Program Progress Performance Report for University Transportation Center at

Portland State University

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Program Director:	Jennifer Dill, Ph.D. Professor, Portland State University Director, National Institute for Transportation and Communities (NITC) jdill@pdx.edu 503-725-2855
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Table of Contents

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 with a liaison (our Technology Transfer Manager) who can interpret results, and identify 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 extra 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 funds research through General Research, Small Starts and Pooled-Fund grants. The General Research grant supports larger scale projects. The Small Starts grant program funds researchers who have not yet had the opportunity to undertake significant transportation research. Projects have to be consistent with NITC's theme, are peer reviewed, and are selected by the NITC Executive Committee via consensus.

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 (64%) involved more than one partner university, demonstrating our commitment to collaboration. The 10 projects are, on average, 61% complete. (Appendix, Table 1). One project is complete and the final report has been posted to the website.

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

- **General Research:** 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. Projects are, on average, 40% 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, on average, 73% completed. One project is fully complete.
- **Small Starts:** Three $20,000 projects (Appendix, Table 3) were funded during this reporting period. They include:
    - Urban Transportation System Flood Vulnerability Assessment with Special Reference to Low Income and Minority Neighborhoods, PI: Courtney Crosson, UA
    - Promoting Environmental Justice Populations Access to Opportunities within Suburban Boomtowns: An Interdisciplinary, Mixed-Methods Approach to Addressing Infrastructure Needs, PI: Jandel Crutchfield, UA
    - Visual Exploration of Utah Trajectory Data and their Applications in Transportation, PI: Nikola Markovich, UU

  Six Small Starts projects were funded in 2017. Project budgets were approximately $20,000, for a total of $119,924 (Appendix, Table 2). Projects are 86% complete. Three projects are 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.

The project, **Exploring Data Fusion Techniques to Derive Bicycle Volumes on a Network**, was awarded to a multi-university team led by Sirisha Kothuri (PSU) and involves Joseph Broach (PSU), Nathan McNeil (PSU), Kate Hyun (UTA), Stephen Mattingly (UTA), and Krista Nordback (University of North Carolina, Chapel Hill). The projects focuses on developing the data fusion techniques needed to combine bicycle traffic counts from various sources. This national study brings together Oregon DOT, Virginia DOT, Colorado DOT, Washington D.C. DOT, Utah DOT, Central Lane MPO, the city of Portland, OR, and the city of Bend, OR, who are funding half of the $200,000 project.

The second project, **Applying an Equity Lens to Automated Payment Solutions for Public Transportation**, was awarded to a multi-university, multi-disciplinary team led by Aaron Golub (PSU) and includes Anne Brown (UO), Jenny Liu (PSU), Candace Brakewood (University of Tennessee, Knoxville) and John MacArthur (PSU). The project will evaluate equity implications for people who may be excluded or greatly inconvenienced by paying for transit through non-cash based collection technologies. This national study brings together moovel NA; cities of Gresham and Eugene, OR; Denver Regional Transit District (RTD); Lane Transit District (LTD); TriMet; and the Washington Metropolitan Area Transit Authority (WMATA) who are funding half of the $150,000 project.

1.2.2 Leadership

High Standing within National and International Arenas of Transportation.

Many of the consortium's faculty members and students serve on national committees and panels and other volunteer positions.

- Faculty, staff and students serve on 70 TRB volunteer committees, task forces or panels (51 on committees/sections and 19 on panels/task forces/workgroups). Three serve as Chair or Co-Chair of panels or committees.
- UA Planning faculty Kristi Currans, PhD, was invited to become a member of the Standing Committee on Transportation and Land Development for the Transportation Research Board (TRB) of the National Academies. She was also invited to be the Paper Review Chair for that committee.
- Faculty, researchers and staff serve on over 80 editorial, policy and other advisory boards.
- NITC's Director, Jennifer Dill, serves on the Board of Trustees for the TransitCenter and on the Board of Advisors, UC Davis Institute of Transportation Studies.
- NITC Advisory Board member Cameron Kergaye was highlighted as a featured volunteer in TR News.

NITC faculty are also leading as experts in the field. Arthur Chris Nelson (UA) was recently contracted by Routledge to co-write the book Impact Fees: Principles and Practice of Proportionate Share Impact Mitigation. According to Nelson, "Barring a Supreme Court decision that bans the practice entirely, the book will likely guide local government impact fee and exaction practice into the 2030s."

Solving Regional and National Transportation Problems.

During this reporting period, NITC research has been instrumental in informing regional and national issues. Activities and progress in this goal area include:

- Anne Brown (UO) gave a webinar on her expertise on equity and ride-hailing services for Eno Transportation Center.
- Kristin Tufte (PSU) joined a panel session at the Society of Applied Anthropology Annual Meeting. She was one of a number of regional experts leading smart city research to discuss technological, social, and demographic changes of smart cities.
- Amanda Howell (UO) joined a panel discussion on emerging technologies with representatives from ODOT and Daimler at the Oregon ITE March Luncheon.
- Kelly Clifton (PSU) presented at an Institute of Transportation Studies seminar at UC Davis on her research relating to Assessing the Transportation Impacts of Affordable Housing Developments.
- Christopher Monsere (PSU) presented "A Primer on the Safe Systems Approach" at the Bellevue, Washington Vision Zero Summit.

Future Leaders.

NITC support plays a critical role in developing students and faculty as leaders in their discipline.

- Kelly Clifton (PSU) was promoted to Associate Dean for Research in the Maseeh College of Engineering and Computer Science.
- Five students, four leaders in transportation academia and one long-time transportation industry advocate from both the public and private sector were honored by the Council of University Transportation Centers (CUTC) for outstanding contributions to transportation research and education at the CUTC Annual Banquet. The Charley V. Wootan Memorial Award, given annually to two graduate students in the transportation field for the best doctoral dissertation and M.S.

thesis with an emphasis on policy and planning, was award to Kyle Sorlie Titlow, University of Arizona.

- University of Oregon, Corrie Parish (graduate student of design) was one of 20 graduate students to be been accepted for the prestigious EnoTrans Future Leaders Development Conference this upcoming summer.
- Three female Portland State University students from the Maseeh College of Engineering and Computer Science and the Nohad Toulan School of Urban Studies and Planning received 2018 WTS Portland scholarships.
- Seven PSU graduate students received Eisenhower Fellowships presented by the U.S. Department of Transportation at this year's annual meeting of the Transportation Research Board (TRB): Mike McQueen, Travis Glick, Greg Norton, Jael Wettach-Glosser and Santiago Espinosa Wild of the Maseeh College of Engineering & Computer Science, and Baxter Shandobil and Kelly Rodgers of the Nohad Toulan School of Urban Studies and Planning at Portland State University.
- Mike McQueen (PSU) was awarded the 1st annual Young Professionals in Transportation StreetLight Graduate Fellowship. The fellowship was a national competition.
- Five graduate students are members of six TRB committees.

Development and Delivery of Programs.

NITC staff track final reports downloaded as a part of systematically trying to understand the usefulness and usage of research results. NITC formally shared the survey instrument and process for integrating this process into standard operating procedures with the National Center for Sustainable Transportation (NCST) at the University of California, Davis.

1.2.3 Education and Workforce Development

Offer Degrees and Courses in Multiple Disciplines.

The six-university consortium offers a total of **1 certificate, 13 bachelor, 26 graduate** and **8 PhD programs** in transportation and closely related fields, including several dual degree options. Two of the degree programs offered by the University of Utah and seven of the programs offered by the University of Texas at Arlington also receive support from other U.S. DOT-funded UTC programs.

Provide Experiential Learning.

Our campuses continue to incorporate access to community partners and employment opportunities in a number of ways. This includes the support for **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. These groups coordinated or participated in 56 webinars, activities and events that attracted 1,174 participants. A detailed list of activities of each student group and the Executive Committee can be found in Appendix, Table 4.

NITC researcher Marc Schlossberg of University of Oregon taught an EPIC (Educational Partnerships for Innovation in Communities) Workshop on Nov. 2 in Spokane, Washington. The EPIC model offers a proven, replicable and sustainable locally-based model for building partnerships between universities and public agencies and other organizations while transforming higher education into an arena where students learn through real-life problem solving.

A class project (North PDX Connected: A Community Based Active Transportation Plan for N Willamette Blvd) by a group of Master's in Urban and Regional Planning (MURP) at PSU will be help inform the city of Portland on a design for a bicycle neighborhood greenway.

Develop Innovative New Curriculum and Learning Opportunities.

NITC funded a new curriculum project through its education grant that will focus on developing a GIS workshop for high school girls: **S.T.E.A.M. TRAINing: Engaging High School Girls in Transportation Issues through GIS** (Randal Morris & Nancee Hunter, PSU). The goal of the project is to use the artistic and cartographic elements inherent in map-making to excite the interest of girls who might normally steer clear of more exclusively STEM-centric programs (hence the "A for Art" in STEM). The curriculum will cover the theory and general principles of GIS. Projects will allow students to apply what they learned in class to real life scenarios. Students will gather data during field trips and use them in the classroom for analysis.

Educate Professionals.

During the reporting period, NITC supported **50 events** that were attended by **3,677 professionals.** These events are detailed below.

NITC hosted three webinars for this reporting period. The webinars were attended by **280 individuals,** who were primarily practitioners (*Figure 1*).

- Modeling Freeway Traffic in a Mixed Environment: Connected and Human-Driven Vehicles, Xianfeng (Terry) Yang , UU (49 attendees)
- Rethinking Streets for Bikes: An Evidence Based Guide of Bike-Friendly Street Retrofits, Marc Schlossberg, UO and Roger Lindgren, OIT (139 attendees)
- E-Bikes for Everyone: Electrifying Communities in New Ways, John MacArthur, PSU and Sergio Lopez, Forth (92 attendees)

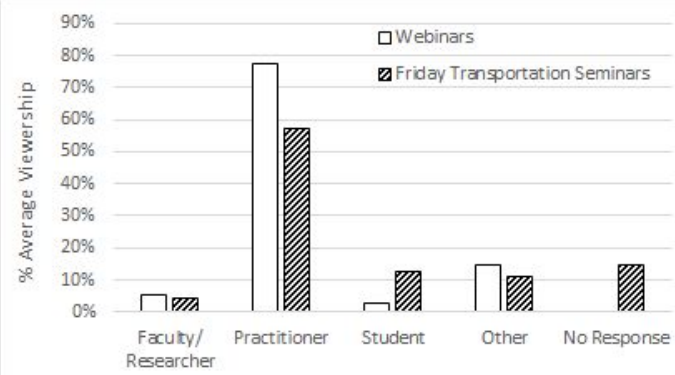

Figure 1. Practitioners consistently make up the greatest percentage of viewers in our webinars and seminars.

During the academic year, PSU holds **Friday Transportation Seminars** that are open to the public and webcasted to enable professionals and individuals across the country to participate. During this reporting period, PSU held **14 seminars** that were attended or streamed live by **1,338 non-students.** Viewers streamed seminars from 37 contiguous states in the U.S. and four Canadian provinces.

The PSU's Initiative for Bicycle and Pedestrian Innovation (IBPI) held its annual Ann Niles Active Transportation Lecture in October 2018. This year's speaker was Elise Roy to share her unique perspective on how active transportation interfaces with the Deaf community and others with unique needs. She spoke to a 140 professionals with a wide range of backgrounds - practitioners, community members, researchers, faculty, students, advocates, and more. The lecture concluded with a conversation between Elise and Dr. Paula Carder, Director of Portland State University's Institute on Aging, discussing further how universal design in mobility options and infrastructure truly does benefit everyone at every stage of life.

During this reporting period, TREC offered **32.5 professional development** credits for 22 events through the **American Planning Association (APA).** APA awarded practitioners **1,193.5 AICP credits** for these events, who gave the events, on average, a **4.28 star rating** (based on a five star rating system). Since 2016, TREC's APA events have achieved a **4.15 star rating,** on average.

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. As a result, we continually work on supporting current undergraduate students while also expanding NITC's reach into the K-12 classroom. These efforts and resulting events are detailed here and in the *Diversity* section.

- **One-day High School Workshop.** In partnership with ChickTech Portland, a one-day workshop was developed using open source ArcGIS Online mapping software for high school students who are female and female-identified. The workshop introduced the students to transportation curriculum and careers. Two of the students who took this GIS workshop applied and have been accepted to one of our summer transportation camps. One student writes in her camp application: "*High school has turned me onto STEM and I was nominated for the ChickTech program. One of our recent workshops focused on GIS mapping which I found very exciting. I would like to further pursue this interest along with my interest in civil engineering. Portland is a transportation innovator and I would like to contribute to the health of my city.*"
- **High School Summer STEM Camps.** We plan, host, and facilitate four separate one-week STEM camps for high school girls interested in STEM and transportation. In 2019, three of the camps will be hosted at Portland State University and one will be hosted at Oregon Tech. We invite over local transportation professionals to work with the students through classroom instruction, workshops, and field tours. Three of the camps are for female and female-identified students only.
- **Elementary and Middle School STEM Connect.** In4All and WTS Transportation You organized volunteer opportunities for transportation professionals to deliver hands-on learning experiences in the classroom that increase interest in STEM-related fields in 4th and 5th grade classrooms.
- **MESA Demo Days.** Oregon MESA hosted two Demo Days in Portland, Oregon for middle and high school students to compete and present their innovation demonstrations. There were 60 competing students and over 350 attendees that comprised of other students, families and volunteers.
- **Transportation Undergraduate Research Fellowships (TURF).** NITC continues to offer undergraduate students the opportunity to learn more about transportation engineering and planning research during the summer months by working alongside faculty and research advisors at PSU. This year, the program will host seven students from West Chester University of Pennsylvania; California State Polytechnic University, Pomona; SUNY Plattsburgh; University of Missouri, Kansas City; Northern Arizona University; University of California, Santa Cruz; and University of Southern California. One student from last year's TURF program will be starting PSU's graduate program in civil engineering Fall 2019. Her experience with the TURF and with her faculty advisor was a critical factor in her decision to enter grad school.
- **K-12 Transportation Presentation.** NITC staff, Lisa Patterson, was invited by a high school summer camp student alumni to give a presentation on bicycle infrastructure design and transportation careers to the Bike Club at St. Mary's Academy, an all-girls high school in Portland.

Attract and Support Graduate Students.

In addition to the graduate students supported through our larger research grants, two graduate students and one Ph.D. student will be supported on the Small Starts grants funded during this reporting cycle.

NITC offers dissertation fellowships to Ph.D. students who have advanced to candidacy. To date, NITC has awarded four dissertation fellowships that are still ongoing. The latest dissertation was awarded to Joey Iuliano (UA) for his research on "Pedal the Old Pueblo: A Naturalistic Study on Bicycling in Tucson, AZ".

1.2.4 Technology Transfer

Move Research into Practice.

Approximately 200 people attended PSU's Mobility Matters 2019 conference to learn about emerging technology and design to help everyone access safe and reliable transportation. Disability specialists, urban planners, engineers, transportation professionals, students and community members converged to share ideas. Lead by NITC researcher Amy Parker (PSU), this was a collaboration between NITC and the PSU College of Education.

Becky Steckler (UO) keynoted the Annual Mobility Management & NW Travel Training Summit in March 2019 and Amy Parker (PSU) spoke on participatory advocacy and inclusive planning for people with disabilities.

Undergraduate research assistant and NITC Scholar Katherine Keeling (PSU) presented her findings on bus/bike conflicts at both a TRB panel and an Oregon ITE Winter Workshop.

Use Innovative Approaches to Communicate Research Results.

Updated daily, the NITC website saw 9,532 site visitors during this reporting period, a 38.5% increase from the last period which indicates we are more effectively reaching a broader audience. The NITC website continues to attract an international audience with 23% non-U.S. visitors, our most notable international reach is with Canada, United Kingdom, Australia, and Germany.

We published twenty-two NITC stories on research results, newly funded projects, the impact of events, and NITC Student Spotlights. 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 (6,201 subscribers - 9% increase; 31% open rate; 8.5% click rate) dedicated to communicating NITC research and events.

In February 2019 we released a new guidebook: Rethinking Streets for Bikes, a NITC-funded joint project led by Marc Schlossberg (UO), Roger Lindgren (Oregon Tech), and partners Dave Amos and John Rowell. In addition to hosting a webinar (139 attended) for applied use of the book, Dave Amos created an episode dedicated to the new guide for his popular YouTube series called City Beautiful. Released on March 21st, it has over 47,000 views to date and drove high traffic to the NITC site. As of March 31st the project page had the highest traffic in the 6-month period and resulted in 1,375 downloads.

As a follow up to an earlier curriculum-based project, researchers Stephen Fickas (UO) and Marc Schlossberg (UO) published their NITC-funded study on V2X: Bringing Bikes into the Mix. In addition to getting our story published in the May edition of the ITE Journal, Fickas and Schlossberg created an animated video to further illustrate the mechanics of their "Bike Connect" project.

1.2.5 Collaboration

Collaborating within our consortium.

NITC's governance structure is collaborative. The Executive Committee met with the NITC Advisory Board in January to help brainstorm research priorities for the current RFP. NITC encourages collaborations within our consortium. Of the 47 research projects funded to date, 45% (21) involve more than one consortium partner.

Collaborating with other UTCs.

Susan Handy (NCST director) and Yinhai Wang (PacTrans director) served on the NITC Advisory Board. Further, we support research dissemination of other UTCs through our social media on a weekly basis.

External collaboration.

NITC's External Advisory Board met on January 7, 2019. The Board provided significant input on our March 2019 call for General Research Proposals. They identified knowledge gaps and pressing research questions concerning the mobility of people and goods, and informed our two major research priorities for the call: Developing Multimodal Data, Models, and Tools and Mobility of People: the Transportation, Land Use and Housing Connection.

In February, PSU began a new professional development partnership with the Portland Bureau of Transportation. PBOT's long-standing "Lunch n' Learn Series" that previously focused on bike innovation, expanded to include more multimodal topics and joined the ongoing roster of TREC's Friday Transportation Seminars. TREC offers the venue, digital streaming, and recording resources to PBOT, and PBOT offers a fresh audience and agency expertise for students and practitioners.

The University of Texas, Arlington (UTA) has had at least three teleconferences with Toyota Foundation to discuss opportunities to collaborate on transportation disadvantage and equity issues. They have some existing programs that they may want UTA to evaluate, and are very interested in the work UTA is doing with the City of Arlington and the handitran and Via systems. UTA has also had one teleconference with Uber to discuss the potential for investigating the provision of subsidized rides and investigating the impacts on environmental justice populations.

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.

Seven students, six of which are female, were selected from 130 applicants for the Transportation Undergraduate Research Fellowship (TURF) summer program. These students are paired with PSU faculty to experience research firsthand.

NITC hosted two trainings for female transportation professionals of color in Portland focusing on equity and understanding, identifying and de-escalating microaggressions in the workplace. One attendee said of the trainings: *"The Microaggressions training for the Alliance of Women of Color in Transportation gave me an opportunity to reflect on interactions I had in my workplace, share them in a comfortable space and process them in a productive way. I took all of the lessons we learned and immediately applied them to my workplace. Now that I have tools and support from other women of color, I feel safe addressing microaggressions with my coworkers."*

PSU is working with WTS International on delivering the transportation challenge project as part of the TransportationYOU DC Youth Summit for high school girls in June 2019.

NITC continues to encourage and provide support to faculty to include an underrepresented, undergraduate or graduate student in their research projects. During this reporting period, NITC awarded one diversity grant to support one undergraduate student.

Priority funding to research with an equity focus.

Many of our research projects address equity (see **Appendix, Tables 1 & 2**) by:

- 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.

1.3 How have the results been disseminated?

Research results are disseminated through various venues that include presentations at conferences, webinars and through papers and reports. NITC researchers gave **19 presentations**, where they reached an audience of **1,510 practitioners** and **academics**. So far, **15 papers** have been published in peer-reviewed journals (Appendix, Table 5).

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 progress of funded research
- Selection of General Research Round 3 projects
- Highlights from four high school transportation-focused summer camps
- Updates on tech transfer and workforce development events

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.

2.1 What organizations have been involved as partners?

Each NITC-funded research project is required to have match. For current projects, **41 different partners** from outside of the consortium provided match or contributed in other ways (Appendix, Table 6). This includes partners from local governments, non-profits, regional government agencies, state DOTs, transit agencies, and industry partners.

2.2 Have other collaborators or contacts been involved?

Twenty-one of the funded research projects (45%) involved investigators from more than one university. Twenty-six of the research projects (55%) included investigators from more than one discipline.

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

Technology transfer performance measures are summarized in Table 7. This section provides the narrative of our progress.

3.1 Publications, conference papers, presentations, and events

NITC researchers gave **11 presentations** of their work that reached an audience of **484 practitioners and academics**. Nine projects were represented in these presentations averaging 1.2 presentations per project and 46 participants per presentation. So far, **6 papers** based on research from this FAST Act grant have been published in peer-reviewed journals, one paper is forthcoming in a peer-reviewed journal, and at least nine additional papers are available in conference proceedings (**Appendix, Table 5**). This is in addition to the 86 peer-reviewed journal articles based on research from our first two NITC grants.

Five final reports have been published to date. A project brief has accompanied each final report helping us adhere to the key performance indicator.

3.2 Website(s) or other Internet site(s)

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. Our followers on these platforms have increased steadily as outlined below:

- **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 (3153 followers, +180):** We promote NITC-sponsored research, publications, and events while also uplifting the activities of fellow UTC's. We also share news from NITC consortium members, including achievements of students, faculty, and ongoing projects. New to this reporting period, we launched a standalone NITC_UTC twitter (186 followers) for more effective framing of the consortium partnership.
- **Facebook (714 followers, +59):** In addition to sharing NITC research, a significant focus of Facebook is to share photos of our events and to connect with other organizations, researchers, and practitioners.
- **YouTube (591 subscribers, +87):** To reach a broader audience, we publish freely accessible video recordings of weekly seminars at PSU and monthly NITC webinars.
- **LinkedIn (183 followers, +54):** 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 (303 followers, +86):** We use this newest platform to our strategy to showcase the people behind the research and put 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

During the last reporting period, NITC supported 50 events that were attended by 3,677 professionals. On average, events are attended by 73 people. Many of these events focused on results of NITC research, while others shared complementary research and practice. We are on track to meeting our key performance indicator of 25 events/year on NITC-funded research with average of 50 attendees/event.

3.4 Technologies or techniques

To track the outputs, we anticipate 20 downloads per tool. We are still working on the process to track these and will report an update in our next PPPR.

3.5 Inventions, patent applications, and/or licenses

Nothing to report.

3.6 Other products

Nothing to report.

4 OUTCOMES: What outcomes has the program produced?

NITC's Technology Transfer (T2) Plan outlines our technology transfer goals, objectives, and process. This provides a structure for NITC's technology transfer program including performance measures to help us evaluate and track our progress. This process will ensure research results have a greater chance of being used in practice. A key aspect of this new plan is the technology readiness level (TRL) scale which is applied to all research projects on a scale from 1 to 5. An implementation plan will be developed for all projects with a ranking of 4 or 5:

TRL 4: Deployment - Research project targets specific practice, application or agency. Examples include demonstrations, pilot projects, proof of concept, feasibility studies.

TRL 5: Implementation - Adoption of results into practice. Examples include informing or updating policy, design guidance, specification updates, process change, commercialization.

Two key outcomes we are tracking include:

1. Number of stakeholders who collaborated on implementing research outcomes. Two local public agency stakeholders have been involved in reviewing and implementing research findings in practice.
2. Number of projects that reach deployment and adoption (measured by the number of projects that reach TRL scale 4 or 5). Currently six research projects have a TRL ranking of 4 or 5.

During this project period, we have one project to highlight at this level. Gerardo Lafferriere (PSU) offers a new approach to urban traffic signal control which is computationally efficient, responsive to local congestion, and at the same time has the potential for congestion management at the network level. Exploiting new developments in communication, sensing and intelligent infrastructure systems, opportunities for new traffic control strategies expand. Discussions with City of Portland's Signals and Street LIghts Division Manager have begun to review potential implementation opportunities.

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 7. Five projects have been completed to date and we are working with stakeholders to assess the impact of the work. Impact takes time to track and assess, and many projects have not been completed long enough to measure. This section

provides the narrative of impacts that we are now seeing from projects funded through the current and previous NITC grants (MAP-21 funds) to offer some insight to the kind of impact we hope to report on in future PPPRs. We are currently undergoing the process of tracking the following performance measures that will reported during the next reporting period:

- Number of stakeholders reporting impact from surveys.
- Number of stakeholders who have adopted, implemented or deployed research findings or technologies

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

The National Committee on Uniform Traffic Control Devices (NCUTCD) used research from Chris Monsere (PSU), research partner Peter Koonce, and civil engineering graduate Stefan Bussey (PSU) to inform their decision around pavement markings for bikes being detected at signals. The changes will be incorporated into the Manual on Uniform Traffic Control Devices — perhaps the most important traffic engineering manual — when it is revised some time in the next few years. One of their five bicycling guidance recommendations is for "Bicycle Detector Markings", due to low comprehension among cyclists. They cite "A study by Portland State University in 2013 found that even with the use of the Bicycle Signal Actuation sign, the purpose of the existing Bicycle Detector Pavement Marking is not apparent to many bicyclists or motorists."

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?

Danya Rumore (UU) researched, synthesized, and developed a range of tools and resources aimed at training planners to work in Gateway and Natural Amenity Region (GNAR) communities. Often located near small towns or rural areas with limited transportation networks, they experience unique challenges due to the periodic influx of visitors that results in congestion and sprawl. Specific strategies were developed to inform planners at both university and professional levels on how to address these unique challenges through regional planning collaboration.

The project team collaborated with the Zion Regional Collaborative in southern Utah and the Bonner Regional Team in northern Idaho. They are working with colleagues from the Utah Community Development Office (formerly the Rural Planning Group) and the National Park Service Rivers, Trails, and Conservation Assistance Program to build out the GNAR online toolkit. The Western Governor's Association has expressed a strong interest in their research findings and work in GNAR communities, and they are now looking to partner with them and a number of foundations and other organizations to expand on and continue this work. All resources and tools developed via this project will be made freely available online in 2019.

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

Liming Wang's (PSU) research on modeling for autonomous vehicles and shared rides seeks to help planners by incorporating emerging travel modes—including car sharing, bike sharing, ride hailing, and autonomous vehicles—into regional travel demand models. A nationwide survey collected data from 1,117 valid participants. The data revealed their recent travel behaviors, attitude, and their stated preferences about using emerging travel modes when presented along with their chosen mode. The team then developed models using the survey data in order to:

1. To allow researchers to understand the tradeoffs that survey respondents are making across different attributes (e.g., costs vs. time) when they choose among travel modes, in particular, along with emerging modes.

2. To enable planners to predict mode shares for existing and emerging modes and subsequent effects under different assumptions of technology and policy scenarios.
3. Make the code for the new travel models available as an open-source repository on GitHub: https://github.com/cities/VETravelDemand.

In the second phase of the research, the team will investigate long-term travel and land use through simulations. The primary aim of the next phase is to identify policy scenarios that can help promote sustainable and equitable future patterns of travel and land use, shaping the evolution of AV technology to help meet these goals.

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:

- **Bicycle design and planning.** Few professionals responsible for designing bikeways were taught bicycle design or planning in their undergraduate or graduate education. PSU's bicycle-focused workshops provide hands-on training for professionals to directly apply to their community and curriculum for faculty to include in their classrooms. An Assistant Professor at University of New Mexico, attended the PSU 2-day faculty bike-ped training in 2018 and reported, "*I've been using the in-class exercises that Chris [Monsere] shared and they've been a hit. I'm actually prepping one today for class tomorrow.*"
- **Interdisciplinary collaboration.** The 2nd annual Mobility Matters Summit at PSU in March 2019 convened a wide range of disciplines to address equitable access to mobility infrastructure. Attendees had this to say:
  [Transportation Professional from a State DOT] "*I really appreciated hearing from people who use the transportation system differently than I do as an able-bodied person. Their willingness to share their experiences provides so much more context and emphasis on improvements than just reviewing the requirements would.*"
  [Transportation Professional from a State DOT] "*I attended the "Applying Equity" session and it was a very eye opening experience that brought issues of racial bias and transportation/ped issues to light that I had not given a ton of thought to. This was the first time it was put into the context of pedestrians at crossings.*
- **Next generation of researchers.** An interdisciplinary NITC research team identified opportunities for enhanced collaboration and training among engineers, planners, and social works in anticipation of emerging transportation needs for environmental justice (EJ) populations. Through this research project at UTA, and as a result of her involvement with NITC research, Jessica Williams, the graduate student on this project, decided to apply and was accepted to the UTA School of Social Work Doctoral Program.

6 *CHANGES/PROBLEMS*

6.1 Changes in approach and reasons for change

Nothing to report.

6.2 Changes that have a significant impact on expenditures

Nothing to report.

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

Nothing to Report.

6.4 Change of primary performance site location from that originally proposed

Nothing to Report.

7 SPECIAL REPORTING REQUIREMENTS

Not applicable.

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 (UA); Stephen Mattingly (UTA)	UA, UTA	Active
	Bringing Bikes into the V2X Smart City Conversation	Stephen Fickas & Marc Schlossberg	UO	Active
	Economic and Business Impacts of Non-Motorized Bike/Pedestrian Infrastructure	Jenny Liu & Jennifer Dill	PSU	Active
	Evaluating Improved Transit Connections for Ladders of Opportunity	Stephen Mattingly (UTA); Yi-Chang Chiu (UA)	UTA, UA	Active
	From Knowledge to Practice: Rethinking Streets for People on Bikes	Marc Schlossberg (UO); Roger Lindgren (Oregon Tech)	UO, Oregon Tech	Complete
	Improving Integration of Transit Operations and Bicycle Infrastructure at the Stop Level*	Miguel Figliozzi & Chris Monsere	PSU	Active
	Key Enhancements to Four-Step Travel Demand Models	Reid Ewing	UU	Active
	Network Effects of Disruptive Traffic Events	Juan Medina & Cathy Liu	UU	Active
	Social-Transportation Analytic Toolbox (STAT) for Transit Networks*	Cathy Liu & Ran Wei (UU); Aaron Golub & Liming Wang (PSU)	UU, PSU	Active
	Foundational Smart Cities Platform for NITC	Kristin Tufte & John MacArthur (PSU); Larry Head (UA)	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 1)	**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 (UU); Alan DeLaTorre (PSU)	UU, PSU	Active
	Understanding Factors Affecting Arterial Reliability Performance Metrics	Avinash Unnikrishnan & Sirisha Kothuri	PSU	Active
	Planning in Gateway and Amenity Communities: Understanding Unique Challenges Associated with Transportation, Mobility, and Access to Opportunity*	Danya Rumore (UU) & Philip Stoker (UA)	UU, UA	Active
	Developing Data, Models, and Tools to Enhance Transportation Equity*	Amy Lubitow & Julius McGee (PSU); Raoul Lievanos (UO)	PSU, UO	Active
	Universally Accessible Trail Improvement with Naturally Occurring, Sustainable Materials*	Matthew Sleep	Oregon Tech	Active
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	Active
	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	Active

*Research projects that address equity related to mobility

Table 3: Research Projects funded by NITC in 2018

Grant	Project Title	Investigators (Univ.)
General Research (Round 2)	**The Connection between Investments in Bus Stops, Ridership, and ADA Accessibility***	Keith Bartholomew (UU) & Arlie Adkins (UA)
	Investigating Effects of TNCs on Parking Demand and Revenues	Benjamin Clark & Anne Brown (UO)
	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)
	Reducing VMT, Encouraging Walk Trips, and Facilitating Efficient Trip Chains through Polycentric Development	Reid Ewing & Yehua Dennis Wei (UU); Shima Hamidi (UTA)
	An Electric Bus Deployment Framework for Improved Air Quality and Transit Operational Efficiency	Xiaoyue Liu (UU); Aaron Golub (PSU); Ran Wei (UCR)
	Connected Vehicle System Design for Signalized Arterials	Xianfeng Yang & Mingyue Ji (UU)
	Revisiting TODs: How Subsequent Development Affects the Travel Behavior of Residents in Existing Transit-Oriented Developments	Nathan McNeil & Jennifer Dill (PSU)
	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)
	Land Use and Transportation Policies for a Sustainable Future with Autonomous Vehicles: Scenario Analysis with Simulations	Liming Wang (PSU) & Yao-Jan Wu (UA)
	Emerging Technologies and Cities: Assessing the impacts of new mobility on cities	Becky Steckler & Rebecca Lewis (UO)
	LRT/BRT/SCT/CRT Development Outcomes FINAL PHASE	Arthur C. Nelson, Kristina Currans, & Nicole Iroz Elardo (UA)
Small Starts (Round 2)	**Urban Transportation System Flood Vulnerability Assessment with Special Reference to Low Income and Minority Neighborhoods***	Courtney Crosson (UA)
	Promoting Environmental Justice Populations Access to Opportunities within Suburban Boomtowns: An Interdisciplinary, Mixed-Methods Approach to Addressing Infrastructure Needs*	Jandel Crutchfield (UTA)
	Visual Exploration of Utah Trajectory Data and their Applications in Transportation	Nikola Markovich (UU)
Pooled-Fund	**Applying an Equity Lens to Automated Payment Solutions for Public Transportation***	Aaron Golub, Jenny Liu & John MacArthur (PSU), Anne Brown (UO), Candace Brakewood (UT, Knoxville)
	Exploring Data Fusion Techniques to Derive Bicycle Volumes on a Network	Sirisha Kothuri, Joseph Broach, & Nathan McNeil (PSU), Kate Hyun & Stephen Mattingly (UTA), and Krista Nordback (UNC, Chapel Hill)

*Research projects that address equity related to mobility

Table 4: Student group activities during this reporting period

Student group	Activity	Date	# of participants
STEP (PSU)	Fall Bike Tour 2018	10/19/2018	7
	Fall Traffic Bowl Qualifiers	11/2/2018	10
	Fall Movie Social - "With My Own Two Wheels"	11/9/2018	22
	Oregon ITE Traffic Bowl	11/15/2018	11
	98th Transportation Research Board Annual Meeting	Jan-19	16
	Western District ITE Student Leadership Summit	Jan-19	4
	TRB Aftershock	2/1/2019	50+
	Winter Movie Social - "Fruitvale Station"	3/1/2019	15
	General Meeting & Technical Presentation by Marisa DeMull	3/6/2019	25
	Prospective Graduate Student Happy Hour	3/8/2019	9
	Mobility Matters 2019	3/11/2019	11
ITE (Oregon Tech)	National Conference on Rural, Public, and Intercity Bus Transportation	10/3/2018	1
	Oregon Tech Civil Engineering Fall Banquet with ITE Chapter recruiting	10/2/2018	95
	ABC Bridge Design Demo at University of Nevada-Reno	10/5/2018	10
	Fall Career Fair ITE mixer with students and industry reps	10/24/2018	50
	Pervious Concrete Pavement Webinar	10/25/2018	6
	ITE Oregon Traffic Bowl and student conference, Portland, OR	11/15/2018	11
	ITE Oregon student tours	11/16/2018	10
	Asphalt Pavement Association of Oregon annual meeting	12/7/2018	3
	ITE Curbside Management Guide webinar	12/18/2019	7
	TRB Annual Meeting, Washington, DC	1/13/2019	11
	ITE International Student Reception, Washington, DC	1/15/2019	9
	Walkable Transportation Systems workshop and field trip	1/22/2019	33
	ITE Western District Student Leadership Summit (UC Berkeley)	1/27/2019	6
	TRB/ITESLS Travel Seminar	2/5/2019	25
	Caveman Bridge Tour (Grants Pass, OR)	2/15/2019	12
	Oregon Tech Engineer's Week	2/18-22/19	75
	Oregon Asphalt Pavement Conference (Eugene OR)	2/18/2019	2
	Winter Career Fair ITE mixer with students and industry reps	2/27/2019	39
ITE (UTA)	TexITE Dallas section meeting	9/14/2018	6
	Ecological momentary assessment methods with transportation disadvantaged populations	9/13/2018	6
	"A consultant view on Transportation Engineering" - October presentation	10/18/2018	35
	TexITE Dallas section meeting	10/11/2018	8
	Texas Institute of Transportation Engineers - Houston, TX	10/8/2018	3
	NITC Symposium for School of Social Work	10/8/2018	16
	"IH 635 LBJ East Project" - November presentation	11/8/2018	35
	INFORMS Annual Meeting	11/6/2018	1
	TexITE Dallas section meeting	Monthly	4
	Fort Worth ASCE Meeting at UTA	11/17/2018	100
	19th Annual Society of American Military Engineers Infrastructure Forum at UTA	2/2/2019	40
	TexITE Fort Worth section meeting	Monthly	4
	Professional Traffic Bowl competition	12/7/2018	4
ITE (UTA)	TRB's annual meeting in DC	1/13/2019	10
	TEXRail field trip	1/30/2019	20

Student group	Activity	Date	# of participants
	"Vision Zero and Road Safety Audit -- Issues and Challenges" - March presentation	3/4/2019	40
	University of Connecticut: Research project collaboration between NITC and CAMMSE	3/29/2019	3
	TexITE Dallas section meeting	9/14/2018	6
Point B (UU)	Utah Bike Summit	3/5/19	125
	Presentation - Veronica O. Davis	3/4/2019	25
UA	UA ITE ADOT Engineering in Training Program	10/10/18	20
	UA ITE / Southern Arizona Institute of Transportation Engineers	10/24/18	20
	UA ITE Lecture Series: Y2K Engineering	11/14/18	25
	UA ITE Lecture Series: Moeurgineering	02/13/19	20
	UA ITE Lecture Series: Kimley-Horn	03/27/19	20
	UA ITE joint meeting with ITS AZ	04/10/19	25
	StreetCar Facility Visit	10/19/18	10
	MESSA-PVC Bridge Competition	03/01/19	8

Table 5. List of publications resulting from work funded by NITC.

Publication type	Citation	Status
Peer-reviewed Journals (scientific, technical, or professional)	Nelson, Arthur C. et al. 2017. *Transit-Oriented Developments Make a Difference in Job Location*, Fordham Urban Law Journal, Vol 44 (4), 1079-1102	Published
	Nelson, Arthur C. 2017. *Transit and Real Estate Rents*, Transportation Research Record: Journal of the Transportation Research Board, Vol 2651(5), 22-30	Published
	(UPDATED) Hinners, S. J., Nelson, A. C., & Buchert, M. (2018). Streetcars and Economic Development: Do Streetcars Stimulate Employment Growth?. Transportation Research Record.	Published
	(UPDATED) Nelson, A. C., Stoker, P., & Hibberd, R. (2018). Light rail transit and economic recovery: A case of resilience or transformation?. Research in Transportation Economics.	Published
	Nelson, Arthur C. and Keuntae Kim. 2018. Commuter Rail Transit and Economic Development, Journal of Public Transportation	Publication, forthcoming
	Haghighi, Nima, Xiaoyue Liu, Ran Wei, Wenwen Li, Hu Shao. 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	Published
	(NEW) 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	Published
Peer-reviewed Published proceedings of conferences & meetings	(NEW) Sleep, MD and Masley, M, (2019) Innovative and Sustainable Uses of Volcanic Ash as a Natural Pozzolan for Dust Abatement and Unpaved Roadway Improvement, Eighth International Conference on Case Histories in Geotechnical Engineering, March 24–27, 2019, Philadelphia, Pennsylvania	Published
	Nelson, Arthur C. and Keuntae Kim. 2018. Bus Rapid Transit and Economic Development: A Quasi-Experimental Treatment and Control Analysis. Meeting Compendium of Papers. Transportation Research Board.	Published
	Nelson, Arthur C. and Robert Hibberd. 2018. Analysis of the Variation in Apartment and Office Market Rents with Respect to Commuter Rail Transit Station Distance in Metropolitan San Diego and Salt Lake City. Meeting Compendium of Papers. Transportation Research Board.	Published
	Nelson Arthur C. et al. 2018. *Commuter Rail Transit and Economic Development*. Meeting Compendium of Papers. Transportation Research Board.	Published
	Nelson, Arthur C. 2018. Express Busways and Economic Development: Case Study of the Miami-Dade South Express Busway. Meeting Compendium of Papers. Transportation Research Board.	Published
	Hinners, Sarah Jack, Arthur C. Nelson, Martin Buchert. 2018. Streetcars and Equity: Case Studies of Four Streetcar Systems Assessing Change in Jobs, People and Gentrification. Annual Meeting Compendium of Papers. Transportation Research Board.	Published
	Hibberd, Robert and A.C. Nelson. 2018. *Longitudinal Cluster Analysis of Jobs-Housing Balance in Transit Neighborhoods*. Meeting Compendium of Papers. Transportation Research Board.	Published
	Nelson, Arthur C. and Robert Hibberd. 2018. Using the Real Estate Market to Establish Streetcar Catchment Areas: Case Study of Multifamily Residential Rental Property in Tucson, Arizona. Meeting Compendium of Papers. Transportation Research Board.	Published
	Nelson, Arthur C. 2018. Bus Rapid Transit and Office Rents. Annual Meeting Compendium of Papers. Transportation Research Board.	Published

Table 6: Organizations partnering with NITC projects.

Organization		Contribution Type			
Name	Location	Financial support	In-kind	Data	Other
Alliance for Walking and Biking	Washington, DC				x[1]
Assoc. of Pedestrian Bicycle Prof.	Lexington, KY	x			x[1]
City of Eugene	Oregon	x			x[1]
City of Gresham	Oregon	x			
City of Portland	Oregon		x		x[1]
City of Seattle	Washington		x		
City of Springfield	Oregon				x[1]
City of Tucson	Arizona	x			
Colorado DOT	Denver, CO	x			
Concord Engineering	Utah	x			
District of Columbia DOT	Washington, DC	x			
League of American Cyclists	Washington, DC				x[1]
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		x			x[1]
Oregon DOT	Salem, OR	x	x		x[1]
OPAL Environmental Justice	Portland, OR				x[1]
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]
Regional Transportation Commission of Southern NV	Nevada	x			
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 County Planning & Transp.	Salt Lake City, UT	x			
Smart Growth America	Washington, DC				x[1]
St. George Area Convention and Tourism	Washington County, UT	x	x	x	
Town of Springdale	Utah	x	x	x	
TriMet	Portland, OR			x	x[1,2]
Unlimited Choices	Portland, OR				x[3]
Unlocking Doors	Dallas, TX		x		
USTAR - Utah Office of Economic Development	Salt Lake City, UT	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			
Wasatch Front Regional Council	Salt Lake City, UT	x		x	x[1]
Washington County Engineering & Construction Services	Hillsboro, OR			x	

[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 7. Technology Transfer Performance Metrics

Tracking Parameter	Performance Metric	Performance Goals & Key Performance Indicators (KPI)
Outputs	Number of final reports **5 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 **none to date**	Meet or exceed the number of publications (KPI: 1 publication/project) **In progress**
	Number of presentations at national/ international and professional/trade conferences **11** presentations (covering 9 projets) of their work that reached an audience of **509** practitioners and academics. This represents 1.2 presentation/project.	Meet or exceed the number of presentations (KPI: 1 presentation/project) **On track**
	Number of events and event participants for technology transfer **50 events/last six months** **73 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 each completed research project **6 briefs**	Meet or exceed the number of dissemination tools or products per project (KPI: 1 brief/project) **On track**
	Number of downloads for electronic tools (databases, scripts, algorithms, etc.) **TBD**	Meet or exceed the downloads per electronic tool (KPI: 20 downloads/tool) **In progress**
	Number of media stories covering NITC faculty, researchers and projects **15 in the last six months**	Meet or exceed the number of media stories (KPI: 30/year) **On track**
	Percentage increase of online engagement with stakeholders NITC Newsletter (subscribers) - **9%** NITC Newsletter (open rate) - **31%** NITC Newsletter (click rate) - **8.5 %** NITC Website (visitors, compared to previous 6-month period)) - **38.5 %** Twitter - **6%** Facebook - **9%** YouTube - **17%** LinkedIn - **41%** Instagram - **39%**	Meet or exceed our currently high averages for online engagement metrics (KPI: NITC Newsletter (subscribers) - 9% NITC Newsletter (open rate) - 31% NITC Newsletter (click rate) - 8.5 %) **On track**

Outcomes	Number of stakeholders who collaborated on implementing research outcomes **Two 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. **Six 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 **In progress**	Meet or exceed response rate of stakeholders. (KPI: TBD) **In progress**
	Number of stakeholders who have adopted, implemented or deployed research findings or technologies **In progress**	Meet or exceed number of adoptions, implementations and deployments (KPI: TBD) **In progress**