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Steering (or Not) Through the Social and Legal Implications of Autonomous Vehicles

Melissa L. Griffin

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STEERING (OR NOT) THROUGH THE SOCIAL AND LEGAL IMPLICATIONS OF AUTONOMOUS VEHICLES

MELISSA L. GRIFFIN^{*}

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I. INTRODUCTION

The National Safety Council (NSC) “estimates 38,300 people were killed on U.S. roads [in 2015], and 4.4 million were seriously injured”¹ This marks the deadliest driving year since 2008, with an 8% increase in vehicle fatalities from 2014 to 2015.² Aside from the obvious emotional cost of these deaths to society, the NSC calculated that “wage and productivity losses, medical expenses, administrative expenses, employer costs and property damage” amounted to \$412.1 billion.³

As 2018 races ahead, manufacturers and visionaries claim to have found the ideal resolution for eliminating the social and economic costs imposed by car accidents: autonomous vehicles. The National Highway Traffic Safety Administration (NHTSA)—the agency “committed to saving lives and improving safety and efficiency in every way Americans move”—describes the near implementation of autonomous vehicles as “a technological transformation that holds promise to catalyze an unprecedented advance in safety on U.S. roads and highways”⁴

This Comment will take a survey-style approach to analyzing the implications of autonomous vehicles. Part II will provide an overview of the evolution of autonomous vehicles.⁵ Part III will discuss a plethora of social and economic advantages of the implementation of autonomous vehicles and reveal disadvantages that are not widely ventilated.⁶ Part IV will discuss existing federal and state regulations regarding autonomous vehicles.⁷ Part V will suggest legislation and provide recommendations for any existing gaps in regulation.⁸ Finally, Part VI concludes.⁹

¹ *Motor Vehicle Deaths Increase by Largest Percent in 50 Years*, NAT'L SAFETY COUNCIL (Feb. 17, 2016), <http://www.nsc.org/Connect/NSCNewsReleases/Lists/Posts/Post.aspx?List=1f2e4535-5dc3-45d6-b190-9b49c7229931&ID=103&var=hppress&Web=36d1832e-7bc3-4029-98a1-317c5cd5c625>.

² *Id.*

³ Stav Ziv, *2015 Brought Biggest Percent Increase in U.S. Traffic Deaths in 50 Years*, NEWSWEEK (Feb. 17, 2016), <http://www.newsweek.com/2015-brought-biggest-us-traffic-death-increase-50-years-427759>.

⁴ FED. AUTOMATED VEHICLES POL'Y 5 (2016), <http://src.bna.com/iJd>.

⁵ See *infra* Part II.

⁶ See *infra* Part III.

⁷ See *infra* Part IV.

⁸ See *infra* Part V.

⁹ See *infra* Part VI.

II. BACKGROUND

A. *The Evolution of Autonomous Vehicles*¹⁰

Several entities pushed the evolution of autonomous vehicles over the past nine decades; however, the following are among the most notable.¹¹ The idea of autonomous vehicles (and an automated highway system) first debuted at General Motor (GM)'s Futurama exhibit at the 1939 World Fair.¹² By the 1960s and '70s, Stanford University created the Stanford Cart, which evolved from a buggy with a video camera and remote control to a cart with image processing capabilities.¹³ The cart was able to cross a room full of chairs in five hours without human intervention.¹⁴ In 1977, a Japanese engineering lab revealed a car that could process images of the road ahead; in other words, the car was truly autonomous.¹⁵

It was not until 1993 that German aerospace engineer, Ernst Dickmanns, who worked on similar projects since the 1980s, piloted a Mercedes S-Class from Munich to Denmark, with about 95% of the distance being driven fully automated.¹⁶ In 1995, the first American entity, Carnegie Mellon University, led a similar pilot.¹⁷ A 1990 Pontiac Trans Sport drove from Pittsburgh to Los Angeles with 98.2% of the distance driven without human assistance.¹⁸

Over the next several years, the Defense Advanced Research Projects Agency (DARPA) held annual competitions for creators of autonomous vehicles in an attempt to foster the technology for military purposes.¹⁹ Several entities in the

¹⁰ Michaela Ross, *5 Things to Know About Driverless Cars*, ELEC. COM. & L. REP. (Oct. 19, 2016), https://www.bloomberglaw.com/search/results/b6a3c221b3692f6218c98137dacedd8/document/X859MB6800000?search32=TUXTEdlgSYbJgzGl2DnRfg%3D%3DtAq3K8iwZ9APrcz35frfeUaIPVX7aH-6HAUfN6NUnY3n_zW3qUmX3foul7IBYHPkN0eLx1foWmusoiiU2e1AQ%3D%3D.

¹¹ See generally Tom Vanderbilt, *Autonomous Cars Through the Ages*, WIRED (Feb. 6, 2012), <https://www.wired.com/2012/02/autonomous-vehicle-history/>.

¹² *Id.* At the World Fair, GM expressed its vision of “abundant sunshine, fresh air [and] fine green parkways upon which cars would drive themselves.” *Id.*

¹³ *Id.*

¹⁴ *Id.*; see generally Les Earnest, *Stanford Cart* (Dec. 2012), <http://web.stanford.edu/~learnest/cart.htm>.

¹⁵ Vanderbilt, *supra* note 11. Though the vehicle could process images of the road ahead, an elevated rail guided it. *Id.*

¹⁶ *Id.* Dickmanns is referred to as “the pioneer of the autonomous car” due to his extensive work in the 1980s. *Id.*

¹⁷ See *id.*

¹⁸ *Id.* This endeavor was coined “No Hands Across America.” *Id.* The vehicle had a computer, windshield-mounted camera, and GPS receiver, along with other equipment, and achieved nearly seventy miles without human intervention. *Id.*

¹⁹ DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA), <http://www.darpa.mil/our-research?Filter=5&oFilter=&sort=undefined> (last visited Feb. 21, 2017); Vanderbilt, *supra* note 11. The first competition was held in 2004; however, none of the fifteen vehicles involved came close to completing the 150-mile course. *Id.* The following year, in 2005, DARPA offered a \$2 million prize and Stanford University took first place, completing the course in just under seven hours. *Id.*

United States and internationally continued to advance the technology of autonomous vehicles.²⁰ In 2010, the Google Driverless Car²¹ program launched (led by DARPA),²² and the fleet of sixty autonomous cars has now covered more than two million miles.²³

The most prominent competitor is Tesla, led by founder and CEO, Elon Musk.²⁴ In 2012, Tesla produced the Model S,²⁵ and pledged that in 2017, it would create an automobile “that can drive itself from Los Angeles to New York City, no human needed.”²⁶ In January of 2018, though the goal was not met entirely, great progress was made when the Tesla Model 3 was driven from Los Angeles to New York in a record-breaking 50 hours.²⁷ “The number of drivers using cars with the Tesla Autopilot currently exceeds 70,000, with over 780 million miles covered using these semi-autonomous vehicles.”²⁸ Now, over forty-four companies are working on their own version of autonomous vehicles,²⁹ which probably means truly driverless vehicles are in the consumers’ near futures, provided state and federal laws permit the technology.³⁰

²⁰ See Vanderbilt, *supra* note 11.

²¹ As of December 2016, Google renamed its autonomous vehicle program to “Waymo.” Michael Liedtke, *Google’s self-driving car project gets a new name: Waymo*, ASS’D PRESS (Dec. 13, 2016), <http://bigstory.ap.org/article/7418ab546ec14d49ac60e403eaf153ee/googles-self-driving-car-project-gets-new-name-waymo>; see also *infra* text accompanying note 31.

²² Vanderbilt, *supra* note 11.

²³ Jack Stewart, *Tesla’s Self-Driving Car Plan Seems Insane, But It Just Might Work*, WIRED (Oct. 24, 2016), <https://www.wired.com/2016/10/teslas-self-driving-car-plan-seems-insane-just-might-work/>.

²⁴ See *Elon Musk*, WIKIPEDIA (Feb. 21, 2017 6:33 PM), https://en.wikipedia.org/wiki/Elon_Musk. Musk is a South African entrepreneur who is, aside from his work in manufacturing autonomous vehicles, also known for his commitment to changing the world and humanity, primarily in terms of reducing global warming and reducing the risk of human extinction. *Id.* Musk founded SpaceX to develop a colony on Mars. *Id.* Additionally, he “was ranked 21st on Forbes list of The World’s Most Powerful People” and, as of February 2017, is the 94th wealthiest person in the world, at an estimated net worth of \$13.9 billion. *Id.*

²⁵ See Josh Lowensohn, *This is Tesla’s D: an all-wheel-drive Model S with eyes on the road*, THE VERGE (Oct. 9, 2014), <http://www.theverge.com/2014/10/9/6955357/this-is-tesla-s-d-an-all-wheel-drive-car-with-eyes-on-the-road>.

²⁶ Stewart, *supra* note 23.

²⁷ Zac Estrada, *Tesla Model 3 driven from LA to New York in 50 hours*, THE VERGE (Jan. 2, 2018), <https://www.theverge.com/2018/1/2/16842816/tesla-model-3-la-new-york-record-cannonball-run>.

²⁸ Vikas Agrawal, *Autonomous cars: A beginners’ guide for 2017 and beyond*, TNW CONF. (Dec. 25, 2016), https://thenextweb.com/insider/2016/12/25/self-driving-cars-a-beginners-guide-for-2017-and-beyond/#.tnw_AbWGIg8.

²⁹ *44 Corporations Working On Autonomous Vehicles*, CB INSIGHTS (May 18, 2017), <https://www.cbinsights.com/blog/autonomous-driverless-vehicles-corporations-list/>. Manufacturers and technology companies have entered the autonomous vehicle market and some are partnering. *Id.* Manufacturers at every price range have started developing autonomous vehicles. See *id.* Among the most recognizable are Honda, Ford, Jaguar, and Toyota. *Id.* Apple has even joined the race by establishing “Project Titan,” which has been kept very secretive and supposedly consists of 1,000 employees. *Id.*

³⁰ See *infra* Part IV.

B. Modern Day Autonomous Vehicles

The race to bring a fully autonomous vehicle to the consumer's market appears to exist primarily between Google³¹ and Tesla.³² Google's "fleet of self-driving vehicles has included modified Lexus SUVs, custom-built prototype vehicles (nicknamed "Firefly"), and . . . fully self-driving Chrysler Pacifica Hybrid minivans."³³ Each vehicle currently has a driver available—just in case.³⁴ The vehicles have "sensors and software that are designed to detect pedestrians, cyclists, vehicles, road work [sic] and more from a distance of up to two football fields away in all directions."³⁵ Though Google continues to advance its development of autonomous vehicles, it has not announced a hard date for release, but 2021 seems to be the aim.³⁶

Tesla³⁷ took a more aggressive route by promising a truly autonomous vehicle in 2017,³⁸ but then announced at the end of the year that the goal was being pushed out by two years.³⁹ "Tesla is equipping its cars with eight cameras and a forward-facing radar" and is using "Nvidia's Drive PX 2, a supercomputer that uses deep learning to teach the car to handle itself."⁴⁰ Additionally, [a]ll Tesla vehicles produced in [the] factory have the hardware needed for full self-driving capability at a safety level substantially greater than that of a human driver.⁴¹

³¹ WAYMO, <https://waymo.com> (last visited Feb. 22, 2017). Waymo is Google's self-driving technology company. *Id.* It stands for "a new way forward in mobility." *Id.*

³² See generally Stephen Fox, *Two Roads Diverged: Tesla, Interruption, and the Commerce Clause*, 22 B.U.J. SCI. & TECH. L. 153 (2016).

³³ WAYMO, *FAQ*, <https://waymo.com/faq/> (last visited Feb. 13, 2018).

³⁴ *Id.*

³⁵ WAYMO, *Technology*, <https://waymo.com/tech/> (last visited Oct. 30, 2017).

³⁶ Stewart, *supra* note 23.

³⁷ Fox, *supra* note 32.

³⁸ Stewart, *supra* note 23; see also James Ayre, *Will Teslas Be Capable Of Fully Autonomous Driving Within Only 6 Months? (#ElonTweets)*, CLEAN TECHNICA (Jan. 25, 2017), <https://cleantechnica.com/2017/01/25/will-teslas-capable-fully-autonomous-driving-within-6-months-elontweets/> (showing that Elon Musk Tweeted that a subset technology will be available in "3 months maybe, 6 months definitely."). Ayre, CLEAN TECHNICA. Realistically, though Tesla will have the technology available, it will likely take regulators one to two years to approve it. Jason Taylor, *Tesla and fully autonomous cars will change your life*, TESLARATI (Feb. 8, 2017), <https://www.teslarati.com/tesla-fully-autonomous-cars-change-your-life/>.

³⁹ Fred Lambert, *Elon Musk updates timeline for a self-driving car, but how does Tesla play in to it?*, ELECTREK (Dec. 8, 2017), <https://electrek.co/2017/12/08/elon-musk-tesla-self-driving-timeline/>.

⁴⁰ Stewart, *supra* note 23.

⁴¹ *Model X*, TESLA, <https://www.tesla.com/modelx> (last visited Feb. 13, 2018). "Model X is the safest, quickest, most capable sport utility vehicle ever—with standard all-wheel drive, best in class storage and seating for up to seven adults." *Id.*

“Tesla’s rapid-fire approach is in line with its image as a small but significant auto industry disruptor, while Google—a tech company from whom no one expects auto products—has the luxury of time.”⁴²

“The divergent approaches reflect companies with different goals and business strategies,”⁴³ which helps explain why the technology rolled out in stages.⁴⁴ As this Comment will show, not all autonomous vehicles are created equally.⁴⁵

There are six different levels of autonomous vehicles.⁴⁶ Level 0 does not entail any level of automation; the driver is completely in control.⁴⁷ Level 1 includes technology that most consumers are familiar with today—a vehicle equipped with functions such as cruise control and anti-lock brakes.⁴⁸ Under Level 2, the driver monitors lane correcting and traffic jam assistance, and the vehicle will alert the driver if it senses he or she is not paying close attention to road conditions.⁴⁹ Level 3 requires that the driver monitor the route and take control as necessary.⁵⁰ Levels 4 and 5 are both fully automated and do not require driver interaction; however, Level 5 vehicles do not have a steering wheel or driver controls.⁵¹ The following chart provides a visual representation of the various levels of autonomy vehicles may possess.

⁴² Tracey Lien, *Tesla and Google are both driving toward autonomous vehicles. Which is taking the better route?*, LOS ANGELES TIMES (July 3, 2016), <http://www.latimes.com/business/technology/la-fi-hy-tesla-google-20160701-snap-story.html>.

⁴³ *Id.*

⁴⁴ Ross, *supra* note 10.

⁴⁵ *Id.*

⁴⁶ *Id.*; Bryant Walker Smith, *SAE Levels of Driving Automation*, STAN. L. SCH. CTR. FOR INTERNET AND SOC’Y (Dec. 18, 2013), <http://cyberlaw.stanford.edu/blog/2013/12/sae-levels-driving-automation>; see *infra* Section II.F; see also SAE INTERNATIONAL, *AUTOMATED DRIVING* (2014), https://www.sae.org/misc/pdfs/automated_driving.pdf (providing standardized levels of autonomous vehicles in order to eliminate confusion between different professions and to educate the general public).

⁴⁷ Ross, *supra* note 10. Level 0 is described as “the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced warning or intervention systems[.]” Walker Smith, *supra* note 46.

⁴⁸ Ross, *supra* note 10. Level 1 means there is a “*driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*[.]” Walker Smith, *supra* note 46.

⁴⁹ Ross, *supra* note 10. Level 2 is defined as “the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*[.]” Walker Smith, *supra* note 46.

⁵⁰ Ross, *supra* note 10. Level 3 is defined as “the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*[.]” Walker Smith, *supra* note 46.

⁵¹ Ross, *supra* note 10. Level 4 is described as “the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*[.]” Walker Smith, *supra* note 46. Level 5 is defined as “the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*[.]” *Id.*



















Self-Driving Tech Likely to Roll Out in Stages						
Level	0 No Driving Automation	1 Driver Assistance	2 Partial Driving Automation	3 Conditional Driving Automation	4 High Driving Automation	5 Full Driving Automation
Who's steering and controlling speed?						
Who's monitoring the environment?						
Who must be able to take control in case something goes wrong?						
Automation systems limited to certain roadways or conditions	N/A	YES	YES	YES	YES	NO
Examples of tech	No assistant features	Cruise control, anti-lock brakes	Sensors monitoring driver awareness, lane keeping and traffic jam assist	Parking jam pilot, driverless valet parking	Highway driving pilot, closed-campus shuttles	No steering wheel or driver controls
Source: SAE International a Bloomberg BNA graphic						

Figure 1⁵²

III. SOCIAL AND LEGAL IMPLICATIONS

As the evolution of autonomous vehicles advances exponentially and the possibility of fully autonomous vehicles on the road approaches, more information about their advantages and disadvantages—or fears, rather—is being released.⁵³ Some have concluded that future development of autonomous vehicles, like the regulation of fire arms,⁵⁴ will lead to the next cultural war, while others remain optimistic that this technology can benefit society. The concerns addressed throughout this Comment are the most hotly debated topics.

⁵² *Id.* (Source: SAE International).

⁵³ See AUTO INS. CTR., *Top 20 Pros and Cons Associated With Self-Driving Cars*, <http://www.autoinsurancecenter.com/top-20-pros-and-cons-associated-with-self-driving-cars.htm> (last visited Feb. 23, 2017), for a helpful overview of some advantages and disadvantages.

⁵⁴ Jeff Bercovici, *Why Self-Driving Cars Are the New Gun Control*, INC. (Jan. 20, 2016), <http://www.inc.com/jeff-bercovici/self-driving-cars-culture-war.html>

A. General Safety

Eliminating deaths and injuries caused by car accidents is the strongest argument for autonomous vehicles, and the NHTSA heavily relies on safety statistics.⁵⁵ Ninety-four percent of car accidents in the United States are caused by human error.⁵⁶ The NHTSA places emphasis on six particularly dangerous driving risks: drunk driving, distracted driving, drowsy driving, seatbelts, speeding, and drugged driving.⁵⁷ Though drunk driving fatalities have decreased over the past three decades, drunk driving is still one of the highest risks on the road; on average one person every fifty-three minutes dies due to a drunk driver.⁵⁸

Supporters argue that autonomous cars will make our roads safer by eliminating those risks.⁵⁹ The Eno Center for Transportation found that if ninety percent of vehicles on the road were autonomous, the number of accidents would fall from 6 million a year to 1.3 million, eliminating up to two-thirds of driving-related deaths.⁶⁰ Additionally, “Google and other car manufacturers argue that autonomous vehicles will reduce the number of car accident fatalities and injuries resulting from human error because the computer controlling the autonomous vehicle does not get tired, intoxicated, or distracted as does the human driver.”⁶¹

Further, the elimination of many, if not most, car accidents is a real possibility given the technology employed in autonomous vehicles.⁶² “Vehicle-to-vehicle” technology (V2V) allows vehicles to provide information about speed, position, and other driving conditions to other vehicles within a certain proximity on the road.⁶³ This provides a network of information that an individual driver cannot access.⁶⁴ A highly-autonomous vehicle can continuously improve its performance by incorporating incoming data drawn from the experience of thou-

⁵⁵ See generally FED. AUTOMATED VEHICLES POL’Y, *supra* note 4.

⁵⁶ WAYMO, *supra* note 31; FED. AUTOMATED VEHICLES POL’Y, *supra* note 4, at 5.

⁵⁷ *Risky Driving*, NHTSA, <https://www.nhtsa.gov/risky-driving> (last visited Feb. 23, 2017). Approximately 10,220 people die per year from drunk driving; 9,262 from speeding; 3,179 from distracted driving, such as texting and cell phone use; and 856 from drowsy driving. See *id.* One out of every five drivers is drugged, approximately half of which are attributed to marijuana. *Id.* Conversely, 13,941 lives were saved by wearing a seatbelt, but nearly 27.5 million Americans still neglect to use them. *Id.*

⁵⁸ *Drunk Driving*, NHTSA, <https://www.nhtsa.gov/risky-driving/drunk-driving> (last visited Feb. 23, 2017). Drunk driving deaths and damages alone amount to \$52 billion per year. *Id.*

⁵⁹ FED. AUTOMATED VEHICLES POL’Y, *supra* note 4.

⁶⁰ Cadie Thompson, *The 3 biggest ways self-driving cars will improve our lives*, BUS. INSIDER (Jun. 10, 2016, 4:04 PM), <http://www.businessinsider.com/advantages-of-driverless-cars-2016/#roads-will-be-safer-1>.

⁶¹ Jeffrey K. Gurney, *Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles*, 13 U. ILL. J.L. TECH. & POL’Y, 247, 250–51 (2013).

⁶² Will Knight, *Car-to-Car Communication*, MIT TECH. REV. (Mar.–Apr. 2015), <https://www.technologyreview.com/s/534981/car-to-car-communication/>.

⁶³ *Id.*

⁶⁴ *Id.*

sands of other vehicles on the road, “[w]hile a human driver may repeat the same mistakes as millions before them, [a highly-automated vehicle] can benefit from the data and experience drawn from thousands of other vehicles on the road.”⁶⁵

Aside from eliminating human error, autonomous vehicle manufacturers are also focusing on the safety of the vehicle itself.⁶⁶ For instance, Tesla’s Model X has a battery mounted in the floor for center of gravity to reduce the risk of roll-overs, and the absence of a gasoline engine enables the trunk to “act as a giant impact-absorbing crumple zone.”⁶⁷ Other common safety features include stability control, which allows the vehicle to change the speed of individual tires to keep the car on course,⁶⁸ and forward collision avoidance, where different levels of pressure can be applied to the brakes depending on the distance of the danger or obstacle ahead.⁶⁹

B. Products Liability

Can you imagine a world without car accidents? Personal injury lawyers certainly do not want to imagine it. To their security, despite the technological advances of autonomous vehicles, accidents among this type of vehicle continue to occur.⁷⁰ A primary cause of the accidents is the programming that requires the vehicles to obey traffic laws at all times.⁷¹ A traditional driver may commit an infraction such as accelerating or swerving onto the road shoulder in order to avoid an accident, but autonomous vehicles are programmed to obey all traffic laws.⁷² A study conducted by the University of Michigan’s Transportation Research Institute revealed that accident rates are twice as high for autonomous vehicles than traditional ones.⁷³ Luckily, the autonomous vehicles involved in the study had never been at fault—inattentive human drivers always caused the

⁶⁵ FED. AUTOMATED VEHICLES POL’Y, *supra* note 4, at 5.

⁶⁶ *Id.*

⁶⁷ TESLA, *supra* note 41.

⁶⁸ *8 Tech Features that Improve Car Safety*, USAA, <https://www.usaa.com/inet/wc/advice-auto-safety/features??akredirect=true> (last visited Feb. 23, 2017).

⁶⁹ Corinne Iozzio, *4 Driverless Car Features Going Standard*, SCI. AM. (Apr. 1, 2015), <https://www.scientificamerican.com/article/4-driverless-car-features-going-standard/> (discussing advances car manufacturers have made in terms of forward collision avoidance, backup cameras, vehicle-to-vehicle communication, and lane detection).

⁷⁰ Keith Naughton, *Humans Are Slamming Into Driverless Cars and Exposing a Key Flaw*, BLOOMBERG TECH. (Dec. 17, 2015), <https://www.bloomberg.com/news/articles/2015-1218/humans-are-slamming-into-driverless-cars-and-exposing-a-key-flaw>.

⁷¹ *Id.* Aside from fender benders, some autonomous vehicles have caused traffic hazards. *Id.* Sergeant Jaeger became the first officer to pull over an autonomous vehicle. *Id.* The car was traveling at twenty-four miles per hour in a thirty-five mile per hour zone. *Id.* A human driver would have pulled over to the shoulder to allow faster cars to pass; however, the autonomous vehicle was not programmed to do so. *Id.*

⁷² *See id.*

⁷³ *Id.*

fender benders.⁷⁴ As of February 2016, Google reported a total of eighteen accidents involving vehicles from its autonomous fleet.⁷⁵ In May 2016, the first United States fatality in an automated vehicle occurred in a Tesla S⁷⁶ sports car.⁷⁷ Tesla indicated “this was the first known death in over 130 million miles of Autopilot operation.”⁷⁸ But in this situation—when an automated vehicle crashes—who is to blame: the driver or the manufacturer?

Thus far, legal professionals have focused on the impact of autonomous vehicles on products liability.⁷⁹ Products liability is useful to consumers because it “provides the framework for seeking remedies when a defective product (or mis-

⁷⁴ *Id.*

⁷⁵ *Google Self-Driving Car Incidents*, GOOGLE, <https://google-self-driving-car-incidents.silk.com> (last visited Feb. 23, 2017).

⁷⁶ Model S is designed from the ground up to be the safest, most exhilarating sedan on the road. With unparalleled performance delivered through Tesla's unique, all-electric powertrain, Model S accelerates from 0 to 60 mph in as little as 2.5 seconds. Model S comes with Autopilot capabilities designed to make your highway driving not only safer, but stress free.

TESLA, *Model S*, <https://www.tesla.com/models> (last visited Feb. 22, 2017).

⁷⁷ Joan Lowy, *Driver Killed in Self-Driving Car Accident for First Time*, PBS SOCAL (June 30, 2016), <http://www.pbs.org/newshour/rundown/driver-killed-in-self-driving-car-accident-for-first-time/>.

⁷⁸ *Id.* “Recently, Tesla was absolved by the NHTSA for Autopilot’s role in the Florida [fatality]. In fact, the government agency stated that Autopilot reduced accident probability by 40% based on data provided by the company.” Rakesh Sharma, *Tesla Rolls Out Enhanced Autopilot Update*, INVESTOPEDIA (Jan. 25, 2017), http://www.investopedia.com/news/tesla-rolls-out-enhanced-autopilot-update-tsla/?utm_source=personalized&utm_campaign=www.chartadvisor.com&utm_term=8700155&utm_medium=email.

⁷⁹ Jeremy Levy, *No Need to Reinvent the Wheel: Why Existing Liability Law Does Not Need to be Preemptively Altered to Cope with the Debut of the Driverless Car*, 9 J. BUS., ENTREPRENEURSHIP & L. 355 (2016) (analyzing the application of strict liability to autonomous vehicles); Katherine L. Hanna, *Old Laws, New Tricks: Drunk Driving and Autonomous Vehicles*, 55 JURIMETRICS J. 275, 275 (2015) (focusing specifically on laws and accidents regarding driving under the influence); John W. Terwilleger, *Navigating the Road Ahead: Florida’s Autonomous Vehicle Statute and its Effect on Liability*, 89 FLA. B.J. 26, 32–34 (2015) (discussing limited liability for a manufacturer whose vehicle is converted into an autonomous vehicle by a third party and liability of the manufacturer who created the technology); Orly Ravid, *Don’t Sue Me, I Was Just Lawfully Texting & Drunk When My Autonomous Car Crashed into You*, 44 SW. L. REV. 175, 190–200 (2014) (considering different legal theories regarding negligence); Jeffrey K. Gurney, *Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles*, 2013 U. ILL. J.L. TECH & POL’Y 247, 247 (2013) (suggesting that the autonomous technology manufacturer be liable for accidents caused by autonomous vehicles); Kevin Funkhouser, *Paving the Road Ahead: Autonomous Vehicles, Products Liability, and the Need for a New Approach*, 2013 UTAH L. REV. 437, 452–59 (2013) (arguing that current products liability law is not sufficient for defects with autonomous vehicles); Stephen P. Wood, et al., *The Potential Regulatory Challenges of Increasingly Autonomous Motor Vehicles*, 52 SANTA CLARA L. REV. 1423, 1478–92 (2012) (discussing the difficulty of proving defect via numerous performance failures); Kyle Colonna, *Autonomous Cars and Tort Liability*, 4 CASE W. RESERVE J.L. TECH. & INTERNET 81, 118–20 (2012) (proposing a liability framework that includes a two-tiered insurance program mimicking the nuclear industry).

representations about a product) causes harm to persons or property.”⁸⁰ Common causes of action include strict liability, negligence, manufacturing defects, design defects, failure to warn, and misrepresentations.⁸¹ Though there is an overwhelming abundance of case law in this area of law, current products liability law is not equipped to handle lawsuits brought by the “drivers” of autonomous vehicles.⁸² Pillsbury Winthrop Shaw LLP partner Peter Gillon notes, “Drivers are the real risks these days and not the cars. The more you take driver error out of the equation, the more you are looking at an auto insurance market based on safety system performance and product liability.”⁸³

Determining who or what is at fault for an accident requires an extensive analysis of several factors, none of which have been described in legislation or products liability case law.⁸⁴ Liability constantly bounces between accused parties based on varying levels of autonomy, human intervention, and algorithm diagnostics.⁸⁵ For example, if a Level 4 autonomous vehicle is driving on autopilot and warns the driver of an obstacle ahead, but the driver does not take control of the wheel within time to avoid an accident, who is at fault? Should the vehicle have warned the driver earlier? Or should the driver have paid closer attention to the road conditions? These are the questions that need to be answered as autonomous vehicles grow in popularity.

The evolution of products liability law will present a challenge as accidents involving autonomous vehicles increase; however, developing and implementing several factors to determine fault is certainly not enough of a hassle to outweigh the benefit of safer roads and fewer deaths caused by risky drivers.

C. Cost to Consumer

The cost of autonomous vehicles is not entirely clear, primarily because there are different costs associated with different levels of autonomy. For example, a Toyota Prius, which usually begins around \$24,000, can be enhanced “with a \$75,000 to \$80,000 Velodyne LIDAR⁸⁶ system, visual and radar sensors estimated to cost about \$10,000, and a nearly \$200,000 GPS array. Not to mention the cost of the driving computer and software . . . The staid-looking Toyota

⁸⁰ John Villasenor, *Products Liability and Driverless Cars: Issues and Guiding Principles for Legislation*, BROOKINGS (Apr. 24, 2014), <https://www.brookings.edu/research/products-liability-and-driverless-cars-issues-and-guiding-principles-for-legislation/>.

⁸¹ *Id.*

⁸² See Gurney, *supra* note 61.

⁸³ Jeff Sistrunk, *Driverless Cars Will Fuel Surge in Product Liability Coverage*, LAW 360 (Aug. 5, 2016), <https://www.law360.com/articles/824460/driverless-cars-will-fuel-surge-in-product-liability-coverage>.

⁸⁴ See Villasenor, *supra* note 80.

⁸⁵ *Id.*

⁸⁶ See *infra* Section II.F.

Prius . . . costs more than a Ferrari 599.”⁸⁷ Alternatively, Honda is offering a semi-autonomous Civic for around \$20,000.⁸⁸ Its features include: “advanced driver assistance systems (ADAS) that control the steering, lane changing, [and] acceleration and braking while the car is cruising on the highway.”⁸⁹ These features are similar to Tesla’s autopilot vehicles, such as the Model X, but those Tesla vehicles typically cost a minimum of \$75,000, with enhanced Autopilot and full self-driving capability requiring an additional \$10,000 upgrade after delivery.⁹⁰

The good news is that the cost will decrease as more people buy autonomous vehicles.⁹¹ The projected market share for electric cars⁹² will reach a total of 35% of vehicle sales by 2040.⁹³ Further, by 2035, the technology required to make a vehicle completely self-driving is estimated to increase the cost of purchasing a vehicle by only \$3,000.⁹⁴ Another component to consider in terms of cost is the amount of time that will be saved by freeing Americans from numbing driving, and allowing a more productive use of time during a commute or road trip.⁹⁵ Americans spend an estimated 46.9 billion hours in the car annually, or 157 hours per person.⁹⁶ This amounts to massive consumer cost savings in

⁸⁷ Chuck Tannert, *Will You Ever Be Able To Afford A Self-Driving Car?*, FAST COMPANY (Jan. 31, 2014), <https://www.fastcompany.com/3025722/will-you-ever-be-able-to-afford-a-self-driving-car>.

⁸⁸ Chris Neiger, *How Much Do Driverless Cars Cost?*, THE MOTLEY FOOL (Aug. 4, 2016), <http://www.fool.com/investing/2016/08/04/how-much-do-driverless-cars-cost.aspx>.

⁸⁹ *Id.*

⁹⁰ TESLA, *Model X Design*, <https://www.tesla.com/modelx/design> (last visited Feb. 23, 2017). Tesla’s website offers an a la carte for designing a new car. *Id.* The Model X pricing includes an active spoiler, Tesla red brake calipers, five-seat interior, and smart air suspension. *Id.* Consumers can include a variety of add-ons such as a six or seven seat interior (\$3,000 and \$4,000, respectively), enhanced autopilot (\$5,000), full self-driving capability (\$3,000), a premium upgrades package that includes LED lights and carbon air purification filters (\$4,500), a subzero weather package that includes heated seats throughout and a heated steering wheel (\$1,000), ultra high fidelity sound (\$2,500), towing package (\$750), and high amperage charger upgrade (1,500). *Id.* There is an approximate \$76,000 difference between the standard Model X (\$88,800) and fully upgraded (\$165,050), but choice of color can change those figures as well. *See id.*

⁹¹ *See* Tannert, *supra* note 87.

⁹² Not all electric vehicles are autonomous; however, most are and this statistic shows that the electric car market share is on the rise.

⁹³ Tom Randall, *Here’s How Electric Cars Will Cause the Next Oil Crisis*, BLOOMBERG (Feb. 25, 2016), <http://www.bloomberg.com/features/2016-ev-oil-crisis/>.

⁹⁴ Neiger, *supra* note 88.

⁹⁵ Adam Ozimek, *The Massive Economic Benefits Of Self-Driving Cars*, FORBES (Nov. 8, 2014), <http://www.forbes.com/sites/modeledbehavior/2014/11/08/the-massive-economic-benefits-of-self-driving-cars/#1f1b4bf668d9>.

⁹⁶ Ozimek, *supra* note 95. This is calculated using an average travel speed of 60 miles per hour. *Id.* The Department of Transportation (DOT) uses time savings of \$12.98 for cost benefit analysis, but that is assuming an individual is actually productive the entire time, i.e., working, rather than napping or reading. *See id.*

regard to time.⁹⁷ For example, placing a conservative time savings of \$5 an hour on that figure quickly swells to \$500 billion a year in savings.⁹⁸

D. Police Administration

Similar to many social aspects of autonomous vehicles, there have been competing positions on the use in conducting police activity. Police view the use of autonomous vehicles as an opportunity to focus more on fighting crime, with the ability for the officer to read and write police reports while the vehicle navigates to specific locations.⁹⁹ Consequently, it seems that police would become more efficient and involved in the community, but not all believe this is true.

Some believe that the implementation of autonomous vehicles will generally lead to the end of traffic citations, to a decrease in the time spent recording accidents, and to an overall release of administrative work that takes hours away from actual policing.¹⁰⁰ Currently, traffic stops and traffic accidents “account for nearly 50 percent of all police-public encounters.”¹⁰¹ So the question posed is: will the implementation of autonomous vehicles mean less police officers employed or more time spent allocated to other areas of policing? Further, Americans rack up nearly 41 million speeding tickets a year, which amounts to more than \$6.2 billion in fines.¹⁰² The exact financial impact this will have on cities and counties is unknown, but it is certain that resources will need to be reallocated if speeding tickets do disappear.¹⁰³

Naturally, as a result of fewer traffic infractions, less pretextual stops will take place. Currently, pretextual stops allow an officer to investigate suspected criminal activity after initially stopping the driver for a traffic infraction.¹⁰⁴ Police state they are the “major means of catching people when [they] don’t know who [they’re looking] for.”¹⁰⁵ The elimination of pretextual stops excludes officers from engaging in their primary interactions with the public, and may lead to

⁹⁷ *Id.*

⁹⁸ *Id.* For this calculation a conservative speed of 30 miles per hour average speed is used. *Id.*

⁹⁹ See Dan Fink, *Autonomous Cars: Driving on Auto Pilot*, POLICE: THE L. ENF’T MAG. (June 22, 2014), <http://www.policemag.com/channel/vehicles/articles/2014/06/autonomous-cars-driving-on-auto-pilot.aspx>.

¹⁰⁰ Robin Washington, *Driverless Cars Are Coming. What Does That Mean for Policing?*, THE MARSHALL PROJECT (Sept. 29, 2016, 6:00 AM), <https://www.themarshallproject.org/2016/09/29/driverless-cars-are-coming-what-does-that-mean-for-policing#.RJctwpHJH>.

¹⁰¹ *Id.*

¹⁰² Kevin Davis, *Preparing for a Future with Autonomous Vehicles*, POLICE CHIEF MAG. (July 2016), <http://www.policechiefmagazine.org/preparing-for-a-future-with-autonomous-vehicles/>.

¹⁰³ *See id.*

¹⁰⁴ Kathleen M. O’Day, *Pretextual Traffic Stops Injustice for Minority Drivers*, U. OF DAYTON SCH. OF L. (1998), <http://academic.udayton.edu/race/03justice/s98oday.htm>.

¹⁰⁵ Robin Washington, *Autonomous Vehicles Will Mean the End of Traffic Stops*, WIRED (Sept. 30, 2016, 6:00 AM), <https://www.wired.com/2016/09/autonomous-vehicles-will-mean-end-traffic-stops/>.

fewer arrests or more criminals on the streets (depending on your perspective).¹⁰⁶

Lastly, there is concern that autonomous vehicles will be used to commit terrorist attacks.¹⁰⁷

Picture hackers employed by a hostile nation finding a way to command large numbers of cars on U.S. roads . . . [O]r ordering the vehicles to suddenly accelerate and turn hard to the right, flipping them over, killing many passengers and clogging freeways with junked cars . . . Or envision a lone-wolf terrorist loading explosives into a car and programming it to drive to a targeted building or public space.¹⁰⁸

These are among the concerns citizens fear regarding autonomous vehicles and terrorism, especially after a commercial truck was used in a terrorist attack against Nice, France.¹⁰⁹ “Take the suicide bomber out of the mix and now you can have that very same threat delivered to your doorstep autonomously.”¹¹⁰ Preventative measures, such as sensors inside the vehicles that can detect hazardous material, have been suggested,¹¹¹ but the extent to which these are employed may depend on future offenses.

*E. The Fourth Amendment*¹¹²

Some have argued that the police use of autonomous vehicles will pose Fourth Amendment issues regarding the technology used inside of the vehicles such as recorders, cameras, and GPS cameras.¹¹³ One of the burning questions is whether police need a warrant to access data from autonomous vehicles.¹¹⁴ The

¹⁰⁶ *See id.*

¹⁰⁷ *See id.* The topic of terrorists hacking autonomous vehicles also falls under cybersecurity. *See infra* Section II.G.

¹⁰⁸ David R. Baker, *How self-driving cars could become weapons of terror*, S.F. CHRON. (Oct. 10, 2016, 6:51 AM), <http://www.sfchronicle.com/business/article/How-self-driving-cars-could-become-weapons-of-9958541.php>.

¹⁰⁹ *See id.*; Daniel Bukszpan, *Could autonomous trucks be the next weapon for terrorists?*, CNBC (July 21, 2016), <http://www.cnbc.com/2016/07/21/could-autonomous-trucks-be-the-next-weapon-for-terrorists.html>.

¹¹⁰ Washington, *supra* note 105.

¹¹¹ Baker, *supra* note 108.

¹¹² The Fourth Amendment provides that “[t]he right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.” U.S. CONST. amend. IV.

¹¹³ Geoffrey Wills, *To Protect and Serve, but Not Drive: Police Use of Autonomous Vehicles*, 31 SYRACUSE J. SCI. & TECH. L. REP. 158, 164 (2015).

¹¹⁴ John Frank Weaver, *The Fourth Amendment and Driverless Cars*, SLATE (July 27, 2015), http://www.slate.com/articles/technology/future_tense/2015/07/fourth_amendment_and_autonomous

answer will likely be influenced by the Massachusetts Supreme Judicial Court in its pending decision in *Commonwealth v. Dorelas*, which considers the Fourth Amendment requirements in terms of searching cell phones.¹¹⁵

There are two major schools of thought about warrants for searching cellphones. The first considers a smartphone a “container” and holds that a warrant essentially needs only to describe the phone and the probable cause. The second recognizes that smartphones are computers with tens of thousands of files; to satisfy the Fourth Amendment, which prohibits unreasonable search and seizure, a warrant must describe the phone and files sought, as well as explain the probable cause.¹¹⁶

Additionally, some believe that the use of autonomous vehicles will help prevent discrimination by police officers by decreasing the amount of officer subjectivity,¹¹⁷ and will establish a level of objectivity that legislation has never been able to accomplish.¹¹⁸ Law enforcement’s use of autonomous vehicles “could eliminate prejudicial stops based on race or religion, and could be a significant building block in restoring public trust in police departments and government that has faded tremendously.”¹¹⁹ This is particularly relevant for pretextual stops, especially in minority communities.¹²⁰

For example, in 1993, two officers dressed in regular clothing stopped two African-Americans in Washington D.C.; the stop involved circumstances that supported alleged discrimination.¹²¹ The police stopped the vehicle because it was in a high-drug area, the driver failed to use a turn signal, and the car was traveling at an unreasonable speed.¹²² During the stop, the officers discovered drugs.¹²³ Defendants argued that the police did not have reasonable suspicion or probable cause to stop the vehicle; however, the court found that the stop and

_vehicles_should_cops_need_a_warrant_for.html.

¹¹⁵ *Id.*

¹¹⁶ *Id.*

¹¹⁷ See Wills, *supra* note 113, at 173–78.

¹¹⁸ See *id.* at 173.

¹¹⁹ *Id.*

¹²⁰ *Id.* at 175.

¹²¹ *Whren v. United States*, 517 U.S. 806 (1996); Wills, *supra* note 113, at 173–74. The officers’ “suspicions were aroused when they passed a dark Pathfinder truck with temporary license plates and youthful [African-American] occupants waiting at a stop sign, the driver looking down into the lap of the passenger at his right. The truck remained stopped at the intersection for what seemed an unusually long time—more than 20 seconds.” *Whren*, 517 U.S. at 808. Additionally, “[w]hen the [unmarked] police car executed a U-turn in order to head back toward the truck, the Pathfinder turned suddenly to its right, without signaling, and sped off at an ‘unreasonable’ speed.” *Id.*

¹²² *Whren*, 517 U.S. at 806; Wills, *supra* note 113, at 173.

¹²³ *Whren*, 517 U.S. at 806; Wills, *supra* note 113, at 173–74.

search were reasonable, regardless of the officers' lack of uniform and unmarked vehicle.¹²⁴ "The court reasoned that as long as legal justification existed, the officer's subjective intent was irrelevant."¹²⁵ Society's use of autonomous vehicles will eliminate pretextual stops due to their law-abiding programming, which will, in turn, eliminate any plausible connection between police officers and the Fourth Amendment violations in terms of vehicle stops.¹²⁶

F. Product Development

Most vehicles on the road are Level 1, meaning the car can do a single "automated" task, such as cruise control.¹²⁷ With car manufacturers teasing us with automated vehicle features of the future, simple cruise control is hardly what we would consider automated. Level 2 is where the vehicle actually starts to assist the driver.¹²⁸ Tesla's autopilot, in its current capacity, is Level 2—it can adjust speed and correct lanes, but any obstacle would require driver intervention to avoid.¹²⁹ Level 3 autonomy takes that a step further by making decisions to change lanes or pass another vehicle.¹³⁰ Level 4 can handle any situation without driver interference, as long as the vehicle is geographically programmed in a contained area such as a college campus.¹³¹ The ultimate goal of a Level 5 autonomous vehicle is no driver intervention required—that means no steering wheel, no pedals, and full capacity to navigate the roads to any requested destination.¹³² Since the autonomous vehicle technology is advancing so quickly, it is likely that a Level 3 vehicle will never be available on the market—Google and Tesla are aiming directly for a Level 5.¹³³

The Google car uses Light Detection and Ranging technology (LIDAR), which is "a technology where 64 lasers spin at about 900 rpm to give a 360 degree view to the driver."¹³⁴ Cameras detect traffic signals and recognize moving objects, such as pedestrians.¹³⁵ Radar sensors are placed around the vehicle to measure the distance between the car and other objects.¹³⁶ The main computer

¹²⁴ Whren, 517 U.S. at 806; Wills, *supra* note 113, at 174.

¹²⁵ Wills, *supra* note 113, at 174; *see also* Whren, 517 U.S. at 806–07. This is a seminal case regarding pretextual stops. *See* discussion *supra* Section III.D.

¹²⁶ Wills, *supra* note 113, at 177.

¹²⁷ Alex Davies, *Everyone Wants a Level 5 Self-Driving Car—Here's What That Means*, WIRED (Aug. 26, 2016), <https://www.wired.com/2016/08/self-driving-car-levels-sae-nhtsa/>.

¹²⁸ *Id.*

¹²⁹ *Id.*

¹³⁰ *Id.*

¹³¹ *Id.*

¹³² *Id.*

¹³³ *See id.*

¹³⁴ WEEBLY, *Google's Autonomous Vehicle*, <http://googlesautonomousvehicle.weebly.com/technology-and-costs.html> (last visited Feb. 23, 2017).

¹³⁵ Guilbert Gates et al., *When Cars Drive Themselves*, N.Y. TIMES (last updated June 6, 2017), https://www.nytimes.com/interactive/2016/12/14/technology/how-self-driving-cars-work.html?_r=0.

¹³⁶ *Id.*

located near the trunk analyzes the data captured and compares it to the computer's maps.¹³⁷ Tesla, on the other hand, does not use LIDAR technology.¹³⁸ It uses a computer, vision-based system,¹³⁹ which includes cameras for 360-degree visibility, ultrasonic sensors to detect objects, and radar that provides information regarding weather conditions.¹⁴⁰

Google and Tesla disagree about the use of LIDAR in autonomous vehicles.¹⁴¹ There are four different sensor technologies¹⁴² that can be employed, but LIDAR is the only one that measures distance using a laser light.¹⁴³ LIDAR has to be mounted on the top of the vehicle, making it difficult to detect objects near the car. Additionally, it works well in a variety of light weather conditions, but does not work as well in snow, fog, or rain.¹⁴⁴ In comparison, Tesla uses ultrasonic sensors as its primary sensor technology.¹⁴⁵ Ultrasonic sensors “emit[] ultrasonic sound waves and detect[] their return to determine distance.”¹⁴⁶ The range is not as expansive, but it can easily detect objects close to the vehicle.¹⁴⁷ Ultrasonic sensors also work well in a variety of light and weather conditions.¹⁴⁸

Autonomous vehicles will also eventually be equipped “with sensor technologies such as vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) capabilities to improve system performance,”¹⁴⁹ which allow vehicles to “broadcast their position, speed, steering-wheel position, brake status, and other data to other vehicles within a few hundred meters.”¹⁵⁰ This technology allows the vehicle to combine its data with that of the other vehicles in close proximity to adjust

¹³⁷ *Id.*

¹³⁸ Davies, *supra* note 127.

¹³⁹ *Id.*

¹⁴⁰ TESLA, *Full Self-Driving Hardware on All Cars*, <https://www.tesla.com/autopilot> (last visited Feb. 23, 2017).

¹⁴¹ Michael Barnard, *Tesla & Google Disagree About LIDAR — Which Is Right?*, CLEANTECHNICA (July 29, 2016), <https://cleantechnica.com/2016/07/29/tesla-google-disagree-lidar-right/>.

¹⁴² In addition to LIDAR and ultrasonic, which are briefly discussed *infra*, radar and passive visual are also utilized. Barnard, *supra* note 141. Radar is “an object-detection system that uses radio waves to determine the range, angle, or velocity of objects.” Barnard, *supra* note 141. Passive visual is “the use of passive cameras and sophisticated object detection algorithms to understand what is visible from the cameras.” Barnard, *supra* note 141. Google and Tesla both utilize ultrasonic, radar, and passive visual; however, only Google relies on LIDAR. Barnard, *supra* note 141. Tesla CEO, Elon Musk, firmly holds the stance that the same results can be achieved without using LIDAR, which tends to be expensive. Steve Hanley, *Elon Musk won't be using LIDAR in upcoming Tesla Autopilot update*, TESLARATI (July 15, 2016), <http://www.teslarati.com/elon-musk-wont-using-lidar-upcoming-tesla-autopilot-update/>.

¹⁴³ Barnard, *supra* note 141.

¹⁴⁴ *Id.*

¹⁴⁵ *Id.*

¹⁴⁶ *Id.*

¹⁴⁷ *Id.*

¹⁴⁸ *Id.*

¹⁴⁹ FED. AUTOMATED VEHICLES POL'Y, *supra* note 4, at 5.

¹⁵⁰ Knight, *supra* note 53.

to the route, therefore, correcting bad habits that drivers would likely repeat.¹⁵¹ This is a level of intricacy that human drivers are not able to obtain even with a GPS device. Ultimately, with a Level 5 autonomous vehicle:

All you will need to do is get in and tell your car where to go. If you don't say anything, the car will look at your calendar and take you there as the assumed destination or just home if nothing is on the calendar. [It] will figure out the optimal route, navigate urban streets (even without lane markings), manage complex intersections with traffic lights, stop signs and roundabouts, and handle densely packed freeways with cars moving at high speed. When you arrive at your destination, simply step out at the entrance and your car will enter park seek mode, automatically search for a spot and park itself. A tap on your phone summons it back to you.¹⁵²

G. Cybersecurity

Cybersecurity in terms of autonomous vehicles relates to “the hacking of autonomous vehicle operational systems.”¹⁵³ Security executives have opined “self-driving cars will prove an irresistible target for hackers.”¹⁵⁴ This can manifest in a variety of offenses. For instance, security executives are concerned about ransomware¹⁵⁵ being used against the drivers of autonomous vehicles.¹⁵⁶ Worse scenarios exist such as a hacker rerouting a vehicle to a particular location in furtherance of crime, or a terrorist manipulating a vehicle to drive a bomb into a populated area.¹⁵⁷ “Anytime you have wireless technology . . . there’s an

¹⁵¹ FED. AUTOMATED VEHICLES POL’Y, *supra* note 4, at 5.

¹⁵² TESLA, *supra* note 140.

¹⁵³ Davis, *supra* note 102.

¹⁵⁴ Alex Hern, *Self-driving cars irresistible to hackers, warns security executive*, THE GUARDIAN (Jan. 28, 2016), <https://www.theguardian.com/technology/2014/jan/28/self-driving-cars-irresistible-hackers-security-executive>.

¹⁵⁵ Ransomware (or “jackware” to refer to its use with vehicles) is software that hackers employ to break a device and then demand a fee to fix it. Peter Suci, *Ransomware: The Next Big Automotive Cybersecurity Threat?*, CAR AND DRIVER (Oct. 26, 2017), <http://blog.caranddriver.com/ransomware-the-next-big-automotive-cybersecurity-threat/>. Ransomware disguises itself as a helpful warning or upgrade. *Id.* When the user clicks the warning, a virus infiltrates the operating system. *See id.* “In vehicles, this could appear to be anything from warnings about vehicles warranties and services to notifications that a satellite-radio subscription will soon expire to threats of traffic violations. *Id.* An unsuspecting motorist could react quickly to such warning, and suddenly find the car locked or worse.” *Id.* The hacker would be able to lock the car or disable the ignition, for example. *Id.*

¹⁵⁶ *Id.*

¹⁵⁷ See Daniel Bukszpán, *Could autonomous trucks be the next weapon for terrorists?*, CNBC (July 21, 2016), <http://www.cnbc.com/2016/07/21/could-autonomous-trucks-be-the-next-weapon-for-terrorists.html>.

opportunity for a bad actor to hack into [the] system. . . . In theory it would be possible for someone to take over a 70,000 – or 80,000-pound vehicle. . . . If it was a fuel tanker, they could drive into anything and cause a big explosion.”¹⁵⁸ In order to prevent such circumstances from occurring, law enforcement has started to work with “manufacturers and lawmakers to ensure law enforcement’s needs and concerns are considered in the development of these vehicles and the related regulations.”¹⁵⁹

A study conducted by the University of Michigan¹⁶⁰ suggests that cybersecurity is one of the primary concerns consumers have regarding the autonomous vehicles.¹⁶¹ In addition to fear of losing control of the vehicle due to hacking, citizens are concerned that access to driving patterns and location will create an invasion of privacy.¹⁶²

Before losing faith in the security of autonomous vehicles, however, it is important to recognize that many of these threats are present today with Level 2 vehicles, and thus far, malicious attacks have not rampant. In 2015, two security researchers were able to remotely hack into a Jeep Cherokee’s digital system and disable it while driving on the highway.¹⁶³ Just a year later, “hackers were arrested for stealing more than 100 cars in Texas by using a computer to unlock and start the vehicles.”¹⁶⁴ Additionally, hackers can access smart phones or GPS systems to gather sensitive information and location.¹⁶⁵ This is especially concerning considering advanced communications systems in autonomous vehicles plan to interconnect the vehicle to almost everything, including mobile devices.¹⁶⁶

¹⁵⁸ *Id.*; see also Section III.D (discussing terrorism and the commercial truck used in the Nice, France terrorist attack).

¹⁵⁹ Davis, *supra* note 102.

¹⁶⁰ The University of Michigan is home to Mcity—a 32-acre site with more than 16 acres of road and infrastructure for the purpose of testing autonomous vehicles. U. OF MICH., *Mobility Transformation Center*, <http://www.mtc.umich.edu/test-facility> (last visited Feb. 23, 2017). Mcity includes “five land-miles of road with intersections, traffic signs and signals, sidewalks, benches, simulated buildings, street lights, and obstacles such as construction barriers.” *Id.*

¹⁶¹ Tiffany Hsu, *Cybersecurity Concerns about Autonomous Vehicles Spark Consumer Anxiety*, TRUCKS.COM (Feb. 8, 2017), <https://www.trucks.com/2017/02/08/cybersecurity-autonomous-vehicle-s-concerns/>.

¹⁶² *Id.*

¹⁶³ Andy Greenberg, *The Jeep Hackers Are Back to Prove Car Hacking Can Get Much Worse*, WIRED (Aug. 1, 2016), <https://www.wired.com/2016/08/jeep-hackers-return-high-speed-steering-acceleration-hacks/>.

¹⁶⁴ Clarence Hempfield, *Why a cybersecurity solution for driverless cars may be found under the hood*, TECH CRUNCH (Feb. 18, 2017), <https://techcrunch.com/2017/02/18/why-a-cybersecurity-solution-for-driverless-cars-may-be-found-under-the-hood/>.

¹⁶⁵ See Greenberg, *supra* note 163; Jennifer Schlesinger, *Your Smartphone Could be Hacked Without Your Knowledge* (June 17, 2016), <http://www.cnbc.com/2016/06/17/your-smartphone-could-be-hacked-without-your-knowledge.html>.

¹⁶⁶ Dorothy J. Glancy, *Privacy in Autonomous Vehicles*, 52 SANTA CLARA L. REV. 1171, 1178 (Dec. 14, 2012).

Aside from vehicle-to-vehicle interconnectivity, an interconnected autonomous vehicle could also communicate vehicle status data in real time to road-

Basically, everything is hackable.¹⁶⁷ At this point, “[d]ozens of researchers have now shown that it’s possible to hack in to [sic] a car and commandeer its controls. But in the real world, such dire automotive cyberattacks have yet to materialize.”¹⁶⁸

Unsurprisingly, DARPA¹⁶⁹ is paving the road in terms of finding and resolving vulnerabilities in cybersecurity. In 2016, DARPA held “[t]he World’s First All-Machine Hacking Tournament” where teams “identified software flaws, and scanned a purpose-built, air-gapped network to identify affected hosts. For nearly twelve hours teams were scored based on how capably their systems protected hosts, scanned the network for vulnerabilities and maintained the correct function of software.”¹⁷⁰ The goal of this challenge was to encourage making “software safety the expert domain of machines.”¹⁷¹ Though cybersecurity concern of autonomous vehicles was not solved overnight, this challenge was a promising catalyst to get researchers and companies motivated, especially since this was the same strategy used to jumpstart autonomous technology and research in the United States.¹⁷²

Other strategies are being utilized to ensure the security of autonomous vehicles as well. Automakers are employing “white hat” hackers to find vulnerabilities in autonomous vehicle technology.¹⁷³ The U.S. Department of Justice has created a threat analysis team to study connected technology, including self-driving cars, and its relationship to national security.¹⁷⁴ Additionally, the NHTSA

side infrastructure for use by traffic management centers, toll collection agencies, or law enforcement through vehicle-to-infrastructure (V2I) communications or to mobile devices (V2D). Sometimes the array of potential recipients to vehicle data is simply described as vehicle to “whatever” (V2X).

Id.

The potential outcome of hacking into these systems is clear, but there are other dangers as well. *Id.* Autonomous vehicles will have “continuous data regarding vehicle location, as well as information about where the user wanted to go, did go, and what the user could have seen along the way. . . . This personal information [contained within the vehicle] would be vulnerable to hacking, burglary, and potential access by investigators, both private and governmental.

Id. at 1179–80. “[M]easures such as encryption, personal data minimization, and frequent data destruction would be crucial to protect personal information in [autonomous vehicles].” *Id.* at 1180.

¹⁶⁷ Schlesinger, *supra* note 165.

¹⁶⁸ Suci, *supra* note 155.

¹⁶⁹ See *supra* Part II.A.

¹⁷⁰ DARPA, <http://archive.darpa.mil/cybergrandchallenge/about.html> (last visited Mar. 31, 2017).

¹⁷¹ *Id.*

¹⁷² DARPA, *supra* note 19 and accompanying text.

¹⁷³ Joseph Szczensny, *Connected, self-drive cars pose serious new security challenges*, PHYS. ORG. (July 23, 2016), <https://phys.org/news/2016-07-self-drive-cars-pose.html>.

¹⁷⁴ Dustin Volz, *Justice Department group studying national security threats of self-driving vehicles*, AUTOMOTIVE NEWS (Sept. 9, 2016), <http://www.autonews.com/article/20160909/OEM11/160909819/justice-department-group-studying-national-security-threats-of-self>.

released a report including best practices for the cybersecurity of vehicles, which suggests a layered protective approach and five principal functions: Identify, Protect, Detect, Respond, and Recover.¹⁷⁵ The Society of Automotive Engineers (SAE) also released a guidebook of standards for the cybersecurity of vehicles.¹⁷⁶ The guidebook provides basic information, techniques for threat analysis, and best practices for the entire lifecycle of the vehicle.¹⁷⁷

H. Impact on Employment

Autonomous vehicles will both displace and create jobs; however, there is much debate about whether these numbers will balance out. The primary focus has been on the loss of jobs for professional drivers, such as truck drivers and Uber, Lyft, and taxi drivers, when the managing companies are able to employ autonomous vehicles that do not require a salary.¹⁷⁸ “According to the 2014 Census data, there are more than 4.4 million Americans aged 16 and over working as drivers”¹⁷⁹ There were approximately 1.6 million truck drivers in 2014 and “[w]hen you include delivery truck operators, which numbered around 800,000 in 2014, we end up with 2.4 million [truck drivers] who may be out of a job”¹⁸⁰ That amounts to a loss of approximately \$67 billion dollars in income,¹⁸¹ and that figure only relates to the trucking industry.

But from the employers’ standpoint, autonomous vehicles in the trucking industry are game changers. “[L]abor accounts for approximately 75% of the cost to move a full truckload from L.A. to New York,”¹⁸² and there are no shortcuts. Federal regulations impose a limit on the number of hours truck drivers can work per day, and it has become increasingly difficult for trucking companies to attract employees.¹⁸³ In April 2016, several European countries tested a

¹⁷⁵ NHTSA, *Cybersecurity Best Practices for Modern Vehicles*, https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812333_cybersecurityformodernvehicles.pdf (last visited Mar. 31, 2017).

¹⁷⁶ SAE, *Cybersecurity Guidebook for Cyber-Physical Vehicle Systems*, <http://standards.sae.org/wip/j3061/> (last visited Mar. 31, 2017).

¹⁷⁷ *Id.*

¹⁷⁸ See Joel Lee, *Self Driving Cars Endanger Millions of American Jobs (And That’s Okay)*, MOU (June 19, 2015), <http://www.makeuseof.com/tag/self-driving-cars-endanger-millions-american-jobs-thats-okay/>.

¹⁷⁹ Mark Fahey, *Driverless cars will kill the most jobs in select US states*, CNBC (Sept. 2, 2016), <http://www.cnbc.com/2016/09/02/driverless-cars-will-kill-the-most-jobs-in-select-us-states.html>.

¹⁸⁰ Lee, *supra* note 178.

¹⁸¹ *Id.*

¹⁸² *Automated Technology: Driving Change in Real Estate*, CBRE GLOB. INDUS. & LOGISTICS 6 (Aug. 29, 2016), <http://folkestone.com.au/wp-content/uploads/2016/10/Automation-and-Real-Estate-CBRE-September-2016.pdf>.

¹⁸³ *Id.*

convoy of autonomous trucks using Wi-Fi, and as a result, a survey predicted the truck platoons will be in operation within the next nine years.¹⁸⁴

Drivers for Uber¹⁸⁵ and Lyft¹⁸⁶ are also at risk. Lyft has taken a bold stance by predicting that most Lyft rides will be autonomous within five years.¹⁸⁷ Meanwhile, in September 2016, Uber launched Self-Driving Ubers in Pittsburgh—with a safety driver present.¹⁸⁸ In an attempt to counterbalance the announcement, Uber explained that “[t]echnology also creates new work opportunities while disrupting existing ones. Many predicted that the ATM would spell doom for bank tellers. In fact, ATMs cut the cost of running a local bank so more branches opened, employing more people.”¹⁸⁹

Though Uber and Lyft are the most visible employers of professional drivers, there are many other companies whose transition to autonomous vehicles would leave thousands jobless.¹⁹⁰ For example, there are approximately 500,000 school bus drivers, 180,000 taxi drivers, and 160,000 transit bus drivers in the country.¹⁹¹ Further, and on the peripheral, meter maids, parking lot attendants, gas station attendants, and rental car agencies would be affected.¹⁹²

¹⁸⁴ *Id.* at 7.

¹⁸⁵ Uber has created thousands of jobs since its inception in 2009. Matt McFarland, *Is Uber's push for self-driving cars a job killer?*, CNNTECH (Aug. 19, 2016), <http://money.cnn.com/2016/08/19/technology/uber-self-driving-cars-jobs/index.html>. “[It] has 600,000 drivers in the United States and 1.5 million around the world.” *Id.* The valuation of Uber is convoluted at best. Estimates range anywhere from \$28 billion to \$68 billion. See Julie Verhage, *An Expert in Valuation Says Uber Is Only Worth \$28 Billion, Not \$62.5 Billion*, BLOOMBERG TECH. (Aug. 17, 2016), <https://www.bloomberg.com/news/articles/2016-08-17/an-expert-in-valuation-says-uber-may-have-already-peaked>; David Spiegel, *Uber's books still top secret, but its biggest weakness isn't*, CNBC (June 8, 2016), <http://www.cnbc.com/2016/06/08/ubers-66-billion-valuation-may-ride-on-shaky-foundation.html>; Paul R. La Monica, *Is Uber really worth more than Ford and GM?*, CNN MONEY (Oct. 27, 2015), <http://money.cnn.com/2015/10/27/investing/uber-ford-gm-70-billion-valuation/>. Estimates on the lower end of the spectrum considered factors such as the potential reduction in revenue in the future, increases in operating expenses (i.e. Seattle's decision to let Uber drivers unionize), and competitors such as Tesla, Apple, and Google. Verhage, *supra*.

¹⁸⁶ “It is unclear how many drivers Lyft currently has across the country. The company operates in more than 200 U.S. markets and has raised about \$1.4 billion to date from investors It is valued in the private market at \$5.5 billion.” Reuters, *Lyft Drivers, If Employees, Owed Millions More*, FORTUNE (Mar. 20, 2016), <http://fortune.com/2016/03/20/lyft-drivers-owed-millions/>.

¹⁸⁷ Tom Krisher, *Exec: Most Lyft Rides Will Be in Autonomous Cars in 5 Years*, BLOOMBERG TECH. (Sept. 18, 2016), <https://www.bloomberg.com/news/articles/2016-09-18/exec-most-lyft-rides-will-be-in-autonomous-cars-in-5-years>. Others believe this timeframe is too ambitious since the technology probably will not be perfected for another decade. *Id.*

¹⁸⁸ *Pittsburgh, your Self-Driving Uber is arriving now*, UBER NEWSROOM (Sept. 14, 2016), <https://newsroom.uber.com/pittsburgh-self-driving-uber/>.

¹⁸⁹ *Id.* Uber includes that the self-driving vehicles will be running 24 hours a day, and will, therefore, require more *human* automotive maintenance. *Id.*

¹⁹⁰ See Lee, *supra* note 178.

¹⁹¹ *Id.*

¹⁹² *Id.*

Additionally, there are secondary industries that would have to adapt.¹⁹³ “Ancillary industries such as the \$198 billion automobile insurance market, \$98 billion automotive finance market, \$100 billion parking industry, and the \$300 billion automotive aftermarket will collapse as demand for their services evaporates.”¹⁹⁴ For instance, “[l]ower accident rates would lead to less frequent visits to auto body repair shops, and that would leave a good portion of the 445,000 auto body repairers without a job.”¹⁹⁵

Opposing parties do not view the loss of jobs as an employment crisis.¹⁹⁶ Millions of jobs will not just disappear overnight.¹⁹⁷ Not everyone will have an autonomous vehicle, and even the vehicles that are purchased still need employees in a factory to create and assemble them.¹⁹⁸ Indeed, autonomous vehicles are coming quickly, but the transition will gradually take place over the next fifteen years.¹⁹⁹ Whole billion dollar industries such as automobile insurance will not completely disappear, but they will adapt.²⁰⁰ “One UK insurer recently became possibly the first in the world to publish terms and conditions for its driverless car policy, providing cover for some completely new types of incident, in cases of software hacking, satellite failure or software malfunction, related to self-parking and autopilot systems initially.”²⁰¹

Additionally, the increase in autonomous vehicles will require comparable “growth in IT infrastructure and data centers.”²⁰² “[T]here will be a need for real-time traffic data,” and the development of sensors, software, and anything else that collects data.²⁰³ “Development, maintenance and improvements to telematics and other programming for software running the vehicles, plus infrastructure required to run autonomous public [transit]” will also require massive teams of employees.²⁰⁴ Resultantly, many jobs may phase out due to the implementation of autonomous vehicles over the following decades; but opportunity in other areas will create jobs as well.²⁰⁵

¹⁹³ *Id.*

¹⁹⁴ Michael Ballaban, *Saying That Autonomous Cars Will Kill Millions Of Jobs By 2025 Is Crap*, JALOPNIK (May 13, 2015), <http://jalopnik.com/saying-that-autonomous-cars-will-kill-millions-of-jobs-1704200122>.

¹⁹⁵ Lee, *supra* note 178.

¹⁹⁶ See Ballaban, *supra* note 194.

¹⁹⁷ *Id.*

¹⁹⁸ *Id.*

¹⁹⁹ Paul Stacy, *Driverless Cars Will Create New Jobs, Not Destroy Them*, LEXISNEXIS (2017), <http://blogs.lexisnexis.com/insurance-insights/2016/09/driverless-cars-will-create-new-jobs-not-destroy/>.

²⁰⁰ *See id.*

²⁰¹ *Id.*

²⁰² CBRE GLOB. INDUS. & LOGISTICS, *supra* note 182, at 7.

²⁰³ *Id.*

²⁰⁴ Stacy, *supra* note 199.

²⁰⁵ *Id.*

I. Other Considerations

There are several other social and legal implications of autonomous vehicles that either affect fewer people or do not receive attention in the media. The following discusses some of those topics.

*1. Autonomy*²⁰⁶

Autonomy Levels 1 to 4 require human intervention in the case of an unexpected obstacle.²⁰⁷ Therefore, “the driver would still be required to maintain some knowledge about how to operate [the vehicle] safely.”²⁰⁸ This requires that the driver pay attention—even if minimal—to ensure proper correction as necessary.²⁰⁹ This will likely present a challenge as drivers become comfortable with letting the car do all the driving. The investigation of Tesla’s first Model S fatality proves this risk.²¹⁰ Driver, Joshua Brown, was operating his car under Tesla’s autopilot when it collided with a commercial truck that was crossing the road in front of him.²¹¹

Tesla has said its camera failed to recognize the white truck against a bright sky. But [the NHTSA] essentially found that Mr. Brown was not paying attention to the road. It determined he set his car’s cruise control at 74 miles per hour about two minutes before the crash, and should have had at least seven seconds to notice the truck before crashing into it.²¹²

As autonomous vehicles are perfected, Level 5s will be introduced to the market.²¹³ Level 5 does not require any human intervention or attention, and actually does not even permit it, since it is characterized by no steering wheel or pedals.²¹⁴ This “reliance on technology could mean that over time, drivers are no longer equipped with the skills to operate cars.”²¹⁵ It also means that humans may lose sense of direction.²¹⁶ This requires that autonomous vehicles have per-

²⁰⁶ Referring to human autonomy.

²⁰⁷ Ross, *supra* note 10.

²⁰⁸ AUTO INS. CTR., *supra* note 53.

²⁰⁹ *Id.*

²¹⁰ See Neal E. Boudette, *Tesla’s Self-Driving System Cleared in Deadly Crash*, THE NEW YORK TIMES (Jan. 19, 2017), <https://www.nytimes.com/2017/01/19/business/tesla-model-s-autopilot-fatal-crash.html>.

²¹¹ *Id.*

²¹² *Id.*

²¹³ See Ross, *supra* note 10.

²¹⁴ *Id.*

²¹⁵ AUTO INS. CTR., *supra* note 53.

²¹⁶ Abigail Beall, *Sat Navs Are Robbing Us of Our Sense of Direction: Expert Warns We Risk Losing Our Navigation Skills If We Keep Relying on GPS*, DAILYMAIL.COM (Mar. 30, 2016), <http://www.dailymail.co.uk/sciencetech/article-3515950/Sat-navs-robbing-sense-direction-Expert-warns-risk-losing-navigation-skills-relying-GPS.html>.

fectly programmed maps, otherwise a driver who cannot drive his or her car may end up stranded.²¹⁷ Highly detailed maps “already exist[] in GPS programs like Google Maps, and it’s getting more sophisticated all the time, but occasionally it’s just plain wrong.”²¹⁸

2. Accessibility for Disabled Citizens and Others

Autonomous vehicles revolutionize travel for those who do not have the luxury of driving at all.²¹⁹ “[They] have the potential to provide people who cannot currently drive with an opportunity to increase their mobility and independence, which should lead to happier lives.”²²⁰ In fact, the first passenger of Google’s self-driving car was a blind man.²²¹ “With reasonable rules that take into account public safety, while allowing fully autonomous vehicles on the road now, more people with disabilities that cannot drive will be able to experience the opportunity that may have been nonexistent in the face of a disability.”²²²

This sentiment extends to any citizen who is not able to drive. Those who are elderly, unable to obtain a license, or recently injured will have the option to travel without depending on a relative or driver. “The lack of mobility after an accident can be a crushing blow in some ways equal to the original injury. If technology can help alleviate that, we should not stand in the way.”²²³

IV. FEDERAL AND STATE LEGISLATION

“Vehicle performance is traditionally tested at the federal level by NHTSA, and driver performance is traditionally tested at the state level by [the Department of Motor Vehicles]. [Automated vehicles]—in which the driver *is* the vehicle—complicate these traditional roles.”²²⁴ Due to this complication, the cost of performance testing, and the uncertainty of the technology, policymakers are taking a reactive stance in terms of federal and state legislation.²²⁵

²¹⁷ Ellen Hall, *Self-Driving Cars: Can We Really Trust Them?*, ESURANCE, http://blog.esurance.com/self-driving-cars-can-we-really-trust-them/#.VGNVTPnF_II (last visited Feb. 22, 2017).

²¹⁸ *Id.*

²¹⁹ AUTO INS. CTR., *supra* note 53.

²²⁰ Jeffrey K. Gurney, *Crashing into the Unknown: An Examination of Crash-Optimization Algorithms Through the Two Lanes of Ethics and Law*, 79 ALB. L. REV. 183, 193 (2016).

²²¹ Martin LaMonica, *Google Self-Driving Car Chauffeurs Legally Blind Man*, CNET (Mar. 29, 2012), <https://www.cnet.com/news/google-self-driving-car-chauffeurs-legally-blind-man/>; Google, *Self-Driving Car Test: Steve Mahan*, YOUTUBE (Mar. 28, 2012), <https://www.youtube.com/watch?y=peDy2st2XpQ>.

²²² Jules Polonetsky & Henry Claypool, *Self-Driving Cars: Transforming Mobility for the Elderly and People With Disabilities*, THE HUFFINGTON POST (Oct. 24, 2016), http://www.huffingtonpost.com/jules-polonetsky/selfdriving-cars-transfor_b_12545726.html.

²²³ *Id.*

²²⁴ JAMES M. ANDERSON, ET AL., AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS 138 (RAND Corp., 2016).

²²⁵ *See id.*

A. Federal Legislation²²⁶

With innovation comes legislation. Despite cybersecurity concerns, Federal regulators are pro-autonomous vehicles, primarily based on the decrease in fatalities due to risky drivers and human error.²²⁷ The NHTSA and DOT jointly published a policy “as agency guidance rather than in a rulemaking in order to speed the delivery of an initial regulatory framework and best practices to guide manufacturers and other entities in the safe design, development, testing, and deployment of [automated vehicles].”²²⁸ The policy addresses four primary topics, which are summarized below: (1) vehicle performance guidance for automated vehicles, (2) model state policy, (3) the NHTSA’s current regulatory tools, and (4) new tools and authorities.²²⁹

1. Vehicle Performance Guidance for Automated Vehicles²³⁰

The first section provides data to promote testing of autonomous vehicles to evolve the technology. Figure I below illustrates the framework the NHTSA sets forth in the policy, which ultimately sets the scope and maintains the right to apply collective and individual standards based on review.²³¹

Under Scope & Process Guidance, manufacturers must “bear the responsibility to self-certify that all of the vehicles they manufacture for use on public roadways comply with all applicable Federal Motor Vehicle Safety Standards (FMVSS).”²³² If the vehicle complies with these guidelines and “maintains a conventional vehicle design,” the vehicle can technically be offered for sale (according to federal regulations).²³³ Further, this applies to any entity or individual involved in anything autonomous vehicle related in the United States.²³⁴ Entities that wish to test their product need to request an NHTSA exemption authority and show that the product meets all FMVSS.²³⁵

Under Guidance Applicable to All Autonomous Vehicle²³⁶ Systems on the Vehicle, the NHTSA requires that entities provide safety reports covering the

²²⁶ See generally FED. AUTOMATED VEHICLES POL’Y, *supra* note 4.

²²⁷ See *id.*; see also *supra* Part I & *supra* discussion Section III.A.

²²⁸ NHTSA Federal Automated Vehicles Policy, *Accelerating the Next Revolution In Roadway Safety*, <https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf> (last visited Sept. 13, 2017).

²²⁹ FED. AUTOMATED VEHICLES POL’Y, *supra* note 4.

²³⁰ *Id.* at 11–36.

²³¹ See *id.* at 6 & 14.

²³² *Id.* at 11.

²³³ *Id.*

²³⁴ *Id.* “This Guidance should be considered by all individuals and companies manufacturing, designing, testing, and/or planning to sell automated vehicles systems in the United States.” *Id.*

²³⁵ *Id.* at 12.

²³⁶ Throughout the policy, NHTSA refers to autonomous vehicles as “highly autonomous vehicles” (HAV). *Id.*

following areas, at minimum: (1) data recording and sharing, (2) privacy, (3) system safety, (4) vehicle cybersecurity, (5) human machine interface, (6) crashworthiness, (7) consumer education and training, registration and certification, (8) post-crash behavior, federal, state and local laws, (9) ethical considerations, (10) operational design domain, (11) object and event detection and response, (12) fall back (minimum risk condition), and (13) validation methods.²³⁷ Based on the information provided, NHTSA will determine whether to grant an exemption authority, and will promulgate new FMVSS.²³⁸

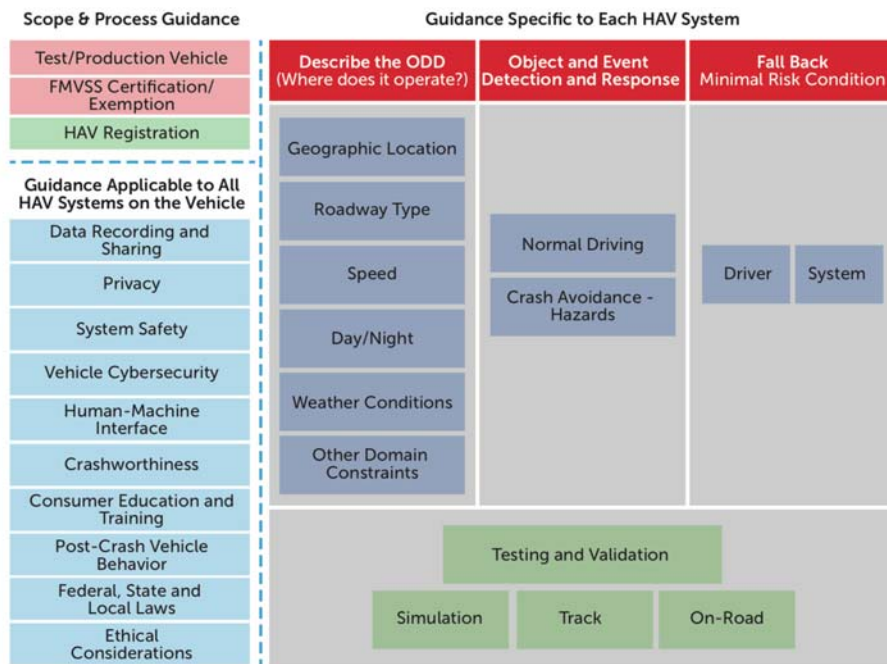


Figure 2²³⁹

2. Model State Policy²⁴⁰

“Vehicles operating on public roads are subject to both Federal and State jurisdiction,”²⁴¹ which makes the [distinction] between the two very important. The model state policy proposed by the NHTSA focuses on allowing autonomous vehicles to cross state borders with ease, much like a human driver would today, and ensuring manufacturers do not have to provide fifty different products

²³⁷ *Id.* at 15.

²³⁸ *Id.* at 36.

²³⁹ *Id.* at 14. (Entitled: Figure 1: Framework for Vehicle Performance Guidance).

²⁴⁰ *Id.* at 37–47.

²⁴¹ *Id.* at 37.

based on state laws.²⁴² Consistent framework is an important factor in the success of state legislation.²⁴³ It distinguishes NHTSA responsibilities from those of the states.²⁴⁴ NHTSA responsibilities include setting and enforcing FMVSS, investigating recalls and remedies, communicating with and educating the public, and issuing guidance, such as the guidelines discussed *supra*.²⁴⁵ State responsibilities include licensing and registration, enacting and enforcing traffic laws, conducting safety inspections, and regulating insurance and liability.²⁴⁶

3. *The NHSTA's Current Regulatory Tools*²⁴⁷

The NHSTA maintains its regulatory authority over automated vehicles in the areas of interpretations, exemptions, notice-and-comment rulemaking, and defects and enforcement authority.²⁴⁸ Further, the NHSTA commits to a sixty-day review period for interpretations, and six-month ruling on exemption requests.²⁴⁹ The first tool, letters of interpretation, can “help the requestor and others understand how the Agency believes existing law applies to the requestor’s motor vehicle.”²⁵⁰ The second, exemptions, provides the opportunity for an entity to request (and the NHTSA to approve or decline) limited exemptions with the FMVSS.²⁵¹ The third tool, rulemaking, gives the NHTSA the option to “adopt new standards, modify existing standards, or repeal an existing standard.”²⁵² Entities can petition for any of the latter options.²⁵³ The final tool, enforcement, gives the NHTSA the power to declare “the existence of a defect that poses an unreasonable risk to motor vehicle safety.”²⁵⁴ Lastly, the Agency considers employing special hiring tools to expand the network of experts to include vehicle and technology specialties.²⁵⁵

²⁴² *Id.* at 7.

²⁴³ *Id.* at 6.

²⁴⁴ *See id.*

²⁴⁵ *Id.* at 38; *see* discussion *supra* Section IV.A.1.

²⁴⁶ FED. AUTOMATED VEHICLES POL’Y, *supra* note 4, at 38.

²⁴⁷ *Id.* at 48–67.

²⁴⁸ *Id.* at 7.

²⁴⁹ *Id.*

²⁵⁰ *Id.* at 51.

²⁵¹ *Id.* at 49. Exemptions are usually limited in both time and scope. *Id.*

²⁵² *Id.*

²⁵³ *Id.*

²⁵⁴ *Id.* at 50.

²⁵⁵ *Id.* at 81–82.

4. *New Tools and Authorities*²⁵⁶

This section, recognizing the rapidity with which autonomous vehicles have evolved, considers potential new tools to match the speed of technological changes and enable further evolution of autonomous vehicles.²⁵⁷

The NHTSA outlines the following new tools to adapt to the rapid evolution of autonomous vehicles: authorities, tools, and agency resources. Authorities refers to a number of safety assurance tools including pre-market testing, data, and analyses from a variety of sources, including the manufacturer.²⁵⁸ Tools, a very general category, recognizes the need for a variety of safety courses to test a vehicle.²⁵⁹ By employing a variety of courses, the NHTSA eliminates the possibility of automated vehicles “gaming” the course by memorizing obstacles and turns.²⁶⁰ Lastly, agency resources refers to a vehicle safety rulemaking priority plan and focusing on “those matters that will have the greatest safety benefit to the public.”²⁶¹

B. *State Legislation*²⁶²

State legislation cannot keep up with the technological advances in the development of autonomous vehicles.²⁶³ “Sixteen states introduced legislation in 2015, up from twelve states in 2014, nine states and D.C. in 2013, and six states in 2012.”²⁶⁴ In 2016, twenty states introduced legislation and in 2017, the number increased to thirty-three; however, only twenty-one states and Washington D.C. have *passed* legislation related to autonomous vehicles.²⁶⁵ Those states include: Alabama,²⁶⁶ Arkansas,²⁶⁷ California, Colorado,²⁶⁸ Connecticut,²⁶⁹ Flori-

²⁵⁶ *Id.* at 68–82.

²⁵⁷ *Id.* at 8.

²⁵⁸ *Id.* at 70.

²⁵⁹ *Id.* at 78.

²⁶⁰ *Id.*

²⁶¹ *Id.* at 65.

²⁶² Danielle Lenth, *Chapter 570: Paving the Way for Autonomous Vehicles*, 44 MCGEORGE L. REV. 787 (2013).

²⁶³ *Id.*

²⁶⁴ National Conference of State Legislatures (NCSL), *Autonomous Vehicles: Self-Driving Vehicles Enacted Legislation* (Aug. 29, 2017), <http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx>.

²⁶⁵ *Id.*

²⁶⁶ Alabama’s state law established a Joint Legislative Committee to engage in a study of self-driving vehicles. NCSL, *supra* note 264; SJR 81 (2016).

²⁶⁷ Arkansas’s law regulates testing of autonomous vehicles and addresses truck platooning systems. NCSL, *supra* note 264; HB 1754 (2017).

²⁶⁸ Colorado’s law defines “automated driving system” and permits the use of autonomous vehicles if the system is capable of adhering to every state and federal law. NCSL, *supra* note 264; SB 213.

²⁶⁹ Connecticut’s law defines “fully autonomous vehicle,” “automated driving system,” and “operator.” It also establishes a pilot program and requires that an operator performing testing on

da,²⁷⁰ Georgia,²⁷¹ Illinois,²⁷² Louisiana,²⁷³ Michigan,²⁷⁴ New York,²⁷⁵ Nevada, North Carolina, North Dakota,²⁷⁶ Pennsylvania,²⁷⁷ South Carolina,²⁷⁸ Tennessee,²⁷⁹ Texas,²⁸⁰ Utah,²⁸¹ Virginia,²⁸² Vermont,²⁸³ and Washington D.C.²⁸⁴ The

autonomous vehicles maintain insurance of at least \$5 million. NCSL, *supra* note 264; SB 260 (2017).

²⁷⁰ Florida's laws set forth safety standards for the testing and operation of autonomous vehicles. NCSL, *supra* note 264; HB 1207 (2012). The state permits operations of autonomous vehicles on public roads by individuals with a valid driver's license, and allows driver-assistive truck platooning. NCSL, *supra* note 264; HB 7027 (2016) & HB 7061 (2016).

²⁷¹ Georgia has enacted two laws. The first defines "automated driving system," "dynamic driving task," "fully autonomous vehicle," "minimal risk condition," and "operational design domain." It also exempts someone that is using a fully autonomous vehicle from carrying a driver's license. NCSL, *supra* note 264; SB 219 (2017). The second exempts vehicles in a coordinated platoon from traffic laws related to distance between two vehicles. NCSL, *supra* note 264; HB 472 (2017).

²⁷² Illinois's law, which is effective June 1, 2018, defines "automated driving system equipped vehicle," and prevents local authorities from enforcing ordinances that prohibit autonomous vehicles. NCSL, *supra* note 264; HB 791 (2017).

²⁷³ Louisiana's state law simply defines "autonomous technology" for the purposes of the Highway Regulatory Act. NCSL, *supra* note 264; HB 1143 (2016).

²⁷⁴ Michigan state law provides basic definitions and limits the liability of the vehicle manufacturer or upfitter for damages in product liability suits resulting from modifications. NCSL, *supra* note 264; SB 169 (2013) & SB 663 (2013). Additionally, in 2016, it allowed the operation of autonomous vehicles without a "driver." NCSL, *supra* note 264; SB 996 (2016). It also exempts mechanics and repair shops from liability on fixing automated vehicles. NCSL, *supra* note 264; SB 998 (2016).

²⁷⁵ New York passed a law permitting testing and requiring a minimum of \$5 million dollars for proof of insurance. NCSL, *supra* note 264; SB 2005 (2017).

²⁷⁶ North Dakota passed a state law permitting research regarding traffic fatalities and crashes, congestion, and improved fuel efficiency. NCSL, *supra* note 264; HB 1065 (2015). It also enacted a law permitting a study on the use of autonomous vehicles on the highway, and required a review of "laws dealing with licensing, registration, insurance, data ownership and use, and inspection and how they should apply to vehicles equipped with automated driving systems." NCSL, *supra* note 264; HB 1202 (2017).

²⁷⁷ Pennsylvania allocated up to \$40 million for intelligent transportation system applications, such as autonomous and connected vehicle-related technology. NCSL, *supra* note 264; SB 1267 (2016).

²⁷⁸ South Carolina enacted a law to exempt vehicles traveling in a platoon from traffic laws related to the distance between vehicles. NCSL, *supra* note 264; HB 3289 (2017).

²⁷⁹ Tennessee law prohibits local governments from banning the use of vehicles with autonomous technology. NCSL, *supra* note 264; SB 598 (2015). It also establishes a certification program for manufacturers before the vehicles can be tested, operated, or sold. NCSL, *supra* note 264; SB 1561 (2016). This creates a per mile tax structure for autonomous vehicles. *Id.* Further, Tennessee law permits autonomous platoons on streets and highways, and created the Automated Vehicles Act to address laws related to autonomous vehicles. NCSL, *supra* note 264; SB 676 (2017) & SB 151 (2017).

²⁸⁰ Texas established state law to preempt local ordinances that prohibited autonomous vehicles. NCSL, *supra* note 264; SB 2205 (2017). Additionally, it established that autonomous vehicles, even without an operator, are legal as long as certain requirements are met. *Id.* Texas also enacted a law to permit the use of an automated braking system between vehicles. NCSL, *supra* note 264; HB 1791 (2017).

²⁸¹ Utah state law authorizes a testing program for autonomous vehicles and requires that a study be conducted before further action. NCSL, *supra* note 264; HB 373 (2015) & HB 280 (2016).

emphasis on California, Nevada, and Arizona—each operating under an executive order—is explained below.

1. California

“California’s law . . . requires autonomous cars to allow passengers to disengage the autopilot and to warn passengers when there is a failure in the autopilot system.”²⁸⁵ Additionally, the state has adopted safety standards that are enforced by the Department of the California Highway Patrol.²⁸⁶ A special bill authorizing Contra Costa Transportation Authority to test a Level 5 autonomous vehicle was passed last year.²⁸⁷ California has also authorized Livermore Amador Valley Transit Authority to conduct a demonstration relating to different levels of autonomy.²⁸⁸ California and Nevada “have determined that the [autonomous vehicle] ‘operator’ is liable for any injury or damage caused by the vehicle.”²⁸⁹ Most recently, it has extended the sunset date of the testing of vehicle platooning from January 2018 to January 2020.²⁹⁰

Because California has one of the largest automotive markets in the country, it tends to set policy for the nation’s automakers.²⁹¹ “Through setting regulations in the state legislature, it logically follows that it becomes cheaper for an auto manufacturer to comply with California regulations across its entire fleet than it is to specially customize cars for sale in California.”²⁹² This does not mean that California state law will influence all states in terms of autonomous vehicles, but it will be an influential state to keep track of, especially since Tesla and Google are based there.²⁹³

²⁸² Virginia state law allows the viewing of a visual display while a vehicle is being operated autonomously. NCSL, *supra* note 264; HB 454 (2016).

²⁸³ Vermont’s state law “[r]equires the department of transportation convene a meeting of stakeholders with expertise on a range of topics related to automated vehicles.” NCSL, *supra* note 264; HB 494 (2017).

²⁸⁴ The District of Columbia requires that a human driver is available to take control and addresses the liability of the original manufacturer. NCSL, *supra* note 264; DC B 19-0931 (2012).

²⁸⁵ Nicholas Stringfellow, *Law and the Problem of Autonomous Cars*, THE COLUM. SCI. & TECH. L. REV. (2015), <http://stlr.org/2015/11/22/law-and-the-problem-of-autonomous-cars/>.

²⁸⁶ NCSL, *supra* note 264; SB 1298 (2012).

²⁸⁷ NCSL, *supra* note 264; AB 1592 (2016).

²⁸⁸ NCSL, *supra* note 264; AB 1444 (2017).

²⁸⁹ Christopher B. Dolan, *Self-Driving Cars & the Bumpy Road Ahead*, AM. ASS’N FOR JUSTICE 31, 35 (2016).

²⁹⁰ NCSL, *supra* note 264; AB 669 (2017).

²⁹¹ Levy, *supra* note 79, at 7.

²⁹² *Id.*

²⁹³ See Alan Ohnsman, *Tesla Has Little To Show In California’s Autonomous Car Data Tally*, FORBES (Feb. 1, 2017, 4:03 PM), <https://www.forbes.com/sites/alanohnsman/2017/02/01/tesla-has-little-to-show-in-californias-tally-of-autonomous-car-test-data/#4a918a606a48>; Barbara Farfan, *Google World Headquarters and Other Locations*, THE BALANCE (Aug. 18, 2017), <https://www.thebalance.com/google-headquarters-offices-2892790>.

2. Nevada

Nevada paved the way in 2011 by being the first state to allow testing of autonomous vehicles.²⁹⁴ The first state laws enacted were also in 2011, and permitted the operation of autonomous cars, but prohibited the use of any cell phones or handheld devices.²⁹⁵ In addition to assigning operator liability, Nevada law determined that “a vehicle manufacturer is *immune from any liability* for after-market adaptation that converts a stock vehicle into an [autonomous vehicle].”²⁹⁶ In 2017, Nevada enacted a law requiring that any crashes involving autonomous vehicles be reported to the DMV within ten days if personal injury or property damage exceeds \$750.²⁹⁷ The same law also permits platooning technology, use of autonomous vehicles by motor carriers and taxi companies, and “the operation of fully autonomous vehicles in the state without a human operator in the vehicle.”²⁹⁸

3. Arizona

Arizona recently became a key state in terms of autonomous vehicles. In late 2016, Uber moved its autonomous vehicle fleet to Arizona after the “California Department of Motor Vehicles revoked Uber’s autonomous vehicle registration . . . after the company failed to obtain proper permits before hitting the public streets of San Francisco.”²⁹⁹ Arizona attempted to introduce “legislation that would not require a human to be seated in an autonomous vehicle,”³⁰⁰ but it failed to clear the House Transportation Committee.³⁰¹ Currently, the state allows testing of autonomous vehicles under an executive order that was signed in 2015, allowing various agencies to “undertake any necessary steps to support the testing and operation of self-driving vehicles on public roads within Arizona.”³⁰²

Overall, state laws regarding autonomous vehicles are attenuated at best. Since California, Nevada, and Arizona have proved to be early adopters of autonomous vehicle testing, and since California is home to the two primary contenders—Tesla and Google—to release a fully automated vehicle to consumers,

²⁹⁴ NCSL, *supra* note 264.

²⁹⁵ NCSL, *supra* note 264; AB 511 (2011) & SB 140 (2011).

²⁹⁶ Dolan, *supra* note 289, at 35.

²⁹⁷ NCSL, *supra* note 264; AB 69 (2017).

²⁹⁸ *Id.*

²⁹⁹ Selena Larson, *Uber to test self-driving cars in Arizona after California roadblock*, CNN TECH (Dec. 23, 2016), <http://money.cnn.com/2016/12/22/technology/uber-self-driving-cars-arizona/>.

³⁰⁰ William J. Kohler & Alex Colbert-Taylor, *Current Law and Potential Legal Issues Pertaining to Automated, Autonomous, and Connected Vehicles*, 31 SANTA CLARA HIGH TECH. L.J. 99, 118 (2015).

³⁰¹ See Chloe Brooks, *Lawmaker: Arizona needs a law to be ready for driverless cars*, TUCSON SENTINEL (Feb. 6, 2013, 9:38 AM), http://www.tucson sentinel.com/local/report/020613_driverless_cars/lawmaker-arizona-needs-law-ready-driverless-cars/.

³⁰² NCSL, *supra* note 264.

the current and future legislation in these three states will be extremely influential on other states and the federal government.

V. SUGGESTED LEGISLATION

It is anticipated that first generation autonomous vehicles will encounter issues with law related to products liability, criminal law and procedure, insurance, land use, privacy and security laws, and communications privacy, to name a few.³⁰³ However, as discussed above,³⁰⁴ a growing number of states have adopted laws regarding the testing and “driving” of autonomous vehicles. This is partially because “The Department of Transportation (DOT) strongly encourages States to allow DOT alone to regulate the performance of [autonomous vehicle] technology and vehicles.”³⁰⁵ Other states recognize that establishing state laws may be a waste of resources. “Congress could enact national legislation that regulates autonomous vehicles on a uniform national basis, to the exclusion of state and local laws. . . . Under the Supremacy Clause of the United States Constitution, such federal autonomous vehicle legislation could preempt varied state laws”³⁰⁶

Autonomous vehicle legislation should be promulgated by the federal government sooner rather than later. Designating this task to the states would only deplete resources, especially when federal laws are likely to preempt state law. Due to the national risks outlined above,³⁰⁷ the legislation should be proactive instead of reactive, and then amended as needed based on issues that occur as higher levels of autonomous vehicles enter the United States roads. “Whether autonomous vehicles will be instruments that facilitate intrusion or will be equipped to prevent intrusion will depend on how autonomous vehicles are designed and built.”³⁰⁸ For example, proactive legislation would focus on privacy and cybersecurity primarily because those seem to be the only areas of concern that can actually offset the benefit of utilizing autonomous vehicles (saving lives versus taking lives due to terrorist attacks or hacking) if they are not properly regulated and protected.

Further, even with proactive legislation and security, criminals are bound to find vulnerabilities in the system. Criminal law experts and professionals should be tasked with identifying these vulnerabilities and drafting or revising potential causes of action to ensure timely prosecution of those who maliciously manipulate the developing technology.

³⁰³ Dorothy J. Glancy, *Autonomous and Automated and Connected Cars—Oh My! First Generation Autonomous Cars in the Legal Ecosystem*, 16 MINN. J.L. SCI. & TECH. 619, 661–79 (2015).

³⁰⁴ See *supra* Parts IV.B.1–3.

³⁰⁵ FED. AUTOMATED VEHICLES POL’Y, *supra* note 4, at 37.

³⁰⁶ Glancy, *supra* note 303, at 655.

³⁰⁷ See *supra* Part III.G.

³⁰⁸ Glancy, *supra* note 166, at 1194.

VI. CONCLUSION

Autonomous vehicle manufacturers have committed to bringing Level 5 vehicles to the market within the next decade, but for all intents and purposes, the wave of this new technology has already arrived. Yet, only a minority of states has addressed the primary legal and social implications.³⁰⁹ With a lack of state and federal laws that properly address autonomous technology, the next five years will be a test run at the state level as the federal government picks and chooses what federal law may become based on the states' successes and failures. Regardless of the evolving law, if Elon Musk's statement is accurate, perhaps even these setbacks will not stunt the evolution of autonomous vehicles: "What we've got will blow people's minds, it blows my mind . . . it'll come sooner than people think."³¹⁰

³⁰⁹ See *supra* Sections III & IV.

³¹⁰ Fred Lambert, *Elon Musk on Tesla fully autonomous car: 'What we've got will blow people's minds, it blows my mind. . . it'll come sooner than people think,'* ELECTREK (Aug. 3, 2016), <https://electrek.co/2016/08/03/elon-musk-tesla-fully-autonomous-car-blows-mind/>.