

# Program Progress Performance Report for University Transportation Centers



MID-AMERICA  
TRANSPORTATION CENTER

- **Federal Agency and Organization Element to which Report is Submitted**  
United States Department of Transportation, Office of the Assistant Secretary for Research and Technology
- **Federal Grant or Other Identifying Number Assigned by Agency**  
69A3551747107
- **Project Title**  
University Transportation Centers Open Competition 2016
- **Program Director (PD) Name, Title, and Contact Information**  
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- **Submission Date**  
October 30, 2018
- **DUNS and EIN Numbers**  
DUNS: 55-545-6995  
EIN: 47-0049123
- **Recipient Organization**  
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- **Recipient Identifying Number or Account Number**  
25-1121-0005-001
- **Project/Grant Period**  
December 5, 2016 – September 30, 2022
- **Reporting Period End Date**  
September 30, 2018
- **Report Term or Frequency (annual, semi-annual, quarterly, other)**  
Semi-annual
- **Signature of Submitting Official (signature shall be submitted in accordance with agency- specific instructions)**

L.R. Rilett, Director, Mid-America Transportation Center

## 1. ACCOMPLISHMENTS

### ***What are the major goals of the program?***

The major goals of the Mid-America Transportation Center (MATC), which were outlined in the MATC proposal, are indicated in the table below. Several activities related to research, education, and USDOT requirements are well underway. Several technology transfer activities are currently in the development phase. Please refer to the table below for an update on the status of each activity.

Table 1: Status of MATC’s Research, Educational, and Technology Transfer Activities and Reporting Requirements

<b>Research Activities:</b>	<b>Status</b>	<b>Percent Completed</b>
Call for Problem Statements	Complete	100%
Request for Proposals	Complete	100%
Final Proposal Ranking & Selection	Complete	100%
Data Management Plan (DMP) - Overarching Plan for MATC	Complete	100%
Collect DMPs from PIs for Individual Research Projects	Complete	100%
Collect ORCIDs from all MATC Researchers	Complete	100%
Submit Project Descriptions to TRB's RiP Database	Complete	100%
Submit Final Research Reports	On Schedule	0%
Collect & Store Final Data in UNL Data Repository	On Schedule	0%
<b>Educational Activities:</b>		
Grad/Undergrad MATC Course Development & Implementation	Forthcoming	0%
MATC Undergraduate Summer Internship Program	On Schedule	Yr 1 & 2 100%
MATC Scholars Program	On Schedule	Yr 1 & 2 100%
MATC/UTC Outstanding Student of the Year	On Schedule	Yr 1 100%; Yr 2 in progress
MATC Roads, Rails, and Race Cars After-School Program	On Schedule	Yr 1 & 2 100%
MATC/NCIA Sovereign Native Youth STEM Leadership Academy	On Schedule	Yr 1 & 2 100%
MATC Summer Institute	Forthcoming	0%
MATC Research Experience for Undergraduates (REU) Program	On Schedule	Yr 1 100%
MATC Joint Activities with Student Chapters	On Schedule	100%
<b>Technology Transfer Activities:</b>		
Technology Transfer Plan – Overarching Plan for MATC (Approved October 19, 2018)	Complete	100%

Collect Tech Transfer Plans from PIs for Individual Research Projects	Forthcoming in October 2018	0%
Technology Transfer Tech Briefs, Webinars & Presentations on Research Results	On Schedule	Yr 1 & 2 100%
Roadside Safety Short Course (UNL)	Forthcoming	0%
Roadside Safety Workshop (UNL)	Forthcoming	0%
Traffic Safety Classes (KU)	Forthcoming	0%
Structural Condition Assessment Short Course (MS&T)	Forthcoming	0%
LTAP Workshop	Forthcoming	0%
<b>USDOT OST-R Reporting Requirements:</b>		
Federal Financial Reports	On Schedule	Yr 1 & 2 100%
Post Research Project Descriptions on MATC Website	On Schedule	Yr 1 & 2 100%
UTC Program Progress Performance Reports (Semi-annually)	On Schedule	Yr 1 & 2 100%
Annual Performance Indicators Reports	On Schedule	Yr 1 & 2 100%
<b>Additional USDOT OST-R Requirements:</b>		
Establish and Maintain Center Website	Complete	100%
Directory of Key Center Personnel	Complete	100%
Attendance at UTC Grantees' Meetings	On Schedule	Yr 1 & 2 100%

***What was accomplished under these goals?***

**Research Activities:**

Several research activities were accomplished during this reporting period. MATC Principal Investigators submitted proposals for year 2 projects. External reviews have been collected or are in the process of being collected from USDOT and State DOT personnel and experts from the public and private sector. Once the external reviews are complete, the MATC Executive Committee reviews the proposal materials and external evaluations to determine if a project is approved. Four year 2 projects have already received approval. The remaining proposals will be reviewed before the end of the year.

Throughout the reporting period, Principal Investigators submitted quarterly reports detailing the progress, activities, and outcomes of their individual research projects. MATC staff maintained project records on the Transportation Research Board’s Research in Progress (RiP) database and on MATC’s online database at: [http://matc.unl.edu/research/research\\_search.php](http://matc.unl.edu/research/research_search.php). Links to the RiP database and MATC’s website for all of the center’s current research projects are provided in the table below.

Table 2: MATC Website and RiP Links to Research Project Descriptions

University	Project Title	Principal Investigator	Link to MATC Website	RiP Access
Missouri University of Science and Technology	Behavior and Repair of Corroded Steel H-piles – Phase I (Axial Behavior)	Mohamed El Gawady	<a href="http://matc.unl.edu/research/research_project.php?researchID=528">http://matc.unl.edu/research/research_project.php?researchID=528</a>	<a href="https://rip.trb.org/View/1503933">https://rip.trb.org/View/1503933</a>
Missouri University of Science and Technology	Multi-criteria Hazmat Routing on Rail with Railroad-Highway Crossing Considerations	Dincer Konur	<a href="http://matc.unl.edu/research/research_project.php?researchID=529">http://matc.unl.edu/research/research_project.php?researchID=529</a>	<a href="https://rip.trb.org/View/1502165">https://rip.trb.org/View/1502165</a>
Missouri University of Science and Technology	A Smart Assistance System for Increasing the Safety of Transportation Workers	Ruwen Qin	<a href="http://matc.unl.edu/research/research_project.php?researchID=526">http://matc.unl.edu/research/research_project.php?researchID=526</a>	<a href="https://rip.trb.org/View/1501857">https://rip.trb.org/View/1501857</a>
Missouri University of Science and Technology	Rapid Repair of Earthquake-Damaged Reinforced Concrete Bridges	Lesley Sneed	<a href="http://matc.unl.edu/research/research_project.php?researchID=530">http://matc.unl.edu/research/research_project.php?researchID=530</a>	<a href="https://rip.trb.org/View/1508431">https://rip.trb.org/View/1508431</a>
Missouri University of Science and Technology	Automated Image Interpretation of Hazardous Material Transport Incidents	Zhaozheng Yin	<a href="http://matc.unl.edu/research/research_project.php?researchID=527">http://matc.unl.edu/research/research_project.php?researchID=527</a>	<a href="https://rip.trb.org/View/1502086">https://rip.trb.org/View/1502086</a>
Missouri University of Science and Technology	Sensor-assisted Condition Evaluation of Steel and Prestressed Concrete Girder Bridges Subjected to Fire	Genda Chen	<a href="http://matc.unl.edu/research/research_project.php?researchID=531">http://matc.unl.edu/research/research_project.php?researchID=531</a>	<a href="https://rip.trb.org/View/1501845">https://rip.trb.org/View/1501845</a>
Missouri University of Science and Technology	SMART Shear Keys for Multi-Hazards Mitigation of Diaphragm-Free Girder Bridges	Genda Chen	<a href="http://matc.unl.edu/research/research_project.php?researchID=532">http://matc.unl.edu/research/research_project.php?researchID=532</a>	<a href="https://rip.trb.org/View/1501809">https://rip.trb.org/View/1501809</a>
University of Kansas	Development of an Automated Bridge Inspection Methodology using Digital Image Correlation	William Collins	<a href="http://matc.unl.edu/research/research_project.php?researchID=521">http://matc.unl.edu/research/research_project.php?researchID=521</a>	<a href="https://rip.trb.org/View/1504815">https://rip.trb.org/View/1504815</a>

University of Kansas	Impact of Electric Bikes on Rider Safety on Campus	Christopher Depcik	<a href="http://matc.unl.edu/research/research_project.php?researchID=523">http://matc.unl.edu/research/research_project.php?researchID=523</a>	<a href="https://rip.trb.org/View/1501813">https://rip.trb.org/View/1501813</a>
University of Kansas	Modeling Driver Behavior and Driver Aggressiveness Using Biobehavioral Methods	Alexandra Kondyli	<a href="http://matc.unl.edu/research/research_project.php?researchID=524">http://matc.unl.edu/research/research_project.php?researchID=524</a>	<a href="https://rip.trb.org/View/1501846">https://rip.trb.org/View/1501846</a>
University of Kansas Medical Center	Assessing and Improving the Cognitive and Visual Driving Fitness of Older Long Haul Truck Drivers	Shelley Bhattacharya	<a href="http://matc.unl.edu/research/research_project.php?researchID=525">http://matc.unl.edu/research/research_project.php?researchID=525</a>	<a href="https://rip.trb.org/View/1502454">https://rip.trb.org/View/1502454</a>
University of Iowa	Development of New Design Guidelines for Protection Against Erosion at Bridge Abutments and Embankments	George Constantinescu	<a href="http://matc.unl.edu/research/research_project.php?researchID=534">http://matc.unl.edu/research/research_project.php?researchID=534</a>	<a href="https://rip.trb.org/View/1501768">https://rip.trb.org/View/1501768</a>
University of Iowa	Infrastructure Inspection During and After Unexpected Events	Salam Rahmatalla	<a href="http://matc.unl.edu/research/research_project.php?researchID=533">http://matc.unl.edu/research/research_project.php?researchID=533</a>	<a href="https://rip.trb.org/View/1502360">https://rip.trb.org/View/1502360</a>
University of Iowa	Transportation Planning with Floods	Ann Melissa Campbell	<a href="http://matc.unl.edu/research/research_project.php?researchID=535">http://matc.unl.edu/research/research_project.php?researchID=535</a>	<a href="https://rip.trb.org/View/1503958">https://rip.trb.org/View/1503958</a>
University of Iowa	Reducing Flammability for Bakken Crude Oil for Train Transport	Albert Ratner	<a href="http://matc.unl.edu/research/research_project.php?researchID=537">http://matc.unl.edu/research/research_project.php?researchID=537</a>	<a href="https://rip.trb.org/View/1503831">https://rip.trb.org/View/1503831</a>
University of Iowa	Real-time Flood Forecasting for River Crossings	Witold Krajewski	<a href="http://matc.unl.edu/research/research_project.php?researchID=536">http://matc.unl.edu/research/research_project.php?researchID=536</a>	<a href="https://rip.trb.org/View/1505631">https://rip.trb.org/View/1505631</a>
University of Nebraska Omaha & University of Nebraska Medical Center	Real-Time Emergency Communication System for HazMat Incidents (REaCH)	Ann Fruhling	<a href="http://matc.unl.edu/research/research_project.php?researchID=538">http://matc.unl.edu/research/research_project.php?researchID=538</a>	<a href="https://rip.trb.org/View/1503413">https://rip.trb.org/View/1503413</a>

University of Nebraska-Lincoln	Virtual Barriers for Mitigating and Preventing Run-off Road Crashes	Cody Stolle	<a href="http://matc.unl.edu/research/research_project.php?researchID=546">http://matc.unl.edu/research/research_project.php?researchID=546</a>	<a href="https://rip.trb.org/View/1522941">https://rip.trb.org/View/1522941</a>
University of Nebraska-Lincoln	Investigation of a MASH Test Level 6, Cost-Effective, Barrier System for Containing Heavy Tractor Tank-Trailer Vehicles and Mitigating Catastrophic Crash Event	Ronald Faller	<a href="http://matc.unl.edu/research/research_project.php?researchID=545">http://matc.unl.edu/research/research_project.php?researchID=545</a>	<a href="https://rip.trb.org/View/1515475">https://rip.trb.org/View/1515475</a>
University of Nebraska-Lincoln	Protecting Critical Infrastructure Against Impact from Commercial Vehicles	Daniel Linzell	<a href="http://matc.unl.edu/research/research_project.php?researchID=547">http://matc.unl.edu/research/research_project.php?researchID=547</a>	<a href="https://rip.trb.org/View/1524134">https://rip.trb.org/View/1524134</a>
University of Nebraska-Lincoln	Evaluation of Concrete Models in LS-DYNA to Develop a MASH Test Level (TL-6) Barrier System	Yong-Rak Kim	<a href="http://matc.unl.edu/research/research_project.php?researchID=548">http://matc.unl.edu/research/research_project.php?researchID=548</a>	<a href="https://rip.trb.org/View/1562291">https://rip.trb.org/View/1562291</a>

**Education and Outreach Activities:**

MATC has implemented several educational outreach programs in support of USDOT’s Strategic Plan and the center’s mission to increase the number of students from underrepresented groups in STEM education and transportation-related careers. Descriptions of each educational program and the activities that took place during April 1, 2018 – September 30, 2018 are detailed below.

**MATC After-School Program - Road, Rails, and Race Cars (RRRC)**

MATC’s after-school program combines the talents of 4<sup>th</sup> – 12<sup>th</sup> grade teachers, engineering graduate and undergraduate college and university student mentors, and professional and industry partners to educate the diverse leaders of tomorrow about STEM principles. Each participating school offers the club for an hour every week. Mentors present on an engineering or transportation-related topic and lead students in an interactive activity that encompasses the concepts of the lesson. Examples of activities include constructing bridges and conducting strength tests, creating towers that can withstand simulated earthquakes, and building race cars powered by potential energy stored in a rubber band.

During the reporting period, RRRC was implemented at a total of 11 locations in 3 cities across Nebraska. The spring, summer, and fall programming were attended by 273 students.

**Spring 2018 Programming**

The spring semester portion of the 2017-2018 academic year of RRRC was implemented at nine (9) sites from January to May, 2018: Culler Middle School, Dawes Middle School, Goodrich Middle School, Lefler

Middle School, Mickle Middle School, Park Middle School, and Maxey Elementary School. All of these sites are located in Lincoln, NE. Additionally, RRRC was implemented at two sites outside of Lincoln: Umo<sup>N</sup>ho<sup>N</sup> Nation Public School in Macy, NE, and Winnebago Public School, in Winnebago, NE. In the period from April 1, 2018 to May 22, 2018 there were a total of thirty-four (34) implementation dates with total attendance being 286 by 92 unique students.

For the spring semester, RRRC at **Umo<sup>N</sup>ho<sup>N</sup> Nation Public School** was offered on Wednesdays from 3:45 p.m. to 4:45 p.m., beginning on March 22, 2018, and ending on May 23, 2018. A total of seven (7) implementation dates were completed between April 1 and May 23, with the total attendance being 56 by 15 students. The typical weekly participation was approximately 8 students. The curriculum included activities under the topics of designing for disasters and structural engineering.

For the spring semester, RRRC at **Winnebago Public School** was offered on Wednesdays from 3:00 p.m. to 3:30 p.m., beginning on March 22, 2018, and ending on May 23, 2018. A total of seven (7) implementation dates were completed between April 1 and May 23, with the total attendance being 28 by 12 students. The typical weekly participation was approximately 4 students. The curriculum included activities under the topics of designing for disasters and structural engineering.

For the spring semester, RRRC at **Culler Middle School** was offered on Wednesdays from 3:10 p.m. to 4:00 p.m., beginning on January 24, 2018, and ending on April 25, 2018. A total of four (4) implementation dates were completed between April 1 and April 25, with the total attendance being 19 by 6 students. The typical weekly participation was approximately five (5) students. The curriculum included activities under the topics of designing for disasters, aeronautical engineering, structural engineering, civil engineering, and physics.

For the spring semester, RRRC at **Dawes Middle School** was offered on Tuesdays from 3:30 p.m. to 4:30 p.m., beginning on January 23, 2018, and ending on April 24, 2018. A total of four (4) implementation dates were completed between April 1 and April 24, with the total attendance being 42 by 11 students. The typical weekly participation was approximately 8 students. The curriculum included activities under the topics of designing for disasters, aeronautical engineering, structural engineering, civil engineering, and physics.

For the spring semester, RRRC at **Goodrich Middle School** was offered on Thursdays from 3:10 p.m. to 4:10 p.m., beginning on January 18, 2018, and ending on April 26, 2018. A total of four (4) implementation dates were completed between April 1 and April 26, with the total attendance being 36 by 10 students. The typical weekly participation was approximately 9 students. The curriculum included activities under the topics of designing for disasters, aeronautical engineering, structural engineering, civil engineering, and physics.

For the spring semester, RRRC at **Lefler Middle School** was offered on Mondays from 3:10 p.m. to 4:00 p.m., beginning on January 29, 2018, and ending on April 23, 2018. A total of three (3) implementation dates were completed between April 1 and April 23, with the total attendance being 24 by 8 students. The typical weekly participation was approximately 6 students. The curriculum included activities under the topics of designing for disasters, aeronautical engineering, structural engineering, civil engineering, and physics.

For the spring semester, RRRC at **Mickle** Middle School was offered on Wednesdays from 3:10 p.m. to 4:00 p.m., beginning on January 17, 2018, and ending on April 25, 2018. A total of three (3) implementation dates were completed between April 1 and April 25, with the total attendance being 21 by 8 students. The typical weekly participation was approximately 7 students. The curriculum included activities under the topics of designing for disasters, aeronautical engineering, structural engineering, civil engineering, and physics.

For the spring semester, RRRC at **Park** Middle School was offered on Fridays from 3:10 p.m. to 4:00 p.m., beginning on January 19, 2018, and ending on April 27, 2018. A total of four (4) implementation dates were completed between April 1 and April 27, with the total attendance being 44 by 14 students. The typical weekly participation was approximately 11 students. The curriculum included activities under the topics of designing for disasters, aeronautical engineering, structural engineering, civil engineering, and physics.

For the spring semester, RRRC at **Maxey Elementary** School was offered on Mondays from 3:45 p.m. to 4:30 p.m., beginning on 26 February, 2018, and ending on April 16, 2018. A total of two (2) implementation dates were completed between April 1 and April 16, with the total attendance being 16 by 8 students. The typical weekly participation was approximately 8 students. The curriculum included activities under the topics of transportation systems, mechanical engineering, aeronautical engineering, and magnets and physics.

Additional RRRC tasks completed during the 2017-2018 academic year included club promotion and recruitment at Culler Middle School, Dawes Middle School, and Park Middle School, developing a curriculum schedules for both semesters, daily meetings with mentors to develop strategies and track progress of the lessons and activities, and communication with mentors, teachers, CLC staff, and MATC staff. RRRC expanded its implementation to Umo<sup>N</sup>ho<sup>N</sup> Nation Public School and Winnebago Public School during this period. Recruitment efforts were made in each school to promote the program. A partnership with Nebraska Indian Community College (NICC) was made during the Spring 2018 semester to train an NICC intern to assist the program.

#### Summer 2018 Programming

The summer semester portion of the 2017-18 academic year of RRRC was implemented at four (4) sites from June to July, 2018: Umo<sup>N</sup>ho<sup>N</sup> Nation Public School, Ponca Tribe of Nebraska, Culler Middle School, and at the Young Women's Christian Association (YWCA) Eurkea! program. Umo<sup>N</sup>ho<sup>N</sup> Nation Public School is located in Macy, Nebraska, and the remaining sites are located in Lincoln, NE. A total of seventeen (17) implementation dates were offered during this period with total attendance being 494 by 128 unique students.

For **Umo<sup>N</sup>ho<sup>N</sup> Nation's** summer program, RRRC was offered on Thursdays from 10:00 a.m. to 12:00 p.m., beginning June 7, 2018 and ending on June 21, 2018. A total of three (3) implementation dates were completed during the summer iteration, with the total attendance being 27 by 17 students. Weekly participation was approximately 9 students. The curriculum included activities under the topics of structural engineering, circuits, and motion.

For **Ponca Tribe of Nebraska's** summer program, RRRC was offered on Wednesday from 10:00 a.m. to 11:00 p.m., beginning June 6, 2018 and ending on June 28, 2018. A total of three (3) implementation



dates were completed during the summer iteration, with the total attendance being 15 by 5 unique students. Weekly participation was approximately 5 students. The curriculum included activities under the topics of structural engineering, circuits, and motion.

For **Eureka!**'s summer program for young girls, RRRC was offered Monday – Thursday from 10:30 a.m. to 12:00 p.m. beginning July 16, 2018 and ending July 26, 2018. A total of eight (8) implementation dates were completed, with the total attendance being by 182 by 26 unique students. Daily participation was approximately 24 students. The curriculum included activities under the topics of designing for disasters, aeronautical engineering, structural engineering, civil engineering, and physics.

For **Culler**'s summer program, RRRC was offered on Fridays from 12:00 p.m. to 3:00 p.m., beginning June 8, 2018 and ending on June 22, 2018. A total of three (3) implementation dates were completed during the summer iteration, with the total attendance being 270 by 90 students. Weekly participation was approximately 90 students. The curriculum included activities under the topics of structural engineering, circuits, and motion.

### Fall 2018 Programming

The fall semester portion of the 2018-2019 academic year of RRRC is currently implemented at nine (9) sites from September to December 2018: Culler Middle School, Dawes Middle School, Goodrich Middle School, Lefler Middle School, Mickle Middle School, and Park Middle School. All of these sites are located in Lincoln, NE. Additionally, MATC is preparing for the start of the fall semester at Umo<sup>N</sup>ho<sup>N</sup> Nation Public School and Winnebago Public School on October 2, 2018, and at Maxey Elementary School on October 22, 2018. Fall RRRC details are provided below for sites that were implemented before the reporting end date of September 30, 2018 (9/30).

For the fall semester, RRRC at **Culler** Middle School is offered on Wednesdays from 3:10 p.m. to 4:00 p.m., beginning on September 5, 2018 and ending on December 5, 2018. A total of four (4) implementation dates were completed before 9/30, with the total attendance being 48 by 14 students. The typical weekly participation was approximately 13 students. The curriculum included activities under the topics of transportation systems, civil engineering, structural engineering, mechanical engineering, railway safety, city planning, physics, and material science.

For the fall semester, RRRC at **Dawes** Middle School is offered on Tuesdays from 3:30 p.m. to 4:30 p.m., beginning on September 4, 2018 and ending on December 4, 2018. A total of four (4) implementation dates were completed before 9/30, with the total attendance being 28 by 7 students. The typical weekly participation was approximately 7 students. The curriculum included activities under the topics of transportation systems, civil engineering, structural engineering, mechanical engineering, railway safety, city planning, physics, and material science.

For the fall semester, RRRC at **Goodrich** Middle School is offered on Thursdays from 3:10 p.m. to 4:10 p.m., beginning on September 6, 2018, and ending on December 6, 2018. A total of four (4) implementation dates were completed before 9/30, with the total attendance being 28 by 7 students. The typical weekly participation was approximately 6 students. The curriculum included activities under the topics of transportation systems, civil engineering, structural engineering, mechanical engineering, railway safety, city planning, physics, and material science.

For the fall semester, RRRC at **Lefler** Middle School is offered on Mondays from 3:10 p.m. to 4:00 p.m., beginning on September 10, 2018, and ending on December 3, 2018. A total of four (4) implementation dates were completed before 9/30, with the total attendance being 24 by 6 students. The typical weekly participation was approximately 5 students. The curriculum included activities under the topics of transportation systems, civil engineering, structural engineering, mechanical engineering, railway safety, city planning, physics, and material science.

For the fall semester, RRRC at **Mickle** Middle School is offered on Wednesdays from 3:10 p.m. to 4:00 p.m., beginning on September 6, 2018, and ending on December 6, 2018. A total of four (4) implementation dates were completed before 9/30, with the total attendance being 28 by 7 students. The typical weekly participation was approximately 6 students. The curriculum included activities under the topics of transportation systems, civil engineering, structural engineering, mechanical engineering, railway safety, city planning, physics, and material science.

For the fall semester, RRRC at **Park** Middle School is offered on Fridays from 3:10 p.m. to 4:15 p.m., beginning on September 7, 2018, and ending on December 7, 2018. A total of four (4) implementation dates were completed before 9/30, with the total attendance being 48 by 12 students. The typical weekly participation was approximately 11 students. The curriculum included activities under the topics of transportation systems, civil engineering, structural engineering, mechanical engineering, railway safety, city planning, physics, and material science.

For the 2017-2018 academic year, RRRC employed: one (1) Education and Outreach Coordinator, eleven (11) on-site teachers, and fourteen (14) undergraduate engineering student mentors. On weekly average, each school had one (1) teacher and two (3) undergraduate engineering student mentors.

### **MATC Scholars Program**

The MATC Scholars Program is a three-day conference designed to promote graduate study among underrepresented groups and women in STEM fields, which is accomplished through targeted seminars, workshops, and networking opportunities. The sixth MATC Scholars Program took place October 10-12, 2018 and focused on encouraging and assisting Native American undergraduates with transitioning from 2-year tribal and community colleges to 4-year degree granting universities. The curriculum was developed by Native American faculty and MATC staff. The program was attended by 15 students from Nebraska Indian Community College and 23 leaders from University of Nebraska-Lincoln, Nebraska Commission on Indian Affairs, University of Montana, University of South Dakota, Indianz.com, and Vision Maker Media. More information about the 2018 Scholars Program can be found at: <http://matc.unl.edu/education/scholars-program2018.php>.

### **MATC Intern Program**

The MATC Intern Program partners with private companies, local government, and academia to provide undergraduate students with paid summer internship opportunities in the transportation and engineering fields. During this 12-week program, students gain hands-on experience in their area of interest under the mentorship of a professional from organizations such as the Nebraska Department of Transportation, Iteris, Inc., Olsson Associates, City of Lincoln Public Works and Utilities Department, City of Omaha, and Felsburg Holt & Ullevig. Students work 40 hrs/wk while experiencing the day-to-day tasks

and responsibilities of their desired career. The program culminates in a written paper and presentation detailing the student's internship experience.

The 2018 MATC Intern Program took place May 11-August 10. Sponsors from 8 organizations in the private and public sector employed 16 undergraduate students, 44% of which were from the transportation industry's underrepresented groups. The number of participating students more than doubled from the previous year. For three students, the 2018 Intern Program marked their second year participating in a MATC educational outreach program. One student previously participated in the 2017 Intern Program, another served as a mentor for RRRC and the STEM Leadership Academy and as a panelist for the 2018 Scholars Program, and the third student traveled from the University of Maryland Eastern-Shore for an internship at UNL after hearing about the program during his participation in the 2017 MATC Scholars Program. After completing the 2018 MATC Intern Program, four interns were offered extended positions by their employers. Reports and presentation slides from the 2018 interns can be viewed on the MATC website at: [http://matc.unl.edu/internship/internship\\_success.php](http://matc.unl.edu/internship/internship_success.php).

On August 3, MATC took the 2018 interns on a technical field trip to the Union Pacific Harriman Dispatching Center, Schemmer Associates, Inc., Metropolitan Area Planning Agency, and City of Omaha Public Works Department. Students had the opportunity to tour facilities and hear about current projects at these locations, exposing them to additional career opportunities.

Beginning March 2019, MATC will contact potential sponsors and accept intern applications for the upcoming MATC Intern Program.

### **NCIA/MATC Sovereign Native Youth STEM Leadership Academy**

The Sovereign Native Youth STEM Leadership Academy is a six-day summer camp that provides Native American high school students with the leadership skills to positively impact their tribal communities and shape their futures. The academy, held on the University of Nebraska-Lincoln campus, offers a broad range of interactive, hands-on activities that expose students to science, technology, engineering, and math (STEM) and transportation-related opportunities after high school. The curriculum is developed and implemented by Native American faculty, community leaders, students, and MATC staff.

The 2018 program took place on June 24-29 and was attended by 18 students and 3 teachers from reservation schools across Nebraska. The attendees were joined by 3 mentors and 19 distinguished speakers and panelists. Activity highlights include building a boat large enough to hold over 1,800 lbs. and touring helicopters with Senator Tom Brewer, the first Senator of Native American descent to serve in Nebraska's Unicameral. Additional information about the 2018 can be found on the MATC website at: [https://matc.unl.edu/education/SNY-Leadership/2018\\_Program.php](https://matc.unl.edu/education/SNY-Leadership/2018_Program.php).

### ***How have the results been disseminated?***

All MATC activities are in the planning or implementation phases. News of MATC's activities have primarily been shared on our social media and website. A MATC Newsletter and Annual Report are currently being developed to share more in-depth news of MATC's research projects, educational outreach programs, and technology transfer activities. For MATC research projects that ended during the reporting period, final reports were collected and posted on MATC's website and sent to the libraries required by the *Grant Deliverables and Reporting Requirements for 2016 and 2018 for University Transportation Centers*.

On October 11, 2018, the first event in MATC's Fall 2018 webinar series took place. Mr. Lonnie Burklund, Transportation Engineer, presented on the City of Lincoln's current traffic projects and plans for preparing streets for autonomous vehicles. The event was attended in-person or viewed via livestream by 24 students, faculty, and members of the wider community.

MATC is currently planning future webinars to feature the center's Principal Investigators. Partner Institutions and interested community members will be able to participate live via Zoom with audio and video feed and ask the speakers' questions via chat. All of the presentations will be posted online via SlideShare. The speakers will be recorded and shared on MATC's YouTube channel.

***What do you plan to do during the next reporting period to accomplish the goals?***

Implementation of the activities outlined in Table 1 for all research, education, technology transfer, and USDOT requirements will continue toward completion on-schedule. MATC anticipates that the Technology Transfer Plan, which was approved by USDOT on October 19, 2018, will be fully operational during the next reporting period.

## 2. PRODUCTS

***Publications, conference papers, and presentations:***

Journal Publications:

1. Blankenau, I. D., Zolotor, M., Choate, A., Jorns, A., Homann, Q., & Depcik, C. (2018). Development of a Low-Cost LIDAR System for Bicycles. *Society of Automotive Engineers – World Congress Experience*, doi: 10.4271/2018-01-1051. Accepted. Yes, acknowledgement of Federal Support.
2. Xing, X., Gurjap, S., Bhama, J. K., & Ratner, A. Wireless Power Transfer Systems Based on LCC-Compensated Topology for Left Ventricular Assist Device (LVAD) Battery Charging Application. *IEEE Transactions on Power Electronics*. Accepted. Yes, acknowledgement of Federal Support.

Presentations:

1. Sahu, V. & Fruhling, A. Improving Decision-Making for Incident Commanders by Analyzing Visualizations for First Responder's Vital Information, Technology Research, Education, and Opinion (TREO) Talk. Americas Conference for Information Systems, New Orleans, LA, August 2018.
2. Venkatesan, C., Medcalf, S., & Fruhling, A. Assessing Wearable Technology's Role to Reduce HAZMAT Health Risks, Technology Research, Education, and Opinion (TREO) Talk. Americas Conference for Information Systems, New Orleans, LA, August 2018.
3. Godse, P., Xue, J., Long, S.K., & Qin, R. Data Analysis for Identifying High Chance Scenarios of Hazardous Material Highway Transportation Incidents. International Conference of American Society for Engineering Management (ASEM), Coeur d' Alene, Idaho, October 17-20, 2018.

4. Godse, P., Al-Amin. M., Xue. J., Long. S.K., & Qin, R. (2018). An Analysis of Human Involved Incident Data for Enhancing the Safety of Hazardous Material Transportation. Institute for Industrial and Systems Engineering (IISE) Annual Conference, Orlando, Florida, May 19-22, 2018.
5. Yuan, X. & Chen, G. An Adaptive SMART Shear Key and its Mechanical Properties for Earthquake/Tsunami Mitigation. 7th World Conference on Structural Control and Monitoring, 7WCSCM, Qingdao, China, July 22-25, 2018.
6. Choate, M. & Depcik, C. Development of Low-Cost LIDAR System for Bicycles. Society of Automotive Engineers World Congress Experience, Detroit, Michigan, April 11, 2018.
7. Sneed. L. H. Repair of Earthquake-Damaged Reinforced Concrete Bridges – Challenges and Solutions. Politecnico di Milano, Milan, Italy, July 10, 2018.
8. Sneed. L. H. Repair of Earthquake-Damaged Reinforced Concrete Bridges – Challenges and Solutions. University of Bologna, Bologna, Italy, July 3, 2018.
9. Singh, G., Pitts, S., Lopes, E. & Ratner A. Settling Characteristics of Polymeric Additives in Dodecane. ASME International Mechanical Engineering Congress and Exposition, Track: Fluids Engineering, Pittsburgh, PA., November 11-15, 2018.
10. Pitts, S., Singh, G., Esmailpour, M., & Ratner, A. 37<sup>th</sup> International Symposium on Combustion, Dublin, Ireland, July 29-August 3, 2018.

**Website(s) or other Internet site(s):**

Currently, MATC maintains 5 online sites that distribute information utilizing the internet. Links to each site, as well as report period information, can be found below:

**MATC Website**

By clicking the following link, <http://matc.unl.edu>, you will be directed to MATC’s website. Below is highlighted information from Google Analytics about the website’s traffic from April 1, 2018 through September 30, 2018. By understanding and capitalizing this knowledge, we are able to make our homepage engaging, relevant, and resourceful to our viewers. Since our last progress report, the average duration of users’ visits climbed from 22 seconds to 1 minute and 3 seconds.

Visits: 30,160	Page views: 66,274	Pages per visit: 2.07	Average visit duration: 00:22
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**SlideShare**

The top 5 countries that viewed our Slideshare presentations during the reporting period are: the United States, Germany, India, South Korea, and Canada. Below is a snapshot of MATC’s SlideShare activity and the link to view the page. <https://www.slideshare.net/matcRegion7UTC/presentations/>.

Total Views: 1,325	New Uploads: 16	Downloads: 30	Favorites: 0
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### **Facebook**

The MATC Facebook page has experienced an increase of 313 total page likes since the last reporting period. Metrics for the MATC Facebook page can be viewed below, and the page can be accessed by clicking on the following link.

<https://www.facebook.com/pages/Mid-America-Transportation-Center-MATC/141238439284182>

Views: 1,205	Total Page Likes: 360	Reach: 3,124	Total Countries (of Followers): 32	Total Languages (of Followers): 14
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### **Twitter**

MATC's Twitter handle is @MATCNews. The page can be viewed by clicking the following link: <https://twitter.com/MATCNews>. The highlighted numbers for MATC's Twitter activity can be seen below.

New Followers: 11	Tweet Impressions: 17,260	Profile Visits: 1,145	Tweets: 40
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### **YouTube**

MATC's YouTube feed can be viewed by clicking the following link: [http://www.youtube.com/user/midamericatrans?feature=results\\_main](http://www.youtube.com/user/midamericatrans?feature=results_main).

New Videos: 0	Views: 2,784	Minutes Watched: 3,873
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### ***Technologies or techniques:***

Nothing to report.

### ***Inventions, patent applications, and/or licenses:***

Nothing to report.

### ***Other products:***

Nothing to report.

## **3. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS**

### ***What other organizations have been involved as partners?***

During the reporting period, the Mid-America Transportation Center worked with 50 unique organizations to develop the research, education, and technology transfer activities that are currently underway at the center. Each organization and its location are listed in the table below, along with information describing the specific area or capacity in which the respective organization is committed to supporting the center. For more detailed information on how each organization is working with the center, or to contact affiliated professionals at any of the organizations, please email the MATC Research Coordinator, Amber Hadenfeldt, at [ntc-ahaden@unl.edu](mailto:ntc-ahaden@unl.edu).

Table 3: MATC Partners and Type of Collaboration

MATC Program Affiliation	Organization Name	City	State	Financial Support	In-Kind Support	Contribution Facilities	Collaborative Research	Personnel Exchanges
Intern Program	City of Lincoln Public Works	Lincoln	NE			X		X
Intern Program	City of Omaha Public Works	Omaha	NE			X		X
Intern Program	Metropolitan Area Planning Agency	Omaha	NE			X		X
Intern Program	Schemmer Associates, Inc.	Omaha	NE			X		X
Intern Program	Nebraska Department of Transportation	Lincoln	NE			X		X
Intern Program	Alfred Benesch & Company	Lincoln	NE			X		X
After-School Program	Culler Middle School	Lincoln	NE		X	X		
After-School Program	Lefler Middle School	Lincoln	NE		X	X		
After-School Program	Mickle Middle School	Lincoln	NE		X	X		
After-School Program	Goodrich Middle School	Lincoln	NE		X	X		
After-School Program	Dawes Middle School	Lincoln	NE		X	X		
After-School Program	Park Middle School	Lincoln	NE		X	X		
After-School Program	Maxey Elementary School	Lincoln	NE		X	X		
After-School Program; Summer Academy	Umó <sup>o</sup> ho <sup>n</sup> Nation Public School	Macy	NE	X	X	X		X
After-School Program;	Winnebago Public School	Winnebago	NE		X	X		X

Summer Academy								
Summer Academy	Santee Community School	Santee	NE					X
After-School Program	State Farm	Bloomington	IL	X				
Scholars Program; Summer Academy; After-School Program	Nebraska Indian Community College	Macy	NE					X
Scholars Program	University of Montana	Missoula	MT					X
Scholars Program	Indians.com	Lincoln	NE					X
Scholars Program	University of South Dakota	Vermillion	SD					X
Scholars Program	Vision Maker Media	Lincoln	NE					X
All Programs	University of Nebraska-Lincoln	Lincoln	NE	X	X	X	X	X
Scholars Program; Summer Academy	Nebraska Commission on Indian Affairs	Lincoln	NE		X		X	
All Outreach Programs	Union Pacific	Omaha	NE	X		X		
Summer Academy	University of Nebraska Medical Center	Omaha	NE	X		X		
Summer Academy; Scholars Program	Nebraska State Legislature	Lincoln	NE	X		X		X
Summer Academy	Great Plains Art Museum	Lincoln	NE	X		X		X
Summer Academy	Claire Hubbard Foundation	Omaha	NE	X				
Summer Academy	Union College	Lincoln	NE			X		X
Summer Academy	Legal Aid of Nebraska	Lincoln	NE					X



Summer Academy	Nebraska Dept. of Health and Human Services	Lincoln	NE					X
Summer Academy	Duncan Aviation	Lincoln	NE			X		X
Summer Academy	National Park Service	Omaha	NE			X		X
Summer Academy	Baylor Evnen, LLP	Lincoln	NE					X
Summer Academy	Encompass Architects	Lincoln	NE					X
MATC Research	Iowa Flood Center	Iowa City	IA				X	
MATC Research	IIHR Hydroscience & Engineering, University of Iowa	Iowa City	IA		X			
MATC Research	University of Florida	Gainesville	FL		X	X	X	X
MATC Research	LBT, Inc.	Omaha	NE		X	X		
MATC Research	LGT Transport	Omaha	NE				X	
MATC Research	Werner Trucking	Omaha	NE				X	
MATC Research	Trailer Washer	Plattsmouth	NE				X	
MATC Research	SAPP Brothers	Omaha	NE				X	
MATC Research	Missouri Department of Transportation	Jefferson City	MO	X		X		
MATC Research	Santa Catarina State University	Itacorubi, Florianópolis	Brazil		X		X	X
All Programs	Nebraska Transportation Center	Lincoln	NE		X	X	X	
After-School Program	Ponca Tribe of Nebraska			X		X		
After-School Program	Lincoln Public School Board	Lincoln	NE	X				
After-School Program	Young Women's Christian Association	Lincoln	NE	X		X		

***Have other collaborators or contacts been involved?***

MATC’s research activities are highly multi-disciplinary, featuring faculty from disciplines including, but not limited to, civil engineering, mechanical engineering, computer science, psychology, and public health. MATC’s Principal Investigators are listed in the Table 2. Co-Principal Investigators are listed in Table 4 below.

Table 4: Co-Principal Investigators of MATC’s Research Projects

Name	Position	University	Department
Suzanna Long	Interim Department Chair & Associate Professor	Missouri University of Science & Technology	Engineering Management & System Engineering
Ibrahim Demir	Assistant Professor	University of Iowa	Civil & Environmental Engineering
Ricardo Mantilla	Assistant Professor	University of Iowa	Civil & Environmental Engineering
Caroline Bennett	Associate Professor	University of Kansas	Civil, Environmental & Architectural Engineering
Christopher Ramey	Assistant Professor	University of Kansas	Psychology
Elaina Sutley	Assistant Professor	University of Kansas	Civil, Environmental & Architectural Engineering
Evangelia Chryssikou	Assistant Professor & Director	University of Kansas	Psychology
Jian Li	Assistant Professor	University of Kansas	Civil, Environmental & Architectural Engineering
Matthew Fadden	Assistant Professor	University of Kansas	Civil, Environmental & Architectural Engineering
Aaron Yoder	Assistant Professor	University of Nebraska Medical Center	Public Health
Chandran Achutan	Associate Professor	University of Nebraska Medical Center	Public Health
Sharon Medcalf	Director & Assistant Professor	University of Nebraska Medical Center	College of Public Health
Jennifer Schmidt	Research Assistant Professor	University of Nebraska-Lincoln	Civil Engineering
Joshua Steelman	Assistant Professor	University of Nebraska-Lincoln	Civil Engineering
Matthew Hale	Assistant Professor	University of Nebraska-Omaha	Information Science and Technology

MATC Principal Investigators have collaborated with the following contacts during the period of April 1, 2018 – September 30, 2018.

1. Professor Chris Cherry, University of Tennessee-Knoxville, Department of Civil and Environmental Engineering, Knoxville, TN.
2. Professor David Noyce, University of Wisconsin-Madison, Department of Civil and Environmental Engineering, Madison, WI.
3. Professor Joseph Kearney, University of Iowa, Department of Computer Science, Iowa City, IA.
4. Dr. Lila Chryssikou, Drexel University, Philadelphia, PA.
5. Missouri Department of Natural Resources, Jefferson City, MO.
6. National Institute of Standards and Technology, Gaithersburg, MD.

#### 4. IMPACT

##### ***What is the impact on the development of the principal discipline(s) of the program?***

Activities conducted during the current reporting period are expected to have an impact upon the transportation engineering discipline in the future. It is anticipated that the results from a number of research projects will be developed into courses for the public that will shape future knowledge of specific transportation-related technologies.

##### ***What is the impact on other disciplines?***

Many of MATC's educational outreach activities offered an interdisciplinary experience in which students, faculty, and staff from various institutions interacted, therefore providing students with professional networking opportunities with leaders from the transportation sector and the community. These activities increased channels of communication between participants in the workforce and individuals from many academic fields while facilitating a more interconnected body of future transportation professionals and creating a highly responsive and skilled next generation within the field.

##### ***What is the impact on the development of transportation workforce development?***

MATC's research and education activities play a vital role in inspiring and preparing students to become future professionals of the transportation workforce. The MATC Scholars Program, STEM Academy, Intern Program, and After-School Program are designed to increase access and retain students from underrepresented groups in STEM and transportation-related degree granting programs and careers. MATC research projects provide graduate students with the opportunity to gain hands-on research experience in the field of transportation.

MATC also provided travel scholarships for 1 undergraduate, 9 graduate students, and 1 postdoctoral research assistant to attend the 2018 American Railway Engineering and Maintenance-of-Way Associate (AREMA) conference in Chicago, IL. Students networked with rail professionals, attended sessions on the

latest research and technology, and competed in the student Quiz Bowl. One of our attending graduate students won first place in the student poster competition. Prior to the conference, the students attended the Union Pacific field day in Oakbrook, IL to visit current project sites and learn about career opportunities with the organization.

On October 3, 2018, MATC met with members of the Nebraska Local Technical Assistance Program to discuss opportunities for collaboration on technology transfer activities and implementing MATC's research results.

***What is the impact on physical, institutional, and information resources at the university or other partner institutions?***

There is currently nothing new to report regarding MATC's impact on physical, institutional, and information resources at the university of other partner institutions.

***What is the impact on technology transfer?***

All MATC research projects are currently in progress. The results will be disseminated via direct implementation, instructional courses, webinars, etc., when the projects are completed. MATC researchers across Region VII are currently cultivating partnerships that will enable successful technology transfer in the future.

During this reporting period, MATC created an overarching Technology Transfer Plan for the center, which was recently approved. MATC will require all Principal Investigators to complete Technology Transfer Plans for their individual research project. MATC is currently developing a template to assist them in this endeavor.

***What is the impact on society beyond science and technology?***

We anticipate that all of the students who participated in the MATC educational outreach programs will significantly benefit from their experiences. The interdisciplinary projects completed during program activities bolstered students' conceptual and practical skills in science, technology, engineering, and mathematics. Students were encouraged to reconfigure their expectations of STEM subjects and perceived barriers and extend their interest beyond classroom experiences. Throughout the educational outreach programs, a diverse group of faculty members and professionals served as guest speakers and mentors to participating students from underrepresented groups by sharing their career paths and achievements in the STEM and transportation fields.

**5. CHANGES/PROBLEMS**

Nothing to report.

**6. SPECIAL REPORTING REQUIREMENTS**

Nothing to report.