REPORT OF THE

GEORGIA HOUSE AUTONOMOUS VEHICLE TECHNOLOGY STUDY COMMITTEE

COMMITTEE MEMBERS:

Honorable Trey Kelley, Chair
Representative, District 16

Honorable Ed Setzler
Representative, District 35

Honorable Terry Rogers
Representative, District 10

Honorable Karla Drenner
Representative, District 85

Honorable John Pezold
Representative, District 133

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I. INTRODUCTION

The Georgia House of Representatives created the House Autonomous Vehicle Technology Study Committee in 2014 through the passage of House Resolution 1265. Recognizing the increasing interest of innovative technology that could greatly benefit the state economy by allowing autonomous vehicles to be tested on local streets and highway systems; the Committee was formed to evaluate the issues facing Autonomous Vehicle Technology and publish its findings with recommendations by December 31st, 2014.

The Committee was chaired by Representative Trey Kelley (16th) and included four (4) additional members of the House: Representative Ed Setzler (35th); Representative Terry Rogers (10th); Representative Karla Drenner (85th); and Representative John Pezold (133rd). The House Budget and Research Office staff member assigned to facilitate the Committee was Mr. Leonel Chancey. The Legislative Counsel Staff member assigned to the Committee was Ms. Jenna Dolde.

The Committee held three public meetings in Atlanta to hear from experts, researchers, auto industry representatives, and legal advisors together to discuss emerging autonomous vehicle technology policy issues. During the course of the public meetings, the following individuals presented testimony to the Committee:

September 18th, 2014 – Atlanta, Georgia at Room 606 Coverdell Legislative Office Building

Robert F. Dallas, Esq. (Former Director of the Georgia Governor's Office of Highway Safety during the Perdue Administration); A. Jarrod Jenkins, Esq. of KREVOLIN/HORST LLC (A member of Primerus International Society of Law Firms); Don Davis of Georgia Tech Research Institute (Principal Research Engineer); Dr. Michael Hunter of Georgia Tech Research Institute (Director Georgia Transportation Institute/School of Civil & Environmental Engineering); Dr. Yaniv Heled, Professor of Law at Georgia State University; and Mr. Eric Sherouse of Georgia Tech Research Institute (Research Engineer).

October 20th, 2014 – Atlanta, Georgia at Room 606 Coverdell Legislative Office Building

Katherine Sheriff of Emory University School of Law and Jane Hayse of Atlanta Regional Commission (Director of Center for Livable Communities).

November 12th, 2014 – Atlanta, Georgia at Georgia Tech Research Institute Center

Wayne Weikel of Alliance of Automobile Manufacturers; Nicole Barranco of Volkswagen; Eric Raphael of General Motors Company (Program Director); Tino Mantella of Technology Association of Georgia; Ron Barnes of Google (Head of State Legislative Affairs); and Christian Kotcher of Metro Tech.

II. EXECUTIVE SUMMARY

Autonomous vehicle technology is machinery installed on a motor vehicle that provides the automobile with the capability to drive without any control by a human operator. The start of motor vehicles began with Henry Ford's Model T where advancements of safety have improved overtime beginning with the safety belt. Mechanical, electronic and body engineering improvements have progressed to disc brakes, air bags and self-parking systems. Autonomous vehicle technology now consists of event data recording, lane departure warnings, preemptive braking and other driver engineering enhancements that are assistive, manageable, and fully independent. With the addition of vehicles that have the capabilities to assess their environment, communicate with other vehicles, and interact with cloud data bases, Georgia's roads and highways could see a reduction in fatal automobile accidents. In the four years spanning from 2010 to 2013 alone nearly 5,000 fatalities were reported on Georgia roads [1].

With an average of approximately 32,000, motor vehicle accidents are the leading cause of death in the United States. The majority of automobile accidents are caused by human error. In 2013 Georgia saw over 359,000 accidents [2]. Nevertheless, new advancements in vehicle technology have significantly increased safety on the roads and highways. Electronic stability control is one piece of technology available that detects loss of steering control and automatically applies the brakes in an automobile to help navigate the vehicle during a slide or skid. According to the 2012 report "Estimating Lives Saved by Electronic Stability Control, 2008-2010", the 863 lives protected in 2010 by dynamic stability control is a substantial increase over the 2009 estimate of 705 and the 2008 estimate of 634 lives saved [3]. Although technology can increase consistency, it is important that the driver's reliability is not minimized. It is likely that fully autonomous vehicles will allow humans to travel with improved mobility, protection, and

[1] Georgia Governor's Office of Highway Safety Crash Data 2010-2013 Summary, July 2014
[2] Ed David Adams, Georgia Department of Transportation Traffic Statistics, July 2014
[3] U.S. Department of Transportation Traffic Safety Facts Research Note, November 2012

sustainability. However, this belief is dependent upon the personalities of the drivers and their interactions with the advanced systems in place. Therefore, the issue of liability was a primary focus of the Committee.

As autonomous vehicle technology continues to develop, liability and safety regulations will also change between drivers, manufacturers, driver accountability, and legal jurisdictions. Liability analysis has been performed over the span of development to automated vehicles subsystem manufactures and software manufactures. However, identifying and assessing potential risks to developers and insurance providers on the possible liability of communications providers, component manufacturers, and any additional parties involved in automobile production would help clarify the liability environment as it relates to the commercialization of autonomous vehicle technology [4].

When establishing liability after an automobile accident, it is likely that the performance of the automated vehicle will initially be held to the human driver. However, as systems become more technological, autonomous vehicles will likely be accountable to intricate specifications. The consequence is the shared connection of responsibility between a driverless car and the human driver that still relies on the human operator of the vehicle to monitor the roadway while maintaining safe operations at all times. Although strict liability on the diver would commercialize automated vehicles quickly, other arguments have considered collisions that could possibly occur when a human operator does not take control of the autonomous vehicle swiftly. A Brookings study [5] by John Villasenor states that “in a product liability lawsuit, an injured party would likely argue that the autonomous vehicle had a design defect, because it should have been designed to provide the driver with more advanced warning.”

Analyzing the transition of horse-drawn carriages to automobile liability, an adjustment to current laws will be essential for the development of automated systems. Liability insurance for testing autonomous vehicles in various states such as Florida [6] have policies in place where, “Prior to the start of testing in the state, the entity performing the testing must submit to the Department of Highway safety and Motor Vehicles an instrument of insurance, surety bond, or proof of self-insurance acceptable to the department in the amount of $5million.” The present standard of driver insurance will likely be inefficient for autonomous vehicles which will require

[4] Workshop on the Challenges and Opportunities of Road Vehicle Automation, 2013
[5] Brookings Products Liability and Driverless Cars: Issues and Guiding Principles for Legislation, April 2014
[6] Florida House Bill 1207 Vehicles with Autonomous Technology, April 2012

research of alternative means. The suggestion of various coverage models would help inform not only insurance providers, but state legislators about potential possibilities to explore in adapting to the production of automated vehicles and reducing traffic congestion.

The benefits of testing autonomous vehicles on the state's highways and local streets could greatly impact the economy of Georgia. The State of Georgia is blessed with numerous technological resources and an innovative business-friendly environment that could benefit from autonomous vehicle research and development. Legislation will adapt as necessary depending on the results of testing and introduction to driverless vehicles. Adopting this technology would ultimately increase mobility, reduce cost of congestion, improve land use, save lives, and place Georgia in a position for future stability and growth.

III. FINDINGS

This committee recognizes autonomous vehicle technology could bring multiple benefits to Georgia, however with any new disruptive technology new complications and liabilities would certainly arise. To understand the successes, opportunities and challenges, the Committee studied various strategies and approaches to the development of autonomous vehicles.

Levels of Autonomy

The first independent vehicle capabilities came into the market in 1958 with the convenient feature known as cruise control. In 1972 anti-lock braking systems (ABS) brought additional ease to the human driver. In the 1990s, electronic stability control improved the loss of tractions in motor vehicles. These technologies along with back-up collision warnings, blind spot monitoring, and lane-departure alerts are considered **Level 1 Autonomy** that assists the human driver's awareness.

Today's vehicles have the ability to make particular driving tasks automated for specific circumstances and determine actions without the driver's intention. For example, adaptive cruise control permits the driver to set the vehicle's speed until sensors detect another vehicle ahead traveling at a slower rate. Then technology decelerates or brakes the automobile to match the slower vehicle in front. If the vehicle ahead changes lanes or is no longer visible, then the adaptive cruise control recommences the original set speed. The same sensors can detect a possible collision if it determines an obstacle or wall is in front of the vehicle. This technology can help avoid collisions but is still considered **Level 2 Autonomy** due to the fact the human driver can override the system at any moment.

Testing is ongoing for **Level 3 Autonomy**, but would essentially implement all the technology mentioned previously, plus many new features. Lane-keeping systems use lane-departure technology to control the vehicle's steering. This allows the driver to maintain the vehicle in a single lane without using the steering wheel. In the event of a sharp turn, adaptive cruise control combined with this steering technology would apply the brakes of the vehicle prior to the bend in the road. With the sequence of the lane-keeping capabilities and adaptive cruise control, the driver only needs to take over when changing lanes on the highway. However, to further this technology there will be a need to improve vehicle communication.

The Society of Automotive Engineers defines **Level 3** technology as "conditional automation" where vehicles can share location, speed, and road network information to reach a destination. At this level of autonomy the vehicle operates, "The driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene" [7]. Since vehicles under autonomous control can react faster than humans, automobiles can travel at interstate speeds within inches of each other to similar destinations. Consequently, drivers would cut down on fuel expenses benefiting from the drag correlating to aerodynamics and thousands of accidents would be avoided.

Level 4 Autonomy is designed to perform all safety-critical driving purposes and oversee roadway conditions for an entire trip [8]. While this level requires the driver to provide a destination or navigation input, the driver is not expected to control the vehicle at any time during the travel. The amount of testing that must be done on these abilities to prove they are safe and reliable for vehicles is significant and may take some time before their arrival. Additionally, the capabilities mentioned in Level 3 and 4 autonomy require wireless connectivity between vehicles.

This network connectivity deserves a lot of policy attention because it is likely to be the source of privacy, cyber security, and radio frequency concerns. Once radar, lane-keeping cameras, LIDAR, infrared cameras, visible light cameras, GPS navigation, and wheel-mounted sensors send information to and from a vehicle while moving, that information could be taken advantage of if not controlled properly. Eric Sherouse, GTRI Research Engineer, gave testimony to the Committee that the controller area network (CAN) which is a specialized internal communications network that connects components inside a vehicle has no intrinsic support for

[7] Society of Automotive Engineers, Levels of Autonomy, 2014
[8] National Highway Traffic Safety Administration 14-13, May 2013

data integrity or authenticity. Malicious messages on CAN bus could be devastating as hacking abilities are available now that can unlock car doors and disrupt sensor capabilities [9]. Intrusion Detection System could provide short-term solutions in addition to teaming and collaboration tactics that have been created to cut-off potentially dangerous vehicles.

Legislation Introduced in the U.S.

Over twenty (20) states have introduced legislation on autonomous vehicle technology. However, only California, Nevada, Florida, Michigan, and the District of Columbia have passed laws regulating this field. Their policy examples specify application prerequisites, certification/insurance requirements, clarification on manufacturer liability, and which drivers can be designated by manufacturers. Dr. Yaniv Heled of Georgia State University College of Law recommended to the Committee that Georgia should create its own laws instead of duplicating what Nevada and California have already established. Testing should not be the only solution, but broadly drafted legislation is needed to allow the consumer market the ability to promote economic growth.

One primary suggestion is to avoid unnecessary obstacles for the development of the autonomous vehicle technology (for example, by not imposing requirements that assume automation level 3). It is important to pass flexible legislation that would allow the technology to easily move between development stages and, eventually, from the “lab” to the market without having to pass new legislation and with as few regulatory changes as possible [10]. State legislators will need to continue evaluating relevant legal and policy issues on an ongoing basis as the technology progresses. However, making sure that public safety is a priority by requiring appropriate insurance coverage for manufacturers and explicitly applying the Uninsured Motorist Statute to autonomous vehicles will be essential.

Liability

Liability analysis on autonomous vehicle technology first begins with determining who is legally responsible in an automated vehicle accident. When an unreliable product causes harm to a person or property, it takes a complex collection of laws and court decisions to give a comparative solution for safety to any automobile. If determining whether those involved in a crash should be held liable based upon a vehicle’s imperfections, then the potential manufacturer

[9] Eric Sherouse, Georgia Tech Research Institute, September 2014
[10] Dr. Yaniv Heled, Associate Professor Georgia State University College of Law, September 2014

liability could be found in a greater percentage of autonomous vehicle crashes than with standard vehicle crashes where driver error is frequently recognized as the cause.

If autonomous vehicle manufacturers have to comply with 50 different standards for development, then the inconsistent state regulations could be another factor for liability. Insurance complications could become more convoluted as vehicle owners would have difficulty traveling to different states. Also, autonomous vehicle software technology would not only need to be adaptive to other state traffic laws and autonomous regulations, but comply with fines for any non-compliance. However, the benefits of autonomous vehicle technology accumulate not only for any purchaser of the automated vehicle, but all parties involved especially the general public which could maximize the social wellbeing of Georgia.

Infrastructure

A 2011 study [11] by Texas A&M Transportation Institute calculated that the City of Atlanta ranked seventh (7th) in the nation for wasted hours in traffic congestions. The yearly average hours delayed per auto commuter is estimated at 51 hours. For a commuter, the travel time index estimated a daily trip of just below an hour and a half (1.24) and a waste of 23 gallons a year of excess fuel. The study estimated the congestion cost to $1,120 a year per auto commuter. Additional studies show the City of Nunez, Georgia ranks twenty-first (21st) nationally for the highest average commute time of 84.5 minutes [12]. Traffic Congestion could be reduced considerably by autonomous vehicle technology as more vehicles would have more efficient operation which would decrease the delays caused by collisions.

Many experts believe that by 2035 nearly 80 percent of the vehicles on the roads could be autonomous. "Cities are struggling with transportation today and will struggle even more in the future. We need to redefine what mobility is for the coming century," said Bill Ford, Jr., executive chairman of Ford Motor Company [13]. Not only would the mobility of the elderly and disabled be increased by autonomous vehicles, other populations could see substantial changes in their community interaction, health, and job opportunities. More system-level intelligence and interdependence will increase connected, coordinated, and smart highways for cooperative driving. New technologies already have the capabilities to increase lane capacity and improve land use by decreasing the need for parking areas. Some estimate that 41 major cities have at

[11] Urban Mobility Report Texas A&M Transportation Institute, 2012
[12] Zip Atlas Average Commute Time in Georgia by Zip Code, 2013
[13] Janice King, Future Structure "Oh the places we'll go!" November 2014

least 31 percent of land use in central business districts devoted to parking space alone [14]. The Committee did find suggestions that fully autonomous vehicles could transport, then drop off passengers to their place of employment and drive to a safe satellite parking area miles away.

The Atlanta Regional Commission (ARC) testified to the Committee on how the emergence of autonomous vehicles will impact Georgia and the Atlanta region. Economic competitiveness would increase the quality of life in the region as autonomous vehicle technology would impact the transit industry allowing for the renovation of transit services. Jane Hayse, Director of Center for Livable Communities, of ARC affirmed that there will be an examination of autonomous vehicles to determine the congestion benefits through regional modeling. Regional surveys will be conducted by the Commission to assess public observations regarding future autonomous vehicles as to what they perceive as barriers to implementation and what degree of understanding there is on the benefits to this technology.

If car accidents drastically decrease, it may be possible to redesign motor vehicles to a lighter more efficient car that enables reductions of fuel costs. Energy consumption and pollution could see significant changes as Mr. A. Jarrod Jenkins confirmed to the Committee that the authorization of autonomous vehicles reduces the need for multiple family cars. Also, connected vehicle technology data would also generate information that transportation analysts could use to make improvements in our infrastructure. Traffic conditions could have faster updates to help motorist avoid congested areas to decrease excess fuel costs. Public transportation would improve as well if autonomous vehicles provided transit services for multiple passengers who knew realistically when their vehicle would arrive.

This new technology will expand mobility applications that could assist people in planning their travels and keep traffic at a constant pace. Mike Pina of the U.S. Department of Transportation states, “Imagine, for instance, apps that can help you find open parking spaces, locate available taxis, guarantee you make your bus or train connections, or help a blind pedestrian cross the street. With an open source system for mobility applications, there will be minimal restrictions and limitless opportunities” [15]. Vehicles will be able to communicate with each other and continuously share safety or mobility information on traffic signals, school zones, road construction sites, and other infrastructure necessities that provide connectivity to all users.

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[14] JM Anderson, Autonomous Vehicle Technology “How to best realize its social benefits, 2014
[15] Mike Pina, Program Manager, Communications and Outreach Research and Innovative Technology Administration, U.S. Department of Transportation, December 2014

Challenges in Georgia Autonomous Vehicles

Georgia's road infrastructure is always a primary focus for legislative officials. However, some testimony was presented to the Committee during the three public meetings pointing out the challenges facing the implementation of autonomous vehicles.

Dr. Michael Hunter, Associate Professor at the School of Civil and Environmental Engineering at the Georgia Institute of Technology, noted the difference in "driverless" vehicles and "connected" vehicles. A driverless car assumes all driving tasks verses a connected vehicle that communicates between other vehicles and infrastructure. As he stated, "I believe that for (at least) decades after the introduction of the commercially available driverless vehicle that both human driven and driverless vehicles will be allowed on most facilities and have significant interaction" [16]. However, there are several questions related to the funding needed in maintaining Georgia's infrastructure once autonomous vehicles are implemented.

With the example of cooperative driving, will a vehicle's following distance be revised while traffic laws are strictly enforced? But then again, the most prevalent question presented by Dr. Hunter was the willingness of drivers in traditional manned vehicles with the connection to driverless cars. In other words, how aggressive are drivers going to be in non-driverless vehicles? There is a high possibility of human drivers taking advantage of autonomous vehicles by cutting-off the driverless car, not allowing the automated vehicle to merge, entering an intersection when there's no room, pulling into the rightmost lane at a stoplight so they can pass the driverless car once the light turns green and many other unpleasing bad driving behaviors. Other challenges must be taken under consideration such as drivers being inexperienced if situations arise requiring manual override.

Economic factors must also be examined carefully as there could be a potential loss of driving-related jobs. Demands will certainly change the way operations are done for daily errands, commutes, and deliveries. Which to that extent, competition would significantly increase for the radio spectrum between communication providers for the autonomous vehicle's communication system. Finally, Georgia's infrastructure could see an increased challenge in assuring all state roads are visible, stable, and standardized so that no variables affect image detection and understanding of signs, lanes, and traffic lights.

[16] Dr. Michael Hunter, Georgia Institute of Technology, House Study Committee Meeting, September 2014

IV. RECOMMENDATIONS

We live in a world that is quickly changing. Technology we now use in our lives every day was nothing more than science fiction and fantasy in the not so distant past. The cell phones we carry in our pockets have thousands of times the computing power used by the computers used by NASA to track all the Apollo space missions. By promoting a more efficient infrastructure system autonomous vehicles could be one piece of Georgia's transportation solution.

While some states are rushing to implement new regulations and requirements on autonomous vehicle technology, committee testimony overwhelmingly cautioned against this hurried action. To best promote the development of autonomous vehicle technology states should allow the market to further mature and grow without government intervention. Just as features such as cruise control and anti-braking systems were implemented as the market demanded them, so too can automobile technology continue to improve to the point of driverless cars.

Much scrutiny has been placed on our current torts system and the impact autonomous vehicles would have on it. To recommend any changes to our current system at this time would be putting the proverbial cart before the horse. The integration of driverless cars onto Georgia roads will certainly lead to tweaks in our liability system; however, our current system provides options for delegating proportional liability as it see fits. It is my belief our judicial system could proportion liability in an autonomous vehicle scenario to either the drivers, auto manufacturers, or software developers much like it does with driven cars today.

Too often we want to rush action to show we are committed to a concept. This committee has shown its interest in the further development of autonomous vehicles in Georgia, but we hold firm in the belief that at this time any new regulations, definitions, or changes to our system would shock the market and cause delay in this exciting technology.

To best promote the development of this technology in Georgia, we must continue on our path to provide a pro-business climate with low taxes and minimal regulation. We should continue our efforts to develop a highly skilled educated workforce with knowledge in the science and technology fields, and we must continue providing adequate funding to higher education facilities and research laboratories. Taking these steps will show the developers of autonomous vehicle technology that Georgia should be their destination for future development. At this time, these are the steps recommended by this committee.