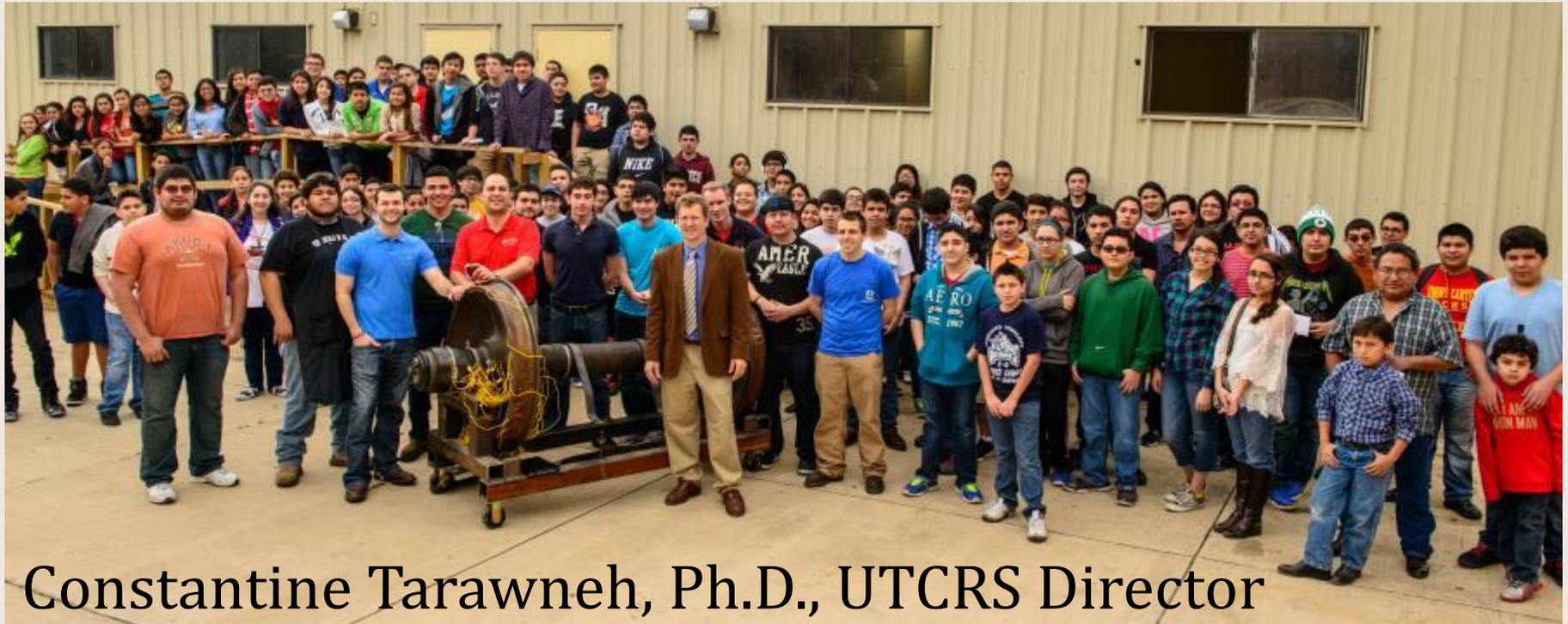


UNIVERSITY TRANSPORTATION CENTER FOR

RAILWAY SAFETY



Constantine Tarawneh, Ph.D., UTCRS Director

RailwaySafety.utrgv.edu

- UTC Railway Safety Consortium Institutions
- Research Efforts – Fall 2013 to Present
- Educational and Outreach Activities
- Professional Development Activities
- UTCRS Achievements and Impacts



UTCRS Group at UTRGV



Research Activity – Fall 2013 to Present

- Research Covers all aspects of railway safety: physical systems; operations and planning; and human factors
- 20 Projects to date
- 80 Bachelor's
- 20 Master's
- 9 Doctoral
- 6 Journal Articles
- 18 Conference Papers
- 6 Research Symposiums
- 6 Master's Thesis
- 9 Senior Design Projects



Research Activity – Fall 2013 to Present

Mechanical Components Safety – UTRGV Research Focus:

- Structural Integrity of Railroad Bearing Adapters with Modifications for Onboard Monitoring Applications [**Completed**]
- Effects of Vapor Grown Carbon Nanofibers on Electrical and Mechanical Properties of a Thermoplastic Elastomer [**Completed**]
- Modeling the Residual Useful Life of Bearing Grease [**Completed**]
- Applications of Magnetostrictive Materials for Real-Time Monitoring of Vehicle Suspension Components [**Completed**]
- Single Bearing Test Rig with Vertical, Lateral, and Impact Load Capabilities [**Completed**]
- The Effect of Heat Generation in the Railroad Bearing Thermoplastic Elastomer Suspension Element on the Thermal Behavior of Railroad Bearing Assembly
- Development of Predictive Models for Spall Growth in Railroad Bearing Rolling Elements
- Radiative Heat Transfer Analysis of Railroad Bearings Using a Single Bearing Test Rig for Wayside Thermal Detector Optimization
- Demonstration of Magnetostrictive Materials for Self-Powered Monitoring of Rail Vehicle Suspension Components

Research Activity – Fall 2013 to Present

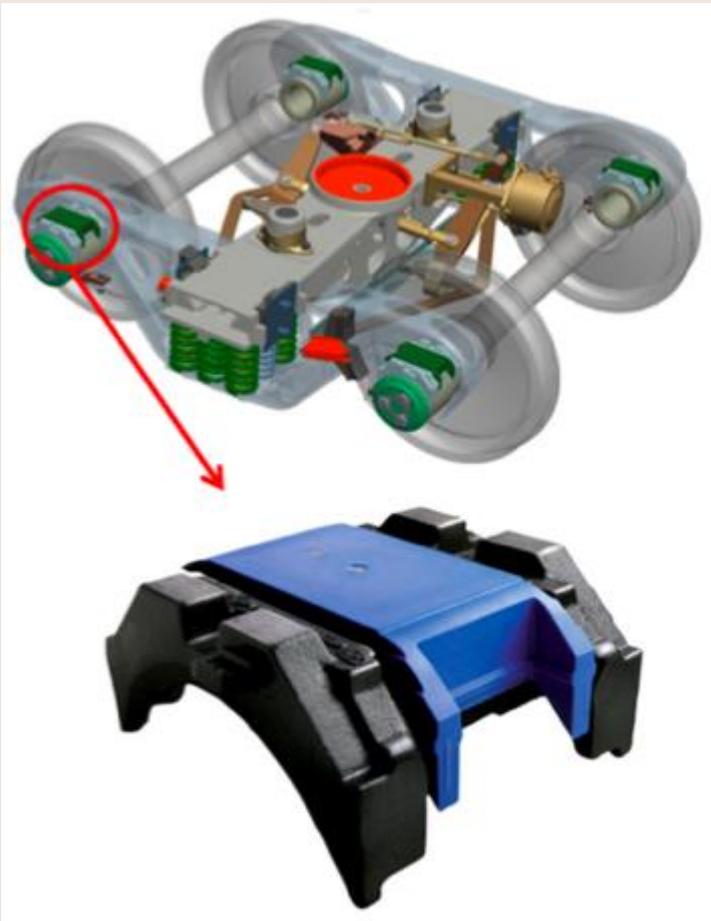
Railway Infrastructure Safety – TAMU Research Focus:

- Rail Neutral Temperature In-Situ Evaluation
- Ultrasonic Tomography for Infrastructure Inspection
- High Speed Train Geotechnics **[Completed]**
- Optimizing Performance of Railroad Rail through Artificial Wear
- Vehicle-Borne Autonomous Railroad Bridge Impairment Detection Systems

Railway Operations Safety – UNL Research Focus:

- Development of Corridor-based Traffic Signal Preemption Strategies at Signalized Intersections near Highway Railway Grade Crossings
- Drivers' Perceptions of Highway-Rail Grade Crossing Safety and Their Behavior
- Safety Modeling of Highway Railway Grade Crossings Using Intelligent Transportation System Data
- Improving Safety at Rural Highway-Rail Grade Crossings by Utilizing Light Detection and Ranging (LiDAR) Technology **[Completed]**

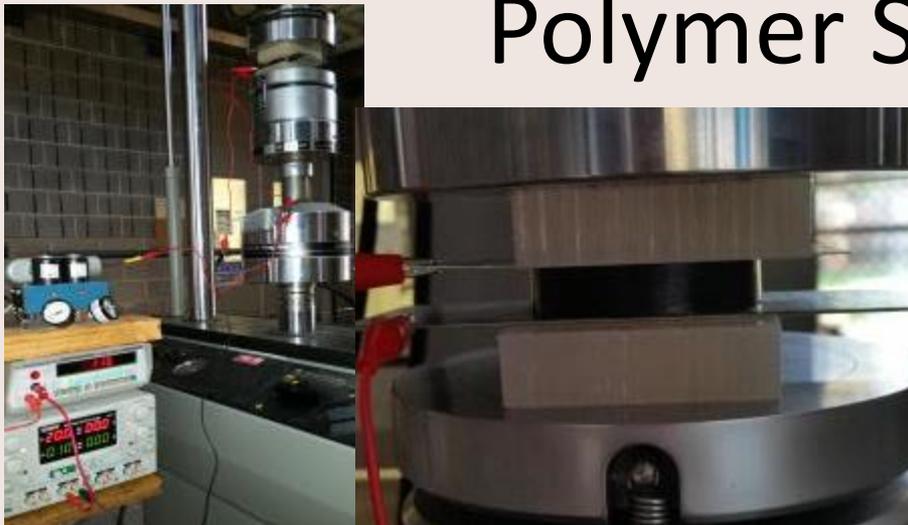
Railroad Industry Needs



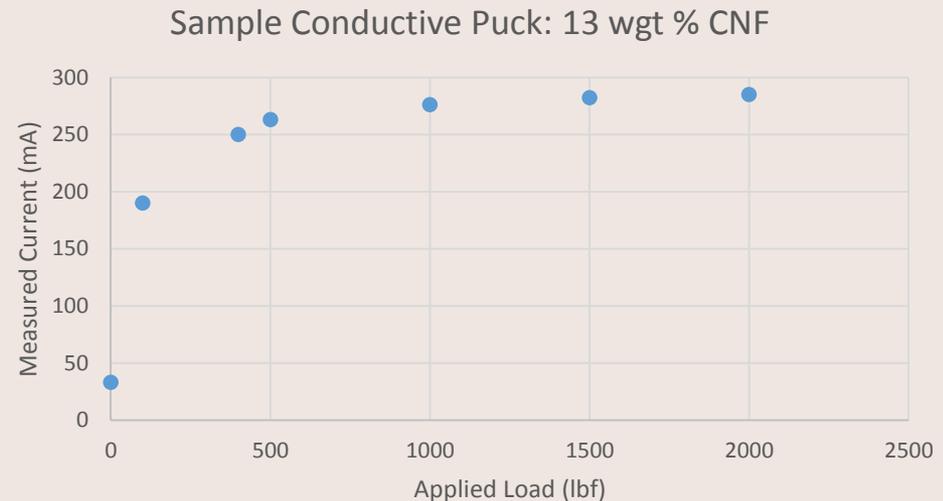
- Current polymer steering pads utilize two copper studs imbedded in the pad to transfer electrical current and open gates.
- Over time, the copper studs deform (compress) and conductivity is lost.
- The railroad industry and private railcar owners have been seeking an alternative solution to replacing the copper studs or the pad itself when electric conductivity is lost.

Picture courtesy of Amsted Rail Industries

Carbon-Nano-Fiber (CNF) Reinforced Polymer Steering Pad



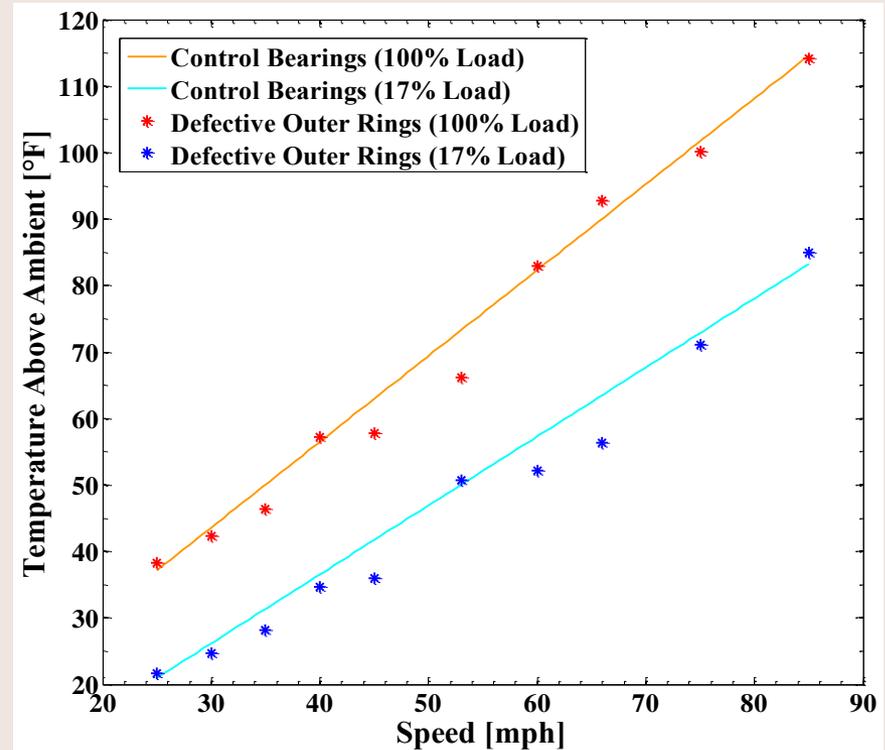
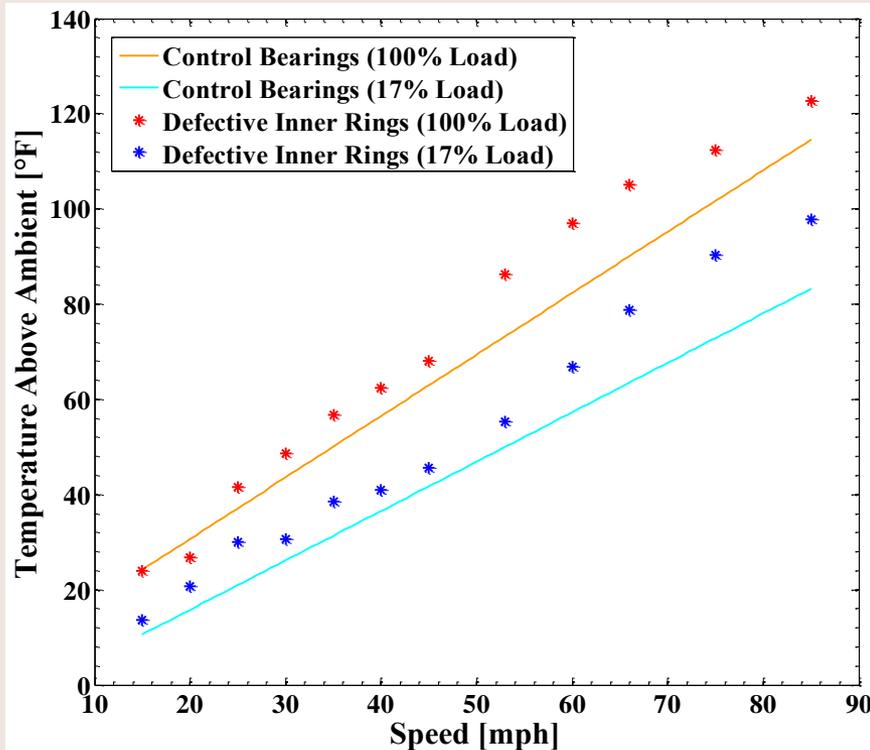
Conductivity Test Setup



Transfer Molded Sample Puck

- The CNF composite developed by the UTCRS allows for the entire pad to be electrically conductive under empty and loaded conditions.
- A private railcar owner plans to purchase 15,000 of these conductive polymer pads once available.

Average operating temperatures above ambient (78°F) of bearings with inner and outer ring defects as compared to healthy (control) bearings at various speeds under 17% (empty railcar) and 100% (full railcar) load conditions.



17% Load condition: $\Delta T = 1.0375 V - 4.9539$

; Regression Coefficient $R^2 = 0.9625$

100% Load condition: $\Delta T = 1.2910 V + 4.8667$

; Regression Coefficient $R^2 = 0.9924$

ΔT is the bearing temperature above ambient in °F ; V is the bearing operating speed in mph

Research Experience for Undergraduates (REUs)

- In 2014: 8 students
(2 men, 6 women)
- In 2015: 12 students
(4 men, 8 women)
- In 2016: 14 students
(8 men, 6 women)
- All historically
underrepresented



UTCRS Summer Camps

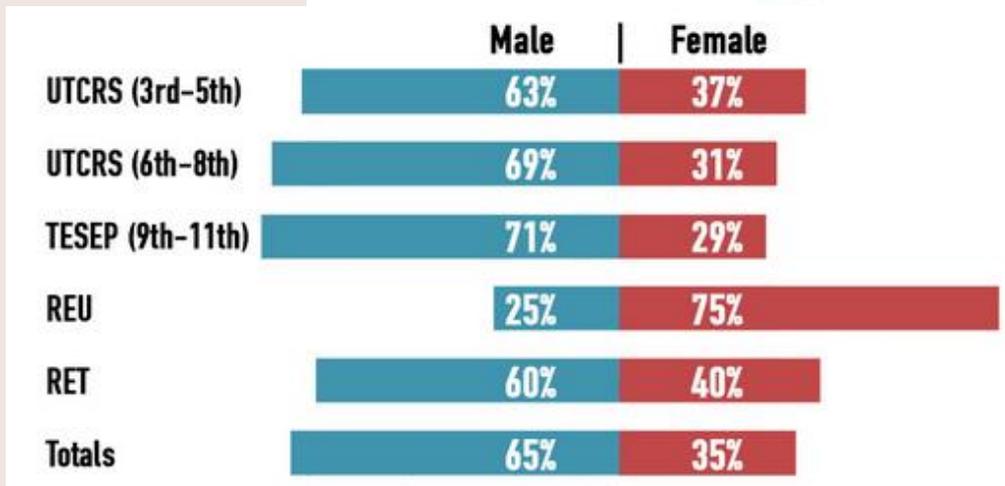
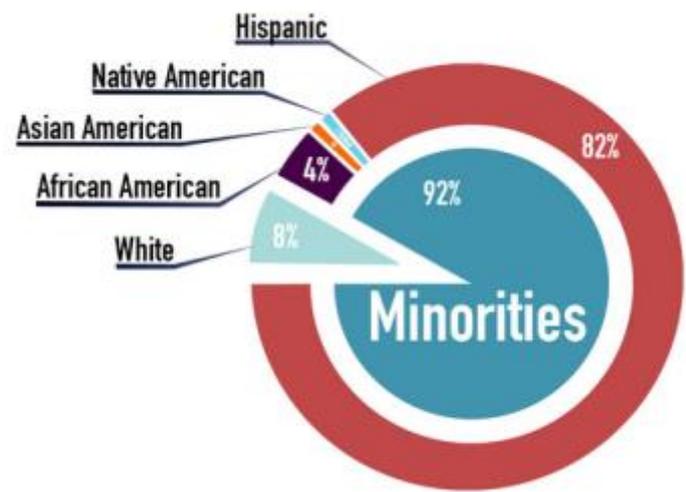
- Summer 2014: the camps served **700 students** (300 elementary, 300 middle school, and 100 high school students) from over 130 schools representing 26 school districts in the Rio Grande Valley (RGV).
- Summer 2015: the camps served **1000 students** (450 elementary, 425 middle school, and 125 high school), again distributed among RGV school districts.
- Summer 2016: current enrollment is **1250 students** (550 ES, 450 MS, 250 HS)





UTCRS Achievements and Impacts

- A major goal of the UTC for Railway Safety is to encourage students from groups traditionally underrepresented in transportation to consider careers in transportation-related fields. The summer camps supported this goal as there were approximately 1000 camp participants, of which over 80 percent were Hispanic and over 35 percent were female.





UTRGV Railway Safety Partners Up With Garza Elementary 5th Grade GT Class

The University of Texas-Rio Grande Valley is currently in its second year of its "University Transportation Center for Railway Safety (UTCRS) Camp" for students with representatives from the U.S. Department of Transportation (USDOT) and The University of Texas Rio Grande Valley.

This local camp, was spearheaded by the GT teacher, Terri Ochoa, at Garza Elementary with the partnership of Dr. Constantine Tarasov of UTRGV. Ms. Ochoa, a summer RET for the program, was able to bring the curriculum for her

5th grade GT students at Garza Elementary. Students learned about engineering and railway safety through hands-on projects including building Maglev railways and testing various variables. The curriculum was extended to include the history of the transcontinental railroad, Newton's Laws of Motion, Science @ EKS, Magnetism, vocabulary, and research projects from the Texas Performance Standards Project (GT curriculum). The students had a wonderful time constructing these models and completing all the activities. They grew a greater

love for science and engineering.

The camp was made possible through a grant the U.S. Department of Transportation (DOT) awarded UTPA. They have extended their curriculum to invite local school districts to use their curriculum and even borrow materials needed to construct and test variables on their own Maglev Railway track. You may find further information on this program at <http://portal.utpa.edu/railwaysafety>



Research Experience for Teachers (RETs)

- In 2014: 66 K-12 STEM Teachers
- In 2015: 85 K-12 STEM Teachers
- In 2016: 100+ K-12 STEM Teachers (National Workshop)





UNIVERSITY TRANSPORTATION CENTER FOR
RAILWAY SAFETY

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

SAVE
the
DATE

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

Thursday June 2, 2016 (8:00 am – 5:00 pm)

- Session 1 - Elementary School STEM Workshop
- Explore the STEM concepts introduced in the workshop with the developed Magnetic Levitation (MagLev) Kits 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 with the developed Lego Mindstorm Robotics Kits curriculum.
 - Make the connection between STEM concepts and hands-on experiences and ways to implement in the classroom.

Friday June 3, 2016 (8:00 am – 5:00 pm)

- Session 3 - High School STEM Workshop
- Explore the STEM concepts introduced in the workshop with the developed MagLev and Robotics Kits 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.



For more information contact:
The University Transportation
Center for Railway Safety (UTCRS)

railwaysafety@utrgv.edu
(956) 665-3070

Community Outreach Activities

UTCRS students, faculty, and staff have taken part in over 50 different community outreach activities since the inception of the center. The pictures below are from a science fair held at Idea Academy, McAllen on 1/23/2016 where UTCRS Director and students talked about opportunities in the transportation engineering field.



Questions

2014 UTCRS SOY



2015 UTCRS SOY