Louisiana Transportation Research Center

Final Report 571

Investigation into Legislative Action Needed to Accommodate the Future Safe Operation of Autonomous Vehicles in the State of Louisiana

by

Chester Wilmot
Marlon Greensword

Louisiana State University

4101 Gourrier Avenue | Baton Rouge, Louisiana 70808
(225) 767-9131 | (225) 767-9108 fax | www.ltrc.lsu.edu

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/LA.16/571		

4. Title and Subtitle	5. Report Date
Investigation into Legislative Action Needed to Accommodate the Future Safe Operation of Autonomous Vehicles in the State of Louisiana	October 2016
	6. Performing Organization Code LTRC Project Number: 15-3SS State Project Number: DOTLT1000056

7. Author(s)	8. Performing Organization Report No.
Chester Wilmot, Marlon Greensword	

9. Performing Organization Name and Address	10. Work Unit No.
Department of Civil and Environmental Engineering Louisiana State University Baton Rouge, LA 70803	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Louisiana Department of Transportation and Development P.O. Box 94245 Baton Rouge, LA 70804-9245	Final Report November 2014 – August 2015
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report addresses the matter of autonomous vehicles and the regulation of their operation in the state of Louisiana. It was prepared in response to a request from the Louisiana State Legislature to study the subject of autonomous vehicles and provide recommendations on legislative and regulatory action to best accommodate this emerging technology. The methodology employed included reviewing the state of the art as published in the literature and other media, noting practice in other states, considering agencies involved and the role they have, and identifying the main issues facing the development of autonomous vehicles today. What was found is that there is an exponential growth in interest in the subject, both officially and among the public at large, that some unrealistic expectations as to what autonomous vehicles will be able to accomplish is beginning to be challenged, and that two paths in the development of autonomous vehicles are being followed: one involving incremental growth toward full automation and the other an attempt to produce a fully autonomous vehicle directly. The general consensus is to place as little restriction and regulation on the development of autonomous vehicles as possible at the moment so that innovation is inhibited as little as possible. At the same time, the potential benefits of uniformity or standardization among states is recognized but any proposals in this regard are limited to suggestions at the moment.

17. Key Words	18. Distribution Statement
Autonomous, legislation, regulations	**Unrestricted. This document is available through the National Technical Information Service, Springfield, VA 21161.**

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
		120	

Project Review Committee

Each research project has an advisory committee appointed by the LTRC Director. The Project Review Committee is responsible for assisting the LTRC Administrator or Manager in the development of acceptable research problem statements, requests for proposals, review of research proposals, oversight of approved research projects, and implementation of findings.

LTRC appreciates the dedication of the following Project Review Committee Members in guiding this research study to fruition.

LTRC Administrator

Special Studies Research Administrator

Kirk Zeringue

Members

John Broemelsiek

Jody Colvin

Stephen Glascock

Dan Magri

Jason Placke

Steve Strength

Betsey Tramonte

Directorate Implementation Sponsor

Janice P. Williams

Investigation into Legislative Action Needed to Accommodate the Future Safe Operation of Autonomous Vehicles in the State of Louisiana

by

Chester Wilmot
Marlon Greensword

Department of Civil and Environmental Engineering
Louisiana State University
Baton Rouge, Louisiana 70803

LTRC Project No. 15-3SS
State Project No. DOTLT1000056

conducted for

Louisiana Department of Transportation and Development
Louisiana Transportation Research Center

October 2016

ABSTRACT

This report addresses the matter of autonomous vehicles and the regulation of their operation in the state of Louisiana. It was prepared in response to a request from the Louisiana State Legislature to study the subject of autonomous vehicles and provide recommendations on legislative and regulatory action to best accommodate this emerging technology. The methodology employed included reviewing the state of the art as published in the literature and other media, noting practice in other states, considering agencies involved and the role they have, and identifying the main issues facing the development of autonomous vehicles today. What was found is that there is an exponential growth in interest in the subject, both officially and among the public at large, that some unrealistic expectations as to what autonomous vehicles will be able to accomplish is beginning to be challenged, and that two paths in the development of autonomous vehicles are being followed: one involving incremental growth toward full automation and the other an attempt to produce a fully autonomous vehicle directly. The general consensus is to place as little restriction and regulation on the development of autonomous vehicles as possible at the moment so that innovation is inhibited as little as possible. At the same time, the potential benefits of uniformity or standardization among states is recognized but any proposals in this regard are limited to suggestions at the moment.

ACKNOWLEDGMENTS

The contribution of the Project Review Committee is acknowledged.

IMPLEMENTATION STATEMENT

Implementation of the recommendations of this report is dependent on the endorsement of the recommendations by the State Legislature and DOTD. In keeping with practice in other states, preparation of draft legislation and regulations should be done in consultation or even collaboration with state agencies such as the Office of Motor Vehicles in the Department of Public Safety. Consultation with Original Equipment Manufacturers (OEMs) during the drafting of legislation is also highly desirable because it works toward establishing an environment where all parties are as satisfied as possible, and progress in the development and deployment of autonomous vehicles can be made.

TABLE OF CONTENTS

INTRODUCTION

This report addresses the matter of autonomous vehicles and the regulation of their operation at the state level. It was prepared in response to a request in the 2014 session of the Louisiana House of Representatives where the Louisiana Department of Transportation and Development (DOTD) was asked to "begin studying and testing autonomous vehicles and consider the promulgation of rules for the safe operation of such vehicles on the roads of the state" (House Resolution 133). Thus, the purpose of the study documented in this report is to provide recommendations on legislative and regulatory action that the state of Louisiana should take to best address the emerging issue of autonomous vehicles on roads in Louisiana.

The interest in autonomous vehicles has grown exponentially in recent years. One analysis of the amount of discussion on the topic shows that the number of recorded discussions increased from approximately 10 per month at the beginning of 2012 to approximately 10,000 per month toward the end of 2013 (KPMG, 2015, p. 6). Anyone following the subject of autonomous vehicles will have noticed the growing proliferation of conference sessions, seminars, blogs, discussion groups, studies, and reports on the subject. The unveiling of the Google car in 2010 is credited with much of the growth in public interest but several auto manufacturers (e.g., Audi, GM, Ford, Toyota, Volvo, Nissan, and Mercedes Benz) have been working on automation in vehicles for years and, in fact, demonstrated autonomous vehicle operation before the Google car.

Considering the historical development of automation and autonomy in vehicles raises the need to distinguish between automated and autonomous vehicles, at least as explained in most of the literature. The terms “automated,” “autonomous,” “driverless,” or “unmanned” vehicles are often used interchangeably. However, each of these terms refer to distinct and specific functions, purposes, or features of a vehicle and its operation. “Automated” vehicles are vehicles that have been converted to contain, or are manufactured with, automated features. These vehicles are designed to either prompt a driver to take certain action or they initiate a mechanical or electronic response to a perceived danger. The stimuli prompting a response may come from the vehicle’s own sensors or from connected vehicles providing information beyond that which the vehicle itself is able to gather. In contrast, an “autonomous” vehicle operates entirely without human intervention, based on previously input data and its ability to learn new information and adapt accordingly (McCarthy and Dopping-Hepenstal, 2010). In other words, while certain features of an automated vehicle's operation are automated (e.g., self-parking, adaptive cruise control, or collision braking), autonomous vehicles are characterized by the entire operation of the vehicle being automated and all decision-making being made by the vehicle, at least for as long as systems on the vehicle determine they are capable of operating the vehicle safely (Nowakowski et al., 2015, p. 1).

The term “driverless” indicates that the vehicle has no human driver due to the robotic ability of the vehicle to operate entirely without a driver in or outside the vehicle. Examples of existing driverless vehicles are automated guided transit systems at airports and theme parks, or elevators in buildings. “Unmanned,” on the other hand, means no human is present in the vehicle, either as a driver or a passenger, with the option that a driver could operate the vehicle from outside the vehicle as with an unmanned aerial vehicle (UAV) or drone. Under these definitions, automated and autonomous vehicles are distinguished by the amount of operational control left to an operator, and driverless and unmanned vehicles by the presence or absence of humans in the vehicle. Note that under this definition, autonomous vehicles can be driverless vehicles but are not necessarily so because control can be ceded to a driver when autonomous operation is perceived to be unsafe. They could also be unmanned when the vehicle is, for example, a driverless truck transporting material on a construction or mining site, or it is a robotic vehicle gathering items in a warehouse.

The National Highway and Traffic Safety Administration (NHTSA) has developed a useful taxonomy of levels of vehicle automation based on the degree of human driver control required in a vehicles’ operation (Marshall, 2013; NHTSA, 2013):

- Level 0: All tasks are manned.
- Level 1: Function-specific: the human driver activates the automated control of specific tasks such as parallel parking or cruise control.
- Level 2: Combined function: although they can be occasionally disengaged (hands and feet off the pedals and steering wheel), drivers monitor vehicle operation and are available for control at all times.
- Level 3: Limited self-driving: the driver can rely entirely on automated operation and is not expected to monitor at all times.
- Level 4: Full self-driving: these vehicles can operate without humans present.

Each of these levels of automation are presented in greater detail below as perceived and described in the literature in general. Each describes an increased level of automation with the final classification (full self-driving) being the classification of interest in this study.

Level 1: Function-specific

At this level of automation, overall control is still in the driver’s hands. There can be more than one automated function, but their operations are independent of one another (Marshall, 2013). In other words, these individual advanced driver assistance systems, or ADASs as they are

commonly referred to in the industry, are distinct, separate add-ons that do not work together to form a *system* (Yeomans, 2014; Schwartz, et al., 2013, p. 13).

Functions include self-parking, collision avoidance systems, adaptive cruise control, and lane-centering or lane-deviation correction (Bamonte, 2013). With the progress of technology, individual ADAS functions are becoming more and more refined and sophisticated. For example, Volvo and Audi models have a smartphone application that allows the driver to get out of the vehicle and command the car to self-park, as well as command it to exit parallel parking to pick the driver up later (Yeomans, 2014).

Level 2: Combined Function

At the "combined function" level of automation, two or more primary control functions are automated. Marshall (2013) gives the example of adaptive cruise control used in combination with lane centering. The driver monitors all functions at all times, and is held liable. With combined function automation, the vehicle can be switched back to manual mode by the driver at any time.

Level 3: Limited Self-driving

In instances of inclement weather or congested traffic, the vehicle can be given full control, whereby the driver does not need to constantly monitor the operation or trust their own ability to see well or accommodate the stop/start operation of congested traffic. Autonomy is conditional as it depends upon the driver assuming control or ceding it to the vehicle's automated operation (Marshall, 2013).

Level 4: Full Self-driving

This level of automation refers to vehicles that are entirely driverless and with no human operational control. Human input is limited to destination entry and, possibly, route preference. Drivers, owners, passengers, or users are not held responsible or liable for the operation of the vehicle at this level of automation. These driverless vehicles use communication, sensors, and computerized systems to evaluate their environment. The sensory data is fed from the external observations and other vehicles into a processor. Based on this data, the vehicle itself elects which route to take to reach a specified destination (Yeomans, 2014). An internal computer directs and maneuvers the vehicle based on this data and initial human input. Data acquisition and processing is completed largely via the "cloud" (large scale internet databases available through broadband connections) or "crowdsourcing" (the voluntary provision of information from individuals on the internet).

In the United Kingdom, a slightly different classification scheme to the NHTSA classification has been suggested in that the fully autonomous category is divided into high autonomy and full autonomy (Yeomans, 2014). High autonomy vehicles are entirely self-driving, but only for a portion of the journey. Eventually, control returns to the driver, with a warning. Full autonomy vehicles are expected to assume total control for an entire journey. No human being even needs to be physically present in the autonomous vehicle. So far, no prototypes of full autonomy vehicles are known to exist but they are discussed by some authors in the context of how they could be used to deliver goods or transport people incapable of driving themselves such as the blind, physically or mentally handicapped, the young, old, and incapacitated (Burns, Jordan, and Scarborough, 2013).

One author raised the issue of how fully autonomous vehicles could conceivably be used to transport contraband without detection because under the Fourth Amendment law enforcement officers are not allowed to stop and search a vehicle unless there is reasonable suspicion or probable cause to believe evidence of a crime exists or a traffic violation has occurred (Roseman, 2013). Since an autonomous vehicle is unlikely to provide evidence of this kind, autonomous vehicles could facilitate illegal activities such as drug smuggling. At the same time, they can provide benefit to society by providing mobility to those incapable of operating a private vehicle or using public transportation themselves.

Many states are asking what they should do to accommodate the emergence of autonomous vehicles. The entry of autonomous vehicles to the transportation scene at this time in history seems inevitable even though they have been promised several times in the past but did not materialize then. The technology seems poised on many fronts to allow vehicles of this nature to develop. They promise to provide improved motoring safety, improved efficiency, smaller fleet sizes (through communal use of vehicles), and reduced cost through shared resources. However, when it will occur and how market penetration will occur, is unknown. What does seem apparent is that the early optimism of early deployment is being replaced with a more realistic appreciation of the issues facing implementation and the difficulty of resolving them, so development may not be as rapid as some believe.

LITERATURE REVIEW

Historical Overview

The idea of autonomous vehicles dates back to the 1939 World Fair in New York where General Motors suggested in its Futurama exhibit that vehicles would be autonomous by the 1960s (Nowakowski et al., 2014, p. 1; DiClemente, Mogos, and Wang, 2014, p. 5; Bamonte, 2013). That obviously did not occur, and autonomous vehicles essentially did not receive further attention until the 1980s when the Eureka PROMETHEUS project was initiated in Europe. The PROMETHEUS (Program for European Traffic with Highest Efficiency and Unprecedented Safety) project was launched in 1986 by Daimler Benz in cooperation with several other European auto manufacturers, electronic component providers, universities, and research institutes (Autoevolution, 2015). Its objective was not to replace the driver in vehicles but to promote safe operation. It cost approximately €749 million over eight years and culminated in a Mercedes Benz S-class W140 vehicle making a trip with minimal driver intervention from Munich to Copenhagen (a distance of over 1,000 miles) in 1995 (Autoevolution, 2015).

In the United States, a legislative effort to promote automation in transportation was made in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 by setting development of intelligent vehicle highway systems as a goal (Public Law 102-240, Section 6051-6057, 1991). However, developing an intelligent highway was more difficult than developing an intelligent vehicle, so the emphasis moved to vehicles and led to the introduction of the Intelligent Vehicle Initiative (IVI). Funding for the IVI was provided for in the successor appropriation legislation to ISTEA, the Transportation Equity Act for the 21st Century (TEA-21) (Schwartz, et al., 2013, p. 6). Several technological systems were developed as part of this initiative: adaptive cruise control (ACC), forward collision warning (FCW), lane departure warning (LDW), lane change assist (LCA), and intersection movement assist (IMA) (Schwartz, et al., 2013, p. 6). The IVI program eventually merged into NHTSA's Connected Vehicle program and classified the emerging technologies as either Vehicle to Vehicle (V2V) or Vehicle to Infrastructure (V2I) systems (Schwartz, et al., 2013, p. 10). Generally, the systems have evolved from warning a driver of impending danger to active intervention in the driving task such as in adaptive cruise control or self-parking.

The U.S. Defense Department’s Defense Advanced Research Projects Agency (DARPA) was created over 60 years ago as part of the space race. Among its many research thrusts, it has conducted research into automated vehicle development to reduce the exposure of soldiers to hazardous conditions. In an effort to open this research area to civilian participation, the 2004 and 2005 DARPA Grand Challenges were initiated. In these Challenges, public entities were

invited to develop a vehicle that could travel through the desert under various road conditions, obstacles, and poor GPS signals. Stanford University won the prize in 2005. DARPA then developed its first Urban Challenge in which autonomous vehicles were required to navigate a 60-mile course through an urban environment (Rouff and Hinchey, 2011). Carnegie Mellon University won first prize in the Urban Challenge. Both Stanford University and Carnegie-Mellon are still active in researching autonomous vehicle technology and operation.

Historically, the event that is probably most responsible for the current interest in autonomous vehicles is the Google Car. Publicly announced in 2010, it established a turning point in the history of autonomous vehicles because it launched public debate on the subject of autonomous vehicles, and it led the U.S. DOT to seriously consider driverless options and legislation surrounding that possibility (Bamonte, 2013). Technology has reached the level of sophistication that many of the functions required to operate a vehicle are becoming increasingly available so the expectation exists that an autonomous vehicle is indeed possible in the foreseeable future.

Existing Systems

There are numerous examples of autonomous transportation systems in operation today if the focus is removed from cars. For example, while elevators were manually operated at first, they have operated autonomously for at least the last 50 years. Escalators have always operated autonomously, and in airports moving sidewalks and driverless trains (automated guided transit) are common.

Autonomous systems where human oversight is not routinely employed are considered “common carriers” and higher safety standards are typically required in their operation (Schwarz et al., 2013, p. 36). Elevators, escalators, and moving sidewalks fit into this category. Driverless trains typically do have some oversight from a central location, so the degree of safety and reliability required is generally not as high as in common carrier systems.

Autonomous vehicles are often used in controlled environments where repetitive activities are conducted in a relatively small space such as in open cast mines, construction sites, warehouses, or container yards (Egbelu and Tanchoco, 1984; Bamonte, 2013; Polishuk and Yin, 2013). In mining, construction, and container yards, vehicles are programmed to move along predetermined routes and perform standard operations, such as loading and unloading without human involvement (Nash and Winkler, 2015; Ross, 2015). In warehouses, automated vehicles retrieve and replenish inventory. What is significant about these applications is that they all operate in limited spatial areas, typically involve a standard vehicle, and perform a limited range of operations. This makes implementation of the system much more manageable than introducing autonomous vehicles to mixed traffic on a complex highway network. However, the fact that autonomous vehicles can operate gainfully in restricted environments suggests that a

feasible way to introduce autonomous vehicles into general transportation in the future is to first introduce them in restricted environments such as exclusive lanes on freeways, on individual transit routes, or in parking lots as part of an automated parking system (Nowakowski, et al., 2014, p. 8).

Looking at where autonomy or automation is employed in existing systems such as airplanes and ships, it is noteworthy that they are employed to perform the more routine tasks while human intervention is required in more demanding situations. If what happens in these areas is seen as a "leading indicator" of what could happen in road transportation, then it may be that autonomous systems will first be applied to operate on selected lanes on particular sections of freeway under stop-and-go conditions when driving conditions are not demanding, or in providing autonomous valet parking service in upscale residential and office buildings. This gradual implementation of autonomous operation in selected locations for specific tasks would be in line with the general notion that autonomous vehicle operation will be achieved as a result of the progressive implementation of more and more automated features in vehicles. That is, the journey to fully autonomous vehicles will be achieved by advancing one Advanced Driver Assistance System (ADAS) feature at a time (Bamonte, 2013; Yeomans, 2014). This is the approach that most auto manufacturers have taken to developing an autonomous vehicle, although Google (and now Apple since they announced their intention to build an autonomous vehicle) have gone directly to the development of an autonomous vehicle, illustrating there are differences of opinion on how autonomous vehicle operation is going to enter transportation market in general.

One aspect of this evolutionary view that may not apply is the assumption of "uniformitarianism" – the time it took for processes to occur in the past is the time it will take them in the future. For example, traction control in vehicles was first introduced in the 1980s but became a required feature in all new light vehicles in 2011, some 31 years later (NHTSA, 2013, p. 5). Some early automated features are taking longer – cruise control was first fitted to passenger cars in 1958 but is still not a standard feature over 50 years later although its availability is widespread (Young, 2015). On the other hand, newer technologies such as forward collision control first introduced in the mid 2000s, is being introduced into new cars much more rapidly in that virtually every major car manufacturer has the option of forward collision control on at least one of its models. Another feature that is entering the market rapidly is rear view cameras. So, the rate at which different technologies are being adopted varies widely.

Autonomous vehicle development has been addressed by research groups and car manufacturers for approximately the last three decades. For example, the Artificial Vision and Intelligent Systems Lab (VisLab) was founded at the University of Parma, in Italy, as part of the European Prometheus project in 1990. Over the years they have developed several autonomous vehicles. They participated in the DARPA Challenges and in 2010 launched the VisLab Intercontinental

Autonomous Challenge, an 8,000 mile trip from Parma, Italy, to Shanghai, China. The vehicles are shown in Figure 1 and Figure 2, and the route they traveled is shown in Figure 3. The vehicles were electric vehicles manufactured by Piaggio in Italy (the company best known for its Vespa “scooters”). On the trip, the vehicles were recharged daily from power outlets or diesel-powered charging stations carried in a support vehicle. Few technical difficulties were encountered on the trip (VisLab, 2010). A power surge on one occasion resulted in battery failure. A mishap with the satellite communication system caused the vans to be without communication for several days, although the GPS system was unaffected. Most hindrances were actually external: crew members suffered from fatigue, journalist-passengers who reportedly pressed inappropriate buttons out of curiosity, and border officials and police officers who delayed the convoy because they were unaware of the driverless vehicle expedition and were unsure of its legitimacy (Banks, 2010). VisLab concluded that obstacles to proper operation are more bureaucratic than technical. The frequent stoppages at the Russia/Kazakhstan and Kazakhstan/China borders indicate that obstacles may also be of a political nature. VisLab recommended that autonomous vehicles feature a tool in the future that enables them to communicate with law enforcement officials in order to circumvent these obstacles. Another issue reported is that the vans were traveling at equal speed, one behind the other, and while they respected local speed limits, this was a source of frustration for other motorists who found it difficult to pass both vehicles on two-lane roadways. This occasionally caused congestion and human operators in the VisLab vans had to intervene (Coxworth, 2010).

As part of Audi's Delphi program, an Audi SQ5 SUV autonomous vehicle made the trip from San Francisco to New York, leaving on March 22, 2015, and arriving at the New York International Auto show on April 3, 2015. Delphi’s 3,500-mile expedition was incorrectly reported to be the longest autonomous vehicle trip ever made, but if the two Italian VisLab vans were considered true autonomous vehicles, this would not be the case (Mearian, 2015; Snavely, 2015). Just like Delphi’s autonomous vehicle’s destination was the New York International Auto Show, VisLab’s vans destination was the Shanghai World Expo in 2010.

Figure 1
VisLab driverless van
Source: http://zedstarr.net/

Figure 2
Twin VisLab vans
Source: http://zedstarr.net/

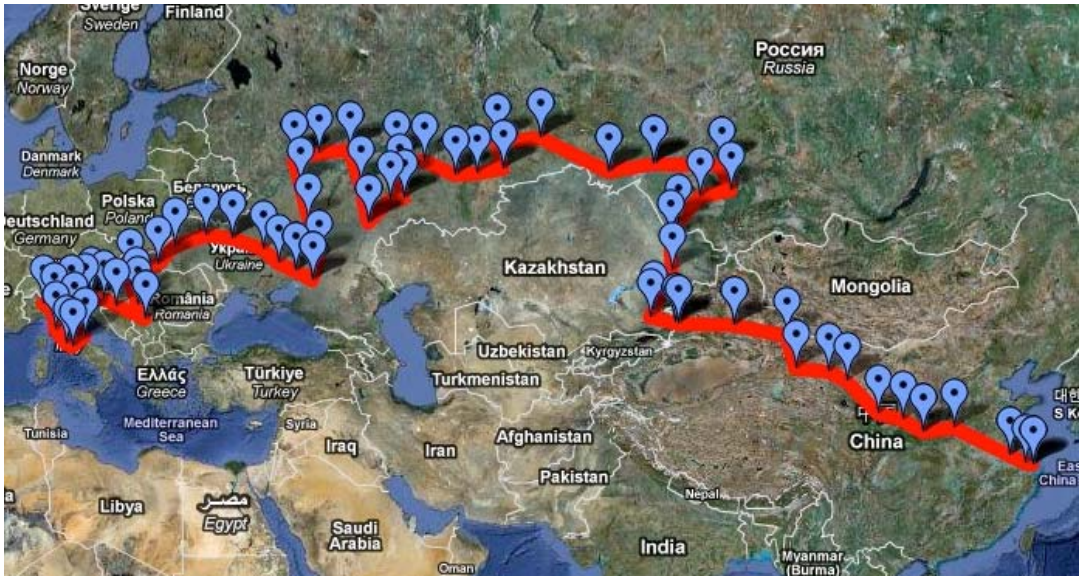

Figure 3
VisLab itinerary
Source: http://zedstarr.net/

Figure 4 shows the Audi SQ5 SUV that Delphi used to attach their equipment to, thereby transforming the vehicle into an autonomous vehicle. The vehicle has three Lidar (laser radar) devices in the front and two in the rear bumper. The vehicle is also equipped with a vision camera mounted inside the front windshield (Lam, 2015). The vehicle was classified as a Level 3 level of automation in NHTSA classification system because it always had a driver in the driver's seat in its trip from San Francisco to New York. Autonomous operation of the vehicle was operated on the interstate highway system only, and only during the day; human operators took over control of the vehicle when driving through city streets (Lam, 2015; Snavely, 2015).

The main purpose of Delphi's cross country expedition was to assess the performance of their suite of advanced driving assistance systems (ADAS) (see Figure 5). The built-in screen displays the vehicle's use of the autonomous vehicle software and vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) wireless communication technology. Another goal of the expedition was promotion and publicity. As autonomous vehicle proponents are seeking lawmakers to champion autonomous vehicle legislation, the Delphi journey was set up to receive as much media attention as possible.

Figure 4
Delphi's automated Audi SQ5 SUV
Source: Mearian (2015)

Figure 5
Built-in screen on Delphi's Audi SQ5 SUV
Source: Mearian (2015)

Future Developments

As mentioned earlier, driver-assistance technology is likely to serve as a precursor to driverless technology and is therefore needed in this study to anticipate the timing and nature of autonomous vehicles. The predicted developments are all the more likely given the enthusiastic

support there is in certain circles of government and among some researchers. Some believe that the publicity the subject has received will likely convince younger generations to embrace the technology in increasing numbers (Forrest and Konca, 2007).

Review of the literature in the past 15 years reveals a change in concerns surrounding autonomous vehicles. Earlier publications focused on the potential benefits of autonomous vehicles (decrease in pollution, traffic, travel time, and accidents, and greater safety and opportunity to conduct other tasks while traveling). In the beginning, speculation was rife but as implementation has continued, researchers have experienced the difficulty of operationalizing certain parts of the process. On the technical side, perhaps the most difficult part of the development of autonomous vehicles is interpreting the data collected by the sensors (Rand, 2014, p. xix). On the human side, it is the response the public will have to autonomous vehicles, and on the legal side, it is the issue of liability (Schwarz et al., 2013, p. 33, 54).

Some researchers point out that a few professional fields are likely to be negatively impacted, if not eradicated, by the spread of autonomous vehicles: valet parkers and taxi drivers are examples of professions that might become obsolete (Bamonte, 2013). In one case, it was predicted that autonomous vehicles will be used in private professional areas such as airports, warehouses, and factories by the end of 2015, changing the face of the common perception of the taxi driver or manufacturer (Sturdee, 2010). However, market penetration of autonomous vehicles is going to be considerably slower than that. According to the majority of researchers, widespread use of autonomous vehicles will probably only occur in the 2030s or 2040s (Underwood, 2014).

Some researchers have mentioned the possibility of vehicle-sharing services where a car can be used episodically like a shopping cart, rather than owned (Bamonte, 2013; Burns, Jordan, and Scarborough, 2013). An analysis by the Earth Institute at Columbia University shows that full use of such a system could have tremendous economic savings due to the greater utilization of vehicles, smaller fleet size, and reduced parking needs (Burns, Jordan, and Scarborough, 2013). The Earth Institute study assumes autonomous vehicles are hailed electronically, pick up a customer at their point of request, and drop them off at their destination without having to park because the vehicle would be again available to serve the next request for service. Utilization of vehicles is increased from approximately 1 hour per day with a privately owned vehicle to approximately 8 hours per day with shared vehicles, the fleet size could be reduced by approximately 85 percent while still incurring wait times of less than a minute, and parking costs would be virtually eliminated (Burns, Jordan, and Scarborough, 2013).

Autonomous vehicles are expected to reduce car crashes due to elimination of human error brought on by imperfect human performance, distraction, fatigue, inebriation, or physical impairment. Autonomous vehicles feature crash avoidance applications, including connected

vehicle technology communication (Jin et al., 2014). They are expected to be able to allow safe operation of vehicles with short headways thereby reducing traffic problems (Bamonte, 2013; U.S. Committee on Transportation and Infrastructure, 2013). While widespread use of such close car-following practice may not occur for a long time due to the need for all vehicles to be autonomous, the prospect of autonomous vehicles operating in platoons is feasible and has been demonstrated by Volvo in the European Union's SARTRE project (Safe Road Trains for the Environment) where four driverless vehicles followed a professionally driven lead vehicle at 20-foot headway for 120 miles in Spain (Iliaifar, 2012). The concept of road trains is that suitably equipped vehicles state their destination and are then guided to the nearest road train which they join by approaching the trailing vehicle in the road train and ceding control. Close to their destination they are given the opportunity to regain control and leave the train by moving out of the line. The remaining vehicles move up to close the gap left by the exiting vehicle. Road trains of up to eight vehicles are envisaged at the moment to limit the restriction they would pose to vehicles wanting to overtake them, the difficulty they would have in overtaking slower vehicles, and entering freeway traffic at an on-ramp.

Authorities such as NHTSA are mindful of the fact that development is being driven by so-called original equipment manufacturers (OEMs) such as auto manufacturers and other developers, and the role of NHTSA in the process is to direct development without inhibiting innovation. In keeping with that mindset, they suggest that individual states not make restrictive laws and regulations, but regulate operations only to the extent necessary to ensure public safety (NHTSA, 2013).

NHTSA (2013) does not recommend the widespread (commercial) introduction of autonomous vehicles on public roads at this stage – only testing is currently supported. They also do not recommend regulating autonomous vehicle technological performance, calling it a premature complication. Beside public policy, there appear to be certain market properties that limit introduction of autonomous vehicles in the current situation:

- Cost is still a problem for car manufacturers. Current costs for autonomous vehicles are typically still above $100,000.
- Research funds are limited. States such as California are taking full advantages of "federal funds that are currently available to states for the purpose of testing automated vehicle technologies on roads and highways" (California Senate Bill 431, 2015), but Fagnant and Kockelman (2013) explain that federal funds must be drastically expanded and involve as many federal and state agencies as possible in order to promote autonomous vehicle research and development on a national scale.

- Consumers – drivers – enjoy being in control of their cars, but there is a growing population of consumers who want to multi-task when driving (Yeomans, 2014). Driverless vehicles allow them to do so safely. Indeed, NHTSA (2013) predicts a significant change in the way drivers interact with vehicles in the next 10 to 20 years. Yeomans (2014) explains that training and education programs should help familiarize drivers with this new mode of transportation.
- The highway infrastructure is not presently ready to accommodate widespread use of autonomous vehicles. Bamonte (2013) explains that this should not be a primary concern. He gives the example of Henry Ford's first horseless carriages that had to first ride dirt roads before bitumen roads were built, due to the "pressure of innovation." He argues, "when onboard and infrastructure technology work together, the full potential of driverless vehicle technology can be realized." Presently, Sweden is the only country with roadways specifically certified for autonomous vehicles (Miller, 2015). Nevertheless, the Iowa City Area Development Group (ICAD), along with Paul Trombino (Director of the Iowa Department of Transportation), are champions for certified autonomous vehicle-only roadways in their state. They report that approval of such roadways is imminent, based on a conversation held at a May 2015 meeting with state officials (Morelli, 2015).
- While in the U.K. liability rests on drivers regardless of their vehicle's autonomy level, the question of liability remains an issue of intense debate in the U.S.
- Autonomous vehicle development is expected because of the growth of the elderly population. Bamonte (2013) explains that these devices are particularly relevant for the mobility needs of an aging baby-boomer population. It is also relevant to the affinity young drivers have of new technology. In Germany, some analysts predict that within 5 to 15 years, autonomous vehicles will be fully functional on motorways, although they expect strong public resistance initially. Nevertheless, they expect that as the younger more computer-savvy generations become a larger portion of the population, autonomous vehicles will be commonplace with little or no human resistance or interference in the next 15 to 25 years (Sturdee, 2010).

A parallel activity to the development of autonomous vehicles has been the development of autonomic computing. In 2001, IBM launched a campaign for autonomic computing as an answer to the growing complexity of information systems and the difficulty that any single individual has in understanding an entire system (Horn, 2001; Eze et al., 2011). Autonomic computing is an Information Technology (IT) system that self-manages in the same way that the human nervous system autonomically initiates human body responses to certain stimuli (Jacob et

al., 2004; Kephart, 2005). For example, when the human body gets hot, it autonomically initiates perspiration activity to cool the body down. Similarly, shivering is autonomically activated to warm the body when it is cold. Autonomic computing systems are designed to operate in a similar manner in that they automatically initiate responses to certain stimuli or “triggers” in the system. Responses to stimuli in autonomic computing systems are typically classified into those that adapt, heal, optimize, or protect the system. Stimuli that launch these responses can be internal conditions that develop in the system due to the dynamic nature of the operation being managed, or they can be policies or standards of a company that are fixed within the system or changed from time to time. The connection between autonomic computing and autonomous vehicle operation is that the fusion of sensor information is going to put great demands on computing capacity and autonomic computing may be necessary to maintain decisions within accepted time norms and resiliency of the decision process to unexpected conditions.

AGENCIES AND ORGANIZATIONS INVOLVED

Specific agencies and organizations have a responsibility or interest in the technological development of autonomous vehicles. These agencies investigate not only technology research, but also administrative and legal matters. For instance, nationwide, Centers for Transportation Research, largely associated with universities, overview the feasibility and legal implications of autonomous vehicle implementation (LSU, North Carolina State University, Texas A & M, UT, and more).

Some agencies such as the National Highway Traffic Safety Administration (NHTSA) are already actively involved in addressing this issue, but the role of other stakeholders such as the insurance industry, auto manufacturers, autonomous vehicle researchers, legislators, U.S. DOT sub-groups and offices, and state Departments of Transportation are also crucial in the development of this technology as they each have a high degree of interest or responsibility in the matter.

NHTSA serves as a liaison to stakeholders and is primarily concerned with safety. The Agency sets and enforces safety performance standards. It manages federal funds and awards financial assistance to state and local research/technology programs that promote safe transportation (Jin et al., 2014). It also provides guidelines and recommendation for safe autonomous vehicle implementation and legislation within each state. NHTSA also has rulemaking authority in vehicle design, as it demonstrated when it mandated (rather than recommended) that all new vehicles sold domestically feature a “black box” type event data recorder (EDR) (Kohler and Colbert-Taylor, 2015).

The U.S. DOT collaborates with several other federal departments in AV development. The Department’s role includes identifying benefit opportunities in AV technology, facilitating development and deployment, investing in research, and establishing standards and guidelines (NHTSA, 2015).

At the international level, the U.S. DOT collaborates with the European Commission Directorate-General for Communication Networks, Content and Technology, Smart Cities and Sustainability (DG-CONNECT) and Japan’s Road Bureau of Ministry of Land, Infrastructure, Transport, and Tourism (MLIT). This collaborative effort makes up the Tri-Lateral Working Group in Road Transport. The group collects GIS data in order to help support V2V and automated vehicle technologies (NHTSA, 2014; Vehicle and Road Automation, 2015).

The Intelligent Transportation Systems Joint Program Office (ITS JPO) within the Research and Innovative Technology Administration (RITA) of the Office of the Secretary of Transportation manages and supervises research programs on Intelligent Transportation Systems (ITS) (Jin et

al., 2014). The ITS JPO has several programs, which are detailed in their 2015-2019 Strategic Plan (Barbesso et al., 2014). Although it focuses mainly on connected vehicles (CVs), it also addresses automation, emerging capabilities, accelerating deployment, interoperability (effective connectivity among devices and systems), and gathering enterprise data. The ITS JPO conducts research on connected vehicle and automated vehicle technology and performance, ITS standards outside the U.S., human factors, and systems engineering. It assesses pilot programs and dynamic mobility apps, and it collects real-time data (Jin et al., 2014; Kohler and Colbert-Taylor, 2015).

Numerous autonomous vehicle legislative bills require the presence of event data recorders. Because of Wi-Fi and EDR data in autonomous vehicle's, concerns have been raised regarding cybersecurity (Koscher et al., 2010; Javaid et al., 2012; Kim et al., 2012; Ibarra and Ward, 2013; Xue et al., 2014) and privacy (Warrior et al., 2003; Douma, 2012; Glancy, 2012; Thierer, 2014) in driverless vehicles. While state bills rarely address these concerns, the Federal Trade Commission is responsible for the regulation of consumer data (Kohler and Colbert-Taylor, 2015).

Law centers worldwide are concerned with issues such as the liability of auto manufacturers in crashes, driver licensing and training, the transport of minors, and the possibility of malicious intervention in the operation of an autonomous vehicle. This remains an essentially unresolved issue.

State Departments of Motor Vehicles (DMVs) and state Departments of Transportation (DOTs) collaborate with the state legislature in the drafting of autonomous vehicle law bills. DOT administrators contribute to autonomous vehicle bill committees, and are sometimes assigned responsibility for revision, editing, and detailing (providing dates, amounts, etc.) of autonomous vehicle bill texts. Administratively, DMVs are also responsible for processing autonomous vehicle testing applications and often for determining the content therein, as exemplified in the California and Nevada laws. In states such as Michigan and in the District of Columbia, the DMV endorses and provides a new class of driver's license for autonomous vehicle operators.

The Federal Communications Commission (FCC) is an independent U.S. government agency that regulates communications across states. This includes communication via media such as television, satellite, cable, radio, and even to some extent the internet[1]. The FCC dedicated the 5.9 GHz band to V2V and V2I vehicle communication, primarily to promote vehicle safety

[1] More recently, a debate emerged concerning the FCC regulating the internet as well. While in September 2014, the FCC stated that it did not oversee either the internet or internet service providers (U.S. Federal Communications Commission, 2014), the February 2015 Net Neutrality debate ended in the FCC voting to take control over the manner in which internet service is regulated.

(FCC, 2004). It is referred to as Dedicated Short Range Communications (DSRC) because transmission is typically less than 1,000 meters and it is dedicated to vehicle communication. It is estimated to add between $100 and $200 to the cost of a new vehicles but new vehicles have not been including it as an embedded item at the expected rate in new vehicles to date, resulting in the question as to whether it should be opened up to other uses as well, such as vehicle diagnostics and commercial transactions (Anderson et al., 2014). Original Equipment Manufacturers (OEMs), generally oppose opening up the DSRC band for more general use but recognize that "tethered" equipment, in contrast to "embedded" equipment (e.g. embedded GPS systems built into vehicles versus GPS tethered to a vehicle via a portable device), may provide greater flexibility and upgrading opportunities. Some researchers feel that DSRC should not continue as “a proprietary technology” in order to remain in the communications environment and develop along with 5G technologies (Moore, 2015).

There is a wide range of literature on the uncertain role of insurance companies resulting from the introduction of autonomous vehicles into road transportation in general. One uncertainty is the expected decrease in accident frequency and the impact this will have on the volume of business in the industry (Anderson et al., 2014; Nash, 2013). Another uncertainty is the issue of liability. Most auto manufacturers are opposed to driverless vehicles because that places the full responsibility on the vehicle's operating system in case of a crash. However, Google has envisaged their vehicle serving the blind and other individuals who cannot currently use transportation on their own, so there are conflicting views on the degree of automation that will be catered for and there is no direct assessment of where liability will be placed and how it will be accounted for. The insurance industry will have to address and resolve this issue before the onset of public use of autonomous vehicles. At the moment, almost all autonomous vehicle legislation requires a driver to be in the driver’s seat of an autonomous vehicle and provide $5m in liability insurance.

Currently, car insurance premiums are contingent upon the driving record and experience of the insured and the distance driven per year in the vehicle. Obviously, driverless vehicles do not provide that information so the way insurance companies determine premiums will need to be altered (Peterson, 2012). In addition, the content of vehicle policy coverage (what to insure the vehicle against) is also uncertain, as testing is not developed enough to determine what constitutes a technical failure in the operation of an autonomous vehicle (Beiker, 2012).

The company KPMG recently published the results of a survey regarding the future of insurance companies in the wake of autonomous vehicle development (KPMG, 2015). The findings counter the common gloom surrounding the question of autonomous vehicles and insurance. The KPMG insurance task force interviewed senior insurance executives throughout the U.S. The report predicted a shift from insuring persons to insuring products. Indeed, as driverless vehicle

components are more expensive than standard vehicles, accidents are predicted to be less frequent but more severe and costlier. Thus, although companies expect to lower their personal insurance premiums, they expect to increase product liability insurance. Approximately 40% of surveyed respondents stated that autonomous vehicles will results in new provider groups and niche writers. Of the respondents, 29 percent foresee an increase in the insurance industry consolidation. Less than 20% expect a drastic reduction in sales and distribution.

Automobile manufacturers are critical agents in the expansion of autonomous vehicle use and marketability[2]. They are strong proponents of the development of autonomous vehicle legislation. Their problem is that when it comes to autonomous vehicles, their profit margin is relatively low (Yeomans, 2014). This limits their motivation to advocate for laws in favor of autonomous vehicle operation. While the integration of autonomous vehicle technology results in expensive vehicles, most manufacturers expect to reduce prices in the future. Nevertheless, the decrease in the cost of Lidar is still uncertain presently, which is why manufacturers have not launched autonomous vehicle's for mass-market yet (Shchetko, 2014).

Autonomous vehicle marketability is strongly influenced by market research companies' publications that set the tone for production launching and legislative efforts to adapt the law to a changing society. In January 2015, *Bloomberg Business* announced that by the end of 2025, the autonomous vehicle global market could reach $42 billion for cars alone (Green, 2015). Other findings foresee an $87 billion market for autonomous cars by 2030 (Drake, 2014). Only the Google Car was found to have a present value of trillions of dollars in 2014[3] (Mui, 2014).

[2] Even in the wake of the autonomous technology era, AV manufacturers have a marketing approach that still targets a majorly male audience who values horsepower, aesthetics, and even more so, reliability (Bizoni, 2009).

[3] In 2014, *Forbes* published an article reporting that the vehicle autonomy increments from Level 1 to Level 4 allow competition between automobile companies progressive familiarization to the public. However, the article also explained that skipping these transitionary steps is what makes the Google Car so profitable. These other companies (Nissan, Ford, Volvo, Daimler, etc.) that use increments create a long-term clientele for mid-level automation vehicles, which will hurt them financially as they progress to Level 4, as Google may be decades ahead of them.

THE CASE FOR STANDARDIZATION

Terminology

Because the subject of autonomous vehicles is relatively new and gaining momentum very rapidly, there is a need to standardize the terminology used in this area. One such term is the word “autonomous” itself which, because it means independent or self-governing, some researchers maintain cannot include connected vehicle technology because the vehicle would then no longer be independent but dependent on input from other vehicles. However, as argued in the introduction to this report, the autonomy of autonomous vehicles relates to the operation of the vehicle, not to the input it receives provided the input is information and not a command relating to the operation of the autonomous vehicle.

NHTSA has provided an important first step in standardizing concepts and terminology in the autonomous vehicle field by its definition of the 5 levels of automation in their Preliminary Statement of Policy Concerning Automated Vehicles (NHTSA, 2013). As described in the introduction of this report, these include no automation, function-specific automation, combined function automation, limited self-driving automation, and full self-driving automation. SAE International, originally established as the Society of Automotive Engineers in the United States in 1905, has also established a taxonomy of motor vehicle automation. The SAE is a premier standard-setting international organization and in 2014 established standard J3016 which defines 6 levels of motor vehicle automation – no automation, assisted automation, partial automation, conditional automation, high automation, and full automation. These classifications are very similar to those established by NHTSA.

Communication Systems

Autonomous vehicles use sensors to detect their environment and can use vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication to enhance input (Anderson et al., 2014). It is the intention that V2V and V2I use Dedicated Short Range Communications (DSRC), a 5.9 GHz frequency assigned by the Federal Communications Commission (FCC) for short range (< 1 km) communication on transportation facilities. U.S. autonomous vehicles typically rely on high-performance radar (70 GHz), laser (24 GHz), and Lidar systems (Moore, 2015). Autonomous vehicles also use satellite communication for location mapping (GPS), but their functioning does not typically depend on GPS technology. Indeed, cloud-based resources provide information through broadband, while sensor and GIS data are part of a knowledge network with other vehicles and surrounding infrastructure (Anderson et al., 2014).

Because the autonomous vehicle industry is still in its early stages of development and there are several auto manufacturers and researchers involved in the development of autonomous vehicles, there are likely to be different technology configurations in the beginning. Already there are a variety of sensors in use but as the industry matures, it is expected there will be a convergence to the same technology (Baker and Wagner, 2013, p. 434).

Legislation and Regulations

In the U.S., several states are currently considering or pursuing the drafting of autonomous vehicle laws. NHTSA provides expert assistance to such states, especially in terms of licensing, training, and vehicle operation (U.S. Committee on Transportation and Infrastructure, 2013). On February 3, 2014, NHTSA began taking steps to enable V2V communication on light vehicles. The goal is that equipped cars can read other cars' speed, they can "see" all surrounding vehicles, sense the possibility of crash, and warn surrounding connected vehicles to avoid a potential crash.

NHTSA recognizes the benefit of uniform national standards with regard to autonomous vehicles but also feels that it may inhibit innovation and impede on states' rights by being too prescriptive at this stage of autonomous vehicle development (NHTSA, 2013). Thus, NHTSA has compiled a list of recommendations for states to consider when developing state legislation including ensuring drivers understand how to operate an autonomous vehicle safely, that testing autonomous vehicles does not cause risks for other road users, and ensuring that testing occurs during optimal conditions, that is, under conditions in which the vehicle is capable of functioning properly (i.e., in good weather, regular traffic, and adequate road conditions).

The NHTSA autonomous vehicle policy statement released on May 14, 2013, details recommendations to states who are considering the adoption of testing and licensing autonomous vehicle legislation on public roadways. NHTSA has developed recommendations that have served as a baseline for all autonomous vehicle bills in content and in form, but has not recommended any autonomous vehicle restrictions. The agency explains that it needs more insight into autonomous vehicle operations and testing, making restrictions premature at this time.

The recommendations developed by NHTSA are as follows (NHTSA, 2013):

1. Autonomous vehicle operators should possess a driver's license endorsed with autonomous vehicle specifications, or a separate autonomous vehicle driver's license should be issued. Such a document should attest to the operator's proficiency in the safe operation of the vehicle, as proven by the successful completion of an autonomous vehicle manufacturer-certified training program and ensuing examination, or that the licensee has completed a

certain minimum number of hours operating an autonomous vehicle. State DMVs should approve the course prior to awarding an autonomous vehicle driver's license. Course contents should include the following:

- Basic operation of an autonomous vehicle
- Capacity and operational limits of an autonomous vehicle
- Resuming control of the vehicle in case of autonomous vehicle technical failure

2. Autonomous vehicle laws must ensure that autonomous vehicle testing does not endanger other road users. Several measures can help strengthen road safety:
    - Conduct autonomous vehicle testing on private property for a certain number of miles before releasing an autonomous vehicle on public roads
    - Report prior testing results and data before an autonomous vehicle is approved for testing on public roads
    - Require applicant testers to submit a plan detailing their safety measures and their concrete steps to minimize safety risks to other drivers and passengers (training program for operators, technological devices, etc.)
    - Require the physical presence of an autonomous vehicle-licensed operator in the vehicle's driver's seat. This operator must be ready to gain control of the autonomous vehicle at any time.
3. Testing should be limited to areas and environmental conditions suitable for the driverless vehicle's capabilities. The applicants' testing plan should include the testing conditions expected or desired and proof that the testing vehicle is capable of functioning autonomously in these conditions. NHTSA encourages lawmakers to impose limitations on testing conditions (including weather and traffic limitations) in order to ensure safety. In addition, lawmakers can impose geographic limitations by establishing no-testing zones on specified state roadways.
4. States should monitor testing by requiring and analyzing data. Testing businesses and individuals should submit a mandatory report of their testing results, observations, and data. Reports should contain, among others, any crash or near crash that occurred while in driverless mode or while transitioning to human control, and any autonomous vehicle technology failure that resulted in the operator being prompted to gain control of the vehicle. The report should detail the conditions in which such failure occurred.
5. Due to the early stage of autonomous vehicle technology, NHTSA recommends holding safety standards to a later time in the development of the legislation. NHTSA acknowledges that autonomous vehicle innovations are still incomplete and imperfect, but that they are changing and evolving rapidly.
6. Lawmakers should require that the transition from driverless to human control mode is safe, easy, and immediate. Control should be regained in a method described as "immediately over-riding, relatively simple, and non-distracting." The command tool or device should be within reach. Examples of methods can be similar to those used to exit cruise control in

contemporary manned vehicles and include the touch of a button or key, braking, or manipulating the steering wheel. Any autonomous vehicle system failure, whether external (traffic, road, and environmental conditions) or internal (vehicle malfunction) that demands that the operator takes control of the vehicle should be communicated to him in the form of an alert signal.

7. The vehicle should be able to store and display its history, as well as detecting its own malfunction. It should also be capable of discerning when vehicle operation occurs in a degraded state, and notify the operator, letting him take control at an adequate time. Accessing the vehicle's internal history should enable testers to determine the origin or cause of any malfunction, degradation, or control failure in the autonomous vehicle technology. In the event of a crash or loss of vehicle control, the vehicle should retain in memory the performance of the driverless technology (sensors, GPS, etc.). The memory should contain sufficient data to diagnose and assess the performance of the autonomous vehicle's technology. Testers must make such data available to the state authority in the event of a crash.
8. Lawmakers should draft bills that ensure that the installation of autonomous vehicle technology and the operation of autonomous vehicles do not conflict with federal safety requirements. Safety systems required by federal authorities may not be disabled for the sake of autonomous vehicle testing. Laws should ensure that such technology does not interfere with federally-mandated safety systems (e.g., safety belts, airbags, emergency exits, etc.) by making them inoperative or unable to be deployed or utilized in a timely manner.
9. Finally, NHTSA recommends that autonomous vehicle operation be limited to testing purposes for the time being. Autonomous vehicles should not be available in large numbers as they have not yet been proven safe on public roadways. Nevertheless, states have the freedom to decide whether to allow autonomous vehicle operation for purposes other than testing. States that permit such practice should require the presence of a human driver ready to take control of the vehicle at any time.

In Europe, standardization is already underway. The World Forum is conducting an international harmonization program for vehicle regulation under the UN Economic Commission for Europe (UNECE). In February 2015, the Forum introduced technical provisions for vehicles of Level 2 and Level 3 automation. This sets a precedent for Level 4 policies and guidance for the future development of technical provisions (UNECE, 2015).

PRACTICE IN DIFFERENT STATES

Several states have developed legislation with respect to the operation of autonomous vehicles. Nevada, Florida, Michigan, and the District of Columbia have already passed legislation related to the operation of autonomous vehicles. It is helpful to study and analyze the legislation developed so far, the method by which the legislation was arrived at, and the result of the legislation. Likewise, cases where legislation was specifically not passed provides counter-arguments that are equally valid. In all cases, all bills presented were highly influenced by NHTSA recommendations.

So far, autonomous vehicle bills have been introduced and then shelved, at least initially, in Colorado, Minnesota, New Hampshire, Oklahoma, South Carolina, South Dakota, Texas, and Washington. Nevertheless, shelving a bill does not necessarily end autonomous vehicle use in that state. Legal opinion is that current motor vehicle legislation in force in the U.S. does not prohibit the use of autonomous vehicles (Smith, 2014b). Under the premise that "everything is permitted unless prohibited," it is suggested that since state laws generally do not require that driver operations such as steering, braking, and accelerating be performed with real-time human input, they can be legally conducted by a computer. It is suggested human supervision is sufficient when it comes to vehicle control (Smith, 2014b). A recent decision by NHTSA to consider autonomous operation equivalent to driver operation of the vehicle reinforces this concept.

In the state of Iowa, Johnson County's Board of Supervisors approved a proclamation welcoming companies to use the area to test driverless car operations (Iowa City Press-Citizen, 2014). Other cities in the state, namely Coralville, Iowa City, and North Liberty, are expected to follow with similar resolutions (O'Leary and Santana, 2014). It is seen as an easier path to authorization than drafting a state law.

States with Autonomous Vehicle Legislation

The American Association of Motor Vehicle Administrators (AAMVA), the non-profit association of motor vehicle administration officials in the U.S. and Canada, has compiled a theme-by-theme comparative chart summarizing autonomous vehicle laws in California, District of Columbia, Florida, Georgia, Nevada, and Michigan (Autonomous Vehicle Information Sharing Group, 2014). The themes covered include statutes and regulations, road restrictions, titling requirements, and registration, license plate, and other vehicle requirements. Because it is a large amount of data, it is presented in a 21-page table in small print. However, it makes a good summary of the legislation from these six authorities and allows easy comparison among them.

Nevada

The state of Nevada was the first to pass statutes and regulations for autonomous vehicle testing. Laws and regulations on autonomous vehicle testing and operation are stated in the Nevada Administrative Code (NAC) Chapter 482, Autonomous Vehicles and Nevada Revised Statutes (NRS) Title 43 (Revised April 2014) (see Appendix A). The Nevada Department of Motor Vehicles (NDMV) provided considerable input in the formulation of the statute (the department's additions are indicated in R084-11, the NDMV's amendments to the NAC passed in February 2012). The NRS and NAC Chapter 482A (§ 482A.010 et seq.) give permission for testing and operation of autonomous vehicles on public roads under specified statutes and requirements. Under these regulations, the term "autonomous vehicle" refers to any motor vehicle that features autonomous technology and has the ability to operate without a human. Such vehicles should still perform the necessary maneuvers that are required for any non-autonomous vehicles, and should be able to react adequately to:

- traffic control devices: roundabouts, stop lights, traffic signs, school zones, cross walks, construction zones
- pedestrians/object of variable size: humans, bicycles, animals, rocks
- speed variations: recognize speed limit signs, temporary speed restrictions, school zone variable speed limits
- weather and environment: rain, snow/ice, fog, night driving.

The NDMV issues Autonomous Vehicle Testing Licenses (AVTLs), green license plates, certificates of compliance for vehicles, operation licenses for private autonomous vehicle certifying facilities, and G-endorsed driver licenses to manufacturers, software developers, and individuals upon approval of their application. The AVTL application[4] (mostly constituted of Form OBL-326), is a dense 13-page packet that contains an instructional section providing directions on vehicle standards, safety practices, weather and road condition requirements, and technology evaluation procedures. A second section is a standard-format application form where applicants must provide vehicle data. Applicants must describe their own safety plan, detail the drivers' employment conditions (hiring and training). The license renewal process is virtually identical to the initial application process. Financial responsibilities also include insurance and surety bond requirements ($5m), as specified in Title 43, Ch. 482A (§ 482A.050, 110).

According to 482A.120, AVTL testing is permitted only in authorized geographic locations (listed on the AVTL), and during non-dangerous weather and environmental conditions.

[4] Google's AVTL application was the first one to be approved in February 2012.

Licensees may request additional testing locations. If the DMV approves an addition, licensees are issued new certificates specifying these new locations.

Vehicles to be tested must be certified with a certificate of compliance in order to be sold and registered in the state of Nevada (482A.030, 190). This certificate is provided by the manufacturer or a licensed autonomous vehicle technology certification facility. This document attests that the vehicle has proper autonomous vehicle sensor and safety systems and an owner's manual. Facilities that provide the certificate operate under a license in which requirements and criteria are detailed in 482A.200-290. Autonomous vehicle sellers and suppliers in the state must also ensure that the vehicles have this certificate of compliance. If not, they can obtain one from the state or a licensed facility (NAC 482A.190) and may proceed to testing their own vehicles as well if they have an AVTL[5]. Certified vehicles do not need a testing operator/driver and can be set in autonomous mode.

All approved autonomous vehicles require a license plate upon registration issued by the Department to certify the vehicle is autonomous. Although license plates are issued to each vehicle separately, Form OBL-326 allows for multiple vehicles to be listed in one application.

AVTL, license plates, certificates of compliance, and G driver licenses may be denied, suspended, or revoked to applicants and licensees with bad financial and judicial records, including child support compliance violations (NAC 482A.240, 260-290).

The state of Nevada has striven to produce legislation that is easy to understand. Nevertheless, liability is not clearly established, and neither are penalties and sanctions other than license revocation and suspension. Nevada legislation is reproduced in Appendix A.

Florida

The state of Florida approved House Bill 1207 in 2012 to allow autonomous vehicle testing and operation on state roadways. The document defines autonomous vehicles as an NHTSA Level 4 driverless vehicle. Florida legislation is reproduced in Appendix B.

Manufacturers are responsible for designating operators. The latter must be physically present in the vehicle's driver seat and able to intervene if needed. The bill does not specify driver license requirements, application fees, or the geographic locations where autonomous vehicles may operate other than the "roads of the state." In terms of vehicle safety standards, the bill states that if the driverless vehicle is the result of an alteration of a non-driverless vehicle, the original manufacturer shall not be liable for autonomous vehicle-related technological failure, unless

[5] Continental was the first supplier to obtain an AVTL in December 2012.

failure is the result of a defect on the original unaltered vehicle. Vehicles must have insurance cover for $5m.

Florida Senate Bill 52, enacted in January 2013, prohibits texting while driving but explicitly exempts autonomous vehicle operators if they are operating their vehicle in autonomous mode. The bill permits collection of device data as evidence in prosecuting drivers violating the law.

District of Columbia

The District of Columbia approved D.C. Code Title 50 Chapter 23A in 2013 to allow the D.C. DMV to authorize autonomous vehicles for testing on the roads in the district as per their Autonomous Vehicle Act of 2012 (see Appendix C). The Act amends Chapters 1, 4, and 20 of the district's Title 18 law (Vehicles and Traffic). The D.C. DMV is responsible for protocols such as establishing designated location and registration requirements and other specifications not specified in the statute such as fees, issuance, permits, and title to operate autonomous vehicles in D.C.

The D.C. DMV has established rules for an autonomous vehicle driver license class. Operating an autonomous vehicle without a human driver who holds a valid driver's license is prohibited. The DMV issues driver licenses endorsed with an "A" to designate testing drivers. D.C. Code Title 50–2352 details autonomous vehicles permitted. Test vehicles must be capable of switching to human control if necessary and immediately upon request or need. A human operator/driver must be present in the vehicle and ensure that the vehicle operates in accordance with traffic and motor vehicle laws. Registered vehicles are issued a special tag from the DMV.

Concerning liability, §50–2353 specifies that proceeding to third party vehicle conversion (converting a human-controlled vehicle into an autonomous vehicle) limits the likelihood of liability of the original manufacturer if defects are caused by the vehicle's conversion. Vehicle models earlier than 2009 may not be converted.

Michigan

The state of Michigan approved Act 231 of the Michigan Vehicle Code in December 2013, after Bill SB 169 was introduced in February 2013 (see Appendix D). It was enacted in March 2014. This Act is a series of amendments to the Public Act (PA) 300 from 1949, pertaining to vehicle operation, licensing, and liability. The Act uses the term "automated motor vehicle," but it corresponds to what has been described as an autonomous vehicle in this report (see pages 1 and 2).

Autonomous vehicles may be operated by operators designated by registered manufacturers only [Sec. 665(2)]. Although vehicles may be operated anywhere when they are in non-autonomous (human driver) mode for purposes other than testing, navigation in autonomous vehicle mode is

limited to streets and highways, and is limited to testing use only (Sec. 663). A human operator or assistant must be in the vehicle at all times during testing, and the vehicle must be capable of switching to human driver mode immediately upon need or request (Sec. 665(2)). During testing in autonomous vehicle mode, operators may use handheld wireless devices [Sec. 602b (4)(e)].

Operators must have a valid driver's license [Sec. 665(2)]. Nevertheless, Michigan is one of the few states that does not adhere to the Driver License Compact in which states recognize each other's driver's licenses in a reciprocal agreement. Michigan's self-exclusion from this agreement will result in non-Michigan registered autonomous vehicles not being recognized in Michigan, and vice versa.

Autonomous vehicle manufacturers must be recognized as such by the Michigan Secretary of State. So-called "up fitters" – individuals or firms who modify an already manufactured vehicle to convert it to an autonomous vehicle – must also be recognized by the Michigan Secretary of State (Section 244 of the Michigan vehicle code, 1949 PA 300, MCL 257.244).

Autonomous vehicles must be registered. Unlike other vehicles, Vehicle Identification Numbers (VINs) are irrelevant for autonomous vehicles because these vehicles are allowed for testing only. Thus, registration is completed based on the manufacturer/owner's information. Upon approval of registration, the Secretary of State issues a special manufacturer-labeled license plate (Sections 224(3), 225, and 665).

Vehicle insurance is mandatory. Conditions for insuring are detailed in Chapter 31 of the Michigan insurance code of 1956, 1956 PA, MCL 500.3101-3179. Regarding reporting terms, the law does not detail expectations regarding the frequency of testing reports. However, Section 665(3) states that the Michigan senate will update its law in 2016, based on findings that follow testing.

California

The state of California approved CA Senate Bill 1298 (Chapter 570) in 2012 to allow the California Department of Motor Vehicles (CDMV) to regulate autonomous vehicle testing and operation on state roadways (Soriano et al., 2014). The CDMV developed regulations in support of California Vehicle Code Division 16.6 (§ 38750 et seq.); Title 13, and California Code of Regulations, Division 1, Chapter 1, §227.00 et seq. (CCR 227) Testing on Public Roads (see Appendix E). The regulations direct the testing, operation, and public deployment of autonomous vehicles in the state in what is called to the Autonomous Vehicle Tester Program (AVTP).

The CDMV issues AVTP Manufacturer's Testing Permits (MTP) (CCR 227.16). Manufacturers are specifically prohibited from operating autonomous vehicles without one. The permit is valid for one year, and it allows for one year of testing 10 vehicles with 20 driver/operators for a $150 fee. Additional testing is offered in increments of 10 vehicles and 20 driver/operators. The MTP

application (Form OL 311) is relatively concise and succinct, considering that only manufacturers may enter the AVTP (as opposed to Nevada that includes individuals and sellers).

CCR 227 does not specify geographic locations in which testing can be conducted, which implies that testing is permitted on all state roadways. California allows using autonomous vehicles on these roadways for purposes other than testing, provided the manufacturer has already tested the vehicle on public roadways and possesses a minimum $5m safety bond or a Certificate of Self-Insurance to that amount (227.04). The manufacturer must certify that the vehicle features a conventional (human) operation system and that transition to human driver mode is not only easily feasible, but also mandatory in instance of autonomous system failure. Special registration of autonomous vehicles is not needed by the CDMV. Commercial vehicles, however, do not qualify for testing on state roadways (CCR 227.52).

Manufacturers may not dispose of their vehicles. They may only be sold to other manufacturers, educational institutions, or museums. If the vehicle is inoperable, they may sell it for parts to a certified auto dismantler, after having applied for and obtained a Nonrepairable Vehicle Certificate (CCR 227.50). Regarding autonomous vehicle evaluation, reports of autonomous vehicle technology failures to the DMV are mandatory: accidents must be reported within 10 days via Form OL 316 (CCR 227.44), and incidents requiring switching to conventional (human-operated) mode must be incorporated in the year's annual report (CCR 227.46).

Drivers/operators are certified through the manufacturer's MTP (manufacturers testing permit) that stipulates who is designated or authorized to operate the autonomous vehicles. They must possess a driver's license corresponding to the vehicle's class and be in good standing (no DUI in the past 10 years, no at-fault accidents, and no more than 1 violation point for traffic violation convictions in the past 3 years). During testing, they are to sit in the vehicle's driver seat. Manufacturers are responsible for training their drivers/operators through a program described in their MTP application (CCR 227.22).

Liability is not addressed. HB 431 that was introduced in February 2015 and passed in May 2015 allows driver-assistive truck platooning and urges the state legislation to pass autonomous vehicle laws in a timely manner in order to benefit from federal funding for states that allow autonomous vehicle testing. In February 2015, AB 1164 was introduced to add Section 14526.7 to the California Government Code, requiring "annual evaluation and rating of the overall quality of the state highway system and the resources" to ensure that roadways are appropriate for autonomous vehicle operation.

Tennessee

Senate Bill 598/House Bill 616 was introduced in February 2015. The Senate Committee for Transportation and Safety submitted a favorable recommendation after making amendments to

the original draft. Under the motivation of public welfare (Section 2), the bill seeks to add a new section to the Tennessee Code Annotated, Title 55, Chapter 8. The bill defines "autonomous technology" as "technology installed on a motor vehicle that has the capability to drive the motor vehicle without the active physical control or monitoring by a human operator." The bill does not indicate limitations of autonomous vehicle use in terms of testing, allowed operators, or geographic areas. It, however, mentions that autonomous vehicle's should adhere to state and local safety regulations. After passing the Senate vote unanimously, SB 598 was signed by the Governor in April 2015 and enacted in May 2015.

Arizona

House Bill 2679 was read and failed in 2012. It sought to amend Section 28-3103 of the state's Revised Statutes. The bill explained that autonomous vehicle testing areas were limited to state highways. The bill also stated that autonomous vehicle operators could obtain an autonomous vehicle endorsement on their prior driver's licenses upon passing an examination. The bill was relatively short (2 pages) compared to bills introduced and passed in other states, and contained limited autonomous vehicle-related propositions.

Then, Arizona's House Bill 2167, drafted by the House's Committee on Transportation was submitted in 2013. It called for an act to amend Title 28, Chapter 3, of the state's Revised Statutes through the addition of Article 22 pertaining to what the committee calls "autonomous motor vehicles." The bill reiterated R.S. §28-1231's definitions of the terms "autonomous motor vehicle" and "autonomous technology." These definitions are comparable to our aforementioned definitions of "autonomous vehicle" and "autonomous vehicle technology."

The bill stipulates that autonomous vehicle operators must possess a valid driver's license in order to operate a vehicle in autonomous vehicle mode. Nevertheless, it does not mention autonomous vehicle driver licensing or license endorsement. An operator should be physically present in the vehicle's driver's seat, ready to intervene if and when needed. Testers and operators are to be designated by the manufacturer (whether the third party that installed the autonomous vehicle technology on an existing non-autonomous vehicle car or the company that built the autonomous vehicle).

Regarding vehicle operation, the bill states that vehicles must meet certain safety standards: they must be able to easily switch from and to human control, the autonomous vehicle mode must be visibly indicated when engaged, and the vehicle must be capable of alerting the operator in the case of autonomous vehicle technology failure. The vehicle must be insured at $5m (surety bond or proof of valid self-insurance) in order to qualify for testing. If it is a vehicle that was modified with autonomous vehicle technology by a third party, the original manufacturer of the non-

driverless vehicle is cleared from liability, unless the original non-driverless vehicle was manufactured defective.

In August 2015, Governor Ducey issued an executive order to allow autonomous vehicle testing on the state's public roadways. Pilot programs are designed and conducted at selected universities. Operators are required to have a valid U.S. driver's license, and are not obligated to be physically present in the vehicle during operation. Operators must be "an employee, contractor, or other person designated or otherwise authorized" by the autonomous vehicle technology manufacturer (Ducey, 2015).

Selected universities are responsible for testing oversight via a committee that must also include at least one representative from the Governor's Office, the AZ DOT, the AZ Department of Public Safety, and "any other pertinent agency" (Ducey, 2015). The order commands that these aforementioned organizations and all state agencies provide full support to the implementation of autonomous vehicle testing. The AZ DOT is charged with establishing the form and amount of financial responsibility of which the vehicle owner must show proof, and with the promulgation of any other rules as appropriate.

Utah

House Bill 373 was introduced in February 2015. The Senate Committee for Transportation and Public Utilities submitted a favorable recommendation in March. The bill was signed by the Governor in March 2015, after being passed by the House and signed by the Senate President.

HB 373 seeks to modify the Motor Vehicles Act's Section 41-6a-711, Chapter 52, adding the state Department of Transportation's authorization to conduct autonomous vehicle testing. The limitation of HB 373 is that it only pertains to vehicles equipped with V2V technology. In the amended Section 41-6a-711(2)(b), the bill only allows autonomous vehicles operated as "a connected vehicle technology testing program that uses networked wireless communication among vehicles, infrastructure, or communication devices." These vehicles must be approved by the Departments of Transportation and of Public Safety.

Operation is allowed for testing purposes only, and it is geographically limited to "outside of an urbanized boundary as defined by the United States Census Bureau." HB 373 states that platoons are exempt from safe distance between vehicles regulations that apply to manned motor vehicles (under a provision comparable to funeral processions). Section 41-6a-711(3) requires the Department of Transportation to report testing results annually, on or before October 30 of any year of testing.

States with Autonomous Vehicle Legislation Pending

Connecticut

In January 2015, the General Assembly proposed House Bill 6344. A Joint Transportation Committee was established, and an official hearing was held in February 2015. The one-sentence-long bill is an Act that aims at "allowing the use of autonomous vehicles in Connecticut for testing purposes," and directs the CT DMV to promulgate regulations on autonomous vehicle use

The Connecticut General Assembly website features published testimonies from the members of the Transportation Committee that report members' positions on the issue. The state's Department of Motor Vehicles issued a letter expressing its opposition to HB 6344 on the basis that the Department does not have enough expertise in the matter to approve autonomous vehicle legislation (Ayala, 2015). The State Relations Analyst of Honda North America, Inc. recommended the legislation should be modeled after Maryland's autonomous vehicle legislation. The Alliance of Automobile Manufacturers (AAM) stated that it was too early to draft legislation (Dooley, 2015). Laura Dooley, Director of State Affairs for the AAM added that legislation such as HB 6344 stifles the advancement of research and development and therefore the AAM could not support the bill. Google agreed with AAM in that the Head of State Legislative Affairs for Google wrote a letter to the Transportation Committee criticizing HB 6344 for limiting autonomous vehicle operation to testing only, which he wrote is too "narrow" and limits the expansion of autonomous vehicle technology development. He added that laws should not be imposed on technology and that they "send the wrong signal" to scientists and potential consumers.

Georgia

In February 2014, Senate Bill 369, sponsored by Georgia Senator Joshua McKoon, was introduced. It was assigned for a second reading, but was then shelved. A month later, the Georgia General Assembly passed House Resolution 1265 that established a House study committee on autonomous vehicle technology.

SB 113 was introduced in February 2015. A replica of SB 369, the bill seeks to amend Title 40 of the Official Code of Georgia Annotated. The bill proposes the creation of a new motor vehicle class: "autonomous vehicles." SB 113 is currently at its second reading.

Section 1 amends Title 40 of the Official Code of Georgia Annotated by adding two new paragraphs to Code Section 40-1-1 that define "autonomous technology" and "autonomous vehicle."

Section 2 adds a new part to Article 13 of Chapter 6. It details that an autonomous vehicle must be operated in compliance with federal and state standards and regulations. Autonomous vehicle operation must be activated and de-activated with ease. Engaged activation mode should be visible inside the vehicle (other states do not specify where the indicator should be placed). The vehicle must feature a security system that notifies the operator of any autonomous vehicle technology failure (Section 40-6-369.5).

Autonomous vehicle operation is reserved for testing purposes only. Testing entities are required to submit to the Department of Revenue a minimum of $5m surety bond or documentation of liability insurance coverage (40-6-369.6). In case of injury, manufacturers of original vehicles are not held liable if autonomous technology was installed in the vehicle by a third party that converted a non-autonomous vehicle into a Level 4 vehicle, unless the defect that caused the injury was present before the vehicle was converted (40-6-369.7).

According to 40-6-369.6, manufacturers are responsible for designating operators. The latter must possess a valid driver's license and be physically present in the vehicle, ready to intervene if needed. The bill also mentions sanctions for anyone who violates the laws it proposes, in the amount of a maximum of $1,000 in fines (40-6-369.8). Unlike other bills that indicate the supremacy of federal laws, Section 3 indicates that this Act supersedes "All laws and parts of laws in conflict with this Act."

Hawaii

In 2014, the Hawaii House of Representatives submitted House Bill 1461. The bill sets out to amend Section 2 Chapter 286 of Hawaii Revised Statutes. The term "manufacturer" is defined as the builder of the autonomous vehicle or the person/corporation that transforms a driving vehicle into an autonomous vehicle by installing the corresponding technology. Manufacturers may not test their non-commercial (Section 286—102) vehicles on state property unless the vehicles are verified to be category 3 or 4 and the DMV approves their application for testing.

To qualify as an autonomous vehicle, certified vehicles must possess access-friendly autonomous vehicle technology that can be activated and de-activated with ease. Engaged activation mode should be visible. The vehicle must feature a security system that safely notifies the operator of any autonomous vehicle technology failure, in which case it should either require manned mode or cause the vehicle to come to a complete stop. Switching to human control should be feasible through more than one action (e.g., manipulating the brake, accelerator pedal, or steering wheel) and disengagement of autonomous vehicle mode should be immediately communicated to the operator. Autonomous vehicle technology may not interfere or enter into conflict with current national and Hawaii laws and standards. The bill requires testing vehicles to be continuously insured through surety bond or self-insurance for $5m. Application and testing fees are

established at a maximum of $500, payable to the Department. Chapter 286-C specifies sanctions (civil actions) for certified manufacturers who willfully and knowingly fail, neglect or refuse to abide by the rules detailed in Section 2. Such sanctions are applied to each distinct offense and are imposed in the form of financial penalties of up to $1,000 per offense.

The operator does not necessarily have to be physically present in the car. The operator is specified as the person who "causes the autonomous technology of an autonomous vehicle to engage" and monitors the operation to ensure that it takes place safely (§286-A and §286-C). Operators who are allowed to test must possess a valid driver's license (section 286-102). Operators must be trained to respond to autonomous vehicle technology failure or emergencies by taking over the control of the vehicle. Operators who fail to abide by the rules specified in this bill may be subject to penalties from the Hawaii code (Chapter 91).

The problem of liability is addressed in §286-D. The bill offers a policy comparable to Nevada, Washington DC, and Michigan laws in the sense that it clears the original manufacturer of an autonomous vehicle that is the product of technological conversion by a third party, provided the original non-autonomous vehicle was not already defective. Unless there is proof of reckless endangerment, the operator is also cleared from any liability.

The bill does not specify testing sites and length of testing for each vehicle. According to §286-E, the deadline for the Director of the Hawaii Department of Vehicles to adopt rules or propose amendments in accordance with chapter 91 (testing autonomous vehicle's) was set for January 2, 2015. These rules aim at detailing licensing conditions and testing limitations. Nevertheless, the decision to adopt is still under consideration. In February 2015, the House gathered a committee whose mission is to conduct further investigation of autonomous vehicle implications.

Idaho

In Idaho, Senate Bill 1108 seeks to amend Title 49 of the Idaho Code by adding Chapter 37, Title 37 and Section 49-102 of the Idaho Code. Chapter 37 would allow autonomous vehicle use for testing purposes only. It differs from other bills in other states in that it requires $1m liability insurance from the testing entity prior to testing, which is $4m less than what most states mandate. Beside insurance coverage, the bill regulates vehicle operation and safety standards. SB 1108 passed the Senate vote in March 2015.

Illinois

House Bill 3136 seeks to amend the Illinois Vehicle Code by creating a new Chapter on autonomous vehicles. The bill defines the terms "autonomous technology," "autonomous vehicle," "operator," and "manufacturer." These terms are defined similarly to the aforementioned bills.

The bill states that autonomous vehicle's may be used on public roadways for the purpose of testing. Upon successful completion of testing, manufacturers may submit an Application to Operate that must be approved by the Illinois Secretary of State (as per subsection (a) of Section 12a-201 and 202).

The application process includes the submission of evidence of $5m insurance, safety bond, or self-insurance. There is also an application fee assessed on the manufacturer/applicant (the amount is unspecified) that aims at recovering all costs incurred by the Secretary. The bill does not specify attribution or clearing of liability.

Drivers are designated by the manufacturer. They must be physically present in the driver's seat while conducting testing on public roads, ready to take manual control in case of an autonomous vehicle technology failure or emergency. The bill does not indicate licensing requirements. However, it states that the Secretary may, along with the Illinois State Police, adopt other regulations such as new driver's licenses and revocation, suspension, or denial thereof.

Regarding vehicle requirements, the bill indicates that the vehicle must be proven safe. The operator should be able to engage and disengage the autonomous vehicle mode easily, and the vehicle should feature a visual indication that it is in autonomous vehicle mode. The vehicle must safely alert the operator of any autonomous vehicle technology failure, letting the operator regain manual control or coming to a complete stop safely if the operator is unable to. Engaging manual control should be easy and feasible at the touch of a button, by braking, or by manipulating the steering wheel, in which case the operator should be alerted that the autonomous vehicle mode is disengaged. The vehicle should meet all federal safety standards imposed on autonomous vehicles and non-driverless vehicles. The autonomous vehicle system cannot interfere or come into conflict with federal standards, and all NHTSA regulations supersede all regulations present in HB 3136. The vehicle must be able to record sensor data for at least thirty seconds before a crash involving another vehicle, a human person, or an object while in autonomous vehicle mode. The data can be extracted in an unalterable format (read-only), and the recorder should retain the data for three years from the day of the crash. Manufacturers are responsible for notifying purchasers in writing of the kind of information collected in the vehicle's internal database. Vehicle registration for autonomous vehicle is not specified in the bill, but the document indicates that registration regulations may be drafted and adopted by the Secretary and the Illinois State Police.

A follow-up to the bill may include a fiscal note that would detail the financing of autonomous vehicle testing, and the drafting and adoption, with the participation of the Illinois State Police, of regulations regarding the number of vehicles allowed to be deployed simultaneously

In regards to the bill's status, no information is available beyond the fact that the Committee on Vehicles and Safety of the Illinois House of Representatives was assigned the bill on March 10, 2015.

Louisiana

House Bills 937 and 938 were introduced in February 2014 to define and regulate autonomous vehicle testing and operation. Both bills were assigned to committee and have remained in "pending" status since March 2014.

HB 937 seeks to enact Part XVII of Chapter 3 of Title 32 of the Louisiana Revised Statutes of 1950, by adding R.S. 32:691 and 692. §691 defines the term "autonomous motor vehicle" as per this report's definition of "autonomous vehicle" (1), the term "operator" (2), and the term "manufacturer." All definitions correspond to those previously mentioned for other states' bills. §692 specify that DOTD is to adopt the regulations of the proposed act and determine further requirements.

HB 938 complementarily seeks to enact Part XVII of Chapter 3 of Title 32 of the Louisiana Revised Statutes of 1950, by adding R.S. 32:691 through 693. This bill authorizes and provides requirements for autonomous vehicle research, testing and related matters.

Prior to testing, the testing must submit a certificate of liability insurance or proof of self-insurance acceptable to the DOTD in an amount of $5m minimum (§691A(1)). §693 exempts vehicle manufacturers from liability if the autonomous vehicle technology was installed by a third party, unless the technological failure results from a defect in the originally manufactured vehicle.

Operators are designated by the testing entity. They must possess a valid driver's license, be physically present in the vehicle, monitor the operation, and intervene in case of autonomous technology failure [§691A(2)].

For manufactured autonomous vehicles to be operated on state roadways, manufacturers must apply for and receive an autonomous vehicle permit from the DOTD, to whom permit costs are due (§691B). §691C details the required certifications to be enclosed in the application. When applying, the manufacturer must certify that the vehicle features an autonomous vehicle mode engage/disengage key that is easily accessible to the operator [§691C(1)]. The manufacturer must certify that the vehicle is equipped with devices, one inside and one outside the vehicle that visibly indicate that the vehicle is operating in autonomous vehicle mode [§691C(2)] (other states do not require an outside indicator). The vehicle must safely alert the operator of any autonomous vehicle technology failure, prompting him or her to take control of the vehicle if

needed. Regaining control should be conducted with ease (such as at the touch of a button or upon pressing on the brake). If manual control is not possible, the vehicle must be capable of stopping safely [§691C(3)]. The applicant's vehicle must meet Federal Motor Vehicle Safety Standards as mandated in 49 CFR Part 571. Regarding, data storage, the autonomous vehicle must record vehicle activity for at least 30 seconds before a crash if the crash occurs while in autonomous vehicle mode. This data must be stored in an uneditable format (Read-only) in an external drive that is to be archived for 3 years after the crash.

It is stated in §692 that the DOTD will submit a legislative report documenting post-testing autonomous vehicle operation, including larger-scale autonomous vehicle use and additional legislative recommendations.

Missouri

House Bill (HB) 924 was introduced in February 2015 and referred to a Transportation Committee two weeks later. HB 924 seeks to amend Chapter 304, RSMo by adding section 304.145. As opposed to other bills, HB 924 does not provide any introductory definitions. The document describes autonomous vehicle operation conditions for the sole purposes of testing and research. Only autonomous vehicle technology manufacturers are authorized to conduct testing (Section 2), and they are responsible for designating operators with valid driver's licenses [Section 2(2)].

According to Section 2(3), a person must be physically present in the vehicle to monitor its operation, and to take control of the vehicle if needed. The bill does not state explicitly that this person must be the designated operator. Nevertheless, this person, along with anyone else present in the vehicle with him/her, must possess a U.S. driver's license [Section 2(4)], otherwise the operator may be fined up to $100 (Section 3). Again, HB 924 differs from other states' bills in that it does not require that the license be specifically from the Missouri DMV.

Concerning insurance and liability, HB 924 specifies that autonomous vehicles must be insured, but there is no mention of the insurance amount [Section 2(1)]. Section 4 lifts liability off any manufacturer if additional autonomous vehicle technology is installed or if the vehicle is otherwise altered by a third party. There is, however, no mention of any original manufacturer's liability if the fault is not in the alteration of a non-autonomous vehicle.

Subsection 2 of the bill details the conditions under which a person is authorized to operate a vehicle in autonomous mode. A public reading of the bill was completed at the end of March 2015, but no other hearing was scheduled afterwards and the bill is currently not on the House calendar.

New Jersey

Assembly Bill (AB) 2757 was introduced in May 2012. It was assigned to a Committee and shelved the same day it was introduced. So was the case for its duplicate, AB 3020, introduced and shelved a month later. In January 2014, the bill was re-introduced under the appellations S 734 and AB 1326. Section 1 of the bill defines the terms "artificial intelligence," "autonomous mode," "autonomous vehicle," and "sensors." "Artificial intelligence" is what other states' bills have defined as "autonomous/autonomous vehicle technology. "Autonomous mode" refers to the autonomous vehicle technology being engaged. "Sensors" are made up of "without limitation, cameras, lasers, and radar."

Section 2 details driver licenses for autonomous vehicle operators. The bill proposes a license endorsement by the NJ Motor Vehicle Commission for autonomous vehicle operation on state roadways. Licensees do not have to manually drive the vehicle, and the bill does not specify whether they must remain present in the vehicle during operation in autonomous vehicle mode.

Section 3 authorizes autonomous vehicle operation, provided such operation complies with regulations adopted by the Chief Administrator of the New Jersey Vehicle Commission. The latter will develop and adopt such regulations concerning pre-operation vehicle requirements, insurance, vehicle registration, operation and safety standards, testing requirements, geographic area restrictions, and other requirements. Section 3 does not indicate whether autonomous vehicle operation would be allowed for testing purposes only. The bill was assigned to a Committee in October 2014.

New York

Assembly Bill (AB) 7391a-2013, also written as SB 4912-2013, was introduced in May 2013. The bill seeks to amend New York vehicle and traffic law in order to authorize and regulate autonomous vehicle testing and operation on public highways. AB 7391a-2013 adds new sections 100-e and 100-f to the vehicle and traffic laws by defining autonomous vehicles and autonomous technology. The bill also adds new sections 379, 507-a, and 1212-a to vehicle and traffic law.

Section 379 states that federal standards and regulations for motor vehicles must be complied with, as NHTSA regulations supersede the bill's promulgation (section 379-2). Section 379-1 details the vehicle's operating conditions. Autonomous vehicle technology must be activated and de-activated with ease. Engaged activation mode should be visible. The vehicle must feature a security system that alerts the operator of any autonomous vehicle technology failure, prompting him to resume control.

Section 507-a defines the operator as the person who causes the vehicle's autonomous technology to engage, even if not physically present in the vehicle. The section states that "any person who holds a Class D license or its equivalent may operate an autonomous vehicle in autonomous mode upon a public highway." This statement somewhat contradicts the new section 1212-a, which limits operators to persons designated by the testing manufacturer. According to section 1212-a, operators must be physically present in the vehicle, ready to intervene and take full control if needed. The same section requires testing vehicles to submit to the Department of Transportation proof of insurance, surety bond or self-insurance for $5m prior to testing.

AB 7391a-2013 also seeks to amend the New York general obligation law by adding a new title 3/sections 9-301 and 9-303. Section 9-301 provides autonomous vehicle and autonomous technology definitions identical to those provided in the aforementioned sections 100-e and 100-f. Section 9-303 exempts vehicle manufacturers from liability if the autonomous vehicle technology was installed by a third party, unless the technological failure results from a defect in the originally manufactured vehicle.

The Commissioner of Motor Vehicles is required to study autonomous vehicle operation and testing and to disclose the findings, recommendations, and legislative proposals to the state's Legislative Assembly. It does not indicate whether autonomous vehicle operation is limited to testing purposes either. The bill was referred to the Committee on Transportation for amendment in May 2014. However, its updated version, AB 31-2015, is virtually identical to AB 7391a-2013. AB 31-2015 was presented and referred to the Transportation Committee in January 2015.

North Dakota

In North Dakota, House Bill 1065 was first introduced in January 2015. It was signed by the Senate President, House Speaker, and Governor in March, and it is currently pending the Secretary of State's approval. HB 1065 seeks to create and enact Chapter 39-10.4 of the North Dakota Century Code. The bill only covers Section 1 of the Chapter, but contains provision for the addition of further details.

Chapter 39-10.4-01 defines the terms "autonomous technology" and "autonomous vehicle." The bill does not define the term "manufacturer." However, it clears from liability all original manufacturers of vehicles that have been converted to autonomous vehicles by a third party in any event of injury related to autonomous vehicle technology installations. Chapter 39-10.4-02 specifies pre-testing insurance requirements, whereby testing entities must possess proof of $5m insurance or self-insurance. Nevertheless, North Dakota's HB 1065 differs from autonomous vehicle bills in other states in that it provides more detailed surety bond conditions. As an alternative to insurance or self-insurance, the testing entities can "make a cash depositor post and maintain a surety bond of $5m" (39-10.4-02).

Vehicle requirements are specified in Chapter 39-10.4-04. Autonomous vehicles are to be registered as motor vehicles and operated as per North Dakota motor vehicle and traffic laws. Federal standards and regulations for motor vehicles apply to autonomous vehicles as well. Autonomous vehicles must have an easily accessible function to engage/disengage the autonomous mode. The vehicle must feature a visual indicator that shows when the vehicle is in autonomous mode. The autonomous vehicle system must alert the human operator to take manual control of the vehicle in the case of autonomous vehicle technology failure.

Regarding operation standards, HB 1065 states that operators must be seated inside the vehicle and be capable of taking immediate manual control of the vehicle in an emergency or if the autonomous vehicle technology undergoes failure. Operators are required to possess a driver's license with an endorsement that acknowledges that the operators are "not required to actively drive" an autonomous vehicle (39-10.4-07). The bill does not specify who may qualify for such license endorsement (other states indicated that operator should be designated by manufacturers or the testing entity).

The bill's content is to be further developed by the Department of State that will provide details, requirements, and limitations for insurance, safety, and testing geographic areas. The current bill only mentions requirements for testing on state highways and the bill does not specify whether autonomous vehicle operation is limited to testing purposes.

Oregon

House Bill 2428 was presented in January 2013 and shelved in July of the same year as the House Committee on Transportation and Development was adjourned. Nevertheless, in February 2015, the state of Oregon introduced Senate Bill 620 that calls for the creation of a 2015 Act to be added to the Oregon Vehicle Code. The bill details certification requirements and process for autonomous vehicle testers, sellers, and operators of state highways. Its definitions of the terms "autonomous system," "autonomous vehicle," and "manufacturer" are comparable to the aforementioned states' bills.

Manufacturers are authorized to both sell and test autonomous vehicles, provided they have the corresponding certification. To be sold and/or operated for testing, an autonomous vehicle must be covered with a liability insurance policy of at least $5m. Vehicle acceptance for certification requires that the vehicle be proven safe to operate on state highways. Thus, it must be easy for the operator to engage and disengage the autonomous vehicle system. The bill requires that the status (on/off) of the autonomous vehicle system be visibly indicated at all times. There should be immediate notice of autonomous vehicle technology failure or emergency, calling for immediate operator response to regain control of the vehicle.

States Where Autonomous Vehicle Legislation Has Been Shelved

Bills for autonomous vehicle testing were introduced and shelved in nine states so far: Colorado, Maryland, Minnesota, New Hampshire, Oklahoma, South Carolina, South Dakota, Texas, and Washington. This means that legislatures have postponed an immediate decision on a legislative issue. These shelved bills are currently under one or more of the following statuses:

- Committee: this is the most common status for shelved bills at the conclusion of a legislative session.
- Failed
- Indefinitely postponed
- Tabled: a tabled bill is a bill that is to be reconsidered at an indefinite time in the future, via a motion of the legislative body. This means that the bill is not considered a priority presently. Law critics argue that tabling is a political tool allowing legislative majorities to lock in a win by disposing of the only motion that might enable reversal of the outcome (Beth et al., 2009[6], p. 2). Tabling can also be used to reject a bill by never reinstituting it.
- Passed
- Second reading
- Substituted
- Unfavorable report from Committee
- Inexpedient to legislate

Colorado

Senate Bill 13-016 was introduced in February 2015. The Senate Committee for Transportation and Safety submitted a favorable recommendation after proceeding to amendments to the original draft. The Senate adopted the amended bill in March, 2015.

SB 13-016 seeks to add 42-4-242 to the Colorado Revised Statutes and to amend 42-4-1008 of the Colorado Revised Statutes. In this bill, autonomous vehicles are referred to as "self-driving motor vehicles," and autonomous vehicle technology as a "guidance system." Section 4 allows the use of autonomous vehicles as long as it is operated in conformity with traffic law [Section 4 (1)(a)]. The bill does not indicate that autonomous vehicle operation is for testing purposes in

[6] The authors detail that "when Senators enter the motion for later consideration, […] they typically do so for strategic purposes. On occasion, Senators whose side is losing have their votes recorded on the side opposite their preference, thereby qualifying to enter a motion to reconsider what they hope to call up at some later point when they have secured additional support to reverse the outcome."

particular, and it advises that the Department and the Colorado State Patrol submit a joint report and legislative recommendations to the General Assembly in 2018, after 4 years of monitoring [Section 4(3)].

Vehicles are required to feature an override switch that immediately allows the driver to regain control of the vehicle [Section 4 (1)(b) and (c)]. Autonomous vehicles are also required to have a device that visibly indicates that the autonomous vehicle technology system is in operation [Section 4 (1)(d)]. The vehicle should also possess a system that alerts the operator of a system failure, in which case it should, if he or she cannot take manual control, bring the motor vehicle to a stop ([Section 4 (1)(e) and (f)].

Autonomous vehicle drivers are required to possess a valid driver's license [Section 4 (2)]. Unlike bills introduced in other states, SB 13-016 assigns financial liability and insurance requirements directly to the driver, even when the vehicle is operated in autonomous mode [Section 4 (2)(b)].

Regarding vehicle operation, Section 5 amends Section 42-4-1008 of the Colorado Revised Statutes by stating that the security distance standard does not apply to autonomous vehicles when using a guidance system. Additionally, the following is indicated in the bill summary, but does not appear in the bill's text: "A driver may use a mobile phone, including text messaging, while using a guidance system. A driver of a motor truck or in a motorcade need not leave room for another vehicle to enter the space in front of the driver while using the guidance system."

After being held on the House desk and reviewed by the House Transportation Committee, the committee report from March 2015 shows that the bill was to be "postponed indefinitely." The vote was unanimous (5-0).

Maryland

Maryland's efforts to introduce an autonomous vehicle bill were thwarted in March 2014 when House Bill 538 received an unfavorable committee report. HB 538 sought to create a task force whose mission was to study autonomous vehicles and subsequently make recommendations on the use of self-driving vehicles. Yet, in March 2015, the House passed House Bill 172 (cross-filed with SB 778), which is virtually a replica of HB 538. In a video footage of the committee hearing, delegate Beidle explained that HB 538 was not passed in 2014 because it was an election year, and staffing the task force would have been too expensive (General Assembly of Maryland, 2015).

Minnesota

House File 1580 is a bill that was introduced in March 2013. The bill proposed that the transportation commissioner "evaluate policies and develop a proposal for legislation governing regulation of autonomous vehicles." The commissioner's document should include regulations pertaining to traffic and safety, equipment requirements, insurance, and any other relevant information. In addition, the proposal should detail conditions for a pilot autonomous vehicle testing program. HF 1580 did not go past its first reading as it was referred to the Committee on Transportation Policy, which is its current status.

New Hampshire

House Bill 444 was introduced in January 2013. It was killed two months later when the committee reported that the bill was "Inexpedient to Legislate" in March 2013.

Oklahoma

House Bill 3007 was drafted by the House's Committee on Transportation and introduced in January 2012, to take effect in November 1, 2012. The bill sought to amend 47 O.S. 2011, Section 6-110.1 of the state's Revised Statutes (which relates to driver license endorsements) through the addition of Section 11-1120 of Title 47 pertaining to what the committee calls "autonomous motor vehicles." The bill's definitions of the terms "autonomous vehicle" and "autonomous" are comparable to our aforementioned definitions of "autonomous vehicle."

The bill explained that autonomous vehicle testing areas were limited to state highways. The bill also stated that autonomous vehicle operators could obtain an autonomous vehicle endorsement on their prior driver's licenses providing all guidelines follows, which defines the terms that provide a codification with an effective date set.

The bill stipulates that autonomous vehicle operators must possess a valid driver's license in order to operate a vehicle in autonomous vehicle mode. Nevertheless, it does not mention autonomous vehicle driver licensing but the Department of Safety will establish rules endorsing the operation of autonomous vehicle on highways in Oklahoma. Before an autonomous vehicle can operate on a highway, insurance is required but the amount is not specified. Section 11-1120 of Title 47 state that the department will adopt rules requiring the establishment of minimum safety standards for autonomous vehicle and operator.

HB 3007 does not feature the sophistication of bills in the aforementioned states. Nevertheless, documentation of the reasons for the failure of HB 3007 were not made available.

South Carolina

House Bill 4015 was introduced in April 2013 to amend the Code of Laws of South Carolina, 1976, by adding Chapter 12 to Title 56.

In June 2014, HB 4621 was introduced to create and enact the "South Carolina Autonomous Vehicle Act." The aforementioned Act would provide for autonomous vehicle operation along South Carolina highways, although the bill acknowledges that there already is an “existing authority to operate vehicles on a public highway” (Section 56-12-120) (Smith, 2014b). Operation is reserved for testing purposes only (Section 56-12-20), and NHTSA and Federal Safety Standards supersede any local or state autonomous vehicle operation criteria and regulation (Sections 56-12-50, 56-12-60, 56-12-130). HB 4015 defines the terms “autonomous vehicle,” “autonomous technology,” “manufacturer,” and operator” [Section 56-12-10(1-5)].

Drivers are required to be physically present and seated in the vehicle, monitoring that the autonomous vehicle operation is safe, and capable of taking over manual control of the vehicle when needed. [Section 56-12-20(2)]. Before conducting testing, manufacturers must submit an application to the SC DMV (Section 56-12-30). The application should include evidence that the vehicle has an insurance, safety bond, or self-insurance of $5m [Section 56-12-20(2); Section 56-12-30(5)] in a format to be determined by the DMV by January 2015 (Section 56-12-70). In this application package, the manufacturer must certify that the vehicle feature an easy access mechanism to engage and disengage the autonomous technology system [Section 56-12-30(1)]. There should also be visual indicator that the vehicle is in autonomous mode [Section 56-12-30(2)], as well as a system that safely alerts the operator of any autonomous vehicle technology failure, either prompting him/her to take control of the vehicle, or causing the vehicle to come to a complete stop [Section 56-12-30(3)]. In the event of a crash, the vehicle must have a memory device that stores data at least 60 seconds before the collision in a read-only format (Section 56-12-70).

The bill was referred to Committee on Education and Public Works, which is its current status.

South Dakota

Senate Bill 139 was introduced in January 2014 to define conditions for autonomous vehicle operation for testing purposes. The Transportation Committee passed a motion to amend it in February of the same year. The same day, the amended bill was tabled.

Section 1 of the bill defines the terms “autonomous technology,” “manufacturer,” “autonomous vehicles,” and “guided operator.” The latter designates what this report refers to as “operator.” However, SB 139 uses the preceding term “guided” because these must be specifically authorized to operate an autonomous vehicle by a manufacturer during a vehicle test. Section 1

defines the term “operator” as the person physically seated in the driver’s seat or the person who causes the autonomous vehicle technology to engage.

Section 2 states that pre-testing requirements are detailed in the application for autonomous vehicle testing that manufacturers must submit to the South Dakota DMV (Sec. 2, 3). Vehicles must possess a mechanism to engage and disengage autonomous vehicle technology that is easy for the operator to access. There must be a visual indication that the autonomous vehicle technology is engaged, as well as a safe alert system that lets the operator know of any autonomous vehicle system failure, either requiring him/her to take action or causing the vehicle to come to a complete stop. A vehicle which is in autonomous vehicle mode must feature more than one command for the operator to take manual control. The vehicle must be insured via $5m insurance, surety bond, or self-insurance.

Guided operators are required to undergo extensive training [Sec. 2(1)] and possess an autonomous vehicle driver’s license [Sec. 5(1)]. This license is issued by the South Dakota DMV and is temporary (Sec. 4). Although guided operators must be “capable of taking over immediate manual control of the autonomous motor vehicle in the vent of technology failure” [Sec. 5(5)], Sec. 3 specifies that manufacturers are “liable for all actions of the guided operators” during testing.

The bill does not specify the geographical areas where testing is allowed, nor the time and duration of testing. The documents indicates, however, that Department of Transportation and the DMV are responsible for determining this information.

Texas

House Bill 2932 was introduced in July 2013. The bill relates to the operation of autonomous motor vehicles, and was to be enacted by the Texas legislature. It sought to amend the Texas Transportation Code, Chapter 545 by adding Section 545.428, and the Motor Vehicles Act’s Section 545.428(b), by adding the state Department of Transportation’s authorization to conduct autonomous vehicle testing, as well as provisions for other drivers on state roadways or public highways.

The operator of an autonomous motor vehicle is defined as the person who causes the vehicle's autonomous technology to engage. The operator is required to possess a valid driver’s license [subsection (b)], and is authorized to test within the state (1-A). Manufacturers are designated as the testing entities (1-B).

Section (2) of the bill details insurance requirements and Section (3) requires the approval votes of two-thirds of the elected members of each house in order to pass, as per Article III of the

Texas Constitution. The necessary votes were not reached which lead to the rejection that goes in effect September 1, 2013.

Washington

House Bill 1439 was introduced in January 2013, to take effect in January 2014. The bill sought to add a new chapter to Title 46 RCW (Revised Code of Washington). Complementarily, House Bill 1649 was introduced in February 2013, and referred to the Committee on Transportation, along with HB 1439. Likewise, it proposes a new section to Chapter 46.04 RCW, and a new chapter to Title 46 RCW. Had it passed, HB 1649's rules would be reviewed in June 2026, based on testing reports and observations, and bill would expire in 2027.

HB 1649 explicitly seeks to encourage advancement in transportation technology, and repeats that there is no current legislation that specifically prohibits or defines the terms of autonomous vehicle use in Washington State (Sec. 1). While HB 1649 (Sec. 2) defines autonomous vehicle technology as "technology installed on a motor vehicle that renders it capable to drive without the active control of or monitoring by a human operator," Sec. 2.3 of HB 1439 defines autonomous vehicle's as "a motor vehicle that uses computers, sensors, and other technology and devices to enable the vehicle to safely operate without the active control and continuous monitoring of a human operator." These vehicles do not include commercial vehicles (HB 1439, Sec. 3.4), and they must comply with state and federal safety standards, laws, and regulations for motor vehicles (HB 1439, Sec. 3.2 and HB 1649, Sec. 5). The standards are defined in HB 1649, Sec. 5. These standards include that the engage/disengage key for the vehicle to function in autonomous vehicle mode must be easy for the operator to access, a visible indication that the vehicle is in autonomous vehicle mode must be provided, and the vehicle must alert the operator of any autonomous vehicle technology failure and direct him to take control of the vehicle.

According to HB 1439, an autonomous vehicle manufacturer is "the person that manufactures the autonomous vehicle as an originally completed vehicle or, in the case of a vehicle not originally equipped with autonomous technology, the person that modifies the vehicle to convert it to an autonomous vehicle." Regarding responsibility in case of malfunction, neither HB 1439 nor HB 1649 exempt vehicle manufacturers from liability if the autonomous vehicle technology was installed by a third party. Before testing, the testing entity (a term that remains undefined in both bills) is required to provide a proof of a $5m surety bond or insurance. The Washington DOT reserves the right to accept this proof as valid.

Operators must have a valid driver's license (HB 1649, Sec. 3 and HB 1439, Sec. 3.1) which allows them to test on sites other than closed courses. Operators are as liable as non-autonomous vehicle drivers when it comes to traffic infractions and criminal offenses (HB 1439, Sec. 3.3). HB 1649 states that operators are designated by autonomous vehicle manufacturers. They must

be physically present in the vehicle, and ready to intervene if needed (Sec. 4), but the bill does not specify where they must sit (other states specify that operators must be in the driver's seat).

Autonomous vehicle operation on state public roads is contingent upon the State Patrol's acknowledgment that the vehicle meets safety standards (HB 1439, Sec. 2). HB 1439 does not restrict autonomous vehicle operation for testing purposes only nor does it restrict it to closed courses. In January 2014, HB 1649 and HB 1439 failed to pass, and are currently under "reintroduced and retained in present status."

ISSUES SURROUNDING AUTONOMOUS VEHICLE LEGISLATION

Safety

The main motivation for autonomous vehicles is indisputably the expected improvement in safety that is expected to accompany the introduction of autonomous vehicles (Fagnant and Kockelman, 2013, pp. 3-5; Schwartz et al., 2013, p. 1; Anderson et al., 2014, p. 13; 2014 Automated Vehicle Symposium, pp. 16, 18). This is underscored by a statement from Sergey Brin, co-founder of Google, who in referring to development of autonomous vehicles stated that "It may sound cliché, but safety is issue one, two, and three" (Recode, p. 2).

Many believe that adoption of autonomous vehicles has the potential to lead to enormous improvement in safety (Steudel, 2013, p. 7; Fagnant and Kockelman, 2013, p. 3; Anderson et al., 2014, p. 12). With over 5 million crashes per year in the United States, and over 90 percent of crashes attributed to human error, automation clearly presents the potential to reduce crashes significantly (Anderson et al., 2014, p. 12; NHTSA, 2008). However, this implicitly assumes that all, or a significant number of the vehicles on the road, are autonomous vehicles with improved safety and any interaction between autonomous vehicles and non-autonomous vehicles does not present new safety hazards such as a lack of gaps on freeways at on- and off-ramps due to platooning of autonomous vehicles, the difficulty of overtaking long platoons of autonomous vehicles following each other at short headways, or misunderstanding of social cues between autonomous vehicles and human drivers. In fact, the public, and many researchers, feel that the safety may be impacted less positively than expected. For example, in a survey conducted at the 2014 Automated Vehicle Symposium, 56 percent of the attendees rated the safety of autonomous vehicles as safe or twice as safe, and only 36 percent 10 times as safe as current vehicles (2014 Automated Vehicle Symposium, p. 12). Sivak and Schoettle state that: "(1) The expectation of zero fatalities with self-driving vehicles is not realistic. (2) It is not a foregone conclusion that a self-driving vehicle would ever perform more safely than an experienced, middle-aged driver. (3) During the transition period when conventional and self-driving vehicles would share the road, safety might actually worsen, at least for the conventional vehicles" (Sivak and Schoettle, 2015). Others estimate it will be decades before autonomous vehicles can perform as well as human drivers in all situations (Gomes, 2014). However, given the estimated annual cost of road crashes in the U.S. is $300b, improving safety remains a very important issue and one where autonomous vehicles are expected to play a significant role by improving safety to the extent they do (Fagnant and Kockelman, 2013, p. 4).

Public Acceptance

While there has been a general groundswell of interest in autonomous vehicles since the public launching of the Google car, and there has been a virtual explosion of interest at the official level, it is interesting to observe what surveys on the topic have revealed. Researchers at the University of Michigan Transportation Research Institute have conducted surveys in the United States, United Kingdom, Australia, China, India, and Japan on public opinion to autonomous vehicles (Schoettle and Sivak, 2014). Their findings were that while most had heard about autonomous vehicles, the majority were concerned about the safety of the vehicles and whether they would perform as well as driven vehicles. The majority wanted the technology in their vehicles but, with the exception of those in China and India, did not want to pay extra for it. This is consistent with another local survey where they found that U.S. consumers were willing to pay only four to five percent more on the price of a car for an autonomous vehicle (Linkenbach, 2014).

One of the obstacles autonomous vehicles face is that people generally like to drive and be personally in control of the vehicle. While they are in control of the vehicle, they feel safer than if the vehicle were being driven by someone else. This may also apply to transferring control to a machine unless it has demonstrated that it is trustworthy or autonomous operation is reserved for safer operating conditions such as stop/start operation on a congested highway.

Progression

There is a general consensus that full autonomy is going to be achieved by way of increasing automation (Schwartz et al., 2013, p. 30; Linkenback, 2014, p. 16). This is because there are many barriers to a fully automated vehicle fleet both technologically and with respect to human behavior (Leonard, 2014, p. 10). As stated by some researchers, “The conversion to a fully autonomous road infrastructure will be one of the most momentous challenges that humanity will face in the 21st century” (DiClemente, Mogos, and Wang, 2014, p. 5). A survey among delegates to the Automated Vehicle Symposium in San Francisco in 2014 found that the average predicted date for a fully automated taxi was 2030, but when respondents were asked when they would allow their children or grandchildren to use the autonomous taxi, approximately 25 percent said 2040 and approximately 8 percent said never (Underwood, 2014, p. 12). A study by the Rand Corporation on future mobility in the U. S. predicts “no more than 5 percent of vehicles operating with a partly or fully automated capability” by 2030 (Zmud et al., 2013, p. 28).

Technologically, the development of an autonomous vehicle is difficult, but addressing the complexities of the human component such as requiring an autonomous vehicle to be able to interpret human gestures and social cues, or recognize that speeding during an emergency may

be appropriate, is even more challenging (Leonard, 2014, p. 10; Gomes, 2014; Lin, 2015). Social cues include drawing inferences from characteristics such as the age of a driver, the vehicle they drive, behavior (e.g., erratic or swerving), and attitude (aggressive or distracted). In relation to the difficulty of interpreting all the input information that autonomous vehicles receive, the lead developer of the Google Car, Chris Urmson, is quoted as saying in response to a less than enthusiastic reaction from someone who was experiencing the operation of Google's autonomous Lexus SUV for the first time, "Do you have any idea how *hard* this is?" (Bergen, 2015). Research at General Motors suggests that technology advancements are needed in "perception and algorithms, 360-degree sensing, sensor fusion, maps, global positioning system (GPS), and V2V/(V2I) (vehicle to infrastructure) integration" (Capp, 2014, p. 15). Thus, a great volume of complex and diverse information must be fused together and then processed appropriately to deliver near-perfect decisions. This is very difficult to accomplish.

Some researchers question whether connected vehicle technology such as V2V and V2I will contribute significantly to the development of autonomous vehicles because dedicated short range communication (DSRC) is not mandated for inclusion in vehicles at the moment, V2I has made little market penetration to date, and there are questions of cost, security, and privacy associated with it (Baker and Wagner, 2013, p. 434).

Infrastructure

At the moment most development related to autonomous vehicles is on sensors in the vehicles and the translation of that information into appropriate operation of the vehicle. A problem is that some of the input information received by the sensors may be insufficiently accurate (e.g., GPS information or records of road alignment) or compromised (e.g., indistinct lane markings, poor visibility due to rain, snow). In addition, conditions can change so that records of infrastructure position and properties may no longer apply (e.g., the introduction of a construction zone). The question thus arises: "What capabilities should be built into the infrastructure to accommodate some of these problems?" One suggestion is to place sensors in the middle of each lane of a highway to provide reliable directional guidance but provision would also be necessary to override the system in the case of an obstruction in the road or a construction zone. At the moment, Sweden is the only country that has a certified roadway for autonomous vehicle's (Miller, 2015). Iowa's Johnson County recently issued a proclamation that would make the U.S. the second country to possess such a roadway (O'Leary and Santana, 2014; Miller, 2015).

Regarding accommodating change in highway infrastructure (e.g., new alignment or construction zones), probably the most achievable way for autonomous vehicles to respond is for them to have the ability to interpret and respond to information on Variable Message Signs (VMS) or Highway Advisory Radio. Highway Advisory Radio (HAR) has fairly widespread use across the

country but its activation and operation must be well managed and the information it conveys must be clear and up to date (Wolshon and Schwehm, 1999). However, this does assume that most autonomous vehicle operation will be on highways, as it has been in the past, but Google recently declared that the focus is changing to street driving (Chatham, 2014).

Permit and License Requirements

Since each state has its own DMV laws, Fagnant and Kockelman (2013) express the need for national licensure. As of July 2013, the following states passed and implemented autonomous vehicle licensing legislation: California, Nevada, and Washington DC. Florida is currently in the testing phase. Regulatory licensing is indeed the responsibility of state DMVs, but there seems to be no consistency among states in terms of licensing, which is why Fagnant and Kockelman (2013) call for a national set of standards.

California legislation refers to a test driver as the person in the driver seat who can take control of the vehicle at any time, that is, who can drive the vehicle when in conventional mode.

According to NHTSA, a driver licensing program should provide for driver's license endorsements (or separate driver's licenses) that authorize the operation of self-driving vehicles. Regular driver licenses are recognized interchangeably in a reciprocal agreement called the Driver License Compact in 45 of the 50 states (Fagnant and Kockelman, 2013, p. 12). The five states not subscribing to the Driver License Compact are Georgia, Massachusetts, Michigan, Tennessee, and Wisconsin.

NHTSA stated that driver's license endorsements (or separate driver's license) to a person should be conditioned upon certain prerequisites, such as that person's passing a test on the safe operation of a self-driving vehicle and presentation of a certificate from a manufacturer of self-driving vehicles (or the manufacturer's designated representative). This would serve as proof that the person has successfully completed a training course provided by that manufacturer (or representative), or a certification by that manufacturer (or representative) that the person has operated a self-driving vehicle for a certain minimum number of hours. As used here, "manufacturer" includes a company that alters a vehicle manufactured originally by another company in order to give it self-driving capability.

The training course should be submitted to the state agency that issues driving licenses for approval prior to the taking of that course by any person seeking a driver's license endorsement certification. The course should include providing an understanding of the basic operation and limits of self-driving vehicles, and knowledge of how to resume control of such a vehicle in the event that it cannot continue to operate automatically.

Nevertheless, the Center for Transportation Research at Texas A & M does not recommend new driver licensing for emerging transportation technology at this time (Jin et al., 2014). Their argument is that such a measure could potentially deter the development and deployment of emerging technology vehicles.

Regulation

The recommendation from the National Highway and Traffic Safety Administration is that is not advisable to draft regulations at the federal or state level at this time because of the rapid change in technology that is currently occurring, and the risk of stifling innovation and development (Anderson et al., 2014, p. 138-139). What NHTSA does recommend is that states address the issues of licensing, driver training, and conditions for operation with the specific suggestion that states authorize the use of autonomous vehicles for testing purposes only. A survey conducted among Original Equipment Manufacturers (OEMs) in 2012 indicated they did not feel that legislation passed so far restricted or inhibited their actions, but felt that when legislation is prepared, they and other industry partners should be allowed to provide input to the process (Baker and Wagner, 2013, pp. 434-435).

Liability

Liability is one of the major barriers to the implementation of autonomous vehicle legislation (Marchant and Lindor, 2012; Fagnant and Kockelman, 2013). Original equipment manufacturers (OEMs) are most concerned about this issue because in autonomous mode, vehicles are generally expected to provide virtually faultless operation (Baker and Wagner, 2013, p. 436). But the question arises, what about unavoidable crashes such as a deer running across the road in front of a car (Fagnant and Kockelman, 2013, p. 12)? Is it reasonable to assume that a machine can instantaneously detect, interpret, decide, and implement the best evasive action possible in any situation? At the moment, OEMs are generally insistent that a driver always be present in a vehicle to take control should the need arise because they are not confident that the control systems on autonomous vehicles can achieve that (Anderson et al., 2014, p. 152; Baker and Wagner, 2013, p. 436). However, this is not the case with some OEMs such as Google who are talking about autonomous vehicles being used by those unable to drive such as the disabled, young, or old, and their autonomous vehicle not having a steering wheel or other controls.

In Rand Report 443, the authors describe several legislative options to address liability in autonomous vehicles, although they suggest that legislative action regarding liability is not recommended at this time (Anderson et al., 2014, p. 142). Legislative options mentioned in Rand Report 443 include passing a statute limiting tort, passing legislation requiring insurance

companies to adopt the “no-fault” system in which crash victims recover damages from their own insurance company rather than from the other party in the crash, or legislation requiring that the driver remains the responsible party irrespective of the level of automation of the vehicle (Anderson et al., 2014, pp. 142-144).

In California, which is in the testing phase, Chapter 570 of the Vehicle Code § 38750 states that autonomous vehicle manufacturers must maintain a $5m insurance policy to cover drivers and equipment. In addition, to address the issue of liability, vehicles are required to feature a “visual indicator” showing the vehicle is in autonomous mode, an easily accessible device for turning the autonomous mode off, and a safety alert system that notifies the operator of technological failure, in which case either the vehicle comes to a complete stop, or the driver is commanded to resume control of the vehicle. A recording device capable of recording and storing all activities for at least 30 seconds before the crash is also required (Lenth, 2013). Such event data recorders (EDRs) are currently being supplied by some insurance companies (Allstate and Progressive) with the promise discounts will be provided for good driving, although the equipment costs almost as much as the discount (Anderson et al., 2014, p. 155).

Generally, insurance companies assume ownership of the data collected in their EDRs. V2V and V2I data is also likely to be stored somewhere, but who owns it, with whom will it be shared, how will it be made available, and how will it be used? There are likely to be many who would like to gain access to the data such as trial lawyers, law enforcement, researchers, industry, or other insurance companies. Some states require a warrant for access to such data but in most states access rights are undefined (Fagnant and Kockelman, 2013, p. 13). Federal guidelines on how to handle data of this nature would be helpful in establishing uniform practice and greater comparability across states.

It is generally not well known but approximately 96 percent of all new passenger vehicles sold in the United States today have EDRs that record events prior to and following a crash (Fagnant and Kockelman, 2013, p. 13). However, the information collected is not as detailed as that in the EDRs issued by the insurance companies. Reportedly, NHTSA has considered requiring an EDR in all new vehicles under 8,500 lbs from late 2014 onwards (Fagnant and Kockelman, 2013, p. 13).

Americans spent approximately $157m on automobile insurance in 2009, so liability is clearly a very big issue and one autonomous vehicle manufacturers are keen to distance themselves from as much as possible (Anderson et al., 2014, p. 140).

Cost

The current cost of sensors and equipment used in autonomous vehicles is in the order of $100,000 although cheaper options are beginning to emerge (Fagnant and Kockelman, 2013, p. 11; DiClemente et al., 2014, p. 16). The cost of sensors and equipment are expected to fall with mass production but some researchers believe they will not fall below $10,000 for at least 10 years (DiClemente et al., 2014, p. 16; Fagnant and Kockelman, 2013, p. 10). The U.S. consumer is very averse to paying substantially more for a car with autonomous vehicle capabilities as evidenced by several surveys. For example, a survey conducted by researchers at the University of Michigan's Transportation Research Institute showed that most U.S. respondents wanted autonomous vehicle technology in the next vehicle but the majority of them were unwilling to pay extra for it (Schoettle and Sivak, 2014). A survey conducted by J. D. Power and Associates showed that while 37 percent of respondents were likely to purchase a vehicle with autonomous features as their next vehicle if they did not have to pay extra for the autonomous vehicle technology, but this dropped to 20 percent when they were told they would have to pay $3,000 extra to obtain it (J. D. Power and Associates, 2012).

Burns, Jordan, and Scarborough (2013) analyze the efficiencies of a system of driverless vehicles that are shared by the population and conclude that with full market penetration, travel costs would be reduced to 20 percent of current costs through reduced ownership and operating costs, and 10 percent of current costs if time savings due to reduced congestion is taken into account.

Platooning

One of the advantages seen for autonomous vehicles is that vehicles will be able to travel at much shorter headways thereby increasing the capacity of facilities by up to 500 percent (Fernandez and Nunes, 2012). Truck platooning is also being investigated and initial results indicate that fuel savings of up to 5 percent for the leading truck and up to 10 percent for the trailing truck can be achieved (Murray, 2015). Thus, large savings in capacity and fuel costs are envisaged to the extent that autonomous vehicles can maintain the tracking and spacing between consecutive vehicles. However, platooning makes overtaking, weaving, and entry and exit to freeways difficult. Effective platooning also assumes that the propulsion and suspension systems of vehicles in the platoon function faultlessly at all times. Recognizing all transportation vehicles are characterized by their propulsion, suspension, and guidance systems, it is noteworthy that the development of autonomous vehicles has centered around the guidance system exclusively, implicitly assuming the propulsion and suspension aspects of the vehicle will either operate without fault or any fault can be accommodated with evasive action within the guidance system. For example, engine failure or a flat tire could be accommodated by guiding the vehicle to the

side of the road as a human driver would do. However, in a platooning situation this will place great demands on the control systems depending on the severity of the situation and rapidity with which it occurs.

CONCLUSIONS

It appears that while autonomous vehicles have been promised for at least the last 50 years, conditions now exist that make anticipation of autonomous vehicles in the vehicle fleet a reality in the foreseeable future. This is because the main components that make autonomous vehicle operation possible, such as the technical components (lidar, video cameras, GPS, and broadband communication); processing capabilities (computers, sensor fusion, and data interpretation); public interest; and commitment from both the private and public sector, are moving into place and the general belief is that autonomous vehicles will materialize in the next few decades.

The development of autonomous vehicles is occurring on two fronts: one followed by auto manufacturers and OEMs (original equipment manufacturers) in general, and the other by new entrants to the market. OEMs are progressing incrementally toward an autonomous vehicle, one advanced driver assistance system (ADAS) at a time. The other approach, taken by Google, is to develop an autonomous vehicle directly without going through the incremental steps. Whichever path proves to be the best strategy, the penetration of autonomous vehicles into the vehicle fleet will have to be gradual due to the large existing fleet (approximately 250m vehicles in the U.S.), the need to bring the cost of autonomous vehicles down while still retaining safety and reliability of the vehicle, and the need for the public to develop trust in the operation of autonomous vehicles before widespread adoption can occur. To what extent will parents trust their children to an autonomous vehicle? What are the potential dangers and how long will it take to develop trust? These features related to the introduction of autonomous vehicles are not known and probably can only be determined as autonomous vehicles are, in fact, introduced into the vehicle fleet and allowed to grow in numbers as the whole process is monitored and studied.

The main issues facing the development of autonomous vehicles at the moment are interpreting the data from sensors on the technical side, trust in the new technology on the human side, and the assignment of liability on the legal side. Other issues include access and ownership of data received, transmitted, or stored relating to the operation of autonomous vehicles, cyber security and the potential for malicious interference in the operation of autonomous vehicles, standardization of technology, regulation without inhibiting innovation and development, the interaction between autonomous and driven vehicles as their market shares change over time, and the rate of market penetration of autonomous vehicles in the future. Another issue that is likely to arise as autonomous vehicles enter the market and display the improved safety that is expected of them, is whether it is fair that improved road safety should be entirely at the expense of the autonomous vehicle owner by having to purchase a more expensive vehicle? All these issues are topics for investigation in the future.

If experience with automation in the airline and mining industry are an indication of how automation is going to occur in the private transport sector, then the greatest application of the autonomous capabilities of these vehicles is likely to first occur in limited areas such as special lanes on urban freeways or in parking lots in upscale office or residential buildings where the capability for autonomous parking and pick up has been established. They may also be employed on regular highways in undemanding traffic conditions such as stop-and-go movement on congested highways or in conditions when human vision is impaired by poor visibility due to heavy rain or snowfall.

Currently, autonomous vehicles can cost in excess of $100,000 depending on what equipment is used. However, surveys indicate that the public are generally only prepared to pay four to five percent more for an autonomous vehicle than a regular vehicle, presenting a wide price gap between the regular consumer and the market price. However, the novelty factor is likely to spur purchase in the beginning and as the benefits are realized (e.g., being able to engage in other activities while traveling, self-parking, and transporting children and the elderly without having to be present), the public may be prepared to pay more to get them. At the same time, there is a general consensus that the cost of autonomous vehicles will decrease over time, and probably over the next decade.

The review of bills and regulations related to autonomous vehicles developed by individual states show considerable similarity. The general format of the legislation is to define an autonomous vehicle, address who is responsible for issuing licenses to operate an autonomous vehicle, who is authorized to provide training to operate an autonomous vehicle, what facilities may be used to operate autonomous vehicles on and what weather conditions (if any) should prevail while autonomous vehicles are operated, and whether certified operators are restricted to testing vehicles or whether permission is granted to operate autonomous vehicles for general purposes. They also generally include the necessity to report any crashes or malfunctions, require that an event recording device be installed in the vehicle, require that an operator be present in the vehicle and be able to regain control of the vehicle at all times, and that liability insurance of $5m be provided for each vehicle tested on public roads.

NHTSA provides guidance and assistance to states in developing legislation and regulations related to autonomous vehicles but is intent on not being prescriptive in its suggestions. NHTSA does not want to stifle innovation or influence development unduly. OEMs feel they have been given sufficient freedom to develop technology as they see fit and want the market to decide on the path development will take. As appropriately stated in one of reports reviewed “aggressive regulatory action is premature and can probably do more harm than good” (Rand Report 443, p. 149).

If and when autonomous vehicles become the major form of passenger (and possibly freight) transportation, parking facilities and fleet sizes will be dramatically decreased from current levels. If vehicles are shared there will be less need for parking and with greater utilization of individual vehicles, fleet sizes will be reduced. In addition, if vehicles can safely sustain short headways between vehicles, capacities of existing roadways would increase several fold. Thus, there will be an overall reduction in demand for infrastructure and, possibly, a greater penetration for autonomous vehicles in the market as their attractiveness eclipses other forms of passenger transportation.

RECOMMENDATIONS

Based on the review of practice in other states the following recommendations are made with respect to legislation and regulations governing the use of autonomous vehicles in Louisiana:

1. Operators of autonomous vehicles must obtain an autonomous vehicle operator's license from the Office of Motor Vehicles, Department of Public Safety in Louisiana.
2. Training in the operation of an autonomous vehicle must precede issuing of an operator's license.
3. Training in the operation of an autonomous vehicle must be provided by an authorized Original Equipment Manufacturer (OEM).
4. Completion of a successful training program must be certified by an authorized OEM before an applicant can apply for an autonomous vehicle operator's license.
5. An autonomous vehicle must be clearly identified as distinct from other vehicles by means of a distinctly colored number plate or other markings.
6. Operation of an automated vehicle on public roads is limited to testing only; use of autonomous vehicles by the public for general use is not recommended until the safe operation of mixed autonomous and driven vehicles is established.
7. Liability insurance of $5m dollars should be required as a condition of registration of an autonomous vehicle in the state.
8. Testing of autonomous vehicles on public roads should only be permitted when conditions on the road permit safe operation. Suitable conditions include good weather, good visibility, and stable traffic conditions.
9. Autonomous vehicles must have an Event Data Recorder (EDR) that is capable of storing and retaining data from at least 30 seconds prior to a crash.
10. Any crash must be reported together with detail regarding the crash and the EDR data prior and during the event.
11. The autonomous vehicle must allow an operator to quickly gain control of an autonomous vehicle in the event of any malfunction in the autonomous features of the vehicle.
12. Autonomous vehicle operation must be consistent with federal safety laws that require the installation and use of devices such as safety belts, airbags, headrests, etc.
13. Monitor development of autonomous vehicles on a continuing basis so that opportunities to update legislation, regulation, policy formulation, or action by public agencies in the state can be identified and acted upon.

BIBLIOGRAPHY

1. Ackerman, F. *Comments on EPA and NHTSA Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards.* Federal Register, 74(186), 2009, 49454-49789.
2. Al-Shihabi, T., and Mourant, R. R. "Toward More Realistic Driving Behavior Models For Autonomous Vehicles In Driving Simulators." *Transportation Research Record 1843: Journal of the Transportation Research Board*, 2003, pp. 41-49.
3. Althoff, M., and Dolan, J. M. "Online Verification Of Automated Road Vehicles Using Reachability Analysis." *IEEE Transactions on Robotics*, 30(4), 2014, pp. 903-918.
4. Anderson, J. M., Kalra, N., Stanley, K. D., Sorensen, P., Samaras, C., and Oluwatola, O. *Autonomous Vehicle Technology: A Guide for Policymakers*. Research Report 443, Rand Corporation, Santa Monica, California, 2014.
5. Autoevolution. *A Short History of Mercedes Benz Autonomous Driving Technology,* 2015. http://www.autoevolution.com/news/a-short-history-of-mercedes-benz-autonomous-driving-technology-68148.html
6. Automated Vehicles Symposium 2014 - see Volpe.
7. Autonomous Vehicle Information Sharing Group. "Analysis of Laws Enacted in Jurisdictions." American Association of Motor Vehicle Administrators, 2014. www.aamva.org/WorkArea/DownloadAsset.aspx?id=5826.
8. Ayala, Jr., A. *Testimony of Department of Motor Vehicles.* Transportation Committee Public Hearing, 2015. http://www.cga.ct.gov/2015/TRAdata/Tmy/2015HB-06344-R000209-Commissioner%20Andres%20Ayala,%20Jr.,%20Demartment%20of%20Motor%20Vehicles-TMY.PDF.
9. Baker, R. T., and Wagner, J. "Policy Pathways to Vehicle Automation." 2013 International Conference on Connected Vehicles and Expo (ICCVE), Rio All-Suite Hotel and Casino, Las Vegas, Nevada, December 2-6, 2013.
10. Bamonte, T. "Autonomous Vehicles: Drivers of Change." *Roads and Bridges*, 2013, pp. 5-10.
11. Banks, B. "Autonomous Vans Reach China After 92 Days On the Road." *Gizmag*, (2010). http://www.gizmag.com/roadtrip-autonomous-vehicle-vislab/16869/.
12. Barnes, R. *Letter to Sen. Maynar and Rep. Guerrera*, Co-Chairs, Transportation Committee, (2015). http://www.cga.ct.gov/2015/TRAdata/Tmy/2015HB-06344-R000209-Commissioner%20Andres%20Ayala,%20Jr.,%20Demartment%20of%20Motor%20Vehicles-TMY.PDF.
13. Beiker, S. A. (2012). "Legal Aspects of Autonomous Driving." *Santa Clara L. Rev.,52*, 1145.

14. Bergenhem, C., Hedin, E., and Skarin, D. “Vehicle-To-Vehicle Communication For A Platooning System.” *Procedia-Social and Behavioral Sciences*, 48, 2012, pp. 1222-1233.
15. Bergen, M. “Google's Homemade Self-Driving Cars to Hit Roads This Summer.” *Recode*, 2015. http://on.recode.net/1cZR2Om.
16. Beth, R. S., Heitshusen, V., Heniff, B., and Rybicki, E. “Leadership Tools for Managing the US Senate.” *APSA 2009 Toronto Meeting Paper*, 2009.
17. Binder, S. “Through The Looking Glass, Darkly: What Has Become Of The Senate?” *The Forum* 9(4), 2011.
18. Bizony, P. “Four wheels good?”, *Engineering and Technology*, 4(16), 2009, pp. 16-19.
19. Brilmayer, L. “Legitimate Interests in Multistate Problems: As Between State and Federal Law.” *Michigan Law Review*, 1981, pp. 1315-1349.
20. Broggi, A., Bertozzi, M., Fascioli, A., Bianco, C. G. L., and Piazzi, A. “The ARGO Autonomous Vehicle’s Vision And Control Systems.” *International Journal of Intelligent Control and Systems*, 3(4), 1999, pp. 409-441.
21. Brown, N. “Idaho Lawmakers Prep For Driverless Cars.” Government Technology, 2015. http://www.govtech.com/transportation/Idaho-Lawmakers-Prep-for-Driverless-Cars-.html.
22. Burns, L. D., Jordan, W. C., and Scarborough, B. A. “Transforming Personal Mobility.” The Earth Institute, Columbia University, New York, 2013.
23. Capp, J. *2014 Automated Vehicle Symposium.* Proceedings, Volpe National Transportation Systems Center, Cambridge, Massachusetts, 2014.
24. California Vehicle Code, Section 38750, 2014. http://www.leginfo.ca.gov/cgi-bin/displaycode?section=veh&group=38001-39000&file=38750 (accessed 08/11/15).
25. Chatham, A. *2014 Automated Vehicle Symposium.* Proceedings, Volpe National Transportation Systems Center, Cambridge, Massachusetts, December 2014.
26. Clifton, J. (2011). *The Coming Job War*. Gallup Press.
27. Dávila, A., and Nombela, M. “Safe Road Trains For The Environment.” *Conference on Personal Rapid Transit PRT@ LHR, 2010*, SARTRE, vol. 3, 2010, pp. 2-3.
28. Davis, C. M. Invoking Cloture in the Senate. *Congressional Research Service Report*, 2011.
29. DiClemente, J., Mogos, S., and Wang, R. “Autonomous Car Policy Report.” Carnegie-Mellon University, Department of Engineering and Public Policy, New Technology Commercialization Project Class, 2014.
30. Dooley, L. *Testimony of the Alliance of Automobile Manufacturers for the Joint Transportation Committee on House Bill 6344-Autonomous Vehicles*, 2015. http://www.cga.ct.gov/2015/TRAdata/Tmy/2015HB-06344-R000211-Laura%20Dooley,%20Director%20of%20State%20Affairs,%20Alliance%20of%20Automobile%20Manufacturers-TMY.PDF.

31. Douma, F., and Palodichuk, S. A. “Criminal Liability Issues Created By Autonomous Vehicles.” *Santa Clara L. Rev.*, 52, 2012, p. 1157.
32. Drake, M. “Driverless Car Market Worth $87 Billion By 2030.” *The Washington Times*, 2014. http://www.washingtontimes.com/news/2014/may/22/driverless-car-market-worth-87-billion-by-2030/?page=all.
33. Dresner, K. M., and Stone, P. “Sharing the Road: Autonomous Vehicles Meet Human Drivers.” *IJCAI*, 7, January, 2007, pp. 1263-1268.
34. Dresner, K., and Stone, P. “Traffic Intersections Of The Future.” *Proceedings of the National Conference on Artificial Intelligence*, 21(2), 2006, p. 1593.
35. Egbelu, P. J., and Tanchoco, J. M. “Characterization Of Automatic Guided Vehicle Dispatching Rules.” *The International Journal of Production Research*, 22 (3), 1984, pp. 359-374.
36. Eze, T., Anthony, R. J., Walshaw, C., and Soper, A. “The Challenge Of Validation For Autonomic And Self-Managing Systems.” *The Seventh International Conference on Autonomic and Autonomous Systems*, 2011, pp. 128-133.
37. Fagnant, D. J. “The Future Of Fully Automated Vehicles: Opportunities For Vehicle-And Ride-Sharing, With Cost And Emissions Savings.” Doctoral dissertation, Department of Civil and Environmental Engineering, University of Texas at Austin, 2014.
38. Fagnant, D. J., and Kockelman, K. M. “Preparing a Nation for Autonomous Vehicles: Opportunities, Barriers and Policy Recommendations.” Eno Center for Transportation, Washington D.C., 2013.
39. Fagnant, D. J., and Kockelman, K. “The Travel and Environmental Implications of Shared Autonomous Vehicles Using Agent-based Model Scenarios.” *Transportation Research Part C*, 40(0), 2014, pp. 1-13.
40. Federal Communications Commission (FCC). *Wireless Telecommunications Bureau Announces Details Concerning The Licensing And Transmitter Location Registration Process For The Dedicated Short Range Communications Service In The Intelligent Transportation Service.* Public Notice DA 04-3165, September 30, 2004. https://apps.fcc.gov/edocs_public/attachmatch/DA-04-3165A1.pdf
41. Fernandez, P., and Nunes, U. “Platooning with IVC-Enabled Autonomous Vehicles: Strategies to Mitigate Communication Delays, Improve Safety and Traffic Flow.” IEEE Transactions on Intelligent Transportation Systems, 13(1), 2012, pp. 91-106.
42. General Assembly of Maryland. “ENV_2_12_2015_meeting_1.”, 2015. http://mgahouse.maryland.gov/house/play/488125797fbe4797af36540fea09e6a8/?catalog/03e481c7-8a42-4438-a7da-93ff74bdaa4c&playfrom=101.
43. Glancy, D. J. “Privacy In Autonomous Vehicles.” *Santa Clara L. Rev.*, *52*, 2012, p. 1171.

44. Gomes, L. “Urban Jungle a Tough Challenge for Google's Autonomous Cars.” *MIT Technology Review*, July 24, 2014.
45. Goodrich, J. “Comment, Driving Miss Daisy: An Autonomous Chauffer System.” *Hous. L. Rev*. 265, 2013, pp. 268-275.
46. Graham, K. “Of Frightened Horses And Autonomous Vehicles: Tort Law And Its Assimilation Of Innovations.” *Santa Clara L. Rev.*, *52*, 2012, p. 1241.
47. Green, J. “Driverless-Car Global Market Seen Reaching $42 Billion By 2025.” *Bloomberg Business*, 2015. http://www.bloomberg.com/news/articles/2015-01-08/driverless-car-global-market-seen-reaching-42-billion-by-2025.
48. Gurney, J. K. “Sue My Car Not Me: Products Liability And Accidents Involving Autonomous Vehicles.” *U. Ill. JL Tech. & Pol'y*, 13, 2013, pp. 247-423.
49. Horn, P. “Autonomic Computing: IBM\'s Perspective on the State of Information Technology.” 2001.
50. Ibarra, I., and Ward, D. D. “Cyber-Security As An Attribute Of Active Safety Systems And Their Migration Towards Vehicle Automation.” *8th IET International System Safety Conference Incorporating the Cyber Security Conference 2013*. Cardiff, UK, 2013.
51. Insurance Information Institute. “Self-Driving Cars And Insurance.” 2015. http://www.iii.org/issue-update/self-driving-cars-and-insurance.
52. Insurance Journal. “Insurers Unprepared For Self-Driving Car Disruption.” KPMG, 2015. http://www.insurancejournal.com/news/national/2015/06/18/372214.htm.
53. Iowa City Press-Citizen. “Johnson County First In Nation To Welcome Driverless Cars.” 2014. http://www.press-citizen.com/story/news/local/2014/07/24/johnson-county-first-in-nation-to-welcome-driverless-cars/13099701/.
54. J. D. Power and Associates. “2012 U.S. Automotive Emerging Technology Study.” 2012. http://autos.jdpower.com/press-releases/2012-us-automotive-emerging-technologies-study
55. Jacob, B., Lanyon-Hogg, R., Nadgir, D.K., and Yassin, A.F. “A Practical Guide To The IBM Autonomic Computing Toolkit.” (2004). http://www.redbooks.ibm.com/abstracts/sg246635.html?Open (accessed July 10, 2015).
56. Javaid, A. Y., Sun, W., Devabhaktuni, V. K., and Alam, M. “Cyber Security Threat Analysis And Modeling Of An Unmanned Aerial Vehicle System.” *Homeland Security (HST), 2012 IEEE Conference on Technologies for Homeland Security*, IEEE, 2012, pp. 585-590.
57. Jin, P. J., Fagnant, D., Hall, A., and Walton, C. M. “Policy Implications of Emerging Vehicle and Infrastructure Technology.” SWUTC/14/600451-00087-1, 2014.
58. Kephart, J. O. “Research Challenges Of Autonomic Computing.” *Proceedings, 27th International Conference on Software Engineering*, IEEE, 2005, pp. 15-22.

59. Kim, A., Wampler, B., Goppert, J., Hwang, I., and Aldridge, H. “Cyber Attack Vulnerabilities Analysis For Unmanned Aerial Vehicles.” *Infotech@ Aerospace*, 2012.
60. KPMG. “Automobile Insurance in the Era of Autonomous Vehicles. Survey Results.” 2015. https://www.kpmg.com/US/en/IssuesAndInsights/ArticlesPublications/Documents/automobile-insurance-in-the-era-of-autonomous-vehicles-survey-results-june-2015.pdf.
61. Kohler, W. J., and Colbert-Taylor, A. “Current Law and Potential Legal Issues Pertaining To Automated, Autonomous And Connected Vehicles.” *Santa Clara High Technology Law Journal*, *31*(1), 2015, p. 99.
62. Koscher, K., Czeskis, A., Roesner, F., Patel, S., Kohno, T., Checkoway, S., McCoy, D., Kantor, B., Anderson, D., Shacham, H. and Savage, S. “Experimental Security Analysis Of A Modern Automobile.” *Security and Privacy (SP), 2010 IEEE Symposium*, 2010, pp. 447-462.
63. Lam, S. “This is Big: A Robo-Car Just Drove Across the Country.” Wired, 2015. http://www.wired.com/2015/04/delphi-autonomous-car-cross-country/
64. Lenth, D. “Chapter 570: Paving the Way for Autonomous Vehicles.” *McGeorge L. Rev.*, 44, 2013, p. 778.
65. Leonard, J. “2014 Automated Vehicle Symposium.” Proceedings, Volpe National Transportation Systems Center, Cambridge, Massachusetts, December 2014.
66. Lin, P. “The Ethics of Autonomous Cars.” The Atlantic, 2015. http://www.theatlantic.com/technology/2013/10/the-ethics-of-autonomous-cars/280360/
67. Linkenback, S. “2014 Automated Vehicle Symposium.” Proceedings, Volpe National Transportation Systems Center, Cambridge, Massachusetts, December 2014.
68. Marchant, G. E., and Lindor, R. A. “Coming Collision Between Autonomous Vehicles And The Liability System.” *Santa Clara L. Rev.*, 52, 2012, p. 1321.
69. Markoff, J. “Google Cars Drive Themselves, in Traffic.” *The New York Times, October 9, 2010.*
70. Marshall, J.W. “NHTSA Role in the Future of Automated Vehicles.” 2013 AAMV Regional Conference, Dover, Delaware, 2013.
71. McCarthy, N., Dopping-Hepenstal, L. “Are We Ready For Autonomous Systems?” *Ingenia* (45), 2010, pp. 37-41.
72. Mearian, L. “Self-Driving Audi to Drive from California to New York.” ComputerWorld, March 18, 2015. http://www.computerworld.com/article/2899113/self-driving-audi-to-drive-from-california-to-new-york.html
73. Miller, V. “Iowa Primed To Be First In Nation For Driverless Cars: Road Project May Pave The Way For Driverless Car Requirements: This May Be The Opportunity We Need.” *The*

Gazette, 2015. http://thegazette.com/subject/news/iowa-primed-to-be-first-in-nation-for-driverless-cars-20150417.

74. Moore, L. “Spectrum Needs Of Self-Driving Vehicles.” CRS, 2015. https://www.fas.org/sgp/crs/misc/IN10168.pdf.
75. Morelli, B. A. “Eastern Iowa Considered For Autonomous-Vehicle-Only Roadway: ICAD Hosted State Officials For Conversation About Transportation's Role In Economy.” *The Gazette*, 2015. http://thegazette.com/subject/news/eastern-iowa-considered-for-autonomous-vehicle-only-roadway-20150529.
76. Mui, C. “5 Reasons Why Automakers Should Fear Google's Driverless Car.” *Forbes*, 2014. http://www.forbes.com/sites/chunkamui/2014/08/04/5-reasons-why-automakers-should-fear-googles-driverless-car/.
77. Murray, D. “New Research Assesses Potential for Driver-Assistive Truck Platooning.” *American Transportation Research Institute*, 2015. www.atri-online.org
78. Nash, J. “Unlimited Liability: Autonomous Vehicles And The Insurance Biz.” *Robotics Business Review*, 2013. http://www.roboticsbusinessreview.com/article/unlimited_liability_autonomous_vehicles_and_the_insurance_biz.
79. Nash, J., and Winkler, M. “Driverless Trucks Hired At California Ports Losing Market Share.” Bloomberg Business, May, 2015.
80. National Highway Traffic Safety Administration. “National Motor Vehicle Crash Causation Survey.” *U.S. Department of Transportation, Report DOT HS 811 059*, 2008.
81. National Highway Traffic Safety Administration “Preliminary Statement of Policy concerning Automated Vehicles.” 2013.
82. O’Leary, J., and Santana, M. “Iowa County Says Yes To Driverless Cars.” *USA Today*, 2014. http://www.usatoday.com/story/money/cars/2014/07/25/iowa-driverless-cars/13159845/.
83. Peterson, R. W. “New Technology-Old Law: Autonomous Vehicles And California's Insurance Framework.” *Santa Clara L. Rev.*, 52, 2012, p. 1341.
84. Pinto, C. “How Autonomous Vehicle Policy In Florida And Nevada Addresses Technological And Non-Technological Liabilities.” *Intersect: The Stanford Journal of Science, Technology and Society*, 5, 2012.
85. Polishuk, P., and Yin, C. “Components For Unmanned Vehicle Systems Aircraft/Ground/Sea/Space: Systems, Subsystems, Components, Materials, And Other Infrastructure Equipment And Services.” *Fiber and Integrated Optics*, 32(5/6), 2013, pp. 288-323.

86. Pomerleau, D. A. “ALVINN, An Autonomous Land Vehicle In A Neural Network.” No. AIP-77. Carnegie-Mellon Univ. Pittsburgh, PA. Artificial Intelligence and Psychology Project, 1989.
87. Public Law 102-240 “Intermodal Surface Transportation Efficiency Act of 1991.” Sections 6051-6057, 1991.
88. Roseman, R. “When Autonomous Vehicles Take Over The Road: Rethinking The Expansion Of The Fourth Amendment In A Technology-Driven World.” *Rich. JL and Tech.*, 20, 2013.
89. Ross, P. E. “A Cloud-Connected Car Is A Hackable Car, Worries Microsoft.” *IEEE Spectrum*, 11 April, 2014.
90. Ross, P.E. “Robo-Trucks Come To Canada's Oil Sands.” *IEEE Spectrum*, 9 June, 2015.
91. Rouff, C., and Hinchey, M., (eds.) *Experience from the DARPA Urban Challenge*. Springer, (2011).
92. Schoettle, B., and Sivak, M. “Public Opinion about Self-Driving Vehicles in China, India, Japan, the U.S., the U.K., and Australia.” University of Michigan Transportation Research Institute, Report UMTRI-2014-30, 2014.
93. Shchetko, N. “Laser Eyes Pose Price Hurdle For Driverless Cars.” *The Wall Street Journal*, 21, 2014.
94. Schwarz, C., Thomas, G., Nelson, K., McCrary, M., Schlarmann, N., and Powell, M. “Towards Autonomous Vehicles.” Final Report 25-1121-0003-117, Mid-America Transportation Center, University of Nebraska, Lincoln, Nebraska, 2013. http://digitalcommons.unl.edu/matcreports/92.
95. Sivak, M., and Schoettle, B. “Road Safety with Self-Driving Vehicles: General Limitations and Road Sharing with Conventional Vehicles.” University of Michigan Transportation Research Institute, Report UMTRI-2015-2, January, 2015.
96. Smith, B. W. “A Legal Perspective on Three Misconceptions in Vehicle Automation.” *Road Vehicle Automation*. Springer International Publishing, 2014a, pp. 85-91.
97. Smith, B. W. “Automated Vehicles Are Probably Legal In The United States.” *Texas A&M L. Rev.*, 1, 2014b, pp. 411-521.
98. Snavely, B. “Delphi To Self-Drive From San Francisco To New York Auto Show.” *USA Today*, 2015. http://www.usatoday.com/story/money/cars/2015/03/16/delphi-autonomous-selfdriving-car-nyautoshow/24838897/.
99. Soriano, B. C., Dougherty, S. L., Soublet, B. G., and Triepke, K. J. “Autonomous Vehicles: A Perspective From The Florida Department Of Motor Vehicles.” *Road Vehicle Automation*. Springer International Publishing, 2014, pp. 15-24.

100. Steudel, K. “Testimony before the Subcommittee on Highways and Transit of the Committee on Transportation and Infrastructure.” U.S. House of Representatives, November 19, 2013.
101. Sturdee, S. “German Scientists See Golden Future For 'Self-Driving' Cars.” 2010. http://phys.org/news/2010-10-self-driving-car-unveiled-germany.html.
102. Thierer, A. D., and Hagemann, R. “Removing Roadblocks To Intelligent Vehicles And Driverless Cars.” *Wake Forest Journal of Law and Policy*, Vol. 5, No. 2, 2014.
103. Underwood, S. “2014 Automated Vehicle Symposium.” Proceedings, Volpe National Transportation Systems Center, Cambridge, Massachusetts, 2014.
104. United Nations Economic Commission for Europe. “UNECE To Discuss First International Regulatory Steps Concerning Automated-Driving.” 2015. http://www.unece.org/info/media/presscurrent-press-h/transport/2015/unece-to-discuss-first-international-regulatory-steps-concerning-automated-driving/unece-to-discuss-first-international-regulatory-steps-concerning-automated-driving.html.
105. U.S. Federal Communications Commission.“FAQS – Internet.” 2014. https://www.fcc.gov/encyclopedia/faqs-internet.
106. Volpe National Transportation Systems Center. “Automated Vehicles Symposium 2014: Drivers, Vehicles, Infrastructure.” Proceedings. San Francisco, July 14-18, 2014.
107. Warrior, J., McHenry, E., and McGee, K. “They Know Where You Are.” *IEEE Spectrum*, 40(7), 2003, pp. 20-25.
108. Wood, S. P., Chang, J., Healy, T., Wood, J. “The Potential Regulatory Challenges of Increasingly Autonomous Motor Vehicles.” *Santa Clara Law Review*, 52(40) Article 9, 2012.
109. Xue, M., Wang, W., and Roy, S. “Security Concepts For The Dynamics Of Autonomous Vehicle Networks.” *Automatica*, 50(3), 2014, pp. 852-857.
110. Yeomans, G. (2014). *Autonomous vehicles: Handing Over Control: Opportunities and Risks for Insurance*. Lloyds. United Kingdom.
111. Young, J. “Adaptive Cruise Control.” J. D. Power Main, 2012. http://www.jdpower.com/cars/articles/tips-advice/adaptive-cruise-control
112. Zmud, J., Ecola, L., Phleps, P., and Feige, I. “The Future of Mobility: Scenarios for the United States in 2030.” Institute for Mobility Research, Rand Corporation, 2013.

GLOSSARY

AAM	Alliance of Automobile Manufacturers
ACC	Adaptive Cruise Control
ADAS	Advanced Driver Assistance Systems
AVTL	Autonomous Vehicle Testing License
AVTP	Autonomous Vehicle Tester Program
DARPA	Defense Advanced Research Projects Agency (U.S. Department of Defense)
DMV	Department of Motor Vehicles
DG-CONNECT	European Commission Directorate-General for Communication Networks, Content and Technology, Smart Cities, and Sustainability
DOTD	Department of Transportation and Development (Louisiana)
DSRC	Dedicated Short Range Communication
EDR	Event Data Recorder
FCC	Federal Communications Commission
FCW	Forward Collision Warning
GIS	Geographic Information Systems
GPS	Global Positioning System
HAR	Highway Advisory Radio
IMA	Intersection Movement Assist
ISTEA	Intermodal Surface Transportation Efficiency Act
IT	Information Technology
ITS	Intelligent Transportation Systems
ITS JPO	Intelligent Transportation System's Joint Program Office (U.S. DOT)
IVI	Intelligent Vehicle Initiative (in U.S. DOT)
LCA	Lane Change Assist
LDW	Lane Departure Warning
LIDAR	Light Detection and Ranging
LSU	Louisiana State University
MLIT	Ministry of Land, Infrastructure, Transport, and Tourism (Japan's Road Bureau)
MTP	Manufacturer's Testing Permits
NHTSA	National Highway and Traffic Safety Administration
OEM	Original Equipment Manufacturer
RITA	Research and Innovative Technology Administration (U.S. DOT)
SARTRE	Safe Roads and Trains for the Environment
TEA-21	Transportation Equity Act for the 21st Century
UAV	Unmanned Aerial Vehicle

UNECE	United Nations Economic Commission for Europe
V2I	Vehicle to Infrastructure (communication)
V2V	Vehicle to Vehicle (communication)
VisLab	Artificial Vision and Intelligent Systems Lab
VMS	Variable Message Signs

APPENDIX A: NEVADA LAWS

Assembly Bill No. 511– Enacted June 2011

AN ACT relating to transportation; providing certain privileges to the owner or long-term lessee of a qualified alternative fuel vehicle; authorizing in this State the operation of, and a driver's license endorsement for operators of, autonomous vehicles; providing a penalty; and providing other matters properly relating thereto. Legislative Counsel's Digest: Existing law authorizes the Department of Transportation to adopt regulations to allow certified low emission and energy-efficient vehicles to be operated in a lane on a highway under its jurisdiction designated for the preferential use or exclusive use of high-occupancy vehicles. (NRS 484A.463) Section 6 of this bill defines the term "qualified alternative fuel vehicle" in such a manner as to include within the definition both plug-in vehicles that are powered by an electric motor, and vehicles which are powered by an alternative fuel and meet specified federal emissions standards. Section 7 of this bill requires that, with limited exceptions, each local authority shall establish a parking program for qualified alternative fuel vehicles. Section 7 provides that the owner or long-term lessee of such a vehicle may: (1) apply to the local authority for a distinctive decal, label or other identifier that distinguishes the vehicle from other vehicles; and (2) while displaying the distinctive identifier, park the vehicle without the payment of a parking fee at certain times in certain public parking lots, parking areas and metered parking zones. Section 10 of this bill authorizes the use of a qualified alternative fuel vehicle in high-occupancy vehicle lanes irrespective of the occupancy of the vehicle, if the Department of Transportation has adopted the necessary regulations. Section 13 of this bill causes the provisions of this bill that pertain to qualified alternative fuel vehicles to expire by limitation ("sunset") as of January 1, 2018. Section 8 of this bill requires the Department of Motor Vehicles to adopt regulations authorizing the operation of autonomous vehicles on highways within the State of Nevada. Section 8 defines an "autonomous vehicle" to mean a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator. Section 2 of this bill requires the Department, by regulation, to establish a driver's license endorsement for the operation of an autonomous vehicle on the highways of this State.

EXPLANATION – Matter in bolded italics is new; matter between brackets [omitted material] is material to be omitted.

THE PEOPLE OF THE STATE OF NEVADA, REPRESENTED IN

SENATE AND ASSEMBLY, DO ENACT AS FOLLOWS:

Section 1. (Deleted by amendment.)

Sec. 2. Chapter 483 of NRS is hereby amended by adding thereto a new section to read as follows:

1. The Department shall by regulation establish a driver's license endorsement for the operation of an autonomous vehicle

On the highways of this State. The driver's license endorsement described in this subsection must, in its restrictions or lack thereof, recognize the fact that a person is not required to actively drive an autonomous vehicle.

2. As used in this section, "autonomous vehicle" has the meaning ascribed to it in section 8 of this act. Sec. 3. NRS 483.230 is hereby amended to read as follows: 483.230 1. Except persons expressly exempted in NRS 483.010 to 483.630, inclusive, and section 2 of this act, a person shall not drive any motor vehicle upon a highway in this State unless such person has a valid license as a driver under the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act for the type or class of vehicle being driven.

2. Any person licensed as a driver under the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act may exercise the privilege thereby granted upon all streets and highways of this State and shall not be required to obtain any other license to exercise such privilege by any county, municipal or local board or body having authority to adopt local police regulations.

3. Except persons expressly exempted in NRS 483.010 to 483.630, inclusive, and section 2 of this act, a person shall not steer or exercise any degree of physical control of a vehicle being towed by a motor vehicle upon a highway unless such person has a license to drive the type or class of vehicle being towed.

4. A person shall not receive a driver's license until the person surrenders to the Department all valid licenses in his or her possession issued to the person by this or any other jurisdiction. Surrendered licenses issued by another jurisdiction shall be returned by the Department to such jurisdiction. A person shall not have more than one valid driver's license. Sec. 4. NRS 483.620 is hereby amended to read as follows: 483.620 It is a misdemeanor for any person to violate any of the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act unless such violation is, by NRS 483.010 to 483.630, inclusive, and section 2 of this act or other law of this State, declared to be a felony. Sec. 5. Chapter 484A of NRS is hereby amended by adding thereto the provisions set forth as sections 5.3 to 8, inclusive, of this act. Sec. 5.3. "Original equipment manufacturer" means the original manufacturer of a new vehicle or engine, or relating to the vehicle or engine in its original, certified configuration.

Sec. 8. 1. The Department shall adopt regulations authorizing the operation of autonomous vehicles on highways within the State of Nevada.

2. The regulations required to be adopted by subsection 1 must:

(a) Set forth requirements that an autonomous vehicle must meet before it may be operated on a highway within this State;

(b) Set forth requirements for the insurance that is required to test or operate an autonomous vehicle on a highway within this State;

(c) Establish minimum safety standards for autonomous vehicles and their operation;

(d) Provide for the testing of autonomous vehicles;

(e) Restrict the testing of autonomous vehicles to specified geographic areas; and

(f) Set forth such other requirements as the Department determines to be necessary.

3. As used in this section:

(a) "Artificial intelligence" means the use of computers and related equipment to enable a machine to duplicate or mimic the behavior of human beings.

(b) "Autonomous vehicle" means a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator.

(c) "Sensors" includes, without limitation, cameras, lasers and radar. Sec. 9. NRS 484A.010 is hereby amended to read as follows: 484A.010 As used in chapters 484A to 484E, inclusive, of NRS, unless the context otherwise requires, the words and terms defined in NRS 484A.015 to 484A.320, inclusive, and sections 5.3 to 6.5, inclusive, of this act have the meanings ascribed to them in those sections. Sec. 10. NRS 484A.463 is hereby amended to read as follows: 484A.463 1. To the extent not inconsistent with federal law, the Department of Transportation may, in consultation with the Federal Highway Administration and the United States Environmental Protection Agency, adopt regulations establishing a program to allow a vehicle that is certified by the Administrator of the United States Environmental Protection Agency as a low emission and energy-efficient vehicle to be operated in a lane that is designated for the use of high-occupancy vehicles.

Sec. 13. 1. This section and section 12 of this act become effective upon passage and approval.

2. Sections 5 to 7, inclusive, 9, 10 and 11 of this act become effective on January 1, 2012.

3. Sections 2, 3, 4 and 8 of this act become effective on March 1, 2012.

4. The following provisions expire by limitation on January 1, 2018:

(a) Sections 5 to 7, inclusive, of this act;

(b) The amendatory provisions of sections 9, 10 and 11 of this act; and

(c) Subsections 2 and 3 of section 12 of this act.

SB 140, enacted in June 2011

Assembly Bill No. 511–Committee on Transportation

AN ACT relating to transportation; providing certain privileges to the owner or long-term lessee of a qualified alternative fuel vehicle; authorizing in this State the operation of, and a driver's license endorsement for operators of, autonomous vehicles; providing a penalty; and providing other matters properly relating thereto. Legislative Counsel's Digest: Existing law authorizes the Department of Transportation to adopt regulations to allow certified low emission and energy-efficient vehicles to be operated in a lane on a highway under its jurisdiction designated for the preferential use or exclusive use of high-occupancy vehicles. (NRS 484A.463) Section 6 of this bill defines the term "qualified alternative fuel vehicle" in such a manner as to include within the definition both plug-in vehicles that are powered by an electric motor, and vehicles which are powered by an alternative fuel and meet specified federal emissions standards. Section 7 of this bill requires that, with limited exceptions, each local authority shall establish a parking program for qualified alternative fuel vehicles. Section 7 provides that the owner or long-term lessee of such a vehicle may: (1) apply to the local authority for a distinctive decal, label or other identifier that distinguishes the vehicle from other vehicles; and (2) while displaying the distinctive identifier, park the vehicle without the payment of a parking fee at certain times in certain public parking lots, parking areas and metered parking zones. Section 10 of this bill authorizes the use of a qualified alternative fuel vehicle in high-occupancy vehicle lanes irrespective of the occupancy of the vehicle, if the Department of Transportation has adopted the necessary regulations. Section 13 of this bill causes the provisions of this bill that pertain to qualified alternative fuel vehicles to expire by limitation ("sunset") as of January 1, 2018. Section 8 of this bill requires the Department of Motor Vehicles to adopt regulations authorizing the operation of autonomous vehicles on highways within the State of Nevada. Section 8 defines an "autonomous vehicle" to mean a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator. Section 2

of this bill requires the Department, by regulation, to establish a driver's license endorsement for the operation of an autonomous vehicle on the highways of this State.

EXPLANATION – Matter in bolded italics is new; matter between brackets [omitted material] is material to be omitted.

THE PEOPLE OF THE STATE OF NEVADA, REPRESENTED IN

SENATE AND ASSEMBLY, DO ENACT AS FOLLOWS:

Section 1. (Deleted by amendment.)

Sec. 2. Chapter 483 of NRS is hereby amended by adding thereto a new section to read as follows:

1. The Department shall by regulation establish a driver's license endorsement for the operation of an autonomous vehicle

- On the highways of this State. The driver's license endorsement described in this subsection must, in its restrictions or lack thereof, recognize the fact that a person is not required to actively drive an autonomous vehicle.

2. As used in this section, "autonomous vehicle" has the meaning ascribed to it in section 8 of this act. Sec. 3. NRS 483.230 is hereby amended to read as follows: 483.230 1. Except persons expressly exempted in NRS 483.010 to 483.630, inclusive, and section 2 of this act, a person shall not drive any motor vehicle upon a highway in this State unless such person has a valid license as a driver under the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act for the type or class of vehicle being driven.

2. Any person licensed as a driver under the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act may exercise the privilege thereby granted upon all streets and highways of this State and shall not be required to obtain any other license to exercise such privilege by any county, municipal or local board or body having authority to adopt local police regulations.

3. Except persons expressly exempted in NRS 483.010 to 483.630, inclusive, and section 2 of this act, a person shall not steer or exercise any degree of physical control of a vehicle being towed by a motor vehicle upon a highway unless such person has a license to drive the type or class of vehicle being towed.

4. A person shall not receive a driver's license until the person surrenders to the Department all valid licenses in his or her possession issued to the person by this or any other jurisdiction. Surrendered licenses issued by another jurisdiction shall be returned by the Department to such

jurisdiction. A person shall not have more than one valid driver's license. Sec. 4. NRS 483.620 is hereby amended to read as follows: 483.620 It is a misdemeanor for any person to violate any of the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act unless such violation is, by NRS 483.010 to 483.630, inclusive, and section 2 of this act or other law of this State, declared to be a felony. Sec. 5. Chapter 484A of NRS is hereby amended by adding thereto the provisions set forth as sections 5.3 to 8, inclusive, of this act. Sec. 5.3. "Original equipment manufacturer" means the original manufacturer of a new vehicle or engine, or relating to the vehicle or engine in its original, certified configuration.

Sec. 5.7. "Qualified alternative fuel" means compressed natural gas, hydrogen or propane. Sec. 6. "Qualified alternative fuel vehicle" means a motor vehicle that:

1. Is equipped with four wheels;

2. Is made by:

(a) An original equipment manufacturer; or

(b) A qualified vehicle modifier of alternative fuel vehicles;

3. Is manufactured primarily for use on public streets, roads and highways;

4. Has a manufacturer's gross vehicle weight rating of less than 8,500 pounds;

5. Can maintain a maximum rate of speed of at least 70 miles per hour; and

6. Is propelled:

(a) To a significant extent by an electric motor which draws electricity from a battery that:

(1) Has a capacity of not less than 4 kilowatt hours; and

(2) Can be recharged from a source of electricity that is external to the vehicle; or

(b) Solely by a qualified alternative fuel, and meets or exceeds the federal Tier 2 bin 2 exhaust emission standard, as set forth in 40 C.F.R. § 86.1811-04. Sec. 6.5. "Qualified vehicle modifier of alternative fuel vehicles" means a manufacturer directly authorized by an original equipment manufacturer to modify a vehicle produced by an original equipment manufacturer to run on a qualified alternative fuel. Sec. 7. 1. Except as otherwise provided in subsection 6, a local authority that has within its jurisdiction a public metered parking zone, parking lot or parking area for the use of which a fee is charged, shall by ordinance establish a parking program for qualified alternative fuel vehicles pursuant to this section.

2. Upon the application of the owner or long-term lessee of a qualified alternative fuel vehicle, the local authority or its designee shall issue to the owner or long-term lessee a distinctive decal, label or other identifier that clearly distinguishes the qualified alternative fuel vehicle from other vehicles.

3. The board of county commissioners or the governing body of the city may charge a fee for the distinctive decal, label or other identifier issued pursuant to subsection 2 in an amount not to exceed $10 annually.

4. Except as otherwise provided in subsection 5, the driver of a qualified alternative fuel vehicle displaying the distinctive decal, label or other identifier issued pursuant to subsection 2 may:

(a) Stop, stand or park the qualified alternative fuel vehicle in any public metered parking zone within the jurisdiction of the local authority without depositing a coin of United States currency of the designated denomination, or making payment using another acceptable method of payment, in the applicable parking meter; and

(b) Stop, stand or park the qualified alternative fuel vehicle in any public parking lot or parking area within the jurisdiction of the local authority without paying a parking fee.

5. In addition to the requirements set forth in this section, the local authority may by ordinance establish such other requirements as it determines necessary for the parking program for qualified alternative fuel vehicles, including, without limitation:

(a) Requiring that the driver of a qualified alternative fuel vehicle comply with any limits on the amount of time for stopping, standing or parking imposed on other drivers; and

(b) Requiring that the driver of a qualified alternative fuel vehicle pay applicable parking fees during certain special events or activities designated by the local authority, regardless of whether the vehicle displays a distinctive decal, label or other identifier issued pursuant to subsection 2.

6. The provisions of this section do not apply to any public metered parking zone, parking lot or parking area of an airport. Sec. 8. 1. The Department shall adopt regulations authorizing the operation of autonomous vehicles on highways within the State of Nevada.

2. The regulations required to be adopted by subsection 1 must:

(a) Set forth requirements that an autonomous vehicle must meet before it may be operated on a highway within this State;

(b) Set forth requirements for the insurance that is required to test or operate an autonomous vehicle on a highway within this State;

(c) Establish minimum safety standards for autonomous vehicles and their operation;

(d) Provide for the testing of autonomous vehicles;

(e) Restrict the testing of autonomous vehicles to specified geographic areas; and

(f) Set forth such other requirements as the Department determines to be necessary.

3. As used in this section:

(a) "Artificial intelligence" means the use of computers and related equipment to enable a machine to duplicate or mimic the behavior of human beings.

(b) "Autonomous vehicle" means a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator.

(c) "Sensors" includes, without limitation, cameras, lasers and radar. Sec. 9. NRS 484A.010 is hereby amended to read as follows: 484A.010 As used in chapters 484A to 484E, inclusive, of NRS, unless the context otherwise requires, the words and terms defined in NRS 484A.015 to 484A.320, inclusive, and sections 5.3 to 6.5, inclusive, of this act have the meanings ascribed to them in those sections. Sec. 10. NRS 484A.463 is hereby amended to read as follows: 484A.463 1. To the extent not inconsistent with federal law, the Department of Transportation may, in consultation with the Federal Highway Administration and the United States Environmental Protection Agency, adopt regulations establishing a program to allow a vehicle that is certified by the Administrator of the United States Environmental Protection Agency as a low emission and energy-efficient vehicle to be operated in a lane that is designated for the use of high-occupancy vehicles pursuant to NRS 484A.460.2. As used in this section, "low emission and energy-efficient vehicle" has the meaning ascribed to it in 23 U.S.C. § 166(f) (3). The term includes, without limitation, a qualified alternative fuel vehicle. Sec. 11. NRS 484B.523 is hereby amended to read as follows: 484B.523 1. [When] Except as otherwise provided in section 7 of this act, when parking meters are erected by any local authority pursuant to an adopted ordinance giving notice thereof, it is unlawful for any person to stop, stand or park a vehicle in any metered parking zone for a period of time longer than designated by such parking meters upon a deposit of a coin of United States currency of the designated denomination.

2. Every vehicle shall be parked wholly within the metered parking space for which the meter shows parking privilege has been granted.

3. It is unlawful for any unauthorized person to remove, deface, tamper with, open, willfully break, destroy or damage any parking meter, or willfully to manipulate any parking meter in

such a manner that the indicator will fail to show the correct amount of unexpired time before a violation occurs.

Sec. 12. 1. The Department of Motor Vehicles shall adopt the regulations necessary to implement the provisions of sections 2 and 8 of this act on or before March 1, 2012.

2. Each local authority to which the provisions of section 7 of this act apply shall adopt the ordinances necessary to implement the provisions of sections 5.3 to 7, inclusive, 9, 10 and 11 of this act on or before January 1, 2012.

3. As used in this section, "local authority" has the meaning ascribed to it in NRS 484A.115.

Sec. 13. 1. This section and section 12 of this act become effective upon passage and approval.

2. Sections 5 to 7, inclusive, 9, 10 and 11 of this act become effective on January 1, 2012.

3. Sections 2, 3, 4 and 8 of this act become effective on March 1, 2012.

4. The following provisions expire by limitation on January 1, 2018:

(a) Sections 5 to 7, inclusive, of this act;

(b) The amendatory provisions of sections 9, 10 and 11 of this act; and

(c) Subsections 2 and 3 of section 12 of this act.

SB 313 enacted in June 2013

Assembly Bill No. 511 – Committee on Transportation

AN ACT relating to transportation; providing certain privileges to the owner or long-term lessee of a qualified alternative fuel vehicle; authorizing in this State the operation of, and a driver's license endorsement for operators of, autonomous vehicles; providing a penalty; and providing other matters properly relating thereto. Legislative Counsel's Digest: Existing law authorizes the Department of Transportation to adopt regulations to allow certified low emission and energy-efficient vehicles to be operated in a lane on a highway under its jurisdiction designated for the preferential use or exclusive use of high-occupancy vehicles. (NRS 484A.463) Section 6 of this bill defines the term "qualified alternative fuel vehicle" in such a manner as to include within the definition both plug-in vehicles that are powered by an electric motor, and vehicles which are powered by an alternative fuel and meet specified federal emissions standards. Section 7 of this bill requires that, with limited exceptions, each local authority shall establish a parking program

for qualified alternative fuel vehicles. Section 7 provides that the owner or long-term lessee of such a vehicle may: (1) apply to the local authority for a distinctive decal, label or other identifier that distinguishes the vehicle from other vehicles; and (2) while displaying the distinctive identifier, park the vehicle without the payment of a parking fee at certain times in certain public parking lots, parking areas and metered parking zones. Section 10 of this bill authorizes the use of a qualified alternative fuel vehicle in high-occupancy vehicle lanes irrespective of the occupancy of the vehicle, if the Department of Transportation has adopted the necessary regulations. Section 13 of this bill causes the provisions of this bill that pertain to qualified alternative fuel vehicles to expire by limitation ("sunset") as of January 1, 2018. Section 8 of this bill requires the Department of Motor Vehicles to adopt regulations authorizing the operation of autonomous vehicles on highways within the State of Nevada. Section 8 defines an "autonomous vehicle" to mean a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator. Section 2 of this bill requires the Department, by regulation, to establish a driver's license endorsement for the operation of an autonomous vehicle on the highways of this State.

EXPLANATION – Matter in bolded italics is new; matter between brackets [omitted material] is material to be omitted.

THE PEOPLE OF THE STATE OF NEVADA, REPRESENTED IN

SENATE AND ASSEMBLY, DO ENACT AS FOLLOWS: Section 1. (Deleted by amendment.) Sec. 2. Chapter 483 of NRS is hereby amended by adding thereto a new section to read as follows:

1. The Department shall by regulation establish a driver's license endorsement for the operation of an autonomous vehicle on the highways of this State. The driver's license endorsement described in this subsection must, in its restrictions or lack thereof, recognize the fact that a person is not required to actively drive an autonomous vehicle.

1. As used in this section, "autonomous vehicle" has the meaning ascribed to it in section 8 of this act. Sec. 3. NRS 483.230 is hereby amended to read as follows: 483.230 1. Except persons expressly exempted in NRS 483.010 to 483.630, inclusive, and section 2 of this act, a person shall not drive any motor vehicle upon a highway in this State unless such person has a valid license as a driver under the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act for the type or class of vehicle being driven.

2. Any person licensed as a driver under the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act may exercise the privilege thereby granted upon all streets and highways

of this State and shall not be required to obtain any other license to exercise such privilege by any county, municipal or local board or body having authority to adopt local police regulations.

3. Except persons expressly exempted in NRS 483.010 to 483.630, inclusive, and section 2 of this act, a person shall not steer or exercise any degree of physical control of a vehicle being towed by a motor vehicle upon a highway unless such person has a license to drive the type or class of vehicle being towed.

4. A person shall not receive a driver's license until the person surrenders to the Department all valid licenses in his or her possession issued to the person by this or any other jurisdiction. Surrendered licenses issued by another jurisdiction shall be returned by the Department to such jurisdiction. A person shall not have more than one valid driver's license. Sec. 4. NRS 483.620 is hereby amended to read as follows: 483.620 It is a misdemeanor for any person to violate any of the provisions of NRS 483.010 to 483.630, inclusive, and section 2 of this act unless such violation is, by NRS 483.010 to 483.630, inclusive, and section 2 of this act or other law of this State, declared to be a felony. Sec. 5. Chapter 484A of NRS is hereby amended by adding there to the provisions set forth as sections 5.3 to 8, inclusive, of this act. Sec. 5.3. "Original equipment manufacturer" means the original manufacturer of a new vehicle or engine, or relating to the vehicle or engine in its original, certified configuration.

Sec. 5.7. "Qualified alternative fuel" means compressed natural gas, hydrogen or propane.

Sec. 6. "Qualified alternative fuel vehicle" means a motor vehicle that:

1. Is equipped with four wheels;

2. Is made by:

(a) An original equipment manufacturer; or

(b) A qualified vehicle modifier of alternative fuel vehicles;

3. Is manufactured primarily for use on public streets, roads and highways;

4. Has a manufacturer's gross vehicle weight rating of less than 8,500 pounds;

5. Can maintain a maximum rate of speed of at least 70 miles per hour; and

6. Is propelled:

(a) To a significant extent by an electric motor which draws electricity from a battery that:

(1) Has a capacity of not less than 4 kilowatt hours; and

(2) Can be recharged from a source of electricity that is external to the vehicle; or

(b) Solely by a qualified alternative fuel, and meets or exceeds the federal Tier 2 bin 2 exhaust emission standard, as set forth in 40 C.F.R. § 86.1811-04. Sec. 6.5. "Qualified vehicle modifier of alternative fuel vehicles" means a manufacturer directly authorized by an original equipment manufacturer to modify a vehicle produced by an original equipment manufacturer to run on a qualified alternative fuel. Sec. 7. 1. Except as otherwise provided in subsection 6, a local authority that has within its jurisdiction a public metered parking zone, parking lot or parking area for the use of which a fee is charged, shall by ordinance establish a parking program for qualified alternative fuel vehicles pursuant to this section.

2. Upon the application of the owner or long-term lessee of a qualified alternative fuel vehicle, the local authority or its designee shall issue to the owner or long-term lessee a distinctive decal, label or other identifier that clearly distinguishes the qualified alternative fuel vehicle from other vehicles.

3. The board of county commissioners or the governing body of the city may charge a fee for the distinctive decal, label or other identifier issued pursuant to subsection 2 in an amount not to exceed $10 annually.

4. Except as otherwise provided in subsection 5, the driver of a qualified alternative fuel vehicle displaying the distinctive decal, label or other identifier issued pursuant to subsection 2 may:

(a) Stop, stand or park the qualified alternative fuel vehicle in any public metered parking zone within the jurisdiction of the local authority without depositing a coin of United States currency of the designated denomination, or making payment using another acceptable method of payment, in the applicable parking meter; and

(b) Stop, stand or park the qualified alternative fuel vehicle in any public parking lot or parking area within the jurisdiction of the local authority without paying a parking fee.

5. In addition to the requirements set forth in this section, the local authority may by ordinance establish such other requirements as it determines necessary for the parking program for qualified alternative fuel vehicles, including, without limitation:

(a) Requiring that the driver of a qualified alternative fuel vehicle comply with any limits on the amount of time for stopping, standing or parking imposed on other drivers; and

(b) Requiring that the driver of a qualified alternative fuel vehicle pay applicable parking fees during certain special events or activities designated by the local authority, regardless of whether the vehicle displays a distinctive decal, label or other identifier issued pursuant to subsection 2.

6. The provisions of this section do not apply to any public metered parking zone, parking lot or parking area of an airport. Sec. 8. 1. The Department shall adopt regulations authorizing the operation of autonomous vehicles on highways within the State of Nevada.

2. The regulations required to be adopted by subsection 1 must:

(a) Set forth requirements that an autonomous vehicle must meet before it may be operated on a highway within this State;

(b) Set forth requirements for the insurance that is required to test or operate an autonomous vehicle on a highway within this

State;

(c) Establish minimum safety standards for autonomous vehicles and their operation;

(d) Provide for the testing of autonomous vehicles;

(e) Restrict the testing of autonomous vehicles to specified geographic areas; and

(f) Set forth such other requirements as the Department determines to be necessary.

3. As used in this section:

(a) "Artificial intelligence" means the use of computers and related equipment to enable a machine to duplicate or mimic the behavior of human beings.

(b) "Autonomous vehicle" means a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator.

(c) "Sensors" includes, without limitation, cameras, lasers and radar. Sec. 9. NRS 484A.010 is hereby amended to read as follows: 484A.010 As used in chapters 484A to 484E, inclusive, of NRS, unless the context otherwise requires, the words and terms defined in NRS 484A.015 to 484A.320, inclusive, and sections 5.3 to 6.5, inclusive, of this act have the meanings ascribed to them in those sections.

Sec. 10. NRS 484A.463 is hereby amended to read as follows:

484A.463 1. To the extent not inconsistent with federal law, the Department of Transportation may, in consultation with the Federal Highway Administration and the United States Environmental Protection Agency, adopt regulations establishing a program to allow a vehicle that is certified by the Administrator of the United States Environmental Protection Agency as a

low emission and energy-efficient vehicle to be operated in a lane that is designated for the use of high-occupancy vehicles pursuant to

NRS 484A.460.

2. As used in this section, "low emission and energy-efficient vehicle" has the meaning ascribed to it in 23 U.S.C. § 166(f) (3). The term includes, without limitation, a qualified alternative fuel vehicle.

Sec. 11. NRS 484B.523 is hereby amended to read as follows:

484B.523 1. [When] Except as otherwise provided in section

7 of this act, when parking meters are erected by any local authority pursuant to an adopted ordinance giving notice thereof, it is unlawful for any person to stop, stand or park a vehicle in any metered parking zone for a period of time longer than designated by such parking meters upon a deposit of a coin of United States currency of the designated denomination.

2. Every vehicle shall be parked wholly within the metered parking space for which the meter shows parking privilege has been granted.

3. It is unlawful for any unauthorized person to remove, deface, tamper with, open, willfully break, destroy or damage any parking meter, or willfully to manipulate any parking meter in such a manner that the indicator will fail to show the correct amount of unexpired time before a violation occurs.

Sec. 12. 1. The Department of Motor Vehicles shall adopt the regulations necessary to implement the provisions of sections 2 and 8 of this act on or before March 1, 2012.

2. Each local authority to which the provisions of section 7 of this act apply shall adopt the ordinances necessary to implement the provisions of sections 5.3 to 7, inclusive, 9, 10 and 11 of this act on or before January 1, 2012.

3. As used in this section, "local authority" has the meaning ascribed to it in NRS 484A.115.

Sec. 13. 1. This section and section 12 of this act become effective upon passage and approval.

2. Sections 5 to 7, inclusive, 9, 10 and 11 of this act become effective on January 1, 2012.

3. Sections 2, 3, 4 and 8 of this act become effective on March 1, 2012.

4. The following provisions expire by limitation on January 1, 2018:

(a) Sections 5 to 7, inclusive, of this act;

(b) The amendatory provisions of sections 9, 10 and 11 of this act; and

(c) Subsections 2 and 3 of section 12 of this act.

APPENDIX B: FLORIDA LAWS

Senate Bill No. 1298 - enacted September 2012

CHAPTER 570

An act to add Division 16.6 (commencing with Section 38750) to the

Vehicle Code, relating to vehicles.

[Approved by Governor, September 25, 2012. Filed with

Secretary of State September 25, 2012.] Legislative counsel's digest

SB 1298, Padilla. Vehicles: autonomous vehicles: safety and performance requirements.

Existing law requires the Department of the Florida Highway Patrol to adopt rules and regulations that are designed to promote the safe operation of specific vehicles, including, among other things, school buses and commercial motor vehicles. Existing law also requires the Department of Motor Vehicles to register vehicles that are being operated in this state and to issue a license plate to an applicant for the operation and identification of that person's vehicle.

This bill would authorize the operation of an autonomous vehicle, as defined, on public roads for testing purposes, by a driver who possesses the proper class of license for the type of vehicle being operated if specified requirements are met, including that the driver be seated in the driver's seat, monitoring the safe operation of the autonomous vehicle, and capable of taking over immediate manual control of the autonomous vehicle in the event of an autonomous technology failure or other emergency. The bill would prohibit, except as provided for testing purposes, the operation of such a vehicle on public roads until the manufacturer submits an application to the department that includes various certifications, including a certification that the autonomous technology satisfies certain requirements, and the application is approved by the department pursuant to the regulations that the department would be required to adopt. The bill would require one of the certifications to specify that the autonomous vehicle's technology meets Federal Motor Vehicle Safety Standards for the vehicle's model year and all other applicable safety standards and performance requirements set forth in state and federal law and the regulations promulgated pursuant to those laws.

The bill would require that the Department of Motor Vehicles adopt regulations as soon as practicable, but no later than January 1, 2015, setting forth requirements for the submission of evidence of insurance, surety bond, or self-insurance required by the bill and requirements for

the submission or approval of an application to operate an autonomous vehicle, including any testing, equipment, or performance standards, as specified, and to hold public hearings on the adoption of any regulation applicable to the operation 91 of an autonomous vehicle without the presence of a driver inside the vehicle. The bill would provide that federal regulations promulgated by the National Highway Traffic Safety Administration supersede state law or regulation when found to be in conflict. The bill would require the department to approve an application submitted by a manufacturer upon making specified findings and would authorize the department to impose additional requirements if the application seeks approval for autonomous vehicles where there is no person in the driver's seat. The bill would also require the department to notify the Legislature of the receipt of an application from a manufacturer seeking approval to operate an autonomous vehicle capable of operating without the presence of a driver inside the vehicle and the approval of the application. The bill would provide that approval of the application is effective no sooner than 180 days after the date the application is submitted. The department would be authorized to charge a fee for the application in an amount necessary to recover all costs reasonably incurred by the department.

The people of the State of Florida do enact as follows:

SECTION 1. The Legislature finds and declares all of the following:

(a) Development is actively under way of new technology that, through the use of computers, sensors, and other systems, permits a motor vehicle to operate without the active control and continuous monitoring of a human operator. Motor vehicles with this technology, referred to as "autonomous vehicles," offer significant potential safety, mobility, and commercial benefits for individuals and businesses in the state and elsewhere.

(b) Autonomous vehicles have been operated safely on public roads in the state in recent years by entities developing and testing this technology.

(c) The State of Florida, which presently does not prohibit or specifically regulate the operation of autonomous vehicles, desires to encourage the current and future development, testing, and operation of autonomous vehicles on the public roads of the state. The state seeks to avoid interrupting these activities while at the same time creating appropriate rules intended to ensure that the testing and operation of autonomous vehicles in the state are conducted in a safe manner.

(d) Toward that end, the Legislature finds it appropriate to authorize the establishment of specific safety requirements for the testing and operation of autonomous vehicles, and to require that future testing and operation of autonomous vehicles in the state comply with those requirements. SEC. 2. Division 16.6 (commencing with Section 38750) is added to the Vehicle Code, to read:

DIVISION 16.6. AUTONOMOUS VEHICLES

38750. (a) For purposes of this division, the following definitions apply:

91 Ch. 570 — 2 —

(1) “Autonomous technology” means technology that has the capability to drive a vehicle without the active physical control or monitoring by a human operator.

(2) (A) “Autonomous vehicle” means any vehicle equipped with autonomous technology that has been integrated into that vehicle.

(B) An autonomous vehicle does not include a vehicle that is equipped with one or more collision avoidance systems, including, but not limited to, electronic blind spot assistance, automated emergency braking systems, park assist, adaptive cruise control, lane keep assist, lane departure warning, traffic jam and queuing assist, or other similar systems that enhance safety or provide driver assistance, but are not capable, collectively or singularly, of driving the vehicle without the active control or monitoring of a human operator.

(3) “Department” means the Department of Motor Vehicles.

(4) An “operator” of an autonomous vehicle is the person who is seated in the driver’s seat, or if there is no person in the driver’s seat, causes the autonomous technology to engage.

(5) A “manufacturer” of autonomous technology is the person as defined in Section 470 that originally manufactures a vehicle and equips autonomous technology on the originally completed vehicle or, in the case of a vehicle not originally equipped with autonomous technology by the vehicle manufacturer, the person that modifies the vehicle by installing autonomous technology to convert it to an autonomous vehicle after the vehicle was originally manufactured.

(b) An autonomous vehicle may be operated on public roads for testing purposes by a driver who possesses the proper class of license for the type of vehicle being operated if all of the following requirements are met:

(1) The autonomous vehicle is being operated on roads in this state solely by employees, contractors, or other persons designated by the manufacturer of the autonomous technology.

(2) The driver shall be seated in the driver’s seat, monitoring the safe operation of the autonomous vehicle, and capable of taking over immediate manual control of the autonomous vehicle in the event of an autonomous technology failure or other emergency.

(3) Prior to the start of testing in this state, the manufacturer performing the testing shall obtain an instrument of insurance, surety bond, or proof of self-insurance in the amount of five million dollars ($5m), and shall provide evidence of the insurance, surety bond, or self-insurance to the department in the form and manner required by the department pursuant to the regulations adopted pursuant to subdivision (d).

(c) Except as provided in subdivision (b), an autonomous vehicle shall not be operated on public roads until the manufacturer submits an application to the department, and that application is approved by the department pursuant to the regulations adopted pursuant to subdivision (d). The application shall contain, at a minimum, all of the following certifications:

(1) A certification by the manufacturer that the autonomous technology satisfies all of the following requirements:

91— 3 — Ch. 570

(A) The autonomous vehicle has a mechanism to engage and disengage the autonomous technology that is easily accessible to the operator.

(B) The autonomous vehicle has a visual indicator inside the cabin to indicate when the autonomous technology is engaged.

(C) The autonomous vehicle has a system to safely alert the operator if an autonomous technology failure is detected while the autonomous technology is engaged, and when an alert is given, the system shall do either of the following:

(i) Require the operator to take control of the autonomous vehicle.

(ii) If the operator does not or is unable to take control of the autonomous vehicle, the autonomous vehicle shall be capable of coming to a complete stop.

(D) The autonomous vehicle shall allow the operator to take control in multiple manners, including, without limitation, through the use of the brake, the accelerator pedal, or the steering wheel, and it shall alert the operator that the autonomous technology has been disengaged.

(E) The autonomous vehicle’s autonomous technology meets Federal Motor Vehicle Safety Standards for the vehicle’s model year and all other applicable safety standards and performance requirements set forth in state and federal law and the regulations promulgated pursuant to those laws.

(F) The autonomous technology does not make inoperative any Federal

Motor Vehicle Safety Standards for the vehicle's model year and all other applicable safety standards and performance requirements set forth in state and federal law and the regulations promulgated pursuant to those laws.

(G) The autonomous vehicle has a separate mechanism, in addition to, and separate from, any other mechanism required by law, to capture and store the autonomous technology sensor data for at least 30 seconds before a collision occurs between the autonomous vehicle and another vehicle, object, or natural person while the vehicle is operating in autonomous mode. The autonomous technology sensor data shall be captured and stored in a read-only format by the mechanism so that the data is retained until extracted from the mechanism by an external device capable of downloading and storing the data. The data shall be preserved for three years after the date of the collision.

(2) A certification that the manufacturer has tested the autonomous technology on public roads and has complied with the testing standards, if any, established by the department pursuant to subdivision (d).

(3) A certification that the manufacturer will maintain a surety bond, or proof of self-insurance as specified in regulations adopted by the department pursuant to subdivision (d), in an amount of five million dollars ($5m).

(d) (1) As soon as practicable, but no later than January 1, 2015, the department shall adopt regulations setting forth requirements for the submission of evidence of insurance, surety bond, or self-insurance required by subdivision (b), and the submission and approval of an application to operate an autonomous vehicle pursuant to subdivision (c).

(2) The regulations shall include any testing, equipment, and performance standards, in addition to those established for purposes of subdivision (b), 91

Ch. 570 — 4 — that the department concludes are necessary to ensure the safe operation of autonomous vehicles on public roads, with or without the presence of a driver inside the vehicle. In developing these regulations, the department may consult with the Department of the Florida Highway Patrol, the Institute of Transportation Studies at the University of Florida, or any other entity identified by the department that has expertise in automotive technology, automotive safety, and autonomous system design.

(3) The department may establish additional requirements by the adoption of regulations, which it determines, in consultation with the Department of the Florida Highway Patrol, are necessary to ensure the safe operation of autonomous vehicles on public roads, including, but not limited to, regulations regarding the aggregate number of deployments of autonomous vehicles on public

roads, special rules for the registration of autonomous vehicles, new license requirements for operators of autonomous vehicles, and rules for revocation, suspension, or denial of any license or any approval issued pursuant to this division.

(4) The department shall hold public hearings on the adoption of any regulation applicable to the operation of an autonomous vehicle without the presence of a driver inside the vehicle.

(e) (1) The department shall approve an application submitted by a manufacturer pursuant to subdivision (c) if it finds that the applicant has submitted all information and completed testing necessary to satisfy the department that the autonomous vehicles are safe to operate on public roads and the applicant has complied with all requirements specified in the regulations adopted by the department pursuant to subdivision (d).

(2) Notwithstanding paragraph (1), if the application seeks approval for autonomous vehicles capable of operating without the presence of a driver inside the vehicle, the department may impose additional requirements it deems necessary to ensure the safe operation of those vehicles, and may require the presence of a driver in the driver's seat of the vehicle if it determines, based on its review pursuant to paragraph (1), that such a requirement is necessary to ensure the safe operation of those vehicles on public roads. The department shall notify the Legislature of the receipt of an application from a manufacturer seeking approval to operate an autonomous vehicle capable of operating without the presence of a driver inside the vehicle and approval of the application. Approval of the application shall be effective no sooner than 180 days after the date the application is submitted.

(f) Nothing in this division shall limit or expand the existing authority to operate autonomous vehicles on public roads, until 120 days after the department adopts the regulations required by paragraph (1) of subdivision

(g) Federal regulations promulgated by the National Highway Traffic

Safety Administration shall supersede the provisions of this division when found to be in conflict with any other state law or regulation. (h) The manufacturer of the autonomous technology installed on a vehicle shall provide a written disclosure to the purchaser of an autonomous vehicle

91— 5 — Ch. 570 that describes what information is collected by the autonomous technology equipped on the vehicle. The department may promulgate regulations to assess a fee upon a manufacturer that submits an application pursuant to subdivision (c) to operate autonomous vehicles on public roads in an amount necessary to recover all costs reasonably incurred by the department.

AB 1164 under committee revision since March 2015

An act to amend Section 38750 of the Vehicle Code, relating to vehicles.

AB 1164, as introduced, Gatto. Autonomous vehicles.

Existing law authorizes the operation of an autonomous vehicle on public roads for testing purposes by a driver who possesses the proper class of license for the type of vehicle being operated if specified requirements are satisfied. Existing law requires the Department of Motor Vehicles to adopt regulations no later than January 1, 2015, setting forth requirements for the submission of evidence of insurance, surety bond, or self-insurance, and for the submission and approval of an application to operate an autonomous vehicle.

This bill would make technical, nonsubstantive changes to that provision.

Vote: majority Appropriation: no Fiscal Committee: no Local Program: no

APPENDIX C: D.C. LAWS

B 19-0931 (“AUTONOMOUS VEHICLE ACT OF 2012”) enacted in January 2013

Codification District of Columbia Official Code 1 2001 Edition

AN ACT IN THE COUNCIL OF THE DISTRICT OF COLUMBIA

To authorize autonomous vehicles to operate on District roadways, to require the Department of Motor Vehicles to create an autonomous vehicle designation, and to establish safe operating protocols for autonomous vehicles.

BE IT ENACTED BY THE COUNCIL OF THE DISTRICT OF COLUMBIA, That this act may be cited as the “Autonomous Vehicle Act of 2012”.

Sec. 2. Definitions.

For the purposes of this act, the term:

(1) “Autonomous vehicle” means a vehicle capable of navigating District roadways and interpreting traffic-control devices without a driver actively operating any of the vehicle’s control systems. The term “autonomous vehicle” excludes a motor vehicle enabled with active safety systems or driver- assistance systems, including systems to provide electronic blind-spot assistance, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lane-keep assistance, lane-departure warning, or traffic jam and queuing assistance, unless the system alone or in combination with other systems enables the vehicle on which the technology is installed to drive without active control or monitoring by a human operator.

(2) “Driver” means a human operator of a motor vehicle with a valid driver’s license.

(3) “Public roadway” means a street, road, or public thoroughfare that allows motor vehicles.

(4) “Traffic control device” means a traffic signal, traffic sign, electronic traffic sign, pavement marking, or other sign, device, or apparatus designed and installed to direct moving traffic.

Sec. 3. Autonomous vehicles permitted.

An autonomous vehicle may operate on a public roadway; provided, that the vehicle:

(1) Has a manual override feature that allows a driver to assume control of the autonomous vehicle at any time;

§ 50-2351

§ 50-2352

(2) Has a driver seated in the control seat of the vehicle while in operation who is prepared to take control of the autonomous vehicle at any moment; and

(3) Is capable of operating in compliance with the District's applicable traffic laws and motor vehicle laws and traffic control devices. Sec. 4. Vehicle conversion; limited liability of original manufacturer.

(a) The original manufacturer of a vehicle converted by a third party into an autonomous vehicle shall not be liable in any action resulting from a vehicle defect caused by the conversion of the vehicle, or by equipment installed by the converter, unless the alleged defect was present in the vehicle as originally manufactured.

(b) The conversion of vehicles to autonomous vehicles shall be limited to model years 2009 or later or vehicles built within 4 years of conversion, whichever vehicle is newer.

Sec. 5. Rules.

The Mayor, pursuant to Title 1 of the District of Columbia Administrative Procedure Act, approved October 21, 1968 (82 Stat. 1204; D.C. Official Code § 2-501 et seq.), shall issue rules on or before December 31, 2013, establishing a class of vehicles for autonomous vehicles and procedures and fees for the registration, titling, and issuance of permits to operate autonomous vehicles.

Sec. 6. Fiscal impact statement.

The Council adopts the fiscal impact statement in the committee report as the fiscal impact statement required by section 602(c)(3) of the District of Columbia Home Rule Act, approved December 24, 1973 (87 Stat. 813; D.C. Official Code § 1-206.02(c)(3)).

Sec. 7. Effective date.

This act shall take effect following approval by the Mayor (or in the event of veto by the Mayor, action by the Council to override the veto), a 30-day period of Congressional review as provided in section 602(c)(1) of the District of Columbia Home Rule Act, § 50-2353 § 50-2354.

APPENDIX D: MICHIGAN LAWS

SB 52 enacted in May 2013

2013 Legislature CS for CS for CS for SB 52, 1st Engrossed

CODING: Words stricken are deletions; words underlined are additions.

An act relating to the use of wireless communications devices while driving; creating s. 316.305, F.S.; creating the "Florida Ban on Texting While Driving Law"; providing legislative intent; prohibiting the operation of a motor vehicle while using a wireless communications device for certain purposes; defining the term "wireless communications device"; providing exceptions; specifying information that is admissible as evidence of a violation; providing penalties; providing for enforcement as a secondary action; amending s. 322.27, F.S.; providing for points to be assessed against a driver license for the unlawful use of a wireless communications device within a school safety zone or resulting in a crash; providing an effective date.

Be It Enacted by the Legislature of the State of Florida:

Section 1. Section 316.305, Florida Statutes, is created to read:

316.305 Wireless communications devices; prohibition.—

(1) This section may be cited as the "Florida Ban on Texting While Driving Law."

(2) It is the intent of the Legislature to:

(a) Improve roadway safety for all vehicle operators, vehicle passengers, bicyclists, pedestrians, and other road users.

(b) Prevent crashes related to the act of text messaging while driving a motor vehicle.

(c) Reduce injuries, deaths, property damage, health care costs, health insurance rates, and automobile insurance rates related to motor vehicle crashes.

(d) Authorize law enforcement officers to stop motor vehicles and issue citations as a secondary offense to persons who are texting while driving.

(3)(a) <u>A person may not operate a motor vehicle while manually typing or entering multiple letters, numbers, symbols, or other characters into a wireless communications device or while sending or reading data in such a device</u> for the purpose of nonvoice interpersonal communication, including, but not limited to, communication methods known as texting, e-

mailing, and instant messaging. As used in this section, the term “wireless communications device” means any handheld device used or capable of being used in a handheld manner, that is designed or intended to receive or transmit text or character-based messages, access or store data, or connect to the Internet or any communications service as defined in s. 812.15 and that allows text communications. For the purposes of this paragraph, a motor vehicle that is stationary is not being operated and is not subject to the prohibition in this paragraph.

(b) Paragraph (a) does not apply to a motor vehicle operator who is:

1. Performing official duties as an operator of an authorized emergency vehicle as defined in s. 322.01, a law enforcement or fire service professional, or an emergency medical services professional.

2. Reporting an emergency or criminal or suspicious activity to law enforcement authorities.

3. Receiving messages that are:

a. Related to the operation or navigation of the motor vehicle;

b. Safety-related information, including emergency, traffic, or weather alerts;

c. Data used primarily by the motor vehicle; or

d. Radio broadcasts.

4. Using a device or system for navigation purposes.

5. Conducting wireless interpersonal communication that does not require manual entry of multiple letters, numbers, or symbols, except to activate, deactivate, or initiate a feature or function.

6. Conducting wireless interpersonal communication that does not require reading text messages, except to activate, deactivate, or initiate a feature or function.

7. Operating an autonomous vehicle, as defined in s. 316.003, in autonomous mode.

(c) Only in the event of a crash resulting in death or personal injury, a user’s billing records for a wireless communications device or the testimony of or written statements from appropriate authorities receiving such messages may be admissible as evidence in any proceeding to determine whether a violation of paragraph (a) has been committed.

(4)(a) Any person who violates paragraph (3)(a) commits a noncriminal traffic infraction, punishable as a nonmoving violation as provided in chapter 318.

(b) Any person who commits a second or subsequent violation of paragraph (3)(a) within 5 years after the date of a prior

SB 0169 enacted in December 2013

STATE OF MICHIGAN

97TH LEGISLATURE

REGULAR SESSION OF 2013

Introduced by Senators Kowall, Casperson, Brandenburg, Hansen, Moolenaar, Emmons, Warren, Bieda, Meekhof, Walker, Richardville, Hood and Young

ENROLLED SENATE BILL No. 169

AN ACT to amend 1949 PA 300, entitled "An act to provide for the registration, titling, sale, transfer, and regulation of certain vehicles operated upon the public highways of this state or any other place open to the general public or generally accessible to motor vehicles and distressed vehicles; to provide for the licensing of dealers; to provide for the examination, licensing, and control of operators and chauffeurs; to provide for the giving of proof of financial responsibility and security by owners and operators of vehicles; to provide for the imposition, levy, and collection of specific taxes on vehicles, and the levy and collection of sales and use taxes, license fees, and permit fees; to provide for the regulation and use of streets and highways; to create certain funds; to provide penalties and sanctions for a violation of this act; to provide for civil liability of owners and operators of vehicles and service of process on residents and nonresidents; to regulate the introduction and use of certain evidence; to provide for the levy of certain assessments; to provide for the enforcement of this act; to provide for the creation of and to prescribe the powers and duties of certain state and local agencies; to impose liability upon the state or local agencies; to provide appropriations for certain purposes; to repeal all other acts or parts of acts inconsistent with this act or contrary to this act; and to repeal certain parts of this act on a specific date," by amending the title, a division heading, and sections 35a, 36, 244, and 602b (MCL 257.35a, 257.36, 257.244, and 257.602b), the title as amended by 2010 PA 10, section 35a as amended by 1980 PA 515, section 244 as amended by 2008 PA 539, and section 602b as amended by 2013 PA 36, and by adding sections 2b, 663, 665, 666, and 817.

The People of the State of Michigan enact:

TITLE

An act to provide for the registration, titling, sale, transfer, and regulation of certain vehicles operated upon the public highways of this state or any other place open to the general public or generally accessible to motor vehicles and distressed vehicles; to provide for the licensing of dealers; to provide for the examination, licensing, and control of operators and chauffeurs; to

provide for the giving of proof of financial responsibility and security by owners and operators of vehicles; to provide for the imposition, levy, and collection of specific taxes on vehicles, and the levy and collection of sales and use taxes, license fees, and permit fees; to provide for the regulation and use of streets and highways; to create certain funds; to provide penalties and sanctions for a violation of this act; to provide for civil liability of manufacturers, the manufacturers of automated technology, up fitters, owners, and operators of vehicles and service of process on residents and nonresidents; to regulate the introduction and use of certain evidence; to provide for the levy of certain assessments; to provide for the enforcement of this act; to provide for the creation of and to prescribe the powers and duties of certain state and local agencies; to impose liability upon the state or local agencies; to provide appropriations for certain purposes; to repeal all other acts or parts of acts inconsistent with this act or contrary to this act; and to repeal certain parts of this act on a specific date.

Sec. 2b. (1) "Automated motor vehicle" means a motor vehicle on which automated technology has been installed, either by a manufacturer of automated technology or an upfitter that enables the motor vehicle to be operated without any control or monitoring by a human operator. Automated motor vehicle does 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 the technology is installed to operate without any control or monitoring by an operator.

(2) "Automated technology" means technology installed on a motor vehicle that has the capability to assist, make decisions for, or replace an operator.

(3) "Automatic mode" means the mode of operating an automated motor vehicle when automated technology is engaged to enable the motor vehicle to operate without any control or monitoring by an operator.

(4) "Manufacturer of automated technology" means a manufacturer or subcomponent system producer recognized by the secretary of state that develops or produces automated technology or automated vehicles.

(5) "Up fitter" means a person that modifies a motor vehicle after it was manufactured by installing automated technology in that motor vehicle to convert it to an automated vehicle. Up fitter includes a subcomponent system producer recognized by the secretary of state that

develops or produces automated technology. Sec. 35a. “Operate” or “operating” means 1 or more of the following:

(a) Being in actual physical control of a vehicle. This subdivision applies regardless of whether or not the person is licensed under this act as an operator or chauffeur.

(b) Causing an automated motor vehicle to move under its own power in automatic mode upon a highway or street regardless of whether the person is physically present in that automated motor vehicle at that time. This subdivision applies regardless of whether the person is licensed under this act as an operator or chauffeur. As used in this subdivision, “causing an automated motor vehicle to move under its own power in automatic mode” includes engaging the automated technology of that automated motor vehicle for that purpose. Sec. 36. “Operator” means a person, other than a chauffeur, who does either of the following:

(a) Operates a motor vehicle upon a highway or street.

(b) Operates an automated motor vehicle upon a highway or street.

Sec. 244. (1) A manufacturer owning a vehicle of a type otherwise required to be registered under this act may operate or move the vehicle upon a street or highway primarily for the purposes of transporting or testing or in connection with a golf tournament or a public civic event, if the vehicle displays, in the manner prescribed in section 225, 1 special plate approved by the secretary of state.

(2) A producer of a vehicle subcomponent system essential to the operation of the vehicle or the safety of an occupant may operate or move a motor vehicle upon a street or highway solely to transport or test the subcomponent system if the motor vehicle displays, in the manner prescribed in section 225, 1 special plate approved by the secretary of state. To be eligible for the special plate, the subcomponent system producer must be either a recognized subcomponent system producer or must be a subcomponent system producer under contract with a vehicle manufacturer.

(3) Subject to section 665, a manufacturer of automated technology may operate or otherwise move a motor vehicle or an automated motor vehicle upon a street or highway solely to transport or test automated technology if the motor vehicle or automated motor vehicle displays, in the manner prescribed in section 225, a special plate approved by the secretary of state.

(4) A dealer owning a vehicle of a type otherwise required to be registered under this act may operate or move the vehicle upon a street or highway without registering the vehicle if the vehicle displays, in the manner prescribed in section 225, 1 special plate issued to the owner by

the secretary of state. As used in this subsection, “dealer” includes an employee, servant, or agent of the dealer.

(5) Solely to deliver the vehicle, a transporter may operate or move a vehicle of a type otherwise required to be registered under this act upon a street or highway if the vehicle displays, in the manner prescribed in section 225, a special plate issued to the transporter under this chapter.

(6) A licensee shall not use a special plate described in this section on service cars or wreckers operated as an adjunct of a licensee’s business. A manufacturer, transporter, or dealer making or permitting any unauthorized use of a special plate under this chapter forfeits the right to use special plates and the secretary of state, after notice and a hearing, may suspend or cancel the right to use special plates and require that the special plates be surrendered to or repossessed by the state.

(7) A transporter shall furnish a sufficient surety bond or policy of insurance as protection for public liability and property damage as may be required by the secretary of state.

(8) The secretary of state shall determine the number of plates a manufacturer, dealer, or transporter reasonably needs in his or her business.

(9) If a vehicle that is required to be registered under this act is leased or sold, the vendee or lessee is permitted to operate the vehicle upon a street or highway for not more than 72 hours after taking possession if the vehicle has a dealer plate attached as provided in this section. The application for registration shall be made in the name of the vendee or lessee before the vehicle is used. The dealer and the vendee or lessee are jointly responsible for the return of the dealer plate to the dealer within 72 hours, and the failure of the vendee or lessee to return or the vendor or lessor to use due diligence to procure the dealer plate is a misdemeanor, and in addition the license of the dealer may be revoked. While using a dealer’s plate, a vendee or lessee shall have in his or her possession proof that clearly indicates the date of sale or lease of the motor vehicle.

(10) A vehicle owned by a dealer and bearing the dealer’s plate may be driven upon a street or highway for demonstration purposes by a prospective buyer or lessee for a period of 72 hours.

(11) The secretary of state may issue a registration plate upon application and payment of the proper fee to an individual, partnership, corporation, or association that in the ordinary course of business has occasion to legally pick up or deliver a commercial motor vehicle being driven to a facility to undergo aftermarket modification, or to repair or service a vehicle, or to persons defined as watercraft dealers under part 801 of the natural resources and environmental protection act, 1994 PA 451, MCL 324.80101 to 324.80199, or to the owner of a marina for the purpose of delivering a vessel or trailer to a purchaser, to transport a vessel between a body of

water and a place of storage, to transport a vessel or trailer to and from a boat show or exposition, to repair, service, or store a vessel or trailer, or to return a vessel or trailer to the customer after repair, service, or storage. A registration plate issued under this subsection shall be used to move the vehicle or trailer.

Sec. 602b. (1) Except as otherwise provided in this section, a person shall not read, manually type, or send a text message on a wireless 2-way communication device that is located in the person's hand or in the person's lap, including a wireless telephone used in cellular telephone service or personal communication service, while operating a motor vehicle that is moving on a highway or street in this state. As used in this subsection, a wireless 2-way communication device does not include a global positioning or navigation system that is affixed to the motor vehicle. Beginning October 28, 2013, this subsection does not apply to a person operating a commercial vehicle.

(2) Except as otherwise provided in this section, a person shall not read, manually type, or send a text message on a wireless 2-way communication device that is located in the person's hand or in the person's lap, including a wireless telephone used in cellular telephone service or personal communication service, while operating a commercial motor vehicle or a school bus on a highway or street in this state. As used in this subsection, a wireless 2-way communication device does not include a global positioning or navigation system that is affixed to the commercial motor vehicle or school bus. This subsection applies beginning October 28, 2013.

(3) Except as otherwise provided in this section, a person shall not use a hand-held mobile telephone to conduct a voice communication while operating a commercial motor vehicle or a school bus on a highway, including while temporarily stationary due to traffic, a traffic control device, or other momentary delays. This subsection does not apply if the operator of the commercial vehicle or school bus has moved the vehicle to the side of, or off, a highway and has stopped in a location where the vehicle can safely remain stationary. As used in this subsection, "mobile telephone" does not include a 2-way radio service or citizens band radio service. This subsection applies beginning October 28, 2013. As used in this subsection, "use a hand-held mobile telephone" means 1 or more of the following:

(a) Using at least 1 hand to hold a mobile telephone to conduct a voice communication.

(b) Dialing or answering a mobile telephone by pressing more than a single button.

(c) Reaching for a mobile telephone in a manner that requires a driver to maneuver so that he or she is no longer in a seated driving position, restrained by a seat belt that is installed as required by 49 CFR 393.93 and adjusted in accordance with the vehicle manufacturer's instructions.

(4) Subsections (1), (2), and (3) do not apply to an individual who is using a device described in subsection (1) or (3) to do any of the following:

(a) Report a traffic accident, medical emergency, or serious road hazard.

(b) Report a situation in which the person believes his or her personal safety is in jeopardy.

(c) Report or avert the perpetration or potential perpetration of a criminal act against the individual or another person.

(d) Carry out official duties as a police officer, law enforcement official, member of a paid or volunteer fire department, or operator of an emergency vehicle.

(e) Operate or program the operation of an automated motor vehicle while testing the automated motor vehicle in compliance with section 665, if that automated motor vehicle displays a special plate issued under section 224(3) in the manner required under section 225.

(5) An individual who violates this section is responsible for a civil infraction and shall be ordered to pay a civil fine as follows:

(a) For a first violation, $100.00.

(b) For a second or subsequent violation, $200.00.

(6) This section supersedes all local ordinances regulating the use of a communications device while operating a motor vehicle in motion on a highway or street, except that a unit of local government may adopt an ordinance or enforce an existing ordinance substantially corresponding to this section.

Sec. 663. Except as otherwise provided in section 665, a person shall not operate an automated motor vehicle upon a highway or street in automatic mode.

Sec. 665. (1) Before beginning research or testing of an automated motor vehicle or any automated technology installed in a motor vehicle under this section, the manufacturer of automated technology performing that research or testing shall submit proof satisfactory to the secretary of state that the vehicle is insured under chapter 31 of the insurance code of 1956, 1956 PA 218, MCL 500.3101 to 500.3179.

(2) A manufacturer of automated technology shall ensure that all of the following circumstances exist when researching or testing the operation of an automated motor vehicle or any automated technology installed in a motor vehicle upon a highway or street:

(a) The vehicle is operated only by an employee, contractor, or other person designated or otherwise authorized by that manufacturer of automated technology.

(b) An individual is present in the vehicle while it is being operated on a highway or street of this state and that individual has the ability to monitor the vehicle's performance and, if necessary, immediately take control of the vehicle's movements.

(c) The individual operating the vehicle under subdivision (a) and the individual who is present in the vehicle for purposes of subdivision (b) are licensed to operate a motor vehicle in the United States.

(3) No later than February 1, 2016, the state transportation department in consultation with the secretary of state and experts from various sizes of automobile manufacturing and automated technology manufacturing industries shall submit a report to the senate standing committees on transportation and economic development and to the house of representatives standing committees on transportation and commerce recommending any additional legislative or regulatory action that may be necessary for the continued safe testing of automated motor vehicles and automated technology installed in motor vehicles.

Sec. 666. (1) A person who violates this division is responsible for a civil infraction and may be fined as provided in section 907.

(2) This division does not prohibit a person from being charged with, convicted of or being found responsible for, ordered to pay a fine or costs, or punished for any other violation of law arising out of the same transaction as the violation of this division.

Sec. 817. A manufacturer of automated technology is immune from civil liability for damages that arise out of any modification made by another person to a motor vehicle or an automated motor vehicle, or to any automated technology, as provided in section 2949b of the revised judicature act of 1961, 1961 PA 236, MCL 600.2949b.

Enacting section 1. This amendatory act takes effect 90 days after the date it is enacted into law.

Enacting section 2. This amendatory act does not take effect unless Senate Bill No. 663 of the 97th Legislature is enacted into law.

This act is ordered to take immediate effect.

SB 0663 enacted in December 2013

STATE OF MICHIGAN

97TH LEGISLATURE

REGULAR SESSION OF 2013

Introduced by Senator Kowall

ENROLLED SENATE BILL No. 663

AN ACT to amend 1961 PA 236, entitled "An act to revise and consolidate the statutes relating to the organization and jurisdiction of the courts of this state; the powers and duties of the courts, and of the judges and other officers of the courts; the forms and attributes of civil claims and actions; the time within which civil actions and proceedings may be brought in the courts; pleading, evidence, practice, and procedure in civil and criminal actions and proceedings in the courts; to provide for the powers and duties of certain state governmental officers and entities; to provide remedies and penalties for the violation of certain provisions of this act; to repeal all acts and parts of acts inconsistent with or contravening any of the provisions of this act; and to repeal acts and parts of acts," (MCL 600.101 to 600.9947) by adding section 2949b.

The People of the State of Michigan enact:

Sec. 2949b. (1) The manufacturer of a vehicle is not liable and shall 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.

(2) A subcomponent system producer recognized as described in section 244 of the Michigan vehicle code, 1949 PA 300, MCL 257.244, 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.

(3) Sections 2945 to 2949a do not apply in a product liability action to the extent that they are inconsistent with this section.

(4) As used in this section:

(a) “Automated motor vehicle” means that term as defined in section 2b of the Michigan vehicle code, 1949 PA 300, MCL 257.2b.

(b) “Automatic mode” means that term as defined in section 2b of the Michigan vehicle code, 1949 PA 300, MCL 257.2b.

(c) “Vehicle” means that term as defined in section 79 of the Michigan vehicle code, 1949 PA 300, MCL 257.79.

Enacting section 1. This amendatory act does not take effect unless Senate Bill No. 169 of the 97th Legislature is enacted into law.

APPENDIX E: CALIFORNIA LAWS

THE PEOPLE OF THE STATE OF CALIFONIA DO ENACT AS FOLLOWS:

SECTION 1.

Section 38750 of the Vehicle Code is amended to read:

38750.

(a) For purposes of this division, the following definitions apply:

(1) “Autonomous technology” means technology that has the capability to drive a vehicle without the active physical control or monitoring by a human operator.

(2) (A) “Autonomous vehicle” means any vehicle equipped with autonomous technology that has been integrated into that vehicle.

(B) An autonomous vehicle does not include a vehicle that is equipped with one or more collision avoidance systems, including, but not limited to, electronic blind spot assistance, automated emergency braking systems, park assist, adaptive cruise control, lane keep assist, lane departure warning, traffic jam and queuing assist, or other similar systems that enhance safety or provide driver assistance, but are not capable, collectively or singularly, of driving the vehicle without the active control or monitoring of a human operator.

(3) “Department” means the Department of Motor Vehicles.

(4) An “operator” of an autonomous vehicle is the person who is seated in the driver’s seat, or, if there is no person in the driver’s seat, causes the autonomous technology to engage.

(5) A “manufacturer” of autonomous technology is the person as defined in Section 470 that originally manufactures a vehicle and equips autonomous technology on the originally completed vehicle or, in the case of a vehicle not originally equipped with autonomous technology by the vehicle manufacturer, the person that modifies the vehicle by installing autonomous technology to convert it to an autonomous vehicle after the vehicle was originally manufactured.

(b) An autonomous vehicle may be operated on public roads for testing purposes by a driver who possesses the proper class of license for the type of vehicle being operated if all of the following requirements are met:

(1) The autonomous vehicle is being operated on roads in this state solely by employees, contractors, or other persons designated by the manufacturer of the autonomous technology.

(2) The driver shall be seated in the driver's seat, monitoring the safe operation of the autonomous vehicle, and capable of taking over immediate manual control of the autonomous vehicle in the event of an autonomous technology failure or other emergency.

(3) Prior to the start of testing in this state, the manufacturer performing the testing shall obtain an instrument of insurance, surety bond, or proof of self-insurance in the amount of five million dollars ($5m), and shall provide evidence of the insurance, surety bond, or self-insurance to the department in the form and manner required by the department pursuant to the regulations adopted pursuant to subdivision (d).

(c) Except as provided in subdivision (b), an autonomous vehicle shall not be operated on public roads until the manufacturer submits an application to the department, and that application is approved by the department pursuant to the regulations adopted pursuant to subdivision (d). The application shall contain, at a minimum, all of the following certifications:

(1) A certification by the manufacturer that the autonomous technology satisfies all of the following requirements:

(A) The autonomous vehicle has a mechanism to engage and disengage the autonomous technology that is easily accessible to the operator.

(B) The autonomous vehicle has a visual indicator inside the cabin to indicate when the autonomous technology is engaged.

(C) The autonomous vehicle has a system to safely alert the operator if an autonomous technology failure is detected while the autonomous technology is engaged, and when an alert is given, the system shall do either of the following:

(i) Require the operator to take control of the autonomous vehicle.

(ii) If the operator does not or is unable to take control of the autonomous vehicle, the autonomous vehicle shall be capable of coming to a complete stop.

(D) The autonomous vehicle shall allow the operator to take control in multiple manners, including, without limitation, through the use of the brake, the accelerator pedal, or the steering wheel, and it shall alert the operator that the autonomous technology has been disengaged.

(E) The autonomous vehicle's autonomous technology meets Federal Motor Vehicle Safety Standards for the vehicle's model year and all other applicable safety standards and performance

requirements set forth in state and federal law and the regulations promulgated pursuant to those laws.

(F) The autonomous technology does not make inoperative any Federal Motor Vehicle Safety Standards for the vehicle's model year and all other applicable safety standards and performance requirements set forth in state and federal law and the regulations promulgated pursuant to those laws.

(G) The autonomous vehicle has a separate mechanism, in addition to, and separate from, any other mechanism required by law, to capture and store the autonomous technology sensor data for at least 30 seconds before a collision occurs between the autonomous vehicle and another vehicle, object, or natural person while the vehicle is operating in autonomous mode. The autonomous technology sensor data shall be captured and stored in a read-only format by the mechanism so that the data is retained until extracted from the mechanism by an external device capable of downloading and storing the data. The data shall be preserved for three years after the date of the collision.

(2) A certification that the manufacturer has tested the autonomous technology on public roads and has complied with the testing standards, if any, established by the department pursuant to subdivision (d).

(3) A certification that the manufacturer will maintain, an instrument of insurance, a surety bond, or proof of self-insurance as specified in regulations adopted by the department pursuant to subdivision (d), in an amount of five million dollars ($5m).

(d) (1) As soon as practicable, but no later than January 1, 2015, the department shall adopt regulations setting forth requirements for the submission of evidence of insurance, surety bond, or self-insurance required by subdivision (b), and the submission and approval of an application to operate an autonomous vehicle pursuant to subdivision (c).

(2) The regulations shall include any testing, equipment, and performance standards, in addition to those established for purposes of subdivision (b), that the department concludes are necessary to ensure the safe operation of autonomous vehicles on public roads, with or without the presence of a driver inside the vehicle. In developing these regulations, the department may consult with the Department of the Florida Highway Patrol, the Institute of Transportation Studies at the University of Florida, or any other entity identified by the department that has expertise in automotive technology, automotive safety, and autonomous system design.

(3) The department may establish additional requirements by the adoption of regulations, which it determines, in consultation with the Department of the Florida Highway Patrol, are necessary

to ensure the safe operation of autonomous vehicles on public roads, including, but not limited to, regulations regarding the aggregate number of deployments of autonomous vehicles on public roads, special rules for the registration of autonomous vehicles, new license requirements for operators of autonomous vehicles, and rules for revocation, suspension, or denial of any license or any approval issued pursuant to this division.

(4) The department shall hold public hearings on the adoption of any regulation applicable to the operation of an autonomous vehicle without the presence of a driver inside the vehicle.

(e) (1) The department shall approve an application submitted by a manufacturer pursuant to subdivision (c) if it finds that the applicant has submitted all information and completed testing necessary to satisfy the department that the autonomous vehicles are safe to operate on public roads and the applicant has complied with all requirements specified in the regulations adopted by the department pursuant to subdivision (d).

(2) Notwithstanding paragraph (1), if the application seeks approval for autonomous vehicles capable of operating without the presence of a driver inside the vehicle, the department may impose additional requirements it deems necessary to ensure the safe operation of those vehicles, and may require the presence of a driver in the driver's seat of the vehicle if it determines, based on its review pursuant to paragraph (1), that such a requirement is necessary to ensure the safe operation of those vehicles on public roads. The department shall notify the Legislature of the receipt of an application from a manufacturer seeking approval to operate an autonomous vehicle capable of operating without the presence of a driver inside the vehicle and approval of the application. Approval of the application shall be effective no sooner than 180 days after the date the application is submitted.

(f) This division does not limit or expand the existing authority to operate autonomous vehicles on public roads, until 120 days after the department adopts the regulations required by paragraph (1) of subdivision (d).

(g) Federal regulations promulgated by the National Highway Traffic Safety Administration shall supersede the provisions of this division when found to be in conflict with any other state law or regulation.

(h) The manufacturer of the autonomous technology installed on a vehicle shall provide a written disclosure to the purchaser of an autonomous vehicle that describes what information is collected by the autonomous technology equipped on the vehicle. The department may promulgate regulations to assess a fee upon a manufacturer that submits an application pursuant to subdivision (c) to operate autonomous vehicles on public roads in an amount necessary to recover all costs reasonably incurred by the department.

APPENDIX F: TENNESSEE LAWS

SENATE BILL 598 By Kelsey

HOUSE BILL 616 By Sexton J

AN ACT to amend Tennessee Code Annotated, Title 4; Title 5; Title 6; Title 7 and Title 55, relative to the regulation of autonomous vehicles.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. Tennessee Code Annotated, Title 55, Chapter 8, is amended by adding the following language as a new section:

(a) No political subdivision may by ordinance, resolution, or any other means prohibit the use of a motor vehicle within the jurisdictional boundaries of the political subdivision solely on the basis of being equipped with autonomous technology if the motor vehicle otherwise complies with all safety regulations of the political subdivision.

(b) For purposes of this section, “autonomous technology” means technology installed on a motor vehicle that has the capability to drive the motor vehicle without the active physical control or monitoring by a human operator.

SECTION 2. This act shall take effect upon becoming a law, the public welfare requiring it.

This public document is published at a total cost of $250
42 copies of this public document were published in this first printing at a cost of $250. The total cost of all printings of this document including reprints is $250. This document was published by Louisiana Transportation Research Center to report and publish research findings as required in R.S. 48:105. This material was duplicated in accordance with standards for printing by state agencies established pursuant to R.S. 43:31. Printing of this material was purchased in accordance with the provisions of Title 43 of the Louisiana Revised Statutes.