

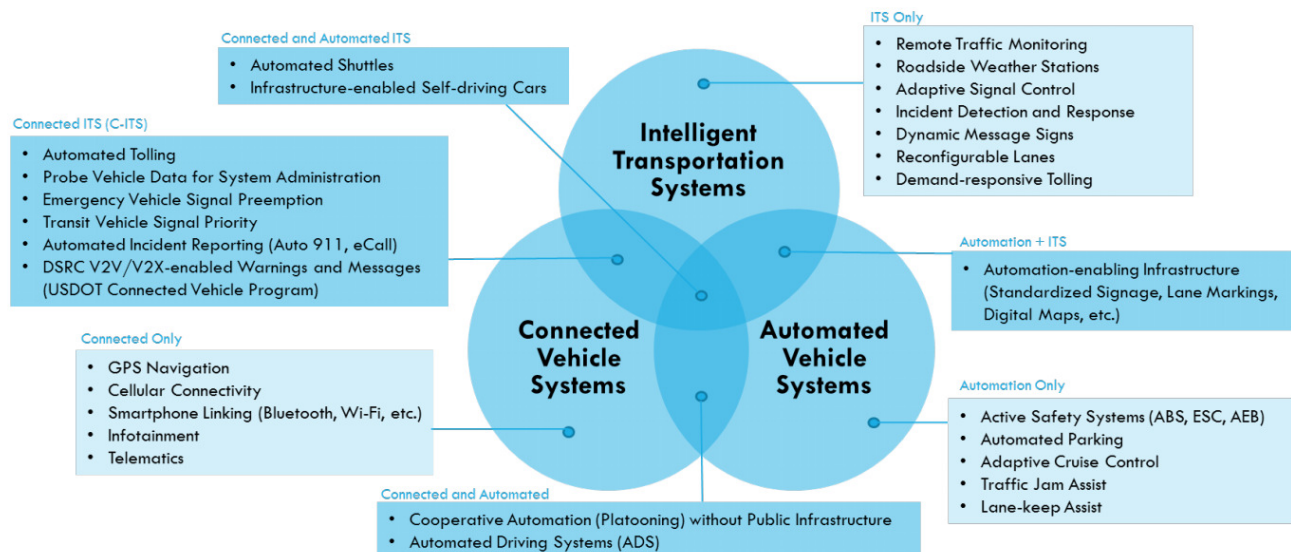
# Emerging Technology within the Transportation System: Connected and Automated Vehicles

Connected and automated vehicles (CAVs) are already impacting the state of Michigan. MDOT has a connected vehicle program that is supported by GM, Ford, the University of Michigan, Oakland County Road Commission, and others. Program assets and testing areas are currently just east of the Jackson MPO in southwest Michigan. A report prepared for the Region 9 Prosperity Initiative in 2017 called “Planning for Connected and Automated Vehicles” looked at the impact of the technologies for southeast Michigan. The report found that the impacts of CAVs will be broad. They will change the commuting behaviors and patterns; government decisions related to land use, zoning, and infrastructure; and equity and social welfare issues for local communities. This section addresses the emerging technology of CAVs.

## Defining Connected and Automated Vehicles

The term “connected and automated vehicles” refers to a variety of vehicle technologies and systems. There are different ways that vehicles can be connected and/or automated. Intelligent Transportation Systems (ITS) is another component of this emerging technology that can interact and influence CAVs. These technologies are explained in the text and image below.

- **Automated Vehicle Systems** are any electronic system that influences the lateral and/or longitudinal motion of a vehicle. If the influence is continuous, this is referred to as a driving automation system.
- **Connected Vehicle Systems** enable the exchange of digital communication between a vehicle and another entity. Some vehicles may only be able to receive information while others may only be able to send it.
- **Intelligent Transport Systems** are electronics, communications, or information processing used to improve the efficiency or safety of a transportation system. ITS is typically implemented by a public or quasi-public entity.



## Impact

The impact of CAVs is largely unknown because their deployment has been primarily limited to test environments. Researchers have begun to consider how transportation will change as a result of this disruptive technology. The influence of computer-driven vehicles may require changes to transportation laws, policy, infrastructure, and access management. The full impact in urban, suburban, and rural environments is unknown.

Road and highway infrastructure is one aspect of transportation that will be affected. Current design standards have been developed to meet the needs of human drivers, and may need to change to accommodate CAVs. Road markings are a critical part of the road system, and CAV's adherence to these markings is imperative to safety and to maintain consistent road operations. Some automated vehicles rely on identifying road markings, but this could be complicated by snow and rain weather events. Not all roads, especially in rural areas, have complete road markings. With the goal of producing a self-driving car, automakers are exploring other ways to automate lane keeping.

CAVs could potentially allow for a more robust and efficient flow of traffic. The same amount of traffic could be accommodated by fewer lanes because vehicles can operate closer together. In mixed traffic situations, risky driving behavior may decrease with CAVs because their behavior is less erratic. Bicyclists have reported feeling safer next to CAV's because their behavior is easier to predict.

The number of vehicle miles traveled may also be affected. Vehicle miles traveled (VMT) is defined by the federal government as a measurement of miles traveled by vehicles within, and is used as a standard to track how much people drive. Below are some factors that may affect VMT.

### ***Factors potentially increasing VMT***

- **Zero occupancy VMT.** Vehicular miles traveled could increase due to vehicles traveling without passengers between a drop-off and pick-up locations.
- **Shift away from mass transit and non-motorized modes:** Increased conveniences and affordability could make CAV's more attractive options than mass transit, biking or walking.
- **Reduced trip chaining.** For example, one vehicle could take a family member to work, return home empty to take another to school, etc. This would mean less vehicle ownership, but may still increase vehicle miles traveled.
- **Increased mobility of non-drivers.** CAV's would offer underserved populations – the elderly, the young, and people with disabilities - access to travel.
- **Urban form and development patterns.** People might be more willing to accept longer commute times because they would be able to engage in other activities

while traveling, and, therefore, live in a more affordable home farther from their workplace. This could give way to an increase in urban sprawl development patterns.

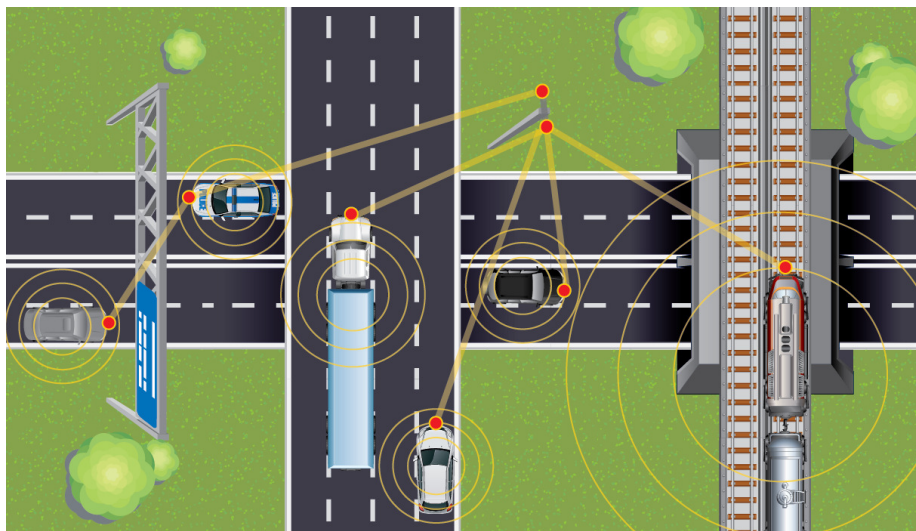
### ***Factors potentially decreasing VMT***

- **Lower car ownership.** If people own fewer vehicles due to carsharing options, unnecessary travel could be reduced.
- **Increased vehicle occupancy.** More people will be interested in carsharing, as technology evolves to make it more convenient and less expensive, including suburban and rural areas. More people in fewer vehicles would decrease the total vehicle miles travelled.
- **CAVs used as first and last mile solution along with mass transit.** If CAVs are used to help get people to and from transit routes, and not replace a trip by mass transit, travel may be reduced.

Parking may also be affected. If a CAV does not need a human driver, there may be few reasons to need to park a car. Municipal parking facilities could be reduced. As parking demands diminish, communities may no longer need to invest in new parking structures. Parking areas could be related to areas with lower land values. Communities could lower minimum parking requirements. Reduced parking demand may reduce the need for parking requirements.

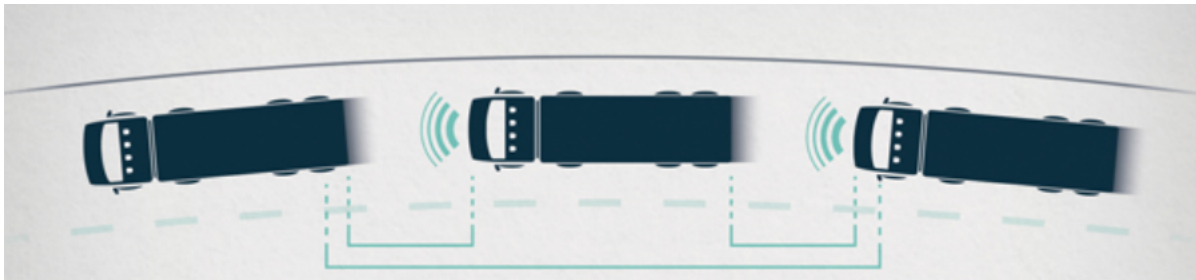
### **Intermodal Implications**

Some forms of rail have been partial or fully automated for some time. Rail infrastructure is optimally designed to take advantage of these technologies, though maintaining connection and automation through tunnels and in extreme weather conditions can be challenging. As technology advances continue, there is incentive to update transportation facilities to increase safety and efficiency. The USDOT, through the Connected Vehicle Safety for Rail initiative, is researching how CAVs and rail will safely interact at railroad crossings.



Drones, or remote-controlled aircrafts, have been around for a period of time. Retail businesses have been exploring how to use them to deliver goods to customers. Videographers and photographers are using them to capture unique perspectives of landscapes. Drones are under the complete control and jurisdiction of the Federal Aviation Administration (FAA). Though drone operation is not limited to airports, the Jackson County Airport specifically addresses drone operations on its website. Drone hobbyists are referred to review the FAA's "Know Before You Fly" campaign, along with following the recommended federal safety guidelines.

The delivery of goods via automated truck convoy, or platooning, has also been under development for nearly a decade. Recent improvement in technologies has made this idea more likely for deployment in the near term, much like CAVs. This will change the appearance and operations of how truck freight will travel on the road network. Platooning will make freight delivery via trucks cleaner by reducing emissions, safer due to less brake time needed, and more efficient use of resources. Platooning will look like a number of trucks have joined a road train, but act as a single unit. Automation may make interacting with human-driven, connected, and automated vehicles more predictable.



Understanding how CAVs will relate to pedestrians and bicyclists has yet to be deeply researched. Experts are raising a number of issues as to how these modes will interact. The Pedestrian and Bicycle Information Center, which is supported by the Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration (NHTSA), have identified key issues on this topic.

- Address how CAV's will be able to detect and predict the movement of pedestrians and bicyclists.
- Determine the ways that pedestrians and bicyclists will identify and communicate to CAVs.
- Address how CAVs will accommodate yielding to pedestrians and bicycles.
- Consider how CAVs will adapt to the varying speed at which bicycles operate and pedestrians move in various environments.

- Since vehicle speed is a critical factor in crashes with non-motorized modes and mortality rates, consider how CAVs will be instructed to operate within environments at which the posted speed limit is not appropriate.

## **Recommendations**

Full deployment of CAVs in Jackson is years away, however, they may be within the planning horizon of the plan. Models, engineering projects, and local policies have not yet begun to consider their role within the community, however, there are important things to consider. **In the near term**, local government entities within the Jackson MPO should consider the following:

- Consider reducing minimal parking standards
- Consider how new streetscape design specification and standards will accommodate pick-up and drop-off areas
- Track how CAVs will reshape road right-of-way and access management
- Review how the Complete Streets policy could accommodate the needs of CAVs

### **Over the mid-term:**

- Encourage the Region 2 Planning Commission to account for CAVs in long range transportation plans
- Work with public transit to investigate the role of CAVs as part of the transit network
- Encourage the state to update the travel demand model and roadway design manuals to take CAVs into account
- Attend regional and state trainings, meetings, and seminars where the impact of CAVs are discussed

### **Over the long-term:**

- Consider policies and pricing that encourages shared deployment of automated vehicles
- Continue to work with public transit agencies to consider how to integrate shared automated vehicle programs with mass transit
- Manage transportation facilities in terms of people throughput, not vehicle throughput
- Consolidate transportation markets at a regional level

More information on CAVs will be revealed as engineers, government officials, and the public have more experience with this emerging technology. Local communities should consider staying abreast of current conversations and follow the state-level conversations to understand how CAVs will impact local communities.