with high school students at the @UNM Summer Transportation Institute July 16-27, 2018. Sixteen students built and tested bridges, planned a future city, competed in a construction equipment productivity challenge, evaluated the use of UAVs in transportation, and visited New Mexico DOT headquarters.



Students participating in construction equipment activity



Tran-SET-Sponsored Students Complete Master Theses

University of Texas at San Antonio students, **Qasim Adegbite** and **Khondoker Al Sabbir Billah**, successfully defended their master theses, "Statistical and Spatial Analysis of Intersection Crashes in San Antonio, TX" and "Pedestrian Crash

Analysis for San Antonio, TX" in July 2018. Both students were involved in Tran-SET's **"Relationship between Urban Intersection Characteristics and Traffic Safety"** project.

EDUCATIONAL & WORKFORCE DEVELOPMENT ACTIVITIES



Tran-SET Participates at Jonesboro Hispanic Center STEM Event

Dr. Zahid Hossain, Tran-SET Associate Director, and his research team of undergraduate and graduate students administered an outreach activity at Jonesboro Hispanic Center. In a three-hour event, over 25 local Kindergarten through 8th grade students participated in a variety of fun engineering-related activities. This included making structures out of marshmallow and toothpicks, and then assessing the stability of these structures in clayey and granular soils (jello and sand) during an earthquake event.



Dr. Hossain educating youth on stability of structures

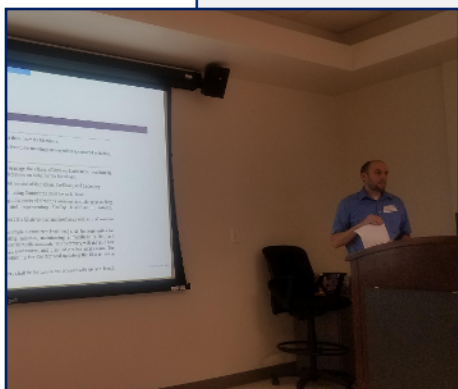


Tran-SET Organizes and Hosts SimCap Louisiana's First Educational Meeting

Christopher Melson, Program Manager of Tran-SET, co-organized and presented at the first educational meeting by the Simulation and Capacity Analysis Users Group of Louisiana (SimCap Louisiana) on July 17, 2018. Mr. Melson is the co-founder of SimCap Louisiana, which is a volunteer network of professionals aiming to support, promote, and improve best practices in the application of traffic simulation and capacity analysis. The meeting consisted of two main presentations: (1) providing an overview of the history, structure, and current activities of the North Car-

olina SimCap chapter and (2) a case study in the application of transportation modeling and simulation analyses to inform planning and the decision-making process. The meeting also included a business discussion on the newly-formed Charter.

Approximately 20 members attended, including members from the private sector, local government, state government, and academia. SimCap Louisiana will be hosting their second educational meeting (via webinar) on October 31, 2018. If interested in attending or to learn more, please contact Mr. Melson (cmelson1@lsu.edu) or visit their **LinkedIn Group**.



Mr. Melson presenting at SimCap Louisiana



Tran-SET Institution Hosts Research Experience for Undergraduates (REU)

Funded by the National Science Foundation (NSF), the Research Experience for Undergraduates (REU) program is a grant-based summer platform hosted by universities across the nation to enhance undergraduate participation in STEM research. Students participate in real-world scientific investigations under the guidance of a faculty mentor. **Dr. Ibrahim Karaman**, Tran-SET Associate Director, and the Department of Materials Science & Engineering at Texas A&M University hosted a 10-week REU program. During this time, 14 students joined dynamic research groups to develop new and exciting research outputs. Students participated in GRE training sessions, professional development courses, rigorous speaking evaluation processes, and weekly research pre-



REU student presenting her research at student poster session

sentations: all culminating in one College-wide poster session.