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Louis A. Beecherl, Jr. Endowed Professor of Engineering

# **DR. CONSTANTINE TARAWNEH**

The University of Texas  
Rio Grande Valley™

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## Increasing Minority Representation in STEM Fields

From a young age, Dr. Constantine Tarawneh was fascinated by airplanes – trying to work out how they were able to fly and what allowed them to carry so much weight in cargo. He found himself contemplating engine design, and how to make them more efficient. His days were spent watching the Discovery channel and documentaries about machines, engines, and mechanical systems. It was then, at the age of six, that he knew he wanted to become a mechanical engineer. Not deterred by his father’s insistence he follow in his footsteps to become a medical doctor, Dr. Tarawneh knew he had the ability and passion to become an exceptional engineer.

Dr. Tarawneh was born in Thessaloniki, Greece. He received his Bachelor of Science degree in mechanical engineering from the University of Jordan Amman (1996). He continued his graduate education in the United States, receiving a Master of Science (1999) and a doctorate (2003) in mechanical engineering from the University of Nebraska-Lincoln.



After graduating, he worked for an airline, maintaining large airplane engines, and completed an internship installing air-conditioning units in large supermarkets, hospitals, and industrial plants. In 2003, Dr. Tarawneh joined the University of Texas Rio Grande Valley’s (UTRGV) legacy institution, the University of Texas-Pan American, as a full-time lecturer in the mechanical engineering department. Though he was offered two tenure-track positions at other institutions, he made the decision to join UTRGV because he felt he could contribute to the growth of the University’s young engineering program.

Expanding on the need to grow the engineering program at UTRGV, Dr. Tarawneh noted the critical ethnic disparity in the education of students in science, technology, engineering, and mathematics (STEM) fields. According to a 2010 report by the U.S. Department of Education, Hispanics represent 20% of the U.S. population—and make up the largest minority group in the public school system—yet less than 2% of the STEM workforce is Hispanic.

“Various research, education, workforce development, technology transfer, and community engagement activities aimed at attracting and recruiting underrepresented groups to pursue careers in STEM fields [are needed],” said Dr. Tarawneh.

# FORGING PATHWAYS FOR STUDENT SUCCESS



Dr. Tarawneh has made significant contributions to the growth of the UTRGV engineering program and increased community outreach and education activities ten-fold. He took on the challenge of expanding Hispanic representation in the STEM field, and earnestly involves students in his work. Soon after being hired, he developed a railroad research team, consisting of seven faculty and staff, 10 undergraduate students, and eight graduate students, to tackle issues important to the railroad industry. The research group is committed to student education and training; by actively engaging students, the group provides the opportunity for students to contribute to the research and development of new technologies, effectively training a sophisticated workforce prepared to enter the field of transportation engineering. At inception, the group was able to attract \$3 million in private funding to engage students in research and scholarship activities, and to provide students with a

source of income to offset the cost of tuition.

In 2013, Dr. Tarawneh formed the University Transportation Center for Railway Safety (UTCRS), which was funded by a \$4.5 million grant from the U.S. Department of Transportation (USDOT). UTCRS operates as a consortium of three institutions – UTRGV, Texas A&M, and the University of Nebraska-Lincoln – whose purpose is to improve railway safety outcomes through student engagement, research, workforce development and community outreach.

One of the main goals of UTCRS is to coordinate outreach activities to teach young students about transportation engineering in an engaging, interactive and hands-on way. This is accomplished through STEM summer camps, research experiences for students and teachers, engineering workshops, K-12 curriculum development, and outreach activities.

“Creating pathways for students to pursue their master’s and doctoral studies in the areas of transportation engineering and railway safety is one of the most important center missions,” said Dr. Tarawneh. “The training of a sophisticated workforce, which is thoroughly grounded in the specific demands of rail service, will have a long-term effect on system safety through improved safety assessments, counter-measures, and decision-making tools.”

# EDUCATING YOUNG STUDENTS AND TEACHERS ALIKE

Through the Louis A. Beecherl, Jr. Endowed Professorship, Dr. Tarawneh has financially supported 275 undergraduate and 120 graduate students who are actively involved in UTCRS activities. He advises 200-300 students every year and actively involves them in his research endeavors. Over the past 12 years he has supervised 30 different senior design projects, enhanced course material, and developed graduate and undergraduate courses. In addition, Dr. Tarawneh developed the Research Experience for Undergraduates Program, which has enabled 35 UTRGV students to spend 10 weeks during the summer working on research projects at the two UTCRS partner institutions, Texas A&M and the University of Nebraska-Lincoln, in an effort to encourage them to pursue graduate degrees. Of these 35 students, 27 have continued their education with graduate degrees, and three are currently pursuing their doctoral degrees.

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Through UTCRS, Dr. Tarawneh organized the largest transportation-related STEM summer camp in the nation, with over 5,500 K-12 student and 500 teacher participants over the past five years. The camp is designed to encourage students to consider careers in transportation-related fields, especially those students traditionally underrepresented in the field, e.g., minorities (92% of camp participants). Utilizing hands-on activities, students learn science and engineering concepts and how they relate to transportation safety.

“The UTCRS Summer Camps were created to expose K-12 students to the transportation field through hands-on, engaging curriculum where students learn fundamental concepts of physics and math and how to apply them to engineering problems involving transportation-related challenges,” said Dr. Tarawneh. “The camp teaches students that engineers in any major can specialize in transportation jobs and they get to work in teams to solve transportation industry challenges and problems.”



Hosted on the UTRGV campus, the camps allow students to explore the field of engineering in a university setting. Seeing firsthand the research and testing facilities, students are able to visualize what engineers do. "It also helps build their confidence seeing university students explain their research to them," said Dr. Tarawneh.

UTCRS also provides professional development workshops for teachers and aids them in developing lesson plans to teach STEM concepts that relate to transportation engineering and railway safety. Teachers have the opportunity to participate in a five-week intensive summer program, called Research Experience for Teachers, wherein they work closely with UTRGV faculty and students on research projects. At the close of the program, teachers are armed with the knowledge and know-how to take what they learned back to the classroom to educate young students about possible careers in transportation.

## FUNDING STUDENT-DRIVEN RESEARCH



The Louis A. Beecherl, Jr. Endowed Professorship provides Dr. Tarawneh with the funding mechanism to further support engineering students through research, educational opportunities, and exposure to large corporations.

"This endowment is an engine that propels me to keep doing what I have been doing to engage undergraduate and graduate students in research, including co-authorship of conference and journal papers, poster presentations at symposiums, and helping students apply for national fellowships that provide them with opportunities to travel to national

conferences where they meet potential employers."

For example, in 2018 Dr. Tarawneh applied for and received funding for the USDOT Dwight D. Eisenhower Transportation Fellowship Program Local Competition, which enabled 11 UTRGV students to attend the annual Transportation Research Board Conference. At the conference, students explored potential industries of interest and were able to present posters to their peers – one UTRGV student won the Best Poster Award, which is a national recognition.

"Receiving the endowment provides a very big motivation for me to go out there and do more for the students, university, community, and profession," said Dr. Tarawneh.

The research that Dr. Tarawneh conducts is as vast as it is varied. He is examining the health of railroad bearings using low power wireless sensors, developing and testing prototypes of railroad suspension pads made from electrically conductive thermoplastic polyurethane, demonstrating the monitoring of self-powered rail vehicle suspension components using magnetostrictive materials, performance testing of the efficacy of railroad bearings, and more. Students actively participate in this research—Dr. Tarawneh has submitted more than 30 external grants and 43 journal and conference peer-reviewed papers co-authored with students.

The work and research that Dr. Tarawneh conducts has not gone without notice; he is frequently recognized and rewarded for his mentorship and teaching prowess. For instance, he received the Regents' Outstanding Teaching Award from the University of Texas System Board of Regents in 2009; this award is one of the nation's largest teaching recognition programs in higher education. In 2010, he received a letter from then Texas Governor Rick Perry commending him for research conducted to solve the bearing temperature trending problem that plagued the railroad industry for over two decades. He has received countless excellence awards for teaching from UTRGV, and in 2010 he was awarded the Dean's Engineering Faculty Support Endowment Award for his dedication to the University's mission of becoming a premier learner-centered research institution. Dr. Tarawneh is also a member of the External Review Committee for three publications: the International Journal of Heat Mass Transfer, the Journal of Thermal Science and Engineering Applications, and the International Journal of Railway Technology.



# ESTABLISHING A LEGACY OF MENTORSHIP

Dr. Tarawneh has a passion for educating and mentoring students. To him, the most gratifying part of his job at UTRGV is working with students throughout the trajectory of their educational career – from incoming freshmen, with hopes and dreams for a bright future in engineering, through undergraduate and graduate studies, and into their dream jobs. It is the way he has been able to involve students in various research and scholarship endeavors, and help launch the careers of students, that Dr. Tarawneh is most proud. These students are employed at reputable engineering firms, teach in academia, work in the rail industry, and run engineering plants.

“It brings me great joy to see that they are successful in their careers and that I played a part in their success,” said Dr. Tarawneh. “To me, this will forever be my proudest accomplishment and my legacy in my career. I will continue to do this until I retire.”

Dr. Tarawneh is the epitome of an astute, resourceful educator. His dedication to developing programs and opportunities to aid students in their journey toward fruitful engineering careers is to be commended and celebrated. The University of Texas Rio Grande Valley will continue to feel Dr. Tarawneh’s positive impact as students graduate prepared to strengthen the field of engineering.

“The entire journey and the challenges that we face as a faculty-student team to overcome barriers and achieve the end goal, which is placing the student in a job that will help them contribute to their families, community, and profession, is one of the most rewarding experiences in my career,” concluded Dr. Tarawneh.