

# State Notes

## TOPICS OF LEGISLATIVE INTEREST

Fall 2017



### **Automated Vehicle Domestic Developments: A Snapshot** **By Drew Krogulecki, Legislative Analyst, and Michael Siracuse, Fiscal Analyst**

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#### **Introduction**

On November 21, 2016, Governor Rick Snyder, U.S. Senators Gary Peters and Debbie Stabenow, and U.S. Representative Debbie Dingell participated in a groundbreaking ceremony for the American Center for Mobility at Willow Run, Michigan. The American Center for Mobility (ACM) is a joint initiative that includes partnerships with the Michigan Department of Transportation, the Michigan Economic Development Corporation, the University of Michigan, Business Leaders for Michigan, and Ann Arbor SPARK. Still under construction, the ACM facility, located in Ypsilanti Township, will be a "center for testing, education and product development for connected and automated vehicles", according to a news release from Governor Snyder's office issued on the same day.

According to the Alliance of Automobile Manufacturers, the auto industry is worth more than \$950.0 billion to the U.S. economy each year, including sales, servicing, supply parts, employment, and tax revenue. The Alliance reports that, in 2015, Michigan had more than \$21.0 billion in car sales, employed more than 940,000 Michigan residents in auto-related jobs, and collected \$3.4 billion in auto-related State tax revenue (including fuel taxes, registration fees, sales tax on new and used vehicles and parts and services, dealer business taxes and fees, and income tax from auto-related employment).

As automated vehicle technology is introduced to the global marketplace, the evolution of the most common means of personal transportation has the potential for revolutionary changes to the automotive industry, including changes in labor, production, education, and technical training, as well as the overall economy. Michigan, with its proximity to the industry, is ideally positioned to benefit from such innovation, but only if the State is prepared to act when the moment arrives via investment, considered policy-making, and a willingness to adapt to the new marketplace.

Much research and commentary are publicly available on the subject of automated vehicle development. This *State Notes* article will describe and compare automated vehicle proving grounds, review Federal guidance regarding automated vehicle policy, and compare enacted automated vehicle legislation across the United States. The article should be read as a "snapshot" of current developments in these topics as they relate to Michigan's position among other states.

It should be noted that the article uses the term "automated" to refer to an Automated Driving System (ADS), as defined by the Society of Automotive Engineers (SAE). In its J3016 publication, *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles*, SAE defines an ADS as the "hardware and software that are

collectively capable of performing the entire Dynamic Driving Task on a sustained basis, regardless of whether it is limited to a specific operational design domain; this term is used specifically to describe a level 3, 4, or 5 driving automation system."

## **Proving Grounds**

### **10 U.S. Pilot Sites**

#### *American Center for Mobility at Willow Run*

Two months after the groundbreaking at Willow Run, the U.S. Department of Transportation (USDOT) named the site as one of its 10 proving ground pilot sites for the testing of automated vehicles. According to a USDOT press release, the group of 10 designees "will openly share best practices for the safe conduct of testing and operations as they are developed, enabling the participants and the general public to learn at a faster rate and accelerating the pace of safe deployment" ("U.S. Department of Transportation Designates 10 Automated Vehicle Proving Grounds to Encourage Testing of New Technologies", 1-19-2017).

Construction on a 2.5-mile highway test track at the ACM proving ground site at Willow Run has an expected completion date of December 2017. The costs for construction have been secured by ACM, as the proving ground has raised just over \$100.0 million, including \$50.0 million from the Michigan Economic Development Corporation and the Michigan Strategic Fund, roughly \$15.0 million in investment from the Michigan Department of Transportation, and about \$36.0 million in private investment. Currently, ACM is seeking additional investment to build a technology park on site.

In addition to field testing, ACM will seek to foster regional development in education and workforce training related to automated vehicle testing, implementation, and repair. On October 16, 2017, ACM announced the creation of an academic consortium to develop workforce courses and training programs related to automated vehicles. Fifteen Michigan colleges and universities, including the University of Michigan, Michigan State University, and Wayne State University, have joined the consortium.

In addition, ACM has received industry support from many private companies, including auto manufacturers headquartered in Michigan, engineering firms, and communication and data companies, including AT&T. In pursuit of its goal to be the national leader in the development of standards for the automated vehicle industry, ACM signed a formal agreement with the Institute of Transportation Engineers and the Society of Automotive Engineers in June 2017. The Center also has a close working relationship with the University of Michigan's MCity, a 16-acre testing facility for urban and suburban automated vehicle testing.

In addition to the ACM site at Willow Run, the nine other locations designated as proving ground pilot sites are shown in [Figure 1](#), below.

*City of Pittsburgh and the Thomas D. Larson Pennsylvania Transportation Institute (LPTI)*

Little is known about developments at the Pittsburgh/Larson site, which was named as a USDOT proving ground in January 2017. Its test track was the site of an automated vehicle summit on September 11-12, 2017, hosted by the Mid-Atlantic Section of the Institute of Transportation Engineers and the Intelligent Transportation Society of Pennsylvania. There are few details, however, about the site's operations and funding, or the partnership between the City of Pittsburgh and the Larson Transportation Institute. The Larson Institute has a history of focusing its research efforts on bus technology, dirt and gravel road studies, and pavement technology. The region does have two other players heavily involved in the development of automotive vehicle technology: Uber and Carnegie Mellon University. As reported by the Center for Automotive Research in July 2017, Uber opened its Advanced Technologies Group in Pittsburgh in 2015 to develop automated vehicle technology. It is currently building a test track and facility in the city. Many former Carnegie Mellon scientists now work for Uber, though the university still excels in automotive robotics research and development through its National Robotics Engineering Center.

**Figure 1**



Source: U.S. Department of Transportation

*The University of Wisconsin - Madison (UWM)*

The Wisconsin proving grounds do not have a dedicated campus, but will have access to multiple private and university testing sites via the partnership group, which includes the university and several testing and data collection companies. State or private funding amounts

Ellen Jeffries, Director – Lansing, Michigan – (517) 373-2768

are currently unknown. According to its website, the Wisconsin program has working groups on basemapping, automated commercial trucking, data security, certification, user acceptance, human factors, shared mobility, and retrofitting older vehicles with automated technology.

*U.S. Army Aberdeen Test Center (USATC)*

The Aberdeen Test Center already was testing automated systems before the USDOT designation. These include systems for automated aircraft (including drones), boats, cars, and other military systems. The facility encompasses more than 40 miles of automotive test courses consisting of paved and unpaved roads for testing across a wide spectrum of terrain types. The Aberdeen facility has a history of working with governmental and private industry research groups, including the Federal Highway Administration, Lockheed Martin, and CGI Group Inc.

*Iowa City Area Development Group (ICADG)*

The Iowa City designation includes a business development group, the University of Iowa, and the Iowa Department of Transportation. The university houses the National Advanced Driving Simulator, the nation's largest driving simulator. To date, no funding or test sites have been identified.

*Contra Costa Transportation Authority (CCTA) & GoMentum Station*

Located on a 5,000-acre former naval base, the CCTA & GoMentum site includes 20 miles of abandoned roads with a variety of infrastructure, including railroad crossings, bridges, and tunnels. The GoMentum projects are intended to test automated vehicles without manual controls. The site partners include the City of Concord (where the site is located), Honda, EasyMile (an automated shuttle bus company headquartered in France), and Otto, a commercial trucking research division of Uber. Through fiscal year (FY) 2016-17, no appropriations had been made for the GoMentum station by the CCTA.

*San Diego Association of Governments (SANDAG)*

With its primary partner, the City of Chula Vista, SANDAG will begin a pilot testing program in early 2018 with a focus on on-road testing of automated vehicles in three environments: I-15 express lanes, the southern segment of the South Bay Expressway, and local streets within Chula Vista. The county government and 18 cities comprise SANDAG which is partnered with the California Department of Transportation. No other partners, private or academic, have been identified for the proving ground. For FY 2017-18, SANDAG has budgeted \$435,825 for the project, up from \$117,614 the previous year; however, sustained funding and development of the project remain in doubt. Key officials within SANDAG recently resigned amid revelations of inflated revenue projections before a vote on a ballot initiative and admissions regarding the purposeful concealment of public documents. The State of California recently stepped in, passing legislation to establish an independent auditor and reorganize SANDAG's governing board.



*Texas AV Proving Grounds Partnership (TAV)*

The Texas partnership, called the Texas Innovation Alliance, includes the Southwest Research Institute, academic partners, and a group of local and state agencies. Academic partners include the Center for Transportation Research at the University of Texas at Austin and the Texas A&M Transportation Institute. The proposal submitted to the USDOT for designation as a proving ground contemplated a vast network of testing sites throughout the state, including Austin, Dallas, El Paso, Houston, and San Antonio. Thus far, the North Central Texas Council of Governments has allocated nearly \$1.7 million for two projects: an automated shuttle called Milo that ferries up to 12 passengers around Arlington's entertainment district, and a 10-mile managed lane section of I-30 that the Texas Department of Transportation can close for high-speed testing purposes. Texas A&M also is developing a high-tech campus that already includes six miles of paved test track, three miles of urban grid roadways, and additional setups for toll and pavement marking testing.

*North Carolina Turnpike Authority (NCTA)*

Details concerning North Carolina's plans for an automated vehicle project, its location, and its funding are scant. The USDOT designation was for North Carolina's Interstate 540 Triangle Expressway, a toll road, as a future testing site. A May 2017 presentation by North Carolina's Department of Transportation (NCDOT) indicated that the Triangle Expressway was fully operational and ready for immediate testing. To date, however, it is not clear that any testing has begun. In June, an NCDOT spokesperson was quoted in the *Winston-Salem Journal* saying, "While waiting for further direction, the N.C. Turnpike Authority is continuing to meet with research partners to develop a strategy for the pilot program." The Turnpike Authority's partners include the University of North Carolina and Duke University.

*Central Florida Automated Vehicle Partnership (CFAVP)*

The proving ground in central Florida, SunTrax (and affiliated projects), is already under construction. With an expected completion in the fall of 2018, SunTrax, a 400-acre testing facility, which includes a 2.25-mile high-speed oval track with a 200-acre interior testing ground, will focus on tolling collections development, high-speed merging in multiple lanes, and driver assisted truck platooning. Partners include the City of Orlando, the Florida Department of Transportation, Florida's Turnpike Enterprise, Florida Polytechnic University, the University of Central Florida, the Central Florida Expressway Authority, and NASA. As of December 2016, up to \$51.0 million in state funding for the project over two years had been authorized.

## **International Sites**

### ***China***

The Chinese Ministry of Industry and Information Technology has set four goals for automated vehicles to reach by 2025: reduce traffic accidents by over 30%, set safe automated driving speeds of 120 kilometers per hour, lower energy consumption by 10%, and reduce emissions by 20%. To reach these goals, China has been developing three main testing facilities in Shanghai, Beijing, and Chongqing, with two additional facilities under construction in the provinces of Hebei and Zhejiang. In 2015, 3.6 kilometers of testing track were revealed at the Shanghai facility, called the National Intelligent Connected Vehicle Testing Demonstration Base. By 2019, the facility plans to have 100 square kilometers of high-speed and urban testing.

In addition to the national initiative, private companies are investing in China. In September 2017, China's largest internet provider, Baidu Inc., announced a \$1.5 billion investment, called "The Apollo Fund", in automated vehicle development. Baidu plans to fund 100 automated vehicle projects over the next three years. In May 2016, it announced a partnership with the Chinese city of Wuhu to gradually introduce automated travel commercially within the city over a period of several years. By investing in small cell wireless infrastructure throughout the city, Wuhu and Baidu intend to intermix automated and human-driven vehicles in the entire city by 2021, with the intention of possibly banning all human-driven vehicles by 2026.

### ***Other International Developments***

In December 2016, the Center for Automotive Research, on behalf of the Michigan Department of Transportation, completed and issued a publication titled "International Scan of Connected and Automated Vehicle Technology Deployment Efforts". The publication includes extensive details on automated vehicle development efforts in the U.S., Europe, East Asia, the Southwest Pacific region, and the Middle East.

### **Availability of Information**

Details about each proving ground's operations, partners, and funding sources have been difficult to find. On the RESOURCES page of the AV Proving Grounds webpage set up by the USDOT ([www.nationalavpg.com](http://www.nationalavpg.com)), nine out of the 10 proving ground locations do not have any information posted about their operations; instead, there is a message that says, "Documents Will Be Posted Soon". Numerous informational requests to the USDOT and many of the individual partnerships have gone unanswered. As a result, the authors of this article have relied heavily upon information available on the internet, particularly news articles and press releases, as well as an examination of individual state budget documents, with varying degrees of success. Based on this research, [Table 1](#) reflects the known partnerships for each proving ground location.



**Table 1**

	ACM	LPTI	UWM	USATC	ICADG	CCTA	SANDAG	TAV	NCTA	CFAVP
Ford	X									
GM										
Toyota	X						X			
Honda						X				
Hyundai	X									
AT&T	X									
Uber		X				X				
Volvo		X								
NASA										X
Data Research & Processing Partners	X		X	X		X		X		
Academic Partnership	X		X		X	X		X	X	X
State DOT Partnership	X				X		X	X	X	X
Local Jurisdictional Partnership	X	X				X	X	X		X

Source: Senate Fiscal Agency

### **Automated Vehicle Legislation**

#### *NHTSA Recommendations*

On September 12, 2017, the National Highway Traffic Safety Administration (NHTSA), a USDOT agency that enforces vehicle performance standards and partners with state and local governments to reduce deaths, injuries, and other motor vehicle-related losses, released new Federal guidance regarding ADSs, titled *Automated Driving Systems 2.0: A Vision For Safety*. The report states that the NHTSA and the USDOT are ready to assist states with challenges regarding the safe integration of SAE Level 3 and above ADSs on public roads. (SAE International is a globally active organization that develops standards for engineering professionals in various industries.) SAE International identified five levels of automation, starting with zero: no automation (0), driver assistance (1), partial automation (2), conditional automation (3), high automation (4), and full automation (5). Level 3 (conditional automation) is defined as "the driving mode-specific performance by an automated driving system of all

Ellen Jeffries, Director – Lansing, Michigan – (517) 373-2768



aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene". Figure 2 explains each level of automation in further detail. Figure 3 displays the highest level of automated testing anticipated to occur at each listed proving ground.

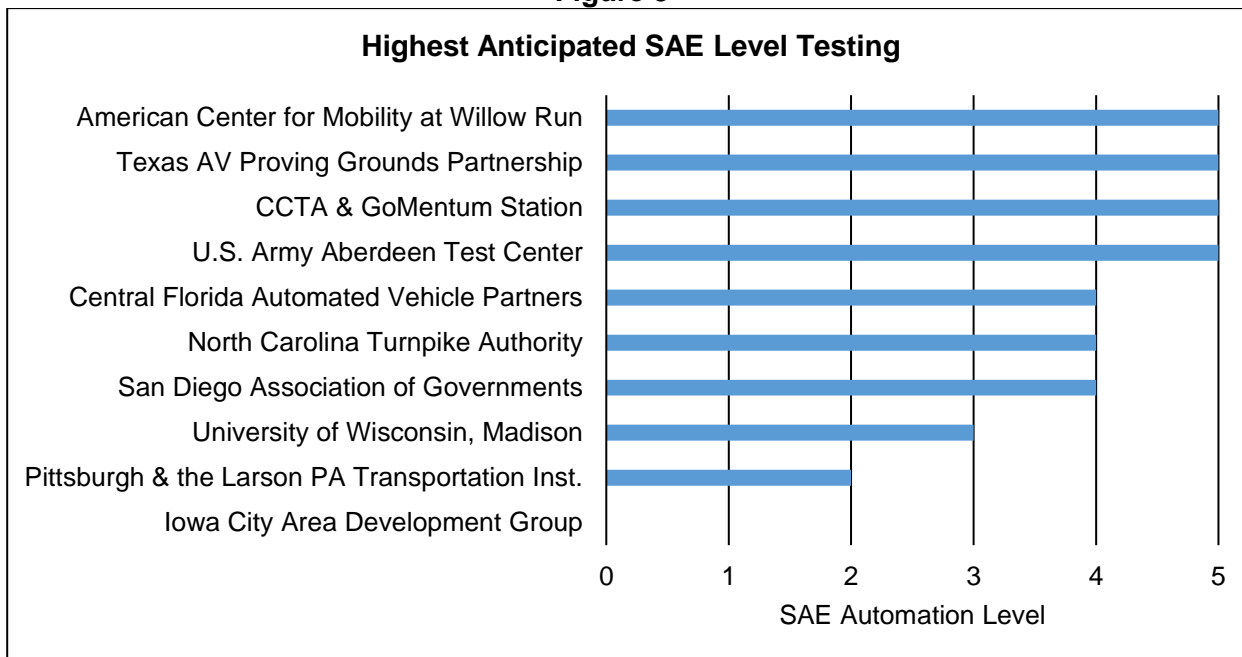
**Figure 2<sup>1</sup>**

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/Deceleration	Monitoring of Driving Environment	Fallback Performance of Dynamic Driving Task	System Capability (Driving Modes)
<b>Human driver monitors the driving environment</b>						
<b>0</b>	<b>No Automation</b>	the full-time performance by the <i>human driver</i> of all aspects of the <i>dynamic driving task</i> , even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
<b>1</b>	<b>Driver Assistance</b>	the <i>driving mode</i> -specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	Human driver and system	Human driver	Human driver	Some driving modes
<b>2</b>	<b>Partial Automation</b>	the <i>driving mode</i> -specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	<b>System</b>	Human driver	Human driver	Some driving modes
<b>Automated driving system ("system") monitors the driving environment</b>						
<b>3</b>	<b>Conditional Automation</b>	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the dynamic driving task with the expectation that the <i>human driver</i> will respond appropriately to a <i>request to intervene</i>	System	<b>System</b>	Human driver	Some driving modes
<b>4</b>	<b>High Automation</b>	the <i>driving mode</i> -specific performance by an automated driving system of all aspects of the <i>dynamic driving task</i> , even if a <i>human driver</i> does not respond appropriately to a <i>request to intervene</i>	System	System	<b>System</b>	Some driving modes
<b>5</b>	<b>Full Automation</b>	the full-time performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> under all roadway and environmental conditions that can be managed by a <i>human driver</i>	System	System	System	<b>All driving modes</b>

<sup>1</sup> Copyright © 2014 SAE International and SAE J3016.



**Figure 3**



Source: SAE International

In addition to encouraging collaboration between Federal and state jurisdictions and ADS entities (such as manufacturers, suppliers, and automated fleet operators), among other interested parties, the NHTSA recommends proactivity in the evolution of automated vehicle policy. While many states have been proactive in enacting legislation related to automated vehicle technologies, the NHTSA has provided policy guidelines for state legislatures that support a national approach to testing and deploying ADSs. According to the NHTSA, one objective of its publication is to create consistency in ADS regulation. The NHTSA recommends that states review other states' draft ADS policies and legislation; maintain a good state of infrastructure design, operation, and maintenance that supports ADS deployment and adheres to the Manual on Uniform Traffic Control Devices; and continue to work with the Federal Highway Administration and the American Association of State Highway and Transportation Officials to "support uniformity and consensus in infrastructure standard setting".

The NHTSA further delineates the regulatory responsibilities of states and the Federal government for motor vehicle operation, which it recommends remain unchanged when facing ADS regulation. Table 2 is a replica of a table included in *Automated Driving Systems 2.0: A Vision For Safety*.



**Table 2**

<b>NHTSA's Responsibilities</b>	<b>State's Responsibilities</b>
<ul style="list-style-type: none"> <li>-- Setting Federal Motor Vehicle Safety Standards (FMVSSs) for new motor vehicles and motor vehicle equipment (with which manufacturers must certify compliance before they sell their vehicles)</li> <li>-- Enforcing compliance with FMVSSs</li> <li>-- Investigating and managing the recall and remedy of noncompliances and safety-related motor vehicle defects nationwide</li> <li>-- Communicating with and educating the public about motor vehicle safety issues</li> </ul>	<ul style="list-style-type: none"> <li>-- Licensing human drivers and registering motor vehicles in their jurisdictions</li> <li>-- Enacting and enforcing traffic laws and regulations</li> <li>-- Conducting safety inspections, where States choose to do so</li> <li>-- Regulating motor vehicle insurance and liability</li> </ul>

Source: *Automated Driving Systems 2.0: A Vision For Safety*.

The following are the NHTSA's recommended safety-related best practices for the crafting of ADS legislation:

- Provide a "technology-neutral" environment.
- Provide licensing and registration procedures.
- Provide reporting and communications methods for public safety officials.
- Review traffic laws and regulations that may serve as barriers to operation of ADSs.

Furthermore, the NHTSA encourages policymakers, when crafting new or reviewing existing ADS policy, to address how ADS implementation affects driver education and testing, licensing, pedestrian safety, law enforcement, vehicle registration and inspection, traffic control, highway design and maintenance, crash prevention, investigation, record-keeping, and emergency services. The NHTSA's *Automated Driving Systems 2.0: A Vision For Safety* provides further recommendations for new ADS policy, such as how to approach administrative oversight; form an application and permission process for entities to test ADSs on public roadways; consider testing, registration, and titling policies; work with public safety officials; and approach liability and insurance.

#### *Currently Enacted State Legislation*

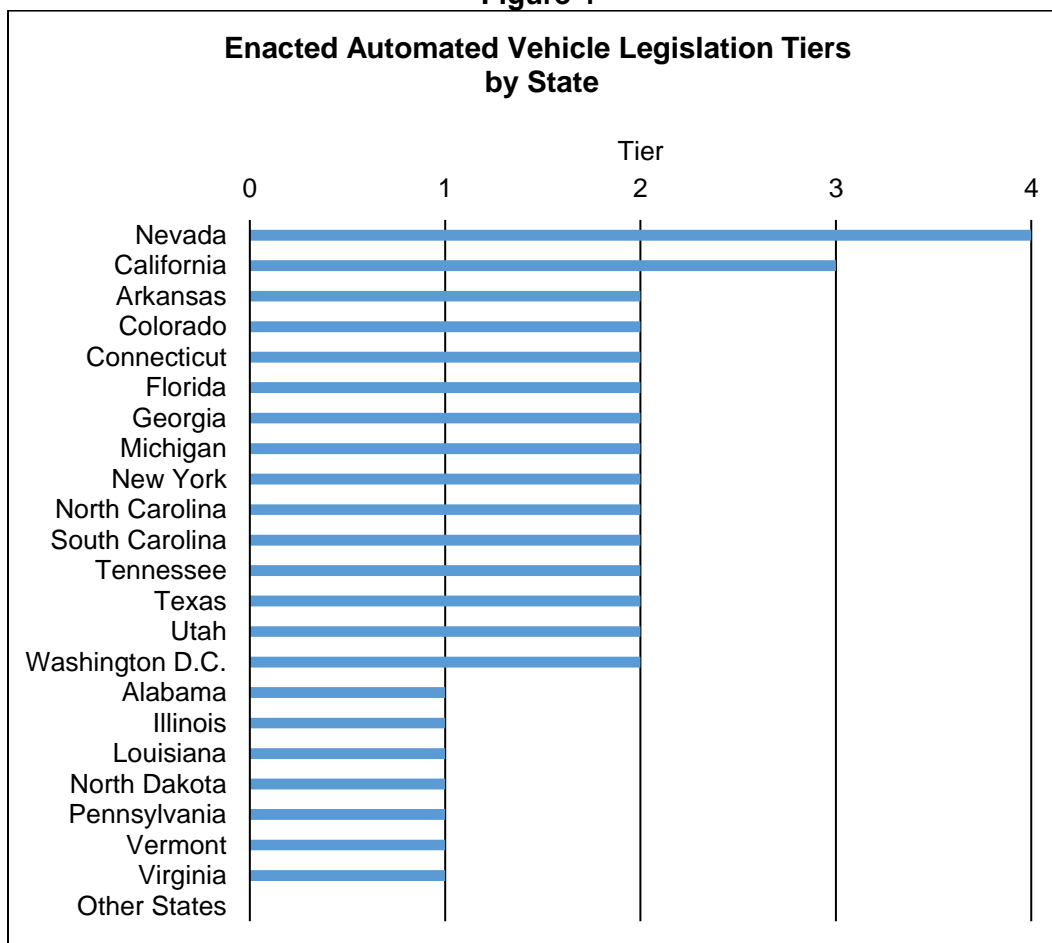
At the time of this writing, 22 states have enacted legislation that addresses or relates to automated vehicles in some capacity. This count does not include several states that have issued executive orders on the subject. [Figure 4](#) categorizes all of the states in four separate tiers, described below, according to their enacted legislation. It is important to note that while some states' laws relating to automated vehicles share similarities, the specific details vary widely between the states. States often have a unique approach that addresses some aspects

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of automated vehicles and technology (such as the entity liable in the event of a crash, or the person responsible for an automated vehicle passenger under the age of 12), while remaining silent on others. While studying [Figure 4](#), readers should understand that the groupings of states are general, rather than complete or total. Readers also may assume that a state in a tier above another state has enacted legislation that generally reflects the legislation enacted by the state in the lower tier.

**Figure 4**



Source: Senate Fiscal Agency

The tiers are categorized as follows:

- Tier Zero: States with no enacted legislation related to automated vehicles.
- Tier One: States with enacted legislation that contains definitions related to automated vehicles or technology, or ancillary automated vehicle or technology provisions (e.g., a law requiring a group to study the condition of automated technology and its potential impact on the state).
- Tier Two: States with enacted legislation that is similar to the previous tier, but also allows some form of testing or operation of automated vehicles within the state, whether it is

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limited to one area or across the entire state, or strictly for purposes of "platooning" (generally defined as commercial motor vehicles communicating and operating in concert with one another in a convoy).

- Tier Three: States with enacted legislation that is similar to the previous tiers, but also provides unambiguous authority to a state department or other entity to promulgate rules and regulations regarding automated vehicles and technologies.
- Tier Four: States with enacted legislation that contains provisions similar to all of the previous tiers, but addresses additional facets of automated vehicle integration.

(It should be noted that state entities may have the authority to promulgate rules and regulations regarding automated vehicles and technologies if, for example, legislation provides a state entity with the ability to promulgate rules and regulations concerning traffic laws. The authors of this article were not able to investigate which states have related automated vehicle or technology rules already promulgated by a state entity.)

While Michigan is considered a Tier Two state in [Figure 4](#), it is difficult to categorize, particularly because of the State's extensive regulation of transportation network companies (TNCs). Only Nevada has similar legislation that addresses TNCs, which is the reason Nevada is placed in Tier Four. Because no Michigan Department or agency has promulgated rules to date, Michigan remains in Tier Two. Similarly, Washington, D.C., is difficult to classify because it required the mayor, by December 31, 2013, to issue rules "establishing a class of vehicles for autonomous vehicles and procedures and fees for the registration, titling, and issuance of permits to operate autonomous vehicles"; and addresses the conversion of existing vehicles to automated vehicles in a detailed way that no other state does. Specifically, Washington, D.C., restricts the conversion of vehicles to automated vehicles to model years 2009 or later or vehicles built within four years of conversion, whichever is newer.

Although 22 states have addressed some aspect of automated vehicle implementation through state law, only 15 have enacted provisions allowing some form of testing or operation of automated vehicles. As of this writing, Michigan has some of the most comprehensive automated vehicle laws in the nation and would be in Tier Four, like Nevada, if not for unfulfilled Tier Three criteria.

### **Summation**

Automated vehicle technology is being developed at a rapid pace, and it is important to understand what the industry and current regulatory structures look like in order to reassess existing policies or evaluate potential policy amendments. This article has provided a brief overview of the background and current standing of the USDOT's designated proving grounds and general information regarding international automated vehicle testing sites; the NHTSA's policy and regulatory recommendations for states; and enacted state legislation regarding automated vehicles.



Readers should understand that current data on these topics are incomplete, particularly when it comes to funding for testing sites, as specific information is not always accessible. Moreover, this article does not address other important subjects regarding automated vehicle implementation. In particular, policymakers and industry members will have to address liability issues regarding future products, the retrofitting of existing infrastructure to accommodate automated vehicles, cyber security to protect automated vehicles, workforce training for the maintenance or sale of future vehicles (including the displacement of current workers if a job is made obsolete by new technology), and agreements on general automated vehicle standards across international jurisdictions.

If applied properly and effectively, automated vehicle technology has the potential to provide many societal benefits, such as reduced injuries and deaths related to motor vehicle accidents, increased travel efficiency, and enhanced mobility for people who cannot drive. The technology's application will be gradual, however. Michigan appears to be one of the leaders of the national effort in the development of this technology through the work of ACM, its industry partners, MCity, and the State of Michigan. Public Act 332 of 2016 created the Michigan Council on Future Mobility, a 21-member group of industry, academic, and political appointees, to provide the Governor and the Legislature with policy recommendations to help keep Michigan at the forefront of the development of automated vehicle technology and implementation. The Council's first report was issued on March 31, 2017, and is available through the Governor's webpage. The Council does not have rule-making power, and, to date, no rules have been promulgated in Michigan regarding automated vehicles by any other agency.

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**Resources**

Center for Automotive Research - [www.cargroup.org](http://www.cargroup.org)

USDOT AV Proving Grounds - [www.nationalavpg.com](http://www.nationalavpg.com)

USDOT Intelligent Transportation Systems Joint Program Office - [www.its.dot.gov](http://www.its.dot.gov)

SAE International - [www.sae.org](http://www.sae.org)

National Conference of State Legislatures: Autonomous Vehicles Legislative Database -  
[www.ncsl.org/research/transportation/autonomous-vehicles-legislative-database.aspx](http://www.ncsl.org/research/transportation/autonomous-vehicles-legislative-database.aspx)

Michigan Department of Transportation - [www.michigan.gov/mdot](http://www.michigan.gov/mdot)