U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology
University Transportation Centers Program
National University Transportation Center Grant No. 69A3551947136

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:
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Submission Date: October 31, 2021

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


Signature of Submitting Official:

_________________________________
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 in their final months and are either complete or nearing completion. All projects selected for Year 2 (shown in Table 2) have begun.

### Table 1. NICR Year 1 Projects 2020 – 2021.

<table>
<thead>
<tr>
<th>Pillar 1 Urban and Rural Traffic Management in the Age of Big Data</th>
<th>Lead</th>
<th>Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1 Demand-Side Management of Auto Traffic</td>
<td>Walker &amp; Hansen UCB</td>
<td>Lin &amp; Z. Wang USF</td>
</tr>
<tr>
<td>1-2 Supply-Side Management of Auto Traffic</td>
<td>Sunkari TTI</td>
<td>Cassidy &amp; Shen UCB</td>
</tr>
<tr>
<td>1-3 System Monitoring of Auto Traffic</td>
<td>Brydia TTI</td>
<td>Shen &amp; Cassidy UCB</td>
</tr>
<tr>
<td>1-4 Transit Priority Phase I</td>
<td>Li USF</td>
<td>Daganzo UCB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pillar 2 Battling Congestion Using Innovative Mobility Platforms</th>
<th>Lead</th>
<th>Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-2 Formulating Innovative Mobility Policies to Reduce Congestion</td>
<td>Shaheen &amp; Frick UCB</td>
<td>Sener TTI</td>
</tr>
<tr>
<td>2-3 Enhancing Equity and Access</td>
<td>Rodriguez UPRM</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pillar 3 Incentivizing Transit in the Face of Innovative Alternatives</th>
<th>Lead</th>
<th>Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1 Influencing Travel Behavior via an Open-Source Platform</td>
<td>Barbeau &amp; Maness USF</td>
<td>Turner TTI</td>
</tr>
<tr>
<td>3-3 Targeting Transit Incentives to Congestion Sources</td>
<td>Rodriguez &amp; Chatman UCB</td>
<td>P. Chen &amp; Winters USF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pillar 4 Battling Congestion on Freeway Corridors</th>
<th>Lead</th>
<th>Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1 Pricing Mechanisms for Managed Lanes</td>
<td>Burris TTI</td>
<td>Figueroa UPRM</td>
</tr>
<tr>
<td>4-2 Proactive Congestion Management</td>
<td>Concas &amp; Perk USF</td>
<td>Kuhn TTI</td>
</tr>
<tr>
<td>4-3 Corridor-Wide Surveillance Using Unmanned Aircraft Systems</td>
<td>Colucci UPRM</td>
<td>Zhang &amp; Kourtellis USF</td>
</tr>
</tbody>
</table>
Table 2. NICR Year 2 Projects 2021 – 2022.

<table>
<thead>
<tr>
<th>Pillar 1 Urban and Rural Traffic Management in the Age of Big Data</th>
<th>Project</th>
<th>Lead</th>
<th>Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4.2 Transit Priority Phase II: Network Control in Realistic Settings with Heterogeneous Vehicles</td>
<td>Li USF</td>
<td>Cassidy &amp; Daganzo UCB</td>
<td></td>
</tr>
<tr>
<td>1-5 Multimodal strategies for mitigating congestion from urban parcel delivery</td>
<td>Hansen &amp; Walker UCB</td>
<td>Lin, Wang, &amp; Zhang USF</td>
<td></td>
</tr>
<tr>
<td>1-6 Predicting Travel and Congestion in a Post-Pandemic America</td>
<td>Burris TTI</td>
<td>Figueroa UPRM</td>
<td></td>
</tr>
<tr>
<td>1-7 Developing a Regional Signal Performance Measurement Methodology in the 2021 Urban Mobility Report</td>
<td>Schrank TTI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Pillar 2 Battling Congestion Using Innovative Mobility Platforms</th>
<th>Project</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3.2 Optimizing Service Areas to Reduce Congestion and Enhance Equity in Access to Transportation Systems</td>
<td>Rodriguez UPRM</td>
<td></td>
</tr>
<tr>
<td>2-4 Enhancing Equitable Access to Opportunities Using Traveler Behavior Data</td>
<td>Lasley TTI</td>
<td></td>
</tr>
<tr>
<td>2-5 Understanding Curb Management and Targeted Incentive Policies to Increase Pooling</td>
<td>Shaheen UCB</td>
<td>Sener TTI</td>
</tr>
<tr>
<td>2-6 Pilot Application of Biometric-Based Vehicle Occupancy Detection on Managed Lanes for Congestion Reduction</td>
<td>Hendricks USF</td>
<td></td>
</tr>
</tbody>
</table>

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<th>Project</th>
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</tr>
</thead>
<tbody>
<tr>
<td>3-1.2 Influencing Travel Behavior via an Open-Source Platform</td>
<td>Valdes UPRM</td>
<td></td>
</tr>
<tr>
<td>3-4 Social Carpooling-based Road Congestion Mitigation: A Three-Level Analysis</td>
<td>Chen USF</td>
<td>Li TTI</td>
</tr>
</tbody>
</table>

<table>
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<th>Pillar 4 Battling Congestion on Freeway Corridors</th>
<th>Project</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-4 Freeway Incident Detection and Management using Unmanned Aircraft Systems</td>
<td>Colucci UPRM</td>
<td>Zhang &amp; Kourtellis USF</td>
</tr>
<tr>
<td>4-5 Feasibility of a Regional Transportation Systems Management and Operations (TSMO) Program</td>
<td>Williams USF</td>
<td></td>
</tr>
</tbody>
</table>

What was accomplished under these goals?

- Three Year 1 projects (listed in Table 1) are complete; 1 has been published to the NICR webpage, and two are in peer review and will be complete within the next month; the remaining six are nearing completion.
- All Year 2 projects (listed in Table 2) are underway, 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.
- Year 2 subcontracts have been fully executed between USF and all NICR partner campuses (UCB/TAMU/UPRM).
- NICR continues to make progress with FDOT, TxDOT and Caltrans regarding matching funds/projects.
▪ The Project 1-1 research team completed their research on Demand-Side Management of Auto Traffic for Urban Parcel Delivery and is now in the process of disseminating their findings.
▪ The Project 1-2 research team identified a method to establish a metering technique in simulation and generate a simulation scenario that simulates an at-grade rail crossing with a preemption applied to the software-in-the-loop controller.
▪ The Project 1-3 research team unveiled how commonplace spatial patterns in transportation-on-demand contribute to congestion formation and propagation on streets networks and how this congestion can be more effectively mitigated using traffic signals to meter vehicle inflows into crowded neighborhoods.
▪ The Project 1-4 research team has developed a preferred means of coordinating traffic signals city-wide.
▪ The Project 2-2 research team executed a photovoice activity for users of pooled mobility services and public transit connected participants with transportation industry stakeholders through focused discussion and relevant photographs.
▪ The Project 2-3 research team trained machine learning-based models to predict the spatial equity of dockless micromobility services at the system-wide level.
▪ The Project 3-3 research team assessed the effectiveness of CTR measures on vehicle trip rates (VTR) over time and on vehicle miles traveled (VMT), quantified the effects of various employer-provided incentives on employees’ modal shift towards sustainable alternatives, and identified the most effective incentive tools.
▪ The Project 4-1 research team completed their research on Pricing Mechanisms for Managed Lanes and is now in the process of disseminating their findings.
▪ The Project 4-3 research team completed their research on Corridor Surveillance using UAS and is now in the process of disseminating their findings.
▪ A website for the Tampa Bay Citizens Transportation Academy (TB-CAT) was developed and launched, TB-CAT was advertised across multiple platforms, residents of the Tampa Bay area have registered for the course, speakers have been identified and scheduled, the course has been launched, and students have been recruited to pair with residents to complete projects.
▪ The final month of the NICR 2021 Summer Undergraduate Research Internships occurred during this reporting period; both interns prepared a paper and did a presentation virtually to faculty, staff and students discussing their internship research. Additionally, both students were hired by the PIs on their summer projects to continue work after their internship concluded.
▪ The Urban Mobility Report (UMR) team developed and released the 2021 UMR on June 29, 2021; 378 media items were disseminated with coverage that includes mentions in USA Today, The Hill, Bloomberg News, The Washington Post, The Chicago Tribune, The Boston Globe, and CNBC news, among other media outlets.

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; three newsletters have been published during this reporting period.
▪ During this reporting period, 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; 341 people viewed these webinars live and an additional 152 people have watched recordings.
- The Project 1-4 research team presented research results at the Automated Road Transportation Symposium (ARTS) on 2021, July 13, 2021.
- The Project 2-2 research team presented their final study results on “Formulating Innovative Mobility Policies to Reduce Congestion” for the NICR webinar on August 26, 2021.
- A member of the Project 2-3 research team presented the paper titled “Equity Considerations in the Rebalancing Operations of Dockless Micromobility Systems” at the XXI Pan American Congress of Transportation and Logistic (PANAM) on August 12, 2021.
- The Project 3-1.2 research team presented on the development of their project at “Mega Viernes Civil,” a civil engineering convention held in Puerto Rico; additionally, this team presented their work on “Influencing Travel Behavior via an Open Source: Implementation of OneBusAway in Mayaguez, Puerto Rico” for the NICR Webinar Series.
- The Project 3-3 research team presented results from their research entitled, “Commute Trip Reduction-Based Congestion Mitigation, What Works and What Doesn't Work?” for the NICR Webinar Series; additionally, the research outcome for this project has been organized as a lecture for a course at USF, URP 6711 Multimodal Transport Planning.
- The Project 3-1.2 research team exposed high school students to their research through the Summer Transportation Institute (STI), a summer camp for high school students to motivate them to pursue STEM related high education; students helped collect data and prepared a presentation titled “Prediction Verification of OneBusAway and Land Use Analysis of the Mayaguez Area.”
- The Project 4-1, Project 2-3.2, and Project 4-3 research teams presented results from their research to the Secretary of Transportation and Public Works, the Executive Director of the Puerto Rico Innovation and Technology Service, and to officers from the Puerto Rico Department of Transportation during Transportation Week Festivities on July 15, 2021.

(From Left) Dr. Alberto M. Figueroa, NICR-UPRM PI; Prof. Ismael Pagán, UPRM Civil Engineering and Surveying Department Head; Eng. Eileen Vélez, Secretary of Transportation and Public Works; Enrique Volkers, Executive Director of The Puerto Rico Innovation and Technology Service, and Dr. Benjamín Colucci, NICR-UPRM CO-PI.

Research Assistants provided a presentation about the objectives and results from the four NICR research projects conducted at UPRM to the Secretary and transportation officers at the event.
The Project 4-1 research team presented “Comparing Pricing Mechanisms for Managed Lanes: Performance Assessment of PR-22 Dynamic Toll Lanes” for the NICR Webcast on August 12, 2021; additionally, this team presented project results to officers of Metropistas Puerto Rico, the Freeway PR-22 operator on August 27, 2021.

The Project 2-5 PI, was invited to a podcast to discuss emerging transportation mobilities together with equity, inclusiveness, and sustainability considerations: To Have or Have Not: When transformative mobility options are beyond the reach of underserved populations.

The Tampa Bay Citizens Academy on Transportation (TBCAT) team conducted outreach activities including sharing flyers and other marketing materials with the City of Tampa staff, the Hillsborough TPO staff, the Center Coordinator for Julian B. Lane Riverfront Park, Sulphur Springs Community Information page on Facebook, and through CUTR social media sites.


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; 8 seminars have been produced this reporting period and are available to view at any time on through the NICR and CUTR website.

NICR continued 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. During this report period, Florida LTAP conducted 41 webinars, which averaged 290 people per webinar and a total of 11,927 attendees from around the world. The Florida LTAPP continues to break attendance records and 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?

- As Year 1 projects are completed the final reports will be published and made available to the public through the NICR website.
- Three project teams have submitted papers regarding their research to journal publications which will be published after this reporting period.
- At least five project teams submitted papers and have been accepted to present their papers at the 101st annual Meeting for the Transportation Research Board in January 2022.
- NICR will continue to present Webcasts through the NICR website; four additional webcasts are scheduled through the end of December.
- The 3-1.2 Project research team will publicly launch the OneBusAway program in two bus systems- Mayaguez municipality and the university’s trolley system, and will begin gathering data on how the implementation of OBA affects ridership.
- Tampa Bay Citizens Academy on Transportation (TB-CAT) will host the TB-CAT class sessions and engage USF students in collaborating with course participants on their projects.
- The Project 4-5 team will convey Task 2 findings on regional collaboration frameworks and success factors to the Central Florida Regional TSMO Working Group.
- 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; six additional seminars are scheduled through the end of December.
- The NICR Summer Undergraduate Research Internships will continue.

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, Caltrans, Colorado DOT, Oregon DOT, Virginia DOT, Minnesota DOT, SanDAG out of San Diego, the City of Tampa, the Central Florida Regional TSMO Working Group, 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, Central Texas Regional Mobility Authority out of Austin, INRIX, the Puerto Rico Drone Academy, 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.
- New partnerships with transportation organizations that have begun during this reporting period include:
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

- Three research reports have been completed and submitted to NICR, one has been published to the NICR website, two are pending publication.
- Seven papers have been submitted to the 2022 Annual Meeting of the Transportation Research Board conference; five of these have already been accepted for presentation at the conference with the remaining 2 pending review.
- The results from three of the research projects are being developed into journal articles; additionally, two articles have already been developed and submitted to research journals and are pending review.
- The Project 3-3 research team has completed and submitted two manuscripts for Transportation Policy which are now under review.
- The NICR website at www.cutr.usf.edu/nicr is fully operational.
- The NICR Webinar Series, which started in January 2021, continues during this reporting period; 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 at https://www.youtube.com/channel/UCuciPnooGK5VvEHTFBCqVlg

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

Table 2. Performance Measures for Research Outputs.
<table>
<thead>
<tr>
<th>A. T2 Goal and Description</th>
<th>B. Performance Measure</th>
<th>C. Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal 1. Share new knowledge to address society’s challenges and opportunities for reducing congestion</td>
<td>Number of presentations and estimated audience sizes</td>
<td>8/545</td>
</tr>
<tr>
<td></td>
<td>Number of research reports and papers</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Number of peer reviewed journal publications and their citations</td>
<td>0</td>
</tr>
<tr>
<td>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.</td>
<td>TBD</td>
<td>--</td>
</tr>
<tr>
<td>Goal 3. Professional &amp; workforce development including educating &amp; mentoring next generation transportation professionals, training existing workforce and grooming future leaders</td>
<td>TBD</td>
<td>--</td>
</tr>
<tr>
<td>Goal 4. Commercialize research products to leverage public investment and yield broader implementation</td>
<td>TBD</td>
<td>--</td>
</tr>
</tbody>
</table>

- The following teams submitted papers to the Transportation Research Board conference set for January 2022.
  - The Project 2-2 research team submitted a paper summarizing their results.
  - The Project 2-5 research team’s paper titled “Strangers on This Road We Are On: A Literature Review of Pooling in on-Demand Mobility Services.” was submitted and accepted for presentation.
  - The Project 3-3 research team submitted two manuscripts which were both accepted for presentation at the TRB conference.
  - The Project 4-1 research team submitted two conference papers to TRB; one of the papers was accepted for presentation and recommended for publication review and the other is pending review. The papers are titled “Estimates of Willingness-to-Pay and Value of Time for the Dynamic Toll Lanes in Freeway PR-22 in Puerto Rico” and “Performance Assessment of the Dynamic Toll Lanes in Freeway PR-22 in Puerto Rico.”
  - The Project 4-3 research team submitted a manuscript titled “Comparison of Object Detection Algorithms Using Video and Thermal Images Collected from a UAS Platform: An Application of Drones in Traffic Management” to TRB which has been accepted for presentation.
- The Project 1-1 research team presented “CAV Traffic Management: Artificial Intelligence (AI) or Physics-based Modeling?” at Automated Road Transportation Symposium (ARTS) 2021, July 13, 2021.
- The Project 1-1 research team also hosted a workshop titled “Workshop for Global Advances and Future of Testbeds on Connected and Autonomous Vehicles” at IEEE ITSC 2021.

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 open-source platform OneBusAway (OBA) technology on buses in Mayagüez to enable future research on congestion reduction strategies. During this reporting period, the Project 3-1 research team implemented OBA in one of the transit services in Mayagüez and used real-time information collected from the platform for modeling and studying the impact on ridership. Their research continues into Year 2 through phase 2 of their project (Project 3-1.2). The main objective of phase two is to explore how travelers choose between public transit, Transport Network Companies (TNC) services, and other modes (e.g., micro-mobility) and how to influence this behavior (i.e., increase transit ridership) using OBA.

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.

<table>
<thead>
<tr>
<th>A. T2 Goal and Description</th>
<th>B. Performance Measure</th>
<th>C. Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal 1. Share new knowledge to address society’s challenges and opportunities for reducing congestion</td>
<td>Number of downloads of Journal of Public Transportation &amp; Journal of TDM Research</td>
<td>92,004</td>
</tr>
<tr>
<td>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.</td>
<td>Usage metrics for NICR website, project-related websites, and Congestion Help Desk</td>
<td>4,954</td>
</tr>
<tr>
<td></td>
<td>Number of articles in popular media</td>
<td>378 media items</td>
</tr>
<tr>
<td></td>
<td>Social media engagement (e.g. shares, comments, etc.)</td>
<td>2,063</td>
</tr>
<tr>
<td>Goal 3. Professional &amp; workforce development including educating &amp; mentoring next generation transportation professionals, training existing workforce and grooming future leaders</td>
<td>Contact hours in training, instructor-led and asynchronous learning</td>
<td>2,835</td>
</tr>
<tr>
<td></td>
<td>Courses taught by personnel on a NICR research project team.</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Number of students in courses taught by personnel on a NICR research project team.</td>
<td>2,437</td>
</tr>
<tr>
<td>Goal 4. Commercialize research products to leverage public investment and yield broader implementation</td>
<td>TBD</td>
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</tbody>
</table>

- The NICR Student Counsel organized the following NICR funded student activities during this reporting period:
  - The NICR Student Counsel organized a NICR workshop and invited four high-profile experts to speak and answer questions on the theme of “Congestion Reduction in the Smart Mobility Era” on September 15, 2021.
o The NICR Student Counsel organized the 2021 Friday Transportation Seminar Series
o A call for submissions for the 2021 NICR Ph.D. Dissertation Award and the 2021 Graduate/Undergraduate Fellowships has been disseminated; application receipt and review is underway.
o The Student Counsel sent three students (one presenter) to 24th IEEE International Conference on Intelligent Transportation Systems September 19-22, 2021.

Qianwen (Cami) Li presents her team’s work titled "Automated Vehicle Identification in Mixed Traffic" in the session of Theory and Models for Optimization and Control. This work posits the use of vehicle trajectory data to identify automated vehicles in a mixed traffic to reduce congestion.

o The NICR Student Counsel sent four students to the 2021 Automated Road Transportation Symposium (ARTS21) on July 12-15, 2021.
o The NICR Student Counsel sent three students to the TRB seminar State & Local Deployments of Connected & Automated Vehicle Infrastructure (3 students) on June 21, 2021
o The NICR Student Counsel sent two student presenters to the 2021 INFORMS Annual Meeting.
o NICR students participated in the Tampa Bay Transportation Supersession on September 23, organized by the Greater Tampa Section ITE (Institute of Transportation Engineers).

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

Year 1 projects are still underway, but innovative methods to address congestion are already being discovered. For example:

- The Project 1-3 research team unveiled how commonplace spatial patterns in transportation-on-demand contribute to congestion on streets networks and how this congestion can be more effectively mitigated using traffic signals to meter vehicle inflows into crowded neighborhoods.
- The Project 1-4 research team has developed a preferred means of coordinating traffic signals city-wide.
- The Project 1-5 team developed models that can assess how current delivery activities contribute to urban congestion and how the alternative delivery activities alleviate traffic congestion in urban areas in terms of congestion reduction percentage or reduction of vehicle hours.
- The Project 2-3 research team trained machine learning-based models to predict the spatial equity of dockless micromobility services at the system-wide level.
- The Project 2-5 team identified four key takeaways and five targeted incentive policy recommendations to increase shared trips among TNC users.
- The Project 3-3 research team assessed the effectiveness of CTR measures on vehicle trip rates (VTR) over time and on vehicle miles traveled (VMT), quantified the effects of various employer-provided incentives on employees’ modal shift towards sustainable alternatives, and identified the most effective incentive tools.
- The Project 4-1 team found that neither variable nor dynamic tolling are preferable; both methods were shown to regulate traffic flow on managed lanes for smooth operation and reduced congestion.
- The Project 1-2 research team identified a method to establish a metering technique in simulation and generate a simulation scenario that simulates an at-grade rail crossing with a preemption applied to the software-in-the-loop controller.
- In Phase 1, the project 4-3 team developed an initial protocol to integrate the use of drones into real-time incident detection on freeways and other high-speed facilities to assist in reducing congestion and delay, improve traffic operations, and enhance safety to be tested and refined in Phase II.

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.

<table>
<thead>
<tr>
<th>A. T2 Goal and Description</th>
<th>B. Performance Measure</th>
<th>C. Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal 1. Share new knowledge to address society’s challenges and opportunities for reducing congestion</td>
<td>Number of citations in professional publications by NICR PIs</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Changes in policies or practice resulting from research</td>
<td>1</td>
</tr>
<tr>
<td>A. T2 Goal and Description</td>
<td>B. Performance Measure</td>
<td>C. Achieved</td>
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<tr>
<td>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.</td>
<td>Numbers of subscribers to online networks, social media post reach, and reach of online peer-to-peer networks</td>
<td>66,368</td>
</tr>
<tr>
<td>Goal 3. Professional &amp; workforce development including educating &amp; mentoring next generation transportation professionals, training existing workforce and grooming future leaders</td>
<td>TBD</td>
<td>--</td>
</tr>
<tr>
<td>Goal 4. Commercialize research products to leverage public investment and yield broader implementation</td>
<td>Cumulative number of patent disclosures, patents received, licenses issued, and businesses formed</td>
<td>0</td>
</tr>
</tbody>
</table>

- The results of the performance measures recommended by the Project 4-1 research team on “Pricing Mechanisms for Managed Lanes” regarding the PR-22 dynamic toll lanes will be used by Metropistas to promote the congestion reduction and travel time savings from the managed lane facility to road users.

![View of the NICR PR-22 DTL prototype dashboard.](image)

The purpose of the tool is to assist transportation officials and freeway users in obtaining performance measures from the facility in a simple and direct way and can be made available for through the Internet as a technology transfer tool.

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.

- Although the immediate effects of the pandemic are easing, some of the projects continue to be impacted by ongoing effects. Some projects had to be delayed and we are still seeing the effects of that. Student activities are beginning to happen again, although our K-12 outreach activities for the summer of 2021 were not able to be conducted. The new USF contracting procedures appear to have the potential to streamline the contracting process in future years, and already seem to be much more efficient.
- Three of the four campuses continue to work both in person and remotely balancing safety and in-person/hands-on requirements for each project.
Due to the continued risks associated with the COVID-19 crisis and the related policies enacted by the government of Puerto Rico and the administration of the University of Puerto Rico, the research teams based out of UPRM continued working on project tasks through virtual meetings and other internet-based methods.

A member of the Project 1-3 research team is currently at Hong Kong University while other members of the research team are still at Berkeley; due to the COVID-19 travel restrictions, in-person meetings are not possible but virtual technology is being used while restrictions are still in place.

The Project 2-4 research team may not be able to receive national dataset from INRIX, in which case the study would have to shift to only examining urban areas in Texas and Maryland where data are readily available.

The Project 2-5 research team determined that, given that the pandemic has had significant effects on shared mobility, the team will include an evaluation of COVID-19 in the literature review.

The Project 2-6 research team had to pivot to a different test corridor and secure support and participation from partners in the new corridor, as the initial proposed participants declined participation. Additionally, this team anticipates that there may be challenges to participant recruitment of carpoolers and vanpoolers needed for their study due to many people working from home.

COVID-19 has made recruiting students for data collection difficult for the Project 3-1 research team. Additionally, data collection for public transportation has been delayed pending safer conditions in Tampa, FL, and software updates to the data collection mobile app were delayed by undocumented changes in Google's Play Store policies surrounding location tracking, which caused initial updates to be rejected.

The transit systems related to Project 3-1.2 have yet to resume pre-pandemic operations, the Urban TIM system has yet to begin operations, and the Rural TIM system is working but under strict guidelines that affect data collection.

Due to the COVID-19 pandemic, the Tampa Bay Citizens Academy on Transportation will provide the classes in a completely virtual platform.

The Summer interns received an in-person experience this summer, however, there were certain opportunities we were not able to offer, such as an in-person presentation at the end, networking opportunities with other students on campus, and the usual social gatherings.

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.