Semi-Annual Progress Performance Report
for University Transportation Centers

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Office of the Assistant Secretary for Research and Technology
University Transportation Center Program

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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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Project Grant Period:  11/30/2016 – 9/30/2022
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Report Term or Frequency:  Semi-Annual

Signature:  [Signature]
What are the major goals of the program?

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 21st century efficiently and safely. We 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
- 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
- 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
- Number and impact of deployments achieved through collaboration

In addition, as part of our Technology Transfer Plan (dated July 31, 2018) the following Research Performance Measures were established:

<table>
<thead>
<tr>
<th>Research Performance Measure</th>
<th>Annual Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output #1 Annual Number of Journal Publications</td>
<td>35</td>
</tr>
<tr>
<td>Output #2 Annual Number of Research Pilot Deployments</td>
<td>10</td>
</tr>
<tr>
<td>Outcome #1 Annual Number of Media Stories Referencing UTC Research, Faculty, or Spinoff</td>
<td>80</td>
</tr>
<tr>
<td>Outcome #2 Annual Number of Instances Providing Exposure to Transportation, Science and Technology for Practitioners, Teachers, Young people, or Other Members of the Public</td>
<td>50</td>
</tr>
<tr>
<td>Impact #1 Annual Number of Instances of Technology Adoption or Commercialization</td>
<td>3</td>
</tr>
<tr>
<td>Impact #2 Annual Number of Instances of Research Changing Behavior, Practices, Decision Making, Policies (Including Regulatory Policies), or Social Actions</td>
<td>3</td>
</tr>
</tbody>
</table>
What was accomplished under these goals?

Research
Forty-seven research projects were active during this report period. On November 27, 2018, a call for proposals was released for CMU researchers to propose projects for the July 1, 2019 – June 30, 2020 period. Over 25 proposals were received, totaling more than $2.5 million in requests. Thirteen of these projects were selected based on the available funding. Mobility21 UTC management worked with the PIs to ensure all US DOT funding & project requirements were met so the projects could start on July 1, 2019. During this report period, CMU’s Mobility21 academic consortium partners were also in the process of finalizing their 2019 - 2020 research projects.

In addition, two Smart Mobility Challenge projects were selected during this reporting period (North Huntingdon Township and the Airport Corridor Transportation Association). Inspired by Traffic21’s years of successful collaboration with the City of Pittsburgh to become a globally recognized smart city test bed, the projects funded as part of this challenge stem from the desire to demonstrate how suburban and rural communities can also benefit from a similar collaboration. The first Smart Mobility Challenge was held from 2017 – 2018, and included research done in collaboration with the municipalities of Millvale, McKees Rocks, Bethel Park, Greensburg, Mt. Lebanon, Dormont, Cranberry and Lawrence County.

During this reporting period, two UTC faculty meetings were also held (scheduled approximately once a month during each of the spring and fall semesters). The meetings are held in person on the CMU campus, and can be attended remotely via webinar. The meetings are held to provide the faculty updates on the Mobility21 UTC, share information among the four UTC academic consortium partners, and research being conducted.

Education and Workforce Development
We view research and education as two sides of the same coin. We cannot educate for future generations without exposing them to research, development and deployment. On the other hand, we cannot do successful research, development and deployment without the input of future generations. Since Traffic21 and the UTC have emerged on campus it has generated interest among faculty and students, bringing exposure to real-world problems, and engaging faculty and students on multiple projects.

During the reporting period one of our students, Bonnie Fan, was chosen as the winner of the Council of University Transportation Center’s ENO Scholarship (she is also our Mobility21 UTC’s 2018 – 2020 Women in Transportation Fellow).

Fan participated in the Enol Leadership Development Conference in Washington, DC during the summer. She reported feeling intimidated at first but quickly started to feel at ease as the twenty students started discussing bike-ped access, vehicle miles traveled funding and autonomous vehicle regulation. Fan noted that she learned just as much from the other fellows as she did from the sessions themselves.

Fan said one of her major takeaways was a desire to incorporate lessons and standards established in aviation around automation, operations and safety into other modes. She is excited to take the lessons learned and connections made from this experience into her academics and work.

At Carnegie Mellon University, a transportation club also convenes throughout the fall and spring semesters, of which the Mobility21 Fellows help lead, and the UTC supports. In September, the club hosted the fall kick-off meeting where the 40+ member audience learned about opportunities for engaging with Traffic21 and Mobility21 and they had an opportunity to discuss ideas for the club to work on throughout the academic year.

In addition, Stan Caldwell designed and taught a course for 15 students in CMU’s PPIA Junior Summer Scholars Program titled “Smart Transportation: Issues in Equity.” The PPIA Junior Summer Institute (JSI) Fellowship Program is a rigorous academic graduate level preparation program for undergraduate juniors committed to public service careers. The program was started to address the lack of diversity across the spectrum of professional public service, including government, nonprofits, public policy institutions, and international organizations. The purpose of the JSI Fellowship is to prepare students to obtain a Master’s or joint degree, in public policy, public administration, international affairs, or a related field.
We have and will continue to focus on education and workforce development in equal and complementary measure to research, development and deployment.

**Technology Transfer**

As the nature of transportation continues to evolve, Carnegie Mellon University has students and faculty conducting transportation related research in data analytics, robotics, public policy, engineering, architecture and design, and more. Since not all of these efforts are co-located in the same building, or even the same department, there was a need to help building a “community space” to bring together people interested in transportation on CMU’s campus. This was the impetus for Mobility21’s launching of the Smart Mobility Connections (SMC) seminar series. One of the University Transportation Center faculty is featured at each hour long session; half of the time is reserved for questions and answers as well as networking. All Mobility21 SMC seminars are advertised on the UTC website and publicized through faculty and student distribution lists. Recordings of each session are posted to the Mobility21 UTC website’s What’s Happening section.

- **October 11** – This Smart Mobility Connection seminar featured Aaron Steinfeld, Associate Research Professor with the Robotics Institute at CMU. Steinfeld talked about “What’s Been Learned from the Tiramisu Transit Deployment.” Steinfeld was part of the team from the CMU Rehabilitation Engineering Research Center who researched, developed and deployed Tiramisu, a transit app with a universal design but focused on improving public transit for individuals with disabilities.
- **September 27, 2019** – This SMC featured Pei Zhang. He discussed utilization of existing taxi fleets to optimize both mobility and passenger pickup as well as smart city sensing. Learn about a vehicular crowd sensing system which was used to efficiently incentivize the vehicle agents to match the sensing distribution of the sampled data to the desired target distribution with a limited budget.
- **September 13, 2019** – The first SMC of the fall semester featured Sean Qian. He discussed how to proactively forecast incident-induced congestion and ultimately alleviate it, this project incorporates real time data inputs from crowdsourced data feeds, traffic sensors and weather reports in the regional proximity of the Cranberry Township to predict traffic delays in real time for 30 minutes in advance.
- **April 26, 2019** – The last SMC of the Spring 2019 semester featured Steve Quick, Adjunct Faculty in the School of Architecture at CMU. Quick highlighted his UTC project that is currently investigating how the integration of multimodal policies onto regional corridors will impact small towns differently from urban and suburban corridors.
- **April 5, 2019** – This SMC featured Professor John Shen and PhD Student, Abhinav Jauhri from the Electrical and Computer Engineering Department at Carnegie Mellon University. This talk highlighted their work with Generative Adversarial Networks (GANs) and how they’re using data sets to improve ride sharing services, mitigating traffic congestion and even what-if scenarios for intelligent transportation systems.

**Collaboration**

At the core of our efforts, is collaboration. During this reporting period Stan Caldwell and Lisa Kay Schweyer had several interactions with each of the Mobility21 Co-PIs at the Community College of Allegheny County, the Ohio State University and the University of Pennsylvania to ensure continued collaboration among UTC academic partners.

Additionally during this report period:

- **On July 30**, Lisa Kay Schweyer, Program Manager for the UTC, visited on-site with the Community College of Allegheny County to discuss their current and future years project activities, the Traffic21 10-Year Anniversary Symposium, and curriculum development.
  - CCAC was also inducted as a new member of the Council of University Transportation Centers during this reporting period.
- **On July 18**, CMU hosted 3 representatives from the Ohio State University. They heard about the work CMU is doing around Smart Cities/Transportation and traveled to CMU to learn about:
  - Smart Cities/transportation initiatives
  - How CMU connects to the city
Other examples of collaboration include:

- September 4-6, 2019 - The Pennsylvania Automated Vehicle Summit is the largest dedicated Automated Vehicle conference in the Northeast region, bringing together both public and private industries – and the Mobility21 UTC students, staff and faculty participated, serving as presenters and session moderators.
  - Mobility21 UTC Director, Raj Rajkumar participated on a panel of CAV Testers during a Plenary Session. He was joined by panelists from AV companies Uber, Aurora, Argo AI and Aptiv.
  - During the Equity breakout session, Allanté Whitmore, Doctoral Candidate and Mobility21 Diversity Fellow, moderated a panel that included Corey Harper, Post-Doctoral Research Associate at CMU who works closely on Mobility21 research projects focused on equity and mobility.
  - Lisa Kay Schweyer, Mobility21 Program Manager, moderated a panel focused on Human Factors: Consumer Expectations & Education. The panel featured a variety of panelists from academic including Penn State and organizations such as AARP and Partners for Autonomous Vehicle Education.
  - Another breakout session entitled Energy Implications, featured Parth Vaishnav, an Assistant Research Professor at CMU, who joined panelists from PA’s Governor Office of Energy, Maryland SHA, Momentum Dynamics and more.
  - Mobility21 UTC academic partner, the Community College of Allegheny County, also had a presence at the summit as Bob Koch presented as part of the breakout session “Jobs for an AV World.”
  - Mobility21 UTC Executive Director, Stan Caldwell and Women in Transportation Fellow, Carlee Benhart were also in attendance, participating in the conference.

- June 6, 2019 - Mobility21 UTC Participated in the Celebration of the Oakland Eruv. Angela Blanton, CMU Vice President for Finance and Chief Financial Officer and Lisa Kay Schweyer, Mobility21 UTC Program Manager were in attendance to help celebrate the extension of the local eruv to now include Oakland. When the original Pittsburgh Jewish community’s eruv was constructed, circa mid-1970’s, it primarily encompassed parts of the Squirrel Hill community. By the mid-1990’s and early 2000’s the eruv was expanded to include larger sections of Squirrel Hill and sections of Point Breeze, Greenfield, and Regent Square. UPMC, the University of Pittsburgh, Carnegie Mellon University and Carlow University assisted with the extension of the Squirrel Hill eruv to Shadyside and the Oakland neighborhoods, which includes hospitals and universities, allowing greater mobility on Sabbath and Yom Kippur for Jewish communities, especially the Orthodox Jewish communities. Mobility21 Executive Director Stan Caldwell was an active member of the planning committee for this eruv extension.

- May 7, 2019 - Mobility21 co-hosted Transport PGH 2019 with T.I.R.E.S. The Forum was a free event featuring guest presentations by transportation providers sharing resources available in and around Allegheny County. The event brought together the region’s leading providers and advocates to help educate the public on what is available. Mobility21 Program Manager, Lisa Kay Schweyer gave welcoming remarks and an overview of the Mobility21 UTC and Shikib Mehtri, Masters of Language Technologies student at CMU’s Language Technologies Institute presented his research in collaboration on a Spoken Dialog System for The General Public with UTC Faculty, Professor Maxine Eskenazi.

- Mobility21 continues to take a leadership role in the Smart Belt Coalition, which is comprised of CMU, The Ohio State University, University of Michigan, Penn State University, Kettering State, PennDOT, ODOT, MDOT, and Pennsylvania and Ohio Turnpike officials. The coalition was initiated by the Mobility21 UTC faculty and has created the first multi-state connected and automated vehicle test bed for research, deployment and deployment of technologies, and policy development.

- Raj Rajkumar, Mobility21 Director, and Stan Caldwell, Mobility21 Executive Director continue to serve on Pennsylvania’s Autonomous Vehicle Policy Task Force and provide both the Pennsylvania Department of Transportation and the State Legislature’s Transportation Committees council on automated vehicle policy.

How have the results been disseminated?
A weekly e-newsletter that highlights research and efforts in the news as well as smart transportation industry news, *The Smart Transportation Dispatch*, is distributed to over 3,350 subscribers (an increase of over 700 people since the last report). The readership represents individuals in industry, government, academia and community organizations from 15+ countries.

A monthly e-publication is also distributed, called *What’s Happened at Traffic21?* This e-publication, sent to the same distribution list as *Breaking in Smart Transportation*, specifically highlights the UTC activities, accomplishments, student work, involvement in conferences, and other news.

Before updates are sent out in either publication, they appear as individual updates/articles on the website blog, and are also posted through our Facebook and Twitter accounts.

A new publication has been developed during this reporting period, called the *Research Recap*. The recaps are easily digestible one-page overviews of the UTC funded research that describe the research project’s purpose, approach, key findings, conclusions, contact information for the research team and a link to the final research report. The goal is to release a new recap after the completion of each UTC project.

Mobility21 UTC Executive Director Stan Caldwell continues to be a regular contributor to the Axios Autonomous Vehicles semi-weekly publication where he and other Mobility21 faculty provide insights on topics related to autonomous vehicle technology and policy.

In addition, we also held the Second Annual National Mobility Summit of UTCs, on April 11, 2019 in Washington, DC. The National Mobility Summit brought together over 125 thought leaders from industry, community, workforce, and academia to explore ‘Exploring the Research Frontier for 21st Century Mobility.’ This also included 10 university transportation centers representing 50+ Colleges and Universities across the US. We were honored to have Diana Furchtgott-Roth, Deputy Assistant Secretary for Research and Technology, U.S. Department of Transportation attend and provide our lunch keynote presentation. After the Summit, a new webpage was added to the Mobility21 website to document the event and provide copies of all the presentations (https://mobility21.cmu.edu/events/the-national-mobility-summit/the-national-mobility-summit-2019/).

See the Summit event wrap-up attached at the end of this report.

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

We will begin planning for the 3rd Annual National Mobility Summit of UTCs on April 2, 2020.

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

*What organizations have been involved as partners?* * Indicates new partners this reporting period.

<table>
<thead>
<tr>
<th>Partner Organization Name</th>
<th>Location</th>
<th>Contribution to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Financial support</td>
</tr>
<tr>
<td>AARP and Age Friendly</td>
<td>Pittsburgh, PA</td>
<td>X</td>
</tr>
<tr>
<td>Allegheny County</td>
<td>Allegheny County, PA</td>
<td>X</td>
</tr>
<tr>
<td>Allegheny General Hospital</td>
<td>Pittsburgh, PA</td>
<td>X</td>
</tr>
<tr>
<td>Argo AI</td>
<td>Pittsburgh, PA</td>
<td>X</td>
</tr>
<tr>
<td>Aurora Innovations, Inc.</td>
<td>Pittsburgh, PA</td>
<td>X</td>
</tr>
<tr>
<td>Automatic Labs (A SiriusXM company)</td>
<td>San Francisco, CA</td>
<td>X</td>
</tr>
</tbody>
</table>
Have other collaborators or contacts been involved?

Our Deployment Partner Consortium is utilized for identifying real-world transportation needs, research project development and deployment, technology licensing and commercialization, student recruitment for jobs and internships, class and capstone projects. The list of partners is continually updated on the Mobility21 website based on the research projects being conducted. The current list of members includes:

- 412 Food Rescue
- American Association of Retired Persons
- American Association of State Highway and Transportation Officials
- Access Transportation Systems
- Airport Corridor Transportation Association
- Alliance for Transportation Working in Communities
- Architecture, Engineering, Consulting, Operations, and Maintenance (AECOM)
- ALCO Parking
- Allegheny Conference on Community Development
- Allegheny County
- Allegheny County Airport Authority
- Allegheny County Office of Children, Youth and Families
- American Public Transportation Association
- Aurora Innovation
- Babst Calland Law Firm
- Bentley Systems
- Bike Pittsburgh
- Bombardier
- Booz Allen Hamilton
- Bosch Research and Technology Center, North America
- The Breathe Project
- Caterpillar
- Children’s Hospital of Philadelphia
- Cisco
- City of Philadelphia
- City of Pittsburgh
- Community College of Allegheny County
- Conference of Minority Transportation Officials
- Cranberry Township
- Crown Castle
- Delaware River Port Authority
- Delaware Valley Regional Planning Commission
- Borough of Dormont
- Economic Development South
- Federal Highway Administration
- General Motors Global Research & Development
- Healthy Ride
- Hulton Arbors
- Hillman Family Foundations
- iNetworks Advisors
- Innovation Works
- Intelligent Transportation Society of America
- Jackson/Clark Partners
- Lawrence County
- League of American Bicyclists
- Marshall Township
- Meter Feeder
- Miovision
- Near Earth Autonomy
- North Huntingdon Township
- Oakland Transportation Management Association
The UTC also has a distinguished Advisory Council of national leaders that provides strategic guidance and counsel. We sought to achieve modal and demographic diversity. The individual members provide significant collaboration opportunities with their extensive professional affiliations. The following prominent transportation professionals serve on the Council:

- Raymond T. Betler, Former President and CEO of Wabtec Corporation
- Rebecca M. Brewster, President and Chief Operating Officer of the American Transportation Research Institute
- Robin Chase, Co-founder Zipcar, Veniam, NUMo
- Ty Gourley, Vice President of Hillman Family Foundations
- Charles L. Hammel III, President and owner, PITT OHIO Express
- Ashley Hand, Co-founder CityFi; formerly Transportation Technology Strategist Fellow for Los Angeles
- Katharine Kelleman, Chief Executive Officer at Port Authority of Allegheny County
- Jane Lappin, Director, Public Policy & Government Affairs, Toyota Research Institute
- Ken McLeod, Policy Director at The League of American Bicyclist
- James A. Misener, Senior Director of Technical Standards at Qualcomm and former Director of UC Berkeley PATH
- Leslie Richards, Secretary of the Pennsylvania Department of Transportation
- David Roger, President of Hillman Family Foundations
- Paul Skoutelas, President and Chief Executive Officer of The American Public Transportation Association
- Kirk Steudle, Director of Michigan Department of Transportation

During the current reporting period, we have continued the planning to host the Mobility21 Advisory Council Meeting on November 7, 2019, and Deployment Consortium Meeting on November 8, 2019. As this is the 10-Year Anniversary of Traffic21, these activities will be combined as the “Traffic21 10-Year Anniversary Symposium.”

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

**Publications, conference papers, and presentations**

<table>
<thead>
<tr>
<th>Title</th>
<th>Citation</th>
<th>Type</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform</td>
<td>Fourth Workshop on International Science of Smart City Operations and Platforms Engineering (pp. 19-24). ACM.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation of vehicle vibration-based indirect</td>
<td>Other</td>
<td>2019-09-10</td>
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structural health monitoring on an in-service railway truss bridge

Other publications, conference papers and presentations:

<table>
<thead>
<tr>
<th>Title</th>
<th>Event</th>
<th>Type</th>
<th>Attended</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel on the Future of Work</td>
<td>Pittsburgh Meeting of the Council of State Governments</td>
<td>Conference-Professional</td>
<td>100</td>
<td>2019-07-29</td>
</tr>
<tr>
<td>Up-to-date city maps for modeling, planning, and assistive technologies</td>
<td>UTC consortium meeting</td>
<td>Other-Professional</td>
<td>100</td>
<td>2018-11-09</td>
</tr>
<tr>
<td>Electricization of semi-trucks</td>
<td>Mobility21 Trucking Summit</td>
<td>Symposium-Professional</td>
<td>50</td>
<td>2018-10-25</td>
</tr>
<tr>
<td>Incentivizing Vehicular Crowdsensing System for Large Scale Smart City Applications</td>
<td>Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2019</td>
<td>Conference-Academic</td>
<td>400</td>
<td>2019-03-07</td>
</tr>
<tr>
<td>Learning Unsupervised Multi-View Stereopsis via Robust Photometric Consistency</td>
<td>3D Scene Understanding workshop at CVPR 2019</td>
<td>Workshop-Academic</td>
<td>100</td>
<td>2019-06-17</td>
</tr>
<tr>
<td>Low-Cost 3D model acquisition for rapid accident investigation</td>
<td>Mobility21 consortium meeting</td>
<td>Symposium-Professional</td>
<td>100</td>
<td>2018-11-09</td>
</tr>
<tr>
<td>Roadway Traffic Flow Estimation using Video Imagery Data Collected from Transit Bus Cameras</td>
<td>TransitData2019 5th International Workshop and Symposium</td>
<td>Workshop-Professional</td>
<td>100</td>
<td>2019-07-08</td>
</tr>
</tbody>
</table>
Technologies or techniques

During this report period, research project PI, Ding Zhao and his team labelled the risk levels of different map layouts, allowing a risk heatmap to be built which will be helpful to guide the deployment of autonomous vehicles. Matching different levels of automated vehicles (AVs) with map areas in different risk levels can help improve traffic efficiency, such as reducing the probability that catastrophes happen and avoiding the traffic congestion caused by incapable autonomous vehicles. Currently, one main contribution is that this team is the first group to use data-driven methods to define driving scenario risks. Instead of manually designing complex features comprising the overall risk, the team built a framework leveraging Dirichlet Process Gaussian Process as an end-to-end way which takes large amounts of naturalistic driving data and outputs the risk level directly. Another main contribution is that besides using objective indicators to define risk, the team studied the human sensed risk represented by subjective logic, which helps increase the human trust level to AVs.
Inventions, patent applications, and/or licenses

A core focus from the beginning of Traffic21 has been to apply university research and technology to real-world mobility problems. This process began by first talking with transportation professionals, identifying real-world problems, and then sharing those problems with researchers. As technologies prove successful, Mobility21 staff work with researchers and government and industry partners to advance the application of that technology. This may result in agencies, such as the City of Pittsburgh, adopting a technology such as Surtrac adaptive traffic signals, commercialization with an industry partner, such as Delphi, or spinning off a company, such as RoadBotics.

During this reporting period, UTC researcher Maxine Eskenazi, PI for project Personalized Trip Planner for Seniors – GetGoing filed for a provisional patent. Since GetGoing has been developed as a senior-friendly system, many of the features can be separated out into a layer. This layer could potentially be applied onto other existing spoken dialog systems to make them more accessible for the senior population. A disclosure of intellectual property for ABLE (AccessiBility LayEr) was submitted to the CMU Center for Technology Transfer and Enterprise Creation on June 13th, 2019. The PI and her research team had a meeting with representatives from the Center for Tech Transfer on August 19th, 2019. After this discussion, a provisional patent was filed on September 3rd, 2019.

In addition, UTC researcher Yang Cai, PI for project Improving Mobility of Low Vision People with Super-Reality Glasses, developed a new method to fuse multi-sensor information for detecting users activities and pavement bumpers. They have filed an Invention Disclosure to CMU Technology Transfer office and will be following up with Provisional Patent.

Discuss the performance measures (a minimum of two) for research outcome your Center identified in your Technology Transfer Plan Report and the targets (goals) for each measure.

<table>
<thead>
<tr>
<th>Research Performance Measure</th>
<th>Annual Target</th>
<th>Previous Reporting Period</th>
<th>This Reporting Period</th>
<th>Annual Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output #1 Annual Number of Journal Publications</td>
<td>35</td>
<td>3</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Output #2 Annual Number of Research Pilot Deployments</td>
<td>10</td>
<td>16</td>
<td>14</td>
<td>30</td>
</tr>
</tbody>
</table>

Please see Section #3 Publications for examples of publications.

Some examples of these research pilot deployments include:

- September 1, 2019 - Mobility21 UTC Researcher, Sean Qian, is leading an interdisciplinary team from Carnegie Mellon University as they attempt to address rural transportation in Southwestern Pennsylvania’s Greene County. Working in collaboration with Greene County and Waynesburg University, the team from Carnegie Mellon University will test an innovative rural county mobility platform, with the ultimate goal that it can be replicated in other rural counties. Sean Qian says this project has “the potential to advance the fundamental knowledge of how energy-efficient, affordable mobility services can work in rural America.”

- August 16, 2019 - DENSO Launches First Smart Mobility Ecosystem In Dublin, Ohio – “DENSO announced today it is investing $1.42 million to launch a Smart Mobility Ecosystem in Dublin, Ohio, designed to enhance transportation. In the project, DENSO is working with a coalition of municipal, state, business and academic partners to test and implement infrastructure technologies, create value-added mobility services, and gather previously untapped data that are vital to increasing road and pedestrian safety and reducing travel times...DENSO is currently working with the following partners in Ohio to
implement its Smart Mobility Ecosystem:
  o The City of Dublin, an innovative municipality that will beta-test a strategically targeted transportation corridor that includes both roundabouts and signalized intersections.
  o The Ohio State University, whose researchers at its Center for Automotive Research will provide a range of smart mobility solutions, including data services and analytics.”

- July 10, 2019 - *Flying blind: Apps help visually impaired navigate airport* – “Navigating airports can be tricky. They’re loud, crowded and not always laid out intuitively. They’re even more challenging for visually impaired people. Chieko Asakawa knows those challenges firsthand, and she has also devised a remedy. Asakawa has been blind since she was 14 and is now an IBM Fellow and a professor in Carnegie Mellon University’s Robotics Institute. This spring, she and other researchers at Carnegie Mellon launched a navigation app for Pittsburgh International Airport that provides turn-by-turn audio instructions to users on how to get to their destination, be it a departure gate, restaurant or restroom. Pittsburgh is one of a growing number of airports around the globe to provide wayfinding apps. The Pittsburgh app, called NavCog, was first used at the Carnegie Mellon campus and works almost like an indoor GPS.”

- May 20, 2019 - *RoadBotics Aims To Help Municipalities Better Decide Which Roads To Pave And When* – “Street maintenance can be a Sisyphean task. Like in the myth of the Greek king sentenced to push a boulder up a hill for all of eternity, the work of paving and filling potholes and cracks is never really done. But Pittsburgh company RoadBotics is working to make the task a little less maddening for municipalities, by creating a detailed, interactive map of road conditions. Each of the company’s drivers is equipped with two smartphones. One phone is affixed on the car dashboard and continuously takes a high definition video of the roadway. The other phone tells the driver the route to take, following municipality-owned and maintained roads. After the drive is complete, the video is uploaded to a company cloud. Then, the artificial intelligence takes over.”

### 4. OUTCOMES
What outcomes has the program produced? How are the research outputs described in section (3) above being used to create outcomes?

Outcomes are the application of outputs; any changes made to the transportation system, or its regulatory, legislative, or policy framework, resulting from research and development outputs.

**INSTRUCTIONS - Outcomes**

This component should describe ways in which the application of outputs has produced outcomes during the reporting period. Describe how research outputs are being used to create expected or actual outcomes with the understanding that outcomes can sometimes take a significant amount of time to realize.

List any outcomes resulting from the program during the reporting period. Examples of outcomes include:

- Increased understanding and awareness of transportation issues
- Passage of new policies, regulation, rulemaking, or legislation
- Increases in the body of knowledge
- Improved processes, technologies, techniques and skills in addressing transportation issues
- Enlargement of the pool of trained transportation professionals
- Adoption of new technologies, techniques or practices

- August 2019, Harvard Business School case study on Testing Autonomy in Pittsburgh and its Connection to Traffic21 & Mobility21: Integral to the Harvard Business School case study on Testing Autonomy in Pittsburgh, was information shared by Traffic21 & Mobility21 UTC Executive Director, Stan Caldwell. The case study provided an overview of the introduction, evolution and lessons learned testing autonomous vehicles in Pittsburgh, presented in a way allowing fellow academics and city leaders access to this unique knowledge on autonomous vehicle testing.
- April 1, 2019, Mobility21 UTC Researcher & CMU Associate Research Professor Aaron Steinfeld helped
contribute to the new whitepaper on “Driverless Cars and Accessibility” published by ITS America, which examines the opportunities around fully automated vehicles: when they begin to be deployed in significant numbers, they will offer the potential to usher in enormous positive changes. The white paper can be found here: http://www.itsa.org/s/ITSAmerica_Driverless-Cars-Accessibility-Mobility_April2019.pdf.

Discuss the performance measures (a minimum of two) for research outcome your Center identified in your Technology Transfer Plan Report and the targets (goals) for each measure.

<table>
<thead>
<tr>
<th>Research Performance Measure</th>
<th>Annual Target</th>
<th>Previous Reporting Period</th>
<th>This Reporting Period</th>
<th>Annual Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome #1</td>
<td>80</td>
<td>66</td>
<td>73</td>
<td>136</td>
</tr>
<tr>
<td>Annual Number of Media Stories Referencing UTC Research, Faculty, or Spinoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome #2</td>
<td>50</td>
<td>53</td>
<td>40</td>
<td>93</td>
</tr>
<tr>
<td>Annual Number of Instances Providing Exposure to Transportation, Science and Technology for Practitioners, Teachers, Young people, or Other Members of the Public (other publications, conference papers and presentations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Some examples of the Media Stories Referencing UTC Research, Faculty, or Spinoff:

- September 27, 2019 - The death of a promising battery startup exposes harsh market realities – “According to former employees, all of whom requested anonymity, Khosla Ventures lost confidence that Pellion could make enough money serving a niche market. The lithium-metal technology worked for products like drones, but the big money in the battery world is in the automotive sector. Investors weren’t willing to sink the money needed to develop the battery for electric vehicles. “There are two camps in the battery world,” says Venkat Viswanathan, a battery expert at Carnegie Mellon University. “One that understands the problems and knows lithium-metal batteries are a long way off. Another that understands the problems, has some solutions, and knows that lithium-metal batteries will be in the market soon.”

- September 23, 2019 - Photographs Of Pittsburgh Hillsides Used To Predict Landslides – “Landslides are difficult to predict, but a Carnegie Mellon University robotics researcher is working to create an early-warning system using “deep learning.” This type of artificial intelligence programs computers to recognize patterns and then make predictions based on existing data. CMU’s Christoph Mertz uses photographs of hillsides around Pittsburgh, which computer algorithms analyze to identify and calculate where a landslide is more likely to occur.”

- September 4, 2019 - UTC Faculty Discusses Tesla’s New Solar Rental Option – Costa Samaras, UTC Faculty in Civil and Environmental Engineering/Engineering and Public Policy at Carnegie Mellon University, discusses Tesla’s newly-unveiled solar rental option with Marketplace’s Jack Stewart. Read the article and/or listen to the conversation here: https://www.marketplace.org/2019/08/20/teslas-plan-for-solar-could-increase-competition/.

- August 21, 2019 - Village Utilizes State of the Art RoadBotics for Street Assessment – “Beginning on Friday, August 2, 2019, RoadBotics, and industry leader in road assessments will conduct an assessment of Skokie’s streets. During the assessment period, a RoadBotics certified operations technician will drive all 145 miles of Skokie’s road network using a passenger vehicle equipped with a windshield-mounted smartphone. After the data is gathered, RoadBotics will upload the collected video to its secure cloud for analysis by a cutting-edge machine learning technology that will identify road surface damage.”

- August 7, 2019 - Too much rain is messing with pipeline operators’ infrastructure plans – “Costa Samaras, an engineering professor at Carnegie Mellon University, said companies building energy infrastructure have to adhere to safety standards, but very few of the standards have been updated to account for how the climate is changing.”

- August 4, 2019 - Mobility21 UTC Director, Raj Rajkumar, Discusses the Future of Transportation on KD/PG Sunday Edition - Mobility21 UTC Director Raj Rajkumar sat down with Dr. Kent Harries, PITT
Engineering Faculty, to discuss ideas for the Pittsburgh 2070 Transportation Plan. The segment includes
discussion on different ways to address older infrastructure, city transportation, and how to build
sustainable infrastructure for the future. Watch the full video here.

- July 17, 2019 - Roadbotics raises $7.5M in latest investment round - “RoadBotics, the Pittsburgh-based startup working to standardize road assessment through A.I., announced Tuesday that it had raised $7.5 million in its latest investment round. Leading the way was Radical Ventures, an A.I.-focused venture capital fund. Other investors include Hyperplane Venture Capital and Wharton Alumni Angels of Silicon Valley…”

- July 1, 2019 - This computer vision tech actually sees around corners - “A group of computer vision researchers from the US, Canada, and Europe have developed a technique to see around corners. It’s the first time researchers have been able to capture shapes of curved objects using non-line-of-sight (NLOS) imaging techniques. “It is exciting to see the quality of reconstructions of hidden objects get closer to the scans we’re used to seeing for objects that are in the line of sight,” said Srinivasa Narasimhan, a professor in the Carnegie Mellon University Robotics Institute. “Thus far, we can achieve this level of detail for only relatively small areas, but this capability will complement other NLOS techniques.”

- July 1, 2019 - On Pothole Patrol in South Jackson - “One of the tools Montgomery used to its advantage was RoadBotics, a road-survey product that uses artificial intelligence to evaluate road conditions for local governments and organizations responsible for maintaining roads. RoadBotics assessed the road every 10 feet, took photos, and showed engineers areas where the pavement was in bad condition, he said.”

- June 19, 2019 - Self-Driving Cars Have a Problem: Safer Human-Driven Ones - “We are sentient beings, and we have the ability to reason from first principles, from scratch if you will, while AI on the other hand is not conscious, and doesn’t even understand what it means that there’s a physical world out there,” says Raj Rajkumar, a professor of engineering at Carnegie Mellon University who collaborates with General Motors Co.”

- May 24, 2019 - CMU to help airport corridor, North Huntingdon with transportation issues - “Officials with the Airport Corridor Transportation Association and North Huntingdon will work with traffic experts at Carnegie Mellon University to develop solutions for very different traffic situations. The airport area group is looking to expand its popular shuttle bus system that takes workers from a Port Authority bus stop directly to their job while North Huntingdon wants help with moving traffic through the area when a major reconstruction project begins on busy Route 30 in a few years. Those projects were selected last week from 11 proposals to CMU’s Smart Mobility Challenge, which uses faculty, graduate students and undergraduate students in its Traffic21 institute to help communities solve problems.”

- May 21, 2019 - Tesla didn’t fix an Autopilot problem for three years, and now another person is dead - “Radar outputs of detected objects are sometimes ignored by the vehicle’s software to deal with the generation of “false positives,” said Raj Rajkumar, an electrical and computer engineering professor at Carnegie Mellon University. Without these, the radar would “see” an overpass and report that as an obstacle, causing the vehicle to slam on the brakes.”

- May 20, 2019 - Ohio, Pennsylvania plan interstate system for managing road work - “Announced last month by the state of Ohio, the project, called the Work Zone Reservation and Traveler Information System, or WZRTIS, is a partnership between the Ohio Turnpike and Infrastructure Commission, an autonomous and connected vehicle initiative called DriveOhio, the Pennsylvania Department of Transportation and the Pennsylvania Turnpike Commission…Talks on this project originated, Newbacher said, through a body called the Smart Belt Coalition, a group of state government agencies and universities from Ohio, Pennsylvania and Michigan.”

- May 5, 2019 - 5 reasons why autonomous cars aren’t coming - “Sandstorms, rain, fog and heavy snow can block the view of the cameras. Light beams think that they are barriers and can bounce snowflakes off. It does not show the shape of a thing needed to determine what it’s, although radar is able to browse through the weather. “It’s like losing part of your vision,” says Raj Rajkumar, a computer engineering professor at Carnegie Mellon University.”

- May 3, 2019 - Mobility21 UTC Executive Director Featured Guest on NPR’s OnPoint - Today’s National Public Radio On Point show “There’s Talk Of $2 Trillion For Infrastructure. How Should The U.S. Spend
It?” features an interview with Mobility21 UTC Executive Director Stan Caldwell. Listen to the broadcast here: https://www.wbur.org/onpoint/2019/05/02/infrastructure-trump-congress-democrats.

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?

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

- July 24, 2019 - the Roads Australia Future Transport: Smart Cities Study Tour delegates and Roads Australia, visited CMU “…to deepen [their] understanding of the progress, challenges and emerging trends in Regulatory and Technological Innovation for future transport and smart cities, as well as our ties with fellow Industry and Government bodies in North America.” Michael Kilgariff, Director of Roads Australia said, “Your [CMU’s] time, generosity and expertise has shed light on strategies and solutions that could potentially be adopted to meet Australia’s future transport and city planning challenges.”

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?

As reported in the Pittsburgh Business Times, the UTC spin-off company, “RoadBotics, the Pittsburgh-based startup working to standardize road assessment through A.I., announced Tuesday that it had raised $7.5 million in its latest investment round. Leading the way was Radical Ventures, an A.I.-focused venture capital fund. Other investors include Hyperplane Venture Capital and Wharton Alumni Angels of Silicon Valley… RoadBotics was formed from the research of Christoph Metz, conducted at Carnegie Mellon University. The company currently has more than 150 customers in 23 states and 11 countries.”

What is the impact on the body of scientific knowledge?

As part of the research project, Actuation System For City-Wide Sensing and Ride Distribution Using Managed Vehicular Fleets, led by PI Pei Zhang, a novel modeling of the incentivizing problem was developed (to the best of the PIs knowledge). His team is the first to model the quality of sensing coverage as the KL-divergence between the target and sensed data distributions and formulate the sensing coverage optimization problem. They further prove that this formulation is a non-linear multiple-choice knapsack problem, which is NP-complete and impossible to solve in polynomial time.

What is the impact on the development of transportation workforce development?

In addition to the transportation workforce development activities mentioned earlier, this grant has expanded workforce development efforts through a partnership with the Community College of Allegheny County’s Automotive Technician Training Program. This program provides students with the education to maintain vehicles. Their coursework involves integrating safety system alignments, and computer assisted diagnostics. The new components being added as a result of research, will need to be maintained and these students are learning how to do that.

CCAC taught incoming students about automotive controls/operations and sensing technologies in the spring of 2019, which 50+ student technicians participated.

CCAC staff continue to explore how to integrate Mechatronics and Data Analytics courses into a certificate for transportation related careers, and we continue to modify our automotive curriculum to enhance the students and technician’s knowledge about technology. For example they are currently proposing adding: Basic Training Bootcamp as well through Transportation Tech to course MEC-220 Mechatronics Practicum. The
final course project would also integrate the skills & knowledge obtained in the first 3 semesters to some transportation related field.

In addition Bob Koch, CCAC UTC Faculty:

- **April** - Discussed advanced transportation related jobs at; Butler County AVTS, Lenape CTC, Steel Center AVTS, United Technology Center in Clarksburg WV, and Eastern Westmoreland CTC. In all, about 200 students were presented with ADAS information. Attended the PA State Perkins meeting held at Butler County Community College. Presented along with Josh Kern CCAC’s plans for incorporating transportation related subjects into other disciplines, i.e.; Cyber Security, Data Analytics and Mechatronics during the UTC Faculty Meeting.
- **May** - Along with other CCAC automotive faculty, discussed advanced transportation related jobs at; Central Westmoreland Career and Technology Center and Western Area Career and Technology Center. Approximately 100 students participated.
- **June** - Met with Rick Price from Pittsburgh Region Clean Cities discussed an endowment scholarship for students attending CCAC in a “Clean Energy” or “Advanced Transportation” program where the goals of the course are to show how any of these technologies improve the environment, or reduce our dependence on foreign oil. A $10,000 endowed scholarship has been created.
- **July** - Attended the Automated Summer Institute training at Sinclair Community College. This week long training included all current areas surrounding Advanced Driver Assist Systems with various manufacturers (Ford, GM, Subaru, Mercedes, Honda, Toyota and Tesla).
- **August** - Met with staff from Electrode. This company makes simulators for educational facilities. The automotive faculty were looking for scaled-down, advanced driver assist simulations to assist students in the learning, understanding and diagnosing of those advanced systems. Participated in various SKYPE meetings preparing for the upcoming PA AV Summit.
- **September** – Met with Rick Price from PRCC to continue planning the upcoming “Odyssey Day”. This event focuses on alternative fuels, and clean energy fuels for transportation.

Discuss the performance measures (a minimum of two) for research outcome your Center identified in your Technology Transfer Plan Report and the targets (goals) for each measure.

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<th>Annual Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impact #1</strong> Annual Number of Instances of Technology Adoption or Commercialization</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td><strong>Impact #2</strong> Annual Number of Instances of Research Changing Behavior, Practices, Decision Making, Policies (Including Regulatory Policies), or Social Actions</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

In addition to what has been previously reported, an additional example of technology adoption is:

- **August 8, 2019** - Port Authority of Allegheny County Cites Traffic21 Study in Successful Funding Request. Port Authority of Allegheny County was one of the recent recipients of Driving PA Forward funding. With this $1,104,000 award, Port Authority will purchase two battery electric buses and charging stations. Helping make the case for battery electric buses the Traffic21 study, *Which Alternative Fuel Technology is Best for Transit Buses?* was included in the grant application package.
6. CHANGES/PROBLEMS

Changes in approach and reasons for change
Nothing to report.

Actual or anticipated problems or delays and actions or plans to resolve them
Nothing to report.

Changes that have a significant impact on expenditures
Nothing to report.

Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards
Nothing to report.

Change of primary performance site location from that originally proposed
Nothing to report.

7. SPECIAL REPORTING REQUIREMENTS

Nothing to report.
“Thank you for a wonderful event. There's so much good information here, and I learned a lot.”

Attendee Feedback

Summit Recap

125 attendees from government, community, industry and universities came together for The Second Annual National Mobility Summit. This included 10 university transportation centers representing 50+ Colleges and Universities across the US.

Photo [Left to Right]:

Dr. Kevin Womack, Director, USDOT Office of Research, Development & Technology, & the Transportation Safety Institute

Allanté Whitmore, Mobility21 Diversity Fellow & CMU Ph.D. Candidate for Civil and Environmental Engineering

Diana Furchtgott-Roth, Deputy Assistant Secretary for Research and Technology, U.S. Department of Transportation

Raj Rajkumar, Director, Mobility21 National UTC, Carnegie Mellon University

The Second Annual National Mobility Summit of US Department of Transportation University Transportation Centers

Exploring the Research Frontier for 21st Century Mobility

April 11, 2019

Carnegie Mellon University
Today’s Agenda

Registration and Networking Breakfast

Welcome, Introductions, & Overview of the Day
Raj Rajkumar, Director, Mobility21 National UTC, Carnegie Mellon University

Remarks from the UTC Program
Dr. Kevin Womack, Director, USDOT Office of Research, Development & Technology, & the Transportation Safety Institute

Mobility-Themed UTC Lightning Round 1: Brief Updates on Research, Education & Technology Transfer Efforts from Participating UTCs
Moderator, Chris Hendrickson, Director, Traffic21 Institute, Carnegie Mellon University
- Wei Fan, Director, Center for Advanced Multimodal Mobility Solutions and Education, University of North Carolina at Charlotte
- Hau Hagedorn, Associate Director, Transportation Research and Education Center, Portland State University
- David Kack, Mobility Director, Small Urban, Rural and Tribal Center on Mobility, Montana State University
- Cole Kopca, Assistant Director, PacTrans, University of Washington
- Hilary Nixon, Deputy Executive Director, Mineta Transportation Institute, San Jose State University

Break

Expert Panel 1: Opportunities and Challenges to Improve the Mobility of People
Moderator, Stan Caldwell, Executive Director, Mobility21 National UTC, Carnegie Mellon University
- Robin Chase, Co-founder Zipcar, Veniam, and NUMO
- Brian Cronin, Director, FHWA Office of Operations Research & Development
- Jane Lappin, Director, Public Policy & Government Affairs, Toyota Research Institute
- Paul Skoutelas, President and CEO, American Public Transportation Association

“IT was great seeing people from many different disciplines, each that touches transportation, present. I’m thinking specifically about the fact that there was someone there from a hospital, Easter Seals, and a community college. The diversity of participants is top notch.”

Attendee Feedback

Lunch and Keynote Speaker
Diana Furchtgott-Roth, Deputy Assistant Secretary for Research and Technology, U.S. Department of Transportation

Mobility-Themed UTC Lightning Round 2: Brief Updates on Research, Education & Technology Transfer Efforts from Participating UTCs
Moderator, Lisa Kay Schweyer, Program Manager, Mobility21 National UTC, Carnegie Mellon University
- Raj Rajkumar, Director, Mobility21, Carnegie Mellon University
- Andrew Farkas, Director, Urban Mobility & Equity Center, Morgan State University
- Jill Hough, Program Director & Associate Professor of Transportation, North Dakota State University
- Evangelos Kaisar, Professor, Freight Mobility research Institute (FMRI), Florida Atlantic University
- Kaan Ozbay, Director, C2 Smart, New York University

Expert Panel 2: Opportunities and Challenges to Improve the Mobility of Goods
Moderator, Loren A. Smith, Jr., Senior Advisor for Policy and Program Operations in the Office of Transportation Policy, U.S. Department of Transportation
- Bob Bourg, Vice President, Strategy & Growth, Waltec
- Steve Boyd, Co-Founder, VP of External Affairs & Market Development, Peloton Technology
- Rebecca Brewster, President and Chief Operating Officer, the American Transportation Research Institute
- Caitlin Hughes, Director, FHWA Office of Freight Management and Operations

Networking Reception and UTC Poster/Demo Session
10 UTCs Representing 50+ Colleges and Universities across the US
The population continues to grow, and infrastructure enhancements are not keeping pace. Hence, our roads are becoming more congested, causing longer transportation delays, higher pollution, wasted fuel, and bigger aggravation. Given this context, mobility-focused UTCs are uniquely positioned to re-think, re-work and re-invent solutions to our mobility challenges — and prepare for a transportation system unlike anything that we have seen before. By leveraging computing and communication technologies in the public infrastructure, in the vehicles, and in the devices we carry, we can dramatically improve mobility and services, leading to the efficient and safe movement of people and goods across the country.

This summit brings together industry, community, workforce, government and academic thought leaders from around the nation to explore ‘Improving the Mobility of People and Goods for All Communities.’ The summit provides the opportunity for discussions about the real-world transportation challenges, technological innovations, policy approaches, successful deployments, workforce training needs and lessons learned.

We were delighted to have Diana Furchtgott-Roth, Deputy Assistant Secretary for Research and Technology, USDOT as our keynote speaker. We were pleased to have Dr. Kevin Womack, Director, USDOT Office of Research, Development & Technology and the Transportation Safety Institute provide opening remarks. We also enjoyed hearing from the panelists affiliated with USDOT, the private sector and non-profit organizations.

We had ten USDOT UTCs represented, who shared their research, workforce initiatives, technology transfer/commercialization activities, partnership opportunities and impact on mobility.

Raj Rajkumar
Director, Mobility21 National UTC on Mobility
2019 – Organizations Represented

AARP Public Policy Institute
American Public Transportation Association
American Traffic Safety Services Association
American Transportation Research Institute
ArtCenter College of Design (Pasadena, CA)
Association for Commuter Transportation
Association of American Railroads
Best Best & Krieger
Bose Public Affairs Group
Carnegie Mellon University
Comet Mobility, LLC
Community College of Allegheny County
Community Transportation Association of America
Department of Energy
District Department of Transportation
Easterscale
Federal City Council
Federal Highway Administration
Federal Transit Administration
Florida Atlantic University
George Mason University
Georgetown University
Grant Thornton
Greater Washington Partnership
Hillman Family Foundations
ICF
Institute of Transportation Engineers
Intelligent Transportation Society of America
Maryland Transportation Builders & Materials Association
Mineta Transportation Institute, San Jose State University
Mobility Lab
Montgomery College
Morgan State University
National Aging and Disability Transportation Center
National Assoc. of Area Agencies on Aging
National Association of Regional Councils
National Association of Workforce Boards
National Center for Mobility Management
National Governors Association
National League of Cities
National Transportation Library, USDOT
NC A&T SU Transportation Institute
New York University
NIHTSA Office of Emergency Medical Services
North Dakota State University
NUMO
O’Hare Infrastructure Strategies LLC
Owner-Operator Independent Drivers Association Foundation Inc.
PacTrans - University of Washington
Peloton Technology
Portland State University
Qualcomm Technologies, Inc.
RETRC
Senate Commerce
Small Urban, Rural & Tribal Center on Mobility
The Children’s Hospital of Philadelphia
The Ohio State University
The University of North Carolina at Charlotte
Toyota Research Institute
Transportation Research Board
Transurban
U.S. Department of Energy
U.S. Department of Transportation
Union of Concerned Scientists
University of the District of Columbia
US Postal Service
Venable LLP
Veniam
Wabtec
Wayne State University
Woodruff Company
Engineered Solutions
WTS International
Zipcar

Save the Date

The Third Annual National Mobility Summit of
US Department of Transportation
University Transportation Centers

April 2, 2020
Washington, DC