

Preparing for the Autonomous Vehicle Future

By Sean Slone

2016 saw the release of federal guidance designed to define the roles of the federal and state governments in regulating autonomous, or self-driving, vehicles. It also saw Michigan enact the most sweeping autonomous vehicle legislation in the nation. But while those efforts sought to focus on the immediate policy concerns and jurisdictional boundary issues involved in the testing and deployment of self-driving cars, others are starting to consider what are expected to be profound long-term policy and planning impacts of these vehicles across a wide variety of sectors in the decades ahead. These include impacts to the economy, the built environment, safety and energy consumption.

In September 2016, the National Highway Traffic Safety Administration, or NHTSA, issued a long-awaited document aimed at delineating responsibilities of the federal and state governments with regards to paving the way for self-driving cars. The “Federal Automated Vehicles Policy” included a “Model State Policy” section that outlined a traditional role for states in overseeing areas like licensing and registering motor vehicles, enacting and enforcing traffic laws and regulations, conducting safety inspections and regulating motor vehicle insurance and liability.¹

Automakers subsequently expressed concern about the NHTSA guidance, calling on the new Trump administration to re-evaluate it, arguing it could delay testing by months and lead to states making the voluntary guidelines mandatory. U.S. Secretary of Transportation Elaine Chao told the National Governors Association, or NGA, in February 2017 that the administration was evaluating the guidance and looking to update and amend it to ensure it “strikes the right balance.”²

While many states in 2016 were keeping a close eye on how NHTSA would weigh in on autonomous vehicle policy, Michigan, late in the year, moved to enact perhaps the most expansive state legislation on autonomous vehicles to date. In a series of four bills, lawmakers voted to allow:

- Driverless cars on all public roads;
- The operation of networks of on demand, self-driving taxis by automotive manufacturers if the vehicles are supplied or controlled by the auto manufacturers;
- Automated truck platoons; and
- The purchase and sale of autonomous vehicles when they become available to the public.³

Most importantly, the legislation reversed a 2013 law that required autonomous vehicles to have a backup driver aboard during testing. In passing the new laws, the state clearly sought to help the homegrown U.S. automotive industry remain competitive with Silicon Valley and other parts of the country in the autonomous vehicle arena.⁴

With states like Michigan looking to enable and encourage testing of autonomous vehicles and perhaps reap an economic windfall and the feds considering how much to oversee the process, the inevitability of the autonomous vehicle future also means that policymakers at all levels must consider the impacts they’re likely to have across a wide variety of sectors in the decades ahead. Many are only just beginning to do so.

In 2015, the National League of Cities conducted an analysis of city and regional transportation planning documents from 68 communities around the country and found that only 6 percent of plans considered the potential effects of driverless technology.⁵

Fortunately some university researchers around the country, often at the behest of state departments of transportation, have been contemplating what the future could bring and what policymakers and transportation planners need to start thinking about now.

Economic Impacts of Autonomous Vehicles

Researchers say policymakers need to recognize that dramatic changes are on the way for a variety of different industries as a result of autonomous vehicles, and those changes could bring dramatic economic shifts, job losses, shifting duty assignments and other impacts.

Engineering professor Kara Kockelman and researchers at the University of Texas at Austin studied literature from consulting firms working for potentially affected industries and estimating the range of impacts to those industries.

Among the most affected industries, according to their study, are likely to be the following: automotive, electronics and software technology, trucking/freight movement, personal transport (trains, planes, public transport), auto repair, medical, insurance, legal profession, construction and infrastructure, land development, digital media, police (traffic violations), and oil and gas.⁶

Some state officials are already concerned about the potential impacts to the trucking and freight movement industries in particular. When Secretary Chao spoke at NGA's Winter Meeting in February 2017, Michigan Gov. Rick Snyder and Massachusetts Gov. Charlie Baker asked her about the workforce challenges that self-driving vehicles could present.

"Autonomous vehicles are a tremendous opportunity, and at the same time, there's this big-time workforce issue," Baker said. "We need to be thinking far enough ahead on that one so that we don't wind up creating a tremendous amount of economic hardship along the way."

Snyder told the secretary: "For truck drivers, we need to be looking farther out as to what are their career opportunities as we see these autonomous vehicles emerge. How do we make sure we're planning far enough ahead so we don't create job-loss opportunities for people?"

Chao responded that "as a former secretary of labor, I am very, very concerned about that and very cognizant of those challenges. So we do have to transition people and we need to keep that in mind."⁷

Truck platooning, which allows two or more tractor trailers to connect to each other and travel together closely, is likely to bring significant job losses. Long-haul trucking routes would likely be the first routes to be eliminated, analysts say. None of this is expected to happen overnight but if and when it does, some may look to government to put in place training programs to help drivers transition to other jobs or take on new roles in a more-automated trucking industry.⁸

"The (trucking) industry employs over 3 million truck drivers and the automation of driving poses a huge threat to the livelihood of these truck drivers," Kockelman and her researchers wrote in their 2017 research report. "The role of the truck driver could become more technical, as they would need

to monitor the (autonomous vehicle) system to ensure it is running properly. Such a role would likely require training and could increase the value and wage of individual truck drivers."⁹

Of course truck drivers are just the tip of the iceberg in terms of the kinds of jobs that will be impacted by autonomous vehicles. Taxi, Uber and Lyft drivers, couriers, bus drivers, valets, chauffeurs and limo drivers and a wide variety of specialty vehicle drivers are all expected to see automation take or alter their jobs sometime in the future, analysts say.¹⁰

Florida Considers Impacts of Autonomous Vehicles on the Built Environment

The autonomous vehicle future is also expected to dramatically reshape the nation's built environment. The Florida Department of Transportation recently partnered with Florida State University, or FSU, to study the potential impact of autonomous vehicles on urban infrastructure design and what it means for policymakers.

"The state of Florida ... has been somewhat of a leader in this area," said Tim Chapin, professor of urban and regional planning at FSU, at the Transportation Research Board Annual Meeting in January 2017. "It's one of a few states that actually allow autonomous vehicles to operate on its roadways. The state has put several million dollars into research initiatives across the state university system and, with the private institutions in the state, is looking at the impact of (automated vehicles) on Florida and on the world as we know it."

Chapin said there is fertile ground in researching key built environment impact questions such as whether autonomous vehicles will be a re-urbanizing force for the nation's cities or a sprawl-promoting force that will allow commuters to live far from where they work. They could be both.

"If you want to be an urban person, (automated vehicles) are going to allow you to do that more successfully," he said. "If you want to live further out and have an easier commute and be productive and read or work and sleep or whatever, you can do that as well. There is some interesting work and thinking to be done on that front."

One of the most anticipated changes to the built environment that automated vehicles will eventually bring is the opportunity for redesign of roadways. But they may also bring new infrastructure challenges.

"They operate much more safely, more efficiently and they don't have the variability of human drivers," he said. "(Automated vehicles) in

fact are so successful in driving in very, very precise ways that we have to think about the impact on our infrastructure. ... If we did have an (automated vehicle) fleet and they're all falling in line behind each other, we would wear out our roadways in very specific corridors."

The elimination of many traffic signs and signals could be possible if roads of the future are designed more for the automated vehicles themselves than they are for human drivers who will no longer be paying attention, Chapin said.

But those aren't the only features of today's built environment that could be relegated to the dustbin of history.

"As the (automated vehicle) can be sort of traveling all the time and doesn't need to park ... we don't need all those parking spaces anymore," he said. "There are some opportunities there. ... We need to start thinking about our parking ratios. We need to start thinking about the location of parking zones and parking sheds for high-activity areas. I think there is going to be a real rethinking of parking and on-site demand for parking."

While automated vehicles might present the opportunity to eliminate space-consuming parking facilities from the urban landscape, they might also require more areas in front of destinations where the vehicles can drop off riders before driving away empty to service other users, to park in a facility outside the city center or to "return home" and wait to be called again.

"If we do move into a world in which we want drop-off locations at just about every land use, that really does sort of fragment your urban environment," said Chapin. "That could very well chop up our (existing) pedestrian and bike infrastructure."¹¹

Chapin also worries that if we're moving to a world in which cars won't need to stop, what will be the impact for pedestrians? The safety of pedestrians is a challenge that Florida already has concerns about. Florida cities like Orlando have long ranked high in the number of pedestrian fatalities due to the design of their streetscapes.¹²

After Chapin and his research team delivered their findings to the Florida Department of Transportation, department officials asked an important question: What should they be doing to prepare for a future with autonomous vehicles? Chapin said the state DOT in the not-too-distant future should be able to rewrite its roadway design manual and reconsider the widths of road lanes, the size of turning radiuses, and the need for turn lanes, signage and traffic signals.

"One of the messages we tried to get across was start doing this in your planning process—your long-range transportation plans where you think about the future of your network and how it's changing—start building (automated vehicles) into that," Chapin said. "We're not quite sure what that means either but we need to start getting people used to this idea and start thinking about the next 30, 40, 50 years of investments in transportation reflecting (automated vehicles) and that needs to begin to happen now."¹³

Virginia Incorporating Autonomous Vehicles into Current Operations

Cathy McGhee, the director of research at the Virginia Department of Transportation, agreed that now is the time to factor autonomous and connected vehicle technologies into planning.

"The typical planning horizon is 20 years," McGhee said. "We're making investment decisions today about what we deploy to provide transportation services that will be greatly impacted by where technology goes in the next five to 10 years."

But McGhee said her department is going farther than that: incorporating autonomous and connected vehicles not just into long-term planning but also into what they're doing today.

"We're trying to embrace the technology but do it in a way that still supports our programs and service provision," said McGhee. "We're looking at implementation from the get-go. While a lot of this work started in my office as research, we began that research with an eye toward implementation. We brought our traffic management center folks in from the very beginning so we could talk about how these technologies get rolled into our traffic management processes."

McGhee said one thing Virginia has not done is change their laws to support automated and connected driving.

"We believe that we don't have anything in the code of Virginia right now that prohibits the testing and deployment of automated vehicles and we don't want to create a law that has unintended consequences," she said. "So we're very open to automated testing and development and at this point we're staying away from any laws that might in any way inhibit that."¹⁴

In 2015, Virginia Gov. Terry McAuliffe announced the designation of 70 miles of interstates and arterial roads in Northern Virginia as the "Virginia Automated Corridors," which allows autonomous vehicle developers to test their vehicles.¹⁵

What has state DOT officials, researchers and others around the country excited about autonomous and connected vehicles is the potential of them to improve safety. According to the National Safety Council, the number of motor vehicle deaths in the United States rose 6 percent in 2016 and exceeded 40,000 for the first time since 2007.¹⁶

“We certainly see the potential for huge decreases in crashes if the system is controlling the vehicle rather than the driver,” McGhee said. “Crashes related to driver error should be pretty much eliminated and that’s a huge part of our crash problem right now—driver inattention and driver error.”

But the proliferation of autonomous vehicles won’t happen overnight and many worry about what the period of transition will look like.

“It’s entirely likely that we’re going to see ... a time of caution while we have this mixed fleet,” she said. “How automated vehicles and traditional vehicles interact on the roadway will be very important to watch and to pay attention to and, as traffic engineers and safety engineers, that is something that we’re very concerned about.”

Another concern is that the period of transition could be a lot longer than many predict, McGhee said.

“User acceptance (of autonomous vehicles) is not a given,” she said. “For every study that says car ownership will go to zero, there is a study that says 65 percent of drivers say ‘no way.’ I live in a very rural county, which clearly will not be an early adopter of automated systems. These folks like to drive. They like their pickup trucks. They like their old cars and I think for some populations, it’s going to take quite a bit longer.”

While many envision an autonomous future that includes shared-use vehicles that will help reduce the number of cars on the roads, the miles they drive and their environmental impacts, that future is far from a given.

“I’m in the camp that believes at least initially that (vehicle miles traveled) will increase,” said McGhee. “People who can’t currently participate in the (transportation) network all of a sudden come back in—younger drivers, older drivers. We could see a significant increase.”

Safer, less taxing travel also could mean travelers change their preferred modes of transportation.

“If you can get in your automated vehicle, set it for Florida and then go to sleep, maybe you would choose to do that as opposed to flying,” she said. “The same is true of transit. ... If you can do a shared ride through Lyft, maybe you don’t get on transit at all. What does that mean to my highway network

from a mobility standpoint? Rather than a 30-passenger bus, I have six or seven individual vehicles.”¹⁷

Potential for Impacts to Energy Consumption

Regina Clewlow also sees the potential for a wide variance in the impact of automated vehicles over the coming decades. As a research scholar at the University of California, Davis Institute of Transportation Studies, Clewlow examined the estimated vehicle miles traveled, or VMT, energy and greenhouse gas impacts based on a meta-review of more than 50 studies.

“Will we see this potential shift from personally owned vehicles to shared-mobility-as-a-service vehicles and in what context?” said Clewlow, who now serves as vice president of business development for Swiftly, a company that is helping transit agencies improve their operational efficiency, investment decisions and rider engagement. “In urban environments it seems more likely that this might occur; perhaps not so in more suburban and rural environments. ... Several estimates suggest that in terms of impacts that one shared fully autonomous vehicle could replace 10 personally owned vehicles. Obviously, that’s a pretty dramatic reduction in the number of vehicles that are owned.”

Clewlow said the studies she examined indicate that depending on how the autonomous vehicle future evolves, it could produce anywhere from a 90 percent decrease in energy use to a 200 percent increase in energy consumption.

Reduction in the cost of travel alone could bring increases of up to 150 percent in vehicle miles traveled. If more commuters choose to live farther away due to the change in the value of time produced by the convenience of being able to multitask as they commute, another 50 percent increase in VMT could result, Clewlow said.

But Clewlow also found a key shortcoming of the research she studied.

“As far as I can tell, there are no studies that really look at how the movement of goods would change VMT and energy use in a future with fully shared autonomous vehicles,” she said. “However I can tell you that Silicon Valley and various automakers and various other companies like Amazon are definitely exploring these scenarios of how they can increasingly deliver goods to your doorstep with a future that has increasingly automated vehicles and associated technologies.”

Moreover, Clewlow noted many of the studies she reviewed make some key assumptions and

projections that could take considerable time to come to pass if they come to pass at all.

“If you look at the literature and you look at many of these estimates, most of them are based on a future that has fully autonomous vehicles that represent the entire fleet of vehicles, and clearly we are marching down a path where we will see partially automated vehicles enter the fleet, vehicles that are owned by individuals and not by shared operators and so we need further research that looks at those gradual scenarios that we’re marching (toward) to see what the impacts of partially automated vehicles might be on travel behavior and on all of these other impacts,” she said.

Clewell said thus far many researchers have also assumed that somehow all the autonomous vehicles introduced in the coming decades will be magically electric. But she believes that’s an issue that requires further study.

“There are a lot of very good studies that look at why this scenario makes the most sense from a financial perspective, from a cost perspective and then what sort of infrastructure might need to be developed on the vehicle electrification side to help us down this path,” she said.¹⁸

Some key partnerships in the private sector could help to make those assumptions a reality.

The ride-hailing company Lyft, for example, announced it is working with General Motors to add the new extended-range electric Chevy Bolt to its fleet under a rental program for new Lyft drivers who don’t have a qualifying vehicle to use in transporting passengers. GM has also invested half a billion dollars in Lyft’s efforts to build out the concept of a shared, autonomous, electric network with the goals of a fully autonomous fleet to provide the majority of rides on the service within five years and the virtual elimination of private car ownership in major U.S. cities by 2025.

“This is a really big change from where we are today and this really undermines some of the very American ideals of car ownership,” said Debs Schrimmer, transportation policy manager at Lyft. “But we believe that there is a strong indication that people will want to get rid of their cars and rather than own their own self-driving car, they’re going to want to participate in a network. ... Right now owning a car is kind of like having a ball and chain attached to you. There are many subscription costs attached to this: of parking, of registration, of maintenance, of getting gas and we think paying for a subscription service, where you’re actually just paying for the trips that you’re taking

and not having to worry about the maintenance of your vehicle is a very compelling use case.”¹⁹

Notes

¹National Highway Traffic Safety Administration. “Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety.” September 2016. Accessed from: <https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf>.

²David Shepardson. “Trump administration re-evaluating self-driving car guidance,” Reuters. February 26, 2017. Accessed from: <http://finance.yahoo.com/news/trump-administration-evaluating-self-driving-212824005.html>.

³Michael C. Hammer. “Autonomous Vehicles—The Future Has Arrived in Michigan.” *National Law Review*. December 16, 2016. Accessed from: <http://www.natlawreview.com/article/autonomous-vehicles-future-has-arrived-michigan>.

⁴Aarian Marshall. “Michigan Just Embraced the Driverless Future.” *Wired*. December 9, 2016. Accessed from: <https://www.wired.com/2016/12/michigan-just-embraced-driverless-future/>.

⁵National League of Cities Center for City Solutions and Applied Research. “City of the Future: Technology & Mobility.” 2015. Accessed from: <http://www.nlc.org/sites/default/files/2016-12/City%20of%20the%20Future%20FINAL%20WEB.pdf>.

⁶Lewis M. Clements and Kara M. Kockelman. “Economic Effects of Automated Vehicles.” January 2017. Accessed from: http://www.cae.utexas.edu/prof/kockelman/public_html/TRB17EconomicEffectsofAVs.pdf.

⁷Pete Bigelow. “Governors’ Warning: Self-Driving Trucks Could Cause ‘Big Time’ Job Losses.” *Car and Driver*. March 1, 2017. Accessed from: <http://blog.caranddriver.com/governors-warning-self-driving-trucks-could-cause-big-time-job-loss/>.

⁸David McCabe, Gerald Rich and Lazaro Gamio. “Here’s where jobs will be lost when robots drive trucks.” *Axios*. February 22, 2017. Accessed from: <https://www.axios.com/heres-where-jobs-will-be-lost-when-robots-drive-trucks-2276682948.html>.

⁹Clements, Kockelman.

¹⁰Thomas Frey. “128 things that will disappear in the driverless car era.” September 21, 2016. Accessed from: <http://www.futuristspeaker.com/job-opportunities/128-things-that-will-disappear-in-the-driverless-car-era/>.

¹¹Transportation Research Board Annual Meeting. Workshop 116: Social & Economic Factors in Autonomous and Connected Vehicles: Current Research, Planning & Policy Trends. January 8, 2017.

¹²Smart Growth America. “Dangerous by Design 2016.” Accessed from: <https://smartgrowthamerica.org/dangerous-by-design/>.

¹³Transportation Research Board Annual Meeting. Workshop 116.

¹⁴Transportation Research Board Annual Meeting. Workshop 777: Planning Implications of Emerging Transportation Technologies and Trends. January 11, 2017.

STATE TRANSPORTATION

¹⁵Office of Gov. Terry McAuliffe. “Governor McAuliffe Announces New Partnership to Make Virginia a Leader in Automated-Vehicle Industry.” Press Release. June 2, 2015. Accessed from: <https://governor.virginia.gov/newsroom/newsarticle?articleId=8526>.

¹⁶National Safety Council. “NSC Motor Vehicle Fatality Estimates.” Accessed from: <http://www.nsc.org/News Documents/2017/12-month-estimates.pdf>.

¹⁷Transportation Research Board Annual Meeting. Workshop 777.

¹⁸Transportation Research Board Annual Meeting. Workshop 116.

¹⁹Transportation Research Board Annual Meeting. Workshop 777.

About the Author

Sean Slone is the director of transportation and infrastructure policy at The Council of State Governments. He staffs CSG’s Transportation Public Policy Committee and writes about transportation policy for CSG publications, such as *Capitol Ideas* magazine, *The Current State* e-newsletter, the Capitol Comments blog and Capitol Research policy materials. He is the author of two CSG national reports: *Transportation and Infrastructure Finance* (2009) and *Shovel-Ready or Not? State Stimulus Successes on the Road to Recovery* (2010). He has written an article for *The Book of the States* each year since 2010.