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University Transportation Centers Program
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**NATIONAL INSTITUTE FOR
CONGESTION REDUCTION**

SEMI-ANNUAL PROGRESS REPORT FOR UNIVERSITY TRANSPORTATION CENTERS

University of South Florida

in partnership with University of California, Berkeley • Texas A&M University and its affiliated
Texas A&M Transportation Institute • University of Puerto Rico at Mayagüez
DUNS 06-968-7242 • EIN 59-3102112-F5 [Tampa Campus]

Submitted by:

Li Xiaopeng, Center Director • National Institute for Congestion Reduction
Center for Urban Transportation Research • University of South Florida
4202 E. Fowler Avenue, ENG030, Tampa, FL 33620-5375
xiaopengli@usf.edu • 831-974-2957

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Grant Period: September 9, 2019–September 30, 2023

Reporting Period: October 1, 2020 – March 31, 2021, Third Semi-Annual Progress Report

Signature of Submitting Official:

A handwritten signature in black ink, appearing to read 'Xiaopeng Li', written over a horizontal line.

Li Xiaopeng, Ph.D., Center Director

1. ACCOMPLISHMENTS: What was done? What was learned?

The information provided in this section allows the OST-R grants official to assess whether satisfactory progress has been made during the reporting period.

What are the major goals and objectives of the program?

The **National Institute for Congestion Reduction (NICR)** mission is to emerge as a national leader in providing multimodal congestion reduction strategies through real-world deployments that leverage advances in technology, big data science, and innovative transportation options to optimize the efficiency and reliability of the transportation system for all users. Our efficient and effective delivery of an integrated research, education, workforce development and technology transfer program will be a model for the nation. NICR is pursuing ideas for reducing surface transportation congestion through three of the research Topics specified by the Secretary of Transportation:

- **OPTIMIZE:** optimize efficiency and reliability of travel for all transportation system users;
- **TRANSIT:** data modeling and analytical tools to evaluate the effects of shifting transit incentive structure; and
- **OPTIONS:** ridesharing and alternative forms of transportation.

NICR is measuring our progress with performance metrics specifically in the areas of: Research, Leadership, Education and Workforce Development, Collaboration, Diversity, and Technology Transfer. Projects selected for Year 1 (shown in Table 1) are nearing completion.

Table 1. NICR Year 1 Projects 2020 – 2021.

	Project	Lead	Collaborator
Pillar 1 Urban and Rural Traffic Management in the Age of Big Data			
1-1	Demand-Side Management of Auto Traffic	Walker & Hansen UCB	Lin & Z. Wang USF
1-2	Supply-Side Management of Auto Traffic	Sunkari TAMU/TTI	Cassidy & Shen UCB
1-3	System Monitoring of Auto Traffic	Brydia TAMU/TTI	Shen & Cassidy UCB
1-4	Transit Priority	Li USF	Daganzo UCB
Pillar 2 Battling Congestion Using Innovative Mobility Platforms			
2-2	Formulating Innovative Mobility Policies to Reduce Congestion	Shaheen & Frick UCB	Sener TAMU/TTI
2-3	Enhancing Equity and Access	Rodríguez UPRM	
Pillar 3 Incentivizing Transit in the Face of Innovative Alternatives			
3-1	Influencing Travel Behavior via an Open-Source Platform	Barbeau & Maness USF	Turner TAMU/TTI
3-3	Targeting Transit Incentives to Congestion Sources	Rodríguez & Chatman UCB	P. Chen & Winters USF
Pillar 4 Battling Congestion on Freeway Corridors			
4-1	Pricing Mechanisms for Managed Lanes	Burris TAMU/TTI	Figueroa UPRM
4-2	Proactive Congestion Management	Concas & Perk USF	Kuhn TAMU/TTI
4-3	Corridor-Wide Surveillance Using Unmanned Aircraft Systems	Colucci UPRM	Zhang & Kourtellis USF

What was accomplished under these goals?

- All Year 1 projects, which are listed in Table 1, are nearing completion, project web pages have been launched on the NICR webpage, all project details are in the Research in Progress (RIP) database, and all faculty and students are actively working.
- An RFP was sent to partner Universities, Year 2 project proposals were submitted to NICR, peer reviews were completed, and final selection of Year 2 projects was completed and announced the last week of April.
- NICR continues to make progress with FDOT, TxDOT and Caltrans regarding matching funds/projects.
- NICR staff met with Rodney Bunner, President of ServiceEdge Solutions to demonstrate TBEST analysis features and investigate research opportunities which could provide transit agencies with the tools and workflows needed to address complex planning issues related to COVID19 and general ridership decline over the past several years. The group discussed the potential for integrating new tools/methodologies which would enable TBEST to evaluate on-demand transportation services, first mile/last mile trip connectivity, transit signal pre-emption and many others.
- Project 1-1 research team developed a simulation model and a theoretical model for the impact of urban delivery operations of street network capacity. Initial results are promising in that the theory and the experiment are in agreement. Research is well underway with papers in draft form in progress for submission to peer-reviewed journals.
- Project 1-2 research team simulations indicate that the TSM strategies tested outperform existing signal coordination schemes in both idealized, grid and real-world network geometries. A journal paper is in the final stages of preparation.
- In exploring methodologies for automatically detecting the development of queues in a street network, Project 1-3 successfully showed that graph theory can be an effective tool for automatically detecting the onset of certain congestion patterns and that adapting control measures for this type of congestion could substantially minimize delays and other travel costs.
- Project 2-3 machine learning analyses suggest that the aggregation of zonal level predictions can result in good prediction of system level performance indicators (e.g., total number of trips within two-hour periods).
- The final report for Project 4-1 Comparing Pricing Mechanisms for Managed Lanes is complete and undergoing peer review. Findings suggest that both variable and dynamic pricing perform well, with neither being clearly dominant. Metrics for use in analyzing the impacts of price on congestion were established.
- USF and UPRM faculty have collaborated to learn, program, and deploy the OneBusAway technology on buses in Mayagüez to enable future research on congestion reduction strategies. During this reporting period the project team met with two transit services to implement OBA in Mayaguez. During this reporting period, a collaborative agreement to implement this project was signed with the City of Mayaguez Mayor's office, a pre-pilot test was coordinated, and effort toward implementation of OneBusAway continued.
- Texas A&M selected two undergraduate summer internships funded by NICR. These interns will participate in a 10-week immersive research experience, contribute to ongoing NICR research projects, and developed a research presentation and research paper/technical memo describing their work.
- The NICR Citizen's Transportation Academy contract was executed and will be initiated next quarter in collaboration with City of Tampa staff who are contributing in-kind time toward the project match.

How have the results been disseminated? If so, in what ways?

- The NICR website is fully operational and is a key hub for dissemination of research: www.cutr.usf.edu/nicr.
- A NICR Newsletter has been created to send updates about research initiatives, education, webinars, presentations, scholarships, community outreach, and more; the first edition was published January 2021
- The NICR Webcast Series has presented seven episodes live; each episode is also recorded and available to view on the NICR Website at any time.
- The Project 1-1 research team presented at two conferences, at 2020 INFORMS annual meeting they presented “Unmanned Aircraft System (UAS) Traffic Management and Resource Allocation In Low-altitude Urban Airspace For Parcel Delivery: San Francisco as Case Study” and at International e-Conference on Pandemics and Transport they presented “Consumer shopping & shipping decisions and public infrastructure policy implications in a pandemic: What will stick? A Case Study of the Sacramento Region”
- The Project 2-3 research team presented posters at the 100th Annual Meeting of the Transportation Research Board. The following paper was accepted for presentation: “User Characteristics, Spatiotemporal Patterns, and Spatial Access in a Dockless E-Scooter Service in Puerto Rico” by Rodriguez-Roman D., Camacho-Bonet A., Yáñez-González G., Acosta- Pérez, F.A., Villa-Zapata, L.M., del Valle González, C., Colucci-Ríos B, and Figueroa-Medina, A.M. (TRBAM-21-02714).
- The Project 4-1 research team made a keynote presentation at the 1st Virtual Congress of the International Journal of Natural Disasters, Accidents and Civil Infrastructure (RIDNAIC) on “Innovative Research that Contributes to Safety, Sustainability and Resilience in Transportation Systems”
- The Project 3-1 and 4-1 research team presented at the UPRM Research Fair, the Transportation Professors Research Panel with ITE-UPRM & Oregon State University Student Chapters and participated in a poster presentation of their data collection tool at the virtual Transportation Research Board (TRB) at USF.



Figure 1. The Project 3-1 and 4-1 research teams presented at the UPRM Research Fair March 12, 2021.

- NICR continues to support the USF Friday Transportation Seminar series which is delivered online, and which hosts discussions on research, engineering, and planning each Friday during the spring and fall semester; 20 seminars have been produced this reporting period and are available to view at any time on through the NICR and CUTR website.

- A series of webinars were offered by UPRM on topics related to transportation flow fundamentals, highway capacity and level of service analysis, and data science, data management, and data-driven analysis.
- NICR formalized its partnership with the Florida Local Technical Assistance Program (LTAP) and the Florida DOT to launch further training and professional development opportunities related to NICR projects. The COVID pandemic has resulted in a need to transition the trainings to a virtual platform. During this report period, Florida LTAP conducted 27 webinar series, which averaged 398 people per webinar and a total of 10,752 attendees from around the world. The Florida LTAPP continues to break attendance records and will serve as an outstanding venue for disseminating NICR research findings.

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

- Year 2 research project selection has been completed and all Year 2 projects are expected to launch in Summer 2021.
- Plans are in place to produce Policy Briefs as research projects are completed, as well as to launch other NICR tech transfer activities, education opportunities, and outreach mechanisms.
- The USF Friday Transportation Seminar series and NICR webinar series will continue during the next reporting period.
- The Project 1-4 research team is currently investigating the impact of the COVID-19 pandemic on agency/city/county efforts in initiating transit signal priority measures, the results of which should be available by the end of the next reporting period. Results of this effort will be shared to research communities and stakeholders via the project report, published presentations, and research articles.

<p>2. PARTICIPANTS & COLLABORATING ORGANIZATIONS: Who has been involved?</p>

<p>OST-R needs to know who has worked on the project to gauge and report performance in promoting partnerships and collaborations.</p>
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What organizations have been involved as partners?

- USF is the lead university in the National Institute for Congestion Reduction program, in collaboration with the University of California Berkeley, Texas A&M University and the University of Puerto Rico at Mayagüez.
- NICR continued to work closely with FDOT, TxDOT and Caltrans, as well as the City of Tampa, Minnesota DOT, SanDAG out of San Diego, The California Department of Motor Vehicles, the California State Transportation Agency out of Sacramento, the Sacramento Area Council of Governments, the San Francisco County Transportation Authority (SFCTA), the San Francisco Municipal Transportation Agency, CTRMA out of Austin, Colorado DOT, Sonnell Transit out of Mayaguez, the Puerto Rico Highway and Transportation Authority out of Santurce, Autopistas Metropolitanas in Puerto Rico, as well as the Municipality of Mayaguez during this period.
- New partnerships with transportation organizations that have begun during this reporting period include: Oregon DOT, Virginia DOT, INRIX, and the Puerto Rico Drone Academy.



Figure 2. The Project 4-3 research students and Co-PIs had their first hands-on experience with drones during this reporting period.

Have other collaborators or contacts been involved? FY2021Q1 FY2020Q4

- NICR faculty members Kristine Williams and Jeff Kramer developed a research project with stakeholder MetroPlan Orlando who is providing a cash match. The project, which was selected for funding in Year 2, will explore the potential for a coordinated regional TSMO program among MPOs in the Central Florida Megaregion and identify potential transportation and equity impacts of technology applications for reducing congestion on the extended I-4 corridor.
- NICR has begun discussions with MetroPlan Orlando to explore possible research collaborations on Transportation Management and Operations (TSMO) strategies for the I-4 Corridor. With MetroPlan Orlando’s support, the USF team has led a proposal entitled “Visual-Enhanced Cooperative Traffic Operations (VECTOR) System” with a total budget of \$7,089,322 submitted to the Department of Energy in response to NOFO DE-FOA0002420.

3. OUTPUTS: What new research, technology or process has the program produced?

Research outputs are any new or improved process, practice, technology, software, training aid, or other tangible product resulting from research and development activities. They are used to improve the efficiency, effectiveness and safety of transportation systems. Many Centers develop significant outputs other than publications. OST-R assesses and reports both publications and other products to Congress, communities of interest, and the public.

- Publications, conference papers, and presentations
- Policy papers
- Website(s) or other Internet sites
- New methodologies, technologies or techniques
- Inventions, patents, and/or licenses
- Other products, such as data or databases, physical collections, audio or video products, application software, analytical models, educational aids, courses or curricula, instruments, equipment, or research material

- Preliminary research outputs were reported on page 4, as the research projects are still underway.
- The NICR website at www.cutr.usf.edu/nicr is fully operational.
- The NICR Webinar Series started in January 2021 with a brief introduction to the grant and its products. The live webinars require preregistration, then the videos are uploaded to YouTube at a later day and are freely available.
- Policy Briefs are well underway.
- NICR’s support of the USF-ITE Friday Transportation Seminar Series continued each Friday throughout the fall and spring semesters. The seminars were advertised throughout social media channels and newsletters. Each seminar is recorded and uploaded to YouTube. <https://www.youtube.com/channel/UCuciPnooGK5VyEHtFBCqVIq>

Performance measures for research output (minimum of two) in Technology Transfer Plan and the targets for each measure

- The NICR T2 Plan only has one research “output,” shown in Table 2 below, as only one of the Year 1 research project is complete. We have added two more outputs from the research activity performance metrics.

Table 2. Performance Measures for Research Outputs.

A. T2 Goal and Description	B. Performance Measure	C. Achieved
Goal 1. Share new knowledge to address society’s challenges and opportunities for reducing congestion	Number of presentations and estimated audience sizes	12/173
	Number of research reports and papers / their downloads	0
	Number of peer reviewed journal publications and their citations	1/6
Goal 2. Provide diverse research products to meet the needs of stakeholders; i.e., to put the right information in the right hands at the right time to combat congestion.	TBD	--
Goal 3. Professional & workforce development including educating & mentoring next generation transportation professionals, training existing workforce and grooming future leaders	TBD	--
Goal 4. Commercialize research products to leverage public investment and yield broader implementation	TBD	--

- The Project 2-3 team produced a paper which was submitted to the 100th Annual Meeting of the Transportation Research Board set for January 2021. The title of the paper is “User Characteristics, Spatiotemporal Patterns, and Spatial Access in a Dockless E-Scooter Service in Puerto Rico.”
- Project 1-1 presented at two conferences:
 - (November 2020): “Unmanned Aircraft System (UAS) Traffic Management and Resource Allocation In Low-altitude Urban Airspace For Parcel Delivery: San Francisco as Case Study” by Ang Li and Mark Hansen at 2020 INFORMS annual meeting.
 - December 2020: “Consumer shopping & shipping decisions and public infrastructure policy implications in a pandemic: What will stick? A Case Study of the Sacramento

Region” Teddy Forscher, Elizabeth Deakin, Susan Shaheen at the International e-Conference on Pandemics and Transport.

- Project 4-1 conducted a presentation titled “Innovative Research that Contributes to Safety, Sustainability and Resilience in Transportation Systems” by Alberto Figueroa-Medina, March 16, 2021, 1st Virtual Congress of the International Journal of Natural Disasters, Accidents and Civil Infrastructure (RIDNAIC).
- NICR is partnering with the USF I-Innovation Corps (I-Corps) program to offer training to faculty and students that will help them focus on “customer” needs via interviews with real-world stakeholders. These interviews allow researchers to test their hypothesis of the research problem statement to ensure that the results of their research are transferrable and provides researchers with an opportunity to rapidly iterate on ideas and obtain valuable feedback. By engaging stakeholders that will use the proposed research output early in the process, the I-Corps program helps avoid the “valley of death” for research. The USF I-Corp program is a site for the National Science Foundation I-Corps program, and more details about this program can be found at https://www.nsf.gov/news/special_reports/i-corps/.
- The Project 3-1 research team gave a virtual presentation at Eloisa Pascual High School to motivate junior high school students to pursue a higher education in a STEAM career related to the topics of this project was prepared during the reporting period. The presentation included a promotional video of OneBusAway technology, the description of NICR and OneBusAway, and the science used to develop and implement the system application.
- The Project 4-3 research team conducted outreach activities by presenting their research project to the students of Aguas Buenas High School.



Figure 3. NICR 4-3 Outreach Activity: Presentation for High Schools Students -Aguas Buenas High School on March 30, 2021

- The NICR-UPRM student research assistants presented the research results at the 1st UPRM Virtual Research Fair held on March 12th, 2021. This event was organized by the

UPRM Student Council to expose students to the different research activities and projects being carried out at UPRM by undergraduate and graduate students as a mechanism to motivate more students to participate in research activities and to pursue graduate studies. During this event, each NICR-UPRM team gave a 15-minute presentation about the goals and objectives of the NICR consortium and the objectives of the research project.

4. OUTCOMES: What outcomes has the program produced? How are the research outputs described in section (3) above being used to create outcomes?
 Outcomes are the application of outputs; any changes made to the transportation system, or its regulatory, legislative, or policy framework, resulting from research and development outputs.

- Increased understanding and awareness of transportation issues
- Passage of new policies, regulation, rulemaking, or legislation
- Increases in the body of knowledge
- Improved processes, technologies, techniques and skills in addressing transportation issues
- Enlargement of the pool of trained transportation professionals
- Adoption of new technologies, techniques or practices

- USF and UPRM faculty have collaborated to learn, program, and deploy the OneBusAway technology on buses in Mayagüez to enable future research on congestion reduction strategies. During this reporting period the project team met with two transit services to implement OBA in Mayaguez. During this reporting period, a collaborative agreement to implement this project was signed with the City of Mayaguez Mayor’s office, a pre-pilot test was coordinated, and effort toward implementation of OneBusAway continued.

Discuss the performance measures (a minimum of two) for research outcome your Center identified in your Technology Transfer Plan and the targets (goals) for each measure.

Table 3. Performance Measures for Research Outcomes.

A. T2 Goal and Description	B. Performance Measure	C. Achieved
Goal 1. Share new knowledge to address society’s challenges and opportunities for reducing congestion	Number of downloads of <i>Journal of Public Transportation & Journal of TDM Research</i>	48,549
Goal 2. Provide diverse research products to meet the needs of stakeholders; i.e., to put the right information in the right hands at the right time to combat congestion.	Usage metrics for NICR website, project-related websites, and Congestion Help Desk	3,184
	Number of articles in popular media and their reach	0
	Social media engagement (e.g. shares, comments, etc.)	1,239
Goal 3. Professional & workforce development including educating & mentoring next generation transportation professionals, training existing workforce and grooming future leaders	Contact hours in training, instructor-led and asynchronous learning	1,680
	Courses taught by personnel on a NICR research project team.	35
	Number of students in courses taught by personnel on a NICR research project team.	1,091
Goal 4. Commercialize research products to leverage public investment and yield broader implementation	TBD	--

- Two summer undergraduate research internship positions were awarded by Texas A&M. Contributions from the selected interns will be reported on the next report.

- Faiza Hasan, TAMU Environmental Geoscience undergraduate
- Cordell Cielencki, TAMU Industrial Distribution undergraduate

5. IMPACTS: What is the impact of the program? How has it contributed to improve the transportation system: enhance safety, reliability, durability; improve transportation education; strengthen the workforce, etc.?

Impacts are the effects of outcome on the transportation system, or society in general, such as reduced fatalities, decreased capital or operating costs, community impacts, or environmental benefits. The taxpaying public and its representatives deserve a periodic assessment to show them how the investments they make benefit the nation. Through this reporting format, and especially this section, UTCs provide that assessment and make the case for Federal funding of research and education by demonstrating the impacts that UTC funding has had on technology and education. USDOT uses this information to assess how the research and education programs:

- Improve the operation and safety of the transportation system;
- Increase the body of knowledge and technologies;
- Enlarge the pool of people trained to develop knowledge and utilize new technologies; and
- Improves the physical, institutional, and information resources that enable people to have access to training and new technologies.

- The effectiveness of the transportation system
- Technology transfer (include transfer results to entities in government or industry, adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company)
- The increase in the body of scientific knowledge
- Transportation workforce development

- Nothing to report. Year 1 projects are still underway.

Discuss the performance measures (a minimum of two) for impact your Center identified in your Technology Transfer Plan and the targets (goals) for each measure.

- The NICR T2 Plan has four research “impacts,” shown in Table 4 below.

Table 4. Performance Measures for Research Impacts.

A. T2 Goal and Description	B. Performance Measure	C. Achieved
Goal 1. Share new knowledge to address society's challenges and opportunities for reducing congestion	Number of citations in professional publications by NICR PIs	46,000
	Changes in policies or practice resulting from research	0
Goal 2. Provide diverse research products to meet the needs of stakeholders; i.e., to put the right information in the right hands at the right time to combat congestion.	Numbers of subscribers to online networks, social media post reach, and reach of online peer-to-peer networks	5,388
Goal 3. Professional & workforce development including educating & mentoring next generation transportation professionals, training existing workforce and grooming future leaders	TBD	--
Goal 4. Commercialize research products to leverage public investment and yield broader implementation	Cumulative number of patent disclosures, patents received, licenses issued, and businesses formed	0

6. CHANGES/PROBLEMS

The grantee is required to obtain prior written approval from the OST-R grants official whenever there are significant changes in the project or its direction. See agency specific instructions for submission of these requests. If not previously reported in writing, provide the following additional information, if applicable:

- Changes in approach and reasons for change;
- Actual or anticipated problems or delays and actions or plans to resolve them;
- Changes that have a significant impact on expenditures; or
- Significant changes in use or care of animals, human subjects, and/or biohazards.

- Contractual issues delayed execution of year 1 subcontracts with NICR partner campuses by several months. The NICR Director has taken steps to ensure that Year 2 and 3 subcontracting proceeds smoothly and efficiently.
- All four campuses continue to work remotely. While most faculty and some staff have been used to working at home periodically, most staff have not. New communications media and productivity tools such as GoToMeeting, Zoom and Teams are now being used.
- Project 2-2 adjusted their research project due to the pre-test their photovoice methodology. The pretest involved participants receiving weekly photography assignments to specific locations at specific times of day. Due to concerns related to convenience, comfort, and practicality of assigning photography locations, the assignment structure was removed. A different approach was developed that focuses on participants taking pictures at locations they visit at the times they normally visit these places. By relaxing the location assignments and time of day assignments, the expected time commitment of the photography part was reduced as were potential barriers to participating in the study related to traveling to specific, assigned locations. The asynchronous learning materials (e.g., video demonstration, presentation) were modified to reflect these changes.
- Project 4-1 requested a No-Cost Extension (NCE) on October 20, 2020 to allow project activities to continue after the initial end date of December 2020. The NCE was approved by NICR establishing a new project end date of June 30, 2021.
- The COVID-19 pandemic necessitated a change in how the summer undergraduate internships were conducted. Interns were required to work remotely and research mentors led and supported this change by restructuring the interns' work activities to enable remote work, and by making extensive use of videoconferencing platforms and Cloud-based data sharing. Intern activities such as socials and lunchtime "Brown Bag" presentations (delivered by researchers to introduce the interns to the variety of topics and disciplines represented at TTI/TAMU/NICR and to provide information on graduate school and job hunting) were also delivered using videoconferencing. A planned research poster session was changed to WebEx project presentations.
- We continue to work with the Executive Committee and faculty investigators on all campuses to minimize the impacts of the many uncertainties due to COVID-19 on our projects and programs.
- Due to Covid 19, Project Local buses have continued to run in "essential trips" mode which may reduce the accuracy of our results regarding transit trips. Transit volumes are reduced which impacts route speeds, stop quantity, and dwell times. Field testing includes additional COVID-19 protection protocols for the protection of participants that would not otherwise have been used. Recruitment of students to help with testing is more challenging than otherwise would have been.

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- Due to Covid 19, Project 4-3 was affected in all the field work activities associated with the use of the drones for air surveillance in the urban freeway corridors that were initially considered for the project. Additionally, the process of taking the pilot exam during summer 2020 to meet the 14 CFR Part 107 requirements was temporarily postponed by the FAA in Puerto Rico. A No Cost Extension with a revised schedule is requested to complete the approved Work Plan.
 - While NICR had a plan to partner with TBARTA on a potential congestion reduction research collaboration, TBARTA experienced budget issues and our plan was disrupted.

7. SPECIAL REPORTING REQUIREMENTS

Respond to any special reporting requirements specified in the award terms and conditions, as well as any award specific reporting requirements.

Nothing to Report.