



Center for Safety Equity in Transportation

If you have a right to get there, you have a right to get there safely.

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Semi-Annual Progress Report for University Transportation Centers

Submitted to: Office of the Assistant Secretary for Research and Technology
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Project Title: Tier 1 University Transportation Center for Safety Equity in Transportation (CSET)

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Submission Date: October 30, 2021

Grant Number: 69A3551747129

DUNS Number: 615245164

EIN Number: 92-6000147

Recipient Organization: University of Alaska Fairbanks
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Project Grant Period: December 7, 2016 – September 30, 2022

Reporting Period End Date: September 30, 2021

Report Term: Semi-Annual Progress Report

Signature:

Billy Connor
CSET, Director

Abbreviations

- AKDOT&PF – Alaska Department of Transportation and Public Facilities
- ANTHC – Alaska Native Tribal Health Consortium
- AUTC – Alaska University Transportation Center
- CSET – Center for Safety Equity in Transportation
- GIS – Geographic Information System
- ORCID – Open Researcher and Contributor ID
- PI – Principle Investigator
- PPPR – Program Progress Performance Report
- RiP – Research in Progress
- RITI – Rural, Isolated, Tribal, Indigenous
- UAF – University of Alaska Fairbanks
- UHM – University of Hawai'i Manoa
- UI – University of Idaho
- UW – University of Washington

1. Accomplishments

What are the major goals and objectives of the program?

The goal of CSET is to develop context-sensitive transportation solutions that address the safety needs of RITI communities. The Center will develop safety approaches that are sensitive to heritage, traditional ways of knowing and learning, and the preservation of culture. The mission of the Center for Safety Equity in Transportation (CSET) is to provide everyone with fair and equitable access to a safe transportation system.

What was accomplished under these goals?

During the past six months of the project:

- *Email list, website, and social media*

The official CSET email, cset.utc@alaska.edu, has been used to communicate with Executive and Advisory Board members as well as project PIs. A contact list is being maintained for the duration of the project. Center announcements are distributed through emails and social media posts to various audiences and stakeholders. Activities are posted to the website in a timely fashion.

- *Communication*

Zoom is being used for meetings and webinars. The access to Zoom is provided by the University of Alaska Fairbanks at no cost to the Center.

- *E-newsletters*

The Center distributed its thirteenth and fourteenth quarterly newsletters in June 2021 and August 2021. The newsletter is available under the *Publications* section of the website. <http://cset.uaf.edu/publications/>

- *Research projects*

Thirty-five projects were active during this reporting period. Five final reports were submitted to TRID during the reporting period.

- *Training programs*

The project, *Investigation of Cost-Effective Technologies for Quick Response to Traffic-Related Crash in RITI Communities*, developed educational/training materials for both fire departments and high school students about drone related technologies to help them get a drone license and to operate it successfully in the future. These materials will be used for training workshop/courses about drone related knowledge and operation skill. Specifically, researchers, as part of a follow-on project, will be assisting in getting a drone club functioning and self-sustaining at the Ocosta High School in Westport, Washington.

- *Active student internships*

None developed during this period.

- *Teacher training and curriculum development activities*
None developed during this period.

- *Data collection tools developed*
 - The University of Idaho CSET project, *Promoting Positive Traffic Safety Culture in RITI Communities through Active Engagement: Barriers and Opportunities*, developed a survey tool that is being used for in-depth interviews with community leaders. The project used it to conduct several in-depth interviews (via zoom video conference) with community leaders from several tribal communities during the period covered by this report.
 - The University of Washington project, *Developing Pedestrian Safety Data Visualization and Analysis Tool for RITI Communities*, is actively engaged in creating the pedestrian safety tool. The data management and visualization functions have been designed and developed.
 - The UAF project, *Development of a Tabletop Dustfall Column and Test Procedure for Chemical Dust Suppressant Performance Testing*, is in the final stages of testing the mini-column that is the focus of the project. An undergraduate student hired to work on the project in the spring of 2021 with the easing of COVID restriction enabled testing to leap forward and resulted in a redesign of the system so that results are both better and more repeatable. Specifically, the project redesigned the method for lofting soil/dust in the column. The project is working with Envirotek to test the efficacy of calcium chloride and other synthetic fluids used to decrease dust generated from the road surface.

- *Sponsorship*
Nothing to report for this period.

How have the results been disseminated?

CSET staff and researchers have been actively seeking out opportunities to interact with the public, stakeholders and the transportation community. COVID-19 measures have hampered these efforts, resulting in most activities occurring virtually.

Professional Meetings

During this reporting period in-person meetings were canceled or turned into virtual meetings via online tools due to COVID-19. CSET representatives participated in the following professional events:

- The 2021 National Transportation in Indian Country Conference held virtually September 27 to October 1, 2021.
- The 2021 TRB Conference on Advancing Transportation Equity held virtually September 9, 10, 13, and 14, 2021.
- The 21st CRIPE Workshop on River Ice held virtually August 29 to September 1, 2021.

Outreach

Virtual Meeting with Ocosta School (May 25, 2021)

This meeting discussed scope, feasibility and scheduling for possible school programs for students to learn drone technology using current drone techs held by the school, and to coordinate these with drone-flown and other data gathering activities in the South Beach area currently underway by the UW NHERI RAPID Facility for other NSF-funded synergistic research projects.

Virtual Meeting with Westport community stakeholders (June 6, 2021)

A brainstorm meeting for possible partnering with youth support groups beyond Ocosta Schools. The Westport City Public Works Director, Kevin Goodrich, suggested Grays Harbor Youth Works as an option.

Virtual Meeting with Grays Harbor Youth Works (June 16, 2021)

This meeting discussed possible programs and schedules (summer quarter/autumn quarter) for high school students.

Visit to Westport and Ocosta School (May 4, 2021)

This visit was to acquaint a new team member, student research assistant Sarah Lukins, with the site and key stakeholders in the City and School. The visit coincided with drone deployment by the UW NHERI RAPID Facility on the Westport peninsula to gather data for the NSF Coastlines and People EAGER Project "Coastal Hazard Planning in Time" (Award #1940024).

Visit to Ocosta School (May 27, 2021)

This trip was to understand on-site the current drone technology conditions at Ocosta School. It was found that there are four school drones with two main remote controllers and eight student controllers. During the visit, the research team found that there are connecting issues between the drones and the remote controllers and developed a plan to help the School either repair the issues or replace faulty equipment.

Yakima Nation Tribal Traffic Safety Committee (6/30/2021)

The researchers collaborating with the Yakima Nation on transportation safety issues presented an update about the projects to the committee. The presentation was titled "Rural Data Collection, Management and Visualization Solutions." Approximately 50 people were in the meeting.

Virtual Meeting with Grays Harbor Youth works (Aug 16, 2021, Aug 23, 2021)

These two meetings discussed the time schedules, education program, school regulations (e.g., vaccination requirement), possible funding, recruitment and volunteer plans and materials needed (such as flyers) for spreading drone programs to the students. An after-school program was then determined to start on Oct 8th, 2021 from 2:45 to 4:45 pm (every Friday).

Virtual Meeting with Ocosta School & Grays Harbor Youth (Sep 23, 2021)

A kick-off meeting with Ocosta school teachers and volunteers as well as Grays Harbor Youth staff who will join the afterschool drone program, discussing current enrollment from school (there are 28 students enrolled in the program), possible drone activities for students to learn drone-related tech and applications, including search and rescue (hide and seek), infrastructure monitoring, and critical building mapping. Discussing education plans for the first class, including course content and CSET team participants. The CSET team will either conduct an in-person or online meeting with the students for the entire program period.

Virtual CSET group meeting (Sep 28, 2021)

This meeting discussed the course contents, materials preparation for the first course (e.g., CSET project presentation, drone tech and application introduction), and participation logistics of CSET team. All plans are drafted through miro (an online whiteboard & visual

collaboration platform, link: https://miro.com/app/board/o9J_1AVyVs8=/) with both the Ocosta school and Grays Harbor Youth.

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

We will follow the implementation plan to ensure that all the CSET’s funded research, education, and outreach activities move forward as scheduled.

- The Center website, social media presence, and emailing contact lists will be regularly updated and used to promote the Center and its activities.
- CSET’s 15th and 16th quarterly newsletters will be distributed during the months of November 2021 and February 2022. The newsletters will highlight Center progress, such as projects starting/concluding, new calls for proposals, STIs, etc.
- Steps will be taken to continue bringing students on as research assistants.
- Steps will be taken to develop training programs, curriculum development activities, outreach, and sponsorship opportunities.
- Center researchers and staff plan to participate in the 101st Annual Meeting of TRB in January 2022. Several abstracts submitted based on CSET project research have been accepted for presentations and posters. Citations for the presentations and posters will be provided in the Semi-Annual report due in April 2022.
- Year 6 RFP will be released to solicit proposals.
 - After meeting with the CSET Advisory Board and Executive Board, we agreed that we would focus on outreach and training in an effort to implement the work of the last 5 years. We will also give priority to those project that develop work products based on completed work that develop work products that allow practitioners to integrate the data, survey results or other work products into the community. This includes using the data to influence decision processes, setting of new standards or codes and upgrades to the transportation systems that improve the safety and economic health of the community. We encourage all researchers to work with partners to produce products which can be implemented by the end of the CSET grant.

2. Participants & Collaborating Organizations

What organizations have been involved as partners?

- *Collaborative research and financial support*
Newtok Village Council, Newtok Alaska,
Kawarek, Inc., Nome, Alaska
Yakama Nation, Washington

- *Technology Transfer Expert Task Groups*

CSET projects have established advisory groups for improving technology transfer from the project to interested stakeholders. Each project has met with members of the groups either individually or in a group during the period covered by this report.

Have other collaborators or contacts been involved?

Email correspondence has been exchanged during the reporting period to discuss research ideas and broad collaborations on research, education, workforce development, and outreach activities between CSET and various collaborators.

3. Outputs

Publications, conference papers, presentations, websites, lectures, seminars, workshops, invited talks

Publications

- *Journal Publications*

- Chen, Yanyan, Cong Chen, Qiong Wu, Jianming Ma, Guohui Zhang, John Molton. Spatial-Temporal Traffic Congestion Identification and Correlation Extraction Using Floating Car Data. *Journal of Intelligent Transportation Systems: Technology, Planning, and Operations*. Vol. 25, No. 3. 2020. pp. 263-280.
- Yu, Hao, Runze Yuan, Zhenning Li, Guohui Zhang, and David Ma. Identifying Heterogeneous Factors for Driver Injury Severity Variations in Snow-related Rural Single-vehicle Crashes. *Accident Analysis and Prevention*. Vol. 144. 2020. pp. 105587-105596.
- Yu, Hao, Zhenning Li, Guohui Zhang, Pan Liu, and Jun Wang, Extracting and Predicting Taxi Hotspots in Spatiotemporal Dimensions Using Conditional Generative Adversarial Neural Networks, *IEEE Transactions on Vehicular Technology*, vol. 69, no. 4, 2020. pp. 3680-3692.
- Zhang, Qian, Hao Yu, Zhenning Li, Guohui Zhang, and David T. Ma. Assessing potential likelihood and impacts of landslides on transportation network vulnerability. *Transportation Research Part D: Transport and Environment*. Vol. 82. 2020. pp. 102304-102312.
- Guo, Yuntao, Hao Yu, Guohui Zhang, and Tianwei Ma. Exploring the Impacts of Travel-implied Policy Factors on COVID-19 Spread within Communities based on Multi-source Data Interpretations. *Health and Place*. Vol. 69, 2021. pp. 102538-102550.
- Yu, Hao, Pan Liu, Yueyue Fan, and Guohui Zhang. Developing a decentralized signal control strategy considering link storage capacity. *Transportation Research Part C: Emerging Technologies* Vol. 124, 2021. pp. 102971-102981.
- Yu, Hao, Zhenning Li, Guohui Zhang, Pan Liu and Tianwei Ma. Fusion Convolutional Neural Network-based Interpretation of Unobserved Heterogeneous Factors in Driver Injury Severity Outcomes in Single-Vehicle Crashes. *Analytic Methods in Accident Research*. Vol. 30. 2021. pp. 100-157.

- *Reports*
 - Carneiro Pereira, Luana and Panos D. Prevedouros, *Naturalistic Driving Database Development and Analysis of Crash and Near-Crash Traffic Events in Honolulu*, CSET Final Report, August 2021.
 - Chang, Kevin and Cody Hodgson, *Development of Grass-Roots Data Collection methods in Rural, Isolated, and Tribal Communities*. CSET Final Report. June 2021.
 - Zhang, Guohui, Panos D. Prevedouros, David T. ma, Hao Yu, Zhenning Li, and Runze Yuan, *Extracting Rural Crash Injury and Fatality Patterns Due to Changing Climates in RITI Communities Based on Enhanced Data Analysis and Visualization Tools (Phase I)*, CSET Final Report. September 2021.
 - Shen, Suwan and Dayea Shim. *Building Capacity for Climate Adaptation: Assessing the Vulnerability of Transportation Infrastructure to Sea Level Rise for Safety Enhancements in RITI Communities*. CSET Final Report. August 2021.
 - Ban, Xuegang (Jeff), Daniel Abramson, Yiran Zhang, and Christina Cano-Calhoun. *Investigation of Drone Applications to Improve Traffic Safety in RITI Communities*. CSET Final Report. July 2021.

- *Conference papers*
 - Conference abstract by E. Richards and S. Stuefer entitled "An analysis of GPR methods for identifying varying ice cover types based on dielectric properties: A case study in Interior Alaska" was accepted for oral presentation at the 21st workshop on the hydraulics of ice-covered rivers organized by Committee on River Ice Processes and the Environment (CRIPE). 21st CRIPE workshop is scheduled for August 29-September 1, 2021. Originally, it was planned to be held in Saskatoon, Canada. However, the organizing committee announced transition to either hybrid or completely virtual event due to COVID 19 pandemic.
 - Prevedouros, Panos D. and Tribikram Rajaure, Traffic Safety and Equity Perceptions of Hawaiians, part-Hawaiians and Pacific Islanders, TRB Conference on Advancing Transportation Equity, Virtual, <http://onlinepubs.trb.org/Onlinepubs/Conferences/2021/Equity/program.pdf>, Washington, DC, USA, September 9-14, 2021.

- *Presentations*
 - Shen, S. *Assess Transportation Vulnerability to Sea Level Rise using Community Survey and Crowdsourcing Data—A Case Study of City and County of Honolulu, Hawaii*, November 5-8, 2020 ACSP 60th Annual Conference.
 - Shen, S. *Assess Transportation Vulnerability to Sea Level Rise using Community Survey and Crowdsourcing Data—A Case Study of City and County of Honolulu, Hawaii*”, American Geophysical Union Fall Meeting 2019, December 9-13, 2019. San Francisco, CA.
 - Shen, S. *Examining the Spatial Patterns of Transportation Vulnerability to Sea Level Rise —A Case Study of City and County of Honolulu, Hawaii*. Presentation at 2019 Natural Hazard Workshop, July 13-15, Broomfield, CO.

- Shen, S. *Assess the Impact of Tidal Flooding and Sea Level Rise on Transportation*, Region 10 Transportation Conference. Fires, Viruses, and Floods: New Complexities in Transportation Safety. Oct 21, 2020.
- Shen, S. *Climate Change Impacts on Urban Infrastructure*. Global Dialog 2021 - Hawai'i. Solve Climate by 2030. <https://www.youtube.com/watch?v=VfnQ5UoSVHI>, April, 2021
- Ricord, S., Littlebull, H., Wang, Y., and Sun, W., 2021 September 27 – October 1. *Low-Cost Technology Implementations for Data Collection and Visualization in Tribal Areas* [Conference presentation]. 2021 National Transportation in Indian Country Conference. https://9d4c1830-23f2-4f35-b70b-83fc44816860.filesusr.com/ugd/cea1b2_ba6f0699277640838d2b767994a1344b.pdf
- Chang, K. *Analyzing Rail-Trail Usage for Travel in Rural, Isolated, and Tribal Communities*, Conference on Advancing Transportation Equity - Transportation Research Board; virtual, September 2021.
- *Other Products*
 - The UHM project, *Extracting Rural Crash Injury and Fatality Patterns Due to Changing Climates in RITI Communities Based on Enhanced Data Analysis and Visualization Tools*, upgraded and enhanced the Rural Crash Visualization Tool System (RCVTS) created by the CSET project *Develop an Interactive Baseline Data Platform for Visualizing and Analyzing Rural Crash Characteristics in RITI Communities*. The RCVTS, which is capable of visualizing and analyzing rural crashes in RITI communities, was improved with more interactive graphs. The project investigated the Bayesian vector autoregression-based approach for mixed frequency crash data interpretations with missing values, and proposed a finite mixture random parameter model to explore driver injury severity patterns and causes in low visibility conditions in the tool.
- *Website Updates*
 - The CSET website is live at cset.uaf.edu.
 - Final reports are added to the website once submitted to TRID.
- *Lectures/Seminars/Workshops/Invited Talks*
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- *New methodologies, technologies or techniques*
 - The UAF project, *Development of a Tabletop Dustfall Column and Test Procedure for Chemical Dust Suppressant Performance Testing*, is in the final stages of testing the mini-column that is the focus of the project. An undergraduate student hired to work on the project in the spring of 2021 with the easing of COVID restriction enabled testing to leap forward and resulted in a redesign of the system so that results are both better and more repeatable.
- *Inventions, patents and/or licenses*
 - The UA project, *Developing a Prototype of a Smart-Lighting System for Isolated Rural Intersections*, has filed for a provisional patent on the system. The system

was deployed at a test site on the UAA campus and functioned as expected. A phase 2 project has been approved for further testing, improvements and possible implementation with funding from CSET year 5.

4. Outcomes

- *What outcomes has the program produced? How are the research outputs described in section 3 being used to create outcomes?*

The CSET project, *Assessing the Transportation Adaptation Options to Sea Level Rise for Safety Enhancement in RITI Communities through a Structured Decision-Making Framework*, used spatial network analysis to identify communities currently with limited and reduced accessibility under a scenario of an extreme high tide (1.4 ft above the mean high-water level) on Oahu Island, Hawai'i. The analysis found that residents of North Shore communities in Kahuku, those in the eastern part of the island in Hawaii Kai, and the central areas near Honolulu Harbor are the most at risk from tidal flooding. On average, access to universities, employment, and grocery shopping are affected most, followed by K-12, and recreational facilities. The mapped accessibility pattern reveals that flooding would exacerbate the negative effects of existing common problems in metropolitan areas, such as the spatial mismatch between housing affordability and jobs, the lack of mixed-use development in the suburban sprawl, and the lack of community facilities in remote rural communities. It demonstrates the importance of integrating land use and transportation strategies for adaptation.

The CSET project, *Investigation of Drone Applications to Improve Traffic Safety in RITI Communities*, worked with the City of Westport and other South beach Communities in Washington State. As a result of the project's efforts the Westport City Council on July 12, 2021 formally adopted the Comprehensive Plan Update including provisions recommended by the research team and approved by the City's Planning Commission. These provisions included adding a new sub-element on Telecommunications to the Transportation and Circulation element, and enabling language for use of drone technology to increase community resilience, mitigate hazards, and improve public safety.

The CSET project, *Development of Grass-Roots Data Collection Methods in RITI Communities*, evaluated whether drones would be useful and practical for collection of data by RITI communities. The project concluded that from a grass-roots data collection standpoint, while purchasing and owning a drone requires relatively minimal investment, the initial steps required to operate a drone, along with processing time required to analyze the data collected, represent up-front barriers that may prevent widespread usage at this time. However, as the price point continues to decline and as local policies are established to allow for this type of device, it seems inevitable that the use of drones and the opportunities that it presents in the long-term will offer promising outcomes.

5. Impact

- *What is the impact on the development of the principal discipline(s) of the program?*
- *Other Disciplines –*
CSET is a multidisciplinary Center, and will therefore have an impact in fields outside of the traditional areas of transportation research. In future reports, this section will serve to answer the following questions.
- *What is the impact on the development of transportation workforce development?*
- *What is the impact on safety in RITI communities?*
- *What is the impact on physical, institutional, and information resources at the university or other partner institutions and communities?*
- *What is the impact on technology transfer?*

The UAF project, *Development of a Tabletop Dustfall Column and Test Procedure for Chemical Dust Suppressant Performance Testing*, has discussed the mini-column with the Alaska DOT&PF. They are planning to include the testing procedure in the Alaska Test Methods document used by the department. Industry representatives have expressed interest in the device and procedures as well.

The UW project, *Community-Embedded Drone Program for Improving Traffic Safety of RITI Communities in Washington State*, met numerous times online with partner communities. This project is a follow-on project to the CSET project, *Investigation of Drone Applications to Improve Traffic Safety in RITI Communities*, building on the relationships established in the previous project to transfer knowledge and skills related to drones into the community of Westport, Washington. The project has purchased and checked current drone equipment (four Rubiq drones from Ocosta school and three DJI drones from the UW CSET team) for incoming after-school drone program at the Ocosta High School. The previous project determined the status of current drone technology access and literacy in the community. The research team secured agreement to conduct an after-school youth drone technology program for Fall 2021 and developed draft program overview, education plan and recruiting materials. The work by the team will result in the transfer of drone piloting and utilization skills from the research team to members of the community.

- *What is the impact on society beyond science and technology?*
 - The UHM project, *Effects of Tourism on Rural Road and Rural Delivery with CAV*, was referenced and discussed on a PBS Hawai'i Insights program called "The Allure of the

Green Sea Turtle.” The program aired on July 8, 2021. <https://www.pbshawaii.org/the-allure-of-the-green-sea-turtle/>

- The UAF project, *Improved Safety for Winter Travel along Minimally Improved Routes*, has been in contact with Senator Murkowski of Alaska. She has expressed an interest in improving Alaska’s trail network. The project is keeping her apprised of their progress.
- *In what ways have researchers and students who are part of or who focus on native or federally recognized tribes and communities been involved?*

CSET continues to work with tribes to reduce dust in their communities. The focus is moving from institutional controls to application of calcium chloride with minimal equipment.

CSET projects at the University of Washington continue to work closely with tribal leaders in the state, including the Yakima Nation, on issues of concern to the tribal leaders.

6. Changes/Problems

- Impacts on the Center from COVID-19
 - The CSET project, *Development of Grass-Roots Data Collection Methods in RITI Communities*, intended to collect two sets of school travel data for analysis. The project successfully acquired the initial data set in the fall of 2019. The second set was planned for collection in the spring of 2020. The impacts of the COVID-19 pandemic canceled these plans. Since in-person schooling was not allowed for the remainder of the 2020 calendar year, it was not possible to collect a follow-up set of school travel data during the spring time period as the elementary schools were closed and students were limited to at-home learning. However, the key takeaways and findings from this study were not affected by this impact, and the comparison of school travel patterns during different time periods of the academic year is suggested as an area for future study.
 - Multiple projects requested no-cost extensions due to COVID impacts. The reasons included lack of access to lab facilities due to campus closures, delays in the arrival of graduate students, difficulty recruiting undergraduate students and inability to conduct field work for data collection.
 - CSET year 5 projects experienced start up delays due to contract processing issues due to COVID restrictions on campus. At this point, one project has not yet started due to contract processing issues though all others have begun.
- We have accomplished the task of developing baseline data and building on that data set. We have also developed tools to collect and evaluate new data as they become available. However, due to COVID we were unable to spend time in communities to collect information on site and to provide transportation safety training to the community. Training for bicycle, ATV and snowmachine safety require in person training so we have not been able to complete those goals. We may be able to provide some of that training over the next year as communities open to travelers from outside the community. While we developed several relationships, that too has been

hampered by COVID. The culture in most RITI communities is based on in-person interaction, we simply have not been able to achieve as much as we would have liked. While we have accomplished many of our goals, implementation continues to be hampered because we have not been able to enter most of the communities. We are just now being able to bring new graduate students onto campus. That has hampered our ability to complete many of the goals we had hoped for. UAF has been hit particularly hard as a result. We have been able to bring only one graduate student on over the last two years. Unfortunately, it may take another semester to add to that pool of students. We have also noticed that the number of undergraduate students interested in working with us has diminished even though students are back on campus. We suspect that the stress of restarting their academic coursework combined with the stresses imposed by COVID is having an impact on their desire to engage in activities beyond their classwork.

7. CSET Technology Transfer Plan Metrics

Research Output

- Number of completed projects - 5
- Number of papers and reports directly resulting from research collaborations - 12
- Number of conference presentations from collaborations - 3

Research Outcomes

- Number of collaborative training programs established and number of attendees - 0
- Number of seminars, meetings, and workshops organized with state, tribal, and local agencies and the number of attendees – 2 events, total attendees over 50, 30 one-on-one interviews,
- Number of implementable work products (e.g., manuals, specifications, and toolkits) - 3

Research Impacts

- Number of organizations/partners actively working with CSET to achieve the strategic RITI-focused goals – 9
- Number of student research internships granted - 8