Ten students attended the TRB 2020 conference in Washington D.C. January 12 - 16. The program was expected to attract around 13,000 transportation professionals from around the world to share their knowledge and upcoming innovations in transportation.

The theme of the 99th annual meeting was *A Century of Progress: Foundation for the Future*. There was something for everyone with nearly 800 sessions and workshops consisting of over 5,000 presentations. Sydney James attended a presentation from the Tribal Transportation Issues Committee to hear about their work with Tribal areas in the US. During the discussion she was able to contribute with her own experience from working with the Nebraska Indian Community College (NICC) and Little Priest Tribal college as a graduate student in Transportation Engineering.

Francisco Garcia presented in front of a room of transportation professionals, students, and professors on his research titled “Integration of Artificial Neural Networks in Bridge Load Rating and Case Study Application.” He received a lot of feedback and interest in the study and left feeling that he could take what he has learned from presenting at TRB and “use it as a baseline to improve upon.” Chen Fang also presented to a crowd during the roadside Safety Design Computational Mechanics Subcommittee. His research study focused on the numerical simulation of isolated highway bridge columns subjected to vehicle collision and air blasts.
Andrew Loken and Huiyuan Liu both participated in one of the two poster sessions. Andrew detailed his research at Midwest Roadside Safety Facility on connected and automated vehicle applications. Huiyuan Liu found the diverse group of transportation professionals in attendance as an exciting part of the conference.

During their time in Washington DC, MATC affiliates from the participating schools in the Midwest meet for a dinner. At the affiliate dinner, students and researchers from UNL, [GET DINNER ATTENDANCE LIST] ate and discussed ongoing MATC projects. During this gathering the MATC Student of the Year Award was presented to Elisa Vasquez from Midwest Roadside Safety Facility during the affiliate dinner.

Awards were given at the conference in which Ernest Tufuor was presented with the Best Paper Award from the TRB Highway Capacity and Quality Service Committee for having the first empirical study to validate the new travel time reliability methodology in the current edition of the Highway Capacity Manual.

The conference had a lot to offer. In his third year of attending TRB, Antonio Hurtado-Beltran presented two posters and was brought into contact with professionals interested in his work. PhD student MM Shakiul Haque saw the conference as “a vital source of academic encouragement” and is taking what he has learned to “think bigger and out of the box.” MATC will have new and returning students and personnel attending the 2021 meeting from January 24 to 28 in Washington D.C.
Middle School Students Learn and Practice STEM During RRRC After School Program

With the help of nine mentors, the 2020 Roads, Rails, and Race Cars after school program has involved middle school students in Lincoln, Macy, Winnebago, and Omaha in a variety of fun activities involving science, technology, engineering, and math. Each meeting began with a lesson on a STEM subject before mentors would demonstrate and help students perform an activity to exemplify what they had learned. A favorite of mentors and students is the air pressure and aerodynamics lesson, which was practiced by powering a paper rocket with air pressure from stomping on a pop bottle. The activity provided a "good combination of technical learning with a cool spectacle once it’s all assembled" as mentor Tom Shaffer explained. Tom has been working with the program for two semesters now and finds it gives the students the opportunity to think for themselves and come up with a multitude of different solutions, showing the creativity and problem solving skills of young minds.

In a series of six simple machines, the students built a windlass from popsicle sticks and catapults to launch marshmallows up to twenty feet while learning about levers. Their creativity was brought out during a city planning exercise, where they drew a city on poster board and added 3D elements to represent things in their city. Other activities included balancing paper butterflies by distributing paper clips, building an Archimedes screw to compete who could move water from one location to another the fastest, and making a pulley tower out of Popsicle sticks in a competition to see whose could hold the most weight.

STEM programs for young students like the RRRC program are important as middle schoolers start to think about their future into high school and beyond. These activities give them the opportunity to think for themselves and come up with their own unique ideas and solutions for the same project. Meanwhile, the program gives the undergraduate student mentors a chance to share their knowledge and love of STEM with young students. Mentor Josh Wagner, now a Civil Engineering major at UNL, mentioned he was in a similar program when he was younger.

There is no doubt the impact of this program to get young students thinking about STEM in their everyday lives, and in their future careers.
In February, MATC affiliates met at Whittier Research Center to discuss infrastructure research endeavors and progress in the 2020 MATC Infrastructure Workshop. The day was split into three sessions, 1) Infrastructure Design, Inspection, Maintenance & Repair, 2) New Technologies, and 3) Infrastructure Inspection & Design for Various Loading Conditions within which four presenters in each session would give a synopsis on their infrastructure projects.

Ronald Faller, Research Professor and Director of Midwest Roadside Safety Facility, introduced the workshop and speakers as the day progressed. There were 17 in-person attendees from the University of Nebraska-Lincoln, University of Kansas, Missouri University of Science and Technology, and the Nebraska Department of Transportation with seven more individuals participating as audience and presenters online.

Many of these projects look at a specific application, but the research found can be used for various purposes. During the discussion portion of Lesley Sneed's presentation, Performance of Earthquake-Damaged Reinforced concrete Bridges with Repaired Columns, those present at the workshop mentioned the potential of using these reinforcement plans for events outside of earthquakes, such as flooding or high winds. MATC director Dr. Laurence Rilett took the opportunity to remind associates “we’re showing two or three year projects, but really it’s part of a larger one,” meaning the research discussed in the workshop has many applications to be used for years to come.

The widespread results of these projects were further iterated when presenters mentioned the interest already gained from other researchers around the country. Dr. Cody Stolle presented on the MwRSF project exploring virtual barriers, explaining how the project was different from things MwRSF has done in the past. “Instead of the traditional work of Midwest Roadside Safety Facility to protect vehicles through the design of barrier features or safer roadsides, we try to keep the vehicles in the lane entirely” by creating a system in which the vehicle itself would recognize the lane barriers (virtually) and stay within them. This research has the opportunity to be used worldwide, as Dr. Stolle explained there was already interest garnered from Canadian provinces.

In Dr. ElGawady’s presentation, “Repair of Corroded Steel H-Piles Using High Performance Material”, he discussed the 35 thousand bridges in Missouri, 10 thousand of which need some sort of maintenance and 700 of those needing immediate repair. Dr. ElGawady has had contact with firms in California and Australia where researchers are interested in hearing the results of his work. Dr. Rahmatalla is also expecting a broad outreach with his research “Infrastructure Inspection During and After Unexpected Events”, as the findings will be applicable to emergency response teams making plans for readiness, maintenance, repair, and logistics so they can assess whether or not a bridge is safe during or after unexpected events.

The projects included in the workshop are ongoing MATC research projects. Their reports will be published on the MATC website.
Autonomous Vehicle Barrier Research Earns Student SAE Publication

Ricardo Jacome, graduate research assistant at UNL’s Midwest Roadside Safety Facility (MwRSF), recently published an article in the SAE International journal on his research with Dr. Cody Stolle on autonomous vehicle guidance systems.

The article, “Road Curvature Decomposition for Autonomous Guidance”, proposes the Midwest Discrete Curvature (MDC) method in which road data is digitally stored to create these sort of virtual boundaries to guide autonomous vehicles. The method was evaluated by discretizing three road segments, and results indicated potential implementation of new vehicle guidance systems that could be used in tandem with existing systems, while also leaving room for expanding findings through further research.

Ricardo explains it was challenging during research, as he needed to outsource and form partnerships. The new method proposed was the result of incorporating many different ideas gleaned through research. The most challenging part of the project, as Ricardo explained, was coming up with an original idea that is able to keep up with the current demands in vehicle technology. It took a lot of testing ideas, rejecting, and combining them until they found something that worked. Ricardo says “we never knew how/what shape the project would take for a long time.”

Through the challenges, Ricardo enjoyed the mathematical design aspect of the project. It, too, involved combining ideas from a multitude of sources, but Ricardo found this gave him freedom to implement them all together, forming a new method. Previously, this research has earned Ricardo the Dwight D. Eisenhower Fellowship award.

This research has the potential impact of bringing implementation of autonomous vehicles where there was previously none. All autonomous vehicle testing facilities are in warm-weather places such as California and Texas. This method brings the opportunity to expand this research to snow-weathered places such as Nebraska.

Share your News with MATC!

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

Send your information to Madison Schmidt at mschmidt24@unl.edu, and it could appear in the next issue as well as MATC’s website, Facebook, and Twitter.

Facebook: MidAmericaTransportationCenter
Twitter: @MATCNews
Website: matc.unl.edu
Since 2006, MATC has been designated as the US DOT Region VII University Transportation Center. Region VII is composed of Iowa, Kansas, Missouri, and Nebraska. MATC is a consortium of nine universities. The University of Nebraska-Lincoln (UNL) serves as the lead institution, and MATC has its headquarters on the UNL campus.

MATC’s research priority is promoting safety with an emphasis on reducing the number of incidents involving hazardous material transport, mitigating the negative effects of crashes, and improving emergency response to unexpected events.

MATC’s education priority includes increasing the number of students from underrepresented groups in STEM education and transportation-related careers.