

Semiannual Program Progress Performance Report for  
**Southeastern Transportation Center (STC)**  
US DOT Regional University Transportation Center



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# STC Program Progress Performance Report

## 1. Accomplishments

### a. What are the major goals of the program?

The Southeastern Transportation Center (STC), under the leadership of the University of Tennessee, Knoxville (UTK), is striving to fulfill the mission of the USDOT's University Transportation Center (UTC) Program in Region 4, with special emphasis on our programmatic theme: *comprehensive transportation safety*. In this current UTC Grant reporting period, we have continued on-going activities and initiated key new activities in each of our four program areas - research, education, work force development, and technology transfer - to address existing and emerging transportation challenges in the Southeast, across the US, and throughout the world.

Safety of all users is paramount in the conception, planning, design, building, operation and maintenance of every transportation mode and facility. The STC understands this and the need for vital research and technology transfer to address current and emerging safety issues and challenges. To promote Comprehensive Transportation Safety in our region, STC researchers are striving to better understand the region's safety culture; to gather, curate, and effectively utilize the vast amount of safety-related data available; to integrate and optimize the human interface with our current and future transportation infrastructure and vehicles; and to enhance and more effectively use safety tools like the Highway Safety Manual.

The STC also embraces its role in developing and expanding the transportation workforce – tomorrow's problem solvers and implementers. We are attracting the best and brightest students in our region to careers in transportation, and giving these students the knowledge and tools to be tomorrow's leaders. We are effectively reaching out to teachers, to high school and younger students, and to the private sector to expand the transportation workforce pipeline.

The STC is a "mover" and we are constantly moving forward to advance the UTC Program goals in our Region and beyond!

### b. What was accomplished under these goals? What opportunities for training and professional development have the program provided?

## Research Accomplished under Program Goals

### *Major Research Initiatives (MRI)*

At the start of the program, we conducted a targeted safety research needs assessment in our region to generate the MRI component of our program. Seven DOTs of the 12 SASHTO states reported their priority safety research needs. We supplemented these data with input from our university partners in the states from which no survey responses were received. Based on this, we selected and designed projects to address common and high-priority needs within Region 4. We also coordinated our MR Initiatives with specific research topics identified by the USDOT modal administrators. This process generated four Major Research Initiatives, which are strategically focused research efforts with multiple sources of matching funds, and

collaborations with other UTCs and research entities. These initiatives are continually coordinated and progress is reviewed quarterly. With the completion of each program year, all initiatives are assessed (semi-quantitatively) and refinements are made to ensure focused progress and project success. The next report will indicate any adjustments to the MRIs and individual projects based on the completed assessment.

*MRI 1. Crash Modification Factors and the Highway Safety Manual*  
*Reginald Souleyrette, University of Kentucky, Coordinator*  
*Participating schools: UTK, UK, HSRC, UA*

With the publication of the Highway Safety Manual (HSM), there is now a formal document that can be used to link roadway design with safety consequences. Part C of the HSM provides prediction models that can be used for project level analysis to assess the safety impacts of alternative designs. Crash modification factors (CMFs), which provide an estimate of the safety effectiveness of specific treatments, are available for selected treatments from Part D of the HSM. However, there are many treatments for which reliable CMFs are not available. One of the principal thrusts of MRI 1 is developing CMFs for high priority engineering treatments (stop to signal conversion and two-way to multiway stop conversion). This thrust complements NCHRP Project 17-63 (also being conducted by STC team members) that is developing guidelines for the development of crash modification functions. In addition, research is focusing on work zone procedures in the HSM, verification of previously developed Safety Performance Functions, and performance comparison of four calibration methodologies for SPFs focused on two-lane rural roads. Work is concluding on the initial match projects of this MRI and products, outputs and impacts will be fully reported as the research work is fully documented.

*MRI 2. Integrated Simulation and Safety*  
*Essam Radwan, University of Central Florida*  
*Nikiforos Stamatiadis, University of Kentucky; Co-Coordinators*  
*Participating schools: UTK, UK, UCF*

Simulation has evolved into a productive tool for predicting and evaluating safety on roadways and street networks. Simulation aptly defines human actions, addresses the effectiveness of roadway design and traffic operations on transportation safety, and helps to develop surrogate safety measures. Judicious and creative implementation of simulation tools holds great promise for enhancing HSM methodologies and approaches. Projects within this initiative evaluate the use of simulation in assessing and possibly predicting safety levels for roadway environments for pedestrian and bicycle conflicts with vehicular traffic; review of commonly used simulation tools and their capability to model incidents, accidents, and traffic operation under large-scale incidents requiring evacuations; and are developing vehicle-to-vehicle crash prediction models for intersections. Projects have resulted in an interim draft report that has been updated, papers and abstracts have been submitted and student theses have been initiated and completed. A substantial amount of analysis will have been completed that compares real world cases with simulation scenarios. This will assist in determining the efficacy of simulation for intersection design.

*MRI 3. Exploring Socio-Demographic Characteristics and Culture Factors in Differential Safety Performance across Geography*

*Shashi Nambisan, University of Tennessee*

*Steve Polzin, University of South Florida; Co-Coordinator*

*Participating schools: UTK, USF, UA*

The southeastern US has the highest roadway incident and injury rates in the country. While this disparity in roadway safety has been explored numerous times, these studies most often investigate the physical design characteristics of the transportation infrastructure. Some studies focus on the weather, government policies (e.g., speed limits, seat belt law), and the role of human factors in designing the infrastructure or vehicles. When socio-demographic characteristics are considered, they are typically limited to gender, age, and race or ethnicity. The results have not provided a comprehensive picture or convincing explanation for regional safety performance differences.

The research effort underway with this initiative expands this limited set of characteristics to include socio-demographic characteristics, risk-taking and health characteristics, land use patterns, and other measures that consider the culture and values of the population as potential explanatory factors. Specific projects now underway include the determination of the extent to which population characteristics might explain differential safety performance (dataset development and comprehensive analysis). Research work includes a special focus on motorcycles and heavy vehicle safety. Multiple papers are in various stages of submission and review that includes publication in a major peer reviewed journal. This program area was developed from the beginning with a multi-year progressive research intent. Significant products, outcomes and impact are anticipated.

*MRI 4. Big Data for Safety Monitoring, Assessment, and Improvement*

*Asad Khattak, University of Tennessee, Coordinator*

*Participating schools: UTK, UK, UCF*

Emerging sensor and communication technologies have made traffic, mobility, safety, and other information available ubiquitously and in real-time with appreciable temporal resolution and spatial accuracy. Some of the real time and dynamic data come from infrastructural investments by government agencies for traditional traffic monitoring (e.g., in-road loops and RTMS sensors), some come from private enterprises for logistical operations (e.g., RFID), and still other data come from crowd-sourced personal electronics (e.g., smartphone and Bluetooth equipped units). All these and other increasingly available data can be collected, fused, and mined to help monitor, assess, and improve transportation safety in real-time as well as after the fact.

Along with the potential benefits of big data come issues related to large data volumes, high data velocities, varied data types and formats, and the veracity of the data's accuracy and reliability, thus making big data and the proactive applications that rely upon it vulnerable to interruption, overload, and misuse. Projects within this initiative are: assessing/investigating data sources and scenarios for how different data types can contribute to improving safety; macroscopic safety analysis and real-time crash risk analysis (including pedestrians); analyzed real-time travel time data quality collected from license plate readers, Bluetooth readers, probe vehicles, INRIX database, NAVTEQ, Remote Traffic Microwave Sensors (RTMS). Projects have

already resulted in several research papers and presentations at the Transportation Research Board Annual meeting in Washington, D.C. This research is at a critical stage of data assessment and scenario building that will determine the strategic potential of large amounts of data and data integration. The expectation is that high fidelity prediction of a range of highway safety incidents will be possible and provide for the possibility of avoidance or mitigation.

### ***Opportunity & Exploratory Grants (O&Es)***

All of the current O&E Projects are completed or are nearing completion. An RFP for another round of O&E Projects is being prepared and will be issued in November or December, with the new O&E Projects targeted to begin in the first calendar quarter of 2016.

*UTK – Chris Cherry*

*New technologies and bicycle safety*

*This project is complete and the final report has been submitted.*

The main object of the research is to assess travel behavior of bicycle users: travel speeds, use of bicycle route, wrong-way riding, and route choice preferences. This project aims to point out the characteristics of the route chosen by the cyclists, such as speed limit, traffic volume, and type of bicycle facilities. Finally, these inputs will be used for assessing user safety. Additionally, the research project will modify “The Cycle Atlanta” application for Knoxville, which could provide a huge array of data from the users about their travel characteristics. Hence, using the data from the bikeshare users from Phoenix, AZ and regular cyclists from Knoxville, TN, this research will formulate the methodology to assess the bicycle safety by understanding their behavior. Besides, determining the difference in behavior of these two group of cyclists is one of the objectives. The results of the research project will be shared with Knoxville Transportation Planning Organization, bicycle program planners and the City of Knoxville Engineering Department to assist in bicycle planning and design, so that the agencies can more effectively prioritize investments regarding bicycle infrastructures.

The project started with review of relevant literature that could supplement the project with user behavior and route choice information, which ultimately impacts the safety of bicyclists. This was done to collect information about the probable factors and methodology relevant to the project. The application is named “I BIKE KNX,” and will be used to collect GPS data; it was published in the Play Store and App Store. Both versions can use the phones’ GPS technologies to automatically map the route of the user in addition to collecting the trip data to detect the behavior at various location of the road segments and roadway facilities. The flyers promoting use of the application were distributed all over the campus and downtown areas, most of them attached to parked bicycles. Similarly, e-mail was sent to the bicyclists of Knoxville through a listserv. As a result, there was a significant increase in users of this smartphone application. Additionally, all routes selected by the app users could be now visualized through the map. The street network for Knoxville was available to us previously, and we gathered required street network components for Phoenix, AZ. Social Bicycles gave us access to its raw bikeshare data from Grid Bike Share in Phoenix, which is now being used for the analysis. Preliminary analysis on the data has been done along with the data preparation for the final analysis.

*UTK – Rupy Sawhney*

*Utilizing Assistive Technology to Remove Communication Barriers in the Public Transportation System for Passengers with Disabilities*

The objective was to survey disabled or elderly passengers and transit drivers for collecting information on communication barriers occurring during lifecycle of the transit (Boarding, Travelling, Getting Off) and build a technological communication aid for the disadvantaged passengers.

Our greatest resources are the people: seniors and the various disabled participants and the agencies with whom we had been dealing with, over the last few months. They have voiced their feelings and shared their experiences that have opened doorways to our approach towards the application design. Through their discussions we realized that no two organizations or disabilities should be treated equal. Thus, we came to realize that a multi-cluster application approach was going to be necessary instead of just the initial single application process.

We tested a few groups by taking tablets and making the participants finish the survey online. Participant were:

- People who had no previous computer technological experience
- People who utilized a regular computer to take the survey, and
- Persons who used the tablet technology to take the survey (which seemed to be the easiest application for all three situations).

Some of the participants struggled while trying to do the online survey using a computer, but found that using tablet-based technology was much simpler for them. A lot of it depends on the muscle tone or dexterity of the participant. Even the sensitivity of the equipment itself has been a factor where we have had to modify our approach and use adaptive technology, like a pencil eraser or stylus for accuracy in answering questions on the tablet.

Conclusion: Those who had never used computer technology of any kind previously, adapted quickly to the ease of the tablet application with a few quick lessons or instructions from one of the facilitators from a hands-on approach. This was particularly noticeable with the agencies hosting senior populations who may not be as tech savvy or may be more fearful of newer electronic technologies.

*Clemson – Wayne Sarasua*

*Automated Traffic Surveillance from an Aerial Camera Array*

The primary research objective on this project is to design and develop a tracking algorithm that can identify and track individual vehicles through a network of 16 square miles in near real-time. Other objectives include developing algorithms to map the locations of the vehicles and to extract traffic parameters for data mining purposes. During this last quarter, we have settled on a machine learning approach to detect and track vehicles in aerial camera array video. Our approach, based on deep learning, is holds greater promise than our previous approaches—especially with challenging video sequences with seams and variation in luminance. We continue to try to improve the tracking algorithms while improving computational efficiency. Our goal for the next quarter is to extract traffic data.



*NCAT - Maranda McBride and Lemuria Carter  
Intervention Strategies for Unsafe Cell Phone Usage Among Teen Drivers  
This project is complete and the final report has been submitted.*

Drs. Maranda McBride and Lemuria Carter completed the final phase of their O&E grant. For their research project entitled “Exploring the Importance of Personality Traits, Sanctions, and Fear Appeals on Teen Driver Cell Phone Usage and Textile While Driving (TWD) Law Compliance,” Drs. McBride and Carter developed and administered two surveys to gather data on teen drivers’ texting while driving attitudes and behaviors. Some of the constructs that were tested included personality traits, threats, sanctions, self-efficacy, response efficacy, response cost, attitudes, norms, behavioral control, movable phone involvement, anticipated regret, and perceived advantages and disadvantages of texting while driving.

During the course of the research, an undergraduate student was hired to assist with the literature review, data organization, and result presentation. Since this was her first time working as a research assistant, she was first given a lesson on research methodology. She was also provided general background information regarding the topic and how it contributes to the STC’s goals.

*UCF - Haitham Al-Deek  
Evaluating the Wrong-Way Driving (WWD) Incidents Problem on the Florida’s Turnpike Enterprise (FTE) Roadway System*

Several accomplishments have been made to date. Specifically, the UCF Research Team presented two TRB papers on wrong way driving at TRB 2015 and both papers got accepted for publication in the *Transportation Research Record: Journal of the Transportation Research Board*. One of these two papers won the best freeway operations paper award in April 2015. A third paper on wrong way driving that came out of this project will be presented in the Road Safety and Simulation Conference (RSS2015) sponsored by STC, Orlando, Florida, October 6-8, 2015. Another paper was submitted in July 2015 to TRB 2016 for presentation and publication.

Submitted third progress report along with an updated analysis of wrong way crash data and wrong way event data analysis. Completed literature review and methodology development. Completed WWD hot spot macroscopic route and county ranking and mapping incident hot spots as well as countermeasure identification. Designed, conducted, and analyzed WWD survey (900 sample). Continue to receive SunGuide Traffic Management Center data on WWD events. Received new WWD 911 and citations data. Met with the project sponsor during this period and presented results of the WWD Internet survey which has been completed.

*UK - Adam Kirk  
Development and Evaluation of Coordinated Traffic Signal Emergency Preemption System*

The objective of this research is to quantify the operational benefits of preempting an entire corridor for emergency vehicle operations, rather than preempting each individual intersection as the emergency vehicle arrives.

To date, we have: finalized the simulation models in VISSIM; established priority rules used to model yielding behavior of general traffic to emergency vehicles achieved in simulation; completed volume calibration in the simulation model. identified controller transition types and





measures of effectiveness for evaluation. Travel time data of emergency vehicles on typical arterials has been gathered from the fire department database. Hardware in the loop system has been established and tested for preemption call. Type 2070 Controllers have been upgraded with ASC/3 firmware and timings plan installed and verified using Econolite Centrac Central Management Software.

*USF - Jerri D. Edwards*

*Promoting Safe Transportation Among Older Drivers:*

*Risk Assessment via Driving Simulator Technology*

The primary objective is to validate driving simulator scenarios to assess older driver safety in a clinical-setting. Older drivers' performance in the driving simulator will be validated as compared to in-clinic assessments, on-road driving performance, and state recorded driving citations and crash involvement. Metrics of driving simulator performance indicative of older driver risk will be determined. There is a pressing need for developing and implementing safe and valid methods of assessing older drivers' risk, which will be met by the proposed study.

We obtained IRB approval, trained staff in recruitment procedures and driving simulator assessment. We obtained all supplies and equipment. We finalized the objective on-road performance evaluation. We have enrolled 32 participants in the study: 14 completed the study, 15 experienced simulator sickness, three are enrolled and have completed two out of three study visits. We additionally have successfully recruited and scheduled 20 participants, who will be tested this quarter. We plan to recruit and schedule an additional 10 participants by mid-May. We are finishing the data management system and are training RAs on data entry. We are submitting our IRB-renewal. Our next milestone is the enrollment of 50 older adult drivers. We will be presenting research at the Aging and Cognition Congress in April, 2016.

## **Education Accomplished under Program Goals**

STC-sponsored programs and activities are underway at all nine of the STC consortium schools, and are fully integrated with STC research whenever appropriate. The following sections summarize and demonstrate the scope and variety of education program and activity accomplishments during the current reporting period.

*UTK*

A course on intelligent transportation systems covering safety aspects of connected and automated vehicles was offered by Dr. Khattak during Fall 2015, with 10 graduate students. Another safety course on accident reconstruction was offered in Summer 2015 by Dr. Richards. These two transportation safety courses were revised and updated for delivery. A total of 5 courses were offered in Spring 2015 as part of the transportation curriculum in Civil & Environmental Engineering.

STC and Civil & Environmental Engineering jointly sponsored speaker series and webinars during the reporting period of 2015.

Dr. Cherry participated in STEMPUNK Reverse Science Fair, a part of UTK's Middle School Introduction to Engineering Systems for rising seventh-graders, which is funded by National



Science Foundation. Dr. Cherry introduced some of the STC work on big data and urban transportation safety.

Six UTK students received STC stipends. They worked on safety issues during the reporting period. Nine new students were recruited successfully for Fall 2015.

Dr. Shashi Nambisan partnered with the Office of Diversity Programs, College of Engineering to conduct eVol9, a weeklong program for 9th Grade Students, as part of the 2015 Summer Pre-College Program. The program is titled “Experiments in Transportation: Speed, Distance, Volume, Mass, Acceleration, Braking - So What?” Two graduate students provided support.

This summer, three different educational activities were organized by Shashi Nambisan, the STC Education Director. STC funded these three programs, either fully or in part:

- Program 1: Transportation Systems STEM Summer Academy for Teachers. This program had participation of 14 selected school teachers in Eastern Tennessee. The program included a brief “in-class” overviews of transportation systems, logistics and supply chain management, followed by “Site” or “Field” visits to a variety of real-life settings such a state Department of Transportation (DOT), Traffic Management Center, an air-traffic control tower, a commercial airport and airfield, a traffic signal systems laboratory, and a crash-reconstruction study site. Teachers also had the experience of using a driving simulator operated by TESP on UTK campus.
- Program 2: A Summer Transportation Education Program for Ninth Graders (eVOL9). The primary foci of this program were first to introduce 30 ninth grade students to aspects of transportation engineering, particularly on how human and vehicle factors impact the design and operation of roadways and secondly, to educate teenagers on why road safety should be of value and priority to them. Specific activities included the following: Lecture sessions on topics related to road infrastructure, vehicle and road users; Experimental design of how “stopping sight distance” impact the design of road infrastructures; in class activity on how vehicle loads impact the design of roadway pavement; evaluations were made through a before and after in-class and online survey. Results of the surveys showed a positive impact of the program.
- Program 3: CURENT & TESP Summer Research Program for High School Students. In this program two high school students were mentored by professors and graduate students to conduct research related to transportation and energy. This program was a 6-week joint effort organized by TESP and CURENT (Center for Ultra-Wide-Area Resilient Electric Energy Transmission Network). The topic the students research on was “Analysis of Naturalistic Electric Bike Rider Behavior: Energy and Power Considerations”. At the end of the program, the students made powerpoint and poster presentations at a fair hosted by CURENT.

STC sponsored travel for three UTK students to attend and present technical papers at the Orlando conference. The following activities summarize the awards received by CEE students.

Time	Award	Entity	Recipient
July, 2015	Robert E. Stammer, Jr. Student Chapter Award	Tennessee Section Institute of Transportation Engineers (TSITE)	UTK ITE Student Chapter
July, 2015	Student Paper Competition First Place	TSITE	J. Liu
July, 2015	Student Paper Competition Second Place	TSITE	J.J. Yang
July, 2015	Student Paper Competition Third Place	TSITE	H. Lim
July, 2015	William L. Moore, Jr. Student Scholarship	TSITE	H. McCracken
July, 2015	T. Darcy Sullivan Student Scholarship	TSITE	K. Boakye
July, 2015	TSITE Student Scholarship	TSITE	K. King
July, 2015	Bill D. Kervin Jr. Scholarship	TSITE	Z. Ling
July, 2015	TSITE Student Scholarship	TSITE	L. Taboada

### *Clemson*

In the fall of 2015, Clemson University offered 12 transportation engineering and planning related courses:

- CE 2550 Surveying and Geomatics
- CE 3110 Introduction to Transportation Engineering
- CE 4100/6100 Traffic Engineering Operations
- CE 2520 Economic Evaluation of Highway Projects
- CE 4560/6560 Pavement Design and Construction
- CE 8140 Intelligent Transportation Systems
- CRP 8020 Site Planning and Infrastructure
- CRP 8140 Public Transit
- CRP 8060 Urban and Regional Economics for Planners
- CRP 8340 Spatial Modeling Using GIS
- PSYCH 4350 Human Factors Psychology
- PSYCH 8350 Advanced Human Factors Psychology

Two students received teaching assistantships: Kweku Brown (for CE 2550) and Gowtham Cherukumalli (for CE 3110). Three students received research assistantships: Bryanna Saunders (Masters student studying risk perception in driving environments); Kimmie Lyons (PhD student studying safety effects of open graded friction courses); and Logan Reed (Masters student studying pavement performance optimization).

### *HSRC*

HSRC made progress evaluating and updating the Road Safety 101 course. A course review was completed by an outside instructional design firm, Reify Media, and detailed recommendations were made for overhauling and enhancing the content. The team plans to supplement course modules and instructor delivery with a host of interactive elements involving various types of assignments and activities.

The next steps will involve implementation of the course modifications, as well as the development of a learning management system page that the Road Safety 101 (and other Road



Safety Academy courses) will use to provide content to students. The team plans to roll out Road Safety 101 in Spring 2016.

#### *NCAT*

The STC Education Award application process was held with 45 undergraduate applicants and six graduate applying. Twenty-one undergraduates and one graduate student were selected to receive the STC Education Award this fall. All awardees will receive faculty mentoring through research opportunities, internships, advisement and experiential learning activities. Three recipients are participating in the Transportation Research Board Minority Student Research Fellow program. They will be responsible for writing and submitting a research paper for presentation at TRB. Two former STC recipients have been selected as Dwight David Eisenhower Transportation Fellows for 2015-2016 academic year. They also will be presenting their research papers at TRB.

The Supply Chain program graduated thirteen students in May. All graduates received permanent employment with starting salaries ranging between \$60,000-\$75,000 before their graduation date. Supply Chain majors are heavily recruited from our program.

#### *UA*

- One PhD student is supported with STC funding, working on projects related to the Highway Safety Manual.
- We have begun planning how to use Educational funding to support graduate student travel to the 2016 TRB Conference.
- On June 15-17, 2015, the University of Alabama in association with the Alabama Department of Transportation West-Central Region conducted its “Advanced Transportation Institute” for 10 high school students from underrepresented groups. The Institute had two main purposes:
  - a. To introduce high school students to careers in transportation by partnering with a transportation agency.
  - b. To introduce those students to the college application process, scholarships, and college life.

Institute activities included:

- ALDOT materials laboratory tour
- Quarry tour
- Free-flow speed measurement using radar guns
- Computer bridge design and bridge break
- Presentations by ALDOT and UA personnel on job opportunities and university life
- University dormitory tour
- 3-D printing lab tour
- Culminating banquet (with families)



### UK

Our education objective is to select, engage, and support graduate students in safety research, and support undergraduate and high school teacher and student outreach. Our supporting activities included:

- Selecting and assigning three graduate students to STC research projects
- Conducting high school student mentoring at UK

We accomplished engaging graduate students and high schoolers to support safety research. One high school student entered college at UK, and is now working as part time undergraduate research assistant.

Dr. Nick Stamatiadis continued work on the Safety Engineering Education Symposium (SEES) modular course materials, completing 85% of materials, including nine of the 10 planned original presentations with instructor notes. Dr. Stamatiadis gave an overview presentation during the Road Safety and Simulation 2015 conference in Orlando, FL where the content of the material was presented and a sample presentation was reviewed. Feedback was solicited and received on the content, topics, and possible additional items to be included. The course will be piloted at UK in Spring 2016 semester by faculty with no experience in the course, and Dr. Stamatiadis will monitor progress.

### USF

During this period progress continued on our research as well as student support activities. Four different students have received STC support during the past year. One student completed her MSCE thesis requirements completing her thesis titled, “Risk-Taking Characteristics as Explanatory Variables in Variations of Fatality Rates in the Southeastern United States” and graduated in May 2015. This effort was carried out in conjunction with MRI 3 and these efforts contributed to the descriptive analysis as well as become a component of the analysis for USF MRI 3 activities.

## Technology Transfer Accomplished under Program Goals

A variety of STC-sponsored technology transfer activities were underway or completed at our STC consortium schools during the current reporting period. Most notable were the STC co-hosting of the 2015 Road Safety and Simulation International Conference, and the STC-organized and led session at the 2015 Annual SASHTO meeting, *State DOTs and University Partnerships*. These events and many other technology transfer activities and accomplishments are highlighted in the following sections.

### UTK

On October 6–8, UCF and UTK hosted the 2015 Road Safety & Simulation International Conference. Under the auspices of the Southeastern Transportation Center, three world-class research centers supported the conference: Center for Advanced Transportation Systems Simulation, and the Institute for Simulation and Training at UCF; and UTK’s Center for Transportation Research. See page 16 for complete details of RSS 2015.



STC organized and led a session at the 2015 Annual SASHTO meeting, *State DOTs and University Partnerships*, and gave these presentations (click on titles to download presentations):

- *State DOT & University Partnerships*, Stephen H. Richards, University of Tennessee
- *Combining University and Consultant Resources: The Farmer and the Cowboy Can Be Friends*, Mark Burton, University of Tennessee and Paula Dowell, Cambridge Systematics
- *University Role in Transportation Workforce Development Activities*, David B. Clarke, University of Tennessee
- *Using Universities to Carry Out State DOT Research: Opportunities and Challenges*, Joe Crabtree, University of Kentucky
- *Dealing with Emerging Technology and State Standards*, Daniel S. Turner, University of Alabama

STC will host the 2016 UTC Conference for the Southeastern Region, March 31-April 1, 2016 in Knoxville, Tennessee. The conference theme is *Safety, Mobility & Sustainability*. This innovative conference will bring together faculty, students, practitioners, and public agencies in the southeast to showcase recent achievements and collaborations. The program promises to be a fast-paced and engaging opportunity to share where we've been and where we're going in transportation research, education, and tech transfer.

UTK staff created a numbering scheme to track progress on STC-funded Major Research Initiative and Opportunity & Exploratory projects. They also completed an online application to allow STC researchers to add their reports, conference papers, publications, and presentations into an indexed searchable database. This application will be rolled out the week of November 2, 2015.

UTK staff created a comprehensive email list to reach our stakeholders, colleagues, and peer programs to communicate via newsletters (three were produced during this reporting period), conference invitations, and requests for input.

Other T2 highlights at UTK during this reporting period include:

- Dr. Khattak worked to enhance the visibility of STC sponsored Journal of Safety and Security by serving as “special adviser” and Dr. Nambisan served on the “editorial board member.” Dr. Khattak continued as Editor-in-Chief of SCI-Indexed Journal of Intelligent Transportation Systems and Associate Editor of SCI-Indexed International Journal of Sustainable Transportation.
- Dr. Han continued to serve on the editorial board of International Journal of Transportation Science and Technology in 2015; and editorial board of Journal of Traffic and Transportation Engineering in 2015; and on the editorial board of the Scientific World Journal.



- Dr. Cherry served on the editorial board of International Journal of Sustainable Transportation. He also served on the Editorial board of a new journal, “Traffic and Transport Theory & Practice.”
- Ms. Lissa Gay was named chair of the Standing Committee on Technology Transfer (ABG30) Task Group for Marketing.
- Transportation Engineering & Science Program, Department of Civil & Environmental Engineering maintained the UTK STC project website that provides information about relevant activities and results. Also, UTK faculty collaborated with STC staff on STC website content.
- Faculty, staff, and students wrote and submitted several technical papers for presentations in the Transportation Research Board annual meeting in January 2016. The papers provide significant results related to safety. Details will be available in the next reporting period.
- Dr. Nambisan participated in quarterly meetings of local law enforcement agencies which addressed enforcement activities to enhance road safety and provided updates on ongoing research projects.
- A team of researchers from the UTK Center for Transportation Research, Dr. Nambisan, and Kwaku Boakye and Alexandra Boggs, graduate students, participated in outreach activities that involved using STC’s *Seatbelt Convincer* to impress upon the general public the importance of wearing seatbelts as occupant of motor vehicles. These included events at UTK, Knox County, and Blount County where more than 200 people took a ride on *The Convincer*.
- Dr. Nambisan continued his work as immediate past-president of the Council of University Transportation Centers.

UTK CEE faculty, staff, and students served on various Transportation Research Board committees:

- Dr. Nambisan continued his work as president of the Council of University Transportation Centers. Dr. Nambisan continued as co-chair the TRB National Data Requirements and Programs committee, a member of the TRB Education and Training Committee., and a member of the Conduct of Research Committee.
- Dr. Khattak served as co-chair of Advanced Traveler Information Systems sub-committee.
- Dr. Cherry served as a member of ANF20, bicycle transportation. He also chaired the joint (bike, ped, motorcycle, law enforcement committees) subcommittee on emerging technologies for low speed vehicles. He serves on the Knoxville Greenway Commission.
- Dr. Han served on the TRB Managed Lane committee, which is a standing committee that deals with the operational and safety aspects of lane management policies and technologies. Dr. Han continues to be a full member of TRB Emergency Evacuation Task Force, which was elevated to a full committee status. Several STC MRI efforts can benefit

and can influence the efforts at this committee. Dr. Han continues to serve as the University of Tennessee's Representative to TRB.

Notably, all research, education and outreach/technology transfer goals were met for the reporting period. Substantial activity was directed toward gaining momentum on research initiatives, working with and recruiting new STC students, and preparing research papers for presentation at the Transportation Research Board annual meeting in 2016.

### *Clemson*

Several undergraduate students were hired as researchers to collect data related to safety calibration sites and safety/accessibility issues on the Clemson campus. The students participated in a number of outreach activities including the K-6 Engineering Expo at Clemson University. Hundreds of students got hands on experience with research projects including this biking and texting experiment. Students rode around a small course trying to maintain lane position while responding to texts on a handlebar mounted smart phone. Not surprisingly, the young students were no better at this than the adults who tried.

The Clemson University office of Programs for Educational Enrichment and Retention known as P.E.E.R. hosted a week of activities designed to engage 24 incoming minority freshmen and transfer students through research experiences. This summer program was called F.I.R.E., which is an acronym for Foundations in Research Experience. This is the first year for FIRE at Clemson. Each day, participants had the choice of choosing from a different research experience in either mechanical engineering, supply chain simulation, sustainability, bio-engineering, electrical engineering, or civil engineering.

The Civil Engineering research experience, led by Dr. Jennifer Ogle, and graduate student Bryanna Saunders, revolved around the topic of universal design and accessibility and engaged the new students in an interactive research experience from obtaining background knowledge on a topic, to field data collection and then mapping and using data in a geographic information system. The students participated in the following activities:

- **Guest Speaker:** Malaya Reece, a current Clemson junior majoring in Computer Science, talked to us about her experiences on the Clemson University campus, and growing up with a disability – she is legally blind. We learned what resources are available to blind or disabled students at Clemson. Reece also joined us on our interactive tour around campus and showed up how she used her cane and other senses to navigate.
- **Video Discussion:** Prior to coming to the FIRE workshop, the students were asked to watch one or more TED Talks given by individuals with disabilities or disability advocates. The group spent some time discussing relevant issues, viewpoints, and themes from the video homework.
- **Accessibility Terms Training:** Students learned about universal design, components of accessibility in design, and how to identify/measure impediments to accessibility.
- **Interactive Experience:** Students had the opportunity to participate in observing and geocoding accessibility enhancements and detractors on the Clemson campus. They also had to experience the challenges of maneuvering in a wheelchair.



- GIS Data Challenge: Learn to import GIS data, and use that data to identify problem areas. The group reviewed accessibility maps from around the country at other facilities.

We received phenomenal feedback about the activity from participants and the director of P.E.E.R.

“That was absolutely fascinating! Thank you so much for offering your eye-opening research experience for FIRE. I knew Clemson wasn’t a universal design-friendly campus from unfortunate personal experience, but learning a little about all the many, many things that have to be considered to make an environment truly open to all was an education for me – not just the students! I think they really welcomed the hands-on challenges you presented, and I know the service aspect of your research had a great appeal.” – *Susan Lasser, FIRE Director*

“ I have a friend who is blind too. We’ve been friends since the kindergarten and he’s coming to Clemson too. It’s good to see someone else here [with a disability] who has made Clemson their home.” – *FIRE student participant, Tevin, after hearing Malaya Reece’s presentation.*

Students are invited to attend several field trips and professional meetings throughout the year, and in the last reporting period students participated in:

- Visited Clemson Chamber of Commerce to see the new retaining wall and railroad structures – April 4, 2015
- SDITE Meeting and Traffic Bowl in Biloxi, MS – April 19-21, 2015
- A visit to the Doodle Bicycle Trail construction site and meeting with the City of Easley Public Works Director – April 24, 2015
- Spring Retreat in Charleston – May 3-5, 2015
  - a. Lunch with Luke and Mary Fant who endowed the ITE Student Chapter at Clemson.
  - b. Demolition/construction service project with Citadel Professor Dr. Jeff Davis
  - c. Tour of the SCDOT Traffic Management Center with Paul Register
  - d. Tour of the Clemson University SCE&G Energy Innovation Center
  - e. Presentation at CARTA by Jeffrey Burns, Executive Director
  - f. Drop in visit at STANTEC Offices in Charleston

Students are encouraged to participate in technical service projects throughout the year, and in the last reporting period students participated in:

- Clemson Area Transit (CAT) Fall Semester Ridecheck
- Clemson University Football Traffic Study
- Clemson University Parking Utilization Study
- Clemson Elementary Traffic Study

#### *NCAT*

Twenty-five students applied to the 2015 Summer High School Transportation Institute (STI). Sixteen students were selected, seven girls and eight boys attended. Although the STI has a

commuter student format, three states and several North Carolina counties were represented. These high school juniors and seniors received a rigorous curriculum over the five and one half weeks. They studied the five modes of transportation, examining a mode each week including a focus on safety for each mode. Federal, state, local, corporate and university partners delivered interactive lectures and presentations to the participants. They researched careers for each mode as well. Several on site field trips were taken both in-state and out-of-state. The highlight of the summer field trips was to participate in the Garrett Morgan Youth Symposium sponsored by the Conference of Minority Transportation Officials (COMTO). This activity was held at the Harvard University Law School in Boston, MA. A local high school debate team debated a transportation topic focusing on minorities and women in decision making positions in the transportation industry.

Dr. Laquanda Leaven is evaluating, and revising as well as developing transportation themed STEM educational materials for use in the current school curriculums to interest and engage students in transportation as a career choice. This work is for the Garrett A. Morgan Technology and Transportation Education Program Clearinghouse. North Carolina A&T State University is working in conjunction with the Knox County School System and University of Tennessee, Knoxville.

#### *UCF*

On October 6–8, UCF and UTK hosted the 2015 Road Safety & Simulation International Conference.

The RSS series showcases advancements in traffic simulation and driving simulator technologies, introducing new initiatives and concepts that have emerged since the first RSS conference in Rome, Italy in 2007. Under the auspices of the Southeastern Transportation Center, three world-class research centers supported the conference: Center for Advanced Transportation Systems Simulation, and the Institute for Simulation and Training at UCF; and UTK's Center for Transportation Research. These centers conduct sponsored research in driving simulators, traffic simulation, traffic safety, commercial vehicle operations, Intelligent Transportation Systems deployment, and congestion pricing; human factors; and comprehensive transportation safety, including surface modes, rail, and bicycle and pedestrian issues.

Close to 210 people attended RSS 2015. There were 96 podium presentations, 65 posters, and three keynote speakers: Dr. Peter Hancock (Provost and Distinguished Research Professor in the Department of Psychology and the Institute for Simulation and Training), Dr. David Yang (FHWA Human Factors Team Leader Office of Safety Research and Development), and Jeff Greenberg (Senior Technical Leader at Ford Motor Company's Research and Advanced Engineering group). Dr. Nick Stamatiadis gave a special session course modules for safety education curriculum.

The sponsors and exhibitors were the Southeastern Transportation Center, Transportation Research Board, PTV Group, Elsevier, FHWA, National Advance Driving Simulator (NADS), Midwest Transportation Center, and Caliper.

### c. How have the results been disseminated?

#### UTK

The University of Tennessee Civil & Environmental Engineering faculty has disseminated the STC related results through several sources, including the internet, and prepared/given presentations at conferences, e.g., for the Transportation Research Board Annual Meeting in 2016. Several graduate students are involved in research efforts. A list of TRB technical papers/posters, reflecting collaborations between various UTK entities and other universities will be available in the next reporting cycle, after the outcomes of the review process are communicated. Representative technical papers prepared for TRB annual meeting in 2016 are mentioned below:

- Liu, J., A. Khattak, & M. Zhang, What role do pre-crash driver actions play in work zone crashes? Untangling hierarchies in crash data. To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Lim, H., L. Han, & A. Khattak, The impact of narrow lanes on safety of arterial lanes. To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Liu, J., & A. Khattak, Delivering improved alerts, warnings, and control assistance using basic three safety messages transmitted between connected vehicles, To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Liu, J., A. Khattak, & M. Zhang, Structuring and integrating data in metropolitan regions to explore multi-level links between driving volatility and correlates, To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Dong, Chunjiao, M. Burton, S. Nambisan, and J. Sun, Effects of car-truck mix on the occurrences of truck-related crashes, for presentation at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Nambisan, Shashi, Kwaku Boakye, and Ebony Lemons, An Overview and Preliminary Assessment of a Summer Transportation Experiential Learning Program for Ninth Graders, for presentation at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Ranjit Khatri, Chris Cherry, Shashi Nambisan, and Lee Han, Modeling route choice of bikeshare users with GPS data, for presentation at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- S. Nambisan Increasing Nighttime Seatbelt Usage Rates: Program Overview, Data Needs, and Evaluation Strategies, Traffic Enforcement Joint Network Meeting, Alcoa, TN. April 9, 2015.
- S. Nambisan, J. Everett, M. Cate, K. Boakye, Increasing Nighttime Seatbelt Usage Rates: Baseline Data and Evaluation, Traffic Enforcement Regional Network Meeting, Knoxville, TN. June 8, 2015.

UTK faculty and Center for Transportation Research (CTR) staff have disseminated STC related results through the Internet and presentations at conferences, especially the 2015 ITS World Congress (ITSWC) in Bordeaux, France and 2015 Road Safety & Simulation (RSS) Conference in Orlando, Florida. The faculty involved in research efforts includes Drs. Han, Khattak, Cherry, Nambisan, Baoshan Huang, Stephen Richards (STC Director), David Clarke (CTR Director), and several graduate students. Their efforts are highlighted in production of several technical papers and research presentations/posters, reflecting collaborations between various UTK entities and other universities.

Dr. Cherry gave an invited talk in the Tennessee Bike Summit, Knoxville, TN, April 2015. He discussed the study of bicycle crash at railroad tracks funded by STC.



In July 2015, Dr. Khattak presented at: the 15th COTA International Conference of Transportation Professionals in Beijing, China; the 2015 SWJTU Workshop on Public Transit at Southwest Jiaotong University, Emei Campus, Leshan, Sichuan Province, China; and the 2015 International Workshop on Sustainable Urban Transportation at Beijing University of Technology in Beijing, China.

### *Clemson*

Clemson faculty members serve on several Transportation Research Board Committees

- Dr. David Bodde, Professor and Senior Fellow, ADC70 - Standing Committee on Transportation Energy, Member
- Dr. Johnell Brooks, Assistant Professor, ANB60 - Standing Committee on Safe Mobility of Older Persons, Member
- Dr. Mashrur Chowdhury, Eugene Douglas Mays Endowed Professor of Transportation, ABJ70 - Standing Committee on Artificial Intelligence and Advanced Computing Applications, Member
- Mr. Eric Morris, Assistant Professor of City and Regional Planning, ABG50 - Standing Committee on Transportation History, Member
- Dr. Jennifer Ogle, Associate Professor, ANB25 - Standing Committee on Highway Safety Performance, Member
- Dr. Wayne Sarasua, Associate Professor, ABJ60 - Standing Committee on Geographic Information Science and Applications, Member
- Dr. Richard Tyrrell, Professor of Psychology, AND40 - Standing Committee on Visibility, Member
- Mrs. Terecia Wilson, Senior Fellow, ANB00 - Section – Safety, Member; D1761 - NCHRP Project Panel on Work Zone Crash Characteristics and Countermeasure Guidance, Member; ANB10 - Standing Committee on Transportation Safety Management, Secretary; ANB23 - Standing Committee on Highway Safety Workforce Development, Co-chair & Committee Research Coordinator

Clemson University maintains the LTAP program (T3S) in South Carolina, and hosts a number of training sessions and annual meetings to share research findings from national state and local entities. T3S also provides access to educational and informational materials to agencies, organizations, and companies across the state. The associated transportation training courses and meetings hosted in the last reporting period included sessions in Asset Management, Competent Person Trenching and Shoring, 2015 SCVMA Field Day, SC Pesticide Exam Prep, Chainsaw Safety, Intermediate Surveying, OSHA - 10 Hour for Construction Trades, ITE Vendor Day, Work Zone Safety GSP, Basic Surveying, SC Highway Engineers Conference.

### *HSRC*

We presented a paper on CMF transferability at the 5<sup>th</sup> International Symposium on Geometric Design that was held in Vancouver in 2015. Although this paper was not directly related to the work done in this MRI, it was based on collective knowledge that was gained through work on CMFs that have been conducted in many projects including the STC funded project.

### *NCAT*

The results from the Teen Texting While Driving O&E project were presented at several conferences. Below is a list of the conference presentations to date.

“Influence of personality on teen texting while driving perceptions.” University Transportation Center Conference, Birmingham, Alabama, March 26-27, 2015.





“Distracted driving among teens: How can we educate and protect our youth?” Humanitarian Technology Conference, Boston, Massachusetts, May 12-14, 2015.

“Transportation safety topic: distracted driving.” North Carolina Agricultural and Technical State University Summer High School Transportation Institute, June 29, 2015.

“Teenage texting and driving: how dispositional and situational factors impact behavior.” Applied Human Factors and Ergonomics Conference, Las Vegas, Nevada, July 27-30, 2015.

In addition, a paper has been accepted for presentation at the Transportation Research Board 2016 Annual Meeting. Submissions for additional paper presentations are still pending.

During this reporting period we had fifteen high school juniors and seniors to complete the 2015 Summer High School Transportation Institute (STI). At the beginning of the program the transportation pre-test showed that only six students were interested in transportation as a career choice. At the end of the program a post-test showed that ten of the fifteen were now interested in careers in transportation. The STI program continues to serve as an effective means for enhancing and creating interest in transportation and industry careers.

#### UA

This year, the three day “Advanced Transportation Institute” was pleased to have two Hispanic high school students take part. As a result of this outreach, we anticipate increased participation by Hispanic students in 2016.

#### UCF

“Studying the Effect of Sidewalk/Bicycle-Lane Gaps on Pedestrian Safety.” Dr. Hatem Abou-Senna. Presented 5th International Symposium on Highway Geometric Design, Vancouver, Canada, June 22-24, 2015

“Micro-Simulation Application to Pedestrian Safety at Mid Block Crossing.” Jiawei Wu. Presented at the RSS2015 Conference, Orlando, FL, October 7, 2015.

#### UK

Based on the work Dr. Stamatiadis for task for MRI 2, *Integrated Simulation and Safety—Vehicular Crash Models Development*, a journal paper is under review and a conference paper is in publication.

#### USF

Early results from our MRI research included a Masters thesis by one of the project participants that was subsequently turned into a paper which was awarded the 2015 Daniel B. Fambro Student Paper Award (ITE) “Risk Taking Characteristics as Explanatory Variables in Variations of Fatality Rates in the Southeastern United States”. The paper explored unconventional characteristics tied to risky behaviors such as credit score, educational attainment, overall health, and seat belt use to correlate aggregate risk taking variables with fatality rates by state, focusing on the Southeastern region of the US. The paper was subsequently published in the *ITE Journal* and has been further disseminated via seminars and conference posters.

#### UAB

Nothing to report.

**d. What do you plan to do during the next reporting period to accomplish the goals and objectives?**

There will be no changes to the agency-approved plan for this effort.

*UTK*

The Transportation Engineering & Science Program in Civil & Environmental Engineering at University of Tennessee plans to do the following:

- **Research:** The transportation faculty will continue to work on STC's research initiatives that relate to the Highway Safety Manual, safety simulations, big data/connected & automated vehicle applications in safety, new technologies, pedestrian and bicycle issues and the role of socio-demographics in safety.
- **Education:**
  - a. Transportation faculty in Civil & Environmental Engineering has worked with STC to successfully recruit 9 capable students that have strong interests in safety to the UTK program; we will mentor these students in the coming month and work with them to present research results at the TRB and other conferences. Transportation faculty at UTK will continue the transportation seminar series, with speaker presentations available online. Safety courses including accident reconstruction will be offered.
  - b. Dr. Shashi Nambisan, Department of Civil and Environmental Engineering, will continue his efforts with the Office of Diversity Programs, College of Engineering at the University of Tennessee. Dr. Nambisan will also continue his partnership with Dr. Jennifer Richards (Education and Curriculum Development specialist) on educational efforts.
- **Outreach:**
  - a. In line with USDOT priorities, the UTK faculty will continue to work on pedestrian and bicycle transportation issues, focusing on technical aspect of their safety. We will coordinate our efforts with consortium partners, especially University of North Carolina Pedestrian and Bicycle Information Center.
  - b. International links will be further strengthened with various universities in Asia, Europe and Australia.
  - c. The Transportation Engineering & Science Program website will continue to provide up-to-date information about research, education, and outreach activities of the UTK faculty.
  - d. The faculty at University of Tennessee will work to further strengthen the Journal of Safety and Security. It has already seen very good growth in technical paper submissions and a special issue on railroad grade crossing safety is in the works. Our aim is to have the journal listed in the Science Citation Index.

### *Clemson*

Dr. Jennifer Ogle, in conjunction with Rhagavan Srinivasan and Daniel Carter at UNC-HSRC, began work on MRI 1 to study commonalities of calibration factors across southeastern states as well as begin development of region specific SPFs using data from North and South Carolina. This research component has been awaiting final data development in a SPR funded research program, which will be used as the match. Dr. Wayne Sarasua will complete the O&E grant, “Automated Traffic Surveillance from an Aerial Camera Array.” Dr. Jennifer Ogle will complete five course modules for the transportation safety course.

### *HSRC*

The final report for our task in MRI 1, *Development of Crash Modification Functions for Engineering Treatments*, will be completed in the next reporting period.

### *NCAT*

We plan to continue disseminating the results of our O&E research, *Teen Texting While Driving*, through conference presentations, proceedings papers, and journal articles. Conference paper abstracts have already been submitted to the Lifesavers Conference, Industrial and Systems Engineering Research Conference, and PreICIS workshop on HCI Research in MIS. The following is a list of the conferences and journals targeted for the next reporting period.

- Human Factors and Ergonomics Conference
- Digital Government (dg.o) Conference
- Journal for the Association of Information Systems Special Issue
- Transportation Research – Part F

Additionally, we are working on developing the next phase of our Teen Texting While Driving project. The O&E grant allowed us to complete Phases 1 through 3 and initiate Phase 4. During the next reporting period, we will work on obtaining funding to complete the development of the differential transportation training protocols and create the actual training programs.

During the next reporting period several of our STC Education Award recipients will engage in research activities with faculty. Some will present papers at the 2016 Transportation Research Board Meeting. Additionally, the proposal process will begin to seek funding for the 2016 STI program.

### *UA*

Continue in the program as established.

### *UAB*

A study of guardrail terminal safety will be undertaken with the objective of developing guidelines for upgrading out-of-date terminal designs. Guidelines for design of bridge rails and decks to withstand MASH level design impacts will also be completed.

### *UCF*

Using the videotape data, the goal is to complete the validation and calibrations of the eight signalized intersections then plan the driving simulator experiments for MRI 2. In Year 2, MRI4

will focus on microscopic big data, and will add travel time reliability and surrogate safety measures to enrich the data.

For Dr. Al-Deek's O&E Project, the plan is to continue data analysis and modeling, and complete the STC final project report.

#### UK

Continue in the program as established.

#### USF

The subsequent period will include the production of technical memorandum which will provide material for subsequent journal articles and professional presentations.

## 2. Products: What has the program produced?

### a. Publications, conference papers, and presentations

#### UTK

The faculty, staff and students presented technical papers at the conferences listed below and they prepared several research papers for presentation and presentation at the 2016 Transportation Research Board Annual Meeting. The work reflects collaborations between various UTK entities and other universities. STC related technical papers are as follows:

#### *Technical papers presented at conferences during reporting period*

- Khattak A. *Improved Warning and Control Assistance Information Embedded in Basic Safety Messages Transmitted between Connected Vehicles*, Plenary Session Invited Talk, 15th COTA International Conference of Transportation Professionals, CICTP, Beijing, China, July 2015.
- Khattak A. *Role of the MPOs in the Deployment of Connected Vehicles*, Invited Talk, Tennessee Metropolitan Planning Organization Conference, Kingsport, TN, 2015.
- Shashi Nambisan, Jennifer Richards, and Wenshu Li. *Transportation System Based Summer Academy for Teachers*, 122<sup>nd</sup> Annual Conference of the American Society for Engineering Education, Seattle, WA. June 14-17, 2015.
- Shashi Nambisan, *HazMat Shipment Tracking: e-HM Initiative*, OHMS Research and Development Forum, US Department of Transportation, Washington, DC, April 16, 2015. (Invited).
- S. Nambisan, *Some Reflections on Developing Broad Based Strategies to Enhance Road Safety*, Tennessee Society of Professional Engineers, Knoxville, TN. August 26, 2015.
- S. Nambisan, J. Everett, M. Cate, C. Waxstein, K. Boakye, S. Dillard, and B. Hall, *Nighttime Seatbelt Usage Research: The Good, The Bad & The Ugly*, Tennessee Lifesavers Conference, Murfreesboro, TN. August 19, 2015.
- S. Nambisan. *Transportation Systems Overview*, STEM in Motion Workshop for Teachers, Garrett Morgan Clearinghouse Summit - Case Study on Highway Safety, L&N STEM Academy, Knoxville, TN. July 22, 2015.
- S. Nambisan, J. Everett, M. Cate, K. Boakye, *Increasing Nighttime Seatbelt Usage Rates: Baseline Data and Evaluation*, Traffic Enforcement Regional Network Meeting, Knoxville, TN. June 8, 2015.
- S. Nambisan, *Increasing Nighttime Seatbelt Usage Rates: An Evaluation of Enforcement, Education, and Outreach Strategies*, Tennessee State Institute of Transportation Engineers 2015 Spring Meeting, Kingsport, TN. May 2015.
- S. Nambisan *Increasing Nighttime Seatbelt Usage Rates: Program Overview, Data Needs, and Evaluation Strategies*, Traffic Enforcement Joint Network Meeting, Alcoa, TN. April 9, 2015.

*Technical papers prepared for presentation/publication at 2016 Transportation Research Board Annual Meeting*

- Liu, J. & A. Khattak. Improved Warning and Assistance Information from Connected Vehicle Basic Safety Messages, 2015 Intelligent Transportation Systems World Congress, Bordeaux, France, 2015.
- Liu, J., A. Khattak & S. Richards. What Are the Consequences of Drivers Trespassing Highway-Rail Grade Crossings Equipped with Gates? A Spatial Approach Integrated with Path Analysis, 2015 Road Safety & Simulation International Conference, Orlando, FL, 2015.
- Liu, J., A. Khattak & S. Richards. How Safe Are Narrow Lanes? Applications of Safety Models, 2015 Road Safety & Simulation International Conference, Orlando, FL, 2015.
- Liu, J., A. Khattak & M. Zhang, Exploring Links between Naturalistic Driving Behaviors and Various Factors in Hierarchies: A Study Integrating Multiple Data Sources, 2015 Road Safety & Simulation International Conference, Orlando, FL, 2015.
- Zhang, M., A. Khattak, J. Liu & D. Clarke, The Role of Rail-Trespassing Crashes at Highway-Rail Grade Crossings and Non-crossing Tracks? A Comparative Study on Injury Severity, 2015 Road Safety & Simulation International Conference, Orlando, FL, 2015.
- Lu, W., L. Han & C. Liu, Impacts of Geospatial Zoning and Road Network Resolutions on Large-Scale Traffic Simulations, 2015 Road Safety & Simulation International Conference, Orlando, FL, 2015.
- Ling, Z., C. Cherry, W. Lawhorn & D. Stone, Study on Dynamic Factors on Single-Bicycle Crash Caused by Railway Tracks, 2015 Road Safety & Simulation International Conference, Orlando, FL, 2015.
- Liu, J., A. Khattak, & M. Zhang, What role do pre-crash driver actions play in work zone crashes? Untangling hierarchies in crash data, To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Lim, H., L. Han, & A. Khattak, The impact of narrow lanes on safety of arterial lanes, To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Liu, J., & A. Khattak, Delivering improved alerts, warnings, and control assistance using basic 3 safety messages transmitted between connected vehicles, To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Liu, J., A. Khattak, & M. Zhang, Structuring and integrating data in metropolitan regions to explore multi-level links between driving volatility and correlates, To be presented at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Dong, Chunjiao, M. Burton, S. Nambisan, and J. Sun, Effects of car-truck mix on the occurrences of truck-related crashes, for presentation at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Nambisan, Shashi, Kwaku Boakye, and Ebony Lemons, An Overview and Preliminary Assessment of a Summer Transportation Experiential Learning Program for Ninth Graders, for presentation at the Transportation Research Board, National Academies, Washington, D.C., 2016.
- Ranjit Khatri, Chris Cherry, Shashi Nambisan, and Lee Han, Modeling route choice of bikeshare users with GPS data, for presentation at the Transportation Research Board, National Academies, Washington, D.C., 2016.

*Clemson*

*TRB Papers accepted for presentation and possible publication:*

- 16-6766, "Safety Analysis of Driveway Characteristics along Major Urban Arterial Corridors in South Carolina"
- 16-6874, "Too Close to Home? An Investigation into Crash Proximity Relative to Driver Residences in South Carolina"
- 16-5034, "Safety Planning: Analysis of the Socioeconomic and Demographic Characteristics of At-Risk Driver Residential Areas in South Carolina"

### NCAT

*The following conference presentations were made during the reporting period:*

- “Influence of personality on teen texting while driving perceptions.” University Transportation Center Conference, Birmingham, Alabama, March 26-27, 2015.
- “Distracted driving among teens: How can we educate and protect our youth?” Humanitarian Technology Conference, Boston, Massachusetts, May 12-14, 2015.
- “Teenage texting and driving: how dispositional and situational factors impact behavior.” Applied Human Factors and Ergonomics Conference, Las Vegas, Nevada, July 27-30, 2015.

### UCF

- A paper titled “Studying the Effect of Sidewalk/Bicycle-Lane Gaps on Pedestrian Safety” was presented at the 5th International Symposium on Highway Geometric Design, held in Vancouver, Canada June 22-24, 2015
- A paper titled “Micro-Simulation Application to Pedestrian Safety at Mid Block Crossing” has been submitted and accepted for presentation at the RSS2015 conference scheduled for October 6-8 in Orlando, FL.
- Abdel-Aty, Using Transportation Big Data in Safety Analytics, Florida data Symposium, FDOT, Aug. 2015.

### UK

- Stamatiadis, N., Sallee, T., Kirk, A. “Conflict Prediction Models for left-Turn Phasing Decisions,” Proceedings, Road Safety and Simulation 2015 Conference, Orlando, FL.

### USF

- “Risk Taking Characteristics as Explanatory Variables in Variations of Fatality Rates in the Southeastern United States” Masters Thesis of Jodi Godfrey, May 2015.

## **b. Journal publications**

### UTK

*STC related publications by CEE faculty at UTK: Published or forthcoming*

- Zhang H., M. Cetin, and A. Khattak, Queuing delays associated with secondary incidents, *Journal of Intelligent Transportation Systems*, 19:2, 2015.
- Liu, J., A. Khattak, S. Richards & S. Nambisan. What are the Differences in Driver Injury Outcomes at Highway-Rail Grade Crossings? Untangling the Role of Pre-Crash Behaviors, *Accident Analysis & Prevention*, 2015, 85, 157-169. DOI: 10.1016/j.aap.2015.09.004
- Wang X., J. Liu, A. Khattak & D. Clarke. Non-crossing Rail-Trespassing Crashes in the Past Decade: A Spatial Approach to Analysis of Injury Severity. *Safety Science*, 2016, 82, 44-55. DOI: 10.1016/j.ssci.2015.08.017
- Liu, J., B. Bartnik, S. Richards, & A. Khattak. Driver Behavior at Railway-Highway Grade Crossings with Passive Traffic Controls: A Driving Simulator Study, *Journal of Transportation Safety and Security*, 2015. DOI: 10.1080/19439962.2015.1043478
- Ling Z. C. Cherry. H. Yang, L. Jones, From e-bike to car: A study on factors influencing motorization of e-bike users across China. Forthcoming in *Transportation Research Part D*, 2015.
- Chunjiao Dong, Shashi S. Nambisan, Stephen H. Richards, Zhuanglin Ma. Assessment of the effects of highway geometric design features on the frequency of truck involved crashes using bivariate regression, *Transportation Research Part A: Policy and Practice*, Vol 75, May 2015, pp 30-41. [doi:10.1016/j.tra.2015.03.007](https://doi.org/10.1016/j.tra.2015.03.007)



### HSRC

- Foss, R.D., & Williams, A.F. (2015) Adolescent drivers: Fine-tuning our understanding. *Journal of Adolescent Health* 57(1),S1-S5.
- McDonald, C.C., Goodwin, A.H., Pradhan, A.K., Romoser, M.R.E., & Williams, A.F. (2015). A review of hazard anticipation training programs for young drivers. *Journal of Adolescent Health*, 57, S15-S23.
- Sandt, L., Marshall, S., & Ennett, S. (2015). Developmental framework and process evaluation of a community-based pedestrian and bicycle safety program. *Transportation Research Record*, in press.

### NCAT

- McBride, M. and Carter, C. “Distracted driving: How individual differences influence youth texting while driving behavior.” Under review for the *Transportation Research Board 2016 Annual Meeting Compendium of Papers*.

### UAB

- Cost-Effective Safety Treatment of Trees on Low-Volume Rural Roads. Karla A. Lechtenberg · Cody S. Stolle · Ronald K. Faller · Kevin D. Schrum. *Transportation Research Record Journal of the Transportation Research Board* 05/2015; 2472:194-202. DOI:10.3141/2472-22
- Cost-Benefit Analysis of Crash Cushion Systems. Kevin D. Schrum · Francisco D. B. De Albuquerque · Dean L. Sicking · Karla A. Lechtenberg · Ronald K. Faller · John D. Reid. *Journal of Transportation Safety & Security* 01/2015; 7(1). DOI:10.1080/19439962.2013.846448

### USF

- Godfrey, Jodi, “Risk-Taking Characteristics as Explanatory Variables in Variation of Fatality Rates in the Southeastern United States,” *ITE journal* Volume 85. No. 9, pp 42 -47, September 2015.

## c. Books or other non-periodical, one-time publications

### UTK

- Liu, Jun, *Driving Volatility in Instantaneous Driving Behaviors: Studies Using Large-Scale Trajectory Data*, PhD Dissertation (supervisor: Dr. Khattak), Federal (STC) support acknowledged.
- Hargrove, Stephanie R., *Self-Learning License Plate Matching Algorithm – Some Enhancements and its Role in Travel Time Ground Truth Measurement*, PhD Dissertation (Supervisor: Dr. Han), Federal (STC) support acknowledged.
- Yang, Jianjiang, *Spatio-Temporal Dynamics of Short-Term Traffic*, PhD Dissertation (Supervisor: Dr. Han), Federal (STC) support acknowledged.
- Lu, W. and L.D. Han (2015) “*Impacts of Vehicular Communication Networks on Traffic Dynamics and Fuel Efficiency*,” Chapter 7 of *ICT for Transport Opportunities and Threats*, 161-178, ISBN 978-1-78347-129-4, Edward Elgar Publishing (Forthcoming).

### NCAT

- McBride, M. and Carter, C. “Teenage texting and driving: how dispositional and situational factors impact behavior.” Abstract published in the *Applied Human Factors 2015 Proceedings*, 2015.

### UCF

- Rogers, J., A. Sandt, H. Al-Deek, A. Alomari, N. Uddin, E. Gordin, C. Dos Santos, G. Carrick. “Wrong Way Driving Multifactor Risk-Based Analysis for Florida Limited Access and Toll Facilities.” *Transportation Research Record: Journal of the Transportation Research Board*, February 2015. (This won the best paper award in freeway operations for the year 2015, April 2015.)
- Sandt, A., H. Al-Deek, J. Rogers, A. Alomari. “Wrong Way Driving Prevention: Incident Survey and Current Practiced Solutions.” *Transportation Research Record: Journal of the Transportation Research Board*, February 2015.

Rogers, J., H. Al-Deek, A. Alomari, F. Consoli, A. Sandt. "Wrong-Way Driving on Florida Toll Roads: An Investigation into Multiple Incident Parameters and Targeted Countermeasures for Reductions." *Inderscience Journal for Engineering Management Transport*.

*Clemson, HSRD, NCAT, UA, UAB, USF*

Nothing to report.

#### **d. Other publications, conference papers and presentations**

##### *UTK*

Ling Z., C. R. Cherry, L.M. Wade, and D. Stone, Study on dynamic factors on single-bicycle crash caused by railway tracks. Accepted for presentation at 2015 Road Safety & Simulation International Conference, Orlando, FL. 2015.

Liu J. & A. Khattak. Improved warning and assistance information from connected vehicle basic safety messages, Accepted for presentation at 2015 Intelligent Transportation Systems World Congress, Bordeaux, France, 2015.

Liu J. & A. Khattak, Using large-scale behavioral and sensor data to explore the link between driving volatility and safety outcomes. Accepted for presentation at 2015 Road Safety & Simulation International Conference, Orlando, FL 2015.

Liu J. & A. Khattak, Using large-scale behavioral and sensor data to explore the link between driving volatility and safety outcomes. Accepted for presentation at 2015 Road Safety & Simulation International Conference, Orlando, FL 2015.

Khattak A., X. Wang & J. Liu, Transportation Data Needs for Making Transportation Decisions, In preparation for presentation.

Ling, Z., C. Cherry, How to Prevent Railroad Crossings from Becoming a Hazard to Bicyclists. Joint Rail Conference, Columbia, SC. April 12-15, 2016.

##### *HSRC*

LaJeunesse, S., Pullen-Seufert, N, & Marchetti, L. (2015). Active Routes to School project evaluation baseline results, Prepared for Community and Clinical Connections for Prevention and Health, NC. Division of Public Health.

Lambert, D., Marchetti, L., & Oliver, C. (2015). Bicycling to school together, a bike train planning guide, Developed as part of the National Center for Safe Route to School and Schwinn's Helmets on Heads partnership.

Smith, S. (2015). Synthesis of countermeasure service life and crash severity costs user guide. Washington, D.C.: Federal Highway Administration. Retrieved from [http://www.cmfclearinghouse.org/resources\\_servlifecrashcostguide.cfm](http://www.cmfclearinghouse.org/resources_servlifecrashcostguide.cfm)

Gelinne, D., Sundstrom, C., & Langford, K. (2015, June). Step Up! Walk Friendly Communities. Invited presentation to the Mid-America Regional Council, Kansas City, MO.

Goodwin, A. (2015, May). Risks for newly licensed teen drivers. Presented to the North Carolina Professional Driving Schools Association, Greensboro, NC.

O'Brien, N. & Kirley, B. (2015, May). Overview of teen driver safety in North Carolina and suggestions for effective programs. Presented to the North Carolina Safe Kids Conference, Concord, NC.

Pullen-Seufert, N. & LaJeunesse, S. (2015, April). Safe Routes to School workshop, Thomasville, NC.

Sundstrom, C. & Langford, K. (2015, April). Seattle: Building a Walk Friendly Community. Presented to the American Planning Association National Planning Conference, Seattle, WA.

Sundstrom, C. & Langford, K. (2015, April). Best practices in separated bike lanes. Presented to the American Planning Association National Planning Conference, Seattle, WA.

#### *NCAT*

“Transportation safety topic: Distracted driving.” North Carolina Agricultural and Technical State University Summer High School Transportation Institute, presented June 29, 2015.

“Texting while driving: The role of personality, protection motivation, and general deterrence theory.” Virginia Commonwealth University Information Systems Department Research Seminar, presented August 28, 2015.

#### *Clemson, UA, UAB, UCF, UK, USF*

Nothing to report.

### **e. Websites or other Internet sites**

STC’s web address is <http://stc.utk.edu/>.

#### *UTK*

- RSS 2015 - <http://stc.utk.edu/STCevents/rss2015>
- The Transportation Engineering & Science Program, Civil & Environmental Engineering, University of Tennessee website disseminates results of research and/or program activities at <http://tesp.engr.utk.edu/>. The website provides information about key research, education, and outreach activities underway. It is linked to the Southeastern Transportation Center website.
- STC also helped with funding “bikeshare” with Dr. Cherry managing the program and website at: <http://www.cycleushare.com>
- Dr. Han’s research and education activities can be found at: <http://web.utk.edu/~lh>
- Dr. Cherry’s education and research activities can be found at: <http://www.chrisrcherry.com/>

### **f. Technologies or techniques**

#### *UTK*

“I Bike KNX” smart phone app for iOS and Android has been developed by Dr. Cherry and several other researchers. It uses smart phone’s GPS to record routes and allows users to report problems along their route such as potholes and so on. It would contribute to the safety improvement and route choice optimization for cyclists. This app was developed for the OE grant but its data can be used in this grant as well, focusing on behavior analysis from big datasets.

### **g. Inventions, patent applications and licenses**

#### *UTK*

Patent application under review: “Device for level bicycle at-grade crossing of rail tracks.”

### **h. Other products**

*UTK*

Faculty purchased from ARADA Technologies in-vehicle, mobile, and roadside units for field testing in Connected and Automated Vehicles. Traffic and incident data from INRIX and TDOT are being obtained. (*Data & Research Material*)

Professional service activity, peer-recognition, and enhanced visibility for the STC is reflected in editorships of high-quality refereed scholarly journals by UTK faculty. Dr. Khattak served as Editor-in-Chief of Journal of Intelligent Transportation Systems, Impact Factor = 1.377, & Associate Editor of International Journal of Sustainable Transportation; IF = 2.548), and as special advisor to the UTK-based Journal of Transportation Safety & Security (SNIP=0.353) and as board membership of another safety journal.

UTK Civil & Environmental Engineering Department is well-positioned to take advantage of Connected and Automated vehicle technologies and worked collaboratively with faculty from Electrical Engineering & Computer Science Department as well as Mechanical Aerospace and Biomedical Engineering toward research sponsored from various sources that include the National Science Foundation (NSF) and VW. In this regard, the UTK faculty has started a seminar series devoted to the creation of Southeastern Smart Mobility Consortium (<http://tesp.engr.utk.edu/ssmc/ssmc.php>), with potential for TDOT and USDOT support. Seminars were conducted (5 in total) focusing on proposal development and to better coordinate UTK expertise in connected and automated vehicles.

UTK faculty are seeking investments in transportation laboratory software and hardware for research and education projects, e.g., they are working to purchase of equipment to display traffic data in real-time and create a well-functioning functioning transportation lab. The Lab includes a driving simulator, and software capabilities, e.g., Accident reconstruction software ARAS, TransCAD and TransModeler software are available for modeling and simulations.

**3. Participants and Other Collaborating Organizations**  
**a. Table of Collaborating Organizations**

<b>Organization Name</b>	<b>Location of the Organization</b>	<b>*Partner's Contribution to the Project</b>	<b>Name (First and Last)</b>	<b>University</b>
Conference of Minority Transportation Officials (COMTO)	Washington, DC	Collaborative Support-Garett Morgan Youth Symposium	Mioshi Moses, President/CEO of COMTO	North Carolina A&T State University
NC Department of Transportation	Raleigh, NC	In-kind support-presentations, financial support-internship program	Ashley Goolsby, Director of Education Initiatives	North Carolina A&T State University
NC FHWA Division	Raleigh, NC	In-kind support-presentations, collaborative support	Lynise DeVance, Program Manager, Civil Rights Office	North Carolina A&T State University
Caterpillar		Financial support-STI program		North Carolina A&T State University

Knox County School System	Knoxville, TN	Collaborative Support	Jamie Wilson	North Carolina A&T State University
The University of Tennessee-Knoxville	Knoxville, TN	Collaborative Support	Jerry Everett	North Carolina A&T State University
FL. DOT District 5 and Central Office	Deland and Tallahassee	Data and funding	Rick Morrow and Joe Santos	University of Central Florida
City Of Orlando		Data	Charles Ramdatt	University of Central Florida
Transportation Center at UK	Lexington KY	Joint MRI	Nick Stamatiadis	University of Central Florida
Central Florida Expressway		Data		University of Central Florida
Florida's Turnpike Enterprise (FTE)	Ocoee FL	Provided direct match for this project	Eric Gordin, P.E.	University of Central Florida
Kentucky Transportation Cabinet	Frankfort, KY	In-Kind support Collaborative support Financial support	Jason Siwula	University of Kentucky
Center for Transportation Research, UTK	Knoxville TN	Collaborative support	Airton Kohls	University of Kentucky
NURail--UIUC	Champaign Urbana IL	Collaborative Support	Ahmed Shabana	University of Kentucky
Alabama DOT (West Central Region)	Tuscaloosa, AL	Collaborative support and facilities		University of Alabama
Alabama DOT Office of Safety Operations	Montgomery, AL	In-kind support	Tim Barnett	University of Alabama
Center for Advanced Public Safety (at Univ. of Alabama)	Tuscaloosa	Collaborative support	Randy Smith	University of Alabama
Tennessee DOT	Nashville TN	Matching request & data	N/A	University of Tennessee
ORNL	Oak Ridge TN	Collaborative support		University of Tennessee
INRIX	Kirkland WA	Collaborative support	N/A	University of Tennessee
US Dept. of Energy	Washington DC	Sponosr of projects	N/A	University of Tennessee
Knoxville Regional Trans Planning Org	Knoxville TN	Collaborative support & personnel time	N/A	University of Tennessee
Social Bicycles (SoBi)	New York	Collaborative support & data match	N/A	University of Tennessee
Georgia Tech	Atlanta	Collaborative support	N/A	University of Tennessee
NURail--UIUC	Champaign Urbana IL	Collaborative Support	Chris Barkan	University of Tennessee
Various Jiaotong Universities in China	Beijing, Nanjing, Guangzhou, Shenzhen, Changsha, China	Collaborative support & personnel exchanges	Dr. Xuedong Yang	University of Tennessee
Social Bicycles	New York	Data match, personnel time, and collaboration	Ryan Rzepeki	University of Tennessee
Community Action Committee	Knoxville TN	In-Kind Support, collaborative support	Karen Estes	University of Tennessee
East Tennessee Human Resource Agency	Knoxville TN	personnel exchanges	Aaron Bradley	University of Tennessee
Knoxville Area Transit	Knoxville TN	personnel exchanges	Melissa Roberson	University of Tennessee

e-HM consortium – see info below	Label Master, Blue Dot Solutions, etc.	Support of initiative		University of Tennessee
National Science Foundation	Washington DC	Support of Big Data from CAVs	N/A	University of Tennessee
CURRENT (an NSF Engineering Research Center)	College of Engineering, UTK	In-Kind Support, collaborative support and nominal stipend for a graduate student to mentor two high school students in the Young Scholars Program	Dr. Chie-Fei Chen	University of Tennessee
MKT 466: Capstone Design course	Haslam College of Business, UTK	In-Kind Support for 42 students to develop a marketing campaign to increase seat belt usage during nighttime hours	Cindy Raines	University of Tennessee
International Road Assessment Program	Hampshire, UK	Provided access to iRAP training and data collection software	James Bradford	Clemson
Zanmi Lasante	Cange, Haiti	Provided translators and community introductions to enable field data collection efforts	Marie Flore-Chipps	Clemson
National Cooperative Highway Research Program	Washington, D.C.	Collaborative match using funds from NCHRP Project 17-63: Guidance for the Development and Application of Crash Modification Factors	Raghavan Srinivasan	University of North Carolina Highway Safety Research Center
Florida Department of Transportation	Tallahassee Florida	Provide financial support for match projects		University of South Florida
Barber MotorSports	Birmingham AL	In-Kind	Dean Sicking	University of Alabama Birmingham
Dunn Construction	Birmingham AL	Financial	Dean Sicking	University of Alabama Birmingham

*\*Choices are: In-kind support, financial support, personnel exchanges, collaborative support, Facilities, other*

## b. Additional collaborators

### UTK

Noteworthy new projects obtained by UTK faculty include:

- Khattak, A., S. Chakraborty & S. Nambisan, Study of Driving Volatility in Connected and Cooperative Vehicle Systems, US National Science Foundation, University of Tennessee at Knoxville, \$399,793, Sept. 1, 2015-Aug 31, 2018.
- Khattak A., S. Richards & D. Chimba, Highway Safety Manual, Safety Performance Functions (SPF) and Roadway Calibration Factors, Tennessee Department of





Transportation, University of Tennessee at Knoxville, \$249,996, Oct. 1, 2015-Sept 30, 2017.

A team led by Dr. Nambisan was selected in an internal competition at UTK to develop and submit a proposal to the National Science Foundation to a Resaerh Experiences for Teachers Site that is focused on Transportation Systems. The co-Principal investigator on this is Dr. Jennifer Richards with a Education and Curriculum Development expertise. Additionally, the team includes faculty from the following departments at UTK: Civil & Environmental Engineering, UTK Industrial and Systems Engineering, UTK Mechanical Aerospace and Biomedical Engineering, Electrical Engineering and Computer Science

Collaborations are underway between UTK Civil & Environmental Engineering, UTK Industrial and Systems Engineering, UTK Mechanical Aerospace and Biomedical Engineering, Electrical Engineering and Computer Science, & UTK Department of Geography.

Collaborations are underway between all UTK Civil & Environmental Engineering faculty and 8 consortium partner schools in the context of 4 STC major research initiatives. Additional collaborations are underway with staff from the Center for Transportation Analysis, Oak Ridge National Lab, TN

International collaborations in safety during the reporting period include Beijing Jiaotong University, Southeast University, Tongji University, Southwest Jiaotong University, Kunming University of Science and Technology, Tsinghua University, Shenzheng University, and Changsha University of Science and Technology; and COTA-Chinese Overseas Transportation Association. Utrecht University, Monash University, TU Delft, and University of Novi Sad.

Another collaboration is the electronic Hazardous Materials (e-HM) Initiative Consortium. Label Master, Blue Dot Solutions, American Trucking Associations, CHEMTREC, Commercial Vehicle Safety Alliance, Eastman Chemical Company, FedEx, International Association of Fire Chiefs, Pilot Flying J, National Tank Truck Carriers, OmniTracs, ORNL, UPS. The goal of this consortium is to develop and demonstrate a proof-of-the-concept for an e-HM system. We have started with developing mock-ups of the envisioned system. The next step is to develop a prototype systems, and eventually to conduct pilot tests to demonstrate how software, cloud computing and communications hardware. Members of the consortium have so far made “in-kind” contributions in the form of personnel time, travel, hardware, software, and communications resources.

#### *HSRC*

As part of the MRI1 research area, we have collaborated with the NCHRP Project 17-63 team that includes:

- Dr. Bhagwant Persaud, Ryerson University
- Dr. James Bonneson, Kittelson and Associates
- Dr. Ezra Hauer, University of Toronto, Retired

#### *UA*

We are working with Cambridge Systematics on writing the Strategic Highway Safety Program for the State of Alabama. This project is funded by the Alabama DOT.

#### *UAB*

Selco Construction conducted a survey of SRT guardrail terminals installed in Alabama. The survey identified 68 installations that were improperly installed and infomed Alabama ADOT.

#### *Clemson, NCAT, UCF, UK, USF*

Nothing to report.

### **4. Impact**

#### **a. What is the impact on the development of the principal discipline(s) of the program?**

#### *UTK*

The work that is undertaken by Civil & Environmental Engineering faculty at University of Tennessee is enhancing safety through research on Highway Safety Manual, safety simulations, big data applications, and the role of socio-demographics in safety. The multi-disciplinary research activity underway with diverse consortium partners is creating the knowledge-base and foundation needed for innovations in safety countermeasures and making methodological advances in safety modeling, simulation, and visualization. The impact of safety research will be felt in multiple modes of transportation and by multiple stakeholders.

As an example, findings from the STC Big Data major research initiative are creating new metrics of driving volatility. These can be used in real-time to support instantaneous driving decisions. This work is providing new analytics (driving volatility) using big data coming in from sensors to enhance safety. The information on driving volatility can be used, for example, in high-schools to reward students who show “calm” driving patterns rather than volatile driving patterns. The idea of driving volatility appealed to the National Science Foundation, awarding a 3-year research grant titled “Study of Driving Volatility in Connected and Cooperative Vehicle Systems,” for \$399,793.

The e-HM Initiative Consortium led by the University of Tennessee and STC aims to develop and demonstrate a proof-of-the-concept for an electronic Hazardous Materials (e-HM) system. Our partners in the consortium include Label Master, Blue Dot Solutions, American Trucking Associations, CHEMTREC, Commercial Vehicle Safety Alliance, Eastman Chemical Company, FedEx, International Association of Fire Chiefs, Pilot Flying J, National Tank Truck Carriers, OmniTracs, ORNL, UPS. We have started with developing mock-ups of the envisioned system. The next step is to develop a prototype systems, and eventually to conduct pilot tests to demonstrate how software, cloud computing and communications hardware. We have been invited to present our efforts and their outcomes at the 2016 TRB Annual Meeting and also at a US DOT OHMS Research and Development Forum.

Several outreach activities were conducted were at UTK, and locations in Knox County and Blount County using “The Seatbelt Convincer.” These attracted hundreds of individuals and at each event at least 50 individuals experienced a ride in the Convinver. These helped impress upon the general public the importance of wearing seatbelts as occupants of motor vehicles.

### *HSRC*

Most of the crash modification factors in the Highway Safety Manual, the CMF Clearinghouse, and other sources are just single factors implying that the safety effect of a treatment does not depend on the characteristics of a site. The MRI<sup>1</sup> effort from HSRC will develop crash modification functions that will provide insight into how the safety effect of a treatment may vary depending on the characteristics of a site.

### *NCAAT*

The results of the texting while driving (TWD) study provide evidence of individual differences that impact teenager TWD behavior. The data helped identify characteristics of teenage drivers who are more (or less) likely to comply with TWD policies. These differences can be used to develop customized driver training protocols that will be more effective in discouraging teenage TWD behaviors which, in turn, will lead to transportation safety improvements.

### *UAB*

UAB's major progress has been supporting three doctoral and one master's student who are studying transportation safety issues.

### *UCF*

MRI 2: This research provides an added dimension for using microscopic simulation and traffic conflicts as safety tool and surrogate measure, respectively. The lack of pedestrian safety data has been a major hurdle for researchers to better quantify pedestrian crash rates. This research will assist with this goal.

MRI 4: This research study proves the potential of using Big Data in safety research. It also shows that Big Data from multiple sources are able to be collected and they are found to be useful for both microscopic and macroscopic safety analyses.

### *UK*

MRI 2: The findings of this work will allow transportation agencies to evaluate alternative left-turn phasing based on the relative safety performance of the location. The models to be developed will allow designers to consider the specific site data to determine the option to consider. This provides transportation engineers and designers (i.e., those with a Civil Engineering background) with a valuable tool that is not existing available.

### *USF*

We believe the results will provide further verification that factors beyond built environment, vehicles, and traditional sociodemographic characteristics may be relevant explanatory variables in understanding traffic safety.

## **b. What is the impact on other disciplines?**

### *UTK*

The transportation field is multi-disciplinary and applied. As such transportation research produces domain knowledge that helps improve mobility and safety. The comprehensive view of safety taken by the CEE faculty at UTK impacts other disciplines. As an example, the safety work

underway is relevant to social sciences, e.g., the findings from the study of socio-demographics have the potential to create new social science-based knowledge. Analysis of spatial/geographical aspects of safety has the potential to impact the field of geography. Another example is the application of modeling, simulation, and visualization techniques to safety. These can in turn impact/improve transportation operations (e.g., incident/accident management), transportation planning and sustainability (e.g., by taking into account the costs of injuries and death and potential improvements in facility design) and also link with epidemiology and health.

Additionally, in the 2015 Spring Semester, Dr. Nambisan collaborated with a faculty member in the Haslam College of Business to lead a capston design course in marketing. A total of 42 senior students worked in seven teams to developing marketing approaches to help raise awareness of the importance of wearing seatbelts in motor vehicles in the population segment between 18 years of age and 25 years of age. A survey of the students showed that the class as a whole significantly increased their awareness of traffic safety concerns and their knowledge of factors related to injuries and fatalities from motor vehicle crashes on roadways.

#### *NCAT*

While the texting while driving study was focused on transportation safety, the findings can potentially impact any area of safety. The methods used in the study can be applied to research investigating industrial safety concerns and general risk taking behaviors.

#### *UCF*

Once Big Data from transportation field are found useful to predict either microscopic (real-time) and macroscopic traffic crashes, there will be efforts to collect, process, and archive transportation related Big Data in more reliable and dependable ways in various fields including but not limited to computer sciences, planning, public health, statistics, et cetera.

### **c. What is the impact on the development of transportation workforce development?**

#### *UTK*

The following work force development activities at UTK are relevant and underway:

- The Civil & Environmental Engineering faculty at UTK offered these transportation courses during Spring 2015:
  - CE 355 - Transportation Engineering
  - [CE 550 - Transportation Seminar](#)
  - CE 553 - Geometric Design (DE section included)
  - CE 558 - Planning and Transportation
  - CE 595/IE 591 - 3-D Simulation Modeling of Transportation Systems
  - CE 652 - Analysis Techniques for Transportation Systems II
- The Civil & Environmental Engineering faculty at UTK offered these transportation courses during Fall 2015:
  - [CE 550 - Transportation Seminar](#)
  - CE 551 - Traffic Engineering: Characteristics

- CE 554 - Public transit
- CE 595 - Special Topics (ITS)
- CE 595 Intelligent Transportation Systems
- The Accident Reconstruction course was revised and offered by Dr. Richards in Summer 2015.
- Undergraduate and graduate students are being exposed to transportation safety through their courses. This should motivate them to seek careers in transportation safety.

#### *HSRC*

We expect that the Road Safety 101 course that we plan to offer will provide basic skills to practitioners in the traffic safety area, and encourage them to make better holistic decisions.

#### *NCAT*

The texting while driving study incorporated the work of an undergraduate and graduate student who had not previously been exposed to transportation research. Both students assisted with the literature review and data collection process. In addition, the presentation given to the STI students provided several high school students with a different look at the field of transportation from a human factors or cognitive psychology point of view. The high school students were quite engaged during the presentation and expressed their interest via high energy responses. Exposing the undergraduate and graduate students to the field of transportation through the research experience and bringing a different spin on the field of transportation to the high school students may entice more youth to pursue a job in transportation thus positively impacting the transportation workforce. Furthermore, all of the students involved in the research and STI program were minorities, so these experiences also help address the goal of increasing diversity of the transportation workforce.

#### *UA*

The University of Alabama Advanced Transportation Institute for underrepresented high school students conducted June 15-17, 2015 provided opportunities for 10 high school students to learn about careers in transportation as well as opportunities in higher education.

#### *UAB*

We distributed training DVDs for teaching contractors to install roadside safety features to four states.

#### *UCF*

MRI 2: One Ph.D. student, two M.S. students (one female and one African American), and one undergraduate student.

MRI 4: Graduate (20 students) and some undergraduate students (three students) in the transportation program at UCF are now familiar with the concepts of big data and its benefit for safety. A female PhD student is funded and working on this project.

#### UK

Transportation research opportunities have been provided to three faculty members, four research professionals and six graduate students.

#### USF

Our first graduate from those receiving STC student support has secured employment conducting safety research as part of her professional activities.

### **d. What is the impact on physical, institutional and information resources at the university or other partner institutions?**

#### UTK

Generally, UTK offers excellent physical, institutional, and information resources that have a positive impact the mission of STC, as mentioned below:

- The Civil & Environmental Engineering Department at University of Tennessee is in a newly constructed facility-the John D. Tickle building (construction video available at: <https://www.youtube.com/watch?v=84py8lbDMgM>). It has ample space for transportation labs, and houses the UTK driving simulator used for safety studies.
- The CEE Department has four full-time faculty members, Dr. Cherry (Associate Professor), Dr. Han (Professor), Dr. Khattak (Beaman Professor), and Dr. Nambisan (Professor). They are all working on transportation safety issues and are deeply involved in working with STC to enhance its research, educational, and technology transfer goals.
- The 8 partner universities in the Southeast are benefiting from interactions and collaborations with the active Transportation Engineering and Science Program faculty in Civil & Environmental Engineering at UTK.

#### UAB

UAB is developing a graduate course on Roadside Design for Safety.

#### UCF

We can share our experiences in collecting, processing, and analyzing Big Data, with colleagues at the university.

### **e. What is the impact on technology transfer?**

#### UTK

*The technology transfer activities for UTK Civil & Environmental Engineering faculty included:*

- Working on the STC & Civil Engineering Speaker Series & Webinars, Spring and Fall 2015
- Assisting with development of a searchable website for STC Publications, Technical Reports, Conference Papers & Presentations

- Assistance with editing STC related journals, *Journal of Transportation Safety & Security*, and *Journal of Intelligent Transportation Systems*
- Preparation and delivery of safety research presentations at the 2015 Transportation Research Board annual meeting.

UTK faculty assisted with the 2015 Road Safety & Simulation International Conference (October 6—8, 2015), in Orlando, Florida by submitting technical papers and by playing a major role in reviewing submitted papers. The conference is co-hosted by University of Central Florida & The University of Tennessee. UTK faculty, staff and students presented several papers at the conference (they are listed above).

UTK staff created and maintained the website for RSS 2015, assisted with registration issues, and handled inquiries from presenters, sponsors, exhibitors, and attendees.

UTK faculty are assisting as STC projects progress, we are disseminating the results to various stakeholders in the transportation safety arena. We worked on presenting technical papers in various forums that impact diverse stakeholders, including transportation practitioners, researchers, policy makers, and the private sector. Also, STC affiliated faculty at UTK have an important impact internationally through collaborations with Asian and European countries.

#### *NCAT*

The texting while driving study is likely to have an impact on the current driver training practices. The goal of the study was to identify certain characteristics that may incline a teenage driver to violate the texting while driving laws. The next step in the process is to design customized training protocols that will more effectively deter young drivers from texting while driving. These training protocols will be used to developed training modules that can be implemented in driver training classes thus helping to decrease the number of teenage texting while driving accidents.

#### *UK*

Impacts are most likely to begin accruing as a result of MRI-1 Crash Modification Factors research work specifically in the area prioritization of safety countermeasures. Strategic site specific future roadway safety improvement investments will tend to reduce crashes and their severity.

MRI 2 - The findings will provide the opportunity for new practices in the transportation design arena allowing designers to properly evaluate design choices.

### **f. What is the impact on society beyond science and technology?**

#### *UTK*

The Southeastern Transportation Center and UTK CEE faculty are well-positioned to directly affect transportation safety in many ways.





- Socio-demographic, attitudinal, and behavioral research on safety will improve public knowledge and provide a fundamental understanding of how to improve safety from broad social, economic, spatial, and behavioral perspective.
- Highway Safety Manual improvements (one of the major research initiatives) can lead to reductions in hazards and application of new countermeasures that save lives.
- The Big Data applications in safety provides a means to innovate and consider new ways of approaching safety comprehensively by combining information from diverse databases and in a dynamic context.
- Safety simulations can lead to a better understanding of vehicles' interactions, why collisions occur, how to better respond to them, and their consequences. The simulations advance the knowledge and skills of people who work in the safety field, and facilitate the study of human factors. Modeling, simulation, and visualization helps formulate regulatory policies that lead to safety improvements.

These efforts of UTK faculty directly contribute to the development of methods and applied knowledge in safety, they are training a skilled workforce, they are forming and expanding social networks that stimulate safety research, and creating new problem solving approaches that enhance safety.

#### *Clemson*

In the fall of 2014, STC students coordinated with Clemson Engineers for Developing Countries to aid in the investigation of an accident site in Cange, Haiti. In light of this investigation, a new research program was established. Clemson researchers reached out to the International Road Assessment Program (iRAP) to gain assistance in the form of training and software for data collection for international road assessments. iRAP provided free training for students and assisted in technology specification and software to conduct data collection in the field. Dr. Jennifer Ogle and several other students traveled to Cange Haiti in March 2015 to test the data collection software and conduct a more thorough analysis of the market area along National Highway 3. While in Haiti, the research team found that the Haitian's were incredibly interested in our data collection and we trained several locals – children and adults – how to use data collection devices to measure traffic flow, traffic speeds, and take roadway measurements. The program will continue into the next reporting period, and the research team is considering how we can work with the local school to incorporate transportation safety training into the curriculum.

#### *NCAT*

The research examined by Drs. McBride and Carter will improve public knowledge and attitudes towards texting while driving. The target audience will have a better understanding of the current texting while driving laws and encourage safer and more responsible driving behavior.

#### *UAB*

UAB's efforts to provide training materials for construction workers and design engineers will make the nation's highways safer.

*UCF*

We can suggest several possible policy or education related countermeasures to prevent traffic crashes from our understanding of the nature of traffic crash using Big Data. These efforts may save not only people's lives but also tremendous amounts of societal costs from traffic crashes.

*UK*

Improved safety and mobility through intersections.

*USF*

Improved safety.

**5. Changes/Problems**

**a. Changes in approach and reasons for change**

None to report.

**b. Actual or anticipated problems or delays and actions or plans to resolve them**

*USF*

Work on our task in MRI 3, *Exploration of Socio-Demographic Characteristics and Culture as Factors in Differential Safety Performance Across Geography*, is progressing somewhat slower than anticipated, but progress is continuing. Securing data in a timely fashion is challenging.

**c. Changes that have a significant impact on expenditures**

None to report.

**d. Significant changes in use or care of human subjects, vertebrate animals and/or biohazards**

None to report.

**e. Change of primary performance site location from that originally proposed**

No Change.

## Additional information regarding Products and Impacts

### Outputs:

#### UTK

STC related publications by CEE faculty at UTK, submitted for review

Liu J. A. Khattak & X. Wang, Comparative Analysis of How People Drive in a Region, International Journal of Sustainable Transportation.

Liu J. & A. Khattak. Delivering Warning and Control Assistance Information Embedded in Basic Safety Messages Transmitted between Connected Vehicles, IET Intelligent Transportation Systems.

#### UCF

Submitted conference papers

Shi, Q., & Abdel-Aty, M. (2016). Evaluation of the Impact of Travel Time Reliability on Urban Expressway Traffic Safety. Submitted to the TRB 95th Annual Meeting, TRB16-0407.

Wang, L., Abdel-Aty, M., Shi, Q., & Park, J. (2016). Predicting Expressway Weaving Segments Crashes Using Bayesian Multilevel Logistic Regression. Submitted to the TRB 95th Annual Meeting, TRB16-1103.

Lee, J., & Abdel-Aty, M. (2016). Exploring Zonal Level Bicycle Traffic Crashes and Hot Zone Identification. Submitted to the TRB 95th Annual Meeting, TRB16-4000.

Adrian Sandt, Haitham Al-Deek, John Rogers. "Modeling Driver Responses to Wrong-Way Driving Countermeasures through a Driver Survey and Countermeasure Implementation in Florida." Submitted to the Transportation Research Board 2016 for presentation and publication.

John Rogers, Jr., P.E., Adrian Sandt, Haitham Al-Deek, Ph.D., P.E., and Ahmad Alomari. "Wrong Way Driving Multifactor Prediction Models for Florida Limited Access Facilities." Presented at RSS 2015 and published in RSS proceedings. Orlando, Florida, October 6-8, 2015.

### Outcomes:

#### UAB

Two STC graduate fellows co-authored a winning proposal for acoustic monitoring of head impacts to identify injury risk. This study will begin in November 2015.

#### UCF

- Improved processing skills of Big Data related to transportation, real-time traffic, socio-demographic, and crash data;
- Increased understanding of macroscopic contributing factors for traffic crashes; and
- Increased use of real-time contributing factors for traffic safety
- Safer travel on high speed roads.
- Combating the dangerous behavior of wrong way driving.

#### UK

MRI 2 - The main impact of the work to be accomplished will be the improvement in the body of knowledge (new approach and tools for design) and improved processes for addressing transportation (safety and mobility) issues.

*USF*

Continued support for students supports the workforce development pipeline.

***Impacts:***

*UCF*

- More effective long-term strategic plans to reduce traffic crashes using Big Data from multiple sources;
- Improved real-time safety risk management using Big Data;
- Better application of various data mining techniques

*UK*

MRI 2 - Improved mobility for intersection could result in lower delays and therefore could have an impact on emissions. Safety will also be improved given the opportunity to determine the potential impacts of a design choice and select the most appropriate.

*USF*

Opportunities for targeting safety resources in the most effective manner based on an enriched understanding of safety factors.

**Special Reporting Requirements**

None