



Letter from the Director/In the News P.1  
Research Activities P.2  
Education Activities P.3  
Upcoming Events P.4

## In the News



UTCRS celebrates second Railway Safety Camp with USDOT and UTRGV officials. [READ MORE...](#)



UTCRS partners up with Garza Elementary (La Joya ISD) 5<sup>th</sup> grade Gifted and Talented Class. [READ MORE...](#)



UTCRS 2014 REU participant, Ms. Gabriela Perales, named 2015 Student of the Year. [READ MORE...](#)



UTCRS director and undergraduate and graduate students honored and recognized during the UTRGV 2016 Engineering Week Awards Banquet.

## Letter from the Director

As the founding director of the University Transportation Center for Railway Safety (UTCRS), I am extremely proud of the work that has been accomplished by the faculty, staff, and especially our undergraduate and graduate students in only our second year as a newly established UTC. The UTCRS continued to engage in a wide variety of impactful research, education, technology transfer, professional development, and community outreach activities.

In research and technology transfer, our committed team of faculty and students were able to bring seven projects to a successful completion. These projects were funded as part of the inaugural 2014CY Call for Proposals. Final reports for projects can be found in our new [UTRGV-UTCRS Web Site](#). As part of the 2015CY Call for Proposals, four new UTRGV - Mechanical Components Safety research projects and eight new TAMU - Infrastructure Safety research projects were selected for funding, bringing the total number of projects funded by the UTCRS to 26 research projects. The research efforts have yielded four journal articles, ten conference papers, six theses, six national presentations, and five research symposiums. Furthermore, the results from one of the projects are currently being utilized by a major railroad industry manufacturer to fabricate an electrically conductive version of the railroad bearing adapter steering polymer pad.

In education, the UTCRS continues to lead the way in the number of undergraduate students involved in transportation engineering research activities. The Research Experience for Undergraduates (REU) Program has been a great success with five of the eight 2014 REU participants choosing to continue their graduate studies at the consortium institutions. Two of those students were named Student of the Year honorees, one for the UTCRS and another for the Nebraska Transportation Center (NTC) (pictured to the right). In 2015, the number of REU participants was increased to twelve and in 2016, fourteen REU participants have been selected. Of the 2015 REU participants, two have started their graduate studies at TAMU, and another will be starting her studies at UNL this summer. Since UTRGV does not have any engineering doctoral programs or a civil engineering graduate program, the UTCRS has been able to establish a bridge to graduate studies at its partner institutions for those students who are interested in majoring in transportation engineering fields. Moreover, these students have greatly benefitted from co-authorship of conference and journal papers, and presenting their research findings at national engineering conferences and research symposiums.

The community outreach activities have been one of the main highlights of the UTCRS. The community has embraced the UTCRS and has come to depend on the K-12 STEM summer camps and teacher professional development workshops focused on transportation engineering. The UTCRS serves a region that is known for its explosive economic growth yet with some of the highest poverty rates in the nation. Specifically, 53.1% of households earn well below the per capita income of the state of Texas. The region is over 90% Hispanic, a population who have been underrepresented in the transportation engineering fields. The UTCRS has established a very strong partnership with the 26 school districts who have invested financially to assist the UTCRS in growing these vital STEM summer programs. In fact, the UTCRS offers the only STEM camps for elementary students in the Lower Rio Grande Valley. This mutually beneficial partnership has resulted in the largest K-12 STEM summer camps, focused on transportation engineering, in the nation. These camps benefited 700 students in summer 2014, 1000 in summer 2015, with a current enrollment of 1250 students for summer 2016. Additionally, this summer, the UTCRS is offering a national STEM teacher workshop. These professional development efforts are designed to train teachers on how to effectively implement the curricula that has been developed for the K-12 STEM Summer Camps. This railway safety themed curricula is an integrated STEM curricula that has been aligned to state and national standards.

Constantine Tarawneh, Ph.D., UTCRS Director



**Funding for the University Transportation Center for Railway Safety (UTCRS) has been generously provided by the United States Department of Transportation**



## Making Rail Bridges Safer



In December 2015, Texas A&M University student Lisa Rachal (pictured with her research team performing field tests on a railway bridge) successfully defended her Master's thesis titled "Determination of Bent Cap and Stringer Deflections for Timber Railway Bridges Under Live Load". Lisa was instrumental in collecting valuable field data for the UTCRS sponsored project "Vehicle-Borne Autonomous Railroad Bridge Impairment Detection Systems."

The research addresses the instrumentation and analysis of timber railway bridges in order to assess the health of America's aging timber bridge infrastructure. Many timber bridges currently in use around the United States are exposed to harsh conditions and increasing loads from rolling stock. Such exposures can cause a decrease in strength and increased deflections. Within the U.S. railroad network, there are thousands of aging timber bridges that require inspection. The goal of this research was to obtain and analyze bent cap and stringer deflections of a timber railway bridge under live load. The analysis of the data provides a better understanding of how aging bent caps and stringers behave while in service. In order to obtain these deflections from the timber bridge, the following tasks were performed:

1. Design and implement a small-scale railcar-bridge experiment,
2. Develop a data acquisition system and sensor network for a large-scale test-bed,
3. Develop and implement a wheel path position sensor system, and
4. Conduct a large-scale test to collect bent cap and stringer deflections as a railcar traverses a timber railway bridge.

Deflections of bent-caps and stringers were measured for a small-scale bridge in the lab, a large-scale open deck bridge, and a large-scale ballast deck bridge while under live loads. Each set of data was recorded and analyzed. The data obtained in field tests provides a greater understanding of timber bridges in service, resulting in better safety evaluations.

## Workforce Development

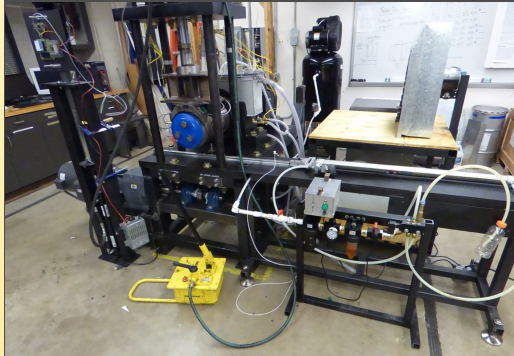
Since its inception in fall 2013, the **University Transportation Center for Railway Safety (UTCRS)** has engaged **over 120 undergraduate and graduate students** in its various research, education, technology transfer, professional development, and community outreach activities. These students are mentored by a team of highly qualified and dedicated faculty that are committed to providing a well-rounded education and research experience in the transportation engineering field. Students develop valuable skill-sets through hands-on projects relevant to the railroad industry, co-authorship of journal and conference papers, presentation at local and national symposiums and conferences, and writing theses and dissertations. One of the core missions of the UTCRS is to develop and graduate engineering professionals that are well-prepared to tackle and solve the challenges faced by the transportation industry.

In addition to developing a transportation engineering workforce, the UTCRS is collaborating with the **Uteach Program**, an organization advancing pedagogy within the UTRGV College of Education, to provide internship opportunities for students. As part of this collaboration, **12 undergraduate interns (10 female and 2 male)** conducted research related to K-12 STEM education and career interests of the 1000 students who participated in the 2015 UTCRS Summer Camps.

UTRGV Students involved with the UTCRS are primarily of Hispanic descent and statistically underrepresented in the professional transportation field (as reported by the Department of Labor Statistics of 2014). Moreover, of the **120 students** engaged with the UTCRS, **35% of them are female**, a statistic which **more than doubles the national average of 15.7% female workforce** in Transportation and Materials Moving Occupations. In fact, six of the eight REU participants who are currently pursuing their graduate studies in transportation engineering fields are females who were not considering continuing their post-graduate education prior to their involvement with the UTCRS.

## One-Of-A-Kind

Dynamic and thermal performance characterization of tapered-roller bearings for railcars is an active area of investigation for UTCRS researchers at The University of Texas Rio Grande Valley (UTRGV). In fact, researchers at UTRGV have been conducting a variety of testing for one of the largest railroad industry manufacturers since 2005. Most of the testing has been performed on two four-bearing test rigs that can accommodate four railroad bearings on one test axle. These two testers provide static vertical loading that can simulate railcar cargo loads. However, in order to more closely simulate the conditions that a railroad bearing experiences in field service operation, UTCRS researchers, designed and built a Single Bearing Tester as part of a UTCRS funded project. This tester is capable of applying vertical, lateral, and impact loads on one tapered-roller railroad bearing of any class, which allows researchers to mimic specific conditions that a bearing experiences in field service. A 2013 literature review revealed that no other testers with vertical, lateral, and impact load capabilities in a dynamic single railroad bearing configuration exist in a laboratory setting, making the UTCRS Single Bearing Tester a **one-of-a-kind** innovative research apparatus.



The Single Bearing Tester allows UTCRS researchers to analyze and characterize the thermal and dynamic performance of all railroad bearing classes used in North America and Canada. State-of-the-art bearing condition monitoring systems are employed that can detect the onset of bearing defect formation or failure. The UTCRS Single Bearing Tester is designed to provide up to 5,000 lb<sub>f</sub> of lateral load, a variable frequency (0-4 Hz) impact load, in addition to static vertical loads of up to 60,000 lb<sub>f</sub> applied to a single railroad bearing.

As part of a new project funded through the 2015CY call for proposals, UTCRS researchers designed and implemented a unique system that can be used to assess the efficacy and accuracy of the current wayside thermal detector systems employed in our rail network. Since it is

not feasible to have the railroad bearing pass over the infrared thermal detector at speeds of 30-35 mph in a laboratory setting, UTCRS researchers devised a fully-automated pneumatic system that allows the infrared thermal detector to sweep underneath the bearing at speeds that can range anywhere from 5 to 35 mph. The focus of this study is to quantify the accuracy and limitations of the current wayside thermal detectors, and identify ways to optimize their use in field service.



Three ongoing research projects are currently utilizing the Single Bearing Tester to perform experiments and acquire data for analysis. The findings will be summarized in future reports and publications by the UTCRS.

## Technology Transfer

UTCRS researchers at The University of Texas Rio Grande Valley and its consortium partners have a well-established track record in the area of experimentally validated finite element analysis related to railroad components, both mechanical and infrastructure. Research findings from a recently completed project funded by UTCRS, "Structural Integrity of Railroad Bearing Adapters with Modifications for Onboard Monitoring Applications" were presented in national and international conferences and local research symposiums with audiences ranging from students and faculty, to private and public sector railroad industry representatives. A summary of the report can be found [here](#), and a copy of the published conference papers can be downloaded [here](#). Additionally, a list of completed and ongoing theses studies can be found [here](#), and a list of published journal articles is provided [here](#).





## Second Annual REU Symposium



The University Transportation Center for Railway Safety hosted its Second Annual UTCRS Research Experience for Undergraduates (REU) Symposium at the University of Texas Rio Grande Valley on November 15, 2015. The event served as a forum for the 12 UTRGV REU students who participated in the 2015 REU Program. The students prepared professional posters and had the opportunity to present their railway safety research projects in front of engineering faculty and students. The event was open to the public and the community at large as part of the UTCRS outreach efforts to raise awareness regarding transportation engineering fields.

Each year, the UTCRS REU Program sponsors some of the most talented UTRGV students from various engineering fields (Mechanical, Civil, Electrical, Manufacturing, Computer Science, and Computer Engineering) to participate in a ten-week research-intensive experience to work on projects related to transportation engineering with a focus on railway safety. During the program, REU participants work closely with faculty members, graduate students, and undergraduate mentors from the consortium institutions on railway safety related projects, prepare professional presentations and posters, and present their findings at the end of the ten-week internship. In 2014, eight students (6 female, 2 male) were selected to participate, and in 2015, twelve students (8 female, 4 male) participated in the REU program. Based on their research area preferences, the REU participants traveled to the consortium institutions, Texas A&M University (TAMU) and the University of Nebraska-Lincoln (UNL).

The success of the REU program is gauged by a number of quantitative and qualitative measures which include the number of student participants who end up pursuing graduate studies in transportation engineering fields, the professional growth of the participants as witnessed by the faculty research supervisors, and the ability of the participants to conduct research, overcome challenges, manage expectations, and present their research findings in a manner that can be easily understood by an audience that is not familiar with the technical terms of the research.



them to railway safety applications and transportation engineering careers.

Over the past two years, the UTCRS in collaboration with the 26 school districts have been able to put together two of the largest STEM summer camps in the nation to serve one of the

fastest growing regions. In **2014**, the inaugural year, more than **700 K-12 students** participated. In **2015**, student participation grew to **1000 students (500 elementary, 400 middle, and 100 high school students)**. Enrollment for the 2016 UTCRS Summer Camps has reached **1,250 K-12 students** with the support and assistance of the school districts in the lower RGV, making the UTCRS summer program the largest five-week transportation related STEM camp in the nation.

The developed UTCRS STEM curricula utilize LEGO® MINDSTORMS® NXT 2.0, LEGO® MINDSTORMS® Education EV3, and MagLev educational toolkits to engage students in hands-on, inquiry-based activities. The curricula have been developed with scalability in mind; hence, it can be implemented in any K-12 grade level classroom. UTCRS curricula and educational toolkits are available for teachers, educators, and STEM program coordinators to borrow and implement in their own classrooms at no cost.

UTCRS is extremely proud to be part of the efforts to strengthen the institutional collaborations between UTRGV, the host university, and the local Rio Grande Valley School Districts. As part of our commitment to community outreach activities, UTCRS faculty and staff collaborate with the local teachers year-round as they borrow the UTCRS STEM curricula and toolkits to implement in classrooms across local school districts. This mutually beneficial relationship provides free resources, research facilities tours, and trainings for K-12 STEM teachers and, in turn, UTRGV and UTCRS meet their educational goals of encouraging students to learn about and consider careers in STEM, transportation, and railway safety fields.

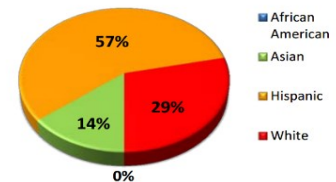
## EARLY STEM EDUCATION

The UTCRS Summer Camps have become the most popular K-12 programs in the lower Rio Grande Valley (RGV) due to the overwhelming demand to deliver STEM education to students at an early age through engaging, hands-on, inquiry-based activities.

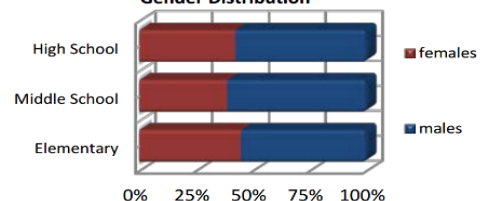
The STEM curricula for the elementary, middle, and high school students were developed by UTCRS faculty and staff in collaboration with K-12 teachers from local school districts that participated in the Research Experience for Teachers (RET) Program. The developed STEM modules are aligned with the Texas Essential Knowledge and Skills (TEKS) to allow teachers to easily incorporate and implement these modules into their lesson plans. The main goal of these modules is to inform and educate students on current transportation issues and opportunities, as well as, introduce

### { OUR DIVERSITY }

2015 UTCRS Summer Camp  
Diversity Distribution



2015 UTCRS Summer Camp  
Gender Distribution

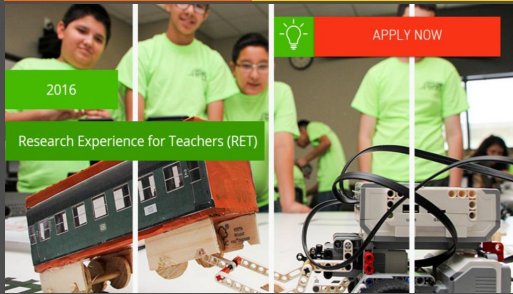




# UPCOMING EVENTS 2016

June 2 – July 11

2016 Research Experience for Teachers (RET) Program



Twelve K-12 teachers have been selected to participate in a research-intensive five-week program working closely with faculty, students, and staff during the 2016 UTCRS Summer Camps. This experience serves as professional development in the field of transportation engineering with emphasis on railway safety. The ultimate goal is to raise awareness about careers in transportation among K-12 students. Teachers participating in this program are expected to take the knowledge they gained to their classrooms, and work on current educational research projects, prepare professional presentations, participate in workforce development workshops, and submit a written final report describing their research results and the experience they gained.

May 31 – August 5

2016 Research Experience for Undergraduates (REU) Program



Fourteen undergraduate engineering students have been selected to participate in our 2016 REU ten-week program. Participants selected for this program will work closely with faculty, graduate students, and undergraduate mentors on railroad research projects. Students will have the opportunity to use state-of-the-art research facilities and report their findings and results to supervising faculty and peers during the program.

June 6 – July 11

2016 Railway Safety Summer Camps



Almost 1250 K-12 students will have the opportunity to participate in interactive, hands-on, inquiry-based activities during the 2016 UTCRS Summer Camps in which the various modes of transportation engineering will be highlighted with emphasis on railway safety. As part of the camp activities, students will be introduced to current research projects, as a means of stimulating their interest in the engineering fields. The camps will be held on the campus of The University of Texas Rio Grande Valley. These camps are the result of the strong collaborative efforts between UTCRS and the local Rio Grande Valley Independent School Districts.

## UTCRS K-12 STEM Teacher National Conference

We invite you to attend the first **UTCRS Transportation in the STEM Classroom K-12 National Teacher Workshop**. This two-day workshop will be taking place at the campus of The University of Texas Rio Grande Valley (UTRGV) June 2-3, 2016. The workshop will feature four hands-on STEM sessions for educators to develop the skill-sets required to teach transportation engineering concepts in their classroom. The intent is to train educators to implement the UTCRS Curricula, and provide them with activities that they can use to engage students in STEM fields.

Anyone interested in STEM education, including teachers, administrators, home-schooling parents, STEM/CTE coordinators and UTC coordinators are welcome to attend. The cost of this two-day workshop is \$50. Attendees will receive:

- 16 Continuing Education Credit Hours,
- UTCRS STEM Modules and curricula for all grade levels, and
- Hands-on, challenge-based professional development.

For more information contact UTCRS at [railwaysafety@utrgv.edu](mailto:railwaysafety@utrgv.edu) or call us at (956) 665-3070

**ONLY REGISTRATION FORMS ARE AVAILABLE HERE...**

UNIVERSITY TRANSPORTATION CENTER FOR RAILWAY SAFETY

**June 2-3, 2016**  
**Transportation in the STEM Classroom**  
**K-12 Teacher National Workshop**

Hosted at  
The University of Texas Rio Grande Valley

Continuing Education Credits Available  
Transportation STEM Modules and Curriculum Provided  
Hands-on, Challenge-Based Professional Development

**SAVE the DATE**

Thursday June 2, 2016 (8:00 am – 5:00 pm)  
**Session 1: Elementary School STEM Workshop**  
• Explore the STEM concepts introduced in the workshop  
• Gain the background knowledge and resources for K-5 curriculum  
• Make the connection between STEM concepts and hands-on experiences and ways to implement in the classroom

**Session 2: Middle School STEM Workshop**  
• Explore the STEM concepts introduced in the workshop  
• Gain the background knowledge and resources for K-6 curriculum  
• Make the connection between STEM concepts and hands-on experiences and ways to implement in the classroom

**Session 3: High School STEM Workshop**  
• Explore the STEM concepts introduced in the workshop  
• Gain the background knowledge and resources for K-12 curriculum  
• Make the connection between STEM concepts and hands-on experiences and ways to implement in the classroom

**Session 4: Raising the Bar - Challenge-Based Instruction**  
• Learn to develop engaging, relevant challenges for K-12 students with real-world applications  
• Learn how to implement effective STEM design challenges

The University Transportation Center for Railway Safety (UTCRS)  
[info@utrgv.edu](mailto:info@utrgv.edu)  
(956) 665-3070

## About UTCRS Activities

For more information about the activities described here, contact Constantine Tarawneh, Director of the University Transportation Center for Railway Safety (UTCRS) at [railwaysafety@utrgv.edu](mailto:railwaysafety@utrgv.edu) or call (956) 665-8878. The following colleagues contributed to this newsletter: Citlalli Garcia, Sr. Program Coordinator; Wendy Fowler, Diversity Coordinator; Angela Chapman, Educational Coordinator; Robert Freeman, UTRGV Associate Director; Gary Fry, TAMU Associate Director.