Testimony of

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for the Pennsylvania Senate Transportation Committee Hearing

"Act 89 of 2013: The Benefits and Needs for Transportation Funding"

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Chairman Rafferty, distinguished members of the Senate Transportation Committee and Mayor Gresock, thank you for hosting this hearing and inviting me to testify today. At Carnegie Mellon University I am an Adjunct Associate Professor of Transportation and Policy in the Heinz College and serve as Executive Director of the Traffic21 Institute. Traffic21 houses two US Department of Transportation National University Transportation Centers; Technologies for Safe and Efficient Transportation and Mobility21, the latter of which also includes the University of Pennsylvania, the Community College of Allegheny County and the Ohio State University.

Since 2009 Traffic21 has been supporting an interdisciplinary team of faculty researching and deploying intelligent transportation systems. Our motto of *Research, Development and Deployment* drives our active partnerships with federal, state and local agencies, corporations and civic organizations. Through this research we have spun out multiple companies including Rapid Flow Technologies, Raodbotics and Ottomatika (acquired by Delphi and now Aptiv), creating hundreds of high paying job here in Pennsylvania. We began with using Pittsburgh as our "real-world" test-bed and expanded throughout the state and now the multi-state region.

The enactment of Act 89 in 2013 provided critical long term funding for state transportation programs which was particularly important in an era of federal inaction. During this time Carnegie Mellon was working with PennDOT on a groundbreaking research study to prepare the state for emerging connected and automated vehicle technologies - *Hendrickson, Chris, et al (2014) "Connected and Autonomous Vehicles Vision 2014".* This research provided PennDOT with a roadmap for near and long term initiatives and investments to prepare for connected and automated vehicles. Under the progressive leadership of the Pennsylvania House and Senate Transportation Committees, PennDOT Secretaries Barry Schoch and Leslie Richards and Turnpike CEO Mark Compton, Pennsylvania is internationally recognized as one of the leading states in the testing of automated vehicles and deployment of connected vehicle infrastructure. We now have five companies testing automated vehicle technology on Pittsburgh streets, host one of ten US DOT automated vehicle proving grounds, maintain multiple connected vehicle test beds and planning a new test track in State College.

With more stable transit funding, the Port Authority of Allegheny County has the opportunity to work with researchers at Carnegie Mellon on testing connected vehicle technology to improve transit operations through the connected vehicle test bed and proposed bus rapid transit route.

Act 89 funding is going a long way in addressing the capital investment backlog of Pennsylvania highway, bridge and transit systems. The automated vehicle industry is currently developing their

systems to operate on existing infrastructure, but that infrastructure needs to be well maintained so that the sensors on these vehicles can detect signs, lane markings and hazards as human drivers do today. Investments in connected vehicle technology greatly enhances safety and mobility of traditional and automated vehicles.

Act 89 funding was an important component to Pittsburgh's finalist proposal to the 2016 US DOT Smart City Challenge and subsequent $11 million US DOT Advanced Transportation Congestion Management Technology Deployment grant to develop *Pittsburgh's Smart Spines* and expand its connected vehicle test bed. Funding infrastructure like adaptive traffic signals and traffic cameras are strategic investments in technology. The US DOT is clearly looking to invest research and technology deployment grants in communities where there is significant state and local support.

These pilot technology deployments have demonstrated safety and mobility benefits but they are also providing insights on future investment needs including sensors in the field such as cameras, radar and Bluetooth, and advanced wireless and broadband communications infrastructure. The predicted 2020 roll out of the 5G cellular network will be a significant driver of the internet-of things economy, and transportation applications are at the tip of spear. Pennsylvania has the opportunity and responsibility to consider policies and programs to ensure that these new technologies are equitably distributed. The state already realizes disadvantages of communities without access to broadband communications.

Three of the four most disruptive technologies facing vehicle technology; (1) *Automated, (2) Connected and (3) Shared,* are enable by communication, sensor and computing technology. This information communication technology (ICT) infrastructure can be supported and enabled by state and local governments. In past transportation technology revolutions state and local governments have supported innovative infrastructure investments for ports, canals, railroads, highways, airports and now ICT infrastructure. This new ICT infrastructure will provide Pennsylvanian's with transportation safety and mobility benefits along with significant economic and social opportunity as seen with past transformative transportation investments.

PennDOT and the Turnpike Commission are beginning to make these investment as well as some progressive municipalities such as Pittsburgh and Cranberry Township but programs need to be put in place to support municipal adoption and investment. Recognizing that transportation technologies have the potential to benefit all municipalities in Pennsylvania, Traffic21 launched the Smart Mobility Challenge in 2017 to fund research pilot deployments with six municipalities in four counties. Twenty-four municipalities in eight counties applied for the Challenge demonstrating wide interest and need.

Pennsylvania has a competitive advantage to other states in being home to the birthplace of autonomous vehicles from research that began in the 1980s. This early research investment resulted in CMU winning of the US Department of Defense DARPA Urban Grand Challenge in 2007 which spawned many of the leaders in the autonomous vehicle companies thriving in Pennsylvania and the Silicon Valley today. This activity is a leading driver of Pittsburgh's

innovation economy and the City's evident economic renaissance. Pittsburgh now has a growing transportation technology industry cluster, but to assure long term growth, continued investment in research is critical in this competitive environment. With this transformative economic potential we appreciate Secretary Dennis Davin and the staff of the Department of Community Economic Development for co-hosting the PA Automated Vehicle Summits. The multi-agency partnership is crucial because PennDOT can apply these infrastructure technologies for transportation safety and mobility and DCED can advance Pennsylvania's position as a leader in transportation technology leverage ICT infrastructure for economic and community development.

To further capitalize on transportation technology investments in the region, two years ago CMU initiated the first multi-state connected and automated vehicle test bed which resulted in the Smart Belt Coalition which was then launched by Pennsylvania, Ohio and Michigan. This coalition provides an opportunity for Pennsylvania and its neighbors to leverage their collective research and technology investments to further transform the "rust belt" into the "smart belt".

These disruptive transportation technologies have emerged quickly have come with many opportunities including improved transportation safety and mobility and access to social and economic opportunity. But they also comes with ethical, privacy and cybersecurity risks and unintended societal consequences including increased vehicle miles traveled, sprawl, worker displacement and inequitable access. Continued research is necessary to guide policy makers for the coming change. One new effort at CMU's Heinz College is the recently launched Block Center for Technology and Society to research to examine societal impact of emerging technology. The state and local leaders need the information and the tools to make right policies and investments. CMU is also leading the way in research to evaluate the safe and secure deployment of this disruptive technology in the public realm.

Just over 100 year ago the disruptive transportation technology of motorized vehicles emerged and literally changed the landscape of Pennsylvania. Investments in transportation innovations such as the first turnpike, enabled our industrial heritage and shaped our communities. As we enter this next era of redefined mobility Pennsylvania's innovations and investments will also define its future.

Recommendations:

- Maintain a high quality of existing roadways and provide real-time information on road closures.
- Support the development of information and communications technology infrastructure to enable safety and mobility applications as well as economic development.
- Invest in research and test beds to develop next generation technology, evaluate emerging disruptive technology and recommend policy.
- Assist local government in technology investment and policy development.
- Encourage and promote the emerging transportation technology industry in Pennsylvania.
- Develop policy to mitigate the risks and unintended societal consequences.