REGULATING AUTONOMOUS VEHICLES IN THE UNITED STATES

by

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Abstract

The evolution of Autonomous Vehicles, Autonomous Vehicle technology and artificial intelligence is at the forefront of conversations in the United States and around the world. As self-driving vehicles continue to grow in technology and on Americas roads and highways protecting and ensuring the safety of pedestrians and all individuals is #1 priority. This proposal seeks to pass legislation that would regulate autonomous vehicles and the technology at the Federal level. The new legislation would ensure that all 50 states follow the same standard and structure regarding regulation, policy and law for self-driving vehicles. Not only will Federal regulation keep America safe but it can help create the guideline for all countries around the world to follow.
Table of Contents

I. Action Forcing Event ........................... 1
II. Statement of the Problem ....................... 2
III. Background/History ......................... 14
IV. Policy Proposal ............................... 32
V. Policy Analysis ................................. 41
VI. Political Analysis ............................. 55
VII. Recommendation ............................. 76
VIII. Addendum ..................................... 81
      Curriculum Vitae ............................. 89
List of Figures

Figure 1. “Theoretical potential for avoiding accidents with vehicle automation.”

Figure 2. “A diagram from the police report from the Tesla Crash shows how the vehicle in self-driving mode (V02) struck a tractor-trailer (v01) as it was turning left.”

Figure 3. “View of the self-driving system data playback at about 1.3 seconds before impact, when the system determined an emergency braking maneuver would be needed to mitigate a collision. Yellow bands are shown in meters ahead. Orange lines show the center of mapped travel lanes. The purple shaded area shows the path the vehicle traveled, with the green line showing the center of that path.”

Figure 4. “Provides Illustrative Results from the RAND Analysis”.

Figure 5. Autonomous Vehicle “Fact Sheet”

Figure 6. SAE Automation Levels

Figure 7. Autonomous Vehicle Technology

Figure 8. Author’s visualization. H.R. 3388 does not include reporting requirement specifications, so it is not included here

Figure 9. States with Autonomous Vehicles- Enacted Legislation and Executive Orders

Figure 10. Framework for Vehicle Performance Guidance

Figure 11. American’s Likelihood of Using Self-Driving Cars

Figure 12. 64% of the public from the CARAVAN poll express concerns about sharing the road with driverless cars

Figure 13. 84% out of the 1,005 adults who took the poll support “rules to ensure that human drivers are alert to be able to safely take control from an Autonomous Vehicle”.

Figure 14. Consumer Concerns about Self-Driving Cars
MEMORANDUM

TO: Senator John Thune (R-SD)
FROM: Rebecca Ackerman
RE: Federal Regulation for Autonomous Vehicles

I. ACTION FORCING EVENT

In 2018, there were an increased number of motor vehicle incidents related to autonomous vehicles (AVs) that caused human fatalities. For example, an Uber Self-Driving Vehicle in Tempe, Arizona, struck and killed a pedestrian crossing the road at 40 miles per hour.1 Additionally, a Tesla Model X also operating under the “autopilot” system steered toward a barrier and sped up in the moments before impact, killing the driver”.2 Within the same year, a Tesla AV operating under its “autopilot” system crashed into the rear of a fire vehicle in Utah, the women operating the vehicle did survive.3 These three incidents, along with others, have increased public awareness on the issues surrounding AVs. In the state of California alone, the California Department of Motor Vehicles received 129 Autonomous Vehicle Collision Reports4. These incidents included hitting curbs, stopping in-traffic, disabling self-driving mode,

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drifting between lanes and crashing into vehicles at low impact, as well as more serious collisions that have increased the concern for human safety\(^5\).

With the growing number of AVs on the road, increased safety concerns are forcing Federal, State and Local officials to establish proper safeguards, policies and regulations.\(^6\) The United States Department of Transportation National Highway Traffic Safety Administration reported that 37,133 individuals were killed in motor vehicle accidents in 2017.\(^7\) Without the development of policies to regulate AVs, accidents will continue to rise, threatening the safety of everyone on the road.

**II. STATEMENT OF THE PROBLEM**

In 1966, the Department of Transportation was established in order to advance transportation legislation.\(^8\) That same year the House of Representatives passed the National Traffic Vehicle Safety Act due to concerns about the death and injury toll on American highways.\(^9\)\(^10\) To date, “there have been more than 2.2 million motor vehicle related fatalities in the United States”.\(^11\) Proposed autonomous driving technology aims to decrease the number of fatalities each year as these vehicles navigate the roads

\(^5\) ibid.
\(^8\) ibid.
“without any human failings that result in accidents”.12 While self-driving technology has grown rapidly and public awareness surrounding self-driving vehicles has increased, the regulatory space is still largely nonexistent. Because there is no industry-wide standard for these vehicles, each manufacturer can determine the safety of their autonomous vehicle according to their own definition of what is “standard” based on state regulation.

Currently, autonomous vehicle technology and policy is regulated on the state level, allowing states to have inconsistencies in the regulation across all 50 states. “The lack of regulation has allowed unproven vehicles onto our roads,” causing concern for the safety of individuals interacting with the rapidly growing technology. If the lack of federal regulation over autonomous vehicle manufacturing continues, the growing number of accidents and harm to individuals from self-driving vehicles will increase, and people will continue to be unnecessarily killed by AVs.

Autonomous vehicles are intended to be safer than conventional vehicles because they remove the possibility of human error from driving. After all, “AV cars don’t drink and drive, fall asleep, text and talk, or put on makeup”.13 These vehicles use sensors, cameras, processors, navigation detection, and data to navigate safely on America’s highways and roads. While these systems are built to mitigate the number of crashes caused by conventional driving, there are a number of other risks caused by automation and this new technology. As seen in figure 1, the “theoretical potential for avoiding accidents with vehicle automation” is shown in journal article “Autonomous

Driving: Technical, Legal and Social Aspects,” which looks at the number of “conventional accidents” in 2016 versus “accidents prevented by future vehicle automation” and then concludes with “accidents due to the risk of automation”. The tested theory through a mathematical formula “assumes that accidents are avoided by means of AV, however, accidents also can be caused by the risks of automation”.14 Thus, concluding that the prevention of all accidents through the use of Autonomous Vehicles is unlikely to occur based on all the risks and the number of accidents that occur each year.

![Figure 1. “Theoretical potential for avoiding accidents with vehicle automation.”](image)

Recent events in the media related to AVs technology have sparked interest in the public with the problems associated with self-driving vehicles. Due to the fact that AVs is still a new topic and is currently evolving, we have to rely mostly on cases where AVs have failed us in society rather than looking at testing, research and data.

that is largely non-existent and limited. The Department of Motor Vehicles published a data report in 2016 attempting to compare Google’s Fleet performance with human-driver performance, due to the limited AV data the study concluded, “that there was simply not enough autonomous driven miles to make statistically significant comparisons” and was “missing critical metrics: injuries and fatalities”.16 Thus, many of the concerns surrounding AVs are focused on self-driving accidents and human fatalities.

In Florida, a 2015 Tesla Model S operating under its autopilot system crashed into a tractor-trailer that was crossing the road after failing to apply the brakes.17 As seen in figure 2 below, the vehicle turning left crashed directly into a tractor-trailer. A Tesla analyst determined “the camera failed to recognize the truck against the brightly lit sky”.18 Given that the vehicle was going around 75 mph for two minutes before the crash, the analyst also determined that the autopilot should have had at least seven seconds to notice the truck before crashing into it.19 This also indicated that the driver was not paying close attention to the road. Nevertheless, the analyst found “that the Tesla’s automation system failed to identify the truck that was crossing in the car’s path or recognized the impending crash”.20 Thus, the vehicle’s autopilot did not slow the

vehicle’s speed, failed to provide an alert, and did not activate the proper systems. It was not until this accident occurred that Tesla implemented a “15 second auditory warning sound” in order to engage the driver in case of an emergency”.21

Figure 2. “A diagram from the police report from the Tesla Crash shows how the vehicle in self-driving mode (V02) struck a tractor-trailer (v01) as it was turning left.”22,23

The NTSB safety report on this specific accident concluded that although, “the driver was able to use the system on the road for which it was not designed, and turned his attention away from the road for an extended period of time before the crash”.24 In addition to concluded that the crash was still preventable because the sight distance

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should have provided ample time for the vehicle to engage the proper systems, which it failed to do. This specific incident involved the driver of the vehicle operating under Traffic-Aware Cruise Control (TACC), “an adaptive cruise control system that maintains the set cruise speed, applies brakes to preserve a predetermined following distance when approaching a slower-moving vehicle ahead of a Tesla, and accelerates to set cruising speed when the area in front of the Tesla is no longer obstructed.” TACC provides acceleration, deceleration and steering control. In addition, the vehicle was using the Auto Steer “lane-keeping system”, Forward Collision Warning system (FCW) and Automatic Emergency Braking (AEB). It was determined that these systems failed to activate, and that the vehicle speed at impact remained at 75mph. Regardless of the driver’s attentiveness, this fatal crash was the result of a failure in the safety of AV technology, for which there is currently no standard.

In a more recent incident in Tempe, Arizona, a Volvo XC90 Uber self-driving car going 40 mph struck and killed a human. The video footage taken from inside the vehicle showed that the women operating the AV was looking down at her phone, not paying attention to the road, and did not have her hands hovering over the steering wheel. However, the National Transportation Safety Board’s (NTSB) preliminary report disclosed that Uber had disabled the emergency braking function called “City

25 ibid.
26 ibid.
Safety” on the Volvo XC90 to reduce the potential for erratic vehicle behavior.\(^29\) The report noted that, “Uber disables the City Safety feature when the car is being controlled by the self-driving system and keeps it on when the car is driven manually”.\(^30\) In this instance, the emergency-braking function would likely have mitigated the collision. Seen in figure 3. If the emergency braking had been turned on, the radar and LIDAR sensors would have detected the unknown object and would have determined 1.3 seconds before impact to activate the system.\(^31\) In addition the figure shows the “SUV needed to brake when it was at least 20 meters (65.6ft) from the individual”.\(^32\) The women operating the vehicle did not show signs of impairment nor was poor weather a factor.\(^33\)


Figure 3. “View of the self-driving system data playback at about 1.3 seconds before impact, when the system determined an emergency braking maneuver would be needed to mitigate a collision. Yellow bands are shown in meters ahead. Orange lines show the center of mapped travel lanes. The purple shaded area shows the path the vehicle traveled, with the green line showing the center of that path.”34

After the NTSB report was established, Uber stated that “the system is not designed to alert the operator and the vehicle operator is relied on to intervene and take action” which meant that “the system did not warn the driver and essentially had no way to” in the end.35 As Mike Ramsey, a Garner analyst focusing on AV technology, stated, “There is only two possibilities: the sensors failed to detect [the victim], or the decision-making software decided that this was not something to stop for”.36 Thus it was determined, “both the safety driver and car’s computer failed to avoid killing the

individual despite the clear weather, streetlights and vehicle sensors”.

In the end, numerous forensic analysts determined the crash was preventable, specifically senior forensic engineer Zachary Moore at Wexo International Corp who “analyzed the video footage and concluded that a typical driver on a dry asphalt road would have perceived, reacted and activated their brakes in time to stop about eight feet short of the individual”. This accident establishes the need to look at mandates regarding the disabling of potentially life-saving features. It also questions the manufacturer’s ability to determine the risks associated with disabling features such as the emergency braking function.

Even the role of driver error in AV accidents can be partially attributed to a lack of standards for safety and for disclosure of risks associated with relying on the Autopilot System. In a recent instance in 2018, a Tesla Model X in Mount View, California crashed into a barrier as the car sped up in the moments before impact killing the driver. The NTSB report found that the driver had been alerted throughout his drive with two visual and one auditory alert, but no alerts were made for 15 minutes prior to the crash. In addition, 60 seconds before the crash the driver had his hands on the wheel for a total of 34 seconds, but 6 seconds before the crash the driver did not.

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seconds prior to the crash and up to the time of impact with the crash attenuator, the
Tesla’s speed increased from 62 to 70.8 mph, with no pre-crash braking or evasive
steering movement detected”\textsuperscript{41}. As of the middle of last year it was determined by
NTSB that this was particularly due to driver fault but also partially Tesla’s for the
“drivers inattentiveness, due to the over-reliance on the Autopilot System, which
casted the accident”\textsuperscript{42}. In this instance, the lack of safety regulations extends to include
the failure to properly caution drivers of the potential risks associated with AVs and the
absolute necessity for the driver to remain vigilant, even when engaging the Autopilot
System.

While there is evidence to show the harm caused by autonomous vehicles and
their lack of regulation, it is important to note that there are complications with the
issues surrounding autonomous vehicles. In her article, “Challenges and Approaches to
Realizing Autonomous Vehicle Safety,” writer Nidhi Karla recognizes that there is
currently “no proven, practical way to test autonomous vehicle safety prior to
widespread use.” There is also “no consensus on how safe AV should be”. In addition,
Karla points out that “real world driving experience is an essential ingredient for
improving safety, but also exposes people to the very risks that AV are aiming to

\textsuperscript{41} National Transportation Safety Board. "Preliminary Report Highway: HWY18FH0111". June 7\textsuperscript{th}, 2018.
\textsuperscript{42} National Transportation Safety Board. "Driver Errors, Overreliance on Automation, Lack of Safeguards, Led to
releases/Pages/PR20170912.aspx
reduce". She concludes that “self-driving technology is still in an experimental stage and governments are still trying to regulate it”

There are a number of real life challenges involved in attempting to increase safety on the roads using self-driving vehicles. The article “Autonomous Vehicles: No driver… no regulation?” discusses a recurring problem in many autonomous vehicle accidents--distracted drivers. “AVs that require monitoring by a human driver have been the first introduction of AV technology to the general public. However, humans are inherently bad at monitoring semi-autonomous systems and are readily distracted.” So while safety drivers are a way to be the researcher’s eyes and ears of the vehicle, they fail in instances where they are distracted, not looking at the road and do not have their hands hovering the steering wheel. This article concludes that manufactures need to find a way to ensure the driver behind the AV is fully engaged and prepared to take control of the vehicle at any given time. The question then is how can we ensure safety testing for AVs and standardized safety regulations without continuing to endanger people in the process?

There have been a number of other accidents and incidents where AVs killed or injured individuals operating under a self-driving feature ranging from more critical concerns to less impacting accidents (hitting curbs, stopping short, going through

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yellow to red lights). In addition, it is important to note that Tesla is one of the leading companies to test Autonomous Vehicles, thus it is not unexpected that many of the incidents related to AVs occur under Tesla’s manufacturing autopilot mode. As one of the leaders in the Autonomous Vehicle market Tesla is aware that problems occur under autopilot mode and are making changes to mitigate many of these issues. One of the main issues surrounding the topic of AVs is the question, “Will self-driving vehicles become safer than human drivers?” To test this question, many research firms and companies are expanding their studies to see how many miles it would take to prove that self-driving vehicles will demonstrate more reliability and safety than conventional drivers.\(^47\)

RAND Corporation, one of the largest institutions that “improves policy and decision making through research and analysis” had researchers study “How Many Miles of Driving Would It Take to Demonstrate Autonomous Vehicle Reliability.” While the study was done in 2016, the findings give some interesting conclusions on the safety of Autonomous Vehicles and some of the problems associated with them. In figure 4 (below) it shows that “autonomous vehicles would have to be driven hundreds of millions of miles and sometimes hundreds of billions of miles to demonstrate their reliability in terms of fatalities and injuries”.\(^48\) The study concludes, “Developers of this technology and third-party testers cannot drive their way to safety”.\(^49\) In addition, completely avoiding accidents and fatalities is unlikely due to


\(^{48}\)ibid.

\(^{49}\)ibid.
events that cannot be predicted, for example potholes, lines that are foggy, detours and rerouted roads, and unexpected incidents where quick decisions need to be made.\textsuperscript{50}

<table>
<thead>
<tr>
<th>Statistical Question</th>
<th>How many miles (years\textsuperscript{*}) would autonomous vehicles have to be driven...</th>
<th>(A) 1.09 fatalities per 100 million miles?</th>
<th>(B) 77 reported injuries per 100 million miles?</th>
<th>(C) 190 reported crashes per 100 million miles?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) without failure to demonstrate with 95% confidence that their failure rate is at most...</td>
<td>275 million miles (12.5 years)</td>
<td>3.9 million miles (2 months)</td>
<td>1.6 million miles (1 month)</td>
<td></td>
</tr>
<tr>
<td>(2) to demonstrate with 95% confidence their failure rate to within 20% of the true rate of...</td>
<td>8.8 billion miles (400 years)</td>
<td>125 million miles (5.7 years)</td>
<td>51 million miles (2.3 years)</td>
<td></td>
</tr>
<tr>
<td>(3) to demonstrate with 95% confidence and 80% power that their failure rate is 20% better than the human driver failure rate of...</td>
<td>11 billion miles (500 years)</td>
<td>161 million miles (7.3 years)</td>
<td>65 million miles (3 years)</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{*} We assess the time it would take to complete the requisite miles with a fleet of 100 autonomous vehicles (larger than any known existing fleet) driving 24 hours a day, 365 days a year, at an average speed of 25 miles per hour.

Figure 4. “Provides Illustrative Results from the RAND Analysis”.\textsuperscript{51}

Even acknowledging the practical challenges of fully testing autonomous vehicles, it is still clear that as a whole, society will suffer the consequences that will evolve from self-driving vehicles remaining unregulated. Currently, having no universal standard of how to regulate autonomous vehicles has allowed car companies under their individual state’s laws, to make decisions on how to run their AV testing. The result has been many injuries, deaths and future concerns. It is situations like the Uber accident where the emergency braking function was disabled that question if the manufacturers, developers, and actors involved have society’s best interest when it comes to safety and protection of human beings, especially on the road. While the innovative technology, flexible regulation and oversight allows for company innovation

\textsuperscript{50} idid.

and growth, the Federal Government needs to create an established framework that ensures certain safety standards are required and not optional.

III. BACKGROUND/HISTORY

“The first modern automobile has been considered to be the Benz Motor Car No.1 patented in 1886 by Karl Benz”.52 Fast forward seventy years, and lead traffic engineer, Leland Hancock made the first attempt at driverless vehicle technology when “a 1957 Chevy moved slowly down U.S. (United States) 77 near the Nebraska 2 intersection guided by wire coils buried in the highway. It was the first real highway demonstration of a system its inventor and promoters believed would allow cars to be guided by signals from electronic wiring buried in the highway, rather than by human drivers”.53 Now into the 21st century, we have seen an incredible evolution in the automobile industry. Perhaps the most striking example was in 2009 when Google developed its self-driving car project now known as “Waymo.” Waymo has snow driven over 5 million road miles in 25 cities across the United States.54 In addition, major automotive companies such as Tesla, General Motor, Ford, Mercedes Benz, Volvo, BMW, Honda, have all developed and are currently working on their own self-driving technology.55 While self-driving cars is still a relatively new concept, it is something becoming more of a reality every day.

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To understand Autonomous Vehicle technology and how the system operates, it is important to understand the function and brief history of artificial intelligence (AI). John McCarthy, the “father of AI”, defines AI as the “science and engineering of making intelligent machines, especially intelligent computer programs. AI is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable”\(^\text{56}\). AI can mimic human reasoning, can increase levels of data being processed, and can improve algorithm capabilities. It has the ability to take us into a new age of technology. The creation of Artificial Intelligence was intended to make human lives easier by creating intelligent machines to do some of the basic features and functions that impact society daily. This historical transformative technology will “grow the GDP 14% higher in 2030- the equivalent of an additional $15.7 trillion” to the economy\(^\text{57}\). With AI technology beginning to developing at an increasingly fast rate, the government must “respond to the economic and societal challenges brought on by advances in AI”\(^\text{58}\). Prime examples of the societal challenges that AVs are able to manipulate using AI technology is the ability to handle complex situations, learn from experiences, communicate through intelligent behavior and react and copy human behaviors.

While self-driving technology is still in the experimental stage it is important that federal regulators, officials, companies and individuals understand how this technology


has progressed and how it operates on the road today. There are a number of important factors that go into the backend of AV technology and the development of self-driving automobiles. The first is Machine Learning (ML) which enables “developing systems to improve their performance with experience” so that over time the technology improves. “Self-driving [vehicle’s] excellent performance is largely enabled by ML algorithms that have been trained on torrents of data about roads, intersections and street furniture”.

Second, and more relevant to recent AV technology, is deep learning. Deep Learning (DL) a subset of machine learning is a “rebranding of neutral networks, it allows for recognition, speech, language translation, controlling self-driving cars, and other factors”. Deep Learning involves 3 parts: data generation for autonomous systems, training the autonomous system and testing the autonomous system. All three enable the vehicle to see images (right and left), steer the vehicle, control the speed of the car, brake, etc. DL is a very powerful tool--without it, AVs would not be able to do some of the following: detect pedestrians in the road, identify traffic lights, make ethical decisions and respond to weather behavior patterns. DL is a vital component of AV technology which “requires massive amounts of training data to work properly, incorporating every scenario the algorithm (self-driving car technology) will or could encounter”. Thus, making it important to note that the United States manufactures autonomous vehicles

62 Ibid.
making the car smart while other countries, for instance China make their roads smart so that the car technology does not have to be updated daily.

On the up side making the road smart helps to identify factors such road closers, accidents up ahead and pot holes, but on the down side the system does not allow the cars to communicate, transfer data and solve some of the problems that the United States manufacturers have addressed.64

Figure 5. Autonomous Vehicle “Fact Sheet”65

In addition to understanding DL and ML- the process behind the technology, it is important to understand the two most important factors that go into self-driving vehicles. First, figure 5, shows a “wide variety of electronic sensors that would determine the distance between the vehicle and obstacles; detect lane markings, pedestrians, and

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bicycles; park the vehicle; use GPS, inertial navigation, and a system of built-in maps to
guide the vehicle direction and location; employ cameras that provide 360-degree views
around the vehicle; and use dedicated short-range communication (DSRC) to monitor
road conditions, congestion, crashes, and possible rerouting”.

Without these 9 components the vehicle would not be able to run as though mimicking human behaviors.

Perhaps the most important factor for self-driving technology is the levels of
automation developed by the Society of Automotive Engineers International (SAE). The
levels of automation help to define what an autonomous vehicle is. While there are a
number of definitions for autonomous vehicles depending on the manufacturer and
organization the short version of the definition for this proposal will focus on an AV as “a
vehicle that uses a combination of sensors, cameras, radar and artificial intelligence to
travel between destinations without a human operator”.

While most governmental organization refer to the SAE Automation Levels as the overall definition of AV and how
the technology is defined.

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As seen in figure 6 above, the standard for automation ranges from no automation to full automation and has been adopted by the federal guidelines for AV, as well as many automobile industries as well as researchers, developers, scientist, and other actors are adopting this standard of automation. The levels of automation are used by the Department of Transportation (DOT) in their recommended guidelines on how AVs should be tested and at what level of automations need human interaction and guidance. Found in article “The Employment Impact of Autonomous Vehicles” figure 7 below shows the status of automation in vehicles today and how many vehicles are currently autonomous. As seen in both figures, most vehicles on the road qualify for Level 0 (No Automation), Level 1 (Driver Assistance) and Level 3 (Partial Automation). The goal for many of autonomous vehicle companies is to get to Level 5.

Along with the technology, several other external factors have played a role in the evolution of AVs. Some of the first self-driving vehicles were deployed in the state of Arizona, a location chosen for its “good weather and wide roads.” In 2015, the current Governor of Arizona Doug Ducey approved automobile industries to test driverless vehicles in his state. As the CEO of Waymo stated “Phoenix is hot, which is a problem— we can talk about the challenges heat provides— but at least there isn’t snow, which right now is challenging for self-driving technology.” Essentially, AVs need to be tested in

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climates where external factors like weather do not play into the issues that arise with the technology. Thus, manufacturers are attempting to perfect the vehicle’s performance in ideal conditions. Of course, this shows that many self-driving vehicles are not able to “perform at the same level of safety” if taken out of environments that are not seen as “perfect weather conditions”.72

A final essential factor that ensures the safety of self-driving vehicles is that, many AVs currently have individuals called “safety drivers” helping with handling them, especially in the case of an emergency. After many of the incidents occurred in Arizona and California safety drivers were required to work in pairs to monitor each other’s behavior, the environment, how the car is operating and if manual control is needed and when it should be engaged.73 The safety drivers must be alert at all times and work together with, one operating the vehicle, while the other is monitoring and taking notes. This is essential during the testing and development of AVs because it allows manufacturers to update their features, reaction time issues, safety problems that arise, and other issues that occur.

Relevant to the topic, many leaders in the industry have discussed the reality of fully autonomous vehicles being on the road in the near future many times. It was not until 2018, where every accident involving a self-driving vehicle had some sort of unforeseen circumstance that the conversations began to change and discussion around

this technology not being “viable on a massive scale for decades”. Why is this relevant? CEO of Waymo, John Krafcik, admitted at the end of 2018 that “level 5-autonomous vehicles, will in fact never exist” and that “it will take decades for self-driving cars to become common roads..”.

Krafcik’s statement is significant due to the fact that until recently no one would admit that level 5 full autonomy was not in fact truly possible. In fact, CEO of Tesla, Elon Musk, has said that as “self-driving cars continue to proliferate, human driven vehicles may need to be banned,” the very opposite of the statements made by Krafcik. In addition, Krafcik has stated that “the technology won’t be ubiquitous for decades for driverless vehicles will always have constraints,” and also that, “we will always have to be completely alert and in control of the cars that we are driving every minute, every second that we are on the road,” Krafcik does not envision a day where there is no “user interaction” with AV technology.

It is puzzling to read that Krafcik an industry expert in this field recognizes and sees the limitations and concerns surrounding this technology and the future. This raises an important discussion surrounding how we should approach the legislation and policy if there is hesitation with this technology from the experts developing self-driving vehicles.

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The increase in accidents, resulting in a number of pedestrian deaths and injuries, has raised many questions and concerns about advances in self-driving technology and their future safety on the road. ⁷⁹ The rise in this technology has sparked conversations within local, state and the federal government. Before the Obama Administration the discussion around self-driving technology and artificial intelligence was largely nonexistent on the federal level. In a series of reports, the Obama Administration in 2016 started the discussions surrounding the future of AI. The first report is titled “AI: Preparing the future of AI, second, “National AI Research and Development Strategic Plan and third, “AI, Automation and the economy” all detailing the future of AI, the recommendations going forward relating to AI, the National plan for the future and the federal governments role in this new technology. In addition, the Obama Administration started workshops surrounding AI and technological advancements. ⁸⁰

During the end of the Obama Administration, the Department of Transportation announced a “15 point safety assessment” that was required for any new technology company experimenting with autonomous vehicles and meeting a “cohesive set of national regulations”. ⁸¹ The 15-point system was a voluntary policy that “incentivized automakers to certify they have addressed all relevant issues related to AV, ranging from “technology failure, passenger privacy, protection of occupants during crashes, and how

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to communicate with passengers and other roads users.”\(^82\) While the voluntary assessment tool was the first step in the right direction towards creating a standard for manufacturers to adopt, the policy has now changed from one Presidential administration to the next.

Within the last three years the conversation surrounding autonomous vehicles has grown tremendously. As the current President of the United States, Donald Trump, stated at an event surrounding emerging technology and infrastructure, “We’re on the verge of new technological revolutions that could improve virtually every aspect of our lives, create vast new wealth for American workers and families, and open up bold, new frontiers in science, medicine, and communication.”\(^83\) The Trump administration has made AI a top priority, holding one of the first White House Summits on “Artificial Intelligence for American Industry” gathering hundreds of senior government officials, tech experts from top academic institutions, heads of research labs and business leaders to discuss the future of technology and AI.\(^84\) Key takeaways from the summit were supporting the national AI Research and Development (R&D) ecosystem, developing the American workforce to take full advantage of the benefits of AI, removing barriers to AI innovation in the United States and enabling high-impact sector specific applications of AI.”\(^85\) With the government support it would allow companies, organizations, manufacturers, and other actors to be creative, innovative and yet ensure all Americans


\(^{85}\) ibid.
are safe with the new technology and are moving forward in a better direction. The
summit also addressed that AI would be included in the 2019 budget request to Congress
and establish a Select Committee on Artificial Intelligence as well as launch a bipartisan
Artificial Intelligence Caucus for the 115th Congress launching in May of 2017.86

Under the Trump Administration there has been a tremendous amount of progress
surrounding Autonomous Vehicle policy and proposed regulation, guidelines and
resources. Both the House of Representatives and United States Senate introduced bills to
provide new regulatory tools to the National Highway Traffic Safety Administration
(NHTSA). First, in July of 2017 Representative Robert Latta (R-OH-5) introduced to the
House of Representatives bill H.R. 3388 known as the “Self-Drive Act” or “Safely
Ensuring Lives Future Development and Research in Vehicle Evolution”.87 The bill in short established a “federal role for the safety of highly automated vehicles by
encouraging the testing and deployment of such vehicles”.88 “The bill preempts states
from enacting laws regarding the design, construction, or performance of highly
automated vehicles or automated driving systems unless such laws enact standards
identical to federal standards.” In addition, the bill works with DOT to develop safety
assessment certification and continued research. This bill did pass Congress in September
of 2017, with 31 cosponsors and moved onto the Senate where you introduced your bill
S.1885 the “AV Start Act”. Similar to H.R. 3388, S. 1885 addresses “state preemption,
safety standards, exemption authority, consumer information, cyber security and

policy/
88 ibid.
As you know S. 1885 was introduced on the Senate floor but no further action has been taken due to the new 116th Congress.

Politicians and industry leaders alike were frustrated by the delay in passing legislation. In a joint statement by Chairman of the House Energy and Commerce Committee, Greg Walden (R-OR) and Chairman of the Digital Commerce and Consumer Protection Subcommittee Bob Latte (R-OH), “leaving the 115th Congress without getting self-driving vehicle legislation across the finish line is more than just a missed opportunity, it threatens to derail efforts for the United States to be the leader in the advancement and development of this potentially life-saving technology,” in addition to, Industry leaders expressing their disappointment at Congress failing to act decisively.

In a tweet, Toyota’s director of technology and innovation policy Hilary Cain said it was a "missed opportunity" and that she thinks in the future everyone will "shake our collective heads over how Congress failed to get out ahead of this". At this time, the aim is that in 2019 the bill will be reintroduced and opened for further discussion.

Seeking the guidance and help of NHTSA, bi-partisan politicians begin to set the stage for developing a federal regulatory framework but as we currently know NHTSA has not been “provided with sufficient funds to deal with expanded duties that will respond to AVs from Congress” and has only issued voluntary guidelines that place no mandate on the industry to develop and test AVs safely by federal standard. If NHTSA

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91 ibid.
moves forward with expanding the policy and regulating goals the agency would need financial assistance and support. Thus, “in the absence of NHTSA regulation of autonomous vehicles, nearly half the states have enacted laws on different levels of autonomous vehicle deployment, resulting in a wide variety of state regulation” with no consistent and unified standard.93

Under the Trump Administration, the NHTSA and the United States Department of Transportation led by Secretary Elaine Chao published voluntary guidelines relating to autonomous vehicles and best practices. The first, published in September of 2017, is titled “2.0-Automated Driving Systems: A Vision for Safety” and is a comprehensive, 32-page voluntary guideline that “supports the automotive industry, the states, and other key stakeholders as they consider the design best practices relative to the testing and deployment of AV technology”.94

“The purpose of the voluntary guidance is to support the automotive industry, all states deploying AVs, and other key stakeholders as they consider and design best practices relative to the testing and deployment of automated vehicle technologies. 2.0- A Vision for Safety updates the Federal Automated Vehicles Policy released in September 2016, which “represented a significant step in the development of a federal regulatory framework to guide the development of automated technologies”.95 While the 2016 Federal Automated Vehicle Policy is no longer adopted, it has helped to create and

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repurpose many of the goals seen in the 2.0 version and has helped designers of ADS (Automated Driving Systems) come up with best practices and new analytical tools for safety considerations prior to the deployment of AVs. While 2.0 is strictly a guide and volunteer practice, the industries and actors involved in the development of AV technology are encouraged to implement many of the standards.

Moving forward, in October of 2018 the Department of Transportation and NHTSA released the newer version of 2.0, calling it “3.0-Preparing for the Future of Transportation”. Building on 2.0, this is the current operating system that DOT, NHTSA and all relevant parties are encouraged to adopt. 3.0 recommends additional safety features, best practices and how state legislators should craft AV policy, in addition to advancing multi-model safety, reducing policy uncertainty, and outlining a process for working with DOT. With a large consideration from stakeholder engagement throughout the United States, 3.0 considers all actors involved in the process surrounding autonomous vehicles and safety. As Secretary of Transportation, Elaine Chao stated “the technology is there, the question is how do we regulate it, how do we continue to promote innovation but also safeguard safety”. While the federal government does not want to impede innovation, it does want to protect our citizens, and allowing states to dictate their own policies thus far has posed concern. As seen in figure 8 below, you are able to see a quick overview of some of the differences between the Automated Vehicle Policy, 2.0

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Automated Driving Systems, and your bill S.1885. As noted by writer Matthew Raifman who created the chart overview, H.R. 3388 is not included because it does not have specific reporting requirements as well the article was published before 3.0 was published.

Figure 8. Author’s visualization. H.R. 3388 does not include reporting requirement specifications, so it is not included here.99

As of November of 2018, 33 states have introduced legislation and currently 30 states have enacted legislation related to autonomous vehicles. Figure 9 below, indicates which states have legislation, executive orders, both or none. Found on the National Conference of State Legislation 29 states have passed Legislation: Alabama, Arkansas,

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California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Michigan, Mississippi, Nebraska, Nevada, New York, North Carolina, North Dakota, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, and Vermont, Washington & Washington D.C., Wisconsin. In addition the following 10 states have issues executive orders related to AVs: Arizona, Delaware, Hawaii, Idaho, Maine, Massachusetts, Minnesota, Ohio, Washington and Wisconsin. To view a complete list of all enacted legislation and executive orders see the addendum.

Figure 9. States with Autonomous Vehicles- Enacted Legislation and Executive Orders

[Legend]

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<td>Enacted Legislation</td>
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<td>Executive Order</td>
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<td>Both</td>
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Historically, it has been difficult to determine how to regulate something when truly self-driving vehicles have only recently emerged. The topic of Autonomous Vehicles “continues to make advancements and dominate headlines, thus resulting in more legislation”. It is paramount that all levels of government, all actors involved discuss, development and continue to research the safest and most effective way to allow self-driving vehicles on the road. As AI experts have stated, “the dream of a fully autonomous car may be further than we realize, it will be decades before self-driving systems can avoid accidents” thus, making it clear the urgency of federal regulation for the protection of humans on the road.

RELEVANT ACTORS:

Autonomous Vehicles will impact society as a whole, especially when it comes to the safety and protection on the roads and highways. In every aspect of every individual’s life AVs will impact their future whether positive or not. In some sort of capacity there are a number of organizations federal, local and state that are engaged in this issue, as well as other associations, organizations, advocacy groups and automobile industry manufacturers.

On the federal level the National Highway and Traffic Safety Administration (NHTSA), Department of Transportation (DOT), Federal Highway Administration (FHWA), Federal Motor Carrier Safety Association (FMCSA), United States Department of Health and Human Services and the United States Department of

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Commerce are some but not limited to the agencies that will be impacted by AVs. Whether it is creating strategy, resources and or figuring out how self-driving vehicles will fit into the currently regulatory framework, each agency/department will play a significant role in discussions surrounding AVs policy at the federal level. In addition, the House of Representatives committees on Energy, Commerce, Technology, Artificial Intelligence, Autonomous Systems, House Committee on Appropriations, Infrastructure and Digital Commerce and Consumer protection and the Senate committees on Science and Transportation, Protection, Product Safety and Insurance, as well as the Senate Appropriations committee will all lead discussion and committee hearings on relevant proposed AV policy. Lastly, on the state level the Department of Motor Vehicles per each U.S. State will play a significant role in allowing the safe deployment of self-driving vehicles on their roads.

Acura, Audi, BMW, Buick, Chevrolet, Chrysler, Dodge, Fiat, Ford, GMC, Genesis, Honda, Hyundai, Jeep, Lexus, Mercedes Benz, Nissan, Saab, Saturn, Suzuki, Tesla, Toyota Volkswagen, Volvo are just some of the following automobile industries that are in the process of creating self-driving vehicle technology.¹⁰³ In addition there are some companies that are focused on AV technology, such as Waymo, Apple, Amazon, Udacity, Argo, Voyage and other companies. As some of the biggest car manufacturers these companies take a leading role in the discussion surrounding AV federal policy. Many of the current manufacturers deploying self-driving vehicles on

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the road are not in favor of federal regulation that would hinder innovation and
creativity of their AV researchers, designers, technicians and countless other actors.

Lastly, we have associations, insurance companies, advocacy groups, driving
services and oil and gas companies that will all be engaged in the issue surrounding
Autonomous Vehicles. Associations and advocacy groups such as the American
Automobile Association (AAA), the American Association of Motor Vehicle
Administrators (AAMWVA), the American Association of State Transportation
Officials (AASHTO), the Association of Global Automakers, the Auto Care
Association, Driving Coalition for Safer Street, Advocates for Highway and Auto
Safety and the Governors Highway Safety Association (GHSA) will all have an opinion
and possible concern for self-driving federal regulation.104

Insurance companies such as Progressive, Liberty Mutual, Geico and State
Farm will all be impacted by self-driving deployment on American highways and
roads. Insurance companies will have to reevaluate insurance claims, liabilities and who
is responsible for autonomous vehicle related incidents and accidents. There will be a
significant impact on insurance companies to reevaluate if the current insurance
infrastructure is relevant for when self-driving vehicles are deployment on the roads
throughout America. The way driving services such as Uber, Lyft, VIA, and Taxis will
be impacted if self-driving vehicles take over the jobs for human drivers. Driving
services play a big role in the discussion surrounding AV and how they plan to
integrate self-driving cars into their business and how this will impact both human

drivers and passengers taking rides. Finally, while there is not current discussion about making AVs electric it is important that oil and gas companies such as Exxon Mobil, Chevron, BP, Shell, etc. have a part in making decisions that would impact their businesses and potentially issues that may arise due to self-driving vehicles.

IV. POLICY PROPOSAL

The legislation proposed in this section has one overall goal: to have no rise in the total current number of accidents, injuries and deaths as a result of the introduction of AVs on the roads and highways, ultimately decreasing the number of current accidents by a considerable amount. While legislation is unlikely to eliminate all problems, issues and accidents, it is possible to put proper safeguards in place so that fatalities like those in the Uber and Tesla cases do not take place in the future. Even though autonomous vehicles are still in the testing phase, putting legislation in place now will ensure that safety is the priority moving forward. As you have stated Senator Thune, this could “become the first ever change in federal law governing self-driving cars”.105

POLICY AUTHORIZING TOOL:

Senator Thune, you are commended for your incredible efforts in introducing bill S.1885 “AV Start Act” with cosponsors, Senator Gary Peters (D-MI), Roy Blunt (R-MO), Debbie Stabenow (D-MI) and Roger Wicker (R-MS). S. 1885 is one of the first pieces of legislation relating to autonomous vehicle regulation on the federal level. As we continue into the 116th Congress and beyond, a new piece of legislation will need be introduced in order to regulate AVs on the federal level. With the help of Congressman

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Robert Latta (R-OH) who introduced bill H.R. 1885 and the efforts from you and other members of the House and Senate, we should establish and introduce bipartisan legislation under the Senate committee on Commerce, Science and Transportation and House Energy and Commerce committee combining bills S.1885 and H.R.3388 with added, consolidated and updated sections that would be implemented through the National Highway Traffic Safety Administration. We will look for bipartisan support in introducing the new piece of legislation as it is important to just not just Republicans or Democrats but to human safety overall.

New legislation is the best and most effective solution to creating a standardized way to evaluate autonomous vehicle deployment and safety. H.R.3388 and S.1885 propose very similar policies surrounding autonomous vehicles and safety and new legislation can address the safety concerns surrounding AVs, especially much of the criticism on safety concerns and safeguarding individuals. Again, thank you for the hard work and effort that went into S.1885. To be clear, this new legislation would serve to support and update S.1885, not to replace or discredit it. Again, thank you for the hard work and effort that went into S.1885.

POLICY IMPLEMENTATION TOOL:

After examining both H.R. 3388 and S. 1885 and examining them side by side in a 22- page comparison developed by the ENO Transportation Foundation, the new legislation proposal will be titled, “The Start Act of Autonomous Vehicles Deployment and Safety” combining H.R. 3388 “Self-Drive Act” and S.1885 “AV Start Act”.106 After

comparing the legislation many recommendations and additions will be made to the new legislation of Autonomous Vehicle deployment and safety. The purpose section of the legislation will state, “The purpose of the legislation is to establish a federal role in ensuring the safety, development, testing and advancements in self-driving vehicles and the new technology.” While the two pieces of legislation are different in section-by-section layout, they propose many similarities and differences that will be combined. Referring back to the ENO document comparing the two, the overall biggest change will be to add a section on safeguarding and protecting humans.

A big portion of the proposed legislation will create standards for NHTSA authority and state preemption for autonomous motor vehicles. As seen in Section 3 of the comparison, H.R.3388 allows states to establish their own safety standards only if they are identical to federal standards, and S. 1885 preempts states from adopting laws, regulation and standards until NHTSA establishes a standard.\(^{107}\) The proposed legislation should say, “If the state establishes motor vehicle safety standards, they must match federal standards. The state will be preempted if the state establishes their own guidelines using federal language and is approved.” This section will also require that “until the testing of autonomous vehicles shows significant improvements to safety and reasonably decreases and or eliminates the number of human fatalities caused by self-driving cars, it will be required that all AV operate under the supervision of a human driver with the ability to take control of the vehicle at all times.” All standards that include state

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preemption will be removed unless it is explicitly stated that any standards or additions added by the state first and foremost conform to federal standards.

I am placing special emphasis on the words, requiring and must, meaning the states must abide by the following regulations. In order for safe driving deployment of autonomous vehicles either the owner or the manufacturer testing the self-driving car must have the vehicle registered and up to date with any state and federal standards. The individual must have a state license with a clean driving record, have up to date insurance, safety and emission inspection, a stick identifying the automobile is a self-driving vehicle and (a new addition to the list) a mandatory educational training course focused on AVs. Individuals learning to drive these vehicles will be required to spend a number of hours learning in a classroom and behind the wheel training. You can see similar voluntary educational training guidelines in the Department of Transportations 3.0 “Preparing the Future of Transportation”. This will also apply to self-driving vehicles deployed by manufacturers on the road. The individual operating the AV must be of age, will not be able to operate if he or she only has a permit, and must complete the course with approval from either the DMV or state that is handling the oversight. The next section will emphasize the safety standards for highly automated vehicles and will adopt many standards in both H.R. 3388 and S. 1885. It will require all manufacturers to adopt the federal Safety Evaluation Report (SER) (name copied from S.1885) and will only allow additions if the local state and law establishes more standards in place that must be included in the report.108 The report must be turned in within 90 days as opposed to 24

months as seen in H.R. 3388. The report will combine the 12 issues seen in H.R. 3388 and 9 issues seen in S. 1885.

The following will be required in the report: System safety, vehicle cybersecurity, crashworthiness, human machine interface (HMI), data recording (pre and post test and crash behavior), operational design domain (ODD) (automation function), object and event detection and response (OEDR), validation methods, and provide aggregate results comparing the safety level of their HAV with a vehicle that is not highly automated and that has driven by a human driver. In the report the manufacturers must describe issues, safety, problems, updates and how they will make advancements under the law. In addition, “federal regulators should develop a list of operational scenarios and range of conditions under which AVs can be evaluated” so that there will be a standardized way to analyze data and report on it to the public. While still allowing innovation and creativity, we must establish safeguards for the communities impacted by AVs “because manufacturers should be able to focus on developing a single highly automated vehicle (HAV) rather than 50 different versions to meet individual state requirements”. The aim is to work with DOT and Secretary Chao in including some of the voluntary guidelines seen in 3.0 rather than developing new standards it would be best practice to adopt some of the current voluntary standards in the new proposed legislation.

The biggest addition to the proposed legislation will be the safety standards. In Department of Transportation’s 3.0, there is a section titled “Best Practices for State Legislatures”. In the new legislation it would be vital to take some of the voluntary recommendations and add them as standards in the safety section of the new legislation. First, it will add the section on “roadway readiness”, manufacturers will provide road markings, signage, pavement conditions that would be beneficial for both human drivers and automated vehicles.\footnote{3.0- Preparing for the Future of Transportation. United States Department of Transportation. NHTSA. October 2018. Accessed January 14\textsuperscript{th} 2019. https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf} Under roadway readiness, we will also determine proper weather conditions for the deployment of AVs, as this is an area of great concern and self-driving vehicles are only being tested in specific weather conditions. This section should also include a “vision test” for AV systems “to make sure that it can properly identify its surroundings, including cars, pedestrians, cyclists, and road markings and respond appropriately”.\footnote{Claybrook, Joan, and Shaun Kildare, “Autonomous Vehicles: No Driver...No Regulation?,” Science 361, no. 6397 (July, 2018): 36-27. Accessed January 28\textsuperscript{th} 2019. doi: 10.1126/science.aau.2715.} The vision test and roadway readiness preparation will attempt to help mitigate factors for investigators for when AVs fail and accidents occur. Over time, this section would have to be updated as self-driving vehicles must eventually be able to drive in all road and weather conditions and must always be able to pass vision test without being tested every time. The goal is to make autonomous vehicles as “autonomous” as possible; we want to ensure the safety of individuals but ultimately do not want to have to check the safety features of the vehicle everyday.

In addition to the roadway readiness, the new legislation will include SAE levels 2 through 5. S.1885 does not include SAE Level 2, and this will be included, as we know that the Tesla Model S accident-taking place in Florida was in a level 2 self-driving
vehicle. As defined by H.R.3388, “This bill includes ‘partially automated vehicles’ with SAE Levels 2-5 automated systems.” This will be adopted in the new legislation. The new legislation will not “allow manufacturers to shut down any system or piece of equipment during autonomous operation of the vehicle” as seen in the case in Arizona where the Volvo XC90 Uber self-driving car’s emergency braking function was disabled.\footnote{The Worst of the Worst of the AV START Act (S.1885).” Advocates for Highway and Auto Safety. October, 2017. Accessed February 15th, 2019. https://saferoads.org/wp-content/uploads/2017/10/The-Worst-of-the-Worst-of-the-AV-START-Act.pdf} \footnote{Laris, Michael. “Self-Driving Uber did not have emergency braking turned on when it hit pedestrian, NTSB says.” The Washington Post. May 24th, 2018. Accessed January 14th, 2019. https://www.washingtonpost.com/news/dr-gridlock/wp/2018/05/24/ntsb-self-driving-uber-did-not-have-emergency-braking-turned-on/?} Until autonomous vehicles prove to be safe on the road, no manufacturer is allowed to disable or turn off any safety features, braking systems and disengagement modes. Disengagement mode is essential in the proposed legislation as this automation mode alerts the driver in dangerous situations where the vehicle needs to be manually operated. This mode needs to be required rather than an option for manufacturers to choose to include. These safety standards will only be exempted if the manufacturer deploys the AV in a test roadway area where no pedestrians and outside objects are present. This allows for independent testing in a safe and controlled environment in the manufacturers simulated road and test track.

Advocates for Highway and Auto Safety proposed additional features that are currently not seen in S. 1885. The new legislation will address many of their concerns. First, they propose hands on the wheel and engagement on the road at all times. “The bill will require the establishment of minimum performance standards for driver engagement” as seen in many of the cases where fatalities occurred because the human was not paying
attention to the road nor had their hands near the steering wheel.\textsuperscript{117} In addition, the legislation should propose ideas on how manufacturers and states can collectively work together to share ideas, research and safety features. There is currently no mandatory reporting surrounding AVs, but “manufacturers and federal regulators should be aware of situations identified during testing or deployment that have led to failures and collisions” so that they can improve upon their systems.\textsuperscript{118} By providing mandatory data, reports, and evaluations and by communicating at the local, state and federal level, we can better our understanding of AVs as well as create an environment to grow and improve together. While manufacturers and companies are competing to have the #1 self-driving cars, we should attempt to establish an open and effective line of communication between AV manufacturers so that the goal of protecting humans is addressed first before competing for the #1 spot.

All other sections of H.R. 3388 and S. 1885 will be combined through the help of the AI caucus, Federal Highway Administration (FHWA), Federal Motor Carrier Safety Association (FMCSA), the NHTSA, relevant House and Senate committees and experts in the field that determine any new additions that should be added. The new legislation will address and combine sections on cybersecurity, prospective buyers and AVs, headlamps, privacy, exemptions, highly automated vehicle study and child safety. The proposed legislation updates will not go into further details on these sections but rather let you know they will be addressed in the future as many of these sections will remain the same from S.1885, H.R. 3388 to the new legislation.\textsuperscript{119}


issues, the legislation will establish both a Highly Automated Vehicle Advisory Council and a Data Access Advisory Council established under the Department of Transportation and carried out through the National Highway Traffic Safety Administration (NHTSA).\textsuperscript{119,120}

As of fiscal year 2019, the Presidential Budget Requests $76.5 billion for the Department of Transportation. This is about $500 million less than FY 2017.\textsuperscript{121} Specific sections of the FY budget for the Department of Transportation relating to autonomous vehicles goes into more details on the breakdown of the budget, especially relating to self-driving vehicles. After looking at the Congressional Budget Office (CBO) cost estimate for both S. 1885 and H.R. 1885, it is clear that this legislation would cost much more than $22 million over the next 3 years. This estimate was published in 2017 so it is assumed that the numbers have changed over time. H.R. 3388 was estimated around $10 million for the 2018 to 2019 period and S.1885 was estimated to cost $22 million over the same time period. As of 2018, the president signed a $1.3 trillion spending bill, which “unveiled $100 million for highly automated vehicle research and development (R&D) programs and grants”. After examining the CBO cost estimate, the FY 2019 budget, it is reasonable to say that this new legislation would cost around $30 million over the next 2 to 3 years. With the addition pieces of legislation as well as working with outside individuals more time, resources and money is required.

Senator Thune, passing this new piece of legislation will be beneficial to the community. Within the last month, I know there has been discussion surrounding the reintroduction of the Autonomous Vehicle bills. In February of 2019, there has been discussion surrounding the provisions that would need to be revised in S. 1885 and H.R. 3388 and as you stated “I hope we can close the deal because we really do need to have this sort of framework in place that puts the safety guardrails around the technology”.\textsuperscript{122}

The aim is to revisit the old and new legislation and make updates to the policy so that we can create proper regulation, we hope that we can make these adjustments, update the guidelines, emphasize safety and proactively prepare for automation by the end of 2019 early 2020.\textsuperscript{123}

V. POLICY ANALYSIS

The policy proposal aims to ensure that no one is harmed from the use of autonomous vehicles on the road by creating regulation surrounding self-driving cars. With the increase in artificial intelligence and the technology surrounding self-driving vehicles, now is the time for the United States to take the lead in the political world in creating regulation surrounding AV concerns and safety for society as a whole. If this legislation passes, the United States will be a front runner for adopting a standardized policy practice relating to AI and self-driving technology which other countries can follow. As an industry official stated, “[A] nationwide set of standards would speed the development of self-driving vehicle technology, ultimately leading to fewer highway

deaths, and keep the United States in the forefront of automotive technology”. 124 As we know “recent high-profile accidents, including traffic death of a pedestrian, have raised concerns about the advancement of self-driving technology”. 125 The major strengths of this policy proposal are the way it addresses safety and standardization concerns surrounding AV, the push for transparency across manufacturers and states, and the promotion of research and development of AV technology.

First and foremost, the legislation makes safety a number one priority when it comes to the deployment of AV and self-driving technology. The proposal creates a national policy that promotes safe deployment of self-driving vehicles on the road. 126 The framework provides “clear guidance to companies as they innovate while maintaining states’ and municipalities’ traditional roles in traffic safety and consumer protection”. 127 This means the proposal does not infringe on police and traffic rules in states, but gives high-level guidelines on how the technology should be regulated. Road safety is a major public health crisis responsible for killing thousands of individuals every year. In 2017, there were 37,133 deaths from motor vehicle accidents. While this number is dropping, studies do show that there are more drivers on the road today and that they are more distracted. 128 The NHTSA found that “at least 94% of crashes caused in the United States can be tied to human choice or error behind traditional vehicles on the roadways. Autonomous vehicles have the potential to significantly mitigate distractions

126 ibid.
127 ibid.
such as driving too fast and misjudging other driver’s behavior as well as alcohol impairment, the use of cellphone, distraction and fatigue. In addition, in 2017 the annual economic cost of car accidents in the United States was estimated around $242 billion\textsuperscript{129}.

“Adopting AVs can potentially reduce or eliminate the largest reason of car accidents while also reducing the economic cost and creating better drivers in terms of perception, decision making and execution. Recognizing the federal regulation could help to eliminate traffic related accidents on the roadways,

Taking into consideration recommendations from researchers and experts in the field as well as looking at the work being done internationally surrounding self-driving technology, the new legislation addresses all the concerns and questions needed to create policy that would fit into the current regulatory framework. This leads to the second major benefit of the proposed policy, eliminating state inconsistencies by creating new legislation that builds safety standards and proper safeguards.

There are four major changes in the new legislation. The first addition is the inclusion of SAE levels of automation 0 to 5. Next is banning disengagement of specific safety systems during testing and deployment except in designated testing areas such as a simulation or test course. Third is requiring safety drivers to be behind the wheel and to be engaged at all times until the technology is proven safe. The final addition to the legislation is not allowing for the steering wheel to be removed or any other additional features to be turned off ensuring that manual operation is possible in the case of an emergency. As stated by the Advocates for Highway and Auto Safety, S. 1885 allowed

for “hands off the wheel and mind off the road.” The new legislation will mitigate distractions for drivers and create standards that engage the driver when operating an AV, depending on the human driver to monitor and be the second eyes of the vehicle’s operations. While this might hinder innovation (discussed later) it makes the priority of human safety the top concern. As we saw in the case of the Uber accident, which resulted in a fatality, if the emergency braking function had not been disabled, the human would have been alerted to operate manually. The new legislation seeks to prevent this kind of accident from occurring in the future.

With adequate funding the new legislation will create a number of performance standards including mandatory educational training with a minimum number of hours, a vision test to identify any obstacles for the driver and vehicle, comprehensive testing, roadway readiness, and, while states still remain as the lead for licensing, registration of vehicles, traffic law enforcement, safety inspection, infrastructure, etc. While the proposal suggests up-to-date insurance, license and registration it will be the state’s responsibility to control the enforcement and monitoring, meaning state control will not be hindered. The proposal will fund the additional “road markings, signage, pavement conditions and other signals to identify both the human driver in the AV as well as traditional vehicles on the road.” The new legislation will help achieve its goal by collaborating with manufacturers finally to help create new product warning and AV xs that identify to other vehicles and drivers that a self-driving car is deployed on the road. A similar precedent to this is “Kyleigh’s Law”, passed in 2010 in the state of New Jersey, which requires all drivers under the age of 21 to display a special red decal on their
While the proposal does not have age restrictions as long as the person behind the self-driving vehicle has a valid United States driver’s license, it does propose a system that identifies to other drivers and police the car is self-driving.

The proposed legislation creates transparency among all 50 United States with standardized legislation on the federal level rather than state level. Currently, there is no transparency regarding AV technology and safety across states, therefore there are many inconsistencies across safety frameworks, which has “given rise to a patchwork of fragmented regulation”. Promoting a standardized federal regulatory framework will create consistency across states and could have the potential to promote innovation with the help of all experts in the field as well as shared resources. First, the new legislation, clearly defines what an autonomous vehicle is and recognizes that across state borders AV will have one single definition that all can apply. For example, Nevada and California in two pieces of legislation define AV differently.

- California’s definition of Autonomous Vehicles: “Autonomous technology’ is defined as technology that has the capability to drive a vehicle without the active physical control or monitoring of a human operator” (California Vehicle Code, 2012). “Autonomous vehicle” means any “vehicle equipped with autonomous technology that has been integrated into that 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.”

- Nevada’s definition of Autonomous Vehicles: “Autonomous technology” means technology which is installed on a motor vehicle and which has the capability to

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drive the motor vehicle without the active control or monitoring of a human operator. The term does not include an active safety system or a system for driver assistance, including, without limitation, a system to provide electronic blind spot detection, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lane keeping assistance, lane departure warning, or traffic jam and queuing assistance, unless any such system, alone or in combination with any other system, enables the vehicle on which the system is installed to be driven without the active control or monitoring of a human operator.133

So far, the other 33 states that currently hold or introduce some sort of legislation vary in definition of AV technology, from how the vehicle should operate, who is liable and how the technology works. In addition to setting a standard definition of AV, the new legislation defines best practices and adopts SAE levels of Automation like the NHTSA and Department of Transportation do. This is necessary because, “the algorithms that form the basis for AV function currently have no transparency and have no way to determine whether there are better approaches to solving problems that resulted in collisions or serious system malfunctions.134 Because there is no national policy, manufacturers are able to create their own technology and not collaborate with other manufacturers on developing standardized equipment and technology.

Lastly, the legislation promotes the research and development of AV technology into the future. The proposal promotes pilot programs and continuous research and further provides resources to support advancements surrounding the developing technology. It gives “regulatory relief” to the states and promotes federal involvement when it comes to further research and discoveries.135 The proposed legislation will

133 Ibid.
“provide NHTSA will sufficient funds to deal with expanded duties that will respond to AVs”.\(^{136}\) This section of the proposal requires mandatory standardized data reporting and enables political officials, agencies on all levels, manufacturers and others to collect and created shared solutions to AV challenges.\(^{137}\) The current legislation is “keeping consumers and researchers in the dark”.\(^{138}\) Researchers, experts and manufacturers are not sharing information and relevant data that could help the AV world tremendously. With mandatory evaluation and data reporting we can do the following: collect and analyze relevant information to share nationwide, gather comprehensive high-level data, collaborate on technology advancements and incorporate different values and best practices. In the new proposed legislation we will still require “manufacturers to adopt the federal Safety Evaluation Report (SER) and report on a number of issues.” To take a more comprehensive look, Figure 10. Shows many elements that the SER would require that were taken from the 2016 Federal Automated Vehicles: Accelerating the Next Revolution in Roadway Safety document established by the Department of Transportation.\(^{139}\)


By reporting on all of these different elements and features we can begin to compile data in a relevant and effective manner creating quantitative measures for manufacturers, researchers and developers to use. The federal regulation can begin to be a central repository, which all AV manufacturers adopt and report to.

“Policymakers have the power to support the deployment of and investment in AV technology, which could accelerate its adoption and more quickly deliver its benefits to society”. With the new legislation we will be able to “further maintain, create and provide online, real-time, detailed records and other relevant information in the

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141 ibid.
transportation system”.\textsuperscript{142} Just as the US Food and Drug administration regulate the approval of drugs through “several phases of animal testing, human testing, and post-marketing monitoring,” the Department of Transportation has the ability to regulate AVs through data, reporting, evaluation and collaboration while keeping the public’s interest in mind.\textsuperscript{143} Overall, the new legislation benefits state and local governments by giving the “NHTSA the important functions of creating the safety standards and efficient deployment of AV technology”.\textsuperscript{144}

Despite the many positives that the new legislation would provide like safety and mandatory data reporting, there are some significant concerns and drawbacks. The first is that the legislation will never be able to eliminate all safety issues. While the goal of the new legislation to decrease the current number of accidents, injuries and deaths as a result of the introduction of AVs, we can never eliminate “surrounding uncertainties.” While we can put many safety guards and requirements in place, we can never ultimately say that self-driving vehicles will cause no harm. If the elimination of all accidents and injuries is not possible, many would argue that AV legislation is irrelevant to pursue until we can ensure 100% safety of this developing technology. It is very difficult to put standards in place when we still do not know how this technology is going to advance and develop. Safety assurance is a vital part of this new legislation.

In 2018, the United States Government Accountability Office, delivered a report to the Committee on Science, Space and Technology, House of Representatives titled


\textsuperscript{144}Department of Transportation, National highway Traffic Safety Administration. “Pilot Program for Collaborative Research: Motor Vehicles with High or Full Driving Automation”. Accessed March 2\textsuperscript{nd}, 2019.
“Artificial Intelligence: Emerging Opportunities, Challenges and Implications”. The report mentions “safety assurance” and how policymakers will have to determine how AVs will be deemed safe, when they would be ready for deployment, if the technology can follow traffic laws and avoid hazards, and how policymakers determine if this “assurance is sufficient”. This is pertinent to the new legislation because we have to determine if the new legislation’s goal to avoid fatalities and harm is too unrealistic. Would it be more realistic to use a more precise measurement? For example, to create legislation that says by “2025 we hope that 50% of all incidents caused by AV is eliminated, by 2040 we aim to eliminate all incidences by 20%.” It is impossible to recognize what we do not know, what is not discovered and what we cannot anticipate in the future.

While we are addressing many safety concerns, the proposed legislation would need to look at those “unknown” factors. If we put safety standards in place for the AV and the person in the vehicle, then what about other standards for pedestrians and human error? If a pedestrian is walking in the street during a green light and a self-driving car hits the person, we need to create federal guidelines on how to determine fault of the situation. Thus, we need further information of factors such as liability, insurance and ethical decisions. This legislation is not able to eliminate all the concerns we are currently seeing surrounding AV, and we have to address those other risks that could evolve over time.

146 ibid.
Additionally, the new legislation will not be able to account for any new research and developments in AV technology. The new “unknown” could lead to many unintended consequences on the federal level. If there are significant improvements made, the new legislation will constantly need to evolve and change with the new factors. As we know, the current “regulatory process cannot keep up with the fast pace changes of AV innovation.” Trying to legislate an industry that is relatively unknown and that is changing so rapidly is a challenge because it will require constant revisions as better information becomes available and new innovations are made. Say for example that three weeks after the legislation takes effect, a new development is made in the technology, which was not addressed in the legislation. Although the legislation is only a few weeks old, it would already need to be updated.147 As stated in a policy paper on AV by Aida Acosta a fellow at Harvard University, “while regulations are created through lengthy processes, technologies evolve and move quickly. Even if policymakers are able to enact effective laws or regulations applicable to a given technology, the policies will soon become obsolete if they are not revised iteratively. Because technology develops quickly—facilitating new uses and capabilities that could threaten safety, security, public health, or civil rights— the law that was once developed for it may become outdated and no longer comprehensive or effective.”148

In addition to the safety issue, trying to eliminate all harm and figuring out all the unknowns, another disadvantage of the new legislation is the potential of eliminating

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innovation and creativity on the state level for different manufacturers and the
development of the new technology. As the NHTSA has stated “We do not intend to
write the final world on highly automated vehicles. Rather, we intend to establish a
foundation and a framework upon which future Agency action will occur”149 This
statement, which came from the 2016 document, Federal Automated Vehicles:
Accelerating the Next Revolution in Roadway Safety, still stands today on the federal
level.

It is important to look at whether the proposed legislation takes away state’s
freedom to determine what manufacturers can and cannot do relating to AV. If the
legislation makes mandatory that all steering wheels must be in the vehicle,
disengagement mode cannot be turned off, etc, how will manufacturers continue to make
advancements? While the legislation proposed that these features could be disengaged in
testing areas, it is important that AVs operate similarly to traditional vehicles do today.
Testing on national highways and state roads is imperative to the development of AVs. It
would be important to look at if it is within our rights to make these decisions mandatory
rather than following the Department of Transportations “voluntary guidelines”. We do
not want to hamper the development of this technology, but we do want to protect human
life It is difficult to create a policy that could allow innovation while requiring mandatory
safety measures that might hinder creativity.

From a privacy perspective it is imperative that the new legislation address data
sharing and privacy concerns or that another piece of legislation would need to be

149 Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety.” United States
https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf
developed to address these concerns. We must establish “federal data privacy legislation that both protects citizens and allows companies to build secure data and technology”. While not mentioned in detail in the new proposed legislation, this would need to be considered as we further take action on creating federal standards. An older article from 2013 called “Preparing a Nation for Autonomous Vehicles: Opportunities, Barriers and Policy Recommendations” mentions some of the concerns towards abused data and personal information that are still issues of concern now. If we collect all this information about AV and individuals operating AV, how will sensitive information be protected? The article stated that, “consumers of AV technology will likely have some concerns about the use and potential abuse of data collected from their personal travel. Therefore, AV-enabling legislation should consider privacy issues to balance these legitimate concerns against potential data-use benefits. Since vehicles will inevitably cross state boundaries, federal regulation needs to establish parameters regarding what types of AV data should be shared, with whom it should be shared, in what way the data will be made available, and for what ends it may be used – rather than take a default (no action) position, which will likely result in few to no privacy protections”. This legislation will have to further investigate how to protect data, technology and individuals. It will also need to look at how to report on the information gathered while protecting private information.


Another shortfall identified in the proposal is how to handle all the new information and new standards put in place. We cannot just designate the NHTSA and Department of Transportation to overseer everything without hiring new employees, creating new departments and evaluating the economic impact that this will cause. The Department of Transportation is not able to overview all the data and resources as is, so we would have to come up with some sort of plan to create more employees under the current federal budget. As mentioned above Aida Acosta, a fellow at Harvard University, suggests that the “federal government can use its strengths, such as capacity to promote technology, incorporate values in technology, train workers, bring together stakeholders” and update its current framework to meet the needs of this new technology.\textsuperscript{152} Even though this new plan for legislation sounds great on paper, we need to identify how the responsibilities would be carried out and by whom, It does not make sense to pass legislation if DOT and NHTSA do not have the capacity to follow through.

Finally, we need to look at a number of other factors that are not being addressed in the new legislation. First, does the legislation need to touch base on investing in infrastructure maintenance and adaptation to allow connected vehicles on the roadway? Meaning, as more autonomous vehicles hit the road are we going to have to change how our highway system operates and how traditional vehicles operate? We must look at “better mobile networks, good roads, changing traffic signals, lane widths and on-road information systems”.\textsuperscript{153} In addition, if we are going to have autonomous electric vehicles, does this mean we need to do more to support electric cars at rest stops and gas


\textsuperscript{153} Ibid.
stations along the highway, supplying them with charge stations, proper rest stops, etc. This is a huge consideration as it determines if AVs can actually deploy on main highways and roads. Second, we are going to have to tackle cybersecurity and how this will look relating to AV technology. Just as computers can be hacked, this technology is vulnerable to security threats. We are going to have to look at hacking problems, cybersecurity attacks, secured networks and other factors.

Despite all the positives, one major reservation is whether this new legislation gives Washington DC too much power? “One of the most contentious questions about the bill is how much power it would give Washington to control the introduction of vehicles that might reshape city streets. Critics claim it allows federal regulations to pre-empt rules that cities and states impose on AVs.”154 The new legislation would clearly need to define the power between the state and federal level and what the federal government’s limits are. Another question is whether it is better to just keep the voluntary standards 3.0 from the Department of Transportation as the main resource for AV manufacturers to adopt. Many argue, why change something that is currently enabling manufacturers to make new discoveries with limited restrictions? These are a number of the factors that would have to continue to be considered before making the final decisions and modifications to the new legislation.

The new proposed legislation addressed “the technology that currently does fit into an existing regulatory framework”.155 The policy has the potential to save lives and

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to improve mobility and safety, but it could also infringe on creativity and innovation, put unreasonable and unrealistic restrictions on manufacturers, and cause privacy concerns.

“Traditionally, states are allowed to act where the federal government has not taken specific action” as this is starting to change we will have to discover the political implications of the new legislation proposed.

VI. POLITICAL ANALYSIS

Understanding the political implications of this proposal is imperative in understanding the success of the new legislation if proposed. The topic of Autonomous Vehicles, more specifically the regulation surrounding them, is relatively new, only rising to attention within the last 4 years. Senator Thune, as you know, it was not until the Obama Administration that discussions surrounding AI and Autonomous Vehicles became relevant. The new legislation will be able to promote the creation of this new technology, deliver faster results and ensure safety when AV’s hit the roads. While the new legislation aims to impact the public positively, there are many strong opinions on the implications for federal regulation of Autonomous Vehicles as well as the acceptance of this new technology. Public stakeholders include but are not limited to: the current Trump Administration, members of the Senate, members of the House of Representatives, CEO’s of AV companies, the automobile industry, manufacturers, vehicle associations, advocacy groups, insurance companies, the public at large and lastly foreign governments.

In 2018, the Trump Administration made Artificial Intelligence a top priority.156 Last summer the White House held a summit discussing the emergence of AI. The

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current Administration invited leaders in the community, government officials, experts and researchers to the summit where President Trump stated, “that his administration will allow for AI to freely develop in the US”, and will not dictate, “what is researched and developed”. President Trump also stated, “we’re on the verge of new technological revolutions that could improve virtually every aspect of our lives, create vast new wealth for American workers and families, and open up bold, new frontiers in science, medicine, and communication”. He went on to say that, “we will allow scientists and technologists to freely develop their next great inventions right here in the United States” and “offer resources and the freedom to explore”. As it currently stands, the administration does not want to impose federal regulations that would hinder innovation within the AI and AV community.

Appointed Secretary of Transportation, Elaine Chao, currently expresses some of the same opinions as President Trump. At an Autonomous Vehicle Symposium last year, Chao stated the following: “One thing is certain, the autonomous revolution is coming- and as government regulators it is our responsibility to understand it and help prepare for it.” She has also said, “Our country is on the verge of one of the most exciting innovations in transportation,” but acknowledges we are not in the business-

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don't know how to pick the best technology or to pick the best winners - the market will pick the most effective solution”.

To date, Secretary Chao heading the Department of Transportation has established only voluntary guidelines as seen in documents 2.0 and 3.0 “A Vision for Safety” for manufacturers, experts, researchers, and others to adopt voluntarily when developing, deploying and creating AV technology. As Chao stated in 2018, “The goal is to eliminate unnecessary obstacles to the development and integration of new technology. Our approach will be tech-neutral and flexible - not top-down, or command and control.”

Under the Department of Transportation, other agencies and federal officials have made their remarks against federal AV regulation. The Federal Highway Administration (FHWA) Deputy Administrator Brandye Hendrickson said, “We do not want to mandate the technology because we do not want to hinder innovation”. In addition, the Under Secretary of Transportation for Policy, Derak Tai-Ching Kan stated, “We are not going to be selecting what technology should be used”. Kan also said, “We’re looking at ways to evaluate outcomes. Instead of a regulation that says, ‘Machine must have A, B, and C in a vehicle’, we hope to look at how safe a vehicle is at the other end”.

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166 ibid.
The current administration is “not interested in imposing strict regulations on AVs” and would rather continue with the “NHTSA Vehicle Performance Guidance for all entities involved in manufacture, designing, supplying, testing, selling, operating and deploying”. Deep criticism against federal regulation came from former administrator of NHTSA, Joan Claybrook, who believed the “AV START Act put economic priorities above public safety” and did give “adequate funding and effective authority to NHTSA”. Many people working under the administration felt that the current proposed legislation to date missed some of the most important factors in protecting humans and would give too much control to Washington legislatures. While Secretary Chao does not want to limit creativity and innovation, she has stated that proper safeguards must be put in place surrounding the new technology.

While federal regulation is not the goal, the Department of Transportation has established a council called the “Nontraditional and Emerging Transportation Technology (NETT) to help figure out where AVs and the new technology operate, as they do not fit neatly within the 11 current operating administrations. “NETT will address challenges by ensuring the traditional model silos at DOT not impede the

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deployment of new technology”. That being said, under the current administration and under the direction of President Trump it is going to be difficult to gain support at the federal level for regulation when adopting federal standards is not in the current framework.

As we know, S. 1885 and H.R. 3388 were both bipartisan, attracting support from both the Senate and House of Representatives. While many were in favor of the legislation introduced last year, many members in office strongly opposed the legislation. One benefit of introducing/ re-introducing some of the sections of the old legislation within the new legislation is that all of the cosponsors of S.1885 are still in office, especially Senator Gary Peters (D-MI), Senator Roy Blunt (R-MO), Senator Debbie Stabenow (D-MI) and Senator Roger Wicker (R-MS) who all cosponsored S. 1885. As Senator Peters has said, “Self-driving vehicles will completely revolutionize the way we get around in the future, and it is vital that public policy keep pace with these rapidly developing lifesaving technologies that will be on our roads in a matter of years”. In addition Senator Peters and Senator Stabenow have stated that “connected and automated vehicles are being developed internationally, and we risk the erosion of our leadership position if we do not take steps to facilitate the continued advancement of these technologies in the United States”. In 2018, both Senators led a bipartisan call to “fund

the testing and development of connected and self-driving cars as part of the
government's spending” and to continue to support efforts to fund AV legislation.174

Additionally, 26 out of the 31 members of Congress that cosponsored H.R. 3388 are still in office, and a number of them are sitting on the United States House Committee on Energy and Commerce, which is critical to passing the proposed legislation. Some of those members are: Frank Pallone (D-NJ)- Chairman of Energy and Commerce Committee, Greg Walden (R-OR)- ranking member of Energy and Commerce Committee, Fred Upton (R-MI)- Ranking member of the Energy Subcommittee, Michael Burgess (R-TX)-Ranking member of the Subcommittee on Health, Bobby Rush (D-IL)-Chairman of the Energy Subcommittee and Anna Eshoo (D-CA)- Chairwoman of the House Energy Subcommittee on Health. While there are many other members, these five hold crucial leadership roles within the Energy and Commerce Committee and have expressed their support for legislation that will ensure the coexistence of safety and innovation. As Congressman Greg Walden said “the legislation should work in a bipartisan way to deliver results for the American people”.175 Additionally, during a committee meeting in 2017, Fred Upton discussed that the “automotive industry is completely revolutionizing how we will get around for decades to come” and more specifically, “self-driving cars will play a critical role in Michigan’s economy”.176

175 United States Senate Membership List.https://www.senate.gov/general/committee_membership/committee_memberships_SSCM.htm
concluded with “the bipartisan legislation that will allow self-driving car manufactures to innovate while keeping gold standard safety levels in place”. 177

Senator Thune, as you have said, with the “Democratic Party now in control of the House, it means it is going to be a ‘different dynamic’ for elected officials, and getting legislation moved through will be an ‘evolutionary process’”. 178 I agree with you, “we do need the framework in place that puts the safety guardrails around the technology and that Congress and federal policymakers can keep up with it”. 179 We also recognize similarly to you that Congress will need to address AVs to “update rules, direct manufacturers to address safety requirements and enhance technical expertise of regulators”. 180 Many of the updates and concerns are being proposed in the new legislation. House and Senate members’ support is critical to passing future AV legislation. As we have seen in the media, there have been many members who are vocal about their support and/or concerns with AV federal regulation.

Congresswoman Janice Schakowsky (D-IL) has commented on autonomous vehicles and the growing technology saying, “Congress itself might be at risk of speeding, but we need to figure out a responsible way to keep innovation moving forward, while ensuring safety at every stage”. 181 Schakowsky has also stated on her website that “given the coming boom of AVs on our nation’s roads, it is important that

177 ibid.
179 ibid.
Republicans and Democrats work together to provide a national framework that recognizes the impact of this emerging new technology and ensures the safety of all Americans”.\textsuperscript{182}

In addition, the founder and Co-Chairman of the bipartisan AI Caucus, John Delaney (D-MD) and current Chairman Pete Olson (R-TX) have commented on the emergence of AI and technology. Delaney has stated, “AI promises to be one of the paradigm-shifting developments of the next century, with the potential to reshape our economy and daily life just as fully as the internal combustion engine or the semiconductor.” Olson has stated. “AI is no longer science fiction- and I agree with Congressman Delaney that it will be a positive transformational force”.\textsuperscript{183} The AI Caucus is relevant to the topic of AVs because it brings together experts from academia, government and the private sector to discuss the latest technologies and the implications and opportunities created by these new changes.\textsuperscript{184}

A major opposer of Autonomous Vehicle Regulation is Senator Feinstein of California. Feinstein has “emerged as one of the AV legislation most persistent critics”.\textsuperscript{185} Heading a letter to the United States Senate in March 2018, Senator Feinstein along with Senator Gillibrand (D-NY), Richard Blumenthal (D-CT), Edward Market (D-MA) and Tom Udall (D-NM) have urged the Senate not to pass previous AV legislation


arguing that, “legislation indefinitely preempts states’ and local safety regulations even if federal safety standards are never developed” and would overrule state safety laws.  

In this letter the Senators expressed concern that S. 1885 did not put enough safety standards in place and that it left out important information such as traffic laws and “other traditional state and local responsibilities”.  

In addition Senator Blumenthal has expressed his concerns regarding AV accidents following the death of the pedestrian last year. Blumenthal stated, “This tragic incident makes clear that AV technology has a long way to go before it is truly safe for the passengers, pedestrians, and drivers who share America’s roads”, and, “Congress must take concrete steps to strengthen the AV START Act with the kind of safeguards that will prevent future fatalities”. The opposition’s overall concern is safety and making sure that the public’s interest is the number one priority. With that being said, the new legislation offers a chance to gain bipartisan support from these specific four members of the Senate because many of their concerns surrounding safety are addressed by proposed additions in the new legislation. The proposed legislation is intended to “resolve policy differences with opponents on Capitol Hill”. 

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188 Ibid. 
Local and state officials vary in opinion on the topic of Autonomous Vehicles. Jennifer Cohen, the Director of Government Affairs for the Los Angeles Department of Transportation makes evident how scary the reality of a self-driving vehicle is on the roadways. As she stated, “The idea that I would not be able to prevent a vehicle that I know to be unsafe from operating on our streets is literally terrifying” and, if we know that a vehicle consistently fails to stop at a stop sign, yet we have lost our ability to outlaw that, that should terrify everyone”. In addition, last year Jeff Bridges, a Democratic member of the Colorado House of Representatives, co-sponsored legislation to allow AVs to operate in the state. Bridges’ stance differs from the previous Governor of Colorado and presidential hopeful, John Hickenlooper, who feels regulation should stay within states’ jurisdiction and the states should have the power to make all decisions. Bridges’ goal is that the “federal government should take the lead over states in passing self-driving car legislation”. Bridges has said, “States should not be having to pass legislation about driverless cars”. Also in support of these opinions is Congressman Bob Latta (R-OH) who has agreed that federal regulation is necessary and has said, “You could have 50 states and the District of Columbia doing their own thing” and that the goal is ultimately to get one cohesive set of regulation across all 50 states.

Many CEO’s, automobile industry leaders and researchers in the technology and autonomous vehicle sector have been clear about their support for both AV legislation
and the technology. Numerous organizations, associations and advocacy group have also been vocal actors in helping to gain either opposition or support regarding federal policy. First, in July of 2018, 108 stakeholders that “represent a wide cross section of auto manufacturers, suppliers, repairers, the motorcycle community, technology and communications companies, mobility providers, state and city governments, safety and national security groups, consumers, seniors, and persons with disabilities wrote to Majority Leader McConnell, Leader Schumer, Chairman Thune, and Ranking Member Nelson to express their gratitude and support for federal AV legislation”.195

The letter asserts that “federal legislation will help strengthen existing safety oversight by the National Highway Traffic Safety Administration and complements the iterative work of the U.S. Department of Transportation (DOT) with respect to their highly automated vehicle policy guidance”.196 In addition, “The legislation will help provide a clear delineation of federal and state roles with respect to highly AVs—a critical aspect that will protect against a patchwork of regulations that could stifle innovation, job growth, and the development of safety technologies that will reduce the number of lives lost on U.S. roadways.197 This letter goes into more detail on how “Congress can advance the groundbreaking technology while supporting research and investments in the United States”.198

196 ibid.
197 ibid.
198 ibid.
Of the 108 stakeholders many CEO, alliance groups, associations and automobile industries have also commented on the benefits of federal legislation last year in regard to S. 1885 and HR 3388. Ford Motor Company has stated, “without question, the potential benefits of autonomous vehicles, ranging from increased safety to greater mobility access, will transform transportation in the United States. That opportunity, however, will be missed if the Senate does not pass the AV START Act and reconcile it with its House counterpart, H.R. 3388, the SELF DRIVE Act”. In addition, CEO of Ford Autonomous Vehicles LLS, Sherif Marakby wrote a personal letter to the Senate to thank the Senate for its ongoing efforts in AV legislation in 2018. Marakby said, “Ford is deeply committed to developing and deploying AVs in a safe and responsible manner”.

The Director of Technology and Innovation Policy at Toyota, Hillary Cain tweeted last year her support towards passing AV regulation, saying, “failure to pass the legislation in 2018 is a ‘missed opportunity’” and that there would be remorse that “Congress failed to get ahead of this and establish a federal framework for this emerging technology”. In addition the Toyota Research Institute has stated, “At Toyota, we see the potential for autonomous driving technology to help people -particularly those who cannot currently drive because of a disability or advanced age - enjoy new levels of independence and mobility. Our work on autonomous driving technology is part of our continued effort to improve lives by giving everyone in our society the freedom to move.

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By creating autonomy for cars, Toyota’s ultimate goal is to expand autonomy for people”. 202

The CEO of the Alliance of Automobile Manufacturers Inc., Mitch Bainwol, also commented on the legislation moving forward last year. He stated, “Outdated federal regulations and the potential for a patchwork of state laws could impede the very safety benefits that show great promise. The absence of a clear federal framework, which respects traditional state authorities, could create an environment that is hostile to such innovations and inadvertently hinder America’s leadership when it comes to autonomous technologies”. 203 In addition, the spokesperson for the Alliance, Gloria Bergquist, who represents automobile manufactures such BMW, Ford, General Motors stated “‘without this legislation from Congress, lots of important work that would benefit Americans slows down… we will keep pushing for legislation to pass” 204

The American Highway Users Alliance showed similar support stating, “Unfortunately, with each passing day that the [AV START Act] is not considered, investment in emerging autonomous vehicle technology heads outside of our borders, where other countries are encouraging research and deployment. But with prompt passage of [the] bill, we will have the opportunity to lead, rather than follow others on these lifesaving innovations”. 205 The Association of Global Automakers has also


commented, “It is critically important for the Senate to act now and pass this important and robust framework”.

Vehicle manufacturers like BMW and Volvo Car have responded as well. BMW stated, “Inaction is a vote for the status quo: 9 in 10 accidents on U.S. roads are the result of human behavior. This cannot possibly be acceptable by anyone’s measure. Based on decades of engineering experience, BMW NA firmly believes that automated driving systems and connected car technologies will make a demonstrably positive impact on road safety”. Volvo Car USA affirmed, “Volvo Cars supports [the Senate’s] efforts to ensure passage of this important legislation this year. Globally, Volvo Cars is at a pivotal point in the development of autonomous technology, and therefore, we need the ability to test and deploy our cars in real-life situations around the world”.

On the other hand, Vice President of Advocacy at Consumer Reports and a former deputy and acting administrator of the NHTSA, David Friedman, stated, “My honest fear is this kind of reckless, rush-ahead approach is going to delay the technology because consumers are going to have knee-jerk reactions every time a company messes up”. Friedman believes federal regulators should take the time to create legislation that does not cut corners rather than putting improper policies in place just to get the legislation out there quickly. Similar to Friedman consumer groups and safety advocates, “celebrated the

207 ibid.
208 ibid.
legislation going down last year” and said that the “bill seriously jeopardize[s] public safety”. While many argue that it “recognizes the lifesaving potential for driverless vehicles to make our roads safer” and argues against jeopardizing the public.

Arguably the most important stakeholder in the discussion surrounding self-driving vehicles, legislation and safety is the public at large. Gaining support and trust from the public can enable policy makers to progress in passing AV legislation. Consumers and the overall public need to be considered in every aspect of regulation, policy and safety standards related to autonomous vehicles. In 2018 a number of studies and polls were gathered to report on AVs and public opinions towards self-driving cars. The following shows the significance of how heavily the public's opinion weighs on this issue as it moves forward into the future.

Late in 2018 Gallup released a poll, which “found that 54% of Americans are unlikely to utilize self-driving cars, while a quarter of respondents, 25%, said they would likely use the cars. A majority of respondents, 59%, indicated that they were uncomfortable with the idea of traveling in a fully autonomous vehicle each day. 23% said they are comfortable using a completely self-driven vehicle on a daily basis, while 18% said they feel neither way”. Gallop surveyed 3,297 individuals, as you can see in Figure 11 below.

In addition, the Advocates for Highway & Auto Safety published a study done last year called the “CARAVAN Public Opinion Poll: Driverless Cars”. The poll was conducted by 1,005 adults (18 years and older) and showed some of the following statistics.

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Figure 12. 64% of the public from the CARAVAN poll express concerns about sharing the road with driverless cars.\textsuperscript{214}

Figure 13. 84% out of the 1,005 adults who took the poll support “rules to ensure that human drivers are alert to be able to safely take control from an Autonomous Vehicle”.\textsuperscript{215}


- 2018 Reuters Survey: 67% of Americans polled said they were uncomfortable with the idea of riding in self-driving cars.
- 2017 Deloitte Study: 74% of U.S. consumers polled said they felt that fully autonomous vehicles would not be safe.

As Felix Richter a Data Journalist for Statista stated, “unsurprisingly, safety and the ability of self-driving cars to avoid mistakes are among the biggest concerns of people opposed to autonomous vehicles,” in addition to “Convincing people of the safety and fail-proofness of self-driving technology will be one of the biggest challenges for all companies involved going forward.”\footnote{Richter, Felix. “Consumer Concerns About Self-Driving Cars.” Statista. March 20th, 2018. Accessed March 1st, 2019. https://www.statista.com/chart/5950/concerns-about-self-driving-cars/} Figure 14. Below shows the “percentage of 1,260 respondents naming reasons for their reluctance to use self-driving cars”.\footnote{ibid.}
It is evident from the numerous survey results that “Americans are far from sold on either the safety or the benefits of self driving vehicles”. There is major doubt in the public more than ever, especially after all the incidents that occurred in 2018. A study done by J.D. Power and Associates and the National Association of Mutual Insurance Companies showed that, “There is a deep distrust of the technology, with more than four out of 10 Americans saying they ‘would never ride’ in a fully automated vehicle”.

In the article, “Preparing a Nation for Autonomous Vehicles: opportunities, barriers and policy recommendations” it states “even with how safe AV will eventually become, there is the initial perception that they are potentially unsafe because of their

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219 ibid.
221 ibid.
lack of human driver”.222 There have also been incidents unrelated to road safety that have caused humans to be suspicious of technology. For example, in 2014, “an active shooter situation caused people to call Uber to escape the area. Instead of recognizing the dangerous situation, the algorithm Uber used saw a spike in demand, so it decided to increase prices”.223 Events like these continue to create distrust between humans and the technology. To help build the trust of the public we need to be able to show them that we have the ability and capacity to keep them safe from unintended consequences. We need to be able to address security, privacy, reliability, liability, and other concerns and offers practical solutions to these problems. In order to reintroduce AV legislation we must focus on “ending deregulatory efforts and balancing productive competition while maintaining the levels of safety required by established law and practice”.224

As discussed previously, privacy concerns related to data sharing are another factor in the public’s distrust of the technology. “Since vehicles will inevitably cross state boundaries, federal regulation needs to establish parameters regarding what types of AV data should be shared, with whom it should be shared, in what way the data will be made available, and for what ends it may be used – rather than take a default (no action) position, which will likely result in few to no privacy protections”.225 The government has the ability to promote trust and acceptance of AV technology by “educating the

www.elsevier.com/locate/tra


www.elsevier.com/locate/tra
public, integrating AVs into society, allowing the public to interact with AVs and continue researching the new technology for new developments and discoveries on bettering the systems." It is impossible to guarantee 100% safety of AVs, but by collecting numbers, data and research we can begin to build the public’s trust towards this powerful new technology.

The last relevant actor that is important to discuss is how the United States compares with other countries in the Autonomous Vehicle world. Not only does recent evidence suggest that people are “alarmed that the U.S. government does not have a lot of regulation of AI technology,” but they also feel that they are seeing “China win in the AI Race.” As a world leader, the United States “cannot risk getting outpaced by Europe and Asia, where countries have already enacted legislation to support self-driving cars.” Additionally, Congressman Greg Walden mentioned “leaving the 115th Congress without getting self driving vehicle legislation across the finish line is more than just a missed opportunity, it threatens to derail efforts for the United States to be the leader in the advancement and development of this potentially life-saving technology”.

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In a comprehensive journal article titled, “Governing Autonomous Vehicles: Emerging Responses for Safety, Liability, Privacy, Cybersecurity and Industry Risks” goes into the various ways other countries are taking over the world of AI and AVs.\textsuperscript{230} China, the biggest “competitor” when it comes to AV technology, has announced “exponential growth in AI research and application over the next decade”.\textsuperscript{231} The Chinese government is addressing “safety risks, preventive measures and realistic road conditions for AVs”.\textsuperscript{232} The country still requires human hands be kept on the steering wheel during operation, and one surprising restriction is that “AVs cannot be tested under actual road conditions until the government devises a framework for granting road test exemptions” rather different from the United States where some argue that AVs need to be tested on regular roads and highways.\textsuperscript{233} Since 2016, the Chinese government has identified “AVs as a key sector in the government’s plans in becoming a leader in artificial intelligence by 2025 and to compete with the US’ core AI industries”.\textsuperscript{234}

Like China, Europe has begun to develop permits and regulations surrounding AVs. Unlike the United States the European Union (EU) is much “stricter due to cultural differences” and emphasize “protecting citizens from technical risks rather than looking to race for innovation and progress”.\textsuperscript{235} In Europe AV testing is legally permitted, but the testing is typically “confined to private street, pre-defined routes or restricted to very low speeds”.\textsuperscript{236} Going forward the EU and Europe plan to evaluate “the implications of

\textsuperscript{230} Araz Taeihagh & Hazel Si Min Lim (2019) Governing autonomous vehicles: emerging responses for safety, liability, privacy, cybersecurity, and industry risks, Transport Reviews, 39:1, 103-128, DOI: 10.1080/01441647.2018.1494640
\textsuperscript{233} ibid.
\textsuperscript{234} ibid.
\textsuperscript{235} ibid.
\textsuperscript{236} ibid.
AVs before establishing permanent regulation”. Similarly, Canada and Russia are in the process of developing national strategies. Meanwhile, the United Kingdom (UK) follows more of the United States approach by “not imposing regulations that are too stringent, or to have excessively lenient stance to AV safety, allowing room for innovation”. Lastly, there are a number of other countries like Japan, Australia and Singapore who are all creating strategies, goals and regulation towards AVs and coming up with ways to establish safe deployment. Foreign governments are relevant to the topic of AV policy and regulation in the United States because as world leaders we need to collaborate and work together to address the issue as a whole. As one of the most powerful countries in the world, the United States needs to take the lead in creating outstanding regulation and policy that can serve as a model for other countries to adopt and follow.

VII. RECOMMENDATION

After numerous months of extensive research and analysis, I recommend adopting this policy proposal. Introducing new federal legislation for Autonomous Vehicles will enable the United States to take the lead in the evolution of AI and the growing facets of the technology. While we have made tremendous progress the regulatory space is largely absent and this leads to many safety concerns. The evolution of technology in general and automobiles specifically has come a long way since 1925 when inventor “Francis Houdina demonstrated a radio controlled car” to the present where over 50 automobile

238 ibid.
industries are creating self-driving technology.\textsuperscript{239} As stated by representatives Bob Latta (R-OH) and Jan Schakowsky (D-IL), “Legislation in the self-driving car space is coming at a critical time”, “we have the potential to make a real difference by saving lives and improving mobility through Federal leadership”.\textsuperscript{240} As we are still in the early stages of this emerging technology, we have the ability to gain bipartisan support so that we can establish early on a foundation for manufacturers, data analysts, researchers and other AV stakeholders to adopt and use in the future. We also have the potential to decrease the number of Americans who die in traditional vehicles each year.

The most notable change and benefit to the new proposal compared to other legislation such as S.1885 and HR 3388 is the safety standards added. The biggest criticism received regarding the previous legislation was that it did not put safety of the public and pedestrians as the number one priority. The new policy addresses the concerns and doubts of the public and ensures that all measures will be taken with the well-being of humans in mind, not just the technology. Since the development of Autonomous Vehicles and the related technology is so new, it is hard to get constituents on board with supporting legislation regarding self-driving cars when there are still so many questions to be answered. I believe that presenting the new proposal could bring attention to this topic, which may encourage people to start learning about the technology and eventually start supporting the use of it on the roads.

In terms of gaining the public's trust, we do need to address concerns for future accidents and incidents. The policy proposal does not address the question of who will be responsible for when a self-driving automobile gets into a car accident. Further policy and research will be needed to ensure that standards are put in place to handle AVs on the roads and how insurance companies will handle liability and claims moving forward. In addition, further research would need to address the concerns of weather conditions, the “unexpected” such as potholes, objects in the road, unpredictable human beings, detours and rerouted roads, and how machines will make impromptu decisions when events occur in split seconds.\textsuperscript{241} Further policy would have to address privacy concerns and cybersecurity as many people are concerned with “the potential abuse of data collected”.\textsuperscript{242} Continued research will be needed to evaluate whether the impact of federal law will give too much power to the government, thus limiting states from creativity and innovation. As recommended by the House Oversight and Government Reform Subcommittee on Information and Technology during the 115\textsuperscript{th} Congress, “congress should craft policies that ensure public safety while avoiding the micromanagement of its evolution”.\textsuperscript{243}

As the CEO of Cruise Automation Kyle Vogt stated last year regarding the AV START Act “legislation will pave the way for a safer tomorrow by enabling self-driving


technology to help address the problem”.244 This statement is equally true of the proposed legislation. I believe that the Federal government has a major role in paving the way for “manufacturers to put self-driving vehicles on the road safely, while still allowing continued innovation”.245 Federal law will help us create mandatory data reporting, transparency and information sharing across all 50 United States. Legislators take a major role in helping the public become aware of AV technology and how it is going to be “managed” from both a liability and safety standpoint. Ultimately, “federal legislation legitimizes protection on society from AVs issues and correlates state and local laws making a federal standard” that is adopted by all individuals, stakeholders, manufacturers and other actors.246

Ultimately, the impact Autonomous Vehicles will have on society are more positive then negative. There is enormous potential reduce the number of crashes caused by a distracted human driver. The leading cause of accidents in the United States today is distracted drivers, but self-driving vehicles eliminate the possibility of distraction. In addition, self-driving vehicles will positively impact members of society who often cannot drive traditional vehicles on their own, such as elderly, visually impaired and disabled individuals. With AV technology, these individuals will be able to transport themselves without having to rely on public transportation.247 While other issues

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regarding AVs will arise such as privacy concerns, cybersecurity, abuse of data, expense and elimination of jobs, ultimately the benefit and positive impact on society is evident. We may never be able to say “AV eliminate 100% of all car accidents,” but current research allows us to predict a safer and brighter future with the help of AV technology.

Artificial Intelligence and Autonomous Vehicles are “transforming American life and American business”. Senator Thune, at the beginning of 2019 you said regarding AV legislation, “We want to get that restarted- no pun intended.” You also stated, “We really do need to have this sort of framework in place that puts the safety guardrails around the technology” and, “The technology is moving and it’s important for Congress and federal policymakers to keep up with it”. I completely agree with you. This is an exciting and innovative time for technology, the automobile industry and the American people in general. We have the opportunity to play an instrumental role in developing this transformative technology that has the power to change the lives of all United States citizens. Through proper legislation regarding regulation and safety standards, we can ensure that the technology continues to grow in a way that is beneficial to everyone and set an example for the rest of the world to follow.

Addendum

**List of current enacted AV Legislation:** 251
Information included below: where legislation is passed, name of legislation, year it was published, brief description.252

1. Alabama: (Law Enacted regulating truck platooning)
   - **SB 125** (2018): Motor vehicles, following too closely, exemption provided for, truck platoons under certain conditions, Dept. of Transportation authorized to adopt rules.
     - Defines truck platoon,
     - Electronic brake coordination
     - Establish speeds and distances during electronic coordination.
   - **SJR 81** (2016): Established the Joint Legislative Committee to study self-driving vehicles.

2. Arkansas: (Law passed authorizing AV study)
   - **HB 1754** (2017): An act to regulate the testing of vehicles with autonomous technology; and for other purposes.
     - Regulates the testing of vehicles with autonomous technology, relates to vehicles equipped with driver- assistance truck platooning systems.

3. California: (Authorizes full deployment with a human operator)
     - Requires the Department of California Highway Patrol to adopt safety standards related to AVs.
     - Adopt rules and regulations to promote safe operation.
   - **AB 1592** (2016): Autonomous Vehicles: Pilot Project
     - Authorized the Contra Costa Transportation Authority to conduct a pilot project for testing AVs.
     - Allows for pilot testing of an AV that does not have a driver seated in the drivers seat and are not equipped with a steering wheel, brake pedal, or an accelerator if the testing is conducted only at a specified location.
     - AV operates at speeds of less than 35mph to apply to rule.
   - **AB 669** (2017): Department of Transportation: Motor Vehicle Technology Testing

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https://www.ghsa.org/state-laws/issue/autonomous-vehicles

- Must have a valid driver's license for testing of AV, also allows testing of vehicles with less than 100 feet between each vehicle.

- **AB 1444** (2017): Livermore Amador Valley Transit Authority: Demonstration Project
  - Authorized the Livermore Amador Valley Transit Authority to conduct a share autonomous vehicle project for the testing of AV that do not have a driver in the driver seat and are not equipped with a steering wheel, accelerator, and brake pedal.

- **SB 145** (2017): Autonomous vehicles: testing on public roads
  - Repeals requirements of the DMV that seeks approval by legislature of presence of a driver inside the vehicle on public road.
  - Driver must remain in the driver seat.
  - Driver must be able to take control of AV during emergency.

- **SB 1** (2017): Transportation Funding
  - Encourages Road Maintenance and Rehabilitation Program to use funds to help advance AV technology and systems.

  - Allows law enforcement/public employee to remove AV that use autonomous technology without a permit.

- **AB 1184** (2018): City and County of San Francisco: local tax, transportation network companies: autonomous vehicles.
  - Authorized San Francisco to levy a tax on trips taken in Autonomous Vehicles.

4. Colorado: (Authorizes full deployment with a human operator)

- **SB 213** (2017): Automated Driving Motor Vehicles
  - Concerning authorization for automated driving systems to control motor vehicles throughout Colorado.
  - Defines AV system and functions of vehicle, requires approval for vehicle testing if the vehicle does not comply with relevant state and federal law.

5. Connecticut: (Authorizes AV testing with a human operator)

- **SB 260** (2017): An Act Concerning Autonomous Vehicles
  - Defines what an AV is. Requires pilot program for the testing of AV on public roads.

6. Florida: (Authorizes full deployment of AVs without a human operator)

- **HB 1207** (2012): Vehicles with Autonomous Technology
  - Defines what an AV is. Declares legislative intent to encourage safe deployment. Regulates the testing and authorizes person driving vehicle have a proper valid driver's license.

- **HB 599** (2012): Transportation and Mitigation Programs
  - Updates to HB 1207.
  - Looks over definition of term “limited covered accident”.

- **HB 7027** (2016): An act relating to the Department of Transportation
  - Permits AV on public roads with individuals with valid license. Eliminates requirements that the vehicle operation is done for test purposes.
- **HB 7061** (2016): An act relating to Transportation
  - Defines autonomous technology and driver-assist truck platooning.

7. Georgia: (Authorizes full deployment of AVs without a human operator)
   - **HB 472** (2017): A Motor vehicles and traffic; following requirements for vehicles in a procession when speed is coordinated automatically; provide exception
     - Specifies law prohibiting to closely to non-leading vehicles in a coordinated platoon.
   - **SB 219** (2017): Motor Vehicles; definitions; operation of motor vehicles with automated driving systems on certain public roads; provide
     - Defines autonomous driving systems. Does not require person operating an AV to have a driver’s license.

8. Illinois: (Authorizes a study on AVs)
     - Does not allow local authorities to enact or enforce ordinances that prohibit the use of vehicles equipped with AV systems.

9. Indiana: (Regulates truck platooning)
   - **HB 1290** (2018): Indiana Code Concerning Transportation
     - Defines and clarified “vehicle platoons”. Lays out an approval system for vehicle platoon operations.
     - Defines and clarifies terms.

10. Kentucky: (Regulates truck platooning)
    - **SB 116** (2018):  AN ACT relating to the operation of a commercial motor vehicle
      - Allows operation of a commercial platoon motor vehicle.

11. Louisiana: (Authorizes a study on AVs)
    - **HB 1143** (2016): Defines autonomous technology for the purposes of the highway regulatory act.
    - **HB 308** (2018): Provides relative to vehicle platooning
      - Defines platoon and platooning.

12. Maine: (Authorizes AV testing with a human operator)
    - **HP 1204** (2018): Resolve, to establish he Commission on Autonomous Vehicles and To Allow the Testing, Demonstration and Deployment of Automated Driving Systems
      - Coordinate efforts among state agencies and stakeholders to inform the deployment of a process to allow AV tester to demonstrate and deploy for testing purposes and automated driving system on a public way.

13. Michigan: (Authorizes full deployment of AVs without a human operator)
    - **SB 995** (2016):
      - Allows for AV under certain conditions.
    - **SB 996** (2016):
      - Allows operation without a person in the AV- under certain conditions.
    - **SB 997** (2016):
      - Defines AV system.
    - **SB 998** (2016):
- Exempts mechanics and repair shops from liability on fixing AV.
  - SB 169 (2013):
    - Defines automated technology and modes.
    - Permits testing of AV by certain parties under certain conditions, etc.
  - SB 663 (2013):
    - Limits liability of vehicle manufacturer.

14. Mississippi: (Regulates truck platooning)
  - HB 1343 (2018):
    - Defines platoon, define and exempt certain operators in from traveling distance requirements.

15. Nebraska: (Authorizes full deployment of AVs without a human operator)
  - LB 989 (2013): Authorized automated driving system equipped vehicles, automated driving systems, and driverless capable vehicles as prescribed

16. Nevada: (Authorizes full deployment of AVs without a human operator)
  - AB 511 (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.
  - SB 140 (2011): An act relating to traffic laws; prohibiting a person from using a cellular telephone or other handheld wireless communications device while operating a motor vehicle in certain circumstances; providing penalties; and providing other matters properly relating thereto.
  - SB 313 (2013): An act relating to autonomous vehicles; requiring an autonomous vehicle that is being tested on a highway within this State to meet certain conditions relating to a human operator; prohibiting an autonomous vehicle from being registered in this State, or tested or operated on a highway within this State, unless it meets certain conditions; providing that the manufacturer of a motor vehicle that has been converted to be an autonomous vehicle by a third party is immune from liability for certain injuries in certain circumstances; and providing other matters properly relating thereto.
  - AB 69 (2017): AN ACT relating to transportation; revising requirements for the testing or operation of an autonomous vehicle on a highway within this State; authorizing the use of driver-assistive platooning technology; authorizing the use of a fully autonomous vehicle to provide transportation services in certain circumstances by persons licensed by the Department of Motor Vehicles, Nevada Transportation Authority or Taxicab Authority; providing for the regulation of autonomous vehicle network companies; providing penalties; and providing other matters properly relating thereto.

17. New York: (Authorizes AV testing with a human operator)
  - SB 2005 (2017):
    - Allows the commissioner of motor vehicles to approve autonomous vehicle tests and demonstrations.
  - AB 9508 (2018):
    - A branch of bill SB 2005- adds additional information and language pertaining to autonomous vehicle demonstrations and testing.
18. North Carolina: (Authorizes full deployment of AVs without a human operator)
   - **HB 469** (2017): An act to regulate the operation of fully autonomous motor vehicles on the public highways of this state.
     - Regulation of fully autonomous vehicles.
   - **HB 716** (2017): Law regulating the distance between motor vehicles traveling on the road.
     - Modifies the follow-too-closely law to allow platooning.
19. North Dakota: (Authorized a study on AVs)
   - **HB 1065** (2015):
     - To provide for a legislative management study of automated motor vehicles.
   - **HB 1202** (2017):
     - An act to provide for a department of transportation study/
       - Study the use of autonomous vehicle equipped cars.
20. Oregon: (Authorized a study on AVs)
   - **HB 4059** (2018): Relating to transportation and prescribing an effective date.
     - Modifies and add laws related to transportation.
     - Defines autonomous vehicles.
   - **HB 4063** (2018): Relating to autonomous vehicles; and declaring an emergency
     - Creates a Task Force on Autonomous Vehicles- DOT is the lead agency responsible for autonomous vehicle programs and policies.
       1. Assigns duties to task force.
       2. Requires task force reporting.
21. Pennsylvania: (Authorized a study on AVs)
   - **SB 1267** (2016): An Act amending Titles 74 (Transportation) and 75 (Vehicles) of the Pennsylvania Consolidated Statutes, in traffic signals, further providing for definitions and for maintenance agreement; in general provisions relating to operation of vehicles, further providing for traffic-control signals and for expiration of automated red light enforcement systems provisions; and, in taxes for highway maintenance and construction, further providing for allocation of proceeds.
     - Allows use of up to $40,000,000 for intelligence transportation system applications- such as autonomous and connected vehicle technology, etc.
   - **HB 1958** (2018): An Act amending Title 75 (Vehicles) of the Pennsylvania Consolidated Statutes, in general provisions, further providing for definitions; in rules of the road in general, providing for platooning; and providing for highly automated vehicles.
     - Defines work zone.
     - Defines platoons.
     - Clarifies terms.
     - Establishes the Highly Automated Vehicle Advisory Committee with PennDOT.
22. South Carolina: (Regulates truck platooning)
   - **HB 3289** (2017): Safe Following Distance
- Gives reasonable distance between vehicles.

23. Tennessee: (Authorized full deployment of AVs without a human operator)
     - Prohibits local governments from banning use of motor vehicles equipped with autonomous technology.
   - **SB 2333** (2016): As enacted, allows a motor vehicle to be operated, or to be equipped with, an integrated electronic display visible to the operator while the motor vehicle's autonomous technology is engaged.
   - **SB 1561** (2016):
     - Redefining autonomous technology as it applies to the state.
   - **SB 676** (2017):
     - Authorized a person to operate a platoon on street and highways of this state.
   - **SB 151** (2017): Automated Vehicles Act
     - Enacts the AV Act and other requirements related to the operation of AV on the public road of the state.

24. Texas: (Authorized full deployment of AVs without a human operator)
   - **HB 1791** (2017): Relating to the use of connected braking systems to maintain distance between vehicles.
     - Allows for the use of connected braking system in order to maintain appropriate distance between vehicles.
     - Defines automated driving systems, etc.
     - Specifies owner of AV.
     - Requirements for autonomous vehicle and driver.

25. Utah: (Authorized AV testing with a human operator)
     - Updates and modifies the Motor Vehicle Act by authorizing DOT to conduct a connected vehicle technology testing program.
   - **HB 280** (2016): Automated Vehicle Study
     - Requires a study related to autonomous vehicles.
   - **SB 56** (2018): Vehicle Platooning Amendments
     - Modifies provisions of the Traffic Code related to safe following distance.

26. Vermont: (Authorized study on AVs)
   - **HB 494** (2017): An act relating to the Transportation Program and miscellaneous changes to transportation-related law,
     - Requires DOT to convene a meeting of stakeholders and expertise on a range of topics related to Automated vehicles.

27. Virginia: (Authorizes AV testing with a human operator)
   - **HB 454** (2016): Motor Vehicles: vehicles not to be equipped with televisions and video within view of driver.
     - Law relating to visual display when operating autonomously.

28. Washington: (Authorizes AV testing without a human operator)
- Create a legislative work group to develop policy recommendations to address the operation of AV on public roadways in the state.

29. Washington D.C.: (Authorizes full deployment of AVs with a human operator)
     - To authorize vehicles to operate on the roadways of the district.

30. Wisconsin: (Authorized study on AVs)
   - SB 695 (2018): An act to renumber; to amend and; to create and of the statues; relating to: distances between motor vehicles.
     - Trucks with a specific weight have to maintain a specific distance.

**Executive Orders by State Governors:**

1. Arizona: (Authorizes full deployment of AVs without a human operator)
   - Executive Order: 2015-09
     - Title: Self-Driving Vehicle Testing and Piloting in the State of Arizona; Self-Driving Vehicle oversight committee
     - Executive order signed by Governor Doug Ducey in 2015 directing agencies to “undertake any necessary steps to support the testing and operation of self-driving vehicles on public roads within Arizona”.
   - Executive Order: 2018-04
     - Title: Advancing Autonomous Vehicle Testing and Operating: Prioritizing Public Safety
     - Executive order made by Governor Doug Ducey in March of 2018. Adding onto the 2015 executive order with emerging technologies.
   - Executive Order: 2018-09
     - Title: Establishment of Institute of Automated Mobility (IAM)
     - Executive order signed by Governor Ducey in October of 2018 to created an institute of automated mobility in the state.

2. Delaware: (Study on AVs authorized)
   - Executive Order: 14
     - Title: Establishment of the Advisory Council on Connected and Autonomous Vehicles
     - Executive order signed by Governor John Carney in September of 2017 to establish the council tasked with developing recommendations for innovative tools and strategies used in Delaware for connected and autonomous vehicles.

3. Hawaii: (Authorizes a study on AVs)
   - Executive Order: NO. 1707
     - Title: Autonomous Vehicle Testing
     - Governor David Ige signed executive order in 2017 established AV contact requires a certain government agency to work with companies allow AV testing in the state of Hawaii.

4. Idaho: (Authorizes a study on AVs)
- Executive Order: 2018-01
  o Title: Autonomous and Connected Testing and Deployment Committee
  o Previous Governor C.L. Otter signed executive order in 2018 to create the Autonomous and Connected Vehicle Testing and Deployment Committee.

5. Illinois: (Authorized a study on AVs)
   - Executive Order: 2013-13
     o Title: Executive Order Establishing the Autonomous Illinois Initiative
     o Previous Governor Bruce Rauner signed executive order in 2018 to “help lead an autonomous Illinois initiative to promote the development, testing and deployment of connected autonomous vehicle technologies and related infrastructure and data needs within Illinois”.

6. Maine: (Authorizes AV testing with a human operator)
   - Executive Order: 2018-001
     o Title: An order Establishing the Maine Highly Automated Vehicles Advisory Committee
     o Previous Governor Paul LePage signed executive order in 2018 creating the Maine Highly Automated Vehicles (HAV) Advisory Committee to oversee the technology, development, implementation and recommendation in regards to pilot projects to advance autonomous vehicles.

7. Massachusetts: (Authorizes AV testing with a human operator)
   - Executive Order: NO.572
     o Title: To Promote the Testing and Deployment of Highly Automated Driving Technologies
     o Previous Governor Charlie Baker signed executive order in 2016 to create a group working on autonomous vehicles and experts in the field to create and establish proper legislation.

8. Minnesota: (Authorizes a study on AVs)
   - Executive Order: 18-04
     o Title: Establishing the Governor’s Advisory Council on Connected and Automated Vehicles
     o Previous Governor Mark Dayton signed an executive order in 2018 to establish Governors Advisory Council on Connected and Automated Vehicles.

9. Ohio: (Authorizes AV testing without a human operator)
   - Executive Order: 2018-01K
     o Title: Drive Ohio
     o Previous Governor John Kasich signed executive order in 2018 to establish a one-stop shop for researchers, developers and
manufacturers to collaborate on autonomous and connected vehicle initiatives.

- Executive Order: 2018-O4k
  - Title: Allows for autonomous Vehicle Testing and Pilot Programs in Ohio
  - Previous Governor John Kasich signed executive in 2018 to allow the testing of autonomous vehicles in Ohio.

10. Washington: (Authorizes AV testing without a human operator)
- Executive Order: 17-02
  - Title: Autonomous Vehicle Testing and Technology in Washington State- and Autonomous Vehicle Work Group
  - Governor John Inslee signed executive order in 2017 to address autonomous vehicle testing and establish an autonomous vehicle workshop.

11. Wisconsin: (Authorized a study on AVs)
- Executive Order: 245
  - Title: Relating to the Creation of the Governor’s Steering Committee on Autonomous and Connected Vehicle Testing and Deployment
  - Previous Governor Scott Walker signed executive order in 2017 creating the committee on Autonomous and Connected Vehicle Testing and Deployment and how best to advance the testing and operation of AV in the state of Wisconsin.
Curriculum Vitae

After graduating from the University of South Carolina in 2016, Rebecca Ackerman moved to Washington D.C. to be at the center of American politics. After serving as an AmeriCorps member for one year she moved on to work at the Autism Society of America where her true love for Salesforce, quantitative analytics and data come to the forefront. Currently employed at the Peter G. Peterson Institute for International Economics as the Salesforce Client Relationship Manager, she contributes her success to many of her Johns Hopkins University professor who urged her to take her passion for numbers and make it a long-lasting exciting career. Rebecca Ackerman continues to have a fun, hardworking professional career and will always remember how much her Master’s program shaped her future!