



Transportation Consortium of South-Central States

Solving Emerging Transportation Resiliency, Sustainability, and Economic Challenges through the Use of Innovative Materials and Construction Methods: From Research to Implementation

Semi-Annual Progress Report #7

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1. Accomplishments

Major Goals and Objectives of the Program

The **Vision** of Tran-SET is to “address the accelerated deterioration of the transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes.”

The **Mission** of Tran-SET is to “conduct all phases of research, technology transfer, education, workforce development, and outreach activities as to solve transportation challenges in Region 6 and support implementation.”

The following 14 objectives are at the heart of *all* Tran-SET activities¹:

Table 1. Major Objectives of Tran-SET.

ID ¹	Objective
RESEARCH	
R1	Improve the durability and extend the service life of transportation infrastructure [IF2, IN1 ²]
R2	Preserve the environment [IF1, IN1]
R3	Preserve the existing transportation system [IF2, IN1]
R4	Address immediate transportation priorities in Region 6 [S1, IF2, IF3, IF4, IN1]
TECHNOLOGY TRANSFER	
TT1	Ensure that scientific and technological developments are accessible, disseminated, and transferred to a wide range of users including state agencies, universities, and industries [IN2]
TT2	Ensure that scientific and technological developments have long-term research value and significant impact to the transportation industry by direct collaboration with all levels of government and nonprofit institutions [IN2]
EDUCATION	
E1	Improve and support existing academic programs at Tran-SET’s partnering institutions [IF4, A2]
E2	Improve and support transportation non-degree programs at Tran-SET’s partnering institutions (architectural, business, mechanical, electrical, industrial engineering, etc.) [IF4, A2]
WORKFORCE DEVELOPMENT	
WF1	Ensure research outcomes are disseminated through educational and workforce development activities by supporting the development of seminars, workshops, and training courses [IF4, A2]
EMPHASIS AREAS	
EL1	Develop the next generation of leaders and graduate students of the transportation field by supporting mentoring, networking, training, and other development activities [IF4, A2]
EL2	Provide leadership to regional stakeholders and communities (state agencies, universities, and industries) and provide national leadership to applicable research communities [IN1, IN2]
EC1	Encourage and foster collaboration between partnering institutions and external stakeholders as to: (1) maximize sharing of human expertise and facilities among partners and stakeholders, (2) tackle transportation challenges only solvable by multi-disciplinary teams, (3) facilitate knowledge transfer among the team institutions and stakeholders, and (4) minimize duplicative research to optimize the use of available funds [IN2, A2]
ED1	Integrate diversity-related activities into Tran-SET’s efforts as to increase participation of underrepresented students in STEM fields, particularly the transportation field [IF4, A2]
MANAGEMENT	
M1	Operate and manage Tran-SET as to ensure the highest degree of accountability, cost-efficiency, and optimum use of available funds, facilities, and capabilities [A2]

¹All activities, outputs, outcomes, and impacts are categorized under Tran-SET’s objectives (in blue).

²All Tran-SET objectives, activities, outputs, outcomes, and impacts are categorized under objectives of the US DOT Strategic Plan for FY2018-2022 (in green). Regarding ID abbreviations: S refers to Safety, IF refers to Infrastructure, IN refers to Innovation, and A refers to Accountability objectives, respectively.

Accomplishments (During this Reporting Period)

RESEARCH

Final Reports and Project Datasets for Third-Cycle Projects: Each Tran-SET project consists of a 12-month technical phase, followed by a 6-month implementation phase. In spite of COVID-19 and LSU shutdown ([Mar. 2020- Jul. 2020](#)), Tran-SET worked efficiently with the PIs to deliver the projects on time through (a) continuous follow up through progress reports, (b) virtual meetings, and (c) following CDC practices for physical meetings. Out of the total 33 projects, only 8 projects were granted 3-month extension, due to COVID-19, to end on [May 2021](#) instead of [Feb. 2021](#). The end date for the remaining 25 projects is still on schedule ([Feb. 2021](#)). Out of these 25 projects, 13 projects submitted their third-cycle final reports and datasets ([Aug. 2020](#)), while the remaining 12 projects will submit their final reports and datasets on [Nov. 2020](#).

Tran-SET staff conducted an initial review of submitted third-cycle final reports and datasets ([Sep. 2020](#)), requested revisions ([Sep. 2020](#)), and received revisions ([Oct. 2020](#)). The finalized reports and datasets will be archived and disseminated per UTC reporting requirements ([Oct. 2020](#)). In addition, Tran-SET coordinated review of each report by their respective project review committee ([Aug.-Sep. 2020](#)). Figures 1a and 1b show the distribution of projects by research objective and transportation area, respectively. [R1, R2, R3, R4, S1, IF2, IF3, IF4, IN1].

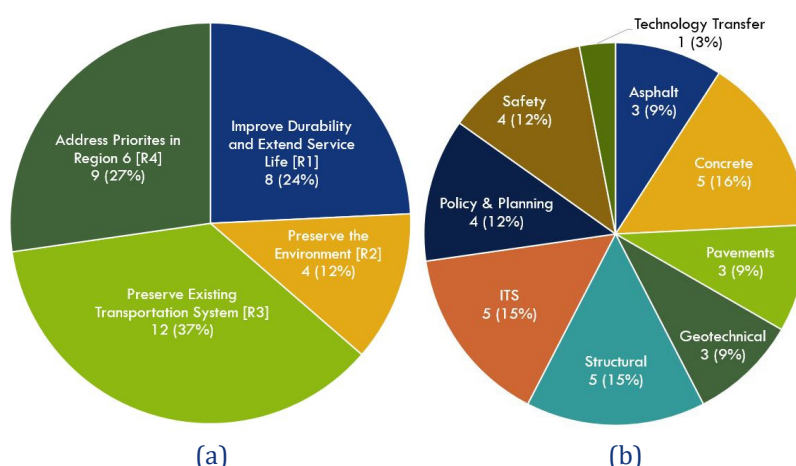


Figure 1. Third-Cycle Projects Categorized by: (a) Research Objective and (b) Transportation Area.

Award of Fourth-Cycle Projects: 43 proposals were reviewed by national subject matter experts ([Apr. 2020](#)), solicited for revisions by the PIs ([May 2020](#)), and finalized ([Jun. 2020](#)). Ultimately, 40 projects were selected for award and started on [Aug. 1, 2020](#). Figures 2a and 2b show the distribution of projects by research objective and transportation area, respectively. Detailed information can be found in Appendix A. [R1, R2, R3, R4, S1, IF2, IF3, IF4, IN1]

Problem Statements for Fifth-Cycle Projects: Tran-SET issued a call for problem statements ([May 2020](#)) for their fifth-cycle of research projects. A total of **95** problem statements were received from 14 institutions in Region 6 ([Sep. 2020](#)). **Nineteen** problem statements were collaborative, involving multiple partnering institutions. **Fourteen** problem statements were geared towards addressing the impacts/challenges of COVID-19 on the transportation infrastructure from different perspectives. Problem statements are currently under review and are being ranked by regional transportation leaders/experts. Figures 3a and 3b show the distribution of problem statements by research objective and transportation area, respectively. [R1, R2, R3, R4, S1, IF2, IF3, IF4, IN1]

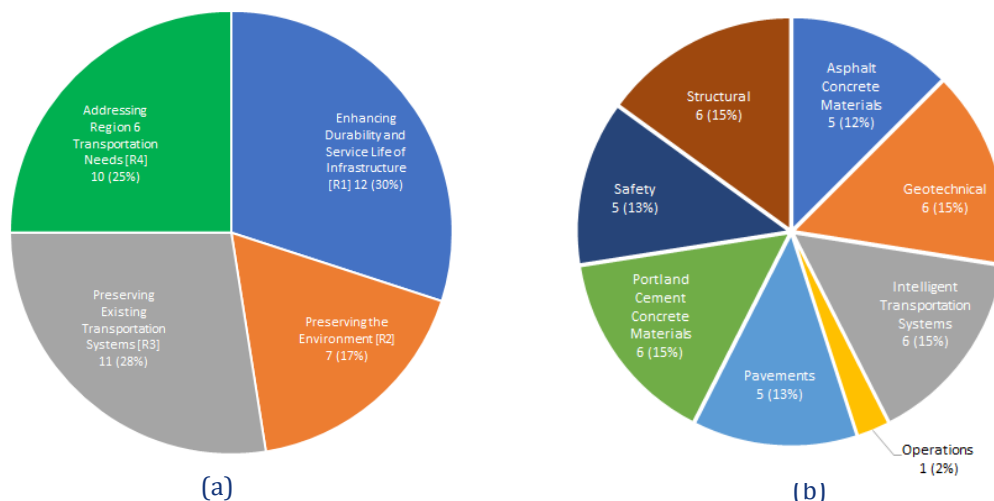


Figure 2. Fourth-Cycle Projects Categorized by: (a) Research Objective and (b) Transportation Area.

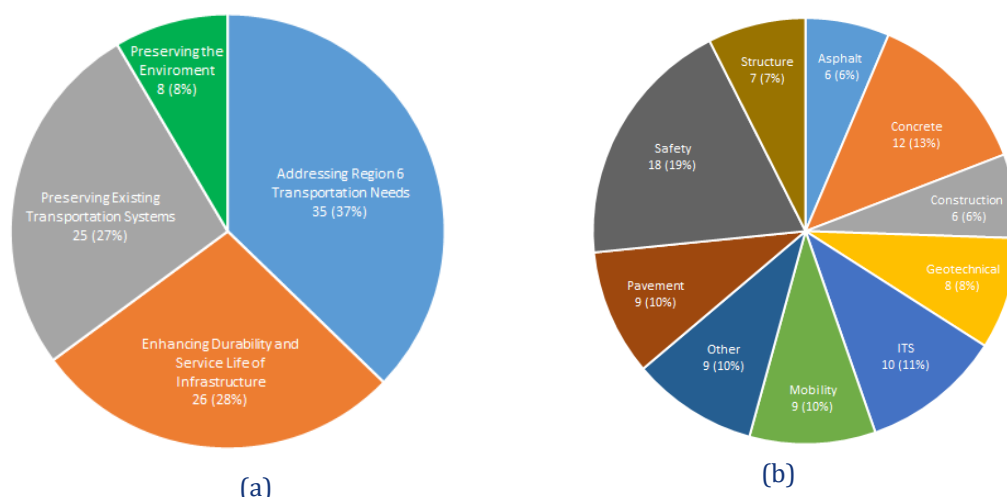


Figure 3. Fifth-Cycle Problem Statements Categorized by: (a) Research Objective and (b) Transportation Area.

TECHNOLOGY TRANSFER

2020 Tran-SET Conference: Tran-SET held its third annual Conference virtually on **Sep. 1-2, 2020**. The conference was organized by the University of New Mexico and New Mexico State University and was co-sponsored by the ASCE Transportation and Development Institute (T&DI). The program included: **56** lectern presentations (covering all third-cycle projects), and **8** students' research showcase. The Conference also included a Business Meeting with the Center Advisory Board (CAB). The Conference had over **110** attendees and provided a unique opportunity to network directly with Region 6 stakeholders and discuss how Tran-SET research can solve regional challenges. The Conference Program and published Conference Proceedings is available on [Tran-SET's website](#). [TT1, TT2, EL2, IN2]

2021 Tran-SET Conference: Tran-SET will hold its fourth annual Conference tentatively on **May 17-22, 2021** in Jonesboro, Arkansas. The Conference will be hosted by Arkansas State University. In this reporting period, the following activities have been conducted: establish the Conference Planning Committee (**April 2020**) and select the venue and date (**May 2020**). [TT1, TT2, EL2, IN2]

Joint Tran-SET Webinar Series: Tran-SET continued its quarterly webinar series with its eighth ([Jun. 2020](#)) and ninth webinars ([Sep. 2020](#)). The eighth webinar was on the topic of “*Future Impacts of Connected and Automated Vehicle (CAV) Applications*” and was offered in collaboration with the University of Memphis. The ninth webinar was on the topic of “*Innovative Techniques in Detecting, Monitoring, and Planning for Flooding*” and was offered in collaboration with United States Geological Survey (USGS) and the University of Iowa. As part of Tran-SET’s response to COVID-19, Tran-SET organized a vital webinar ([May 2020](#)) on the topic of “*Impacts of COVID-19 on Transportation & Logistics*.” About 180 attendees participated in these webinars. Recorded webinars, presentation slides and other outreach materials are available on the [Tran-SET’s website](#). [TT1, TT2, EL1, EL2, EC1, IF4, IN2, A2]

Newsletter: Tran-SET continued to develop and disseminate its quarterly newsletter with the summer 2020 issue ([Jun. 2020](#)) and fall 2020 issue ([Sep. 2020](#)). Newsletters are disseminated via the Tran-SET’s list serve. Current and past newsletters are available on the [Tran-SET’s website](#). [TT1, IN2]

Technology Transfer (T2) Plan: Tran-SET continues to implement the Center’s T2 plan, specifically: requiring fourth-cycle proposals to include project-specific T2 plans and utilizing these plans in the review/selection process ([May 2020](#)), establishing project review committees (PRCs) for each fourth-cycle project ([Jul. 2020](#)), and facilitating meetings between each research team and their respective PRC ([Aug. - Sep. 2020](#)). These meetings have proven effective by providing needed guidance to the research, creating an engaged PRC, and identifying allies to champion T2 activities. [TT1, TT2, EC1, IN2, A2]

EDUCATION

Native American Transportation Internship: Tran-SET will host the Native American Transportation Internship, which is a modification of the Navajo Technical University Internship hosted by Tran-SET in previous years on [June 3-28, 2021, pending clearance from LSU due to the COVID-19 outbreak](#). This internship will support two students from Tran-SET partnering universities to travel to LSU and work onsite on select Tran-SET-funded research projects for one month. Several activities have occurred during this reporting period to make the Internship a success. These activities included ensuring funding for the student’s travel, housing, and stipend ([Jun. 2020](#)). More information regarding the Internship is available on the [Tran-SET’s website](#). [E1, EL1, EC1, ED1, IF4, A2]

Tran-SET Transportation Veteran Scholarship: As part of Tran-SET’s initiative to advance the transportation workforce and to develop its next generation of leaders, Tran-SET offered a scholarship to three veterans. The scholarship awards \$10,000 to each student over a period of two years (spring 2020-fall 2021). During this reporting period, the three students are participating in Tran-SET-funded research projects. [E1, EL1, EC1, ED1, IF4, A2]

Tran-SET STEM Resources: As a part of Tran-SET’s response to COVID-19, Tran-SET launched a [new webpage](#) ([Jul. 2020](#)) to provide STEM (science, technology, engineering, and mathematics) resources to students, parents, and teachers. These resources include at-home STEM events, training for educators, STEM contests, educational videos, transportation/ engineering events, and others. [E1, EL1, EC1, ED1, IF4, A2]

LSU High School Student Research (HSSR) Intern Program: As a part of Tran-SET’s dedication to engage high school students in transportation-related research, Tran-SET participated in the HSSR Intern program organized by LSU to involve 4 high school students in research in summer 2020. Between [Apr. and Jul. 2020](#), 3 Tran-SET PIs mentored 4 high school students on topics related to

their research projects. On **31 Jul. 2020**, the students participated in the HSSR virtual poster presentation day. Out of the total 17 students participating in this program, the first place was awarded to an LSU student. More information regarding the Internship is available on the [LSU's website](#). [E1, EL1, EC1, ED1, IF4, A2]

REHAMS and HALLIBURTON XCITE Summer Camps: Tran-SET provided an “Introduction to civil Engineering” virtual lecture for future female engineers (Halliburton XCITE Summer Camp) and for multicultural students (REHAMS summer camp) on **July 2020**. After the presentation, the students were provided with engineering activities that they could perform at home while being coached by LSU engineering students virtually. [E1, EL1, EC1, ED1, IF4, A2]

Project-Level STEM Events: Tran-SET and its affiliates sponsored, organized, and participated in several STEM events. Examples of these activities are listed below. [E1, E2, EL1, IF4, A2]

- Dr. Momen Mousa (Program Manager) at Louisiana State University (LSU) coordinated with the National Science Teaching Association (**Jun. 2020**) to serve as a virtual judge in eCYBERMISSION that will take place March 16 – 31, 2021. More information regarding eCYBERMISSION is available on [their website](#).
- Dr. Avimanyu Sahoo (Tran-SET PI) participated in the Virtual Greek Discovery Day (**July 2020**) and Summer Bridge events (**August 2020**) at Oklahoma State University.
- Dr. Suyun Ham (Tran-SET PI) from University of Texas at Arlington participated in a STEM event (**August 2020**) in Arlington Primary school to present to the students interesting engineering monitoring techniques (non-destructive evaluation, imaging and sensing, etc.).
- Dr. Su Zhang (PI) from the University of New Mexico participated in a STEM virtual event (**August 2020**) hosted by the New Mexico EPSCoR program.

WORKFORCE DEVELOPMENT

Project-Level Involvement: Tran-SET has sponsored, organized, and participated in various workshops, developed and presented revised course materials, and contributed to several professional societies. Illustrative examples are listed below. [WF1, TT1, TT2, EL2, IF4, A2, IN2]

- Dr. Momen Mousa (Tran-SET program manager) collaborated with the Roadway Safety Foundation (RSF) to provide free training programs to transportation engineers (**May 2020**). As part of this collaboration, RSF offered Tran-SET access to its U.S. ROAD ASSESSMENT PROGRAM (usRAP), a free online training program that offers highway engineers, safety planners, and transportation agencies unique and user-friendly tools for evaluating the safety of their road networks. For more information about this program, please visit [this website](#).
- Dr. Douglas Cortes (Tran-SET PI) of New Mexico State University coordinated with Pontifical Xavierian University (Universidad Javeriana) in Colombia to provide a presentation to educate the public about recent subsurface exploration techniques (**August 2020**).
- Dr. Fernando Moreu (Tran-SET PI) organized a webinar at the University of New Mexico to educate the industry about the smart management of infrastructure (**July 2020**). About 110 attended the webinar from many states and six different countries.

MANAGEMENT

Project Data Management Plan: Tran-SET required all fourth-cycle proposals to include project-specific data management plans. These plans were considered as part of the review/selection process (**May 2020**). [M1, A2]

Section 508/Accessibility: Tran-SET has been working diligently to ensure all public facing content (submitted to NTL and all content residing on the Tran-SET website) is 508 compliant. Completed

content includes documents and reports on Tran-SET's website, all other information on Tran-SET's website and social media page, and videos content. [M1, A2]

CAB Engagement: Tran-SET solicited feedback from the CAB members on how well Tran-SET activities are addressing regional needs and impacting state-of-the-practice (**Aug. 2020**). A rating of 4.2 out of 5 (5 being perfect) was assigned by the CAB members in response to how well the center's research portfolio addresses regional transportation challenges. Related comments included *"At the 2019 conference, I was impressed by the topics and quality of research"* and *"There is excellent collaboration with State DOTs in developing and implementing projects."* In addition, a rating of 4.4 out of 5 was assigned on how effective was Tran-SET promoting its activities/initiatives through newsletters, social media, center website, conference proceedings, seminars, etc. [M1, all, A2]

Dissemination of Results

Please see the "Technology Transfer" subsections of Sections 1 (above) and 3 (below) documenting Tran-SET's main outreach activities. More generally, results have been disseminated via: social media ([Tran-SET website](#), [LinkedIn](#), [Twitter](#), and [YouTube](#)), newsletters, other promotional documents (i.e., project briefs), conferences, educational materials, and peer-reviewed publications.

Activities Planned (for Next Reporting Period)

RESEARCH

- Archive and finalize remaining third-cycle project deliverables (**Dec. 2020**). [TT1, IN2]
- Review/rank fifth-cycle problem statements (**Oct. 2020**), develop request for proposals for selected problem statements (**Nov. 2020**), and finalize review of proposals (**Mar. 2021**). Priority will be given to projects addressing the impacts and/or challenges of COVID-19 on transportation infrastructure. [R1, R2, R3, R4, S1, IF2, IF3, IF4, IN1]

TECHNOLOGY TRANSFER

- Develop and disseminate Tran-SET newsletter for winter 2020 (**Dec. 2020**) and spring 2021 (**Mar. 2021**). [TT1, IN2]
- Organize and jointly host two webinars in the "Joint-Tran-SET Webinar Series" (**Dec. 2020**, **Mar. 2021**). [TT1, TT2, EL1, EL2, EC1, IF4, IN2, A2]
- Continue to develop, promote, and expand Tran-SET's educational video portfolio (on-going); and continue uploading videos from the 2020 Tran-SET Conference (**Oct. 2020**). [TT1, IN2]
- Develop/disseminate "Project Highlights" for each third-cycle project (**Jan. 2021**). [TT1, IN2]
- Develop/disseminate "Project Facts" for each fourth-cycle project (**Nov. 2020**). [TT1, IN2]
- Continue planning activities for the 2021 Tran-SET Conference, tentatively planned on **May 17-22, 2021** in Jonesboro, Arkansas. [TT1, TT2, EL2, IN2]
- Promote and disseminate third-cycle reports and project datasets via Tran-SET listserv and social media (**Jan. 2021**). [TT1, IN2]

EDUCATION

- Continue the organization of the "Native American Transportation Internship", including: developing new applicant processes and instructions (**Jan. 2021**), hosting webinar to explain and promote Internship (**Feb. 2021**), begin working with Native American organizations at partnering institutions to find applicants (**Feb. 2021**), and begin developing Internship program and application selection (**Mar. 2021**). [E1, EL1, EC1, ED1, IF4, A2]
- Continue to offer the Tran-SET Scholarship for Veterans, disseminate, and award to three recipients in the **2020 fall** and **2021 spring** semesters. [E1, EL1, EC1, ED1, IF4, A2]

- Participate in the 3rd Annual Southeastern Back-to-School STEM Fest in Southeastern Louisiana University (**Spring 2021**). [E1, IF4, A2]
- Participate in the 2021 CoE HSSR Program in LSU. At least four high school students will be selected (**Nov. 2021**) to work on four Tran-SET projects. [E1, EL1, EC1, ED1, IF4, A2]

WORKFORCE DEVELOPMENT

- Integrate developed educational modules and revised courses into the recently created LSU Construction Management online programs: B.S., Post Baccalaureate Certification, and M.S. degree programs (on-going). [WF1, TT1, TT2, EL2, IF4, A2, IN2]
- Continue sponsoring, organizing, and participating in workshops, developing and presenting revised course materials, and involvement in professional society activities (on-going). [WF1, TT1, TT2, EL2, IF4, A2, IN2]

MANAGEMENT

- Organize and host an in-person, mid-year meeting with Associate Directors, Program Directors, and CAB members to discuss the management/operation of Tran-SET and ways to improve our processes (**Jan. 2021**). [M1, all, A2]
- Provide 508 compliant captions for remaining video content (**Oct. 2020**). [M1, A2]

2. Participants & Collaborating Organizations

During this reporting period, Tran-SET partnered with **104** organizations (33 academic institutions, 23 government agencies, 41 industrial firms, and 7 nonprofits) to accomplish and oversee its research, technology transfer, education, and workforce development activities. Please see Table 2 for details.

Tran-SET collaborated with **30** organizations/individuals (from 9 academic institutions, 8 government agencies, 5 industrial firms, and 8 nonprofits.). As shown in Table 3, these collaborations embody interdisciplinary approaches.

Partners (Selected)

Table 2. Tran-SET Partners.

Organization Name	Type	Location	Description of Contribution [Tran-SET Affiliation]
Advance Infrastructure Design	Industrial firm	Hamilton Township, NJ	Collaborative research [PRC]
AECOM	Industrial firm	Los Angeles, CA	Collaborative research [PRC]
Alabama Transportation Institute - University of Alabama	Academic institution	Tuscaloosa, AL	Collaborative research [PRC]
Alliance Safety Council (Industry)	Nonprofit	Baton Rouge, LA	Collaborative research [CAB]
Alma Plantation	Industrial Firm	Lakeland, LA	In-kind support [fourth-cycle]
APS Engineering and Testing LLC	Industrial firm	Baton Rouge, LA	Collaborative research [PRC]
ARA	Industrial firm	Albuquerque, NM	Collaborative research [PRC]
Arcadis	Industrial firm	Amsterdam, NL	Collaborative research [PRC]
Arkansas Concrete Pavement Association	Academic institution	Little Rock, AK	Collaborative research [PRC]
Arkansas Department of Transportation (ARDOT)	Government	Little Rock, AR	In-kind support [fourth-cycle]; Collaborative research [CAB]
Association of American Railroads (AAR)	Nonprofit	Washington D.C.	In-kind support [fourth-cycle]
Atlas Asphalt Inc.	Industrial firm	Jonesboro, AR	In-kind support [fourth-cycle]
AZZ	Industrial firm	Fort Worth, TX	In-kind support [fourth-cycle]

Organization Name	Type	Location	Description of Contribution [Tran-SET Affiliation]
Barriere Construction Company	Industrial firm	New Orleans, LA	Collaborative research [CAB]
BASF	Industrial Firm	Florham Park, NJ	In-kind support [fourth-cycle]
Bechtel Oil, Gas & Chemicals	Industrial firm	Reston, VA	Collaborative research [PRC]
Bernalillo County Public Works	Government	Albuquerque, NM	Collaborative research [PRC]
BNSF Railway	Industrial firm	Kansas City, MO	In-kind support [fourth-cycle]
Boise State University	Academic institution	Boise, ID	Collaborative research [PRC]

Collaborators

Table 3. Tran-SET Collaborators.

Organization/Name	Type	Description of Collaboration [Tran-SET Affiliation]
AECOM	Industrial firm	Shared data pertaining to CRPC vanpool program development and inflow-outflow analysis
American Highway Users Alliance	Nonprofit	Tran-SET Joint Webinar Series
Automated Railroad Maintenance Systems (ARMS)	Industrial firm	Provide feedback and assessment of the work
Build Baton Rouge (East Baton Rouge Redevelopment Authority)	Government	Shared unpublished plan documents and information pertaining to station area development planning and strategy
Caltrans	Government	Tran-SET Joint Webinar Series
Chinese Earthquake Administration (CEA)	Nonprofit	Laboratory for testing LiDAR in large scale facilities and input on large scale applications
City of SA	Government	Discussed field implementation
CPS Energy	Government	Presented harvesting results on 9/13/2019
ESPOL University	Academic institution	Process bagasse ash, prepare SCBA-ECC mixtures and evaluate its properties. Conduct research on zeolite-based EGC materials.
FHWA	Government	Discussed application of the vehicle classification software (Debbie Walker)
Greyhound	Industrial firm	Collaboration in in-person data collection for existing intercity passenger service customers
Institute of Engineering Mechanics (IEM) China	Nonprofit	Student to provide input on LiDAR for SHM of structures
Jonesboro High School (JHS)	Academic institution	The STEM Academy of JHS will select qualified students for the internship program
LaDOTD	Government	Help the PIs visit bridge construction sites
Megabus	Industrial firm	Collaboration in in-person data collection for existing intercity passenger service customers
New Orleans Building Corp. (NOUPT)	Government	Facilitated tenant contacts and communication and provided permission and collaboration for survey distribution
PSB Engineering	Industrial firm	Basic advice and guidance for bridge deck condition evaluation
Ride New Orleans	Nonprofit	Shared past survey data of New Orleans-Baton Rouge passengers collected during final months of LA Swift Service
Stantec	Academic institution	Tran-SET Joint Webinar Series
The University of Arkansas	Academic institution	The university is supporting the research team in using high-performance computing clusters, AHPCC.
The University of Iowa	Academic institution	Tran-SET Joint Webinar Series
The University of Texas at Arlington	Academic institution	Tran-SET Joint Webinar Series
U.S. Geological Survey	Government	Tran-SET Joint Webinar Series
University of Memphis	Academic institution	Tran-SET Joint Webinar Series
University of Nebraska at Lincoln	Nonprofit	Sharing LiDAR experience in monitoring reinforcement, possibility of training PhD student in LiDAR monitoring of reinforcement.
University of Texas at San Antonio	Academic institution	Tran-SET Joint Webinar Series

Organization/Name	Type	Description of Collaboration [Tran-SET Affiliation]
Mansourah University (Egypt)	Academic institution	Literature review collaboration and potential share of engineering experience
Virginia Polytechnic Institute and State University	Nonprofit	Collaboration with algorithm development on point cloud data
Women4Climate (C40 Cities)	Nonprofit	Collaboration with local mentor/mentee pair to share stakeholder interview data and support survey distribution efforts
Yangzhou University (YZU)	Nonprofit	Training of Master student in smart structures and structural health monitoring

3. Outputs

Performance metrics and targets for outputs, outcomes, and impacts of Tran-SET's research, T2, education, and workforce development programs are discussed below.

RESEARCH

Table 4 lists Tran-SET's performance metrics for research-related outputs. In total, **61** new technologies/techniques were developed. They are briefly summarized below.

Table 4. Research Performance Metrics: Outputs.

ID	Objective ID	Metric	Value ¹	Ann. Value ²	Ann. Target ³	Percent Compl. ⁴
	R4, S1, IF2, IF3, IF4, IN1	Number of projects specifically addressing regional challenges:				
R-01		Metropolitan growth and congestion	6	6	5	120%
R-02		Future transportation challenges	10	10	15	67%
R-03		Declining public revenues	4	4	3	133%
R-04		Underserved communities	2	2	2	100%
R-05		Safety	5	5	5	100%
R-06	EC1	Number of collaborative (multi-institution) projects	10	10	11	91%
R-07	R1, R2, R3, R4, IN1	Number of new technologies or techniques developed	61	104	60	173%

¹Metric value for reporting period; ²Best estimate for annualized metric value; ³Annual, per funding cycle, target;

⁴Percent completion of annual target; same column definitions for Tables 4 – 13.

Discussion of Performance Metrics: Developed Technologies or Techniques

The target for this metric was re-evaluated and was raised from **30** to **60**. The increase is due to successful research conducted during the third-cycle projects. Examples of developed technologies or techniques are presented below.

1. **Dr. Arturo Montoya (PI)** and his research team in **UTSA** developed a model that models the welding and galvanizing process of high-mast illumination poles (**Project No. 19STUTSA02**).
2. **Dr. Fernando Moreu (PI)** and his research team in **UNM** developed a new procedure for automatic inspection of rebar using LIDAR that measures spacing of rebar in the field without contact or tape measurer, for the entire rebar mesh (**19STUNM02**).
3. **Dr. Zahid Hossain (PI)** and his research team in **ASU** developed a neural network model to predict liquefaction potential of soils near Jonesboro (**19GTASU01**); he also developed database showing the compatibility ranks of different aggregate-binder systems (**19BASU02**).
4. **Dr. Ham (PI)** and his research team in **UTA** developed an Ultrasonic Water Level Detection (UWLD) module (**Project No. 19ASUTA03**).

TECHNOLOGY TRANSFER

Table 5 lists Tran-SET's performance metrics for T2-related outputs. Please see the selected output examples below.

Table 5. Technology Transfer Performance Metrics: Outputs.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
TT-01	TT1, TT2, IN2	Number of stakeholders identified, specifically¹:				
TT-02		Early potential adopters	44	44	30	147%
		Late potential adopters	43	43	30	143%
TT-03	TT1, TT2, IN2	Number of times research products (technology) are disseminated via the following channels:				
TT-04		Featured in Tran-SET newsletter	12	30	25	120%
TT-05		Featured on Tran-SET social media	20	48	50	96%
TT-06		Peer-reviewed publications and presentations	135	199	130	153%
		Webinars	5	11	5	220%
TT-07	TT1, IN2	Tran-SET website traffic:				
TT-08		Number of visitors to website	17k	34k	30k	113%
		Number of visits to website	122k	244k	250k	98%
TT-09	TT1, TT2, IN2	Number of times disseminated research products have informed/been viewed:				
TT-010		Social media engagement levels(s)	5.9/3.8	5.9/3.8	4.5 ² /2.5 ³	132/151%
TT-011		Number of times reports (or related) are downloaded	4,516	8,121	5,000	162%
TT-012		Number of citations from publications	132	213	120	178%
		Presentation attendees or views	7,383	15,653	9,000	174%
TT-013	TT1, TT2, IN2	External funds:				
TT-014		Industrial partners providing funds	8	8	4	200%
TT-015		Public agency partners providing funds	4	4	10	40%
TT-016		Total funds from industrial partners	\$185k	\$185k	\$200k	93%
		Total funds from public agency partners	\$284k	\$284k	\$300k	95%

¹Individual stakeholders as specified in third-cycle, project-specific T2 plans; may contain multiple (but distinct) stakeholders within same agency; ²Average "calculated as clicks/impressions" (LinkedIn); ³Average "engagement rate" (Twitter).

Discussion of Performance Metrics: Building Audience

- **Number of Times Reports (or Related) are Downloaded (TT-010):** This metric has significantly increased in this reporting period from 3,605 to 4,516. Readers originated from 124 countries (strong majority from the US) and included educational institutions (46%), commercial entities (42%), and government agencies (12%). The number of downloads was higher than expected, showcasing high interest in Tran-SET research activities. Therefore, the target for this metric was re-evaluated and raised to 5,000 (from 4,000).
- **Presentation Attendees or Views (TT-012):** The target for this metric was re-evaluated and was raised to 9,000 (from 7,500). The increase is due to successful outreach activities conducted during the second-and third-cycle projects' implementation and technical phases.

Peer-Reviewed Journal Publications (Selected)

1. Ngo, H., Kumar, A., & Mishra, S. (2020). "Optimal positioning of dynamic wireless charging infrastructure in a road network for battery electric vehicles." Transportation Research Part D: Transport and Environment, 85, 102385. [Published] [Federal support acknowledged] [Accessible [here](#)]
2. Kumar, A., Guhathakurta, S., & Venkatachalam, S. (2020). "When and where should there be dedicated lanes under mixed traffic of automated and human-driven vehicles for system-level benefits?" Research in Transportation Business & Management, 100527. [Published] [Federal support acknowledged] [Accessible [here](#)]
3. Sahoo, A. and Narayanan, V. (2020). "Differential-game for resource aware approximate optimal control of large-scale nonlinear systems with multiple players." Neural Networks, 124, pp.95-108. [Published] [Federal support acknowledged] [Accessible [here](#)]
4. Li, L., Sahoo, A. and Chang, L. (2020). "A Novel Evolutionary Algorithm with Pareto Front Adaption for Many-objective Optimization." American Control Conference (ACC) (pp. 3607-3612). IEEE. [Published] [Federal support acknowledged] [Accessible [here](#)]
5. Pandey, Arjun; et al. (2020). "Controllable and Scalable Engineered Soil Surrogates Utilizing Simulated Soil Organic Matter for the Study of Environmental, Ecological, and Agricultural Processes"; ACS Earth and Space Chemistry 2020, 4(6), 912-919. [Published] [Federal support acknowledged] [Accessible [here](#)]

EDUCATION

Table 6 lists Tran-SET's performance metrics for education-related outputs. In total, Tran-SET supported **227** students and produced **50** educational modules. Select modules are described below.

Table 6. Education Performance Metrics: Outputs.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
E-01 E-02 E-03	E1, E2, EL1, IF4, A2	Number of students supported from Tran-SET research:				
		Undergraduate students	60	60	50	120%
		Masters students	67	67	50	134%
E-03		Doctoral students	100	100	50	200%
E-04 E-05	E1, E2, EL1, ED1, IF4, A2	Number of research opportunities for under-representative groups:				
		Undergraduate students	22	22	15	147%
E-05		Graduate students	68	68	15	453%
E-06	E1, E2, EL1, ED1, IF4, A2	Total budgeted costs for women and minorities	\$0.35M	\$0.35M	\$1.1M	27%
E-07	E1, E2, EL1, IF4, A2	Number of new transportation-related educational modules delivered	50	92	50	184%
E-08	E1, E2, EL1, IF4, A2	Number of STEM events sponsored by Tran-SET or that participated in	19	35	20	175%

Discussion of Performance Metrics

- **Number of New Transportation-Related Educational Modules Delivered (E-07) and Number of STEM Events Sponsored by Tran-SET or that Participated in (E-08):** These metrics have increased in this reporting period from 42 to 50 and from 16 to 19, respectively,

reflecting Tran-SET's success in educating and engaging students in transportation-related research.

Educational Modules (Selected)

1. Two lectures highlighting the development of the high-mast illumination pole model were developed for UTSA's Finite Element Method course CE 5193 (Project No. 19STUTSA02).
2. An educational module on seismic hazard analysis of transportation infrastructures has been delivered to Transportation Engineering course in ASU (project No. 19GTASU01).
3. An educational module on characterization techniques on iron-based and copper-based shape memory alloys (SMA) materials for structural and transportation applications was developed for TAMU course "MSEN360: Materials Characterization" (Project No. 19STTAM03).
4. A new training course on drone aerial mapping was developed for New Mexico Local Technical Assistance Program (Project No. 19STUNM04).
5. An educational module was developed in Louisiana State University on vehicle-road interaction simulation using MATLAB (Project No. 19PLSU09).
6. An educational module on hypermobility was developed for UTA course "Advanced Topics in Civil engineer" (Project 19ITSUTA02).

WORKFORCE DEVELOPMENT

Table 7 lists Tran-SET's performance metrics for workforce development-related outputs. During this reporting period, **152** revised courses and **65** seminars/workshops were delivered. Tran-SET re-evaluated targets for each metric below and increased them from the previous reporting period (from 70 to 90).

Table 7. Workforce Development Performance Metrics: Outputs.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
WF-01	WF1, IF4, A2	Number of new or revised transportation-related courses	152	255	90	283%
WF-02	WF1, IF4, A2	Number of seminars/workshops presented	65	143	90	159%
WF-03	WF1, IF4, A2	Number of professional society-related events ¹ sponsored or participated in	79	151	90	168%

¹Events include local and regional meetings of various professional societies (e.g., AASHTO, ASCE, ITE, SAE, etc.); Tran-SET believes these local groups are a critical link in developing the transportation workforce.

Seminars/Workshops (Selected)

1. Hossain, Z. **(April 2020)**, "Safety trainings for ready mix concrete operators." Jonesboro, Arkansas. [Federal support acknowledged].
2. S. Ham. **(April 2020)**, "Flood monitoring for infrastructure". SEAoT meeting. [Federal support acknowledged].
3. Subramanya, K. **(June 2020)**, "Modular Construction Vs. Traditional Construction: Advantages and Limitations: A Comparative Study," Creative Construction Conference, Croatia. [Federal support acknowledged].
4. Chandra, S., **(Sep. 2020)**, "The use of drones and image analysis technologies for addressing critical infrastructure inspections and their benefits." Commercial UAV Expo Americas, Virtual. [Federal support acknowledged].

5. Ozcan, H. **(Sep. 2020)**, "Oligocrystalline FeMnAlNi Shape Memory Alloys: Microstructural Evolution, Scale-up, and Magnetic Sensing." North American Materials Colloquium Series (NAMCS). [Federal support is acknowledged].

4. Outcomes

While some of the outcomes will materialize in the long-term, the following subsections detail how current efforts are driving select outputs towards implementation and towards future, meaningful outcomes.

TECHNOLOGY TRANSFER

Table 8 lists Tran-SET's performance metrics for T2-related outcomes. Tran-SET re-evaluated the targets for all metrics below and increased the goals significantly from the previous reporting period.

Table 8. Technology Transfer Performance Metrics: Outcomes.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
TT-C1 TT-C2	TT1, TT2, IN2	External, derivative initiatives spurred by research products Number of additional research projects Total funding of additional research projects	33 \$7.9M	55 \$10.7M	20 \$6.0M	275% 178%
TT-C3	TT1, TT2, IN2	Number of commercialized/patented/licensed research products	11	16	6	267%
TT-C4	TT1, TT2, IN2	Number of stakeholders MOUs	9	14	6	233%
TT-C5 TT-C6	TT1, TT2, IN2	Number of stakeholders who have: Committed to adopt research products Adopted research products	36 16	54 24	25 15	216% 160%

Discussion of Performance Metrics: Further Development and Adoption of Research Products

- **Number of Additional Research Projects (TT-C1, TT-C2):** A total of **33** sponsored research projects (external to Tran-SET) were initiated as a direct result of research products developed from a Tran-SET-sponsored project. The funding agencies for these projects included but not limited to Louisiana Research Transportation Center (LTRC), Arkansas DOT, Arkansas State University, Texas DOT, New Mexico DOT, National Archives and Records Administration, and National Science foundation.
- **Number of Stakeholder MOUs (TT-C4):** Tran-SET-sponsored projects have resulted in **9** stakeholders MOUs. As an example:
 - (1) Dr. Hatif Sharif (PI) is continuing collaboration with the City of San Antonio on traffic safety studies (Project No. 17ITSTSA01).
 - (2) Dr. Mahmoud Taha (PI) has entered into an agreement with TS-Nano Sealants LLC to use the fit-for-purpose Methyl Methacrylate (MMA) polymer nanocomposites for wellbore seal repair (Project No. 17STUNM03).
 - (3) Dr. Zahid Hossain (PI) has signed a material usage agreement with Boral Resources (Project No. 19BASU02).

New Policies, Regulations, Rulemaking, or Legislation (Selected)

- Dr. Ham (PI on Project No. 19ASUTA03) and his research team developed an algorithm for low energy and low cost Ultrasonic Water Level Detection (UWLD). Using this algorithm may

lead to more efficient techniques to monitor flooding in the United States (and related procedures/policies).

- Dr. Kommalapati (PI on Project No. 19PPPVU01) and his team developed a model to evaluate life cycle emission and life cycle cost when diesel buses are replaced with electric buses. These findings will result in steps toward a fossil fuel-free society and a reduction of emissions.

Adoption of New Technology, Techniques, or Practices (Selected)

- A system to monitor the flood water level was developed (Project No. 19SAUTA03), and the results of real-time data collection and processing technology were utilized by the state of Texas.
- The LiDAR sinkhole detection tool developed in Tran-SET Project No. 18GTUNM01 was adopted by ElephantFish, LLC and Pettigrew & Associates P.A.
- The city of San Antonio used the recommendations of Tran-SET Project No. 17ITSTSA01 on the intersection hot spots with high crash rate.
- The New Mexico DOT started using the wildlife monitoring techniques proposed by Tran-SET researchers to prevent wildlife-vehicle collisions (Project No. 19SAUNM03).

EDUCATION

Table 9 lists Tran-SET's performance metrics for education-related outcomes. In total, **227** students participated in Tran-SET-sponsored research.

Table 9. Education Performance Metrics: Outcomes.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
E-C1 E-C2	E1, E2, EL1, ED1, IN4, A2	Number of students participating in Tran-SET research:				
		Undergraduate students	60	60	75	80%
		Graduate students	167	167	100	167%
E-C3	E1, E2, EL1, IN4, A2	Number of times educational modules have been viewed	1,663	2,726	1,000	273%
E-C4	E1, E2, EL1, ED1, IN4, A2	Number of students attending sponsored or involved STEM events	851	1,913	1,300	147%

Increased Body of Scientific Knowledge (Selected)

- The Tran-SET Transportation Veteran Scholarship attracted three students to the transportation field and provided unique opportunities to better prepare them for the workforce. The *actual* outcome of such a program is yet to be assessed; however, the aim is to develop the next generation of transportation leaders and to advance the transportation workforce in target communities (i.e., veterans).
- Tran-SET engaged three high school students in transportation-related research in Louisiana State University. The students worked on asphalt- and pavement-related research projects. Such engagement provides information, exposure, and positive experiences at an influential stage in students' career trajectory.
- The developed copper-based or iron-based shape memory alloys, design process, fabrication, and characterization will aid in advancing the state-of-the-art in the application of this emerging technology in reinforced concrete bridges (Project No. 19STTAM03).

WORKFORCE DEVELOPMENT

Table 10 lists Tran-SET's performance metrics for workforce development-related outcomes. In total, **7,810** attendees participated in new/revised transportation-related courses, seminars, or workshops. Tran-SET re-evaluated the targets for all the first 3 metrics below (WD-C1, WD-C2, and WD-C3) and increased them significantly from the previous reporting period.

Table 10. Workforce Development Performance Metrics: Outcomes.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
WD-C1	WF1, IF4, A2	Number attending offered new or revised courses	4,549	7,678	4,000	192%
WD-C2	WF1, IF4, A2	Number attending presented seminars/workshops	3,261	9,429	4,000	236%
WD-C3	WF1, IF4, A2	Sponsorship: Number of stakeholders sponsoring seminars/workshops/conferences	18	33	20	165%
WD-C4		Total funds of sponsorship	\$63k	\$409k	\$200k	205%

Enlargement of Trained Transportation Workforce (Selected)

- Dr. Su Zhang (PI) at UNM developed a new training course on drone aerial mapping for New Mexico Local Technical Assistance Program (Project No. 19STUNM04). This course provides the necessary information to contractors, designers, and NMDOT to successfully detect bridge deck surface and subsurface distresses at a low cost using Small Unmanned Aircraft Systems (sUAS)
- Dr. Hossain (PI) conducted safety trainings for ready mix concrete operators in Jonesboro, Arkansas. These sessions educated the attendees on the safety protocols to be followed during concrete operations.

5. Impacts

As with the outcomes, the project impacts will be updated as they become available. The following subsections detail how select project outcomes are *envisioned to impact* the transportation system and workforce.

TECHNOLOGY TRANSFER

Table 11 lists Tran-SET's performance metrics for T2-related impacts. These metrics cover related products from second-cycle projects. Estimated impacts will be updated with third-cycle products once their technical phase ends (Nov. 2020).

Table 11. Technology Transfer Performance Metrics: Impacts.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
TT-I1	TT1, TT2, R1, IF2, IN1, IN2	Improve the durability and service life of transportation infrastructure ¹	-	35%	20%	175%
TT-I2	TT1, TT2, IN2	Reduce costs associated with repair and upgrade of transportation infrastructure ²	-	\$75k	\$10k	750%

¹Represents the average percent improvement to service life estimated by second-cycle project PIs of their specific infrastructure component of study, assuming a full-scale implementation and all other factors constant; ²Represents the average cost savings per lane-mile estimated by second-cycle PIs associated with repairs using their specific infrastructure component of study, assuming all other factors constant.

Discussion of Performance Metrics: Impact on Effectiveness of the Transportation System

- **Improve the Durability and Service Life of Transportation Infrastructure (TT-I1):** This metric encompasses **23** applicable products. For example:
 - Implementation of developed methods to effectively synthesize geopolymer cement (GPC) for soil stabilization may improve performance of roadway sublayers by 15-20% (Project No. 18CTAM03); and
 - Better characterization of asphalt binders can reduce premature pavement failures, potentially increasing the service life of asphalt pavement (with modified binders) by 25% (Project No. 18BASU02).
- **Reduce Costs Associated with Repair and Upgrade of Transportation Infrastructure (TT-I2):** This metric encompasses **9** of applicable products. For example:
 - Improved understanding of how recurring cycles of wetting and drying impact soil strength may reduce the frequency of shallow embankment failures, and based on failure frequency rates in Louisiana, may produce a cost savings of \$50k/mile (Project No. 18GTLSU06).
 - Accurately detecting and mapping sinkholes can assist engineers in identifying causes and repairing sinkholes before they significantly damage transportation infrastructure (Project No. 18GTUNM01). In the scenario of gradual subsidence, a road section may be gradually damaged, and repairs in New Mexico can be approximated as \$100k/mile (will vary based on the type of damage incurred).

Impact on Adoption of New Practices and Commercialization (Selected)

- The developed crowdsourcing method to identify road pavement damage through vehicle vibration data (Project No. 18PLSU08) is expected to reduce the frequency of detection of major road damages from three months on average to within one day. Given the savings attributed to early maintenance, this may increase the service of life of the road infrastructure by 10%. Additionally, this process may replace 30% of current manual inspection tasks, leading to significant cost savings.
- The developed LiDAR-based sinkhole detection and mappings tools will be transferred to state DOTs for their free use, and a guidebook and professional trainings may be further developed to assist DOTs in deploying these tools (Project No. 18GTUNM01). The expected impact is a reduction in cost/labor and an increase in accuracy for sinkhole detection and mapping.

EDUCATION

Table 12 lists Tran-SET's performance metrics for education-related impacts. As shown, funded projects have led to the graduation of a large number of students that will effectively contribute to the transportation workforce. Tran-SET re-evaluated target for E-I1 and increased it significantly from the previous reporting period (from 50 to 80).

Table 12. Education Performance Metrics: Impacts.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
E-I1	EL1, EL2, IF4, A2	Number of graduated, supported students entering the transportation field	89	152	80	190%
E-I2	EL1, EL2, IF4, A2	Feedback ¹ of graduated, supported students who've entered the transportation field ²	4.5	4.5	5	90%

¹Feedback solicited from students' advisors; ²Scale: 0 to 5 (5 being perfect); same definitions for Table 13

Impact on Scientific Knowledge (Selected)

- The optimized manufacturing process of high mast illumination poles (Project No. 19STUTSA02) included a model that models the welding and galvanizing process of high-mast illumination poles. This model will provide a better understanding of the root causes of galvanizing cracks in high mast illumination poles.
- Project No. 19PLSU09 developed a vehicle-road interaction model to calculate vehicle induced dynamic loads on road surface. This has contributed to the body of knowledge in the field of transportation and led to a better understanding of the vehicle-road interaction and the characteristics of the asphalt-base-subsoil system under moving loads.

WORKFORCE DEVELOPMENT

Table 13 lists Tran-SET's performance metrics for workforce development-related impacts.

Table 13. Workforce Development Metrics: Impacts.

ID	Objective ID	Metric	Value	Ann. Value	Ann. Target	Percent Compl.
	WF1, IF4, A2	Feedback of seminar/workshop/ Conference attendees:				
WD-I1		Related to skills gained	5	5	5	100%
WD-I2		Related to improved practices	5	5	5	100%

Impact on Transportation Workforce Development (Selected)

- Over 100 researchers and industry leaders from many states and different countries attended a webinar organized by Dr. Fernando Moreu (Tran-SET PI) on the smart management of infrastructure providing exposure to the practical use of next-generation smart sensing technologies and strategies towards safer, cost-effective, resilient and sustainable structures. At the end of the webinar, two drones were raffled using Matlab as a tribute to the famous software being originated in UNM. Positive feedback was received by the attendees. Interest from the webinar is expected to result in future collaboration of UNM with the National Laboratories in the state of New Mexico.
- The eighth Tran-SET webinar on the future impacts of connected and automated vehicle (CAV) applications engaged a diverse audience of designers, state DOTs personnel, contractors, industry suppliers, and researchers. More than 100 attended this webinar (record high). The webinar successfully transferred knowledge and educated the audience of the future challenges of CAV applications. The number of attendees, positive feedback, and post-webinar engagement indicate its success.

6. Changes/Problems

Nothing to report

7. Special Reporting Requirements

Not applicable.

Appendix A

Table 14. Awarded Fourth-Cycle Projects.

Project No.	Title	Total Cost	Leading Institution	Research Objective	Topical Area
20STLSU01	Bridge Load Posting Prediction	\$180,122	LSU	R3	Structural
20BLSU02	Viability Assessment and Cost-Effectiveness of Using High-Modulus Asphalt Concrete (HMAC) as Base Course in Asphalt Pavements in Louisiana	\$120,000	LSU	R1	Asphalt
20BLSU03 ¹	Maintenance and Restriping Strategies for Pavement Markings in Louisiana	\$86,975	LSU	R1	Asphalt
20PLSU04 ²	Development of Decision Trees for the Selection of Pavement Maintenance and Rehabilitation Activities in South-Central United States	\$106,975	LSU	R3	Pavements
20CLSU05 ²	Determination of the Optimal Parameters for Self-Healing Efficiency of Encapsulated Bacteria in Concrete in a Simulated Subtropical Climate	\$135,000	LSU	R1	Concrete
20SAOSU06	Safety of Road Users in Light-Rail Transit Environment	\$130,000	OSU	R4	Safety
20CLSU07 ^{1,3}	Evaluation of Alternative Sources of Supplementary Cementitious Materials (SCMs) for Concrete Materials in Transportation Infrastructure	\$433,527	LSU	R2	Concrete
20CLSU08 ²	Development of Novel Ultra-High Performance Engineered Cementitious Composites (UHP-ECC) for Durable and Resilient Transportation Infrastructure	\$135,000	LSU	R1	Concrete
20GTLSU10	Calculating Pile Downdrag: Experimental and Numerical Investigations	\$90,042	LSU	R1	Geotechnical
20GTLSU11	Rapid Repair of Cracks on the Embankment Slopes Using Bio-Cement	\$90,001	LSU	R3	Geotechnical
20STLSU12	Efficient, Low-cost Bridge Cracking Detection and Quantification Using Deep-learning and UAV Images	\$90,165	LSU	R3	Structural
20SALSU13	Exploring traffic safety problems and challenges of older roads' users in Louisiana: Causes and countermeasures	\$90,000	LSU	R4	Safety
20PPLSU14	Deep reinforcement learning-based prioritization for rapid post disaster recovery of transportation infrastructure systems	\$150,000	LSU	R4	Pavements
20ITLSU16	Combining Virtual Reality and Machine Learning for Enhancing the Resiliency of Transportation Infrastructure in Extreme Events	\$60,000	LSU	R4	ITS
20ITLSU17	Developing Notification and Enforcement Systems to Communicate and Administer Bridge Load Postings	\$120,000	OPEN	R3	ITS
20GTLSU18	Mining of Unmanned Aerial System Operations and Data to Improve Emergency Operations during Natural Disasters	\$210,000	LSU	R4	Geotechnical
20BLSU19	Catalyst Regeneration of RAP-Binder in Asphalt	\$74,998	LSU	R1	Asphalt
20SATAMU20	Preventing Struck-by Hazards: Defying Risk-desensitization via Virtual Accident Simulation	\$40,000	TAMU	R4	Safety
20GTTAMU21	Evaluation of Sustainable and Environmentally Friendly Stabilization of Cohesionless Sandy Soil for Transportation Infrastructure	\$65,000	TAMU	R2	Geotechnical
20CTAMU22 ¹	Multifunctional corrosion control system as a sustainable approach for reinforced concrete elements	\$220,000	TAMU	R3	Concrete
20BASU23 ¹	Effectiveness of Softening Agents for Enhancing Properties of Asphalt Mixes with High RAP Contents.	\$60,500	ASU	R2	Asphalt
20BASU24 ¹	Feasibility Assessment of Warm Mix Asphalt in Arkansas	\$100,099	ASU	R1	Asphalt
20STUTA25	Residual life and reliability assessment of underground RC pipelines under uncertainty	\$112,001	UTA	R3	Structural
20STUTA26	Study on hybrid model combining super learner and physic-based models for SHM in bridges using low-cost BWIM	\$122,000	UTA	R3	Structural
20ITSUTA27	Development of a Multi-Level Dynamic Model to Measure the Resilience Level of Transportation Infrastructure Networks: A Comprehensive Approach to	\$112,235	UTA	R3	ITS

Project No.	Title	Total Cost	Leading Institution	Research Objective	Topical Area
	Quantification of Resilience Dimensions in Highway and Bridge Projects				
20PUTA28	Network analysis to identify critical links for relief activities during extreme weather events	\$112,000	UTA	R4	Pavements
20STUNM30	Field retrofit and testing of a corroded corrugated metal culvert using Glass Fiber Reinforced Polymers	\$160,000	UNM	R1	Structural
20GTUNM31	An automated system for inspecting rock faces and detecting potential rock falls using machine learning	\$100,000	UNM	R3	Geotechnical
20ITSUNM32	Autonomous Vehicle Communication Strategies Modeled in Virtual Reality	\$120,000	UNM	R4	ITS
20STUNM33 ²	Bridge Cracks Monitoring: Detection, Measurement, and Comparison using Augmented Reality	\$120,000	UNM	R3	Structural
20PUTSA34	Expanding the Concept of Comprehensive Area Ratio Parameter to the South-Central States: Towards Simplifying the Structural Evaluation of Flexible Pavements at the Network Level	\$120,180	UTSA	R1	Pavements
20SAUTSA35	Urban Transportation Infrastructure and Cyclist and Pedestrian Safety	\$100,000	UTSA	R4	Safety
20SAUTSA36	Modeling Crash Severity and Collision Types Using Machine Learning	\$80,010	UTSA	R4	Safety
20OPOSU037	A Resource Guide for State DOT's Maintenance Equipment Fleet Management Decisions	\$140,000	OSU	R1	Operations
20ITSOSU38	Smart Battery Management System for Electric Vehicles: Self-learning Algorithms for Simultaneous State and Parameter Estimation, and Stress Detection	\$110,000	OSU	R2	ITS
20GTNMSU39	Compaction Multimeter	\$120,000	NMSU	R1	Geotechnical
20CNMSU40	Durability of Concrete Produced with an Alternative Supplementary Cementitious Material	\$120,000	NMSU	R2	Concrete
20CUNM41	Resilient 3D-Printed Infrastructure with Engineered Cementitious Composites (ECC)	\$146,000	UNM	R1	Concrete
20PUTSA42	An innovative thermo-energy harvesting Module for asphalt roadway pavement	\$138,001	UTSA	R2	Pavements
20ITSUTSA43	A multi-AI-agent framework for vehicle-infrastructure integration and electric vehicle robust charging	\$80,000	UTSA	R2	ITS

¹Industrial firm providing matching funds (public-private partnership); ²Government agency providing matching funds (public-public partnership); ³Multi-institution project