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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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Grant Period: July 1, 2019–September 30, 2023

Reporting Period: April 1, 2020 – September 30, 2020, Second Semi-Annual Progress Report

Signature of Submitting Official:

A handwritten signature in black ink, appearing to read 'Li Xiaopeng'.

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. NICR has selected its Year 1 projects (in the original proposal) as shown in Table 1.

Table 1. NICR Year 1 Projects 2019 – 2020.

	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	Rodriguez & Chatman UCB	P. Chen & Winters USF
Pillar 4 Battling Congestion on Freeway Corridors			
4-1	Pricing Mechanisms for Managed Lanes	Burriss 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?

- With the departure of Robert L. Bertini in August 2020, the leadership of NICR has smoothly transitioned to the new NICR Director, Li Xiaopeng. He is assisted by the newly designated NICR Senior Program Manager, Kristine Williams.
- All Year 1 projects, which are listed in Table 1, are now 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 1 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.
- 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. The Dean of Administration of UPRM signed off on OBA implementation in the UPRM bus system. The development of a collaborative agreement between the UPRM and the city of Mayaguez has been approved and is underway for review and signature by the corresponding authorities.



What opportunities for training and professional development has the program provided?

- NICR continues to support the USF Friday Transportation Seminar series which is delivered online and will be launching the NICR webinar series during the next reporting period.
- 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.
- Two undergraduate summer internships were offered by Texas A&M. The interns contributed to ongoing NICR research projects and each developed a research presentation and research paper/technical memo describing their work.

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- Three NICR faculty members (Alberto Figueroa, Benjamín Colucci, and Didier Valdés) participated in an expert panel event called The Future of Smart Cities held on May 20, 2020. The event was part of a graduate course but open to the UPRM academic community. Eleven experts from different disciplines (engineering, social sciences, public policy, computer science) shared their knowledge and experience about the implementation of Smart Cities.
 - Planning is underway for the NICR Citizen's Transportation Academy with the City of Tampa; NICR faculty at USF are collaborating with City of Tampa staff to define the project scope and stakeholders and are verifying the project match.
 - 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 36 webinar series, which averaged 419 people per webinar and a total of 15,091 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.

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

- NICR has established a website that will be another key hub for dissemination of research: www.cutr.usf.edu/nicr.
- The Project 2-3 research team produced a paper that was submitted for presentation at the 100th Annual Meeting of the Transportation Research Board in January 2021. The title of the paper is User Characteristics, Spatiotemporal Patterns, and Spatial Access in a Dockless E-Scooter Service in Puerto Rico.
- The Project 1-4 research team produced a paper which was submitted to the 24th International Symposium of Transportation and Traffic Theory (ISTTT24). The title of the paper is Scheduling of Heterogeneous Connected Automated Vehicles at a General Conflict Area.
- Project 3-1's Dr. Sean Barbeau produced a paper called "Improving the Quality and Cost Effectiveness of Multimodal Travel Behavior Data Collection: A Case Study" which was accepted for presentation at the 100th Transportation Research Board Annual Meeting. The paper was also submitted for further review for inclusion in the Transportation Research Record.
- Selected findings from NICR research were conveyed in a Smart Cities seminar held by UPRM.

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

- Preparations for Year 2 research project solicitation will be finalized along with invitations to serve on the NICR Advisory Board. Year 2 research projects are expected to launch in Spring 2021.
- Plans are in place to upgrade the NICR website, develop a newsletter, and 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 will continue and NICR will launch the NICR webinar series during the next reporting period.
- A scope and budget will be finalized and the Citizen's Transportation Academy with the City of Tampa will be launched.

- The Executive Committee continues to consider how best to redeploy resources for research and outreach projects in response to the COVID-19 pandemic.
- 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.
- NICR is currently in discussion with TBRTA and MetroPlan Orlando to establish future partnerships for potential research collaborations and matching funds.

2. PARTICIPANTS & COLLABORATING ORGANIZATIONS: Who has been involved?

OST-R needs to know who has worked on the project to gauge and report performance in promoting partnerships and collaborations.

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 during this period.
- New partnerships with transportation organizations that have begun during this reporting period include: 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.

Have other collaborators or contacts been involved?

- NICR has begun discussions with MetroPlan Orlando to explore possible research collaborations on Transportation Management and Operations (TSMO) strategies for the I-4 Corridor.
- NICR is in the preliminary stages of partnering with TBARTA on a potential congestion reduction research collaboration.

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

- The NICR website at www.cutr.usf.edu/nicr is up and operational.
- NICR is framing and planning its webinar series and Policy Brief formats.

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 many of the research projects were only recently initiated. 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	8/205
	Number of research reports and papers / their downloads	1/83
	Number of peer reviewed journal publications and their citations	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.	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	--

- Project 3-1’s Dr. Sean Barbeau produced a paper called “Improving the Quality and Cost Effectiveness of Multimodal Travel Behavior Data Collection: A Case Study” which was accepted for presentation at the 100th Transportation Research Board Annual Meeting. The paper was also submitted for further review for inclusion in the Transportation Research Record.
- Two additional papers were submitted for consideration, with decisions still pending at the time of this report:
 - 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.
 - The Project 1-4 team produced a paper which was submitted to the 24th International Symposium of Transportation and Traffic Theory (ISTTT24). The title of the paper is Scheduling of Heterogeneous Connected Automated Vehicles at a General Conflict Area.

- 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 and application examples of tools. The webinars were offered by NICR faculty (Didier Valdés, Ivette Cruzado, David González and Alberto Figueroa) and an invited speaker. Twelve students (nine undergraduate and three graduate students) participating in NICR projects also participated in the webinar series. The participating students were from the Civil Engineering, Industrial Engineering, Software Engineering, and Economics specialties. These webinars were offered on July 6, 13, 20, 30 and August 10, 2020 for 10 contact-hours.

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. The Dean of Administration of UPRM signed off on OBA implementation in the UPRM bus system. The development of a collaborative agreement between the UPRM and the city of Mayaguez has been approved and is underway to be reviewed and signed by the corresponding authorities.

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>	5042
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	0, please see issues encountered
	Number of articles in popular media and their reach	1/28,586
	Social media engagement (e.g. shares, comments, etc.)	373
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	776
	Courses taught by personnel on a NICR research project team.	75
	Number of students in courses taught by personnel on a NICR research project team.	2075

A. T2 Goal and Description	B. Performance Measure	C. Achieved
Goal 4. Commercialize research products to leverage public investment and yield broader implementation	TBD	--

- The NICR T2 Plan has four goals and related performance measures to report on research “outcomes,” as shown in Table 3 above.
- Two summer undergraduate research internship positions were awarded by Texas A&M.
 - Laura Holloway, TAMU Civil Engineering undergraduate, was matched with Dr. Mark Burris, conducting data analysis on his project “Pricing Mechanisms for Managed Lanes.”
 - Robert Hendrix III, TAMU Industrial & Systems Engineering undergraduate, was matched with Shawn Turner and Ipek Sener of TTI, conducting data collection and analysis for the USF-led project “Influencing Travel Behavior via Open Source Platform.”
- Two Texas A&M undergraduate summer interns contributed to ongoing NICR research projects and each developed a research presentation and research paper/technical memo describing their work. Laura Holloway analyzed data comparing the effects of different pricing mechanisms on expressways. Robert Hendrix collected and analyzed travel data using the One Bus Away phone application, to examine effects of variables including how the phone was carried and cellular vs. WiFi connectivity.
- UPRM offered a two-day lecture on May 13 & 18, 2020 to faculty and students of the graduate course ICOM 6115 Special Topics: Smart Cities from the UPRM Department of Electrical and Computer Engineering. The research teams from the four NICR projects being conducted at UPRM participated in offering the lecture. The lecture topic was the potential implementation of Smart Cities technologies, its impact on transportation systems and services, and the relationship with NICR and congestion reduction strategies.
- Three NICR faculty members (Alberto Figueroa, Benjamín Colucci, and Didier Valdés) participated in an expert panel event called The Future of Smart Cities held on May 20, 2020. The event was part of the activities of the ICOM 6115 graduate course but was open to the UPRM academic community. Eleven experts from different disciplines (engineering, social sciences, public policy, computer science) shared their knowledge and experience about the implementation of Smart Cities. The NICR faculty discussed how transportation systems are part of the system required to successfully implement smart cities, their respective visions for the implementation of smart cities in Puerto Rico, and their opinions on future economic development and research opportunities. The event was offered using video conferencing technology. Twenty-two participants were present. The online ad used for the event with the invited speakers is included below.

PANEL OF EXPERTS: THE FUTURE OF SMART CITIES



Dr. Ludmila Morales
Cognitive Radio



Dr. Fabio Andrade
Smart Grids



Dr. María Pérez, NCSE, INES
Environmental Sociology



Dr. Cecilio Ortiz, NCSE, INES
Public Policy and Sustainability



Dr. Alberto Figueroa, NICE
Transportation



Dr. Benjamin Colucci, NICE
Transportation



Dr. Odiel Vialdo, NICE
Transportation



Dr. Carla López del Puerto
Resilient Infrastructure



Dr. Fernando Vega
Artificial Intelligence



Dr. Isidoro Couvettier
Networking and Cybersecurity



Dr. Nayla Santiago
High Performance Computing

SMART CITIES GRADUATE COURSE

ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT



WHEN

Wed, May 20, 2020
10:30am to 12:30pm

CONNECTION

Google Meet:

<https://meet.google.com/wky-4hu1-wph>

Join by phone:

+1 216-930-9065

PIN: 906 234 519#

ADDRESSING THE TOPICS OF:

- Future vision of Smart Cities
- Economical and Research Opportunities

ALL ARE WELCOME!!!

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	0
	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	3794
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.
- 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.

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- 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, the I-Corps event was delayed and plans are underway to transition to a virtual platform.
 - Due to COVID-19, OPS (hourly) hiring was suspended at USF for a period of time which resulted in the loss of an intended research specialist. This personnel shortage led to unexpected delays in data analysis for one of the projects. Once able, a Graduate Assistant was hired as a replacement and the project is currently back on schedule as planned.
 - Due to COVID-19, test centers for UAS operator licenses have been closed most of this reporting period and have just recently opened, though with limited capacity. This has affected one team in the scheduling of the critical task of obtaining operator licenses for team members.
 - For two teams, the effect of COVID-19 on travel rendered much of 2020 travel data meaningless. These teams opted instead to use 2019 travel data or secondary sources with no negative impact on their study to date.
 - Travel to observation sites, particularly for partners in Puerto Rico, was impacted and at times prevented by COVID-19.
 - Due to COVID-19, some public transit systems related to one of the projects are not operating as usual; some systems are under strict regulations which include collecting passenger data and limiting bus capacity to 5 riders at a time. Further, the University of Puerto Rico's bus system is not operational due to remote academic operations. To circumvent these inconveniences, the project team has been using their personal vehicles to drive along the bus routes and test the systems related to OBA implementation, testing GPS sensors, and verifying that the program runs smoothly.
 - A technical glitch was discovered that impeded Google Analytics from tracking usage metrics on the NICR website. This issue has been resolved.

7. SPECIAL REPORTING REQUIREMENTS
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Respond to any special reporting requirements specified in the award terms and conditions, as well as any award specific reporting requirements.
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Nothing to Report.