8 • Future Trends and Technology

Introduction

The future of transportation as we presently know it is undergoing massive change. Breakthroughs in computer automation, artificial intelligence, engineering, communications and materials design are all leading to rapid changes in how we will travel. Technology is also changing the ways in which we shop or have items delivered. For example, Figure 8-1 illustrates a robot delivery service in Washington, D.C. These emerging technologies will dramatically alter how we plan for transportation now and in the future. The COVID-19 pandemic has forced us to rethink how transportation may change due to the learned experiences and effects of the pandemic on society, especially how it affects public transit.

Transportation Can Change Quickly

The impact of new mobility technologies on cities could be as significant as the invention of the automobile. The question is not "if" but "when". The timing will be driven in part by funding, policy development, and infrastructure design. Millions of dollars are at stake as new technologies and service models are introduced and adapted to the transportation sector.

Figure 8-1

Is Transportation Ready for Disruption?

Most of the transportation sector has not yet seen the disruption to its longstanding service provision model that other sectors have experienced through the introduction of new technologies. The transportation sector benefits from a particular set of circumstances that have helped insulate it up to now. Some of these include:

- The cost and time to develop transportation infrastructure

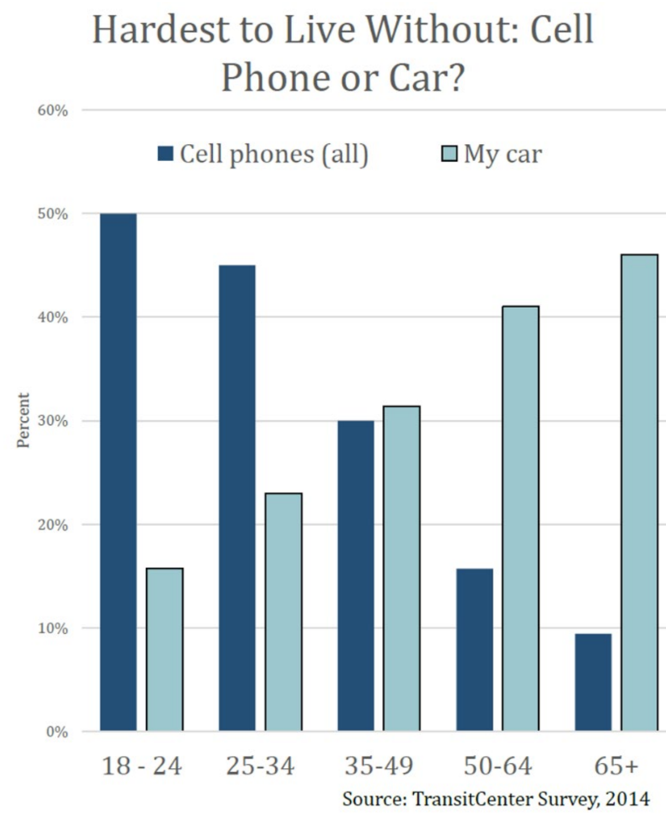
- The cost and complexity of entry into the market
- The regulatory environment
- The difficulty of taking on relatively large and (usually) well-established businesses

New technologies are already breaking down barriers. Uber is an example of a company born from innovative technology, in this case big data analytics, that is now challenging the taxicab industry on a global scale. Uber is moving into personal transportation modes such as electric scooters and bicycles, as well as meal delivery. The COVID-19 pandemic has seen Uber used for deliveries of groceries and prescriptions to those unable to leave their homes. Many more start-up businesses have ideas with the potential to reshape how we see and use transportation and to fundamentally change customers' expectations.

Societal Preferences

Young people are getting their first drivers licenses later and later, if at all, decreasing demand and delaying new car purchases as they rely more and more on transit, bicycles, scooters, and walking as their primary means of transportation. This trend is illustrated in Figure 8-2, which compares how individuals in different age categories felt that life would be harder: without a cell phone or without a car.

Figure 8-2



What is Shaping the Future of Mobility?

The Florida Department of Transportation (FDOT) coined the acronym "ACES" to help describe future trends in the automotive industry: Automated, Connected, Electric and Shared (Figure 8-3). A brief description for each letter follows.

Figure 8-3

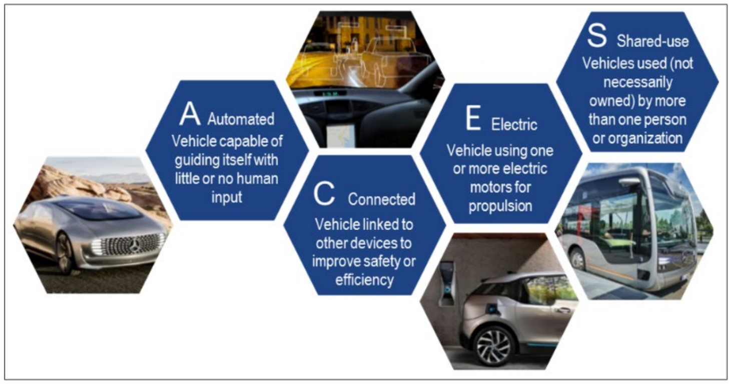
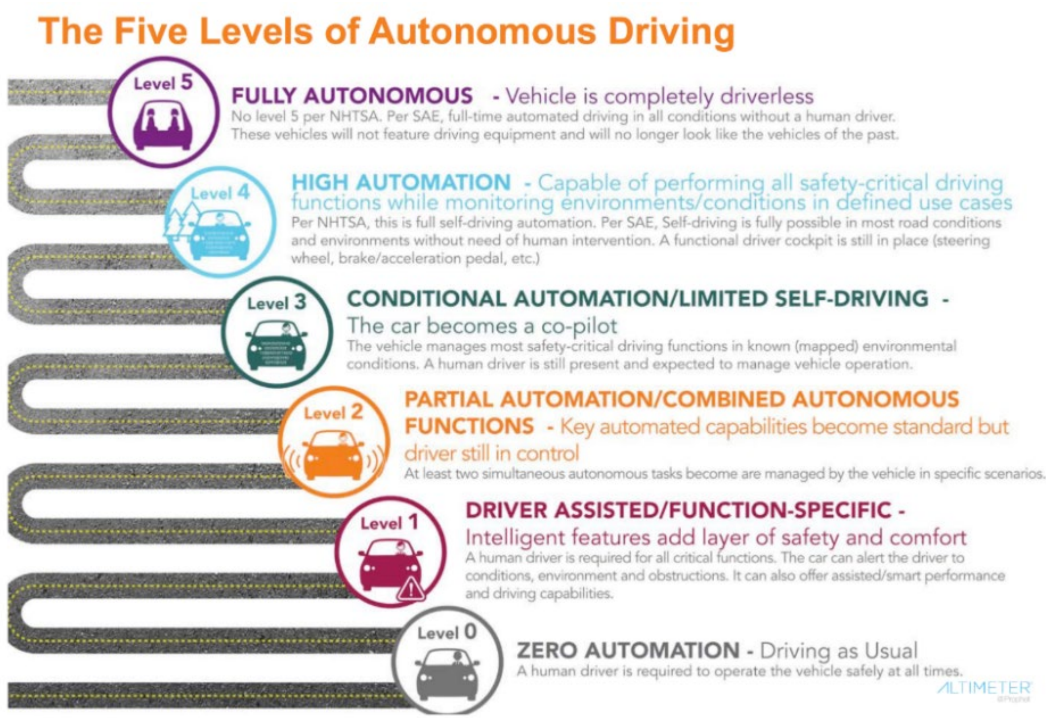


Figure 8-4



Automated Vehicles

Automated (or Autonomous) Vehicles ("AV" or "AVs") use sophisticated computer programming, cameras, and sensors to take control over some, or all, aspects of a driving task. There are five levels of autonomous driving as shown in Figure 8-4. Commonly available features of

Level 2 and 3 automation already available in a variety of vehicles currently available include:

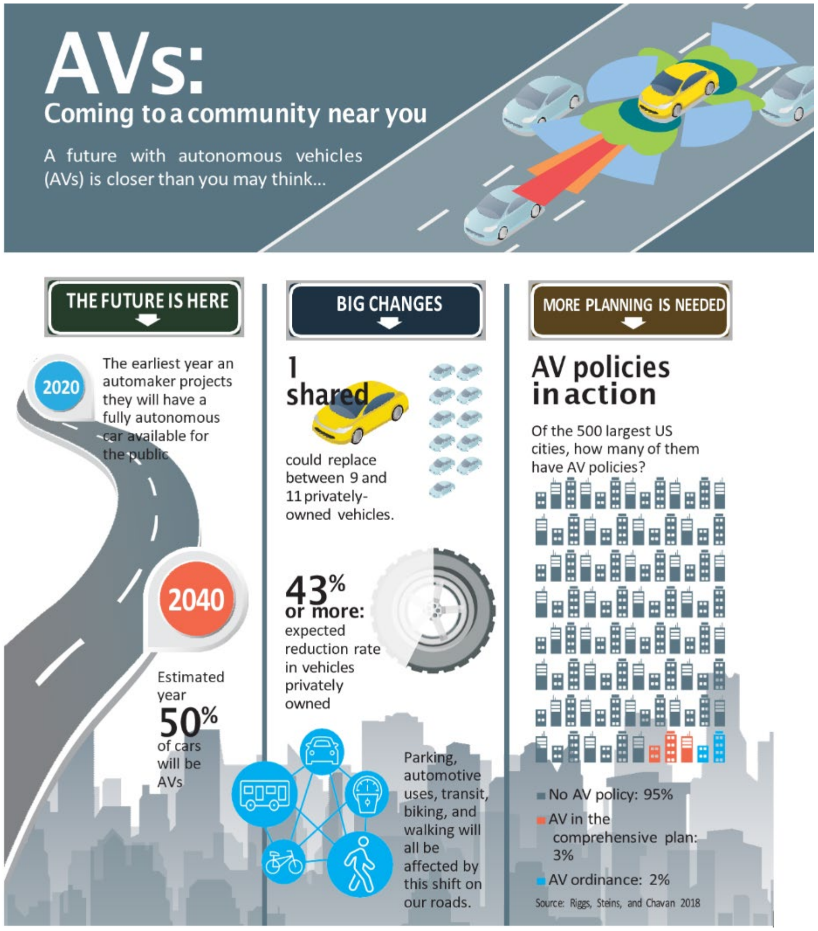
- Adaptive cruise control
- Self-parking features
- Lane keeping assist systems
- GM Super Cruise / Tesla Auto-Pilot
- V2I – signal systems (Audi, BMW, Apps)

The impact of AVs on transportation and society has the potential to be huge, but it is difficult to measure at present, due to many unknown factors. The chart in Figure 8-5 provides some estimates which would appear to only scratch the surface of that potential. Colleges and universities around the world are currently studying AVs, and state and federal agencies are completing policy studies and recommendations at an increasing rate in order to prepare and help guide us into the future.

Connected Vehicles

Connected Vehicles ("CV" or "CVs") use different technologies that allow vehicles to communicate with each other, infrastructure (such as traffic signals), pedestrians, cyclists, and other objects, such as trains and smartphones. CVs can provide information and alerts to drivers and other vehicles; this has the potential to reduce crashes, improve traffic flow, and save energy.

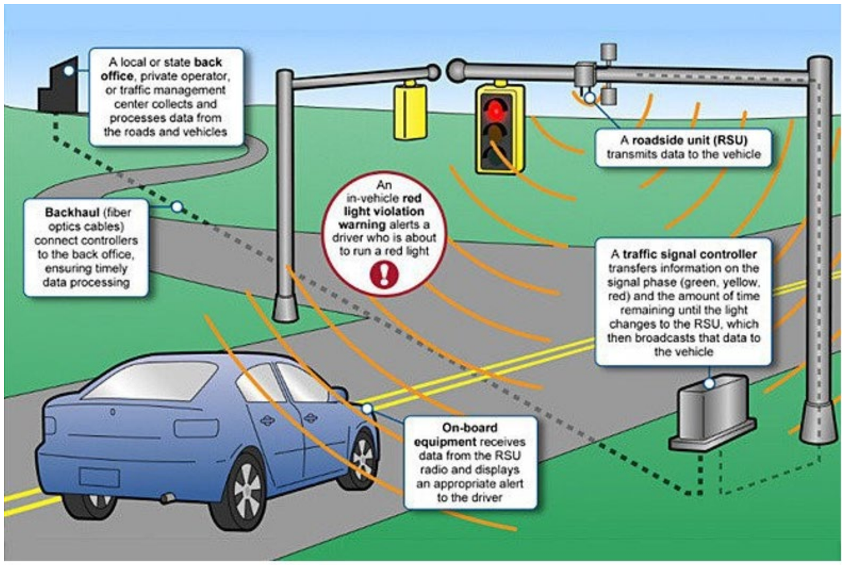
Figure 8-5



Vehicle to Vehicle (V2V) applications exchange information between vehicles regarding forward collision warning and left turn assist applications.

Vehicle to Infrastructure (V2I) applications exchange information between vehicles and infrastructure to notify drivers of upcoming traffic signal changes and lane departure assist. Figure 8-6 highlights some key V2I features.

Figure 8-6



U.S. Government Accountability Office (GAO) from Cooney 2016

Vehicle to People (V2P) applications exchange information between highway infrastructure, vehicles, pedestrians, and bicyclists to, for example, provide collision alerts to pedestrians, bicyclists, and drivers.

Automation and connectivity are complementary. Cooperative automation uses V2V and V2I connectivity, enhances the safety and efficiency of automated driving systems, and provides greater situational awareness and efficiency.

Many research organizations have developed what is referred to as “the five levels of autonomous driving” in one form or another. The five levels as depicted in Figure 8-4 is the one most often referenced in numerous MnDOT research and policy publications.

Electric Vehicles

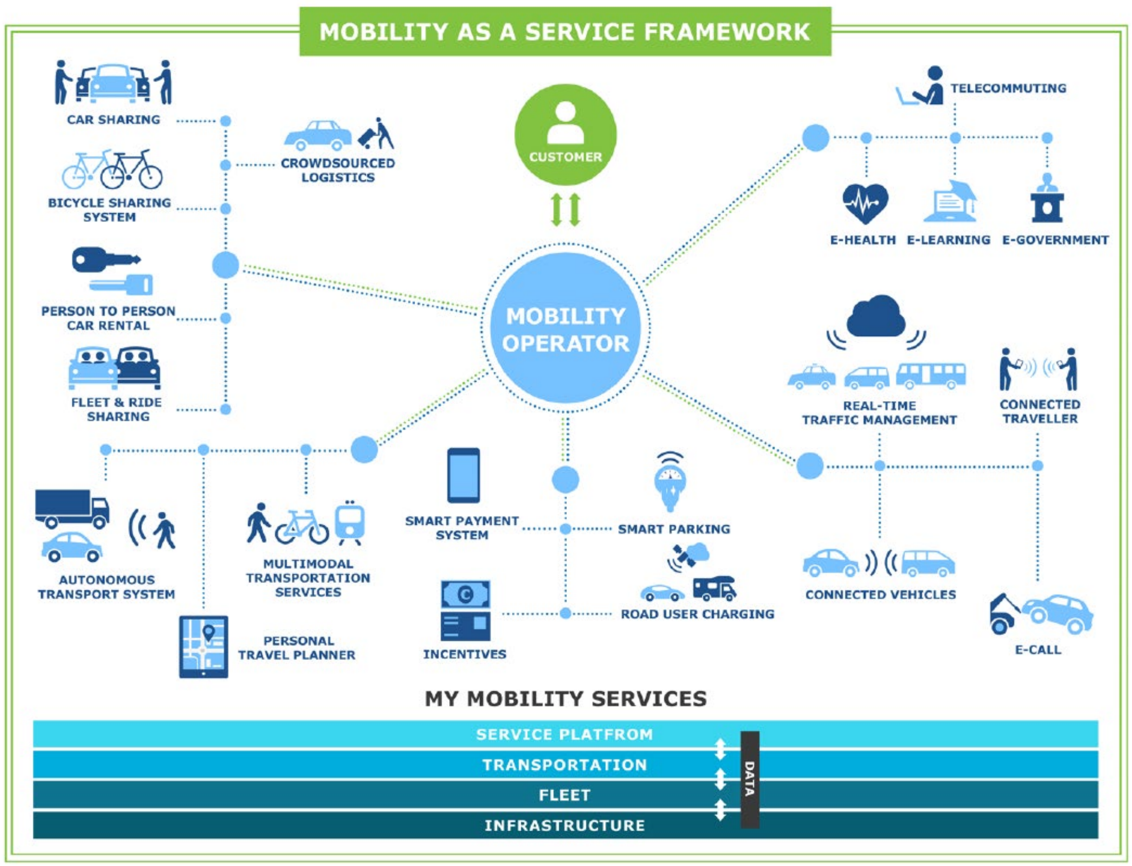
Why the interest in Electric Vehicles (“EV” or “EVs”)? If AVs evolve as a shared-use model, the lower maintenance and operating costs of EVs will be attractive to fleet operators. There is an expectation among industry experts that energy economics will drive vehicles towards electric as generation costs and battery costs drop, which could be as much as 70% of all new cars by 2050. Technology is innovating around the need for faster and more convenient recharging, including possible in-roadway recharging. Lastly, electric cars can help address environmental concerns such as emissions and noise.

Most states around the country struggle with how EVs should pay for their fair share of roadway infrastructure and as such, each state utilizes various tax and fee structures to remedy the situation. Lack of electric charging infrastructure is often the most-cited reason why most Americans are not completely sold on EVs while most European countries have made it an incentive to own an EV.

Shared Vehicles

Shared mobility is the idea that transportation services, such as transit, bike sharing, scooters, ridesharing and other modes of transportation are shared among multiple users. Mobility as a Service (MaaS) allows users to arrange various modes of transportation into a single trip, such as a bike share to a public transit stop, and then a rideshare to an ultimate destination. A future where there is less need for personal vehicles could become a reality when a package of MaaS solutions integrating travel options, as shown in Figure 8-7, becomes a reality.

Figure 8-7



With expanded availability of various transportation services, there could be a significant change in the way people travel. Fewer people may choose to own a private vehicle, either due to social behavior or the costs of technology. The future is uncertain about when ubiquitous availability of MaaS will occur, but it is showing up in larger metropolitan areas across the country and around the world.

Potential Benefits of Connected and Automated Vehicles

According to MnDOT's *Governor's Advisory Council on Connected and Automated Vehicles Executive Report* (December 2018), there are five major potential benefits that can already be seen by Minnesotans from Connected and Automated Vehicles (CAVs):

- Increased safety
- Greater mobility and equity
- Economic and workforce development
- Efficiency
- Maximized health and environment

Increased Safety

In 2019, an estimated 38,800 people were killed on U.S. highways, including 364 in Minnesota. Nearly 94% of these fatalities were caused by human factors, such as distracted driving, speeding, and impaired driving. Autonomous driving has the ability to save lives by reducing the effect of poor personal choices on travel.

Greater Mobility and Equity

CAVs may reduce transportation barriers for persons with disabilities, reduced driving skills due to aging, low income communities, and others who are transportation-challenged. CAVs could provide Minnesotans broader access to live, work, and play where they choose, regardless of income, race, geography, disability, age, and other factors that historically have created barriers to access and personal mobility.

Economic and Workforce Development

Minnesota is competing in a global market. This technology provides Minnesota with an opportunity to maintain a competitive business edge, both nationally and internationally, in the movement of goods, services and people.

Efficiency

CAVs may reduce traffic congestion and improve traffic flow at intersections, work zones, and during adverse weather conditions. Electronic communication among vehicles, without the ambiguity of horns or hand signals, allows for much closer following distances than human-piloted cars can safely accomplish. Rerouting traffic may also assist in incident management.

Maximize Health and Environment

CAVs could help the State rethink the way we plan communities to maximize health and sustainable multimodal transportation. CAVs may reduce greenhouse gas emissions and other air pollutants with the expansion of electric vehicles.

Other Technology Applications

Freight Truck Applications

The prospect of self-driving trucks, especially for long-haul, cross-country use, and automated platooning (vehicles traveling in close proximity to each other, nose-to-tail, at highway speeds), as shown in Figure 8-8, offer potential cost savings to shippers. Additionally, there are safety benefits that would result from this technology, which would include a reduction of fatigued truck drivers on the road.

Automated Delivery Vehicles

In dense urban settings, automated delivery vehicles are being tested. Several large metropolitan areas are already using automated delivery vehicles to deliver meals, as well as groceries and other household items. In some communities, these delivery vehicles have been a lifeline during the COVID-19 pandemic, introducing new ideas on how to best utilize these vehicles now and in the future.

Figure 8-8

Projected Timeframes for Autonomous Driving Adoption

Projections vary widely as to how soon we'll begin to see CAVs in our communities. Level 5 CAVs (see Figure 8-6) could be available in as little as five years, or they could be decades away since the technology is still undergoing development and refinement. Additionally, cities and states are reviewing and determining the regulations for such automation.

Early adoption will most likely be in the form of shared fleets, including small-scale autonomous transit and freight delivery. Realizing many of the potential benefits will require significant fleet turnover, this could take years. More than likely, the transition will be slow and incremental, depending primarily on the construction and/or reconstruction of transportation infrastructure, policy development at the state and local levels, and financial considerations.

Implications of a Mixed Fleet

Human drivers will likely share the road with CAVs for quite some time. Mixed fleets will create unique challenges for drivers unfamiliar with the behavior of AVs, and AVs will constantly be learning and adapting to humans through increased machine capabilities. Some ideas to help minimize transitional impacts include:

- Dedicated lanes for CAVs on highways, similar to today's HOV (High Occupancy Vehicles) lanes
- Equipping human-operated vehicles with technologies to communicate with AVs
- Managing the early development of CAVs to give drivers time to acclimate to the technology

The reality of integrating CAVs into highway traffic will more than likely feature a combination of all of the above.

General Considerations

Some experts believe large numbers of AVs will never be seen on the road. However, experts believe that 80% of the technology needed for AVs has already addressed the easy questions—but the remaining 20% will be extremely difficult to solve. Some of the challenges include:

- Teaching Artificial Intelligence (AI) systems to anticipate what other cars, drivers, pedestrians, bicyclists, and scooter users will do is proving to be extremely difficult.
- Responding under difficult precipitation conditions, such as snow, ice, and rain have yet to be mastered. The testing center in Baudette, Minnesota has hosted numerous experimental and training activities for winter driving.

- The impacts of deficient infrastructure such as faded signage or potholes and how an AV will react to such conditions are still being studied.
- The accuracy of digital mapping for lane navigation is still not where it should be in order for AVs to operate within centimeters of normal parameters.

Responding to these issues by designing AVs to be more cautious may actually cause more problems while a mixed fleet of autonomous and human-driven vehicles exist. Environments that can be tightly controlled are most likely to be where AVs will operate for the near-term. College and hospital campuses as well as some small portions of highly urbanized downtown areas will probably be most suitable for testing and deployment in the coming years.

How Might Travel Change with CAVs

Those who are familiar with the ongoing discussions regarding CAVs and AVs generally reference two visions for a world with CAVs: Utopian and Nightmare.

Utopian Vision

CAVs are mostly owned by businesses providing mobility services. Individuals may purchase their own vehicle but will likely share their vehicles when they're not using them. AVs complement mass transit and active transportation, reducing the total number of cars on the road, increasing safety and mobility options, and freeing up public space currently used for parking. Transit is fast, reliable and competitively priced with single or shared ride services, focused on the line-haul portion of routes with high ridership while driverless vehicles dynamically provide first-mile and last-mile solutions at lower cost than traditional transit service.

Nightmare Vision

AVs induce longer commutes and sprawling development, reduce investment in high-capacity transit, and reduce walking and cycling. Cars are mostly privately owned, but even when people use mobility services, they do not share rides. Parking needs remain about the same due to similar private ownership model as currently exists. Public transportation is limited and, for the most part, exists to support low-income individuals as people come to rely even more on their own vehicles.

Infrastructure

Depending on the evolution of driverless vehicles (and connected vehicle technology), local infrastructure will need to keep up. Local governments may need to update and reconfigure signage, speed limits, and signal timing. Reconfiguration of roadways and parking spaces will be the most expensive and probably last area to address. The poor condition of our current infrastructure presents AVs with recognition problems, making it difficult for them to operate effectively. Painted and repainted pavement markings and the pavement condition itself can confuse AVs' sensor and navigation systems, such as the examples shown in Figure 8-9.

The condition of signage due to vandalism and low to no sign maintenance as shown in Figure 8-10 also make it difficult for AVs' on-board machine recognition sensors to "read" posted signs. One possible solution would be the incorporation of QR (Quick Response) Codes into roadway signage for faster and easier recognition by sensors installed on CAVs, as shown in Figure 8-11.

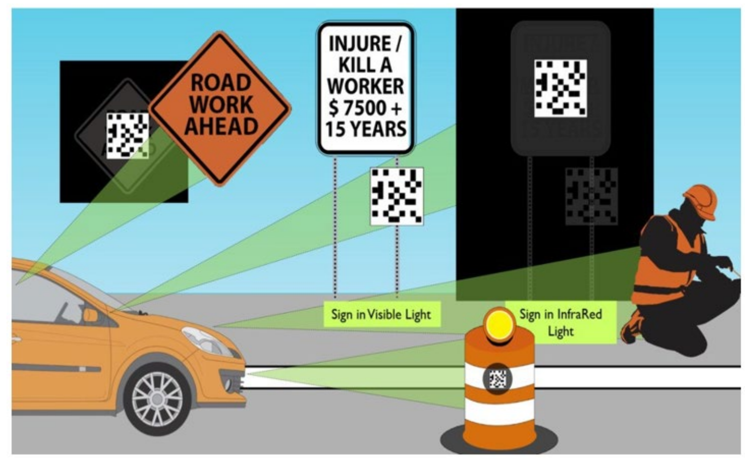
Figure 8-9

Shutterstock

Figure 8-10

FHWA (left) and Shutterstock (two images on the right)

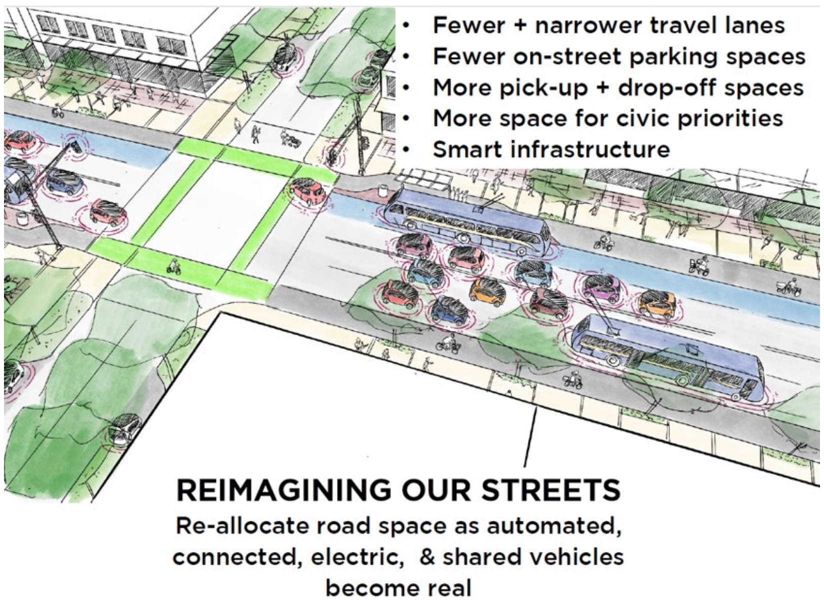
Figure 8-11



Roadway Design

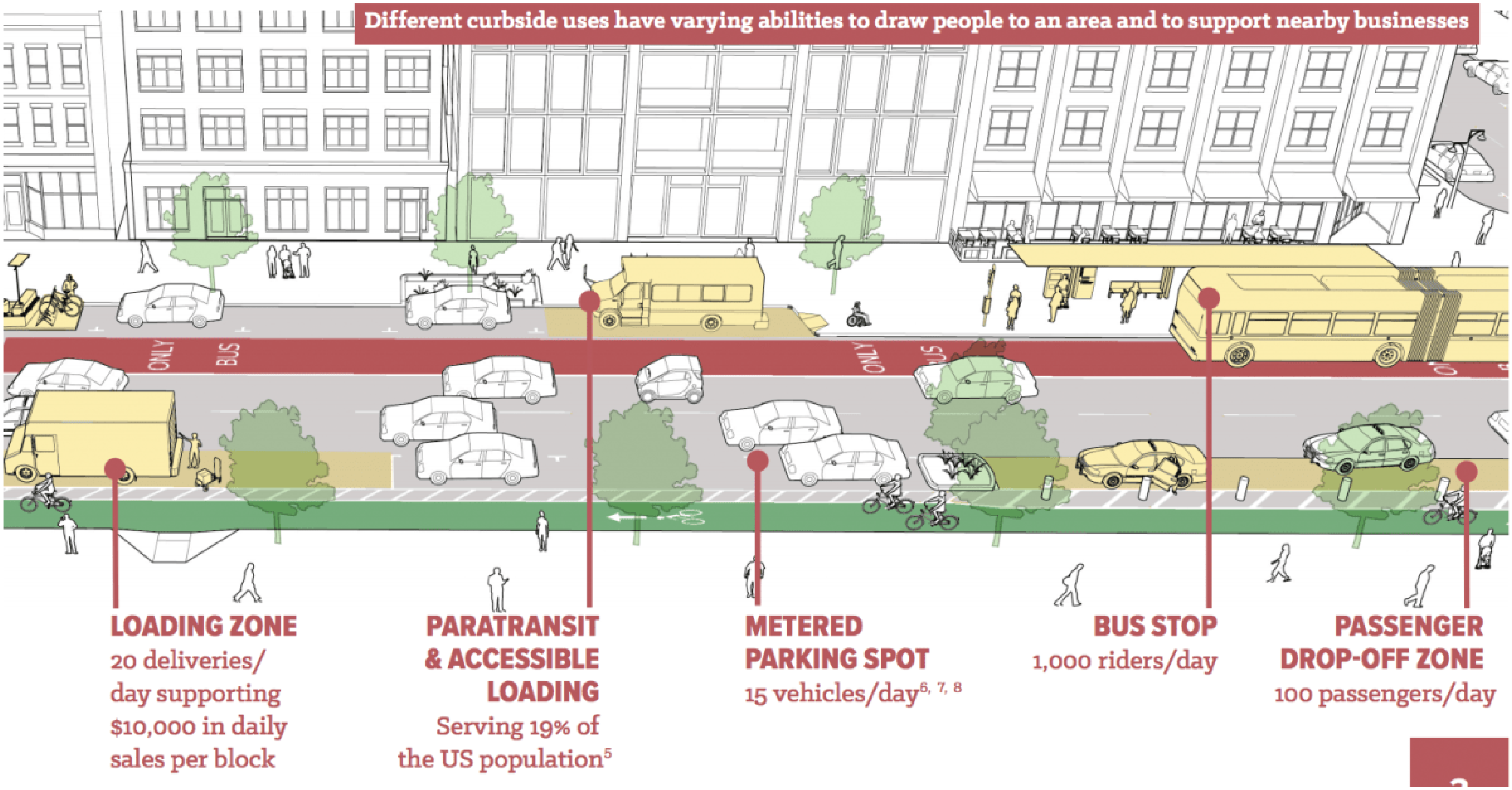
What could our roads look like in the future? Figure 8-12 may give us an idea. With constantly evolving technology and materials science, there are some general assumptions. First, travel lanes could be reduced since AVs should be able to maintain minimal variances. However, this could only be fully accomplished when all vehicles would be automated or when the margin for human error is significantly reduced. There would probably be a need for fewer lanes of traffic, reducing roadway widths, which could allow for increased sidewalk widths and other public spaces. Improvements in technology will mean that more data will need to be collected and made instantly available to CAVs, calling for the installation of sensors, cameras, communication technology, fiber optic cabling, and "smart" traffic signalization.

Figure 8-12



What most experts do agree on is that curb management will become a much more important issue within denser parts of urban areas. As more deliveries, drop-offs, pick-ups, alternative travel options, and transit stops all jockey for position along the curb. Curb space will become very valuable and highly sought-after real estate. An emerging industry is the use of on-line apps that can be used to manage and price curb space for all these various users. CAVs also offer the potential to decrease the need for on-street parking, thus reducing the vehicle footprint in cities, freeing up much needed public space for a wide variety of uses. As we have seen with restaurant re-openings during the COVID-19 pandemic, increased space within the public right-of-way could lend itself to a number of alternative uses that could improve the general livability and environment of our cities. Figure 8-13 provides a glimpse of just a few of the curbside features which will likely become more and more important as the way transportation is delivered evolves.

Figure 8-13



Source: NACTO Curb Appeal

Different Visions of Impacts on Transit

Autonomous Vehicles Replace Transit

Some have speculated that AVs could replace traditional transit vehicles, with transit agencies serving as more of a broker of services in terms of providing trip planning assistance and vouchers for trips. However, the basic geometry of moving a large number of people into an area such as a central business district suggests some type of transit service will still be needed. This service, however, could be fulfilled in the future by autonomous buses like the one shown in Figure 8-14, probably at a lower overall cost if the need for drivers is reduced and the transit fleet is electrified.

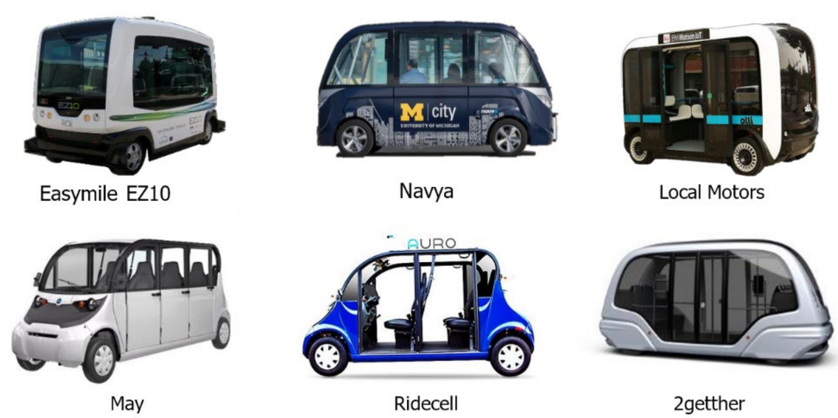
Figure 8-14

Autonomous Vehicles Complement Transit

A service model where AVs complement bus routes can be envisioned. Buses still provide service on higher ridership routes, then connect to new mobility hubs. At these hubs, riders would transfer to/from smaller autonomous shuttles or cars for their first-mile/last-mile connections.

In this model neighborhood or district circulators can feed riders to traditional transit corridors. Testing in some areas of Europe and Asia has shown that small automated shuttles can provide that vital first-mile/last-mile link from isolated areas to more populated areas and regular transit service connections, especially for the disabled and elderly who cannot drive themselves. Some examples of automated shuttles currently undergoing testing around the United States, even in Rochester (Local Motors), are shown in Figure 8-15.

Figure 8-15



Meeting in the Middle on Transit

Historically, the emphasis of transit has been to provide the capacity for moving large numbers of people on high demand corridors. The role autonomous vehicles will play in meeting this demand probably will lie somewhere between total replacement of transit and limited use.

Flex routes in low-demand areas utilizing automated shuttles to feed into high capacity fixed-route service could increase ridership. A network of neighborhood transfer hubs could facilitate transfers. During off-hours, weekends and holidays, scheduled fixed-route service could be reduced and shuttles could be utilized for more direct transport. This mix of transit options could also equate to less need for paratransit since the elderly and mobility-challenged would have options to connect them to fixed-route service. As transportation evolves, growth in ride sharing, bike and scooter usage, and other shared travel options could drive some form of fare integration where all services share a common payment app. This is already being done in Washington, D.C. and other areas around the country.

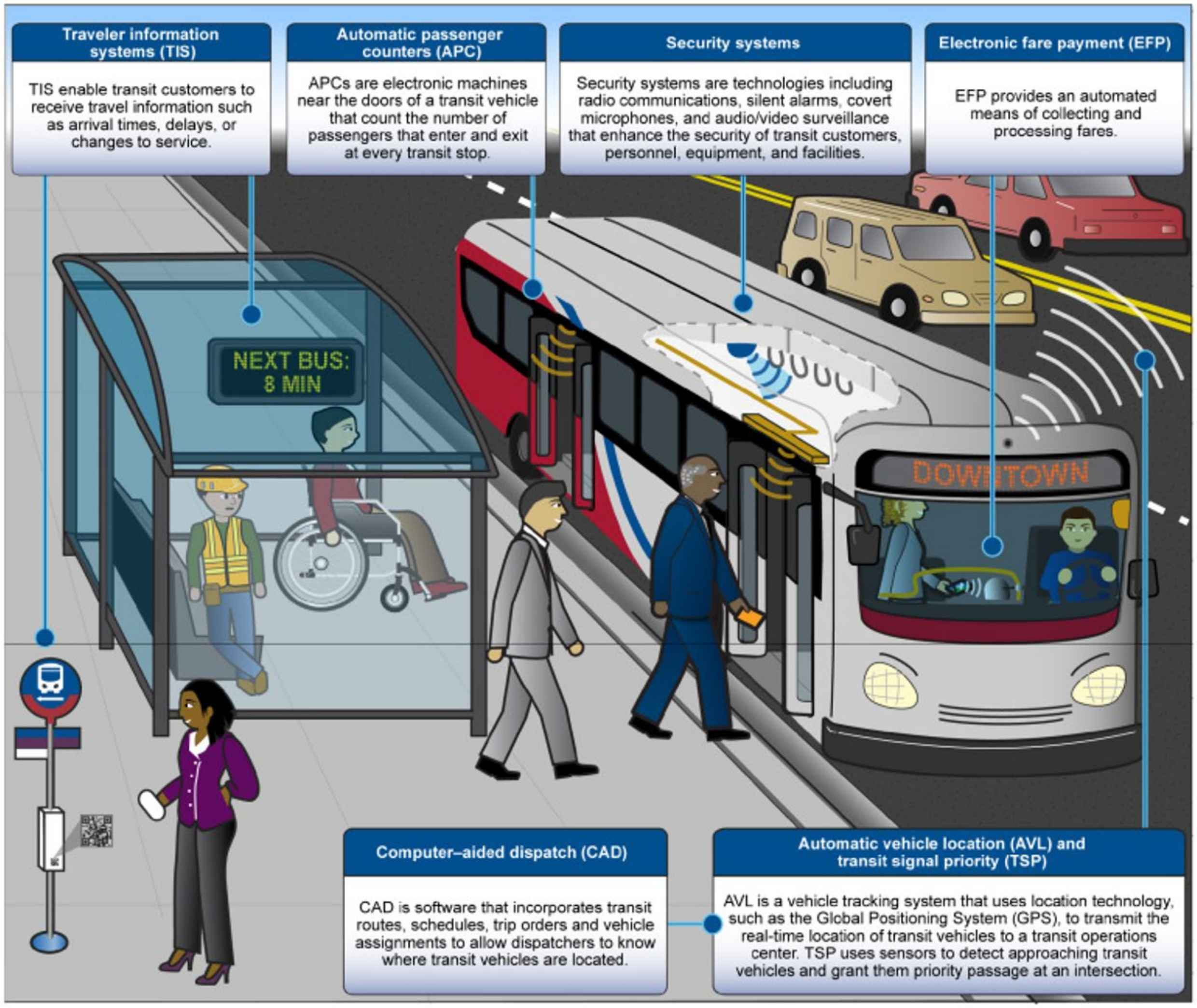
As driverless vehicles become more popular, everything from service coverage to vehicle types to labor requirements stand to change in the transit industry. Transit agencies will need to rethink their services, labor needs, and fare structure in order to stay competitive in the new transportation environment. Both connected and automated vehicles offer transit services many options for moving people around their communities.

While some experts believe these advances in transportation will replace transit systems, others believe they will complement and expand them. Figure 8-16 provides a glimpse of just a few of the features which can enhance transit users' experiences, some of which are currently available. Driverless buses could utilize transit staff to provide security, customer service to those transit users who may need it, as well as assistance to the elderly and disabled.

Local Government Considerations

There are several factors that will influence the level of vehicular travel demand and congestion in the future. The level of shared ride utilization and the competitiveness of public transportation will be a major factor in determining how many vehicles are on the streets and the impacts of a changed mobility landscape. Of concern is the willingness of people to live further from their jobs and other services if they are not required to physically drive and services provide convenient door to door service. At the same time, having more travel options would provide the elderly, disabled, low-income, and youth populations with more travel choices. The role of shared mobility and CAVs and the impacts of these technologies will depend on the regulatory environment that emerges. Table 8-1 identifies key areas of interest for shared mobility policy development at the local government level.

Figure 8-16



Source: GAO analysis of Department of Transportation documents. | GAO-16-638

Table 8-1

FACTORS	Shared Mobility as an Environmental Benefit (maximum governmental support)	Shared Mobility as a Sustainable Business (moderate governmental support)	Shared Mobility as a Business (minimum governmental support)
Allocation of Rights-of-Way to Shared Mobility Services	Allocate public rights-of- way on a case-by-case basis or through more informal processes, such as nonbinding council resolutions.	Jurisdiction that once allocated public rights-of-way through an informal process formalizes this process.	Jurisdiction maintains a formalized and established process for the allocation of public rights-of-way, including to allocate among multiple operators.
Fees and Permits	Recognizing the social and environ-mental benefits of shared mobility, jurisdiction provides public rights-of-way free of charge or significantly below market cost.	Fees based on cost recovery of providing rights-of-way associated with providing on-street parking (e.g., fees based on foregone meter revenue). In other instances, fees may be reduced to reflect environmental goals, such as charging at a reduced car-pooling rate for car-sharing parking.	Fees are based on a cost-recovery or profit-based methodology. This could include permit costs, lost meter revenue, and administrative expenses for program management.
Signage, Markings, and Installation	Jurisdiction pays for the sign installation and maintenance, striping, and markings associated with the shared modes.	Jurisdiction pays for the installation, and the operator pays for the maintenance of signage, striping, and markings.	Jurisdiction requires shared operators to pay for the installation and maintenance of signage, striping, and markings.
Social and Environmental Impact Studies	Jurisdiction requires that shared opera-tors study and document local social and environmental impacts at regular intervals.	Jurisdiction may require shared mobility operators to study and document local social and environmental impacts on a one-time basis or at regular intervals.	Jurisdiction does not require any social and environmental impact studies of shared mobility.
Public and Stakeholder Involvement	Informal process, if any, led by the jurisdiction to elicit public input into the location and scaling of shared modes on public rights-of-way. For example, staff may internally determine the location and number of car-sharing parking spaces or public bike-sharing stations without public comment.	Informal process where the jurisdiction and shared mobility operator seek public input into the locations of shared services through public notification and staff management of possible public concerns.	Highly formalized process where shared mobility operators are responsible for obtaining public input and approval on the locations of services through neighborhood councils, commissions, or formal hearings.

Source: APA PAS Report 583, Planning for Shared Mobility (2017)

Similarly, how governments regulate autonomous vehicles is still under development and will be evolving as the technology advances and becomes available. The chart in Figure 8-17 provides one view of how these responsibilities may be divided among federal, state and local governments.

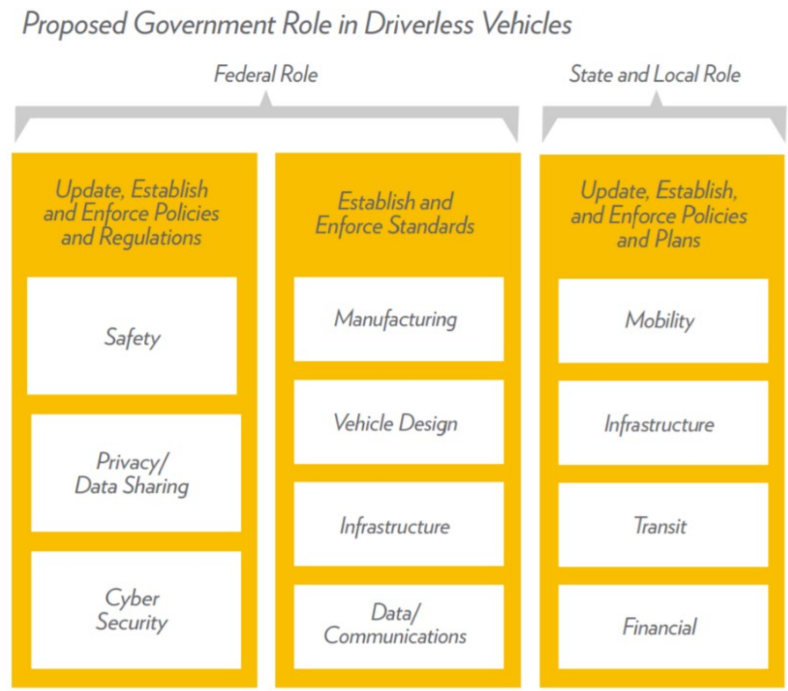
The State of Minnesota has been a leader in this area, both in testing autonomous vehicles on the road and with MnDOT producing guidance documents on how to develop a framework of regulations for autonomous vehicles. It is expected that this will continue in the years to come.

Other communities and states have begun to think about the impact of CAV's on their day to day operations and changes that will be needed to accommodate these new vehicles. A study by the FDOT Office of Policy Planning lists a range of physical improvements that may be needed to realize the potential of CAVs in Figure 8-18.

Potential Financial Impacts of Autonomous Vehicles

The widespread use of autonomous vehicles may have potentially significant financial consequences for both state and local governments. Taxes, registration fees, parking revenue and development costs and enforcement costs are examples of revenues and costs likely to be impacted, as illustrated in Figure 8-19.

Figure 8-17



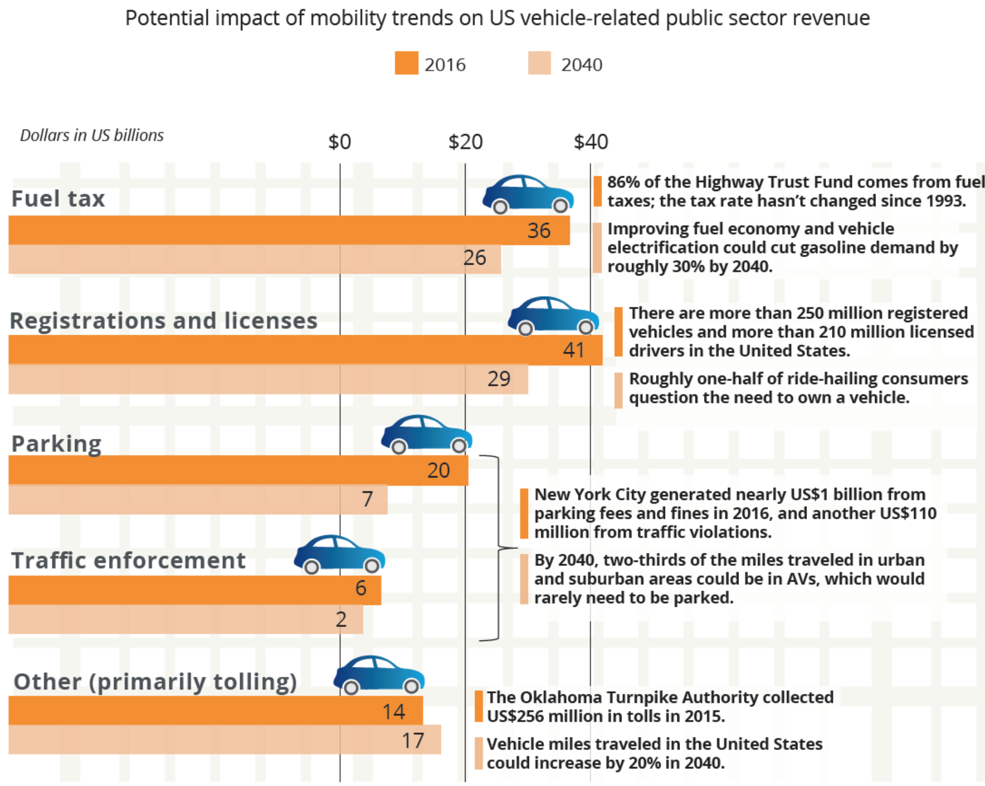
Source: Driving Towards Driverless: A Guide for Government Agencies

Local governments may need to identify new sources of revenue to pay for infrastructure improvements that will be required for CAVs. It is generally thought that traditional transportation revenue streams will likely decline, as has been illustrated by the ongoing discussions about how to charge electric vehicles for their use of public roads when they do not pay gasoline taxes.

Figure 8-18

Road Maintenance (State of Good Repair)	• Lane marking improvements/maintenance for machine vision • Pavement Lane marking maintenance improvements for safe automated vehicle operation improvements
Travel Lanes (Capacity)	• Conversion of on-street parking to other uses • Designation/planning of AV-only limited access arterial lanes or AV only transportation zones
Curb Management (Shared Mobility)	• Designated pick-up/drop-off zones • Curb space value capture policy plans
Parking (Land Use/Urban Design)	• Activity center master plans to guide conversion of parking • Conversion of public parking facilities • ACES parking priority • Electric vehicle charging stations and related support systems
Transit (Trunk and Feeder)	• Transit plans to guide investments in urban corridors • Dedicated high-occupancy AV expressway and arterial lanes • Mobility hubs • First/last mile or paratransit partnership opportunities
Freight (Long-Haul and Local)	• Dedicated AV truck corridors • Suburban/weigh station truck terminals • Intermodal terminal automation • Lane management and restrictions planning • Platooning policies
Smart Cities (Internet of Things)	• V2I roadside units • Traffic signal prioritization • Traffic signal interconnects • Transportation operations management centers/upgrades • Transportation data processing centers • Fleet management facilities

Figure 8-19



Source: Deloitte analysis based on data from the Federal Highway Administration, United States Census Bureau, the CIA World Fact Book, the Congressional Research Service, and *Governing* magazine. These estimates should be considered notional, assume policies remain unchanged, and do not account for operating expenses.

The issue of maintaining revenues in a system where the goal is "user pays" will be an important discussion going forward. A major factor yet to faced is what will be the cost of the infrastructure improvements that will be needed to accommodate CAVs. To realize the benefits of this technology, there will be a need for the installation of new sensor, communications and control technology required for CAVs to function. A report by the Dakota County, Minnesota Office of Performance and Analysis entitled "Autonomous Vehicles Issues and Trends" was completed in 2017 which include Table 8-2, providing some basic cost estimates to start the conversation.

Table 8-2

Item	Quantity	Per Unit Cost	Total Costs
Dedicated short-range communications roadside units	10 intersections	$13,100 to $21,200	$131,000 to $212,000
Signal controller upgrade	10 intersections	$3,200	$32,000
Backhaul communications	1 system (10 intersections)	$30,000 to $40,000	$300,000 to $400,000
Transit vehicle aftermarket onboard unit	5 vehicles	$10,000	$50,000
Connected/Automated Vehicles Project Total		$513,000 to $695,000	

Conclusion

The future of transportation is evolving rapidly and will require input by a variety of transportation officials, elected leaders, MPOs, and others in developing a framework for how to regulate and operate in this new environment. While the State of Minnesota is a leader in research and policy development regarding autonomous vehicles, it is also a leader in implementing advanced transportation technologies into its transportation system. The COVID-19 pandemic of 2020 has clearly shown that there are other factors beyond anyone's control that can affect transportation. The lessons learned from COVID-19 will be implemented going forward and have added another item to consider when making decisions on public transportation policy and planning.

Strategic Directions for ROCOG

With technology development and the application of technology to transportation needs changing constantly, it seems at times that planning for the future of CAVs, MaaS, and Shared Mobility is a difficult endeavor with little to be gained until greater clarity is achieved in terms of what technologies and services will eventually rise to the top. However, in the near term, there are some actions small organizations like ROCOG can undertake to help prepare for a transportation future that will likely be different than today as a result of changes to come in communications, data and information services, and mobility technology, along with societal response to these changes. Strategic directions include:

- ROCOG should continue to monitor advances and deployment in future mobility technology and trends and periodically bring these forward for community discussion as a means to identify early warning signals of potential issues for local government. This includes monitoring developments at the federal and state government level as well as what is happening in the private sector.
- ROCOG should participate with local partners in pilot projects to help understand the potential implications of new services or technology.
- Local leaders should consider their short and long-term infrastructure in light of what may be needed to support and integrate CAV technology and Shared Mobility. This will likely require broader consideration of investment in things like data storage and processing capacity, sensor networks and broadband, and ensuring that streetscapes and rights-of-way can best accommodate AVs. As new patterns of transit evolve, cities should preserve flexibility in planning.