



A USDOT NATIONAL UNIVERSITY  
TRANSPORTATION CENTER

**Carnegie Mellon University**



THE OHIO STATE  
UNIVERSITY

UNIVERSITY of PENNSYLVANIA

## **Program Progress Performance Report for University Transportation Centers**

**Agency:** US DOT  
The Office of the Assistant Secretary for Research and Technology  
UTC Program

**Federal Grant Number:** 69A3551747111

**Project Title:** **Mobility21**, A National University Transportation Center for  
Improving Mobility of People and Goods

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Pittsburgh, PA 15213

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**Reporting Period End Date:** May 30, 2017

**Report Term or Frequency:** Semi-Annual

**Signature:** \_\_\_\_\_

## **1. ACCOMPLISHMENTS:**

*The primary goal of **Mobility 21**, a National University Transportation Center for Improving Mobility is to develop and deploy technologies, policies, incentives and training programs for improving the mobility of people and goods in the 21<sup>st</sup> century efficiently and safely. Mobility 21 will accomplish this through a comprehensive program of interdisciplinary research; education and workforce development with a focus on diversity; collaboration with university, deployment, and government partners; and technology transfer and leadership efforts.*

### **Research Metrics:**

- Faculty scientific leadership as reflected by the number of publications and citations of faculty work in transportation-related areas,
- The number of staff, faculty and students involved in leadership positions in academic, industry and government transportation organizations,
- New research collaborations in fields related to this work,
- Successful technology deployments and their impact, and
- Patents and start-ups.

### **Education and Workforce Development Metrics:**

- Number of transportation-related courses,
- Students participating in transportation research projects,
- Advanced degree programs funding Mobility21 UTC students,
- Mobility21 UTC-funded graduate students,
- Mobility21 UTC-funded students who receive degrees,
- Institutional educational partnerships, and
- Participants in workforce and educational programs.

### **Technology Transfer Metrics:**

- Simple adoption of the innovation by a transportation operator, company or public, to more formalized outcomes such as licensing, patents, commercialization, and spin-off companies.
- Quantify numbers of meetings, attendance, publications, and social media and website activity.

### **Collaboration Metrics**

- Number and diversity of members of both the Mobility21 Consortium and Advisory Council, and by the
- Number and impact of deployments achieved through collaboration.

## **PROGRAM ADMINISTRATION AND MANAGEMENT**

**Objective:** To develop and implement a program that effectively achieves the required deliverables in support of the center's primary goal.

**Accomplishments:**

- Participated in the Council of University Transportation Centers Executive Committee meeting on 11/30/16.
- Hosted Mobility21 meeting across 4 campuses (using webinar software) on 12/14/16, where the primary area of discussion was about pushing the needle on mobility research. Held subsequent faculty meetings on 3/30/17 and 4/27/17
- Participated in the University Transportation Center and Council of University Transportation Centers Winter meeting on 1/8/17.
- Participated in the Council of University Transportation Centers Student of the Year Awards Banquet on 1/7/17, where our Mobility21 Student of the Year, Chris Kaffeine received his award.
- Developed and submitted the Mobility21 Data Management Plan to OST-R on February 1, 2017. It was officially approved on May 19, 2017.
- Launched a temporary Mobility21 website on January 18, 2017. Hired a contractor to develop a comprehensive and dynamic website to make Mobility21 outputs and activity easily transferrable to the public.
- Hosted our Mobility21 University Partner Consortium meeting on 3/21/17. All partners met in Pittsburgh and enthusiastically shared their research and program tactics to achieve our shared goals and discussed areas of collaboration.
- Invited University Partner Consortium members to create their accounts on our online database portal for tracking Mobility21 research project.

## RESEARCH

**Objectives:** The Mobility 21 research activities are aimed at improving congestion, emissions and access using:

1. **Smart City Technologies** that sense, communicate and process information from across a metropolitan region and adapt operational aspects to enable traffic to flow smoothly and safely,
2. **Multi-Modal Connections** that offer multiple travel options including the first-mile/last-mile segments and shared bikes augmented by traveler information services optimized for individual needs,
3. **Assistive Technologies for People with Disabilities** that proactively offer transit assistance, sharpened awareness of the driving environment, and friendlier modes of interaction with a vehicle,
4. **Data Modeling and Analytical Tools** to track VMT, extract inter-dependencies from user lifestyles, obtain safe routes based on vehicle types, and monitor the health and status of the traffic control system,
5. **Novel Modes of Transport** with a strong emphasis on connected and automated vehicles,
6. **Regional Planning** to collect fine-grained traffic information for establishing transportation priorities, to phase in V2X deployments strategically, and to guide pedestrians, and
7. **Improved Transportation Access to Disadvantaged Neighborhoods** using smart automated shuttles.

## Accomplishments:

The most exciting piece of our research program is our newly announced Smart Mobility Challenge, modeled after the success of the US DOT Smart City Challenge. Mobility21, in partnership with the Traffic21 Institute, launched the Challenge, inviting less densely populated suburban and rural communities in the southwestern Pennsylvanian region to submit their most pressing mobility needs. Mobility21 staff will match these problem statements to researchers developing innovative mobility solutions.

Furthermore, Mobility21 selected fifteen research projects across three universities based on their ability to address pressing mobility issues with real world deployment partners. These projects kicked off on July 1, 2017.

### **1. Proactive Management of Mobility Impact of Interdependent Subsurface Utility and Roadway Construction through Incentives, Burcu Akinci, CMU**

This project's goal is to do foundational work towards the development of novel approaches that optimize the coordination of utility/infrastructure and transportation maintenance and repair activities and that enable experimenting with different incentive/disincentive strategies to minimize the mobility impact of scheduled maintenance activities. We are proposing to do this in an integrated manner so as to be able to develop a framework that not only minimizes the mobility impact of maintenance activities, but also proactively manages them through incentives/disincentives that would be dynamically generated for motorists in a given context.

*Deployment Partners: Pennsylvania Turnpike.*

### **2. Low-Cost 3D Model Acquisition for Rapid Accident Investigation, Christoph Mertz, CMU**

This project will build on CMU T-SET UTC work with Structure-from-Motion (SfM) techniques to create 3D models of the whole accident and of relevant parts. We have already developed the core methods where the investigator only needs to use a standard camera to take pictures of the scene from many locations and perspectives. Given enough images, the SfM software computes a 3D model. This project will refine the techniques, develop more tools and bring the method closer to market.

*Deployment Partners: Pennsylvania Turnpike Commission and the PA State Police.*

### **3. The Intelligent Mobility Meter: Portable Data Collection and Analysis of Pedestrian, Cyclist, and Motor Vehicle Traffic, Bernardo Pires, CMU**

This project will develop an Intelligent Mobility Meter (IMM) as a portable device that will have the capability to collect fine-grained statistics on the behavior of all road participants in any key area. Statistics about pedestrians, motor and non-motor vehicles provide important information for government officials to build safe infrastructures for walking, biking and driving. In addition to pedestrian and bicyclist data, having information about the number of motor vehicles can give key insights of the trade-offs when road space is re-assigned from motor to bike usage. The IMM grew from a need to obtain statistics on usage of bike lanes.

*Deployment Partners: City of Pittsburgh, Bike Pittsburgh.*

### **4. Data-driven Network Models for Analyzing Multi-modal Transportation Systems, Sean Qian, CMU**

This project will develop a new theory for modeling both passenger and vehicle flows in a sophisticated transportation network. The model will take data inputs collected from various sources, and analyze individual travel activities and behavior on roadway systems, transit systems and parking systems. This multi-modal network model is the key to systematic planning and operations of transportation infrastructure. Planning, operational strategies and policies can be fully examined in the network model in terms of system delays, reliability, vehicle-miles traveled (VMT), fuel consumption and emissions. Regional MPO and RPO modeling groups including the Southwestern Pennsylvania Commission (SPC), and Delaware Valley Regional Planning

Commission (DVRPC) will be interviewed to better understand their needs related to improving their regional planning models.

*Deployment Partners: The Southwestern Pennsylvania Commission (SPC), and Delaware Valley Regional Planning Commission (DVRPC).*

### **5. User-centric Interdependent Urban Systems: Using Energy Use Data and Social Media Data to Improve Mobility, Sean Qian, CMU**

This project will fuse and analyze massive data from transportation, energy, and social media systems to discover the spatio-temporal correlations of usage patterns among those systems. It will answer two types of questions. First, what can we tell about the morning commute by knowing households' utility or social media use the night before? And how can we optimally manage the morning commute using this new information. Secondly, what can we tell about the evening commute by knowing building energy use or social media activities during the daytime? And how can we optimally manage the evening commute using this new information?

*Deployment Partners: City of Pittsburgh, PennDOT.*

### **6. Latency-Aware Cloud-based Route Planning, Raj Rajkumar, CMU**

Routing strategies that impose turn restrictions (like avoiding left turns at intersections with a steady stream of opposing traffic) can significantly improve safety, latencies and emissions. This project will propose and implement routing policies that take into account the vehicles type, delay implications, hazard likelihoods and GPS availability. The aggregate outcome would be that different vehicle types will be recommended to take different routes customized to their needs and destinations.

*Deployment Partner: General Motors*

### **7. Estimating Changes in Parking Capacity and Urban Form from Vehicle Automation, Costa Samaras, CMU**

Existing technologies can be implemented to reduce parking costs. Ride-share services such as Lyft or UberPool reduce the cost of taxi rides and may reduce dense area parking demand due to mode shifts from dedicated private vehicles. Traveler information services can also reduce the costs associated with parking space search. This project is intended to assess the cost savings and changes in urban form associated with deployment of these lower parking technologies. Assessment will be conducted for downtown Pittsburgh using current parking lot data and parking codes. Results will be generalized to the 100 largest metropolitan areas.

*Deployment Partner: City of Pittsburgh.*

### **8. Real-Time Traffic Congestion Prediction and Mitigation at the City Scale, John P. Shen, CMU**

This project will focus on vehicular traffic in major cities. It will study (1) *Sensing*: Collect and curate GPS traces from large fleets of vehicles in major cities; (2) *Analytics*: Leverage data analytic and machine learning techniques to generate accurate traffic flow and congestion models based on extensive historical data; and (3) *Services*: (a) Develop an accurate real-time prediction system that utilizes historical models and real-time data; and (b) Develop novel ways to introduce real-time intervention to mitigate the potential of traffic congestion. The Data Science research group at Uber will be a project partner and CMU PhD students will be able to access real-world data as research interns at Uber.

*Deployment Partner: Uber*

**9. Integrating transit signal priority with adaptive signal control in a connected vehicle environment, Steve Smith, CMU**

Recent work on adaptive traffic signal control in urban environments has demonstrated the potential for significant gains in vehicle travel times, traffic throughput and air quality. However, Transit Signal Priority (TSP) objectives must be accomplished in an integrated manner to minimize the adverse effects on overall traffic flows. By utilizing onboard communication with the intersection as a means of bus detection rather than as a conduit for priority requests, and incorporating knowledge of bus stops and dwell time into the adaptive procedure for allocating green time to various intersection phases, active attention and priority can be given to buses within the broader framework of optimizing network-level traffic flows. TSP benefits such as greater transit schedule reliability, more effective clearance of buses through intersections, greater safety to pedestrians, etc., can be achieved without undo degradation to overall traffic flow efficiency.

*Deployment Partners: Port Authority of Allegheny County, Rapid Flow Technologies.*

**10. Universal Transit Assistance, Aaron Steinfeld, CMU**

This project will extend the T-SET UTC-supported Tiramisu system to provide personalized stop alerts via the rider's phone. Since there are significant technical challenges related to battery drain, this assistance must be provided in an energy-efficient manner. The project will then test personalized alerts for departure stops within the Tiramisu app and evaluate user acceptance and system performance.

*Deployment Partners: Tiramisu Transit, Port Authority of Allegheny County.*

**11. Using Municipal Vehicles as Sensor Platforms to Monitor the Health and Performance of the Traffic Control System, Benjamin Coifman, OSU**

This project will develop a viable, on-going monitoring program for the signalized intersections in a metropolitan area and to prioritize those signals and corridors in greatest need of retiming. The ultimate goal is to make better-informed resource allocation to determine when and where to deploy conventional traffic studies and advanced signal controls, i.e., to develop a new tool to improve the efficiency of the existing infrastructure.

*Deployment Partner: City of Columbus.*

**12. SmartShuttle: Model-Based Design and Evaluation of Automated On-Demand Shuttles, Levent Guvent, OSU**

This project will study how to deploy a low-speed automated shuttle in an urban setting by using a unified, scalable and, hence, replicable architecture while being safe and dependable. A model-based design approach will be used as the basis of a unified approach and is standard in ADAS and automated driving software development. Model-in-the-loop and hardware-in-the-loop simulations followed by road testing will be used to test this architecture for automated smart shuttle driving.

*Deployment Partner: City of Columbus.*

**13. Understanding and Guiding Pedestrian and Crowd Motion, Umit Ozguner, OSU**

This project will study, implement and evaluate a solution as a network of "on-demand automated vehicles". It will initiate a program to test and demonstrate a selection of such vehicles. The

automated vehicles will have GPS, a map database to help in routing, Vehicle to Vehicle (V2V) communication capability and will be equipped with pedestrian detection technology.

*Deployment Partner: Honda.*

#### **14. Understanding the Determinants of VMT, John Landis, UPenn**

Using household-level vehicle registration data obtained from the Pennsylvania Department of Motor Vehicles, this research project will develop census tract-level estimates of average VMT (vehicle miles of travel) per capita, per household, and per vehicle. Using linear regression and other statistical techniques, it will then compare these estimates to the demographic and socio-economic characteristics of each tract; to the built-form characteristics of each tract; and to the availability of alternative travel modes, particularly public transportation. The results will be immediately useful to local and regional transportation and environmental planners hoping to reduce VMT as a means of reducing regional and local congestion levels, and vehicle-based greenhouse gas emissions.

*Deployment Partner: Pennsylvania Department of Transportation.*

#### **15. Lowering the Cost of Autonomy through Algorithmic Design, Rahul Mangharam, UPenn**

When the computational resources of the hardware platform become overloaded, estimation delays can compromise control performance and even stability and therefore safety. This project will define a framework for co-designing the anytime estimation and control algorithms, in a manner that accounts for implementation issues like delays and inaccuracies. Such methodologies can be used to improve the responsiveness and speed of automated vehicles safely and at lower cost.

*Deployment Partner: General Motors*

### **EDUCATION AND WORKFORCE**

**Objectives:** To create a diverse, cross-disciplinary workforce implement policies and practices that move the needle on improving mobility of people and goods.

#### **Accomplishments:**

- Awarded our Women in Transportation fellowship to an incoming fall 2017 Heinz College student. We also awarded our first Diversity in Transportation Fellowship to an incoming fall 2017 CMU College of Engineering student. These two fellows will work closely with Mobility21 staff, be involved in technology transfer, collaboration, education and workforce programs and gain exposure to our national network.
- Sat on a panel with Peter Rander of Argo AI hosted by the Tepper Business and Tech Club Industry Night on March 27, 2017. The discussion was around the research and innovation of autonomous vehicles and what policies will be necessary to roll them out onto public streets.
- Mobility21 hosted the following faculty seminars, these seminars are live-streamed, recorded and added to our Learning Channel:
  - *Human Mobility Modeling Based on Extensive Data From a Ride Sharing Service,* John Shen
  - *Electrical Vehicles, Air Pollution, and the Motorcycle City: Consumers' willingness to adopt electric motorcycles in Indonesia?* Erick Guerra
- Mobility21 hosted the following guest seminars:

- *From Set-and-Forget Traffic Control to Connected Midas: A Possible Future of Proactive Traffic Management Systems* Pitu Mirchandani, Arizona State University
  - *Modeling and Analysis of Dynamic Pricing of Ride-Sourcing Services* Yafend Yin, University of Michigan
  - Kara Kockelman, University of Texas at Austin
  - Nigel Jacobs, Boston Mayor's office
- Supported students to attend the Womens Transportation Seminar (WTS) Pittsburgh Chapter Scholarship Banquet, where Leslie Richards, PennDOT Secretary, was the keynote speaker.
  - Supported Women in Transportation Fellow to attend TRB.
  - Participated as an advisor on the Heinz College Air Quality Emission Capstone.
  - Participated in WTS Scholarship Committee awarding an undergraduate a scholarship.
  - Hosted a meeting of the Women's Graduates in Transportation Group to gather women in graduate programs in order to create a network.
  - Served on advisory panel for a graduate student capstone course looking at benefits of General Services Administration vehicle fleets converting to automated vehicles.

## **TECHNOLOGY TRANSFER**

**Objectives:** To educate a diverse and cross-disciplinary workforce in research, policies, and practices to improve real world mobility deployments through a robust, sector-crossing efforts where our research is transferred.

### **Accomplishments:**

- Mobility21 hosted our Deployment Partner Consortium kick off meeting in Philadelphia on 1/31/17. At this meeting, researchers listened to real world partners, such as Leo Bagley, PennDOT Chief of Staff, describe their needs in an effort to design research to respond and address the most pressing mobility issues. This Mobility21 Deployment Partner Consortium is continued from the successful T-SET UTC Consortium.
  - PhD students, Stephanie Seki and Fan Tong went to DC the week of May 1st to present the findings of their study Which Alternative Fuel Technology is Best for Transit Buses? Their meetings included: (1) Congressional briefing at the Cannon House Building (2) briefing to the National Governor's Association, (3) briefing to the Department of Transportation, and (4) briefing to US Senator Patrick J. Toomey's office.
  - Hosted the Smart-Belt Coalition Meeting at CMU on March 8, 2017 with a special presentation from FHWA on megaregions. The Smart-Belt Coalition is comprised of Mobilty21 at CMU, Ohio State University, University of Michigan, Penn State, Kettering University, PennDOT, ODOT, MDOT, PA Turnpike and Ohio Turnpike officials.
  - Participated on a panel at the Smart Cities Summit in Boston on December 12, 2016, *How Big Data and IoT Can Revolutionize the Postal Service*, discussing how equipping the postal vehicle fleet and networking with sensors to collect data and leveraging this actionable data and deriving valuable insights through analytics.
- Joined other UTCs in Washington DC to present UTC impacts at a congressional briefing organized by RETRC. We highlighted both T-SET UTC and planned Mobility21 UTC efforts.
  - Presented T-SET UTC and planned Mobility21 UTC research at the Pennsylvania Digital Government Summit in Harrisburg which educates state agencies about innovative technologies.
  - Hosted NSF Cyber Physical Systems Week in Pittsburgh where T-SET and planned Mobility21 UTC research was highlighted.



- Presented a seminar at the National Robotics Engineering Center to discuss how researchers there can further engage with T-SET and Mobility21 UTC activity.
- Presented T-SET UTC and planned Mobility21 UTC research at the Consumer Electronics Show
- Participated in FHWA Access to Smart City Transportation Symposium
- Participated in NIST Global Cities Supercluster
- Presented T-SET UTC and planned Mobility21 UTC research at Southwestern Pennsylvania Commission Freight Forum
- Participated in Ohio Smart Mobility Initiative Meeting in Columbus to further integrate T-SET and Mobility21 efforts in Pittsburgh with OSU efforts in Columbus
- Presented T-SET UTC and planned Mobility21 UTC research at the Pittsburgh Innovates Event on a panel with Congressmen Mike Doyle and Tim Murphy and Mayor Bill Peduto
- Moderated National Association of City Transportation Officials Panel
- Participated in Future Vehicles World 2017 Conference
- Participated with industry, DOT and congressional staff in BMW Group Roundtable discussion in Washington DC on mobility and safety implications of autonomous vehicles
- Sponsored a Global Foresight Event at CMU where industry leaders discussed the future of smart transportation and smart city technology.
- Consulted with the Senate Committee on Commerce, Science, and Transportation Subcommittee on Consumer Protection, Product Safety, Insurance, and Data Security about the implications of vehicle automation.

## **DISSEMINATION**

- Hosted transportation technology tours for real-world practitioners and the community including Women in Transportation Seminar Pgh Chapter, NACO annual meeting attendees, House Transportation Committee, Pittsburgh Inclusive Innovation Week attendees, NREL, University of Pittsburgh Russian Delegation, Army Research Lab, State Farm, etc.
- The CMU autonomous vehicle was featured at the DC Auto Show on January 24<sup>th</sup> and 25<sup>th</sup>, 2017 and provided rides in DC for members of Congress and government officials highlighting T-SET UTC and planned Mobility21 UTC research.
- Distributed the Smart Transportation Dispatch, a weekly newsletter that highlights Mobility21 research and efforts in the news as well as industry news. With over 1,800 subscribers, the readership represents a wide range of interests.
- Continue to use a webinar-based system of linking faculty and students for our bi-monthly Mobility21 meetings. A faculty member interactively presents their research at the beginning of each meeting.
- Promoted various Mobility21 research news articles in the blog and newsletter
- Mobility21 efforts and researchers are frequently mentioned in the news. Below is a short list of pertinent articles:
  - [June 16, 2017 - \\$300,000 up for grabs in CMU's Smart Mobility Challenge](#)
  - [May 30, 2017 - CMU Research Wins Le Monde Smart-Cities 2017 International Innovation Award](#)
  - [May 18, 2017 - Mobility21 UTC Partner, CCAC, Launches Data Analytics Program](#)

- May 11, 2017 - Pittsburgh to Push Good Corporate Citizenship from Self-Driving Companies at Summit
- May 10, 2017 - The Link Between Autonomous Vehicles and Fuel Efficiency Efforts
- April 27, 2017 - CMU: The Birthplace of Driverless Tech
- April 12, 2017 - Harrisburg Street Lights to Get Smarter, Collect Data on Anything from Traffic to Trash
- January 20, 2017 - CMU Joins “Smart Belt Coalition” with PA, OH, MI to Collaborate on Connected/Automated Vehicle Initiatives
- January 3, 2017 - He's Helping Pittsburgher Drivers Get the Green Light
- December 16, 2016 - CMU's Rajkumar Named Fellow of National Academy of Inventors
- December 12, 2016 - CMU grant shows Pittsburgh's growth as a transportation innovation center
- December 7, 2016 - How the U.S. Postal Service could enable smart cities with CMU

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

- In early September, we plan to announce the winners of the Smart Mobility Challenge, launching a new batch of research projects that directly respond to rural and suburban transportation mobility needs.
- In late September, we plan to launch our new Mobility21 website, which will host our learning channel, research database, in the news, and allow the public to access all of our activities.
- In mid fall, Mobility21 will launch a Women in Transportation Podcast, interviewing women in leadership in smart transportation roles in the real world and in research, to highlight diversity in the field and to spotlight mentors.
- Our fall seminar series will kick off in September.
- We will host our newly formed Advisory Council meeting in the fall, bringing together thought leaders to help us reach more real-world partners.
- We will launch our restructured Deployment Partner Consortium to attract more industry partners and to ensure engagement of communities across the nation.

## **2. PRODUCTS:**

### **Publications, conference papers, and presentations**

Nothing to report

### **Website(s) or other Internet site(s)**

<https://engineering.cmu.edu/mobility21/index.html>

<http://ppms.cit.cmu.edu/>

### **Technologies or techniques**

Nothing to Report

## Other products

Nothing to Report

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

#### What organizations have been involved as partners?

Collaborative Research partners are integral to testing and deploying our research in the real world. Below is a table of collaborative research partners working directly with Mobility21 researchers on their projects.

Name	Title	Organization	Phone/email
Tomasic, Anthony	Managing Partner	Tiramisu Transit LLC	tomasic@tiramisutransit.com
Kristin Saunders	Bike Coordinator	City of Pittsburgh	kristin.saunders@pittsburghpa.gov
Glenn Aldridge	Collision Investigator	Pittsburgh Bureau of Police	412-414-5455
Roger Bligh	Senior Research Engineer	TTI	rbligh@tamu.edu
Radek Grzeszczuk	Senior Group Manager	Data Science, Uber	radek@uber.com
Ellen McLean	CEO	Port Authority of Allegheny County	EMcLean@portauthority.org
Douglas G. Smith	Transportation Planning Director	SPC	412-391-5590 ext. 327
Fang Yuan	Principal Transportation Engineer	DVRPC	215-238-2885
Alex Pazuchanics	Policy Advisor	City of Pittsburgh, Mayor's Office	alexander.pazuchanics@pittsburghpa.gov
Karina Ricks	Director	City of Pittsburgh, Department of Mobility and Infrastructure	karina.ricks@pittsburghpa.gov

#### Have other collaborators or contacts been involved?

The Smart Mobility Challenge has four partnering organizations who have agreed to assist in promoting the challenge to municipalities in the region and advance research pilots. They include the Southwestern Pennsylvania Commission, the Regional Transportation Alliance and the Pennsylvania Departments of Transportation and Community and Economic Development.

Mobility21 Deployment Partner meetings are held annually to discuss real world problems and to discuss research partnerships. The 71-member consortium is made up of community, industry, and government partners.

<b>UTC Deployment Partner Consortium</b>		
AASHTO	Delaware Valley Regional Planning	Philadelphia Vision Zero
ACCESS	Economic Development South	Pitt Ohio
Accessible Transportation and Workforce Interagency Cooperative	Economy League of Greater Philadelphia	Pittsburgh Bike Share
AECOM	Econsult Corp	Pittsburgh Parking Authority
ALCO Parking	Econsult Group	Pittsburgh Technology Council
Allegheny Conference on Community Development	Ford Motor Company	Port Authority of Allegheny County
Allegheny County	Gannett Fleming	Port Authority of New York and New
Allegheny County Airport Authority	GM R&D	Port of Pittsburgh Commission
American Public Transportation Association	IBM	Portfolio Associates
American Traffic Signals	International Council on Clean	Regional Industrial Development
Arada	Innovation Works	Renault
Bentley Systems	Intel	Southeastern Pennsylvania
Beth's Barricades	Intelligent Transportation Society of	Southwestern Pennsylvania
Bike Pittsburgh	Larson Design Group	Sustainable Pittsburgh
Blind and Vision Rehabilitation Services of Pittsburgh	League of American Bicyclists	Takata
Bombardier	Marshall Township	TeMeDa, LLC
Booz Allen Hamilton	Mathworks	Three Rivers Workforce Investment Board
City of Philadelphia	Meeterfeeder	Tiramisu Transit, LLC
City of Pittsburgh	Model-Based Development Group	Toyota IST
Community College of Allegheny County	Open Roads	Toyota Technical Center
Conference of Minority Transportation Officials	Pennsylvania Department of Transportation	University of Pittsburgh
Cranberry Township	Pennsylvania Motor Truck Association	Western Pennsylvania School for
Delaware River Port Authority	Pennsylvania Turnpike Commission	Womens Transportation Seminar
Yahoo		

#### **4. IMPACT**

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

Nothing to report

##### **What is the impact on other disciplines?**

- Mobility21 initiated the Smart Belt Coalition, which is comprised of Ohio State University, University of Michigan, PennDOT, ODOT, MDOT, PA Turnpike, Ohio Turnpike and Michigan Turnpike officials. The Coalition was a result of CMU's efforts on the Smart City Challenge and has created a testbed for research, deployment of technologies, and policy development across 3 states and 6 different agencies.
- Mobility21 faculty testified at the PA Legislative Joint Transportation Committees Hearing on HAVs in Harrisburg on March 21, 2017. Additionally, Mobility21 researchers were consulted in drafting the policies for autonomous vehicles and directly impacted the legislative language that is currently under consideration in Pennsylvania

- Mobility21 staff participated and contributed to the ITSA Legislative Committee, providing input over the last 6 months on the Federal Highly Automated Vehicle draft legislation directly impacting the language of the bills currently under consideration by the House and the Senate.
- Raj Rajkumar, Mobility21 Principal Investigator, served on Pennsylvania's Autonomous Vehicle Policy Task Force. The Task Force reviewed its final testing policy in an online public meeting Dec. 12, 2016. The guidance is the result of months of collaboration among state, federal, and private-industry officials — such as the Federal Highway Administration, AAA, Mobility21 at CMU, and General Motors.

**Describe how the program made an impact or is likely to make an impact on transportation workforce development.**

Nothing to report

**What is the impact on society beyond science and technology?**

- The researchers testing Surtrac, the adaptive traffic signal system, in the City of Pittsburgh have continually worked to not only expand the testbed but have created special pedestrian algorithms, responding directly to City feedback. This improvement to the system ensures equity of movement across all modes and prioritizes pedestrians.
- Mobility21 co-hosted the *American Architectural Foundation National Summit on Mobility and Design* in Pittsburgh on May 10, 2017 bringing together city planners, architects, community advocates, and researchers. The objectives of the Summit were to create recommendations, strategies, and ideas that lead to the best outcomes for cities and citizens

**5. CHANGES/PROBLEMS**

Nothing to report

**Additional information regarding Products and Impacts**

Nothing to report

**6. SPECIAL REPORTING REQUIREMENTS**

Nothing to report