

NTC Information Highway

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The Nebraska Transportation Center's Information Highway newsletter keeps you up-to-date on the latest in transportation research, news, and events happening right here at NTC. Information Highway is about big ideas, students with big potential, and NTC's big impact on transportation in Nebraska, and beyond.

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NTC Students at the 2018 AREMA conference (left to right): Li Zhao, Huong Pham, Tiffany Treviño, Santos Ramos, Ernest Tufuor, Ahmed Rageh, Hossein Bahmyari, Mike Ellis, Jared Tomes, and Antonio Hurtado Beltran.

AREMA Trip Provides NTC Students with Rail Knowledge and Professional Connections

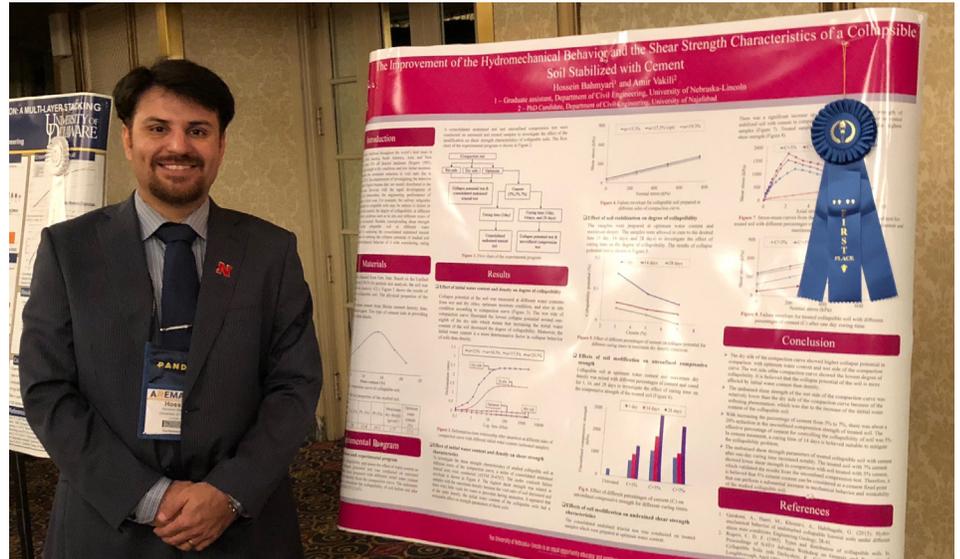
Mid-September eight graduate students, one undergrad, and one postdoctoral research associate attended the American Railway Engineering and Maintenance-of-Way Association (AREMA) 2018 conference in Chicago. The conference provides those in the railway industry, and students interested in it, the opportunity to learn more about the field through

committee meetings, technical discussions, keynote addresses, and a multitude of breakout sessions. The sessions include a variety of railway topics, ensuring the presence of railway engineering experts from all segments of the industry.

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Left: Hossein Bahmyari, Antonio Hurtado Beltran, Ernest Tufuor, and Santos Ramos at the Union Pacific field day.



Right: Hossein Bahmyari receives first place in the graduate student poster competition.

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“The sheer volume shocked me, as there were just so many small parts that go into it that I would’ve never thought,” said undergraduate Jared Tomes. “Whether it be the smallest bolt being manufactured or new technology for switches, it was all rail related.”

The students’ trip was sponsored by Union Pacific (UP), who hosted a field day prior to the conference. Attendees were given a safety briefing at the facility, shown a presentation of current engineering projects, and visited three active sites. Students were pleased to see UNL alumni were part of the UP team, to which Tiffany Trevino, a graduate student from NTC’s Midwest Roadside Safety Facility, said, “meeting someone that was once in my shoes and now was an engineer at UP put things into perspective.” Another graduate student, Santos Ramos, was able to set up an interview with UP recruiters.

AREMA provided activities exclusively for students, including sessions on interview and resume tips and career opportunities in the rail industry. The presentation on careers highlighted perspectives on working for a design engineering firm in the industry. The presenters’ goal was to “cement each student’s commitment to remaining within the railroad industry” and recruit young professionals.

UNL students Ahmed Rageh, Ernest Tufuor, Huong Pham, Antonio Hurtado Beltran, and Hossein Bahmyari represented the university in the Quiz Bowl. The competition included categories about AREMA, general industry knowledge, and popular culture

topics related to railway. The contest included 5 rounds of 10 questions, increasing in difficulty. The teams had one minute to discuss and answer each question. The students used this opportunity to showcase their knowledge of the industry and learn new rail facts.

Students continued to show their competitive sides in the poster competition. Both Bahmyari and Rageh participated, and Bahmyari came away with first place. Bahmyari’s poster, titled “The Improvement of the Hydromechanical Behavior and the Shear Strength Characteristics of a Collapsible Soil Stabilized with Cement”, displayed the materials, experimental program, results, and conclusion of his project testing the strength of collapsible soil at different water contents. The research was conducted by Bahmyari, a graduate assistant in UNL’s Department of Civil Engineering, and Amir Vakili, a Ph.D. candidate in the Department of Civil Engineering at the University of Najafabad.

“Meeting someone that was once in my shoes and now was an engineer at UP put things into perspective.”

The “Meet the Next Generation” panel and reception on the last day provided prospective employees and students the opportunity to learn about the industry and meet representatives from railway companies. In turn, it gave representatives the chance to establish relations with potential employees. Mike Ellis said of the

companies, “it appears they are looking to hire employees with good “people skills”, particularly those who work well with others to solve problems.” The event was a great end to an experience full of learning and networking, helping NTC students to establish connections for bright futures in engineering.

ITS Heartland Award Goes to NTC Student Ernest Tufuor

On April 23, 2018 Ernest Tufuor received an ITS Heartland Award for his paper on the usage of a Bluetooth-plus-Wi-Fi device for travel time research. The organization presented the award to the Civil Engineering Ph.D. student at their annual meeting in Lincoln, NE.

ITS Heartland is an organization that aims to facilitate information sharing for ITS (Intelligent Transportation System) projects and activities. The State Departments of Transportation and major universities in Missouri, Iowa, Kansas, Nebraska, and Oklahoma hold annual meetings to allow members to discuss ITS issues, learn about activities in other states, and provide an opportunity for vendors to display new products.

Tufuor's paper overviews a study using a Bluetooth device to ascertain travel time and determine whether the data collected is reliable. The device developed by NTC, referred to as generic Bluetooth (gBT), consisted of a single board computer (raspberry pi), a power supply, an adjustable antenna, a global positioning system, and a wireless adaptor. A GPS-probe vehicle was used to compare travel times with the gBT for 15 hours in three

consecutive days on a two mile arterial road segment in Lincoln. The study found Bluetooth travel times to be capable of providing reliable estimates of the arterial travel time. Tufuor acknowledges his advisor and the director of NTC, Dr. Laurence Rilett, for the innovative and creative ideas that led to the project's success.

Many researchers, especially students, rely on commercially developed BT detecting devices from local transport agencies, posing location restrictions. The gBT system is modular, readily adaptable, easily assembled, low-cost, and allows research to be conducted on all types of facilities including roadways, pedestrian walkways, and bikeways. The gBT costs around \$500 to produce as compared to the on-shelf vendor BT devices that may cost \$5,000.

"Having Bluetooth and Wi-Fi combined gives the opportunity for a higher sampling rate, which seems to be different from other systems," Tufuor said when asked about his interest in the research subject. He is continuing his work at NTC as a research assistant before his projected graduation in 2019. He aspires to become a faculty member at the University of Nebraska.

Ronald Barnes (left), University of Oklahoma assistant professor and ITS Heartland board member, presents Ernest Tufuor with a best paper award.

Photo courtesy of ITS Heartland.





A 15,000 pound flatbed truck after impacting the MwRSF-developed non-proprietary barrier during a full-scale crash test. Photo courtesy of MwRSF.

NTC's MwRSF Develops First Non-Proprietary Barrier in DOD Approved List

The Nebraska Transportation Center's Midwest Roadside Safety Facility (MwRSF) has developed a non-proprietary barrier to limit the impact of threat vehicles in Entrance Control Facilities (ECFs) as well as provide safe stops for low-speed, non-hostile vehicles. It will be the first federally-accepted, non-proprietary barrier system in the Department of Defense (DOD) Approved Barrier List. This low-cost, high-performance barrier could reduce new barrier construction costs for military base entrances by 50% and can be quickly repaired using standard construction equipment.

The barrier's components consist of mostly standard roadside barrier hardware. Corrugated steel plates, called "thrie beam," form the impact face of the barrier, and are mounted on steel posts embedded in soil. Wood blocks positioned between the post and rail, called "blockouts," reduce both the possibility of edges of the post tearing through the rail, and the chance of an impacting vehicle's wheel extending under the rail and snagging a post. The rail is secured to rigid steel and concrete end anchorages to provide up to 150,000 pounds of tension and disable vehicles intentionally trying to breach the barriers by impacting near the end anchorages.

Full-scale crash testing involved using both a medium-duty flatbed truck weighing 15,000 pounds and a 4,500 pound full-size car impacting perpendicular to the center of the barrier. Both vehicles were safely brought to a stop within 10 feet of the initial point of contact.

This barrier is the first non-proprietary system accepted for the DOD Approved Barrier List and was specially designed to be the least expensive option to reduce stress on domestic military construction budgets. The system was also designed to be safe for occupants during accidental impacts, in compliance with the Manual for Assessing Safety Hardware (MASH). System components can be purchased from any vendor to ensure prices stay competitive from the first time the barrier is installed to subsequent repairs and maintenance.

It has been in development for two years beginning December 2015 and completed full-scale and component testing in December 2017. Funding was provided by the Army Surface Deployment and Distribution Command Traffic Engineering Agency (SDDCTEA) and supported by the Army Corps of Engineers Protective Design Center (USACE PDC).

Future evolutions of this barrier may be applied to non-military applications, including urban areas where impact conditions may be severe, such as T-intersections or sharp roadway curves, or to shield high-profile civilian buildings like schools and government buildings.

NTC's MwRSF will continue to work with SDDCTEA, USACE PDC, and other federal agencies to disseminate research data, develop similar systems for more strenuous impacts, and encourage collaboration and shared research between military structural design innovation and civilian safety design in academia and government. Component and system data generated during this project will be used to inform future projects.

Huiyuan Liu Honored as 2018 Lifesavers Traffic Safety Scholar

NTC Civil Engineering student Huiyuan Liu was named a 2018 Lifesavers Traffic Safety Scholar when attending the 37th annual National Lifesavers Conference spanning April 22-24 in San Antonio, TX. As one of 50 selected, he was given a \$1,000 scholarship and the opportunity to attend multiple workshops from which there were 80 to choose.

Liu's essay outlined two of his current traffic safety projects. The first studies distracted driving behavior at roundabouts, ultimately striving to identify potential driver education and awareness strategies that would mitigate risky driver behavior. Liu is also conducting research that explores the safety improvement of offset right-turn lane treatment by analyzing traffic volume data, sight triangle, and traffic crash data.

There were nearly 2,000 attendees at the conference including local, state, and federal highway safety officials, law enforcement and first responders, victim advocates, and multiple students and researchers. The conference showcased participants' latest research, evidence-based strategies, proven countermeasures, and promising new approaches for addressing the nation's most pressing traffic safety problems.

"It's an exciting and unforgettable experience attending the 2018 Lifesaver conference," said Liu. He is currently attending graduate school at the University of Nebraska-Lincoln to achieve a Ph.D. in Civil Engineering, specializing in transportation.



Huiyuan Liu

NTC Students Receive Awards at 60th Annual IHEEP Conference in Lincoln

In September 2018, Lincoln hosted the 60th annual International Highway Engineering Exchange Program (IHEEP). The event brought together one of the most diverse groups of influencers and highlighted innovation in better processes and technology advancements. Attendees included International, Federal, State, and local levels of government employees, professionals at engineering consulting firms, and some of the biggest technology partners.

Two NTC students won awards on their research during the conference. Ernest Tufuor, a Civil Engineering graduate student, entered his work on "Land Suitability Analysis for EMS Posts along State Highways" in California. The study was developed out of a concern with the response time of emergency vehicles to rural areas. His paper demonstrates the viability of using Geographical



M. Ebrahim Mohammadi receives first place for his paper entry at IHEEP.

Photo courtesy of Nebraska Department of Transportation.

Information System (GIS)-Multi Criteria Analysis in road safety management and provides a logical and consistent approach for identifying potential locations of emergency medical services.

M. Ebrahim Mohammadi, a Ph.D. student in Structural Engineering, received first place for his work on "Automatic Bridge Damage Detection through Point Cloud Data." His research outlines the importance cloud based applications are taking in a variety of disciplines. The study works to introduce a workflow to detect surface damage and other surface imperfections from point cloud data based on cloud geometry. The developed algorithm evaluates two classes of features,



Ernest Tufuor presents his research on identifying EMS locations.

Photo courtesy of Nebraska Department of Transportation.

geometrical and statistical, to identify and quantify the location of potential surface defects of bridges.

The conference focused on project delivery, E-Construction initiatives, data/document management, and business innovation and transformation. Tufuor and Mohammadi were able to share their studies and learn from some of the biggest influencers in the transportation industry. One of the most important applications to their research was presenters' advice to examine experiences gained and lessons learned during the entirety of a project's process, not just the successful completion.



Top: MWRSF director Ron Faller (right) explains how the SAFER barrier works to NASCAR driver Michael Annett.
Bottom: Crash test results of a half-ton pickup truck traveling at 62 mph into a guardrail at MWRSF's Outdoor Proving Grounds.
Photos courtesy of UNL's College of Engineering Communications & Marketing.

NASCAR Driver Witnesses Crash Test and Learns About Track Barriers

NASCAR driver Michael Annett visited NTC's Midwest Roadside Safety Facility (MwRSF) June 5, 2018 to learn about the barriers keeping race tracks safe.

He was welcomed to the facility at the University of Nebraska-Lincoln by MwRSF's director, Dr. Ronald Faller. Research Engineer Robert Bielenberg gave him an overview of the MwRSF-developed Steel and Foam Energy Reduction (SAFER) Barrier that is used by nearly every track on the IndyCar and NASCAR circuits.

The morning continued with a tour of the SAFER Barrier and motorsports exhibits at the Speedway Motors Museum of American Speed, followed by a tour and a crash test viewing at MwRSF's Outdoor Proving Grounds. During the test, a half-ton pickup truck going 62 mph crashed into the barrier. The tested barrier was a three-beam bull-nose guardrail, which is designed so the posts break away when they are hit to allow the metal to wrap around the vehicle and bring it to a safe stop.

The SAFER Barrier began development in 1998 and was intended to absorb and reduce kinetic energy during impact on a high speed track. The 40-inch-high barrier is composed of structural steel tubes and closed-cell polystyrene foam inserted between the tubes and the track's concrete wall. Iowa Speedway will be the first race track to install the SAFER Barrier on an alternative steel backup structure rather than in front of a traditional concrete wall.

Annett has had his fair share of crashes to test the SAFER Barrier. He bruised his sternum in a crash at Daytona International Speedway during an Xfinity Series race in February 2013. He hit the barrier going 180-190 mph at an angle similar to Dale Earnhardt's fatal crash in 2001 before the SAFER Barrier was implemented. There have been no fatalities in NASCAR or IndyCar events on professional tracks across the country since the barrier's installation.

“It was really satisfying to find out that the work you are doing is helping the competitors be safe and return to their friends and family.”

“Speaking with the racers was extremely rewarding on several levels,” says Bielenberg, “It was really satisfying to find out that the work you are doing is helping the competitors be safe and return to their friends and family.”

The energy absorbing techniques of the SAFER Barrier are applicable to highway safety barriers the facility is now working to improve. The RESTORE Barrier, recently developed by NTC's MwRSF from the concepts of the SAFER Barrier, reduces impact forces on vehicles ranging from small passenger cars to 22,000-pound single unit trucks.

Share your News with NTC!

If you are a student, faculty member, or other affiliate of the Nebraska Transportation Center, we are eager to share news of your work and accomplishments.

Send your information to Amber Hadenfeldt at ntc-ahaden@unl.edu, and it could appear in the next issue as well as NTC's [website](#), [Facebook](#), and [Twitter](#).



NEBRASKA TRANSPORTATION CENTER

Contact Us:

2200 Vine Street
262 Prem S. Paul Research
Center at Whittier School
PO Box 830851
Lincoln, NE 68583-0851

402-472-1975

-  [NETransportationCtr](#)
-  [@NTCInfoHighway](#)
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