



Program Progress Performance Report for University Transportation Center at Portland State University

Submitted to: U.S. Department of Transportation
Office of the Secretary-Research

Grant Number: DTRT1-G-UTC27

Project Title: National University Transportation Center
National Institute for Transportation and Communities (NITC)

Consortia members: Portland State University (PSU), University of Oregon (UO), University of South Florida (USF), Oregon Institute of Technology (Oregon Tech), University of Utah (UU)

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Submission Date: April 30, 2019

DUNS: 05-222-6800

Recipient Organization: Portland State University
PO Box 751
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Grant Period: October 1, 2013 – June 30, 2019

Reporting Period End Date: March 31, 2019

Report Term: Semi-annual


Signature: 

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1. ACCOMPLISHMENTS: What was done? What was learned?

The information provided in this section allows the OST-R grants official to assess whether satisfactory progress has been made during the reporting period.

What are the major goals of the program?

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

Research

- **Build and extend our current research through Year 1 Projects.** During the first year, we will undertake research projects that build upon and extend our current work, and reflect priorities identified by our external advisory board. All Year 1 project work plans will be peer-reviewed.
- **Competitive, peer-review project selection process in Years 2 and 3.** Our projects in Years 2 and 3 will be selected through an open RFP process to consortium faculty. These funds will be available for projects consistent with our theme.
- **Transportation for Livable Communities Pooled-Fund Research.** We will continue the Transportation for Livable Communities Pooled-Fund Research program. This program provides regional and local agencies, such as metropolitan planning organizations and municipalities, more opportunity to be invested in research.

Leadership

- **High Standing within National and International Arenas of Transportation.** NITC faculty are well regarded nationally and internationally as leaders in their fields. They will continue to demonstrate this leadership through publishing in the top journals and presenting their work at conferences. NITC takes the concept of leadership far beyond academic circles, as evidenced by the wide dissemination of research results in professional, technical and general publications and other media.

NITC faculty help address national transportation problems through volunteer leadership on TRB committees and in other positions. By serving on these committees, faculty will 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, junior faculty to apply for committee and panel membership and recognize the activities of all faculty members.

- **Solving Regional and National Transportation Problems.** NITC researchers have a long history of conducting research that is useful in solving the problems practitioners and decision-makers face every day. 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 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 will continue to offer a rich array of degrees that serve the transportation profession.
- **Provide Experiential Learning.** A key component of our education strategy is experiential learning, which will help attract and retain students. Our campuses will continue to provide these opportunities, and NITC will seek ways to expand them.
- **Develop Innovative New Curriculum.** We will develop new, innovative curriculum consistent with transportation and livable communities 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 transportation practitioners with the latest tools and techniques.
- **Attract and Support Undergraduate Students.** NITC will build upon existing and effective mechanisms to expose K-12 students to transportation, attract and retain new undergraduate students to our degree programs, and involve undergraduates in our research.
- **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.
- **Sponsor a Transportation and Livable Communities Student Competition.** To further attract students to transportation-related professions and to promote integrated education into transportation and livability issues, NITC will sponsor an annual competition on transportation and livable communities.

Technology Transfer

- **Move Research into Practice.** Each research project will include a well-defined scope of work that identifies the problem the research will solve, how the research will address the problem and how the results will be implemented. We will continue our practice of having every final report peer reviewed by at least one academic and one practitioner with relevant knowledge. We will also identify "implementation champions" the influential decision makers, executives and other top officials who can

cut through organizational obstacles to deploy research results. We will provide these champions yearly summaries of our deployment successes as a reminder of the value of our research. Researchers working closely with practitioners and champions throughout the project ensures that our research stays current with the changing needs of practice and delivers research results in the optimal format.

- **Use Innovative** Approaches to Communicate Research Results. NITC will embark on an ambitious program of sharing information through traditional and new media.

Collaboration

- **Collaborating within our consortium.** NITC's governance structure is cooperative and leadership is distributed. The Executive Committee includes one faculty member from each campus. The Executive Committee provides overall direction for the Center, makes project funding decisions, and selects Center 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
- **External collaboration.** 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.

Diversity

- **Attract underrepresented students to transportation careers.** We aim to attract underrepresented middle through high school students to transportation as a career through our partnerships with STEM and WTS.
- **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. In addition, three of our projects selected for the first year directly address equity issues.

What was accomplished under these goals?

The following progress was made under each of the above stated goals. Most activities during this reporting period was supported by the NITC grant under the FAST Act. Details are provided in the NITC FAST Act PPPR. Funds expended during this period specifically focused on wrapping up final research projects, dissemination of research results and working towards closing out the grant by June 30, 2019.

Research

- **Build and extend our current research through Year 1 Projects.**

Thirteen projects were selected for **NITC National Year 1** funding. Of these projects, eleven projects have been completed and published on NITC's website. The draft final report will be submitted in May and will undergo peer review and final copy edits. One project was cancelled, because the PI passed away and the necessary expertise was not anymore available at the university to complete the project ([Appendix, Table 1](#)).

- **Competitive, peer-review project selection process in Year 2**

Sixteen projects were selected for **NITC National Year 2** funding. Of the funded projects, 15 projects have been completed and published on NITC's website. The remaining project is complete and draft report will be submitted in May ([Appendix, Table 2](#)).

Four Small Starts projects were funded, and all projects have been completed and published on NITC's website ([Appendix, Table 2](#)).

- **Competitive, peer-review project selection process in Year 3**

Ten of the 11 projects funded **in Year 3** have been completed. Ten reports have been published. One project is complete and the draft report will be submitted in May ([Appendix, Table 3](#)).

Both Small Starts projects selected in Year 3 have been completed with one published and the second one is under peer review ([Appendix, Table 3](#)).

- **Transportation for Livable Communities Pooled Fund Research.**

The pooled fund project, **Contextual Guidance at Intersections for Protected Bicycle Lanes (Chris Monsere, PSU)**, is complete and the research team is currently finalizing the report for the project.

The project set out to identify contextually appropriate, safe, and comfortable designs for intersection locations, for planners and engineers. The research team employed a combination of user surveys and simulations to anticipate expected bicyclist and turning vehicle interactions and bicyclist comfort based on design type and volumes. A total of 277 respondents rated 26 video clips showing cyclists riding through a variety of intersections, for a total of 7,166 ratings. Surveys were conducted at four locations in three states, including urban and suburban locations in Oregon, Minnesota and Maryland.

By combining survey comfort findings based on design with expected interactions based on bicyclist and turning vehicle volumes, cities can select designs that meet this criteria. This project will provide valuable information to cities as they seek to include comfort-based factors into design selection criteria – an endeavor that may be essential to attracting the coveted Interested but Concerned riders.

Leadership

- **Shape national & international conversations on transportation research and education.**

Sirisha Kothuri's (PSU) paper on "Minimizing Annual Average Daily Nonmotorized Traffic (AADNT) Estimation Errors: How Many Counters are Needed per Factor Group" won a TRB committee award at the TRB Annual Meeting for the committee's best paper.

Additional updates are included in the FAST Act PPPR.

- **Serve on national committees and panels.**

- Faculty, researchers, staff and students currently hold 59 TRB volunteer memberships, including 41 memberships on committees and 18 on panels / task forces / workgroups. Three serve as Chair on a panel or committee.

- NITC faculty, researchers and staff serve on 57 editorial, policy and other advisory boards.
- NITC's Director, Jennifer Dill, serves on the Board of Trustees for the Transit Center and on the Board of Advisors, UC Davis Institute of Transportation Studies.

- **Solving Regional and National Transportation Problems.**

John MacArthur presented his e-bike research on a Feb 11th panel on "Mobility Transformations via E-biking" at the Washington Bike Summit.

Additional updates are included in the FAST Act PPPR.

Education and Workforce Development

- **Offer Degrees and Courses in Multiple Disciplines.**

NITC universities offer **11 bachelor**, **15 graduate** and **6 PhD degrees** in transportation, closely related fields as well as **seven dual degree** options. Two of the degree programs offered by the University of Utah receive support from the Mountain Plains Consortium.

- **Provide Experiential Learning.**

Our campuses incorporate education with access to community partners and employment opportunities. This is primarily supported through student groups and student scholars.

The city of Portland - PSU transportation class for residents continues to make its impact. The latest example of the course in action is demonstrated by a Portlander who used the knowledge he gained to suggest safety improvements near his daughter's school.

All NITC student group activities are included in the NITC FAST Act PPPR.

- **Develop Innovative New Curriculum.**

NITC funded 13 education projects. All projects have been completed and eleven of these projects developed curriculum are published on NITC's website (Appendix, Table 4).

These projects fill a curriculum gap or offer innovative ways to teach specific topics:

- Multimodal planning is a fast-growing field and university course materials are often derived from an older, auto-centric system. **Two funded projects** (Kristine Williams, USF) develop curriculum for multimodal transportation planning and its role in advancing livability and related objectives. Curriculum developed under this project was designed for integration into university urban planning programs, but is also relevant to graduate-level engineering and architecture/community design programs.
- The project **Pedestrian Observation and Data Collection Curriculum** (Jennifer Dill, PSU) synthesizes new and available and new curriculum to help educators integrate Pedestrian curriculum in their teaching.
- **A Smart Bike Project for Grades 6-12**, (Stephen Fickas, UO) uses YouTube videos developed by students for students to teach how to develop and program a bike box that can be used to trigger a street light remotely.

- **Collaborative Regional Planning: Tools and techniques for teaching collaborative regional planning to enhance livability and sustainable transportation**, a project designed for teaching collaborative planning to students and practitioners, it has become significant traction regionally. The PI, Danya Rumore (UU), has received significant interest for the curriculum and is now developing a webpage with a local partner that will house it.
- The field collection of vehicle dynamic response is a topic not usually found in undergraduate programs, and not all that common in graduate-level electives. This **Instructional Modules for Obtaining Vehicle Dynamics Data with Smart Phone Sensors**, (Roger Lindgren, Oregon Tech) This project supports coursework development at both the undergraduate and graduate level by the creation of field laboratory modules related to vehicle operating dynamics with the use of smartphone/iPod technology.
- The project, **Dynamic Evaluation of Transportation Structures with iPod-Based Data Acquisition** (Charles Riley, Oregon Tech), uses a new and innovative way to teach and evaluate bridge infrastructure.

- **Educate Professionals.**

As NITC is starting to close out this grant, activities and events that focus on educating professionals are detailed in NITC's FAST Act PPPR.

- **Attract and Support Undergraduate Students.**

These activities are detailed in NITC's FAST Act PPPR.

- **Attract and Support Graduate Students.**

Activities related to this are detailed in NITC's FAST Act PPPR.

NITC funded **four Ph.D. fellowships**. Three dissertation fellows have moved on to tenured track positions at the University of Arizona (Kristina Currans), Texas A & M University (Tara Goddard), and Utah State University (Patrick Singleton).

Technology Transfer

- **Move Research into Practice.**

During this reporting period, researchers gave **8 presentations** at conferences, workshops, and webinars **reaching over 770 people**. NITC broadcasted webinars for the following projects:

- Addressing Bicycle-Vehicle Conflicts with Alternate Signal Control Strategies, Sirisha Kothuri, PSU (114 attendees)
- Segmenting the Market for Transportation Demand Management Campaigns, Phil Winters and Amy Lester, USF (131 attendees)

NITC solicits input from practitioners, who downloaded final reports from NITC's website to assess if the reports meet the needs of professionals. During this reporting period, 204 practitioners downloaded final reports from NITC's website. NITC final reports were downloaded approximately 740 times. For example, the feedback for the project

“SEGMENT: Applicability of an Existing Segmentation Technique to TDM Social Marketing Campaigns in the United States” has some specific applications to support planners. One respondent mentioned that, “I work at a nonprofit that works to reduce single occupancy vehicle use in our city, so the report can help us make more informed decisions about how we target residents.” Another works with social marketing to reduce drive alone trips and they will be using the research to inform the development of their travel demand management plan.

- **Use Innovative Approaches to Communicate Research Results.**

Compared to the previous six-month period, the NITC website has seen a significant increase in web traffic:

- Overall, there was a **38.5% increase** in number of visitors to our site, which indicates we are 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.

Collaboration

- **Collaborating within our consortium.**

These activities are detailed in NITC’s FAST Act PPPR.

- **External collaboration.**

The following people and organizations were members of the NITC Advisory Board:

Alan Lehto, Director of Planning & Policy, TriMet
Michael Baltes, ITS Program Manager, Office of Mobility Innovation, Federal Transit Administration
Michael Bufalino, Research Section Manager, Oregon Department of Transportation
Wendy Cawley, Traffic Safety Engineer, Portland Bureau of Transportation
Tyler Deke, Executive Director, Bend MPO
Susan Handy, Director, National Center for Sustainable Transportation
Matthew Hardy, Program Director, Policy and Planning, AASHTO
Susan Herbel, Principal, Cambridge Systematics
Craig Honeyman, Legislative Director, League of Oregon Cities
Cameron Kergaye, Director of Research, Utah DOT
Wayne Kittelson, Founding Principal, Kittelson & Associates, Inc.
Ted Knowlton, Sustainability Director, Wasatch Front MPO
Brian Lagerberg, Director, Public Transportation Division, WSDOT
Ivan Marrero, Division Administrator, Utah Division, Federal Highway Administration
Gabe Rousseau, Safety Operations Team Leader, FHWA
Brian Saelens, Professor of Pediatrics and Psychiatry & Behavioral Sciences, Seattle Children's Hospital
Tom Schwetz, Planning & Development Manager, Lane Transit District
Yinhai Wang, Director, PacTrans

Diversity

- **Attract underrepresented students to transportation careers.**

These activities are detailed in NITC's FAST Act PPPR.

- **Priority funding to research with an equity focus.**

Eight projects directly address equity issues:

- Encouraging Low-Income Households to Make Location-Efficient Housing Choices
Developing a model for Transit Oriented Development in Latino Immigrant Communities (*published*)
- Planning ahead for livable communities along the Powell-Division BRT:
neighborhood conditions and change (*published*)
- What do we know about Location Affordability in U.S. Shrinking Cities? (*published*)
- Integrating Title VI and Equitable Investment in Transportation Alternatives into
the MPO Transportation Planning Process (*published*)
- Racial Bias in Drivers' Yielding Behavior at Crosswalks: Understanding the Effect
(*published*)
- Evaluating Efforts to Improve the Equity of Bike Share Systems (*3 reports published*)
- Evaluating and Enhancing Public Transit Systems for Operational Efficiency, Service
Quality and Access Equity (*published*)
- The Use of Mt. Mazama Volcanic Ash as Natural Pozzolans for Sustainable Soil and
Unpaved Road Improvement (*published*)

How have the results been disseminated?

During this reporting period, NITC published nine final reports of funded research. NITC also created Executive Summaries that distill a project's premise, key findings and recommendations into a brief document. Nineteen NITC research stories were featured in local and national news outlets. NITC research resulted in publications in four peer-reviewed journals and one trade publication. NITC researchers gave eight presentations at conferences that reached over 770 practitioners, fellow academics, and policy makers.

The following press articles include mention of NITC funded research:

- Impacts of Bus Rapid Transit (BRT) on Surrounding Residential Property Values (Martin Catala , Victoria Perk)
 - How the Red Line is expected to affect home values along the route (Indy Star, March 29, 2019)
- National Electric Bike Owner Survey (John MacArthur)
 - E-bikes charge into the Adirondacks (Adirondack Explorer, March 20, 2019)
 - Will electric bikes catch on in LA? (Curbed, Los Angeles, March 6, 2019)
 - E-bikes jolt the bicycling world (The Columbian, December 23, 2018)
 - How do you get people onto an electric bike who have never biked before? (Wired, December 21, 2018)
 - How electric bikes can make cities safer (Curbed, November 30, 2018)
- Project: V2X: Bringing Bikes into the Mix (Stephen Fickas, Marc Schlossberg)

- V2X project aims to allow communication between cars and bikes (NBC 16, KMTR Eugene, March 28, 2019)
- Researchers at UO aim to make cycling around town safer — and more convenient (Daily Emerald, March 22, 2019)
- Evaluating Efforts to Improve the Equity of Bike Share Systems (Jennifer Dill, John MacArthur, Nathan McNeil)
 - 2018 in Bike Share Equity: A Year-End Review (Better Bike Share Partnership, December 31, 2018)
 - Bike-Share Options Are Rarely Available for People With Disabilities (New York Times, December 10, 2018)
- Understanding the Economic Impacts of Urban Greenway Infrastructure (Jenny Liu, Jennifer Dill)
 - PSU studying how bicycles benefit economy (Portland Tribune, Wednesday, December 5, 2018)

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

Expected highlights for the next reporting period include:

- Complete all remaining active projects
- Publication of remaining research reports
- Promote NITC final reports in newsletters, through social media, and webinars
- Identify and implement specific research results with partner agencies

2. PRODUCTS: What has the program produced?

Publications, conference papers, and presentations

A total of **55 final reports** have been published to NITC's website and PDX Scholar, PSU's online archive for scholarly publications. The research was also published as **33 peer-reviewed articles** in academic journals and **8 white papers** in trade publications or on professional or agency websites that have been cited **93 times**. In addition, **116 presentations** on NITC National research reached an audience of **15,455 people** at various venues, including professional and academic conferences.

Website(s) or other Internet site(s)

NITC continues to leverage our strong social media presence to promote the results of our research and tech transfer events as well as raise awareness of important transportation issues and findings nationwide. Our followers on these platforms have increased steadily:

- **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.

Technologies or techniques

Kelly Clifton's project "Transferability & Forecasting of the Pedestrian Index Environment (PIE) for Modeling Applications" offers improved tools for pedestrian modeling. The PIE index improves the sensitivity of walk trip models by incorporating contextual features of the built environment that affect walking behavior in the Portland, Oregon region.

Useful for academic researchers in transportation, Clifton's research provides a framework for incorporating pedestrian travel behavior forecasts into traditional four-step travel demand models. Researchers tested the walkability measure in Los Angeles, Minneapolis, San Diego, San Francisco, and Seattle to see if "PIE" estimated from one region could be applicable in another.

Stephen Fickas and Marc Schlossberg's project V2X: Bringing Bikes into the Mix created an app to help bicyclists at signalized intersections. Most people who bike for transportation can probably think of "that one intersection:" The light where it's impossible to get a green without waiting. Even when there are no cars, pedestrians or other bikes in sight, Fickas' app will let the signal know there's an approaching bicyclist.

Inventions, patent applications, and/or licenses

Nothing to report for this period.

Other products

Nothing to report for this period.

3. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS: Who has been involved?

What organizations have been involved as partners?

Each NITC-funded research project is required to have 120% match; other projects require a 100% match. Match partners for projects funded to date include the following:

American Automobile Association	OPAL Environmental Justice Oregon
Caltrans	Oregon Department of Transportation
City of Cambridge	Oregon METRO
City of Chicago	People for Bikes
City of Eugene	Portland Bureau of Planning and Sustainability
City of Flagstaff	Portland Bureau of Transportation
City of Los Angeles	SRAM
City of Oakland	Summit Foundation
City of Seattle	Tampa Bay Network to End Hunger
City of Tigard	Transportation for America
Cleveland State University	TriMet
District of Columbia Department of Transportation	University of Arizona
Florida Department of Transportation	University of Colorado, Denver
Hillsborough County MPO	Utah Department of Transportation
Institute of Sustainable Solutions (PSU)	Utah Transit Authority
Intel	Vancouver Housing Authority
Lane Transit District	Wasatch Front Regional Council
NACCO Industries	Washington County
Natural Resources Defense Council	

Have other collaborators or contacts been involved?

NITC researchers work closely or are supported in their research efforts by a variety of stakeholders above and beyond match partners. This includes non-profit organizations, private industry, public agencies, research centers or other university partners. Below is a list of these partners.

Bedford Stuyvesant Restoration Corporation in Brooklyn, New York	Philadelphia IndeGO Bike Share
Bicycle Product Suppliers Association (BPSA)	Portland Business Alliance
Bicycle Transportation Alliance	Portland Development Commission
Chicago Department of Transportation	Robert F. Bennett Institute for Transportation and Development
City of Arlington, VA	Sacramento Area Council of Governments (SACOG)
City of Gresham, OR	San Francisco Public Health Department
Cleveland Regional Transit Authority	Sustainable Cities Initiative
Community Cycling Center	Toole Design Group
Department of Land Conservation and Development (DLCD)	Town of Rockville
GTFS-realtime communities (online community)	Town of Springdale
Land Conservation Development Commission (LCDC)	Twin Cities Metropolitan Council
	University of Idaho
	University of Wisconsin at Milwaukee

4. IMPACT: What is the impact of the program? How has it contributed to transportation education, research, and technology transfer?

What is the impact on the development of the principal discipline(s) of the program?

Marc Schlossberg and **Heather Brinton (UO)** are combining their expertise in planning and law to address the need for developing codes and policies that address the possible impacts of autonomous vehicles on cities.

Amy Parker, PSU, the coordinator of PSU's Orientation and Mobility Program under the Graduate School of Education, is leading the way in creating new and innovative ways to address mobility needs of people with disabilities. She has established a partnership with TriMet, the local transit agency, with the ultimate goal of creating urban environments that are designed for all ages and abilities.

What is the impact on the transportation workforce development?

NITC's focus on increasing the diversity of the workforce starts at the K-12 level. Civil Engineering and Urban Planning degree programs are the typical disciplines that educate and train the future transportation professionals. According to the Bureau of Labor Statistics, in 2017 women comprise 14.4% of the civil engineering workforce. In an effort to attract more women to the transportation workforce, NITC has developed programs specially designed to allow girls to explore transportation careers. Based on data collected over the last three years, the findings showed increased knowledge of and interest in transportation. For example, in 2018, self-reported knowledge of transportation increased from an average of 2.4 to 4.2 on a 1-5 scale immediately after the program. In the 1- or 2-year follow-up survey, 60% of the girls agreed that they would like to have a career in a STEM field, and 20% indicated a moderate to strong interest in pursuing a career in transportation.

Programs, such as the summer transportation institute, are proven and effective in increasing exposure and knowledge of transportation careers to girls. Our past experience with offering a summer multimodal transportation camp for girls will grow by four fold this summer. NITC will be offering two residential summer multimodal transportation camps (PSU and Oregon Tech) a GIS-transportation day camp for girls. A fourth co-ed residential camp will be offered at PSU.

What is the impact on physical, institutional, and information resources at the university or other partner institutions?

PSU's two new university research centers focused on solving some of Portland's biggest challenges. TREC and NITC were models for these new centers and we will be collaborating with them on projects The PSU **Homelessness Research & Action Collaborative** will

focus on combating homelessness by understanding its root causes and using evidence-based science. The PSU **Digital City Testbed Center** will examine the benefits technology brings to the city, while also addressing concerns about privacy, security, and equity. This center will also function as a test bed where cities, companies, university researchers and the public will be able to evaluate new technologies before installing them in neighboring communities.

The **UO** established the **new Urbanism Next Center**, which explores the secondary effects of autonomous vehicles, e-commerce, and the sharing economy on the form and function of cities. This new center is part of the **UO's Sustainable Cities Initiative**, which was previously established with the help of NITC seed funds. The Urbanism Next Center held its first national conference in May 2018, drawing over 500 people from the private, public, educational, and non-governmental sectors. Center staff are already busy working with cities across the U.S. to help them proactively understand the secondary impacts of these transformative technological changes on local government finance, land use and transportation systems, street design and curb management, greenhouse gas impacts, equity and health.

Oregon Tech serves as the host for the new **Oregon Manufacturing Innovation Center Research and Development (OMIC R&D)**. The center brings together manufacturing companies and higher education in an innovation environment where applied research with faculty and university students solves real problems for advanced manufacturers while training the next generation of engineers and technologists.

What is the impact on technology transfer?

NITC is examining the development of implementation pathways that can help guide and perhaps streamline getting research results into the hands of practitioners.

Implementation and technology transfer for some of our research is not as clear cut. We are working on identifying implementation pathways for research areas such as policy and practices.

A pathway that we understand well is for bicycle design innovations. 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 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.”

What is the impact on society beyond science and technology?

Racial equity is a priority for many cities like the city of Portland. As a profession, transportation professionals are learning their role in how their planning practices and

designs can further solve some of the issues that racially diverse communities face especially in the public right of way. NITC's research has a broad reach and ultimately impacts the livelihood and daily lives of individuals. For example, Kimberly Kahn's (PSU) research, *Walking While Black: Racial Bias at the Crosswalk*, continues to spark conversations and already produced tangible impacts. Francesca Patricolo, planner with the City of Portland, shares how NITC research has impacted her work on the City's Citywide Pedestrian Plan. "It was a significant driver inspiring us to make concerted efforts to learn more about Black pedestrian experiences in Portland" and "The Walking While Black focus groups we held in response to our demographic results of the Walking Priorities Survey, elevated new concerns and priorities. This PSU research is actively informing City policy to impact safety and security for Black Portland pedestrians and the City hopes to partner with PSU for additional related research to inform continued policy development in this area."

Similarly, many youth equate driving as a significant milestone towards independence. However, research such as Jennifer Dill's (PSU) on community and transportation preferences show that millennials like driving less (the lowest of any generation). Youth are more like to use transit and walk. Autumn Shafer (UO) researched communication strategies to increase public transit choice among youth in Portland, Oregon. Derived from focus groups of middle-school aged Portland Public School students, the strategies are aimed at helping the Portland Bureau of Transportation and TriMet (the transit provider for the Portland metro region) to successfully engage with young riders and encourage them to form lasting habits of car-free travel. The research team chose to focus on seventh, eighth, and ninth grade students because they will soon be eligible for the free transit service provided by TriMet to all PPS high schoolers. The most effective messaging? Autonomy. The biggest deterrent? A lack of feeling safe. Dr. Shafer is now working with the local Safe Rides coordinator from the cities of Eugene and Springfield, Oregon, to partner with them to transfer her methodology to their local setting.

Another example is NITC's research on bicycle transportation has far reaching impacts. A small (less than \$20,000) national study on e-bike owners has been downloaded about 459 times from the NITC website since it was published. A survey of people who downloaded the report have revealed some interesting takeaways:

- **Impact on business and industry.** Feedback provided is that it has been helpful to describe market trends and the consumers of e-bikes. One person noted: "It will be used as part of the business planning process for a proposed e-bike venture. I found the report very useful and relevant. Information I am interested in, that was not in the report, would be information on US e-bike sales over several years, particularly useful if they were market specific."

A manufacturer commented, "As an e-bike manufacturer, there are many great findings in the report to use as a starting point for marketing our products. This report has helped us understand more about our target market and will give us real evidence in making our argument for why folks should embrace the electric bike. Thanks for all the great work!"

- **Incentives and impact on development.** Several respondents noted that the study provides important background information for incentivizing e-bike use. For example, one practitioner commented, “As an Architect, I use data from your research to help make decisions about programming and unit designs in multi-family housing projects. Thank you for making your research available to the public.” Another responded, “The statistics on trip type, percentages, and trip distance on e-bikes replacing automobile trips help support e-bike incentives as greenhouse gas mitigation measures for land use developers.”
- **Making the case for funding.** The results are being used by a variety of people to help support funding of e-bikes. One agency says, “We are using some of the statistics from the report to help support the need and future use of electric pedal-assist bikes for our bike share system when applying for grants.”

5. CHANGES/PROBLEMS

Changes in approach and reasons for change

Nothing to report for this period.

Actual or anticipated problems or delays and actions or plans to resolve them

Nothing to report for this period.

Changes that have a significant impact on expenditures

Nothing to report for this period.

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

Nothing to report for this period.

Change of primary performance site location from that originally proposed

Nothing to report for this period.

6. Additional information regarding Products and Impacts

Nothing to report for this period.

APPENDIX

Table 1. List and Status of Year 1 Research Projects.

NITC Grant	Project	Status
General Research	Changing attitudes toward sustainable transportation: The impact of meta-arguments, David Sanbonmatsu and David Strayer, UU	Published
	Developing a model for Transit Oriented Development in Latino Immigrant Communities: A National Study of Equity and TOD, Gerardo Sandoval, UO	Published
	Do TODs make a Difference? Phase 2, Arthur Nelson and Reid Ewing, UU, and Jenny Liu, PSU	Published
	Encouraging Low-Income Households to Make Location-Efficient Housing Choices, Andree Tremoulet, PSU	Published
	Improving Trip Generation Methods for Livable Communities, Kelly Clifton, PSU and Nico Larco, UO	Published
	Integrating Freight into Livable Communities, Kristine Williams, USF	Published
	Metropolitan Centers: Evaluating local implementation of regional plans and policies, Richard Margerum and Rebecca Lewis, UO, and Keith Bartholomew, UU	Published
	Modeling and Analyzing the Impact of Advanced Technologies on Livability and Multimodal Transportation Performance Measures in Arterial Corridors, Miguel Figliozzi, PSU	Published
	Rapidly Expanding Mobile Apps for Crowd-sourcing Bike Data to New Cities. Sean Barbeau, University of South Florida	Published
	Transportation Cost Index: A Comprehensive Performance Measure for Transportation and Land Use Systems and its Application in OR, FL, and UT, Liming Wang and Jenny Liu, Portland State University	Published
	Improving Bicycle Crash Predictions, Sirisha Kothuri, Portland State University	Published
	Creating Livable Communities through Connecting Vehicles to Pedestrians and Cyclists, John MacArthur, Portland State University	Completed, report pending
Generalized Adaptation of an Electric-Hydraulic hybrid drive system, James Long and David Culler, Oregon Institute of Technology	Cancelled	

Table 2. List and Status of Year 2 Research Projects.

NITC Grant	Projects	Status
General Research	Integrating Title VI and Equitable Investment in Transportation Alternatives into the MPO Transportation Planning Process, Kristine Williams, USF, and Aaron Golub, Lisa Bates and Liming Wang, PSU	Published
	Planning Ahead for Livable Communities Along the Powell-Division BRT: neighborhood conditions and change, Lisa Bates and Aaron Golub, PSU	Published
	How Does Transportation Affordability Vary Between TODs, TADs, and Other Areas, Brenda Scheer and Reid Ewing, UU	Published
	Impacts of Bus Rapid Transit (BRT) on Surrounding Residential Property Values, Victoria Perk and Martin Catala, USF	Published
	What Do We Know About Location Affordability in U.S. Shrinking Cities? Joanna Ganning, UU	Published
	The Economic and Environmental Impacts of Smart-Parking Programs, Nicole Ngo, UO	Published
	Racial Bias in Drivers' Yielding Behavior at Crosswalks: Understanding the Effect, Kimberly Barsamian Kahn, PSU	Published
	Building Planner Commitment: Are Oregon's SB 1059 & California's SB 375 Models for Climate-Change Mitigation? Keith Bartholomew, David Proffitt and Reid Ewing, UU	Published
	Evaluation of roadway reallocation projects, Miguel Figliozzi, PSU	Published
	Evaluating Efforts to Improve the Equity of Bike Share Systems, Nathan McNeil, John MacArthur and Jennifer Dill, PSU	Published
	Effectiveness of Transportation Funding Mechanisms for Achieving National, State, and Metropolitan Economic, Health, and Other Livability Goals, Rob Zako and Rebecca Lewis, UO	Published
	Addressing Bicycle-Vehicle Conflicts with Alternate Signal Control Strategies, Sirisha Kothuri, Christopher Monsere, PSU, Krista Nordback, UNC, and Ed Smaglik, NAU	Published
	Framing Livability: A Strategic Communications Approach to Improving Public Transportation in Oregon, Deb Morrison, Kelli Matthews and Nico Larco, UO	Published
	Understanding the Economic Impacts of Urban Greenway Infrastructure, Jenny Liu, PSU	Published
	Multimodal Trip Generation, Vehicle Ownership and Use: Characterizing The Travel Patterns of Residents of Multifamily Housing, Kelly Clifton, PSU	Completed, report pending
Incorporate Emerging Travel Modes in the Regional Strategic Planning Model (RSPM) Tool, Liming Wang, Kelly Clifton and Jennifer Dill, PSU	Published	
Small Starts	Narratives of Marginalized Cyclists: Understanding Obstacles to Utilitarian Cycling Among Women and Minorities in Portland, Oregon, Amy Lubitow, PSU	Published
	Travel to Food: Transportation Barriers for the Food Insecure in Tampa Bay, Kevin Salzer, USF	Published
	Active and Public Transportation Connectivity between North Temple TOD and Jordan Park River Trail, Ivis Garcia Zambrana, UU	Published
	How Do Stressed Workers Make Travel Mode Choices That Are Good For Their Health, Safety, and Productivity? Liu-Qin Yang, PSU	Published

Table 3. List and Status of Year 3 Research Projects.

NITC Grant	Projects	Status
General Research	Does Compact Development Increase or Reduce Traffic Congestion? Reid Ewing, UU and Shima Hamidi, UTA	Published
	Electric Bicycle Nationwide Survey, John MacArthur, PSU, and Christopher Cherry, UT	Published
	Rapid Transportation Structure Evaluation Toolkit, Charles Riley, Oregon Tech	Published
	Overcoming Barriers for the Wide-Scale Adoption of Standardized Real-time Transit Info, Sean Barbeau, USF	Published
	The Contribution of Transportation and Land Use to Citizen Perceptions of Livability in Oregon MPOs, Rebecca Lewis and Robert Parker, UO	Published
	Transferability & Forecasting of the Pedestrian Index Environment (PIE) for Modeling Applications, Kelly Clifton, PSU	Published
	Biking and Walking Counts: Data Quality, Nathan McNeil and Kristin Tufte, PSU	Published
	Understanding Economic and Business Impacts of Street Improvements for Bicycle and Pedestrian Mobility, Jenny Liu and Jennifer Dill, PSU	Completed, report pending
	Evaluating and Enhancing Public Transit Systems for Operational Efficiency, Service Quality and Access Equity, Ran Wei, UU, and Liming Wang and Aaron Golub, PSU	Published
	SEGMENT: Applicability of an Existing Segmentation Technique to TDM Social Marketing Campaigns in the United States, Philip Winters and Amy Lester, USF	Published
	V2X: Bringing Bikes into the Mix, Stephen Fickas, UO	Published
	Small Starts	Does Compact Development Increase or Reduce Traffic Congestion? Reid Ewing, UU, and Shima Hamidi, UTA
The Use of Mt. Mazama Volcanic Ash as Natural Pozzolans for Sustainable Soil and Unpaved Road Improvement, Matthew Sleep, Oregon Tech		Published
	Engaging Youth to increase their Transportation System Support, Understanding, and Use, Autumn Shafer, UO	Published

Table 4. Education Projects Funded by Grant.

Projects	Link to Deliverable(s)
Multimodal Transportation Planning, Kristine Williams, USF	NITC-ED-851 Final Report.pdf
Phase 2: Multimodal Transportation Planning Curriculum for Urban Planning Programs, Kristine Williams, USF	NITC-ED-998 Phase 2 Final Report , see also Project Brief
Graduate-level Civil Engineering Transportation Course, Roger Lindgren, Oregon Tech	NITC-ED-853 Final Report
Dynamic Evaluation of Transportation Structures with iPod-Based Data Acquisition Charles Riley, Oregon Tech	NITC 985 Final Report , see project page for additional resources
Advanced GIS: Smart Transportation, Christopher Bone, UO	NITC-ED-850 Final Report.pdf
Design of an Aging Population, Trygve Faste and Kirsten Muenchinger, UO	NITC 784 Final Report
Pedestrian and Transit Oriented Design, Keith Bartholomew, UU	NITC-ED-852 Final Report
Introduction to Scientific Computing for Planners, Engineers, and Scientists Liming Wang, PSU	NITC 854 Final Report , see also Executive Summary.pdf
Instructional Modules for Obtaining Vehicle Dynamics Data with Smart Phone Sensors, Roger Lindgren, Oregon Tech	NITC 1073 Final Report , see also Project Brief
Collaborative Regional Planning: Tools and techniques for teaching collaborative regional planning to enhance livability and sustainable transportation, Danya Rumore, UU	NITC 1074 Final Report , see also Project Brief
Graduate Certificate in Sustainable Transportation, Keith Bartholomew, UU	Final report completed but not published
A Smart Bike Project for Grades 6-12, Stephen Fickas, UO	Published; see also You Tube tutorial
Pedestrian Observation and Data Collection Curriculum, Jennifer Dill, PSU	Published; see also Project Brief