BACKGROUND

The Pennsylvania Department of Transportation (PennDOT) commissioned a one-year project, Connected and Autonomous Vehicles 2040 Vision, with researchers at Carnegie Mellon University (CMU) to assess the implications of connected and autonomous vehicles on the management and operation of the state’s surface transportation system. This report explores the impacts of connected and autonomous vehicles on design and investment decisions, communication devices investment, real-time data usage, existing infrastructure, workforce training needs, driver licensing and freight flow as they relate to PennDOT.

FINDINGS

• The impact of connected and autonomous vehicles on lane capacity from the longitudinal perspective is uncertain.
• Radio advisories and ITS message signs will be obsolete in a connected environment.
• Clear zones will need to remain in place.
• Width of lanes, medians, shoulders and clear zones can be decreased.
• Cost of construction time and congestion associated with repainting and reallocating of lanes must be taken into account for investment decisions.
• Collaboration with educational institutions, including provision of funding to support training offered at these institutions, will be important to enhancing workforce training.
• To adequately train its workforce, PennDOT should encourage its personnel to participate in webinars, seminars and training offered by the U.S. DOT and other entities to assure familiarity with connected and autonomous vehicles.
• Changes to training and driver license issues will be incremental.
• For the 2040 design year, a new license class may be introduced for those wishing to drive their manual cars or drive their automated cars manually.
• Driving and skills tests should be required for all levels of automation with an exception of level 4, where there will be no interaction between drivers and vehicles.
• Testing criteria for all levels of automation (0-3) should be updated to assure driver’s basic familiarity with electronic assist features.
• PennDOT should update knowledge and road test requirements as automation advances.
• Under level 4 automation allowances should be made for medically impaired individuals.
• The focus of training should be on automation levels 2 and 3, as level 4 is further out and would need far less involvement from drivers.
• Simulators will be effective tools to use for training purposes as they can be adjusted to different levels of automation.
• PennDOT should insure that information on overweight/oversize and farm equipment movements be made available to connected vehicles in the vicinity of such movements as connected vehicles begin to appear.
• Specialized freight infrastructure such as over-height warnings and weigh stations can be phased out by PennDOT as new technology for weigh-in-motion and connectivity are introduced.
PennDOT should encourage the availability of electronic driver logs in commercial vehicles for providing data on commercial vehicle movements and for apportioning federal diesel fuel tax revenues.

- Most decisions related to freight and automation will not be impacted by PennDOT.
- PennDOT can play a significant role in moving the industry towards automation by providing test beds and insuring that information on incidents and overweight/oversize vehicle movements is available to connected vehicles.

RESULTS

Results of this project presented in the form of actions items and recommendations, presented below, should help PennDOT plan accordingly for the connected and autonomous vehicles technologies. The timelines presented below are based on current available information and the time frames are likely to change over time. These timelines should be updated frequently as connected and autonomous technologies advance.

RECOMMENDATIONS

2014 - 2016
- Thorough evaluation of all existing and planned capacity/LOS enhancement and ITS related investments.
- Collaboration with private sector to convert data into information for sending to cloud.
- Prioritization of safety and mobility applications.
- Identification and prioritization of key locations for DSRC and roadside equipment deployment.
- Funding allocation for DSRC and roadside units.

2016 - 2020
- Upgrading signal controllers, equipment and firmware where necessary.
- Early small-scale deployment of V2I applications at key locations.

2021 - 2030
- Collaboration with local and state educational institutions to enhance workforce training.
- Update of testing criteria for level 3 automation.
- Design of driver licensing training for emergency situations, system malfunctions, regulations and human interaction levels.
- Work with the trucking industry and State Police to design features tailored to these stakeholders.
- Deployment expansions – large scale deployment of equipment and applications.

2031 - 2040
- Provisions for a new license class for those wishing to drive their manual cars.
- Dedicating some highway lanes to autonomous vehicle use.
- Reconfiguration and repurposing of the lanes.
- Phasing out the freight infrastructure (e.g. over-height warnings, weigh stations) as new technologies are introduced.