UTC-Semi-Annual Progress Report

Portland State University

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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 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 has funded 65 research projects through General Research (49), 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 39 active projects, of which 4 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 10 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 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 35% complete.

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. On average, the 11 projects are 70% complete. Research progress has been significantly affected by the COVID-19 pandemic. One project became two projects: the original project was reduced in scale, and a new research project focused on street-level changes taking place during the COVID-19 pandemic.

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.

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 we are processing the final report for one project and they are 70% complete overall. 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. The final report is being processed for the Applying an Equity Lens to Automated Payment Solutions for Public Transportation project. The other project, Exploring Data Fusion Techniques to Derive Bicycle Volumes on a Network, should be completed this summer.

1.2.2 Leadership

High Standing within National and International Arenas of Transportation.

Hau Hagedorn, NITC Associate Director, received the CUTC-ARTBA Award for Administrative Leadership on January 6, 2021.

35 faculty and 50 student researchers from NITC-funded universities contributed to 49 sessions in the 2021 virtual program of the Annual Meeting of the Transportation Research Board. Four NITC Dissertation Fellows presented their NITC-funded doctoral research: Erin Roark Murphy, UTA (Transportation as a Critical Factor in the Homelessness Continuum); December Maxwell, UTA (Land

Allotment, Transportation Access and Indigenous Maternal Mental Health); Sarah Robinson, UTA (Identifying and Measuring Transportation Challenges for Survivors in Intimate Partner Violence Shelters); and Robert Hibberd, UA (Employment-Worker Balance & Polycentric Transit-Oriented Development: Towards an Index).

Solving Regional and National Transportation Problems

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

- In October 2020, Hau Hagedorn was named the new Chair of Oregon's governor-appointed Bicycle and Pedestrian Advisory Committee, which serves as a liaison between the public and Oregon DOT. The eight-member committee advises ODOT in the regulation of bicycle and pedestrian traffic, the establishment of bikeways and walkways, and other statewide bicycle and pedestrian issues.
- Jennifer Dill, NITC Executive Director, was quoted by the New York Times in an article "Why Women Are Biking in Record Numbers in N.Y.C." on the cycling gender gap and changing behavior during the pandemic.

Future Leaders.

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

- Five NITC students were awarded Dwight D. Eisenhower Transportation Fellowships: Aliza Whalen and Clare Haley from UO; and Kelly Rodgers, Katherine Keeling, and Gabriella Abou-Zeid from PSU.
- Garima Desai, a participant in PSU's 2019 Transportation Undergraduate Research Fellowship program was chosen as a Rhodes Scholar. The TURF program is intended to attract undergraduates to transportation careers. Garima graduated from college in 2020 and was working as a transportation planner in Oakland, CA.
- Two projects by UU City & Metropolitan Planning students in the College of Architecture + Planning, were given awards at the American Planning Association, Utah Chapter Virtual Awards Event. Both projects were part of the Spring 2020 Graduate Workshop on Small Town and Resort Community Planning, taught by Bruce Parker, ACIP. This course explores the unique complexities and variety of small towns and resort communities in the United States and around the world. The class provides opportunities to work directly with communities in providing a valuable planning product and experience. The awards "recognize plans, projects, programs, and individuals that are making a significant contribution to planning in Utah."

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 research website. During this six-month reporting period, final reports were downloaded 1,526 times. In addition, 193 surveys were completed by people who downloaded reports (60 practitioners, 18 faculty/researchers, 31 students, 3 media/communications staff, and 81 other stakeholders). Forty percent of respondents indicated that they downloaded the report to help make decisions about practice. They heard about the research/reports from: NITC newsletter 22%, TRB website/TRID search 19%, web searches 36%, colleagues 9%, and other sources 14%. Eighty-eight percent of them rated the reports as very or somewhat useful, with 82% saying the reports met their needs, and 95% 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, 13 bachelor, 25 graduate and 9 PhD programs in transportation and closely related fields, including several dual degree options. Last fall, UO's School of Planning, Public Policy & Management started a new PhD program in Planning and Public Affairs. The program will include students focusing on transportation and sustainable cities. 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 connect transportation-focused students to community partners and employment opportunities by engaging them in activities and research that build on their course learning.

We support 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. The COVID-19 pandemic shut down in-person activities starting in March 2020. The student groups have not held many online activities. A total of nine events were attended by 120 participants (Appendix, Table 6). We hope for in-person activities to resume in Fall 2021.

NITC researcher Cathy Liu is the faculty mentor for UU's Civil and Environmental Engineering senior capstone project on professional practice and design. The six student team is designing a six-block corridor of environmentally friendly and sustainable bike lanes for 300 West, a major street in downtown Salt Lake City. The lanes will connect existing bicycle infrastructure at the north and to the south and will be compatible with the existing built environment along the route. Their project is a partnership with Salt Lake City, which was awarded $2.8 million in state funds to design and construct the protected bike lanes along the corridor. During the Fall semester, the student team completed the feasibility analysis and determined to proceed with the design plan of implementing one protected bike lane along each direction of the 300 W corridor. This Spring semester, the student team completed their drawing set deliverables and the client has provided really positive feedback.

Develop Innovative New Curriculum and Learning Opportunities.

Through TREC at PSU's Better Block PSU pathway program, the PSU senior civil engineering class is working with the César Chávez School in Portland, Oregon to re-design a safer route to the school where a student was recently hit by a driver. Three new projects, submitted by community members, were selected for Better Block PSU pathway program and integrated into the PSU Bicycle and Pedestrian Planning course for the spring 2021 term:

- *City of Independence Neighborhood Greenways*: This project will help create a low-stress biking and walking network through Independence connecting local schools, businesses, and parks.
- *Community Green Space for Parkrose*: This project plans to create a pathway from the Parkrose neighborhood to the Columbia Slough to increase access to green space and community knowledge of the Slough.
- *Arleta Triangle Transformation*: This project will transform a dangerous slipway into community space including a skate park, basketball court, and electric mobility hub, which have been identified as needs from the community.

Educate Professionals.

During the reporting period, NITC supported 15 events that were attended by 2,177 professionals: 5 webinars attended by 993 individuals (primarily practitioners) and 10 Friday Transportation Seminars attended virtually by 1,184 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 (https://nitc.trec.pdx.edu/events). Viewers streamed our events from all over the United States, Canada, and several countries. These events are one-hour long and attendees may receive one AICP professional development credit. During this period, APA awarded practitioners 706 AICP credits, and the practitioners rated TREC's events 3.96 out of 5 stars. Since 2000, the events have a 4.12 out of 5 rating from 8,514 reviews. Attendees must fill out an evaluation form to receive their AICP credit, and we use this feedback to improve future events. For example, some practitioners have indicated that the researcher needs to focus the presentation more on findings rather than the methodology. Additional feedback is included in the impacts section of this report.

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.

In December 2020, the publisher behind the book "The Big & Awesome Bridges of Portland & Vancouver" released an updated electronic version to increase access to this curriculum resource. NITC helped fund the original 240-page, full-color book focused on the Portland, OR and Vancouver, WA region. Featuring 22 big river railway and roadway bridges between Vancouver and Oregon City, with a 19-page bridge building and load-testing unit, the poems and artwork of students and adults, and interviews with engineers, ironworkers, bridge operators, and others.

Attract and Support Graduate Students.

NITC offers dissertation fellowships to Ph.D. students who have advanced to candidacy. This reporting period, NITC's Executive Committee reviewed proposals and awarded dissertation fellowships to two students: Kelly Rodgers (PSU) for The use and influence of health indicators in transportation decision-making, and Sheida Khademi (UTA) for Modeling Highway Capacity and Level of Service for High-Volume Freeways: Multiple Weaving Areas.

During this period, the NITC Consortium supported 58 graduate students by awarding scholarships. Last fall, we awarded the 2020 NITC Students of the Year: Gabby Abou-Zeid, PSU (UTC SOY), Aliza Whalen, UO (Master's level), and Erin Roark Murphy, UTA (Ph.D. level).

1.2.4 Technology Transfer

Move Research into Practice.

Metro (Portland, Oregon regional organization) consulted with Amy Lubitow and Julius McGee in planning for their upcoming regional travel survey. This was a direct result of their NITC research project Developing Data, Models, and Tools to Enhance Transportation Equity. For example, they recommended that Metro translate the survey into many languages and engage in community outreach to local organizations.

Use Innovative Approaches to Communicate Research Results.

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 12,193 site visitors during this reporting period. This was an 11% increase from the last period. Our highest engagement with U.S. web visitors by state is as follows: Oregon, Virginia, California, Texas, and Washington.

We continue to incorporate best practices in targeted communication, and during this reporting period continued to build structures and migrate data to HubSpot – our new online CRM (customer relationship management) database and marketing platform including forms, stakeholder engagement and outreach lists.. When our newsletters are integrated with a robust CRM, it enables NITC staff to more effectively track and manage relationships with partners, researchers, students, alumni, and practitioners.

We published sixteen 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 5,916 subscribers (24.8% open rate; 16.1% click-through rate) dedicated to communicating NITC research and events. We continue to grow our subscriber base steadily, and this reporting period saw a 7% increase.

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 teleconferences to discuss funding of projects, and address issues, particularly how to adapt to effects on research and travel due to the COVID-19 pandemic. Recently, the Executive Committee has been meeting monthly to discuss the next round of research funding and work on creating a collaborative education project focused on racial equity.

NITC also encourages our consortium faculty to collaborate on research projects. Of the 65 research projects funded to date, 45% (29) involve more than one consortium partner. Thirty-six of the research projects (55%) included investigators from more than one discipline.

Collaborating with other UTCs.

Jennifer Dill (PSU), Jesus Barajas (ITS - UC Davis), Kendra Levine (ITS - UC Berkeley), and other transportation faculty have continued to curate and share widely a collaborative, crowd-sourced reading list for university curriculum to elevate anti-racism learning as well as BIPOC academic experts in the field of transportation planning and engineering. The list has been viewed by 432 unique individuals.

NITC contacted UTA's other UTC, CTEDD, about their double-blind peer review process for awarding research grants. CTEDD staff created a multipage document sharing their experience and provided it to other UTCs. We are considering using this process in the future, but based on their information, we need to make significant changes to our forms and to how proposals and reviews are submitted.

Susan Handy (NCST director) and Yinhai Wang (PacTrans director) serve on the NITC Advisory Board. We support research dissemination of other UTCs through our social media on a weekly basis. Many of the peer reviewers of NITC final reports are faculty working with other UTCs.

External collaboration.

During this period, the NITC Advisory Board members did not meet. They will be involved this spring and summer in reviewing the next round of research 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.

- NITC PIs are encouraged to submit requests to support undergraduate or graduate research assistantships for underrepresented students. During this period, Liu-Qin Yang and Amy Lubitow were awarded funding, related to past and current NITC research projects, that will pay two underrepresented students to work on transportation research.
- Portland State University published a new set of four "How Walkable is Your Neighborhood?" education modules for high school students. The modules, which can be taught in sequence or as standalone lessons, provide students with creative ways of observing transportation systems in their neighborhoods through collecting pedestrian data, critically evaluating accessibility, and learning about livable communities. Students will gain a deeper understanding of how people move through their community, and whether the transportation in their community is designed with the needs of all people in mind. The modules were originally developed for PSU's annual transportation summer camp for high school students.

Priority funding to research with an equity focus.

Many of our research projects address equity (see **Appendix, Tables 1-5**) 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, 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 5,916 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.

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
- This summer, we anticipate another round of General Research Grants
- 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 75 different partners from outside of the consortium providing matching funds, or contributions in other ways (Appendix, Table 8). This includes partners from local governments, non-profits, regional government agencies, state DOTs, transit agencies, and industry partners. The Round 4 General Research Projects awarded this summer included at least 18 new partnerships.

2.2 Have other collaborators or contacts been involved?

A round 4 research project, Understanding Connections Between Mobility, Transportation, And Quality Of Life In Refugee Communities In Tucson, Arizona, led by Orhan Myadar, UA, worked with a local refugee organization, Lutheran Social Services, to reach potential participants as well as disseminate their survey. This collaboration was a result of shifting methods due to COVID-19 restrictions.

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

Technology transfer performance measures are summarized in Table 9.

3.1 Publications, conference papers, presentations, and events

Twenty-nine papers based on research from this FAST Act grant have been published in peer-reviewed journals, including four during this reporting period. They have been cited 138 times. Research is also published in conference proceedings (**Appendix, Table 7**). NITC has published 30 final reports, with one-page project briefs for each final report.

Past NITC research projects, supported by prior UTC grants, continue to result in publications. For example, an article in the December 2020 issue of Land Use Policy, by Rebecca Lewis and Richard Margerum of the University of Oregon, examines whether existing conditions and future plans for centers support regional goals. The article draws on findings from their NITC (MAP-21) project "Metropolitan Centers: Evaluating local implementation of regional plans and policies," with co-investigator Keith Bartholomew of the University of Utah.

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: 3,826 followers, +83):** 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 newer NITC_UTC twitter 461 followers, +62) offers more effective framing of the consortium partnership.
- **Facebook (1,038 followers, +28):** In addition to sharing research, this platform shares photos of our events and offers connection with other organizations, researchers, and practitioners.
- **YouTube (932 subscribers, +90):** Where we publish freely accessible video recordings of weekly seminars at PSU, monthly NITC webinars, special lectures, student spotlights and more.
- **LinkedIn (516 followers, +83):** 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 (568 followers, +98):** 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 15 events that were attended by 2,177 professionals: 5 webinars attended by 993 individuals (primarily practitioners) and 10 Friday Transportation Seminars attended virtually by 1,184 people (mostly practitioners). These events eligible for AICP professional development credit. During this reporting period, no additional events to support technology transfer were held.

3.4 Technologies or techniques

The New BikePed Portal Dashboard: A National Non-Motorized Count Data Archive provides a centralized standard count database for public agencies, researchers, educators, and other curious members of the public to view and download bicycle and pedestrian count data. It includes automated and manual counts from across the country, and supports screenline and turning movement counts.

BikePed Portal was established in 2015 by Transportation Research and Education Center (TREC) researchers at Portland State University through a pooled fund grant administered by the National Institute for Transportation and Communities (NITC). Other project partners include the Federal Highway Administration, Oregon Department of Transportation, Metro, Lane Council of Governments, Central Lane MPO, Bend MPO, Mid Willamette Valley Council of Governments, Rogue Valley Council of Governments, City of Boulder, City of Austin, Cycle Oregon, and Oregon Community Foundation.

3.5 Inventions, patent applications, and/or licenses

Nothing to report.

3.6 Other products

Marc Schlossberg's Rethinking Streets for COVID-19 produced a guidebook of case studies showcasing quick street transformations different US cities underwent in the face of COVID and with the need to open up more street space for walking, biking, and being. This is the third guidebook of the Rethinking Streets series focusing on retrofitting streets, and like the other two volumes, the case studies are presented to be accessible for scholars, practitioners, and the general public.

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 outcome: 9.
   They included: City of Seattle, Better Bike Share, MoGo Detroit, Wasatch Front Regional Council, Utah Transit Authority, Salt Lake County, Portland Metro, Pima County Regional Flood, City of Tucson (Tucson Water).

2. Number of projects that reach deployment and adoption (measured by the number of projects that reach TRL scale 4 or 5): 6.
   Additionally, we have identified nine projects that we believe will reach TRL scale of 4 or 5, including three of the recent 2020 General Research awards.

Attracting and retaining undergraduate and graduate students outcomes

- Oregon Tech student Ian Pargeter earned the Asphalt Pavement Association of Oregon (APAO) Scholarship. A BSCE senior graduating in June 2021, Ian has worked for the Wildish Companies on a variety of roadway and bridge construction projects.
- Oregon Tech Engineering Students Win 2020 Oregon ITE Traffic Bowl: The Oregon Tech Student Chapter of ITE won first prize in the 29th Annual Bill Kloos Traffic Bowl on November 19, 2020.
- In January 2021, two Portland State University students earned scholarships from the Portland Chapter of WTS– awarded to exceptional women in their educational pursuits in the field of transportation. Apy Das, a master's student in the department of civil and environmental engineering, earned the Helene M. Overly Memorial Scholarship. Natalie Chavez is a second year Master of Urban and Regional Planning (MURP) student earned the Gail Achterman Leadership Scholarship.
- Lincoln Edwards, was awarded a 2021 TRB Minority Student Fellow, this is the third year in a row this honor has gone to a NITC-supported student and is consistent with UA's federal designation as a Hispanic Serving Institution. Lincoln is a UA GRA on projects that relate to Equitable Transit Oriented Development (eTOD). He was a speaker on the TRB panel "Arrested Mobility: Exploring the Impacts of Over-policing on BIPOC Mobility in the US". His

future career goals center around issues related to transportation planning, gentrification, universal design, and community development.

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 9. Thirty 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 some of the impacts that we are now seeing from projects funded through the current and previous NITC grants (MAP-21, SAFETEA-LU).

- Number of stakeholders reporting impact from surveys: 72
- Number of stakeholders who have adopted, implemented or deployed research findings or technologies: 22

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

Reid Ewing's research project Reducing VMT, Encouraging Walk Trips, and Facilitating Efficient Trip Chains through Polycentric Development identified best practices from four case studies in Portland, Denver, Minneapolis-Saint Paul, and Seattle. The final report's findings will be incorporated into the Wasatch Front Regional Council's new regional transportation plan in Salt Lake County. Additionally, practitioners from Texas and Washington reported understanding new approaches and results from the final report and webinar. For example, "[The webinar] clearly helped articulate how centers affect transportation behaviors. Very interesting and I will be looking for activity centers in my own work."

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?

On February 9, 2021, Oregon Congressman Jimmy Panetta (D-Carmel Valley) and Congressional Bike Caucus Chairman Earl Blumenauer (OR-03) introduced the Electric Bicycle Incentive Kickstart for the Environment (E-BIKE) Act to encourage the use of electric bicycles, or e-bikes, through a consumer tax credit. They cited the NITC study: A North American Survey of Electric Bicycle Owners (2018, NITC).

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

Hal Johnson at Utah Transit Authority used the results of Cathy Liu's NITC 1222 project on environmental equity and battery electric bus deployment model: "We are making investments based on her recommendations from the model and from the tool, for five more high-powered chargers in our system." UTA is placing electric buses & charging infrastructure in neighborhoods that were identified by the model as being the highest priority, meaning the lowest-income neighborhoods with the poorest air quality.

Better Bike Share Partnership has recently re-promoted ten two-page briefs on their website under the headline This Equity Study Is as Important as Ever. NITC funding supported the creation of the briefs in 2020 drawing from the report The National Scan of Bike Share Equity Programs by PSU's John

MacArthur and Nathan MacNeil. The briefs summarize best practices for cities and operators to help them learn from others.

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

Keith Bartholomew's (UU) NITC report and webinar on The Role of Bus Stop Features in Facilitating Accessibility was timely based on comments from practitioners that are involved in this work.

- "Excellent detail on bus stop design and customer access for bus stops. Very relevant to my job."
- "I used the report as a reference for how to better include accessibility within local transit-related plans."
- "Just reviewed it for bus stop improvements, sent to colleagues."
- "This info is useful in my consultations with Transit Agencies and Contractors."
- "It helped us craft an inventory of bus stops and what features to assess."

Bicycle design and planning

Marc Schlossberg's (UO) Rethinking Streets for People on Bikes guidebook, which was published in 2019, continues to be used by practitioners:

- "We are currently doing a bike plan update in our town and I used it for reference in discussions with my engineering colleagues." (comment by transportation planner)
- "I routinely consult with communities on public health, transportation, and land use, and I find many local decision-makers are more moved by real-world examples to which they can relate. So I sometimes refer them to a specific example in the "Rethinking Streets" compilations that is similar to a street or project they are considering. But I also suggest to local engineers and planners that they should download both "rethinking" summaries just for the raw educational and reference value. I find that the inclusion of before & after images, speeds, and ADT and contextual information helps make the examples more relevant to readers. Many thanks for this terrific content."
- "I used to design future rethinking of streets here in Asuncion, Paraguay. I want to know which is the best solution for a 9.5 meter avenue street, to include a cycle lane. Thanks."
- "I am the staff liaison to the Newport Oregon bike-ped advisory committee and I wanted to show the city council possibilities."

Interdisciplinary impact

PSU Transportation Economist Jenny Liu's report Understanding Economic and Business Impacts of Street Improvements for Bicycle and Pedestrian Mobility helps transportation professionals communicate more effectively with their community members.

- A public health and planning consultant from Massachusetts states "I routinely reference the report when doing workshop presentations as high quality research supporting the economic benefits of complete streets initiatives. I find it is often a more compelling argument than simply arguing for the public health benefits of active transportation."
- An engineer from Alberta, Canada, uses it to inform residents about the impacts of active mode projects.

Next generation of researchers.

A researcher at the University of Colorado, Boulder, who looks to NITC for transportation research, recently used the NITC report *Developing Data, Models, and Tools to Enhance Transportation Equity* as a reference for their own report on transportation equity.

Next generation of faculty.

Two UTA doctoral students Md Mintu Miah and Farah Naza are lead authors on a new article exploring the impacts of ride-hailing and other shared services on paratransit use in *Research in Transportation Economics*. They worked with an interdisciplinary faculty team including Kate Hyun, Stephen Mattingly, Courtney Cronley and Noelle Fields. These researchers have worked on several NITC-funded projects focusing on addressing mobility gaps for underserved communities, concentrating on looking at this issue through a cross-disciplinary lens.

6 CHANGES/PROBLEMS

6.1 Changes in approach and reasons for change

As of March 2020, all in-person activities were suspended due to the coronavirus pandemic. This has significantly affected research timelines for our Round 3 and Small Starts 2019 projects. Most of these projects, particularly those requiring in-person data collection, have had no-cost extensions to accommodate delays. Projects that proposed in-person qualitative data collection (e.g. focus groups, interviews) are trying to use other approaches. Other projects may require more significant changes, such as in cases where the transportation system or behavior does not return to pre-COVID conditions. For example, one project became two projects: one is a scaled down version of the original project, and the other is studying new changes in Eugene, OR to cope with COVID-19. The new COVID-19 research project was recently completed, but the scaled down original project requires an extension.

The pandemic has challenged our ability to engage students outside the classroom -- something that was done largely in-person before the pandemic. We expect in-person activities to resume in Fall 2021. NITC continues to support students as research assistants and through fellowships. However, overall students are more stressed than normal and often do not have capacity to engage in activities beyond completing courses and fulfilling work commitments. The restrictions did, however, open up one new opportunity. With the low cost to attend the TRB Annual Meeting virtually in January 2021, Portland State had more students attend than normal, including undergraduate students. The virtual format was also more flexible with student class schedules. Since the PSU winter term starts in early January, students normally miss a full week of courses if they attend in Washington DC. We also hosted a Slack workspace for the NITC TRB attendees to encourage networking during the multi-week event.

6.2 Changes that have a significant impact on expenditures

Travel has not been allowed due to COVID-19. Conferences have been held online at lower costs. The annual Transportation Undergraduate Research Fellowship (TURF) Summer program for undergraduate students was not held in 2020 at PSU. The program will not be held in 2021 either. 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

Social distancing is negatively affecting research projects that use in-person interviews for data collection. Researchers are using online methods such as surveys and interviews.

6.4 Change of primary performance site location from that originally proposed

NITC staff and researchers are working from home. University campuses were closed to in-person meetings. We anticipate campuses will reopen for Fall 2021 term.

7 SPECIAL REPORTING REQUIREMENTS

Not applicable.

8 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.)	Uni	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.)	Uni	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	Active
	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	Active
	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	Active
	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	Active
	Development Of Low-Cost Radar-Based Sensor For Multi-Modal Traffic Monitoring	Siyang Cao Yao-Jan Wu	UA	Active
	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	Active
	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	Active
	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	Active

*Research projects that address equity 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. Student group activities during this reporting period

Student group	Activity	Date	# of participants
STEP (PSU)	TRB Aftershock with local partner YPT Portland	2/9/2021	15
	Lunch and Learn with Nick Gross, from Kittelson & Associates	3/11/2021	
ITE (Oregon Tech)	Oregon ITE Traffic Bowl (virtual)	11/19/2020	10
	TRB Annual Meeting, Washington, DC (virtual)	1/12/2021	10
	ITE Student Chapter meeting	1/19/2021	27
Live Move (UO)	Chapter meetings	weekly	
	Speaker Series: Tamika Butler	10/28/2021	
ITE (UTA)	Joint ITE and WTS October Guest Speaker Lecture	10/26/2020	8
Point B (UU)	Point B: First Meeting of 2021	1/25/2021	11
	Webinar: The Intersection of Equity & Diversity: Infrastructure Impacts on Underserved Communities	2/2/2021	2
	Transport Systems in the USA Documentary	2/24/2021	2
	Legislative Summit: Transportation @ the 2021 Utah Legislative Session	3/24/2021	35
UA	No events due to COVID-19		0

Table 7. List of publications resulting from work funded by NITC.

Publication type	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	**8**
	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	**3**
	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	**14**
	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	7
	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 doi:10.1007/s12469-018-0184-4	15
	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	4
	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	0
	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	1
	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	3
	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	0

Publication type	Citations (alphabetical) and DOIs	# of Citations
	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	6
	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	1
	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	1
	Miller, V. J. (2019). Investigating Barriers to Family Visitation of Nursing Home Residents: A Systematic Review. Journal of Gerontological Social Work, 62(3), 261-278. doi:10.1080/01634372.2018.1544957	6
	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	0
	Nelson, A. C., Stoker, P., & Hibberd, R. (2018). Light rail transit and economic recovery: A case of resilience or transformation?. Research in Transportation Economics. https://journals.sagepub.com/doi/abs/10.3141/2651-03	5
	Nelson, Arthur C. 2017. Transit and Real Estate Rents, Transportation Research Record: Journal of the Transportation Research Board, Vol 2651(5), 22-30	7
	Nelson, Arthur C. et al. 2017. Transit-Oriented Developments Make a Difference in Job Location, Fordham Urban Law Journal, Vol 44 (4), 1079-1102 doi:10.1016/j.retrec.2018.11.003	3
	Park, K., Ewing, R., Sabouri, S., Choi, D. A., Hamidi, S., & Tian, G. (2020). Guidelines for a Polycentric Region to Reduce Vehicle Use and Increase Walking and Transit Use. Journal of the American Planning Association, 14. doi:10.1080/01944363.2019.1692690	13
	Park, K., Sabouri, S., Lyons, T. et al. Intrazonal or interzonal? Improving intrazonal travel forecast in a four-step travel demand model. Transportation (2019). https://doi.org/10.1007/s11116-019-10002-0 https://doi.org/10.1007/s11116-019-10002-0	3
	Wang, Q. Z., Yang, X. F., Huang, Z. T., & Yuan, Y. (2020). Multi-Vehicle Trajectory Design During Cooperative Adaptive Cruise Control Platoon Formation. Transportation Research Record, 2674(4), 30-41. doi:10.1177/0361198120913290	2
	Wei, Y. D., Xiao, W. Y., Medina, R., & Tian, G. Effects of neighborhood environment, safety, and urban amenities on origins and destinations of walking behavior. Urban Geography. doi:10.1080/02723638.2019.1699731	1
	Wu, Y. Y., Wei, Y. D., & Li, H. (2020). Firm Suburbanization in the Context of Urban Sprawl: Neighborhood Effect and Sectoral Difference. Professional Geographer, 72(4), 598-617. doi:10.1080/00330124.2020.1750437	5

Publication type	Citations (alphabetical) and DOIs	# of Citations
	Wu, Y. Y., Wei, Y. H. D., & Li, H. (2020). Analyzing Spatial Heterogeneity of Housing Prices Using Large Datasets. Applied Spatial Analysis and Policy, 13(1), 223-256. doi:10.1007/s12061-019-09301-x	10
	Yang, X. F., Chang, G. L., Zhang, Z., & Li, P. F. (2019). Smart Signal Control System for Accident Prevention and Arterial Speed Harmonization under Connected Vehicle Environment. Transportation Research Record, 2673(5), 61-71. doi:10.1177/0361198119837242	6
	Zhang, Z., Yuan, Y., & Yang, X. F. (2020). A Hybrid Machine Learning Approach for Freeway Traffic Speed Estimation. Transportation Research Record. doi:10.1177/0361198120935875	2
	Zhang, Zhao, & Yang, Xianfeng. (2020). Freeway Traffic Speed Estimation by Regression Machine-Learning Techniques Using Probe Vehicle and Sensor Detector Data. Journal of Transportation Engineering, Part A, 146(12), Journal of transportation engineering, Part A, 2020-12-01, Vol.146 (12). https://doi-org.proxy.lib.pdx.edu/10.1061/JTEPBS.0000455	1
Peer - reviewed Published proceedings of conferences & meetings	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 8: Organizations partnering with NITC projects.

Organization		Contribution Type			
Name	Location	Financial support	In-kind	Data	Other
AARP Oregon	Oregon				x[1,4]
Alliance for Walking and Biking	Washington, DC				x[1]
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 Eugene	Oregon	x			x[1]
City of Gresham	Oregon	x			
City of Irving	Irving, TX		x		x[1,4]
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			
Clevor Consulting Group	Portland, OR	x			
Colorado DOT	Denver, CO	x			
Community Action Committee	Knoxville, TN				x[2]
Concord Engineering	Utah	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]

Organization		Contribution Type			
Name	Location	Financial support	In-kind	Data	Other
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	
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]
Rowell Brokaw Architects	Eugene, OR	x	x		
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		
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		
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			

Organization		Contribution Type			
Name	Location	Financial support	In-kind	Data	Other
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	

[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 9. Technology Transfer Performance Metrics

Tracking Parameter	Performance Metric	Performance Goals & Key Performance Indicators (KPI)
Outputs	Number of final reports 30 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 31	Meet or exceed the number of publications (KPI: 1 publication/project) On track
	Number of presentations at national/ international and professional/trade conferences 50	Meet or exceed the number of presentations (KPI: 1 presentation/project) On track
	Number of events and event participants for technology transfer 15 events/last six months 140 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 4 briefs 5 webinars 3 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.) 347 downloads of 10 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 8 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) - 7% NITC Twitter - 16% Facebook - 3% YouTube - 11% LinkedIn - 19% Instagram - 21% Ongoing performance of online engagement NITC Newsletter (open rate) - 24.8%	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) - 16.1% NITC Website (# of site visitors) - 12,193	NITC Website (# of site visitors) - 10,900 per 6 months On track
Outcomes	Number of stakeholders who collaborated on implementing research outcomes 9 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. 6 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 45 Practitioners 1 Faculty/Researchers 11 Other stakeholders	Meet or exceed response rate of stakeholders. (KPI: TBD) In progress
	Number of stakeholders who have adopted, implemented or deployed research findings or technologies: 22	Meet or exceed number of adoptions, implementations and deployments (KPI: TBD) In progress