UTC-Semi-Annual Progress Report

Portland State University

Submitted to:	U.S. Department of Transportation Office of the Secretary-Research
Grant Number:	69A3551747112
Project Title:	National University Transportation Center National Institute for Transportation and Communities (NITC) *Consortium members: Portland State University (PSU), Oregon Institute of Technology (OR Tech), University of Arizona (UA), University of Oregon (UO), University of Texas at Arlington (UTA), University of Utah (UU)*
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Submitting Official:	same as above
Submission Date:	October 29, 2021
DUNS:	05-222-6800
Recipient Organization:	Portland State University PO Box 751, Portland, OR 97207-0751
Grant Period:	November 30, 2016 – September 30, 2023
Reporting Period End Date:	September 30, 2021
Report Term:	Semi-annual
Signature:	

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1 ACCOMPLISHMENTS: What was done? What was learned?

1.1 What are the major goals of the program?

The major goals for NITC as described in our application fall into six categories:

Research

- **Build and extend existing research through Year 1 projects**. The first year of funding will support projects that extend some of our existing work, supplemented by a competitive peer-review process to select additional projects proposed by researchers of our consortium.
- **Competitive, peer-review project selection process in Years 2 through 5.** Our projects in Years 2 through 5 will be selected through a competitive request for proposal (RFP) process. These funds will be available for projects consistent with our theme.
- **Pooled Fund Research.** We will continue the Pooled Fund Research program which offers a process by which cities, counties, MPOs and other regional or local agencies can pool relatively small pots of research dollars to then leverage NITC matched funds for a single, collaborative project.

Leadership

- **High Standing within National and International Arenas of Transportation.** NITC faculty will continue to demonstrate leadership by disseminating their research within and outside of academia. NITC faculty help address national transportation problems through volunteer leadership on TRB committees and in other positions. By serving on these committees, faculty help set national research agendas and connect with agency leaders and practitioners on pressing research issues. To continue and reinforce this practice, NITC will mentor our new, tenure-track faculty to apply for committee and panel membership and recognize the activities of all faculty members.
- **Solving Regional and National Transportation Problems.** NITC's director and staff will serve as points of contact for agency leaders and policymakers regionally, statewide and nationally. When we identify needs that match the expertise of our researchers, we will make a connection. We will work with key staff at the DOT modal administrations, both in Washington, D.C. and within our regions, to determine the most effective way for our researchers to learn from and inform agency activities.
- **Future Leaders**. We recognize the investment we must make in our young faculty and students by prioritizing research projects that include them. We will also support students traveling to conferences to present their work, a key activity in developing the next generation of leaders.
- **Development and Delivery of Programs.** We demonstrate our leadership in innovating transportation education, workforce development, deployment of research results and conducting research.

Education and Workforce Development

- **Offer Degrees and Courses in Multiple Disciplines.** NITC university partners will continue to offer a rich array of degrees that serve the transportation profession.
- **Provide Experiential Learning.** Our campuses will continue to provide experiential learning opportunities, and NITC will seek ways to expand them.
- **Develop Innovative New Curriculum and Learning Opportunities.** We will develop new, innovative curriculum that can be tested and shared among NITC and other universities.

- **Educate Professionals.** NITC will maintain a vibrant program of seminars, workshops, professional courses and other training opportunities that provide practitioners with the latest tools and techniques.
- **Attract and Support Undergraduate Students.** NITC will support projects and initiatives that expose middle and high school students to transportation concepts and careers. The efforts aim to attract and retain new undergraduate students to our degree programs, involve undergraduates in our research, increase the number of women and students of color in these programs, and expand the diversity and capacity of the transportation workforce.
- **Attract and Support Graduate Students.** NITC will support graduate students directly through research assistantships working on projects. We will provide dissertation fellowships for students to research surface transportation topics that fit under the NITC theme. This will be a competitive process open to Ph.D. students at NITC universities multiple times throughout the year.

Technology Transfer

- **Move Research into Practice.** We aim to bridge research and practice by interpreting results, and identifying how and by whom they can be best applied in practice. Our Technology Transfer Plan systemizes the integration of research into practice. As part of this plan, projects are given a ranking based on their technology readiness level and an implementation plan is developed for all projects showing implementation potential based on this ranking. This process will ensure research results have a greater chance of being used in practice.
- **Use Innovative Approaches to Communicate Research Results**. NITC will embark on an ambitious program of sharing information through traditional and new media.

Collaboration

- **Collaborate within our consortium.** Our governance structure is cooperative and leadership is distributed. The Executive Committee includes one faculty member from each campus, and it provides overall direction for the Center, makes project funding decisions, and selects NITC award recipients, including student of the year. They will meet in person at least once a year, rotating the location between campuses, and hold regular conference calls. Each Executive Committee member will be responsible for representing and supporting their respective campus.
- **Collaborate externally.** In addition to the partnerships that occur through individual projects and the pooled-fund program, NITC will foster collaboration with a range of "end-users" of our work through an External Advisory Board. As the national UTC for improving the mobility of people and goods, NITC will work with OST-R staff to foster collaboration between all the UTCs focusing on this DOT priority. Primary aims will be to avoid duplication of efforts and identify opportunities for collaboration.

Diversity

- **Attract underrepresented students to transportation careers**. We aim to attract underrepresented students to transportation through programs that target middle, high school, or elementary school students. We do this by providing funds to researchers who engage underrepresented students in their projects, collaborating with WTS, STEM and education experts, and expanding our National Summer Transportation Institute (NSTI) Program to partner campuses.
- **Priority funding to research with an equity focus.** We give priority to funding research projects that have an equity focus by awarding them additional points in the RFP process.

1.2 What was accomplished under these goals?

1.2.1 Research

NITC has funded 72 research projects through General Research (56), Small Starts (14) and Pooled-Fund grants (2). The General Research grant program supports larger-scale projects. The Small Starts grant program funds researchers who have not yet had the opportunity to undertake significant transportation research. All projects have to be consistent with NITC's theme, are peer reviewed, and are selected by the NITC Executive Committee via consensus. During this reporting period, there were 35 active projects, of which 5 were completed.

Build and extend existing research through Year 1 projects.

The 10 Initial Research Projects funded by NITC (close to $2 million) engage 22 researchers. Seven projects involved more than one partner university, demonstrating our commitment to collaboration. The projects are, on average, 95% complete. (Appendix, Table 1). Six projects are complete, and their final reports are available online.

Competitive, peer-review project selection process in Years 2-5.

General Research: In August 2021, seven proposals were selected from 29 total proposals for funding through the fifth General Research RFP (Appendix, Table 6). The awards range from $53,991 to $75,000 for a total of $485,456 in NITC funding. The funding request of all proposals was $1,955,716.

In July 2020, 11 proposals were selected out of 43 total proposals for funding through the fourth General Research RFP (Appendix, Table 5). The awards ranged from $67,619 to $147,448 for a total of $1,142,665 in grant funding. The funding request of all proposals was $4,562,006. Their research progress has been significantly affected by the COVID-19 pandemic. On average, the projects are 65% complete. One active project presented their economic impact assessment of supply chain disruptions in a post-earthquake environment to Utah's FEMA Integration Team in April 2021 and to FEMA's RAD-X Training Workshop on September 30th.

In June 2019, ten proposals were selected out of 37 total proposals for funding through the third General Research RFP (Appendix, Table 4). The selection process included prioritization for projects relating to multimodal transportation data and transportation-land use-housing interactions. The awards ranged from $53,702 to $145,650 for a total of $1,035,794 in grant funding. The funding request of all proposals was $3,803,378. Three projects are complete, and their final reports are available online. Two other projects have submitted draft final reports that are being copy-edited and peer reviewed. On average, the 11 projects are 86% complete. These projects have been significantly affected by the COVID-19 pandemic, but progress is being made. One project became two projects, and both have been completed.

In June 2018, eleven proposals were selected for funding through the second General Research RFP (Appendix, Table 3). These projects ranged from $38,049 to $149,973 for a total of $925,578. Nine of the projects are complete, and the other two are 95% complete.

The first RFP for General Research was issued in spring 2017. Six projects were selected, ranging from $39,932 to $99,764, for a total of $437,762 (Appendix, Table 2). These projects are fully complete, and their final reports are available online.

Small Starts: For the third round, five proposals were selected for total funding of $99,916 in November 2019. Their progress was slowed by the COVID-19 pandemic; but three are complete and their final reports are available online. Overall, they are 92% complete. In 2018, three Small Starts projects were awarded $60,000 in funding (Appendix, Table 3). They are all complete. In 2017, six Small Starts projects were funded. Project budgets were approximately $20,000, for a total of $119,924 (Appendix, Table 2). Five projects are complete, and the one still active is 85% complete.

Transportation for Livable Communities Pooled Fund Research

NITC's Pooled Fund program offers a process by which cities, counties, MPOs and other regional or local agencies can pool relatively small pots of research dollars to then leverage NITC matched funds for a single, collaborative project. In January 2019, two Pooled Fund Projects were awarded $350,000 in funding from NITC and partners. One project, Applying an Equity Lens to Automated Payment Solutions for Public Transportation project, is complete and the final report is available online. The other project, Exploring Data Fusion Techniques to Derive Bicycle Volumes on a Network, will be completed by the end of this year.

1.2.2 Leadership

High Standing within National and International Arenas of Transportation

- Sirisha Kothuri, PSU Senior Research Associate in civil engineering, was awarded Association of Pedestrian and Bicycle Professionals (APBP) researcher of the year. This is the second year in a row that PSU researchers have earned this award.
- CJ Riley, OIT, was honored with the 2021 Outstanding Teaching Award by the American Society for Engineering Education PNW for his innovative instruction in bridge and transportation structures design.
- Jennifer Dill, NITC director, received PSU's 2021 PSU Presidential Career Research Award. She also served as a reviewer for TRB's Racial Equity Addendum to Critical Issues in Transportation. The report "is intended to be a step in the process of identifying and building a research agenda for transportation that will help to more fully identify and address inequities and injustices caused and contributed to by transportation."
- Chris Monsere, PSU, was appointed Associate Dean for Academic Affairs and Innovation in the Maseeh College of Engineering and Computer Science.
- In May, Keith Bartholomew was recognized with UU's Distinguished Teaching Award.

Solving Regional and National Transportation Problems

During this reporting period, activities and progress in this goal area include:

- On June 18, Arthur C. Nelson, UA, briefed Representative Earl Blumenauer on his findings on transit impacts on jobs, people, and real estate, which included a decade of NITC research.
- Jennifer Dill, PSU, led a team, in partnership with Toole Design, to develop a Research Roadmap for the AASHTO Council on Active Transportation. The Roadmap was released in July 2021 and will help AASHTO advance research related to active transportation safety and mobility.
- Jennifer Dill, PSU, spoke at the US DOT Gender Justice Work Session, attended by over 80 US DOT staff and leaders on August 5, 2021. The focus was on women and active transportation. Also speaking at the event was Dr. Shuasun Nahar, a former NITC Scholar, now a professor at Texas Women's University. She spoke about her research on women, interpersonal violence, and transportation. DOT's Gender Policy Council is working on a government-wide gender policy strategy due to the President in September. This was one of three work sessions for the Council to help develop that strategy.
- Arizona Public Media interviewed Arlie Adkins, UA, to get his perspective on the Regional Transportation Authority's goals in shaping the Tucson Metro.

Future Leaders

NITC support plays a critical role in developing students and faculty as leaders in their discipline through supporting research projects that include them. Of the 72 research projects, only two do not involve students, and 42 (58%) involve untenured, tenure-track faculty. The recently awarded round five

projects all have students included in their proposals, and four of the seven involve untenured, tenure-track faculty.

- Kate Hyun, UTA, who has been PI or co-PI on five NITC research projects, is the Civil Engineering nominee for the UTA College of Engineering Outstanding Early Career Research Award.

Development and Delivery of Programs

Our communications team leads the way in promoting NITC, UTC, and other transportation agencies' research outcomes and transportation events to the public via newsletters and social media. Our projects' final reports and other products are published and freely available for download from NITC's project websites. They are also available from PSU's institutional repository, PDXScholar. For this report, we have included download data from both sources. Past reports have only included download data from the NITC websites. During this reporting period, nearly half of the final report downloads were from PDXScholar.

Downloads of NITC Outputs	**Reporting period**	**All-time**
Final reports	2,552	13,727
Project briefs	3,232	11,830
Webinars (views)	1,478	10,218
Datasets	128	505
Total	**7,390**	**36,280**

Downloads of final reports from project websites require downloaders to provide their email address, which NITC uses to request feedback. During this period, 74 people completed surveys on NITC reports (38 practitioners, 11 faculty/researchers, 8 students, 1 media/communications staff, and 16 other stakeholders). Fifty-three percent of respondents indicated that they downloaded the report to help make decisions about practice. They heard about the reports from: NITC newsletter 42%, web searches 25%, TRB/TRID search 14%, colleagues 8%, and other sources 11%. Seventy-seven percent of them rated the reports as very or somewhat useful, with 78% saying the reports met their needs, and 88% rated the clarity of reports as excellent or good.

1.2.3 Education and Workforce Development

Offer Degrees and Courses in Multiple Disciplines

The six-university consortium offers a total of 2 certificates, 17 bachelor, 23 master's and 10 PhD programs in transportation and closely related fields, including several dual degree options.

Provide Experiential Learning.

Our campuses connect transportation-focused students to community partners and employment opportunities by engaging them in activities and research that build on their course learning.

- NITC supports student groups on each of our partner campuses. Under the guidance of the Executive Committee member, each group is able to set its own agenda and priority to cater to its unique student body, goals, and interests. Since the COVID-19 pandemic shut down in-person activities in March 2020, the student groups have not held many online activities. During this reporting period, a total of ten events were attended by 147 student group participants (Appendix, Table 8). In-person activities resumed in the Fall 2021 term.
- Last spring, UU students and Salt Lake City Public Lands staff visited parks, trails, and natural lands to share information about the transformative projects in "Reimagine Nature: Salt Lake City Public Lands Master Plan."

- A new Academic Research Community, sponsored by the UO's School of Planning, Public Policy and Management, called "Sustainable Cities & Public Good" will have students explore how communities are designed and function, including transportation.
- In Spring 2021, PSU Civil Engineering students participated in phase 2 of a Better Block project to improve pedestrian safety that started in Fall 2020 involving PSU Urban Planning students. Guided by PSU engineering professor Evan Kristof and community feedback, the civil engineering students came up with a temporary pop-up and more permanent designs for the intersection near a school. "We were given a blank slate to work with, and pushed outside of our comfort zone by Instructor Evan Kristof– but he was always there to bail us out if we went too deep. Unique to this engineering class, we had to learn public speaking skills working with clients and accept that not every solution fits perfectly into a box," shared Raymond Poss, CE student leader. "We experienced a lot of growth in pitching ideas, making mistakes, and supporting one another in finding solutions. Recognizing and learning to accept the limitations of real-world transportation challenges felt good in the end, and it increased our capacity to work holistically with our counterparts in planning wherever we go next."

Develop Innovative New Curriculum and Learning Opportunities.

Oregon Tech created two new transportation courses: Bicycle and Pedestrian Facility Design and Traffic Impact Analyses.

Educate Professionals

During the reporting period, NITC supported 9 events that were attended by 1,217 professionals: 5 webinars attended by 716 individuals (primarily practitioners) and 4 Friday Transportation Seminars attended, virtually, by 501 people (mostly practitioners). The webinars and seminars are open to the public, webcasted to enable professionals and individuals across the country to participate, and recordings are posted on NITC/TREC websites. Viewers streamed our events from all over the United States, Canada, and several other countries. Each of these events are one-hour long and attendees may receive one AICP professional development credit. During this period, APA awarded practitioners 582 AICP credits, and the practitioners rated TREC's events 3.9 out of 5 stars. Since 2000, the events have a 4.1 out of 5 rating from 9,041 reviews. Attendees must fill out an evaluation form to receive their AICP credit, and we use this feedback to improve future events. Some of the feedback is included in the impacts section of this report.

- In September, NITC hosted a week-long bikeway design workshop for 12 transportation professionals from Oregon, Washington, Idaho, Montana, and California. From a post-workshop survey, one attendee mentioned, "I have already started to use it and reached out to instructors and dug through different manuals that were shared in the workshop. I am hoping that some of the things I learned about can be implemented on our bikeways." Another shared, "I've already used references and data presented at the workshop for a project in the Tri-Cities. I am working to strengthen my bike network design resume to continue working on projects across the PNW."

Attract and Support Undergraduate Students.

NITC recognizes that transportation workforce development does not always take place at the university level. Students' interest in transportation can start much earlier, which is why NITC aims to attract and retain new undergraduate students to transportation-related degree programs and increase the number of underrepresented students in these programs. NITC awarded scholarships to 36 undergraduate students.

- John MacArthur and Kelly Clifton mentored two students participating in PSU's altREU project-based program. The students' experience culminated in presentations on grocery delivery and e-scooter safety.

- OIT students introduced middle and high school students to roundabouts and bicycle facility design at the Henley High School STEM night.
- UO included two undergraduate students in the creation of a guidebook based on Marc Schlossberg's NITC Rethinking Streets During COVID-19 project.
- Twenty-three high school students attended the National Summer Transportation Institute at PSU. The objectives of the camp are intended to: improve STEM skills, provide awareness about transportation related careers, encourage students to consider transportation related fields of study in their higher education pursuits; and to attract underserved, underrepresented students to the transportation field. One of the camps was for girls only, and 61% of students identified as non-white or more than one race. The six-member of intermodal advisory committee were women and non-white. The camp utilized the set of four "How Walkable is Your Neighborhood?" education modules developed last year.

Attract and Support Graduate Students.

NITC awarded scholarships to 46 Master's and 5 Ph.D. students. NITC offers dissertation fellowships to Ph.D. students who have advanced to candidacy. This reporting period, NITC's Executive Committee awarded a dissertation fellowship to Seyed Hassan Ameli, UU, for "Toward Automating the Measurement of Urban Design Qualities Related to Walkability."

1.2.4 Technology Transfer

Move Research into Practice.

NITC created a new funding opportunity, Translate Research to Practice, for NITC researchers to build on previous NITC projects' accomplishments, strengthen partnerships with transportation agencies and community organizations, and produce outputs for practitioners. This summer and fall, NITC awarded five projects for a total of $297,223 (Appendix, Table 7). Projects are intended to take research results from previously funded projects and apply them to practice..

Use Innovative Approaches to Communicate Research Results.

NITC created a new effort to communicate past research results, Research Roadmaps, that aim to assess the cumulative body of UTC-funded research and help define what future research and workforce development efforts UTCs can embark on to meet the most important challenges facing transportation agencies and policymakers. There will be six roadmaps involving multidisciplinary and multi-university team members. Each research Roadmap will include the following: overview, current knowledge, research gaps, and workforce needs. During the process of developing the Roadmap, each team will hold at least one virtual workshop with practitioners to help assess key gaps and workforce needs. The six roadmaps will be funded at $50,000 each for a total of $300,000 with 1:1 matching funds.

In a positive shift since the last reporting period, growth and engagement has grown across all social media platforms, the NITC website, and our newsletters. Updated daily, the NITC website saw 13,001 site visitors during this reporting period. This was an 6.5% increase from the last period. Our highest engagement with U.S. web visitors by state is as follows: Oregon, California, Texas, Virginia, and Washington.

We published thirty-four NITC stories on research results, newly funded projects, the impact of events, and monthly NITC Student Spotlight interviews. The Spotlights showcase the outstanding students supported by NITC funding, including student group leaders, NITC Dissertation Fellows, and research assistants on NITC-funded projects. All of these stories are shared in our monthly NITC newsletter with 5,859 subscribers (24.9% open rate; 12.5% click-through rate) dedicated to communicating NITC research and events.

1.2.5 Collaboration

Collaborating within our consortium.

NITC's governance structure is collaborative and encourages multiple perspectives on decision-making from Executive Committee members. The Executive Committee holds regular virtual meetingsto discuss funding of projects, and address issues, particularly how to adapt to effects on research and travel due to the COVID-19 pandemic. During 2021, the Executive Committee has been meeting monthly to discuss the next round of research funding, tech transfer projects, work on creating a collaborative research roadmap, and education projects focused on racial equity.

NITC also encourages our consortium faculty to collaborate on research projects. Of the 72 research projects funded to date, 43% (31) involve more than one consortium partner, and 57% (41) of the research projects included investigators from more than one discipline.

- An active Round 4 research project has PSU and UU faculty working to understand how people from selected historically marginalized communities experience discrimination and harassment on transit.
- PSU Engineering students contributed to UO's Sustainable City Year Program by working on designs and budget estimates for four of their projects.

Collaborating with other UTCs.

- Jennifer Dill and Hau Hagedorn participated in the UTC Mobility Summit, hosted by Mobility21. Jennifer co-led one of the breakout discussion groups.
- Susan Handy (NCST director) and Yinhai Wang (PacTrans director) serve on the NITC Advisory Board.
- NITC supports research dissemination of other UTCs through our social media.
- Many peer reviewers of NITC final reports and proposals are faculty working with other UTCs.

External collaboration

During this period, the NITC Advisory Board members did not meet. Some members were involved this spring and summer in reviewing proposals. In addition to serving on the board, several work for organizations that provide matching funds and collaboration on NITC research projects.

1.2.6 Diversity

Attract underrepresented students to transportation careers

NITC uses several approaches aimed at attracting women and people of color into the transportation field. This includes offering programs and fostering partnerships with partners that achieve this goal.

- Ash Avila, a 2022 TRB Minority Student Fellow, will be a junior this fall in the Sustainable Built Environment undergraduate program at the University of Arizona. She is working with UA faculty, Ladd Keith, Nicole Iroz-Elardo and Kristina Currans, on a NITC Round 5 project looking at the intersection of transportation and heat as it relates to climate adaptation planning for active travelers.
- NITC PIs are encouraged to submit requests to support undergraduate or graduate research assistantships for underrepresented students. During this period, two projects funded by NITC Diversity awards were completed.
    - Victor Pierce, PSU sociology student, worked with Amy Lubitow on a qualitative study on the barriers for BIPOC men from becoming routine cyclists.
    - Summer Stevens, UU civil engineering student, worked with Abbas Rashidi, on evaluating the effect of work zone features on road capacity.

- Oregon Tech's 2021-22 ITE Student Chapter is being led by a woman president for the third consecutive year. Four of the five leadership roles are filled by women, two are women of color.

Priority funding to research with an equity focus.

Over half of our research projects have a significant focus on equity. In the Appendix, Tables 1-6, these 39 projects are indicated by asterisks after their titles. Some examples of equity issues addressed by these research projects include:

- examining barriers to access, including the connections between transportation, land use, and housing;
- developing clear sets of strategies or interventions that will generate more inclusive measures of transportation behaviors;
- examining electronic wayfinding technology for visually impaired travelers;
- evaluating the impact of ADA on transit ridership and equity implications for people excluded or greatly inconvenienced by paying for transit through non-cash based collection technologies; and
- optimizing housing and service locations to provide mobility to meet the mandated obligations for former offenders to improve community health and safety.

In addition to our faculty research projects, two recently completed NITC Dissertation Fellowships included a focus on equity issues.

- "Identifying and Measuring Transportation Challenges for Survivors in Intimate Partner Violence Shelters" was conducted by Sarah Leat, UTA. She explains that her project "sought to identify environmental factors within the built environment which impact survivors of intimate partner violence residing in domestic violence shelters. The findings indicate that…the location of the shelter can impact residents' mobility. Shelters placed in areas lacking public transportation or resources such as places of employment and health care significantly impact residents' ability to regain economic independence."
- "Free Movement: Enhancing Open Data To Facilitate Independent Travel For Persons With Disabilities" was conducted by Shiloah Deitz, UO. She explains that "across the U.S. there is a lack of both data for accessible pedestrian routing, and tools for filling in those data. AI methods have contributed to filling in missing data for applications like autonomous vehicles, but much less often to intervene in quality of life improvements. Critical 'geoAI', that is, bringing a critical geographic lens to artificial intelligence applications, has the potential to contribute to the amelioration of these data and analytic gaps."

1.3 How have the results been disseminated?

Research results are disseminated through various venues that include presentations at conferences, monthly webinars and through papers and reports. The NITC communication team delivers a monthly newsletter on NITC research, tech transfer opportunities, and researcher accomplishments to 5,859 subscribers, as well as social media channels on Twitter, Facebook, YouTube, and LinkedIn. These efforts are described in more detail in sections 1.2.4, 3.1 and 3.2.

- In August, Marc Schlossberg, UO, went on Jefferson Exchange radio station and gave a talk in Ashland about street retrofits and climate change based on his NITC Rethinking Streets projects.
- John MacArthur, PSU, was quoted in a Washington Post article on e-bikes on 9/24/2021: "In studies we have done, we have seen e-bike owners able to get people who have never cycled before as adults to get out and use their e-bikes or people with physical limitations to start exercising again. What is great about e-bikes is that they break down a full range of barriers to cycling," MacArthur said. "If you are a young person that commutes to work, [an] e-bike allows

you to travel farther distances in less time and without sweating. For someone else, they might live in a hilly area and don't feel strong enough to cycle, an e-bike can also help them."

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

Expected highlights for the next reporting period include:

- Reporting on completion and progress of active research projects
- Reporting on student events and activities
- Updates on tech transfer and workforce development activities

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

2.1 What organizations have been involved as partners?

Each NITC research project must be supported by matching funds. Overall, NITC projects have 87 different partners from outside of the consortium providing matching funds, or contributions in other ways (Appendix, Table 10). This includes partners from local governments, non-profits, regional government agencies, state DOTs, transit agencies, and industry partners. The Round 5 General Research Projects awarded this summer included at least 12 new partnerships and 5 continuing partnerships.

- The NITC Round 4 project, App-based Data Collection to Characterize Latent Transportation Demand within Marginalized and Underserved Populations, led by Noelle Fields, UTA has received additional funding from the North Central Texas Council of Governments, which will also help with technology transfer.

2.2 Have other collaborators or contacts been involved?

TREC staff at PSU have been involved in TransPort, a transportation policy advisory group. NITC final reports have been included as supporting documents in the draft of Oregon Metro's 2021 regional Transportation System Management and Operations (TSMO) Strategy.

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

Technology transfer performance measures are summarized in Table 11.

3.1 Publications, conference papers, presentations, and events

Forty-four papers based on research from this FAST Act grant have been published in peer-reviewed journals, including 15 during this reporting period. They have been cited 221 times. Research is also published in conference proceedings (Appendix, Table 9). NITC has published 36 final reports, with one-page project briefs for each final report.

The final reports and publications form the basis for in-demand presentations by our researchers to their colleagues, practitioners, and the public. For example, on July 20, John MacArthur, PSU, presented a combination of several research projects titled "Micromobility & Vehicle Design of Today (and Tomorrow)" to over 300 attendees at the Institute of Transportation Engineers' virtual annual meeting.

3.2 Websites or other Internet sites

We leverage our strong online and social media presence to promote our research findings, expand the reach of our education, and elevate our faculty and student researchers. We also raise awareness of important transportation issues nationwide and findings that advance our center's theme.

- NITC website: Updated daily, the website provides comprehensive information about our center and complete research portfolio. This includes stories about our research, press coverage, tech transfer resources, professional development events, and opportunities for students.
- Twitter (TREC: 3,884 followers, +58): We promote NITC-sponsored research, publications, and events while also uplifting the activities of fellow UTCs. We share news and achievements from NITC-funded students, faculty, and ongoing projects. Launched in 2019, our NITC_UTC twitter 527 followers, +66) offers more effective framing of the consortium partnership.
- Facebook (1,070 followers, +32): In addition to sharing research, this platform shares photos of our events and offers connections with other organizations, researchers, and practitioners.
- YouTube (1,010 subscribers, +78): Where we publish freely accessible video recordings of weekly seminars at PSU, monthly NITC webinars, special lectures, student spotlights and more.
- LinkedIn (659 followers, +143): We target transportation professionals to share tools, practical information, and our latest studies.
- Flickr: An archive of photo collections from events we hosted or attended, most notably used to showcase the presence of NITC researchers and students at the annual meeting of TRB.
- Instagram (652 followers, +84): This platform introduces the people behind the research and puts a face to the center. Instagram has provided a high level of engagement, which we expect to help both our technology transfer and student recruitment efforts.

3.3 Events to support technology transfer

As described under Educating Professionals, NITC supported 9 events that were attended by 1,217 professionals: 5 webinars attended by 716 individuals (primarily practitioners) and 4 Friday Transportation Seminars attended virtually by 501 people (mostly practitioners). These events are eligible for AICP professional development credit.

3.4 Technologies or techniques

For her NITC project, Bi-objective Optimization for Battery Electric Bus Deployment Considering Cost and Environmental Equity, Xiaoyue Cathy Liu, UU, has worked with the Utah Transit Authority (UTA) to help them figure out how to efficiently deploy their new electric buses and chargers. "She developed a model to show run time, charge time, battery life—that we can do a systems deployment if we have a network of high-power chargers," Hal Johnson, UTA, explains. "The initial questions were about getting the charging infrastructure in the right place to support the system." In June, Liu gave a NITC webinar on her optimization model and her research to about 200 practitioners. Liu is in the process of creating a step-by-step guidebook to show, in detail, how to collect the right data and how to run the model. "We'll be developing an online visualization tool that uses the UTA network as an example," she explains. "It will be open source as well. Any agency can use the code and input their data." This project incorporates an equity focus, as co-PI Aaron Golub, PSU notes "typically, new types of amenities are first introduced in affluent neighborhoods—our hope is that this decision-making tool enables agencies to overcome those biases."

3.5 Inventions, patent applications, and/or licenses

N/A

3.6 Other products

N/A

4 OUTCOMES: What outcomes has the program produced?

Research Outcomes

NITC uses two measures to track research outcomes:

1. Number of stakeholders who collaborated on implementing research outcomes: 7.
   They included: City of Eugene, OR; City of Gresham, OR; Lane Transit District; Clever Consulting Group; RTD Denver; Pima County Public Works Administration, AZ; and Utah Department of Transportation.

2. Number of projects that reach deployment and adoption (measured by the number of projects that reach TRL scale 4 or 5): 8.
   Additionally, we have identified 8 projects that we believe will reach TRL scale of 4 or 5.

Attracting and retaining undergraduate and graduate students outcomes

- Sadegh Sabouri, recent UU PhD graduate, has been hired as a postdoc researcher at MIT's Senseable City Lab. He worked on multiple NITC projects with Reid Ewing.
- Alta Planning hired their PSU scholarship recipient, Trevor Luu, as an intern this summer, and just hired him as a part-time planner.
- PSU Masters of Urban and Regional Planning student Nick Meusch received an American Public Transportation Foundation (APTF) Board Scholarship.
- OIT student Anna Sheadel was awarded a dual Asphalt Pavement Association of Oregon (APAO) American Public Works Association (APWA) scholarship. Anna is now working for the Klamath County Roads Department.
- OIT student Jordan Preston-Hancock, NITC's 2017 Student-of-the-year, earned an MSCE focused on urban bicycle corridor design in 2021. She is now working with HLA Engineering in Yakima, WA.
- Two PSU civil engineering masters students, both of them 2019-2020 NITC Scholars, finished their respective theses in spring 2021. Both students went on to be hired as full-time transportation engineers at the Washington State DOT this summer:
    - Frank Boateng-Appiah "Improving Safe Bicycle Crossing at Unsignalized Intersections through Pavement Markings: Analysis of the City of Portland's Innovative Strategy"
    - Apy Das "Determinant Factors of Bicyclist Injury Severity at Signalized and Unsignalized Intersections"
- UA Graduate student capstone project was recognized by the American Planning Association of Arizona as the best graduate student planning project of 2020. The team of ten students worked with the City of Tucson on responses to displacement and gentrification. They were supported by Arlie Adkins, UA's NITC Executive Committee member.
- Clare Haley, Masters of Community and Regional Planning student and a 2020 NITC scholar, was this year's winner of UO's University Sustainability Award for Student Leadership by a graduate student.
- PSU Masters of Urban and Regional Planning graduate Nora Stoelting has been hired as a Safe Routes to School Specialist at Alta Planning + Design after nearly two years of supporting PSU's Better Block PSU and high school transportation camps.

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

The impacts of the NITC program are achieved through interdisciplinary collaboration, our strong and intentional partner relationships, and the active participation of professionals that informs our educational offerings. Technology transfer performance measures are summarized in Table 11. Thirty-six research projects have been completed to date and we are working with stakeholders to assess the impact of the work. This section provides some of the recent impacts from projects funded through the current FAST Act grant and previous UTC grants (MAP-21, SAFETEA-LU).

- Number of stakeholders reporting impact (from surveys): 89 (17 this period)
- Number of stakeholders who have adopted, implemented or deployed research findings or technologies: 32 (10 this period)

5.1 What is the impact on the effectiveness of the transportation system?

A practitioner used the results and data from the Evaluation of Bus-Bicycle and Bus/Right-Turn Traffic Delays and Conflicts to estimate bus delays at transit stops where bike lanes are present.

In an article by Next City, "What Happens When Cash Fares Are Eliminated," Andrew Martin, a development planner for Eugene, Oregon-based Lane Transit District, is quoted commenting on the importance of Aaron Golub's, PSU, recently completed, NITC Pooled Fund Applying an Equity Lens to Automated Payment Solutions for Public Transportation project's findings: "There was just not a lot of research on how different people are affected by changes in fare systems. It's pretty obvious that a fare system that uses smartphones might not be accessible for everyone… We have a group of riders who rely on [cash fares], whether it's because they like it or trust it or whatever. We wanted to learn more about our system and riders but also how to help people more broadly."

A transportation planner at a consulting firm used the report Matching the Speed of Technology with the Speed of Local Government to help inform recommendations to state-level decision makers on the near future of needed AV policy.

The National Electric Bike Owner Survey project (NITC National) continues to have an impact. An agency has used it to help develop an e-bike incentive program targeting low-income households, specifically incentive program criteria. It has helped to inform the development of recommendations relating to micromobility in the 2021 Australian Infrastructure Plan.

5.2 What is the impact on the adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company?

A practitioner, who attended Marc Schlossberg's NITC Rethinking Streets During COVID-19 webinar, informed us that "I am administering the temporary outdoor business program for my city. There are some great ideas on inexpensive implementations for some of these overlays."

A May 2021 article in Bloomberg CityLab "Where Covid's Car-Free Streets Boosted Business" cites PSU research by Jenny Liu on the positive economic impacts of bicycle and pedestrian infrastructure as a counterpoint to maintaining parking spaces.

Wendy Root Askew, Monterey County Supervisor, used NITC research by John MacArthur, PSU, to convince their district board to get an e-bike incentive program started. They are offering a $1,000 incentive for the purchase of an e-bike. Wendy stated "This was so helpful. I was able to convince my colleagues to support our first ever E-bike incentive program! Huge win! Our program will service the entire tri-county region of the Monterey Bay in California." His research on making e-bikes more affordable has also been cited in articles by Outside magazine and The Verge.

5.3 What is the impact on the body of scientific knowledge?

Jennifer Dill, NITC Director, contributed to TRB Circular on Opportunities for Research on Transportation and Equity. The Circular also cited an article by UTA researchers, Noelle Fields, Kate Hyun, and Stephen Mattingly, based on their NITC project: How Can Interdisciplinary Teams Leverage Emerging Technologies to Respond to Transportation Infrastructure Needs.

PSU's BikePed Portal Dashboard: A National Non-Motorized Count Data Archive, which received NITC National funding, was contacted by a researcher from Cal Poly SLO who requested data for their machine learning research project. The data will be used to train and validate their ped-bicyclist-count data model which allows estimating the counts for other locations where data are not available, and estimating reliable adjustment factors, which bridge the gap between continuous and short duration counts.

A researcher is using two recently published NITC final reports, Applying an Equity Lens to Automated Payment Solutions for Public Transportation and Transit Impacts on Jobs, People and Real Estate, on a state DOT research project that is evaluating transit equity metrics.

5.4 What is the impact on transportation workforce development?

The skills and knowledge of the current transportation workforce needs to keep pace with the changing technology, policy, and best practices. NITC has made significant impacts training the current transportation workforce in several areas:

Improving transit accessibility

- A coordinator at New York State DOT shared a recent NITC final report, The Role of Bus Stop Features in Facilitating Accessibility, with staff working on their Mobility Services program.
- A researcher is involved in a study for Caltrans that is similar to the recently completed NITC project, Applying an Equity Lens to Cashless Payment Solutions for Public Transportation. They attended the webinar presented by Aaron Golub, PSU, because they will be conducting a survey with a focus on understanding the needs of CA unbanked transit riders.

Bicycle design and planning

- The City of Portland has installed a mile of bike lanes and overhauled a wide intersection in St. Johns. According to PBOT, the genesis of this project was in the 2019 Traffic and Transportation Class that's co-hosted by the City of Portland and PSU. Interestingly, the student who identified the Wall and Fessenden intersection, Caroline Crisp, is now a second-year Master's student in Urban Planning at PSU.
- The technology transfer project, National Scan of Bike Share Equity Programs, led by John MacArthur, produced 10 equity briefs in 2020, which continue to support operators and stakeholders in prioritizing equity. An April 2021 article in Grist cited this research and, in September, the North American Bikeshare Association promoted the briefs during a two-week Diversity, Equity, and Inclusion Campaign with Better Bike Share, a NITC project partner.
- The report Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S. was used in a presentation to a local APWA chapter about design considerations of Class IV bikeways, with particular focus on single-bicycle crashes, and how selection of vertical separation elements is critical in the safety of users.

Interdisciplinary impact

- A previous NITC project, Racial Bias in Drivers' Yielding Behavior by Kimberly Kahn, PSU Associate Professor of Social Psychology, was recently used to inform an update of a DOT's uncontrolled marked crosswalk guidance for local engineers to consider when installing an uncontrolled marked crosswalk.

Next generation of researchers.

- Maria Sipin, PSU alum and Active Transportation Policy and Programs Analyst at ODOT, was named one of NACTO / BBSP Transportation Justice Fellows of 2021 which honors individuals promoting equity in transportation across the country. She states "decision-makers and large institutions are developing technical tools and grappling with defining measurable outcomes for transportation safety and climate change mitigation. I'd like to participate with others who may also be charged with addressing racial justice, atonement, and healing in a meaningful way when bureaucratic and systemic barriers exist."
- A group of community leaders and University of Utah researchers, including NITC-funded researcher Ivis Garcia, has completed a nearly year-long project to develop guidelines for carrying out community-based research (CBR). They hope the guidelines, which can be viewed and downloaded, will be adopted across the University of Utah and other universities by researchers interested in building equitable, mutually beneficial research partnerships.

Next generation of faculty

- Two UTA Ph.D. students, Erin Murphy and Sarah Leat, both received NITC Dissertation Fellowships and participated in NITC General Research projects, have been appointed to faculty positions at Augusta University and the University of Memphis, respectively.
- Michael Mitchell, UTA master's graduate in Criminology and Criminal Justice, was appointed Assistant Professor in African American Studies and Criminology at The College of New Jersey. He worked on the multi-disciplinary, NITC project: Optimizing Housing and Service Locations to Provide Mobility to Meet the Mandated Obligations for Former Offenders to Improve Community Health and Safety.

6 CHANGES/PROBLEMS

6.1 Changes in approach and reasons for change

The COVID-19 pandemic has significantly affected NITC research, student group activities, and travel. Our Round 3 projects awarded in the summer of 2019 were the most affected due to no in-person data collection. Most of these projects have had no-cost extensions to accommodate delays and have tried online data collection strategies. Other projects may require more significant changes, such as in cases where the transportation system or behavior does not return to pre-COVID conditions. One project has requested a change in scope due to the negative effect on data collection involving a partner's e-scooter program.

The pandemic has challenged our ability to engage students outside the classroom—something that was done largely in-person before the pandemic. In-person activities are resuming in Fall 2021, but a lot of work has to be done to rebuild the student groups. NITC continues to support students as research assistants and through fellowships.

6.2 Changes that have a significant impact on expenditures

COVID-19 prevented travel from March 2020 - September 2021. Travel expenses are expected to increase in 2022 with some conferences being held in-person, such as TRB. The annual Transportation Undergraduate Research Fellowship (TURF) Summer program for undergraduate students was not held in 2020 or 2021 at PSU. The funds are expected to be used for these purposes in 2022.

6.3 Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards

Researchers continue to face difficulties with human subjects data collection. They have been using online methods for surveys and interviews, and they are trying to resume some in-person data collection. Other researchers have used available datasets rather than collect their own data.

6.4 Change of primary performance site location from that originally proposed

NITC campuses have reopened for in-person teaching for Fall 2021 term.

7 SPECIAL REPORTING REQUIREMENTS

Not applicable.

4 APPENDIX

Table 1: Initial research projects funded (2016-2017)

Grant	Project Title	Investigators	Univ.	Status
Initial Projects	Access to Opportunities: Redefining Planning Methods and Measures for Disadvantaged Populations*	Arlie Adkins Stephen Mattingly	UA, UTA	Active
	Bringing Bikes into the V2X Smart City Conversation	Stephen Fickas Marc Schlossberg	UO	Complete
	Economic and Business Impacts of Non-Motorized Bike/Pedestrian Infrastructure	Jenny Liu Jennifer Dill	PSU	Complete
	Evaluating Improved Transit Connections for Ladders of Opportunity *	Stephen Mattingly Yi-Chang Chiu	UTA UA	Active
	From Knowledge to Practice: Rethinking Streets for People on Bikes	Marc Schlossberg Roger Lindgren	UO OIT	Complete
	Improving Integration of Transit Operations and Bicycle Infrastructure at the Stop Level	Miguel Figliozzi Chris Monsere	PSU	Complete
	Key Enhancements to Four-Step Travel Demand Models	Reid Ewing	UU	Complete
	Network Effects of Disruptive Traffic Events	Juan Medina Cathy Liu	UU	Active
	Social-Transportation Analytic Toolbox (STAT) for Transit Networks *	Cathy Liu Ran Wei Aaron Golub Liming Wang	UU PSU	Complete
	Foundational Smart Cities Platform for NITC	Kristin Tufte John MacArthur Larry Head	PSU PSU UA	Active

*Research projects that address equity related to mobility

Table 2: Research Projects funded by NITC in 2017

Grant	Project Title	Investigators	Univ.	Status
General Research (Round I)	Updating and Expanding LRT/BRT/SCT/CRT Data and Analysis	Arthur Chris Nelson	UA	Complete
	Life-Space Mobility and Aging in Place*	Ivis Garcia Zambrana Keith Dias Moore Alan DeLaTorre	UU PSU	Complete
	Understanding Factors Affecting Arterial Reliability Performance Metrics	Avinash Unnikrishnan Sirisha Kothuri	PSU	Complete
	Planning in Gateway and Amenity Communities: Understanding Unique Challenges Associated with Transportation, Mobility, and Access to Opportunity*	Danya Rumore Philip Stoker	UU UA	Complete

Grant	Project Title	Investigators	Univ.	Status
	Developing Data, Models, and Tools to Enhance Transportation Equity*	Amy Lubitow Julius McGee Raoul Lievanos	PSU UO	Complete
	Universally Accessible Trail Improvement with Naturally Occurring, Sustainable Materials*	Matthew Sleep	OIT	Complete
Small Starts (Round 1)	A Decentralized Network Consensus Control Approach for Urban Traffic Signal Optimization	Gerardo Lafferriere	PSU	Complete
	Is There a "Buy Local" Case for Lower Travel Speeds? Testing Differences in Driver Recognition of Local versus National Retail at Different Travel Speeds	Jonathan Bean Arlie Adkins	UA	Active
	How Will Autonomous Vehicles Change Local Government Budgeting and Finance? A Case Study of Solid Waste, Drop-off/Pick-up Zones, and Parking.	Benjamin Clark	UO	Complete
	Vehicle Sensor Data (VSD) Based Traffic Control in Connected Automated Vehicle (CAV) Environment	Xianfeng Yang	UU	Complete
	How Can Interdisciplinary Teams Leverage Emerging Technologies to Respond to Transportation Infrastructure Needs? A Mixed-Methods Evaluation of Civil Engineers, Urban Planning, and Social Workers' Perspectives. *	Noelle Fields Courtney Cronley Kate Hyun Stephen Mattingly	UTA	Complete
	A Comprehensive Examination of Electronic Wayfinding Technology for Visually Impaired Travelers in an Urban Environment*	Martin Swobodzinski Amy Parker	PSU	Complete

*Research projects that address equity related to mobility

Table 3: Research Projects funded by NITC in 2018

Grant	Project Title	Investigators	Univ.	Status
General Research (Round 2)	The Connection between Investments in Bus Stops, Ridership, and ADA Accessibility*	Keith Bartholomew Arlie Adkins	UU UA	Complete
	Investigating Effects of TNCs on Parking Demand and Revenues	Benjamin Clark Anne Brown	UO	Complete
	Matching the Speed of Technology with the Speed of Local Government: Developing Flexible Codes and Policies Related to the Possible Impacts of Autonomous Vehicles on Cities	Marc Schlossberg Heather Brinton	UO	Complete
	Reducing VMT, Encouraging Walk Trips, and Facilitating Efficient Trip Chains through Polycentric Development	Reid Ewing Yehua Dennis Wei Shima Hamidi	UU UTA	Complete
	An Electric Bus Deployment Framework for Improved Air Quality and Transit Operational Efficiency *	Xiaoyue Liu Aaron Golub Ran Wei	UU PSU UCR	Complete
	Connected Vehicle System Design for Signalized Arterials	Xianfeng Yang Mingyue Ji	UU	Complete

Grant	Project Title	Investigators	Univ.	Status
	Revisiting TODs: How Subsequent Development Affects the Travel Behavior of Residents in Existing Transit-Oriented Developments	Nathan McNeil Jennifer Dill	PSU	Complete
	Optimizing Housing and Service Locations to Provide Mobility to Meet the Mandated Obligations for Former Offenders to Improve Community Health and Safety*	Anne Nordberg Jaya Davis Stephen Mattingly	UTA	Active
	Land Use and Transportation Policies for a Sustainable Future with Autonomous Vehicles: Scenario Analysis with Simulations	Liming Wang Yao-Jan Wu	PSU UA	Active
	Emerging Technologies and Cities: Assessing the impacts of new mobility on cities	Becky Steckler Rebecca Lewis	UO	Complete
	LRT/BRT/SCT/CRT Development Outcomes FINAL PHASE	Arthur C. Nelson Kristina Currans Nicole Iroz Elardo	UA	Complete
Small Starts (Round 2)	Urban Transportation System Flood Vulnerability Assessment with Special Reference to Low Income and Minority Neighborhoods*	Courtney Crosson	UA	Complete
	Promoting Environmental Justice Populations Access to Opportunities within Suburban Boomtowns: An Interdisciplinary, Mixed-Methods Approach to Addressing Infrastructure Needs*	Jandel Crutchfield	UTA	Complete
	Visual Exploration of Utah Trajectory Data and their Applications in Transportation	Nikola Markovich (UU)	UU	Complete
Pooled Fund	Applying an Equity Lens to Automated Payment Solutions for Public Transportation*	Aaron Golub Jenny Liu John MacArthur Anne Brown Candace Brakewood	PSU UO UTK	Complete
	Exploring Data Fusion Techniques to Derive Bicycle Volumes on a Network	Sirisha Kothuri Joseph Broach Nathan McNeil Kate Hyun Stephen Mattingly Krista Nordback	PSU UTA UNC	Active

*Research projects that address equity related to mobility

Table 4: Research Projects funded by NITC in 2019

Grant	Project Title	Investigators	Univ.	Status
General Research (Round 3)	Is Transit-Oriented Development Affordable for Low and Moderate Income Households (in terms of H+T)?*	Reid Ewing Arlie Adkins Nicole Iroz-Elardo	UU UA	Processing final report
	Seamless Wayfinding by Individuals with Functional Disability in Indoor and Outdoor Spaces: An Investigation into Lived Experiences, Data Needs, and Technology Requirements*	Martin Swobodzinski Amy Parker	PSU	Active

Grant	Project Title	Investigators	Univ.	Status
	New Mobility For All: Can Targeted Information And Incentives Help Underserved Communities Realize The Potential Of Emerging Mobility Options?*	Nathan McNeil John MacArthur Jennifer Dill	PSU	Active
	Developing Strategies To Enhance Mobility And Accessibility For Community-Dwelling Older Adults*	Kate Hyun Caroline Krejci Kathy Lee	UTA	Active
	Using Social Network Analysis To Optimize Access To Culturally Responsive And Affordable Transportation For Older (Im)Migrants*	Rebecca Mauldin Stephen Mattingly Rupal Parekh	UTA UTA UConn	Active
	Green Waves, Machine Learning, and Predictive Analytics: Making Streets Better for People on Bike & Scooter	Stephen Fickas	UO	Complete
	Rethinking Streets for COVID-19	Marc Schlossberg	UO	Complete
	Data-Driven Mobility Strategies for Multi-Modal Transportation	Yao-Jan Wu Sirisha Kothuri Xianfeng Yang	UA PSU UU	Complete
	Development Of Low-Cost Radar-Based Sensor For Multi-Modal Traffic Monitoring	Siyang Cao Yao-Jan Wu	UA	Processing final report
	Evaluation of Portland Shared E-Scooter Pilot Program Goals and Outcomes *	John MacArthur Jennifer Dill	PSU	Active
	Scooting to a New Era in Active Transportation: Examining the Use and Safety of E-Scooters *	Kristina Currans Reid Ewing Nicole Iroz-Elardo	UA UU UA	Active
Small Starts (Round 3)	Evaluating Mobility Impacts Of Construction Workzones On Utah Transportation System Using Machine Learning Techniques	Abbas Rashidi	UU	Complete
	Developing and Testing Transportation Barriers Scale and Its Impact on Mental Health Among At-risk/Homeless Youth and Emerging Adults *	Philip Baiden Godfred Boateng Stephen Mattingly	UTA	Processing final report
	Do Travel Costs Matter?: Using Psychological And Social Equity Perspectives To Evaluate The Effects Of A Low-income Transit Fare Program On Low-income Riders *	Liu-Qin Yang Aaron Golub Liming Wang	PSU	Active
	E-Scooters and Public Health: Understanding the Implications of E-Scooters on Chronic Disease *	Nicole Iroz-Elardo	UA	Active
	The Impact of Ride Hail Services on the Accessibility of Nonprofit Services *	Dyana Mason	UO	Complete

*Research projects that include an equity focus related to mobility

Table 5: Research Projects funded by NITC in 2020

Grant	Project Title	Investigators	Univ.	Status
General Research (Round 4)	Understanding Connections Between Mobility, Transportation, And Quality Of Life In Refugee Communities In Tucson, Arizona *	Orhon Myadar Arlie Adkins	UA	Active
	Data-Driven Optimization for E-Scooter System Design	Jianqiang Cheng	UA	Active
	Understanding the Mobility Impacts of Decentralizing Homeless Services in Salt Lake County, Utah *	Sarah Canham Ivis Garcia	UU	Active
	Pedestrian Behavior Study to Advance Pedestrian Safety in Smart Transportation Systems Using Innovative LIDAR Sensors *	Taylor Li Sirisha Kothuri	UTA PSU	Active
	App-based Data Collection to Characterize Latent Transportation Demand within Marginalized and Underserved Populations *	Noelle Fields Courtney Cronley	UTA UTK	Active
	Mobility for the People: Evaluating Equity Requirements in Shared Mobility Programs *	Anne Brown Amanda Howell	UO	Active
	Statistical Inference for Multimodal Travel Time Reliability	Avinash Unnikrishnan Miguel Figliozzi	PSU	Active
	Estimating the Economic Impacts Of Transportation-Related Supply Chain Disruptions In The Post-Earthquake Environment	Divya Chandrasekhar	UU	Active
	Marginalized Populations' Access to Transit: Journeys from Home and Work to Transit *	Marisa Zapata Miriam Abelson	PSU	Active
	Integrate Socioeconomic Vulnerability for Resilient Transportation Infrastructure Planning *	Liming Wang John MacArthur	PSU	Active
	Accessing Opportunities for Household Provisioning Post-COVID-19 *	Kelly Clifton Kristina Currans	PSU UA	Active

Table 6: Research Projects funded by NITC in 2021

Grant	Project Title	Investigators	Univ.	Status
General Research (Round 5)	Rural Gentrification and the Spillover Effect: Integrated Transportation, Housing, and Land Use Challenges and Strategies in Gateway Communities *	Danya Rumore Philip Stoker	UU UA	Active
	Housing Choice, Transportation Equity, and Access to Opportunities in Refugee and Immigrant Communities *	Diane Mitschke	UTA	Active

Grant	Project Title	Investigators	Univ.	Status
	Assessing Cool Corridor Heat Resilience Strategies for Human-Scale Transportation *	Ladd Keith Kristina Currans Nicole Iroz-Elardo	UA	Active
	Exploring the Use of Crowdsourced Data Sources for Pedestrian Count Estimations	Sirisha Kothuri	PSU	Active
	Transportation for Seniors (T4S): Developing a New Accessibility Measure to Support Older Adults in a Post-Pandemic World *	Andy Hong Xiaoyue Cathy Liu	UU	Active
	Sustaining Multimodal Choices: Examining Travel Behavior for Non-work Trips Beyond COVID-19	Yizhao Yang Rebecca Lewis	UO	Active
	Developing Data and Solution Focused Approaches to Support Homeless Populations on Dallas Area Rapid Transit (DART) *	Anne Nordberg	UTA	Active

Table 7: Translate Research to Practice Projects funded by NITC in 2021

Grant	Project Title	Investigators	Univ.	Status
Translate Research (Round 5)	Applying a Mt. Mazama Volcanic Ash Treatment as a Trail Accessibility Improvement	C.J. Riley Ashton Greer	OIT	Active
	Using Maps and Online Tools to Operationalize Equity in Shared Mobility Services	Amanda Howell Anne Brown	UO	Active
	Implementing a Community Transportation Academy	Nathan McNeil Keith Bartholomew	PSU UU	Active
	Enabling Decision-Making in Battery Electric Bus Deployment through Interactive Visualization	Xiaoyue Cathy Liu Jianli Chen	UU	Active
	Communicating Research through Comics: Transportation and Land Development	Kelly Clifton Kristina Currans	PSU UA	Active

Table 8. Student group activities during this reporting period

Student group	Activity	Date	# of participants
STEP (PSU)	Club was inactive	Spring 2021	0
ITE (OIT)	ITE Student Chapter meeting	4/20/2021	18
Live Move (UO)	Chapter meetings - 8 during Spring term	weekly	10
	Racial Justice Bike Ride	4/1/21	15
	Houston: Misconceptions, the Facts, and the Future of Transportation	5/1/21	25
ITE (UTA)	Conference on advancing transportation equity (CATE)	9/9/21	6
Point B (UU)	Bicycle Tour of Salt Lake City with Tom Millar	4/17/21	15
	Webinar on the WFRC Proposed 2050 Long Range Plan	4/21/21	20
UA	National APA Conference	4/1/21	12
	UArizona Transportation Research Institute End-of-year Review	4/29/21	22
	Arizona Students' Transportation Summit	4/30/21	4

Table 9. List of publications resulting from work funded by NITC.

Citations (alphabetical) and DOIs	# of Citations
Peer-reviewed Journals (scientific, technical, or professional)	
Adkins, A., Barillas-Longoria, G., Martinez, D. N., & Ingram, M. (2019). Differences in social and physical dimensions of perceived walkability in Mexican American and non-hispanic white walking environments in Tucson, Arizona. Journal of Transport & Health, 14. doi:10.1016/j.jth.2019.100585	**9**
Chen, Z., Liu, X. C., & Wei, R. (2019). Agent-based approach to analyzing the effects of dynamic ridesharing in a multimodal network. Computers Environment and Urban Systems, 74, 126-135 https://doi.org/10.1016/j.compenvurbsys.2018.10.004	**11**
Clark, B. Y. (2020). The Impacts of Autonomous Vehicles on Local Government Budgeting and Finance: Case of Solid Waste Collection. National Tax Journal, 73(1), 259-281. doi:10.17310/ntj.2020.1.08	**4**
Clark, B. Y., & Brown, A. (2021). What does ride-hailing mean for parking? Associations between on-street parking occupancy and ride-hail trips in Seattle. Case Studies on Transport Policy, 9(2), 775-783. doi:10.1016/j.cstp.2021.03.014	**0**
Dai, Z., Liu, X. C., Chen, Z., Guo, R. Y., & Ma, X. L. (2019). A predictive headway-based bus-holding strategy with dynamic control point selection: A cooperative game theory approach. Transportation Research Part B-Methodological, 125, 29-51. doi:10.1016/j.trb.2019.05.001	**17**
Ewing, R., Kim, K., Sabouri, S., Siddiq, F., & Weinberger, R. (2021). Comparative Case Studies of Parking Reduction at Transit-Oriented Developments in the USA. Transportation Research Record, 2675(1), 125-135 doi:10.1177/0361198120965558	**0**
Gehrke, S. R., & Wang, L. M. (2020). Operationalizing the neighborhood effects of the built environment on travel behavior. Journal of Transport Geography, 82. doi:10.1016/j.jtrangeo.2019.102561	10
Haghighi, Nima, Xiaoyue Liu, Ran Wei, Wenwen Li, Hu Shao (2018). Using Twitter Data for Transit Performance Assessment: A Framework for Evaluating Transit Riders' Opinions about Quality of Service. Public Transport. Vol 10, Issue 2, pp 363-377. 2018 doi:10.1007/s12469-018-0184-4	25
Hinners, S. J., Nelson, A. C., & Buchert, M. (2018). Streetcars and Economic Development: Do Streetcars Stimulate Employment Growth?. Transportation Research Record. doi:10.1177/0361198118790096	6
Iroz-Elardo, N., & Currans, K. (2021) Injury Burden of Introducing E-Scooters: A Review of E-Scooter Injury Studies Using Retrospective Review of Emergency Department Records, 2015-2019. Transportation Research Record. doi:10.1177/03611981211032216	0
Iroz-Elardo, N., Adkins, A., & Ingram, M. (2021). Measuring perceptions of social environments for walking: A scoping review of walkability surveys. Health & Place, 67 doi:10.1016/j.healthplace.2020.102468	1
Karimpour, A., Anderson, J. C., Kothuri, S., & Wu, Y. J. (2021) Estimating pedestrian delay at signalized intersections using high-resolution event-based data: a finite mixture modeling method. Journal of Intelligent Transportation Systems. doi:10.1080/15472450.2021.1926246	1
Keeling, K. L., Glick, T. B., Crumley, M., & Figliozzi, M. A. (2019). Evaluation of Bus-Bicycle and Bus/Right-Turn Traffic Delays and Conflicts. Transportation Research Record, 2673(7), 443-453. doi:10.1177/0361198119849063	3

Citations (alphabetical) and DOIs	# of Citations
Kim, J. Y., Bartholomew, K., & Ewing, R. (2020). Another one rides the bus? The connections between bus stop amenities, bus ridership, and ADA paratransit demand. Transportation Research Part a-Policy and Practice, 135, 280-288. doi:10.1016/j.tra.2020.03.019	6
Lievanos, R. S., Lubitow, A., & McGee, J. A. (2019). Misrecognition in a Sustainability Capital: Race, Representation, and Transportation Survey Response Rates in the Portland Metropolitan Area. Sustainability, 11(16). doi:10.3390/su11164336	2
Lubitow, A., Tompkins, K., & Feldman, M. (2019). Sustainable Cycling For All? Race and Gender-Based Bicycling Inequalities in Portland, Oregon. City & Community, 18(4), 1181-1202. doi:10.1111/cico.12470	13
Lyons, T., & Choi, D. A. (2021). Transit Economic Equity Index: Developing a Comprehensive Measure of Transit Service Equity. Transportation Research Record, 2675(3), 288-300 doi:10.1177/0361198120970529	2
Mashhadi, A. H., Farhadmanesh, M., Rashidi, A., & Markovic, N. (2021) Review of Methods for Estimating Construction Work Zone Capacity. Transportation Research Record. doi:10.1177/03611981211002202	3
Miller, S., Vander Laan, Z., & Markovic, N. (2020). Scaling GPS trajectories to match point traffic counts: A convex programming approach and Utah case study. Transportation Research Part E-Logistics and Transportation Review, 143 doi:10.1016/j.tre.2020.102105	2
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Miller, V. J. (2020). The experience of transportation to visit a Nursing home resident: a case study. Social Work in Health Care, 59(5), 300-321. doi:10.1080/00981389.2020.1756556	1
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Table 10: Organizations partnering with NITC projects.

Organization		Contribution Type			
Name	Location	Financial support	In-kind	Data	Other
AARP Oregon	Oregon				x[1,4]
AARP Utah	Utah				x[1]
Agape Clinic	Dallas, TX		x		
Alliance for Walking and Biking	Washington, DC				x[1]
American Planning Association-Idaho	Boise, ID	x			
American Printing House for the Blind	Louisville, KY		x		
Arlington Adult Day Health Care	Arlington, TX		x		
Asian Pacific American Network of Oregon	Portland, OR		x		
Assoc. of Pedestrian Bicycle Prof.	Lexington, KY	x			x[1]
Catholic Charities of Fort Worth	Fort Worth, TX		x		
Central Lane MPO	Eugene, OR	x			
City of Arlington	Arlington, TX		x		
City of Aspen	Aspen, CO		x		
City of Eugene	Oregon	x			x[1]
City of Gresham	Oregon	x			

Organization		Contribution Type			
Name	Location	Financial support	In-kind	Data	Other
City of Irving	Irving, TX		x		x[1,4]
City of Moab	Moab, UT		x		
City of Orem	Orem, Utah	x			
City of Portland	Oregon		x		x[1]
City of Seattle	Washington		x		
City of Springfield	Oregon				x[1]
City of Tucson	Arizona	x	x		
City of Whitefish	Whitefish, MT	x	x		
Clevor Consulting Group	Portland, OR	x			
Colorado Association of Ski Towns	Dillon, CO		x		
Colorado DOT	Denver, CO	x			
Community Action Committee	Knoxville, TN				x[2]
Community Builders	Glenwood Springs, CO		x		
Concord Engineering	Utah	x			
Dallas Area Rapid Transit (DART)	Dallas, TX		x		
District of Columbia DOT	Washington, DC	x			
ECONorthwest	Portland, OR	x			
Gayle Wells Foundation	Houston, TX		x		
Greenlining Institute	Oakland, CA		x		
Institute for Sustainable Solutions	Portland, OR	x			
John S. and James L. Knight Foundation	Miami, FL	x			
Lane Transit District	Eugene, OR	x			
League of American Cyclists	Washington, DC				x[1]
Living Streets Alliance	Tucson, AZ				x[4]
Metro	Portland, OR	x	x		
Metropia	Tucson, AZ		x	x	
Mid-American Regional Council	Kansas City, MI	x			
Mountainland Assoc. of Gov't	Orem, UT			x	
moovel NA	Portland, OR	x			x[1]
Multnomah County	Portland, OR				x[1,4]
Oregon DOT	Salem, OR	x	x		x[1]
OPAL Environmental Justice	Portland, OR				x[1]
PeopleforBikes	Boulder, CO	x			
Pima County DOT	Arizona	x			
Portland Metro	Portland, OR	x	x		x[1,4]
Project 7B	Utah	x	x	x	
Puget Sound Regional Council	Washington				x[1]
RAHOK	Pasadena, CA		x		
Regional Disaster Preparedness Organization	Portland, OR			x	

Organization		Contribution Type			
Name	Location	Financial support	In-kind	Data	Other
Regional Transportation Commission of Southern NV	Nevada	x			
Regional Transportation Council	Dallas-Fort Worth, TX				x[1]
Regional Transportation District	Denver, CO	x			x[1]
Resource Systems Group (RSG)	Salt Lake City, UT			x	
Rowell Brokaw Architects	Eugene, OR	x	x		x[2]
Salt Lake City Corporation	Salt Lake City, UT	x	x		
Salt Lake County Planning & Transp.	Salt Lake City, UT	x			
Sixty and Better	Fort Worth, TX		x		
Smart Growth America	Washington, DC				x[1]
St. George Area Convention and Tourism	Washington County, UT	x	x	x	
State Fair of Texas/Big Tex	Dallas, TX		x		
Streetlight Data Inc.	San Francisco, CA			x	
The Road Home	Salt Lake City, UT		x		
The Senior Source	Dallas, TX		x		
Town of Springdale	Utah	x	x	x	
TriMet	Portland, OR			x	x[1,2]
Tucson Water	Tucson, AZ		x		
Uber Eats	San Francisco, CA			x	x[1]
Unlimited Choices	Portland, OR				x[3]
Unlocking Doors	Dallas, TX		x		
Utah Commission on Aging	Utah				x[1]
USTAR - Utah Office of Economic Development	Salt Lake City, UT	x			
Utah Division of Emergency Management	Utah		x		
Utah Inland Port Authority	Utah		x		
Utah Office of Tourism	Utah	x	x	x	
Utah DOT	Salt Lake City, UT	x		x	x[1]
Utah Transit Authority	Salt Lake City, UT	x		x	
Virginia DOT	Richmond, VA	x			
Volunteers of America, Utah	Salt Lake City, Utah		x		
Wasatch Front Regional Council	Salt Lake City, UT	x		x	x[1]
Washington County Engineering & Construction Services	Hillsboro, OR			x	
Washington Department of Transportation	Olympia, WA				x[1]

[1]Resource partner (provides input into research at various stages of project)
[2]Assistance with data collection and/or processing
[3]Recruitment of survey participants
[4]Facilitates communication with stakeholders.

Table 11. Technology Transfer Performance Metrics

Tracking Parameter	Performance Metric	Performance Goals & Key Performance Indicators (KPI)
Outputs	Number of final reports 36 total	Produce final report that clearly articulate research results and meet NITC standards (KPI: 1 final report/project) On track
	Number of publications in trade/professional publications 44	Meet or exceed the number of publications (KPI: 1 publication/project) On track
	Number of presentations at national/ international and professional/trade conferences 32 last six months	Meet or exceed the number of presentations (KPI: 1 presentation/project) On track
	Number of events and event participants for technology transfer 9 events/last six months 135 attendees/event	Meet or exceed number of events, professional development hours and number of attendees (KPI: 25 number of events/year with average of 50 attendees/event) On track
	Number of dissemination tools and products for recently completed research projects 5 briefs 5 webinars 2 datasets	Meet or exceed the number of dissemination tools or products per project (KPI: 1 brief/project)
	Number of downloads for electronic tools (databases, scripts, algorithms, etc.) 505 downloads of 6 datasets	Meet or exceed the downloads per electronic tool (KPI: 20 downloads/tool) In progress
	Number of media stories covering NITC faculty, researchers and projects 22 in the last six months	Meet or exceed the number of media stories (KPI: 30/year) On track
	Percentage increase in online engagement with new stakeholders: NITC Newsletter (subscribers) - 0% NITC Twitter - 14% Facebook - 3% YouTube - 8% LinkedIn - 28% Instagram - 15% Ongoing performance of online engagement NITC Newsletter (open rate) - 24.9%	Meet or exceed our currently high averages for online engagement metrics (KPI: 10% or greater increase in new stakeholders across platforms -and- Meet or exceed baseline for ongoing online engagement NITC Newsletter (open rate) - 18.7% NITC Newsletter (click-through rate) - 19.5%

Tracking Parameter	Performance Metric	Performance Goals & Key Performance Indicators (KPI)
	NITC Newsletter (click-through rate) - 12.5% NITC Website (# of site visitors) - 13,001	NITC Website (# of site visitors) - 10,900 per 6 months On track
Outcomes	Number of stakeholders who collaborated on implementing research outcomes 7 stakeholders	Meet or exceed the number of stakeholders involved (KPI: TBD) In progress. Two is the baseline.
	Number of projects that reach deployment and adoption. 8 projects	Meet or exceed number of projects that reach TRL scale 4-5 (KPI: TBD) In progress. Six is the baseline.
Impacts	Number of stakeholders reporting impact from surveys 38 Practitioners 11 Faculty/Researchers 8 Students 17 Other stakeholders	Meet or exceed response rate of stakeholders. (KPI: surveys) In progress
	Number of stakeholders who have adopted, implemented or deployed research findings or technologies: 10	Meet or exceed number of adoptions, implementations and deployments (KPI: surveys) In progress