

The State of CATV in Michigan

Introduction

Michigan has a storied history as the automotive capital of the United States. However, as connected and autonomous vehicle (CATV) technology has expanded over recent years, other hubs around the country, such as Silicon Valley and Pittsburgh, have made pushes towards automotive dominance of the future. In the face of competition, Michigan has taken large strides to cement its place in this burgeoning industry. Michigan's CATV industry, bolstered by General Motors and Ford, has grown out of the established automotive center in the state's Southeast region, especially in Detroit and Ann Arbor.

General Motors' and Ford's CATV software development has come from companies based outside of the state, but the design and manufacture of physical systems has remained in-state ([Edelstein, 2019](#); [Hsu, 2019](#)). What Michigan lacks in CATV startups, it makes up for with testing facilities, workforce development, and legislation. The University of Michigan has led the charge in CATV safety and feasibility testing, highlighted by *Mcity* - their modular, 32-acre testing ground, and sprawling connected vehicle deployment based in Ann Arbor. The state assembly has passed comprehensive legislation outlining CATV operation, enabling automotive manufacturers to test their CATV technology on real roadways. The University of Michigan's research and testing facilities, the presence of major automotive manufacturers, the development of future-focused training programs, and extensive relevant legislation have allowed Michigan to play an important role in the CATV arena.

Michigan has established itself as a leader in the national CATV landscape by making notable strides in key areas of the Purdue Policy Research Institute's focus, including safety, workforce development, and connected infrastructure. However, Michigan's legislative actions with regards to privacy, security, and ethical challenges presented by CATV technology have been lacking.



Stakeholders

Michigan Department of Transportation (MDOT)

MDOT executes transportation regulations and policies in the state of Michigan, including those to govern CATV.

Automobile Manufacturers

Southeastern Michigan is a hotbed for automobile manufacturers, including General Motors and Ford. Manufacturers are angling towards a transition into the connected and automated vehicle market.

State Legislators

State legislators are responsible for establishing policies that ensure that the new challenges posed by CATV are addressed, without limiting the growth of the industry within the state.

Local Governments

CATV deployments in Michigan are currently limited to certain geographical boundaries. Local governments adapt their policies to reflect the presence of CATV in their communities, as with the connected vehicle environment in Ann Arbor.

Educational Institutions

Educational institutions are hubs of CATV research, for topics ranging from security to safety. Such institutions must also develop CATV training programs to ensure Michigan's workforce is prepared for the growth of this industry. The University of Michigan is leading the way in CATV research, and Washtenaw Community College, among others, has taken steps to equip the workforce for the future of the automotive industry.

Auto Industry Workers

Manufacturing and implementation of automated technology offers new job opportunities, but many require further training and education than what is currently offered to workers in the auto industry. Manufacturers, governmental bodies, and educational institutions will be responsible for providing training opportunities to ensure a smooth transition.

Legislation

2013:

[SB 169](#) (passed as PA 231)

This act was the first to define important terms in the realm of autonomous vehicles, including “automated motor vehicle,” “automated technology,” “automatic mode,” “manufacturer of automated technology,” and “upfitter.”

Many of these definitions were either updated or removed in 2016 PA 332, and the definitions defined in that bill are listed in the Definitions section. Furthermore, it updated the definition of “operator” to reflect the newly defined “autonomous motor vehicle” and outlined the operational and testing requirements for the autonomous motor vehicles and related technology.

Notably, this act only allows for the operation of autonomous motor vehicles by those authorized by the manufacturer of the automated technology being tested. It also permits the operation of automated motor vehicles on streets and highways for research and testing purposes exclusively.

[SB 663](#) (passed as PA 251) – This act limits liability of vehicle manufacturers or

upfitters for damages in a product liability suit resulting from modifications made by a third party to an automated vehicle or automated vehicle technology under certain circumstances.

2016:

SB 995 (passed as PA 332) – This act updated/removed the terms defined in 2013 PA 231, and added definitions to many new terms, which can be found below in the Definitions section.

It also updated 2013 PA 231 to allow for the operation of autonomous motor vehicles by university researchers and Michigan Department of Transportation employees for testing and research purposes.

Furthermore, it allows autonomous motor vehicles to operate without a human operator, and it permits autonomous motor vehicles to operate on streets and highways without restriction to research and testing purposes.

The act called for the creation of the Michigan Council on Future Mobility, to provide policy recommendations on maintaining Michigan's prominence in the realm of connected and automated vehicles. The act also defines a "SAVE project," which makes on-demand automated motor vehicle networks available to the public.

SB 996 (passed as PA 333) – This act established the conditions for a SAVE project, which allows automated motor vehicle manufacturers, and fleets composed of automated vehicles from an eligible automated motor vehicle manufacturer, to provide on-demand automated motor vehicle networks to the public within geographical boundaries permitted by this act.

Definitions

As outlined by 2016 PA 332 Sec. 2b.:

Automated Driving System

Hardware and software collectively capable of performing all aspects of the dynamic driving task for a vehicle on a part-time or full-time basis, without any supervision by a human operator.

Dynamic Driving Task

All of the following, but does not include strategic aspects of a driving task, including, but not limited to, determining destinations or waypoints:

- a. Operational aspects, including, but not limited to, steering, braking, accelerating, and monitoring the vehicle and the roadway.
- b. Tactical aspects, including, but not limited to, responding to events, determining when to change lanes, turning, using signals, and other related actions.

Automated Motor Vehicle

A motor vehicle on which an automated driving system has been installed, either by a manufacturer of automated driving systems or an upfitter that enables the motor vehicle to be operated without any control or monitoring by a human operator.

Automated motor vehicles do not include a motor vehicle enabled with 1 or more active safety systems or operator assistance systems, including, but not limited to, a system to provide electronic blind spot assistance, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lane-keeping assistance, lane departure warning, or traffic jam and

queuing assistance, unless 1 or more of these technologies alone or in combination with other systems enable the vehicle on which any active safety systems or operator assistance systems are installed to operate without any control or monitoring by an operator.

Automated Technology

Technology installed on a motor vehicle that has the capability to assist, make decisions for, or replace a human operator.

Automatic Crash Notification Technology

A vehicle service that integrates wireless communications and vehicle location technology, to determine the need for or to facilitate emergency medical response in the event of a vehicle crash.

Manufacturer of Automated Driving Systems

A manufacturer or subcomponent system producer recognized by the secretary of state that develops or produces automated driving systems or automated vehicles.

On-Demand Automated Motor Vehicle Network

A digital network or software application used to connect passengers to automated motor vehicles, not including commercial motor vehicles, in participating fleets for transportation between points chosen by passengers, for transportation between locations chosen by the passenger when the automated motor vehicle is operated by the automated driving system.

Platoon

A group of individual motor vehicles traveling in a unified manner, at electronically coordinated speeds.

Upfitter

A person that modifies a motor vehicle after it was manufactured by installing an automated driving system in that motor vehicle to convert it to an automated motor vehicle. Upfitter includes a subcomponent system producer recognized by the secretary of state that develops or produces automated driving systems.

Privacy

The sole instance of the word “privacy” in Michigan legislation governing automated vehicle technology is in 2016 PA 333 Sec 665b.(3)(f), which states that “[b]efore commencing a SAVE project, and for the duration of the SAVE project, the motor vehicle manufacturer shall make publicly available a privacy statement disclosing its data handling practices in connection with the applicable participating fleet.”

Security

There is no mention of security in Michigan CATV legislation. Since automated vehicles are part of a network spanning from connected transportation infrastructure to financial and personal home systems, breaches in the security systems of automated vehicles could have potentially devastating impacts.

Coupling this danger with a general distrust of autonomous vehicles by the public, anything short of unbreachable security for automated vehicles and infrastructure will prohibit widespread adoption of such technology.

In January 2018, University of Michigan’s *Mcity* connected and automated vehicle

center released a report addressing CATV security concerns entitled “Assessing Risk: Identifying and Analyzing Cybersecurity Threats to Automated Vehicles.” The Mcity Threat Identification Model proposed in the report assesses the potential, motivation, and impact of a cyberattack on an automated system component, which is a useful tool for considering the robustness of the security systems in automated vehicle technology ([Weimerskirch & Dominic, 2018](#)).

As vehicles transition from semi-automated to fully automated, the security threat significantly increases, so further research into CATV security is necessary. Legislative benchmarks need to be established to set enforceable standards on such systems before such technology becomes the mainstay of Michigan transportation.

Safety

There is not much explicitly stated about safety in automated vehicles in Michigan legislation. Legislation does state that manufactured and distributed automated vehicles must comply with all applicable federal motor safety standards.

Additionally, 2016 PA 333 Sec. 665b.(3)(e) requires motor vehicle manufacturers “maintain incident records and provide periodic summaries related to the safety and efficacy of travel of the participating fleet to the department and the National Highway Traffic Safety Administration” throughout the duration of a SAVE project.



Figure 1: Diagram of the Mcity Test Track
Source: [GrayMatter](#)

There are multiple centers for safe, controlled testing of automated vehicles to research and optimize automated systems before deploying them for use in uncontrolled environments throughout the state. University of Michigan’s *Mcity* is a 32-acre facility with a test environment that simulates intricate driving scenarios in urban and suburban areas, including various road types, intersections, road signage, lane markings, and peripheral features such as buildings and sidewalks, among other features.

Equipped with a premier network for traffic data collection, *Mcity* allows for thorough experimentation and testing on automated vehicles and their components. *Mcity*’s research topics include big data, connected and automated technology, connected vehicle environment, cybersecurity, human

factors, legal liability and insurance, parking, pedestrian and bicycle safety, and simulation and testing. ([University of Michigan, n.d.](#))

The American Center for Mobility (ACM), located in Ypsilanti, MI, is a “global center for testing and validation, education, product and standards development related to connected and automated vehicles,” occupying more than 500 acres next to Willow Run Airport. The center features a wide range of testing environments, such as a multi-lane modular intersection, a curved tunnel, a 2.5-mile highway loop, a parking area, and a bicycle lane and pedestrian corridor, among others. ACM’s facilities are available for use by academia, government, private industry, and standards bodies. ([American Center for Mobility, n.d.a](#)).

Liability

2016 PA 333 Sec. 665b.(4) states that “automated driving system or any remote or expert-controlled assist activity shall be considered the driver or operator of the vehicle for purposes of determining conformance to any applicable traffic or motor vehicle laws and shall be deemed to satisfy electronically all physical acts required by a driver or operator of the vehicle” and “[f]or each SAVE project in which it participates, during the time that an automated driving system is in control of a vehicle in the participating fleet, a motor vehicle manufacturer shall assume liability for each incident in which the automated driving system is at fault.”

However, 2016 PA 332 Sec. 665a. states that “[a] A manufacturer of automated driving technology, an automated driving system, or a motor vehicle manufacturer is immune from liability that arises out of any modification made to a motor vehicle, an automated motor vehicle, an automated

driving system, or automated driving technology by another person without the manufacturer’s consent.”

[2016 PA 335](#) Sec. 2949b. (1) states that “The manufacturer of a vehicle is not liable and must be dismissed from any action for alleged damages resulting from any of the following unless the defect from which the damages resulted was present in the vehicle when it was manufactured: (a) The conversion or attempted conversion of the vehicle into an automated motor vehicle by another person. (b) The installation of equipment in the vehicle by another person to convert it into an automated motor vehicle. (c) The modification by another person of equipment that was installed by the manufacturer in an automated motor vehicle specifically for using the vehicle in automatic mode.”

Sec. 2969b. (2) states that a subcomponent system producer “is not liable in a product liability action for damages resulting from the modification of equipment installed by the subcomponent system producer to convert a vehicle to an automated motor vehicle unless the defect from which the damages resulted was present in the equipment when it was installed by the subcomponent system producer.” Sec 2969b. (3) states that “[a] motor vehicle mechanic or a motor vehicle repair facility that repairs an automated motor vehicle according to specifications from the manufacturer of the automated motor vehicle is not liable in a product liability action for damages resulting from the repairs.”

Workforce Impacts

Michigan Works! Southeast projects that 46,238 jobs related to the CATV industry will be created in the Southeast Michigan region alone. Major occupation categories in the industry are vehicle design and testing, vehicle manufacturing, vehicle IT design, quality control, data management and cybersecurity, and intelligent transportation systems and infrastructure. Most of these jobs are projected to pay more than \$30 an hour, and most require some form of post-secondary education, often a bachelor's degree. However, it is unclear how current auto workers will be able to obtain such training to transition from working on traditional vehicles to more complex automated vehicles.

Washtenaw Community College (WCC), located in Ann Arbor, MI, has established the Advanced Transportation Center (ATC) to meet the workforce needs of the rapidly changing automotive industry, especially in areas of intelligent transportation systems and advanced manufacturing. WCC received a \$4.4 million grant from the State of Michigan to purchase premier automotive and manufacturing equipment for use by ATC programs.

Furthermore, the college is located near numerous valuable advanced vehicle resources such as the University of Michigan Transportation Research Institute (UMTRI), M-City, the Center for Automotive Research, and the American Center for Mobility, placing trainees in a hotspot of research and testing on CATV technology ([Washtenaw Community College, n.d.](#)).

In 2017, the Academic Consortium at ACM was established with the mission of promoting workforce preparedness for automated vehicle testing and implementation. The consortium is a

partnership between ACM and 15 academic institutions throughout Michigan, and the primary focus is identification of training courses and programs as well as opportunities to gain work experience in the field through internships, co-ops, and work-study program ([American Center for Mobility, n.d.b](#)).

In January of 2019, the Michigan Economic Development Corp. awarded an \$8 million grant to Waymo to retrofit a light manufacturing facility in Detroit for installation of hardware that would convert Chrysler Pacifica Hybrid and Jaguar i-Pace Electric cars into automated vehicles.

Its presence in southeast Michigan promises to bolster the region's status as a leader in the CATV industry. The agreement stipulates that the Waymo facility must be operational and employ at least 100 new employees by the end of 2021, with the goal of creating upwards of 400 jobs in the area ([Thibodeau & Noble, 2019](#)).

Deployments and Initiatives

According to the United States Department of Transportation (USDOT), in September 2018, there were 11 operational connected vehicle deployment in Michigan, with an additional three projects planned ([USDOT, 2018](#)).

In 2012, the USDOT partnered with the University of Michigan Transportation Research Institute (UMTRI) to conduct the Safety Pilot Model Deployment (SPMD), a three-year-long research program that assessed the ability of existing connected vehicle safety technology to reduce crashes.

The deployment area was northeast Ann Arbor, with more than 2,800 vehicles participating on 73 miles of instrumented roadway. The program had volunteers install a device that enabled data collection and connection to other participating vehicles and roadside equipment.

Following the success of SPMD, UMTRI commenced a new connected vehicle deployment called the Ann Arbor Connected Vehicle Test Environment (AACVTE) that expanded the test boundaries to the entire city of Ann Arbor, a 27 square mile area (UMTRI, 2019).

AACVTE plans to deploy roadside devices at 70 locations, including intersections, crosswalks, freeway sites, and a roundabout, and it has a minimum deployment goal of 3,150 vehicles. As of August 2018, there were 450 connected vehicles and only one roadside equipment device deployed. (“A living laboratory”, 2018)

In June 2018, the University of Michigan launched a driverless shuttle service on its North Campus, placing two such shuttles in operation. The goal of this deployment is to collect data on how shuttle passengers react to their experience of using the service, to inform researchers on public trust of autonomous vehicles. A conductor is always present in the shuttle during operation to ensure the safety of pedestrians and those on board (Carney, 2018).

MDOT has planned or launched many deployments that include installation of connected vehicle infrastructure along various roadway corridors to enable vehicle to infrastructure (V2I) interactions. These interactions vary from dangerous weather warnings to traffic signal phase and timing (SPaT) information with aims of improving safety and feasibility of CATV use (MDOT, n.d.).



Figure 2: Michigan's Connected Vehicle Assets (as of April 2016)
Source: Smith, 2016