NAIC
National Association of Insurance Commissioners

JOURNAL OF INSURANCE REGULATION

Cassandra Cole and Kathleen McCullough
Co-Editors

Vol. 35, No. 7

Regulatory Issues Related to Autonomous Vehicles

Lynne McChristian
Richard Corbett

JIR-ZA-35-07

NAIC
National Association of Insurance Commissioners

The NAIC is the authoritative source for insurance industry information. Our expert solutions support the efforts of regulators, insurers and researchers by providing detailed and comprehensive insurance information. The NAIC offers a wide range of publications in the following categories:

Accounting & Reporting
Information about statutory accounting principles and the procedures necessary for filing financial annual statements and conducting risk-based capital calculations.

Consumer Information
Important answers to common questions about auto, home, health and life insurance — as well as buyer's guides on annuities, long-term care insurance and Medicare supplement plans.

Financial Regulation
Useful handbooks, compliance guides and reports on financial analysis, company licensing, state audit requirements and receiverships.

Legal
Comprehensive collection of NAIC model laws, regulations and guidelines; state laws on insurance topics; and other regulatory guidance on antifraud and consumer privacy.

Market Regulation
Regulatory and industry guidance on market-related issues, including antifraud, product filing requirements, producer licensing and market analysis.

NAIC Activities
NAIC member directories, in-depth reporting of state regulatory activities and official historical records of NAIC national meetings and other activities.

Special Studies
Studies, reports, handbooks and regulatory research conducted by NAIC members on a variety of insurance-related topics.

Statistical Reports
Valuable and in-demand insurance industry-wide statistical data for various lines of business, including auto, home, health and life insurance.

Supplementary Products
Guidance manuals, handbooks, surveys and research on a wide variety of issues.

Capital Markets & Investment Analysis
Information regarding portfolio values and procedures for complying with NAIC reporting requirements.

White Papers
Relevant studies, guidance and NAIC policy positions on a variety of insurance topics.

For more information about NAIC publications, view our online catalog at:

http://store.naic.org

Printed in the United States of America

NAIC Executive Office
444 North Capitol Street, NW
Suite 700
Washington, DC 20001
202.471.3990

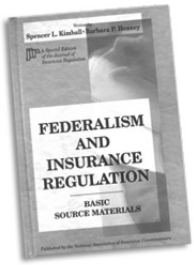
NAIC Central Office
1100 Walnut Street
Suite 1500
Kansas City, MO 64106
816.842.3600

NAIC Capital Markets
& Investment Analysis Office
One New York Plaza, Suite 4210
New York, NY 10004
212.398.9000

NAIC
National Association of Insurance Commissioners

Companion Products

The following companion products provide additional information on the same or similar subject matter. Many customers who purchase the ***Journal of Insurance Regulation*** also purchase one or more of the following products:



Federalism and Insurance Regulation

This publication presents a factual historical account of the development of the framework for insurance regulation in the United States. It does so in part by using illustrative early statutes, presenting them chronologically, and in part by using cases that illustrate the interpretation of the crucial later statutes. Copyright 1995.

Regulation and the Casualty Actuary

This anthology reprints 20 important papers from past issues of the Journal of Insurance Regulation that are most relevant for practicing actuaries and state insurance regulators. It covers a wide range of issues, such as ratemaking, auto insurance pricing, residual markets, reserving and solvency monitoring. This invaluable reference explains these complex topics in straightforward, non-technical language. Copyright 1996.

How to Order

816.783.8300 | prodserv@naic.org | http://store.naic.org

International orders must be prepaid, including shipping charges. Please contact an NAIC Customer Service Representative, Monday - Friday, 8:30 am - 5 pm CT.

Editorial Staff of the *Journal of Insurance Regulation*

Editorial Review Board

Purpose

The *Journal of Insurance Regulation* is sponsored by the National Association of Insurance Commissioners. The objectives of the NAIC in sponsoring the *Journal of Insurance Regulation* are:

1. To provide a forum for opinion and discussion on major insurance regulatory issues;
2. To provide wide distribution of rigorous, high-quality research regarding insurance regulatory issues;
3. To make state insurance departments more aware of insurance regulatory research efforts;
4. To increase the rigor, quality and quantity of the research efforts on insurance regulatory issues; and
5. To be an important force for the overall improvement of insurance regulation.

To meet these objectives, the NAIC will provide an open forum for the discussion of a broad spectrum of ideas. However, the ideas expressed in the *Journal* are not endorsed by the NAIC, the *Journal's* editorial staff, or the *Journal's* board.

Regulatory Issues Related to Autonomous Vehicles

Lynne McChristian*
Richard Corbett**

Abstract

Self-driving cars mean revolution and evolution. The revolution: Humans will leave the traditional rules of the road behind as they turn over the driving to a machine. The evolution: States will not be defining who a driver is but what a driver is, as the term will gradually change from a person steering the vehicle to a product doing so. Along the way, changes are inevitable to the traditional model of auto insurance. The National Highway Traffic Safety Administration (NHTSA) is working to create a national policy on automated vehicles, and the NHTSA is encouraging states to develop best practices while focusing on consistent regulatory objectives. This article looks at where the states are now in the regulatory process and presents the issues surrounding the expected shift in liability.

* Teaching Faculty and Executive Director, Florida State University Center for Risk Management Education & Research (CRMER), 821 Academic Way, Tallahassee FL, 32306-1110; *lmcchristian@business.fsu.edu*.

** Adjunct Professor and Professor Emeritus of Risk Management & Insurance, Florida State University, 821 Academic Way, Tallahassee FL, 32306-1110; *rcorbett@business.fsu.edu*.

Introduction

Americans are united by at least one characteristic: They all consider themselves to be above-average drivers. While that notion belies the definition of average, the fact is that human error is the root cause for about 94% of all traffic crashes (NHTSA, 2015). Most of the driving errors are due to inattentiveness or distractions. People drive too fast for conditions or fail to keep proper distance from the vehicle ahead. Drivers focused on an impending hazard become reflexive, causing them to overcorrect and lose control of their vehicles. Drivers also tend to misjudge what other drivers are doing or should be doing, and even those assumptions often prove wrong. This makes U.S. roadways dangerous. About 38,000 people were killed in traffic crashes in 2015, and more than 4 million are injured (National Safety Council, 2016). Taking humans out of this equation, by way of self-driving technology advances, should result in a reduction in accidents, leading to fewer automobile-related fatalities and injuries.

In early 2016, self-driving automotive technology got a boost when President Barack Obama proposed providing nearly $4 billion over 10 years for pilot programs to test connected vehicle systems in certain designated areas of the U.S. (Solomon, 2016). In addition, the U.S. Department of Transportation's (DOT) Smart City Challenge pledged up to $40 million to the one city that fully integrated innovative technologies into its transportation network, which includes self-driving cars, connected vehicles and smart sensors. The idea was to gain early adopters and role models. The seven finalist cities were Austin, TX; Columbus, OH; Denver, CO; Kansas City, MO; Pittsburg, PA; Portland, OR; and San Francisco, CA. Columbus was announced as the winner of the challenge in June 2016. It will use a combination of the challenge winnings, an additional $10 million provided by Paul G. Allen's Vulcan, Inc. and private funds of $90 million to "deploy three electric self-driving shuttles to link a new bus rapid transit center to a retail district, connecting more residents to jobs." The city also expects to develop better transportation options to improve access to health care for its residences (DOT, 2016).

These financial incentives and general increased interest in self-driving cars has led some to believe the innovation will become mainstream very soon. However, this is a common misconception, brought on by increasingly sophisticated computer power and futuristic safety features being engineered into some new car models (Driverless Car Watch, 2015). Today's technology is dominated by driver assistance devices, which operate in limited settings and for very limited times. For example, emergency braking systems are a last-second savior when a crash appears imminent. Auto-parking only lasts for a few seconds, with the driver required to pay close attention to the process. Lane warning devices, for when a car veers across highway lines, also lasts for a blink of the eye. While today's auto assistance systems are currently driver supervised, they cannot evolve into continuous driving without technological advances that are now mainly on the drawing board. As a result, a decade or more may pass before we

have a mass-produced, fully autonomous vehicle (FAV). A realistic prediction for a time frame when FAVs on the highway are the norm is around 2035, according to a survey of autonomous vehicle experts by the Institute of Electrical and Electronics Engineers (IEEE), a technical professional organization. That is the year experts expect that steering wheels, gas pedals and brakes will be removed from mass-produced cars (IEEE, 2014).

In this article, we discuss the advances in autonomous vehicle (AV) technology that have been made to date. We also provide information on some of the setbacks faced by companies and technology developers. Next, we review existing regulation as it relates to autonomous vehicles and outline some of the challenges faced by developers and manufacturers as it relates to liability. Finally, we provide some concluding statements.

The Transportation Revolution

There has been quite a bit of "hype" generated by the advances in AV technology. Developers, however, are generally taking a cautious approach and are moving slowly with getting these vehicles on the road. As a result, this provides time for other developers to enter the marketplace.

To date, Google has been one of the frontrunners in developing AVs. As the public face of self-driving cars in the U.S., Google has a prototype with a top speed of 25 mph. Google cars are already on the streets in Austin, TX, and Mountain View, CA, with test drivers on board ready to assume control. The company has said it wants to build a fleet of vehicles without a role for the driver, meaning without steering wheels, because its current technology cannot easily switch control from automated driving back to the driver (Markoff, 2014).

No developer of AVs is declaring that its vehicles are ready for the open highway, and some companies have experienced delays and/or setbacks. For example, General Motors (GM) announced in September 2014 that it would offer a Super Cruise system on its large sedans by 2016 to enable hands-free driving on freeways that had proper lane markings. That rollout has been delayed until 2017. In an article in early 2016, GM global product chief was quoted as saying: "Getting the technology right and doing it safely is most important" and "It will come out when it is ready" (Colias, 2016).

While Tesla's Autopilot system has a number of autonomous features, it is not a self-driving car, as the company stressed when it released the system in "public beta" form in October 2015 (Tesla, 2016). Tesla owners were reminded to keep their hands on the wheel and to remain alert at all times. The press kit on the Tesla software upgrade begins by noting that the model "is designed to keep getting better over time." That is the general theme for those whose focus is on deploying and adapting to the technology, not developing it, such as insurers, regulators and state transportation departments.

In May 2016, a fatal crash occurred in Florida involving a Tesla Model S while the vehicle was in self-drive mode. Tesla issued a press release stating, "Neither autopilot nor the driver noticed the white side of the tractor-trailer against a brightly lit sky, so the brake was not applied" (Vlasic and Boudette, 2016). It also indicated to the U.S. Senate Commerce Committee looking into the cause of that crash that it was the crash prevention system, not the assisted driving system or Autopilot, that failed to work properly. The distinction between the auto-braking system and Autopilot may be an important one going forward since technology is Tesla's brand, not auto manufacturing (Boudette, 2016).

Almost immediately after the Tesla incident, BMW announced it would enter the AV market, with a focus on driverless cars for ride sharing. The announcement was called a "radical departure" for mainstream automakers, which have generally let the technology companies take the lead. The time frame for BMW's rollout: 2021 (Marshall, 2016).

The Regulatory Response

In a 2016 article in *The New York Times*, the authors point out the anomaly that a new driver has to pass a licensing exam, but a new computer-controlled vehicle does not face the same hurdle (Sivak and Schoettle, 2016). They recommended a "go slow" approach to the adoption of these vehicles. They were especially adamant that the pattern-recognition software in the vehicles be tested extensively. They also recommended comprehensive standardized tests for new vehicles entering the market. This sentiment seems to be echoed by others.

The NHTSA has begun to provide some guidelines as it relates to autonomous vehicles. In its "Preliminary Statement of Policy Concerning Automated Vehicles" released in 2013, it cited instances in which its research on new technology has led to regulatory requirements. For example, its findings as it related to electronic stability control (ESC) resulted in an industry standard or requirement that ESC now be included on all new light vehicles. These guidelines were updated in early 2016.

The NHTSA's goal is to create a consistent national policy to let innovation thrive and to work with partners to develop a model state policy on automated vehicles, keeping public safety at the core. In September, the NHTSA released the "Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety," which outlined five different levels of automation based on the SAE International definitions. Level 0 is no automation or instances in which the human driver is in full control. Level 1 is the lowest level of automation, which includes vehicles that contain automation systems that can "sometimes assist the human driver conduct some parts of the driving task," while Level 5 is the highest level of automation and involves automation systems that "can perform all driving tasks, under all conditions that a human driver could perform them" (DOT, 2016).

In addition to providing information on the varying levels of automation, the most recent NHTSA publication discusses the federal and state roles as it relates to vehicles, sets forth specific model state policy and provides some regulatory tools. The federal responsibilities are related to establishing and enforcing vehicle safety standards, reviewing and overseeing any vehicle recalls, and educating people about vehicle safety. The primary state responsibilities include managing motor vehicle registrations, managing driver licensing and regulating insurance.

The document suggests that states should "evaluate their current laws and regulations to address unnecessary impediments to the safe testing, deployment and operation of highly automated vehicles (HAVs), and update references to a human driver as appropriate. States may still wish to experiment with different policies and approaches to consistent standards, and in that way contribute to the development of the best approaches and policies to achieve consistent regulatory objectives." Very importantly, the policy also indicates that states should work to create consistency as it relates to "laws and policies to avoid a patchwork of inconsistent state laws that could impede innovation and the expeditious and widespread distribution of safety-enhancing automated vehicle technologies" (DOT, 2016).

As it relates to policy, the document outlines several important areas of consideration including:

1. Administration: Identification of the lead agency that will manage the testing of automated vehicles and the development of a "jurisdictional automated safety technology committee" that is created by the lead agency.
2. Testing: Application process for the testing of automated vehicles. Applications must be approved by the lead agency.
3. Deployed Vehicles: Review of existing regulations related to human drivers (such as safety, crash reporting, liability and environmental impacts) should be conducted and "gaps" identified. Registration and titling of AVs should be developed.
4. Liability/Insurance: A determination should be made regarding allocation of liability among various parties (such as owners, operators, guest passengers, manufacturers and others) and insurance requirements.

Over the past few years, the number of states passing legislation related to AVs has increased, with 16 states introducing legislation related to autonomous vehicles in 2015. This is up from 12 states in 2014, nine states and Washington, DC, in 2013, and six states in 2012.[1] In 2011, Nevada became the first state to authorize AV operation. Since then, five other states—California, Florida, Michigan, North Dakota and Tennessee (plus Washington, DC)—have passed

1. National Conference of State Legislatures, *"Autonomous Vehicles,"* May 26, 2016. *www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx*.

legislation related to AVs. Arizona's governor issued an executive order related to AVs.

Table 1 provides a summary of recent legislative activity. Today's laws on driverless cars deal primarily with testing them, and, according to one expert, it is not even clear that such legislation is necessary (Smith, 2016). Several states have attracted research activities for self-driving cars without specific legislation. In fact, while Google pushed for legislation to get things rolling in Nevada and California, it has pulled away from getting involved in the legislative process in other states due to restrictions imposed.

Table 1:
Synopsis of Self-Driving Car Legislation

State	Legislative Focus				
	Encourages development, research, innovation	Sets safety standards	Establishes testing requirements	Authorizes testing on public roads	Involves insurance regulation or liability
California	Enacted 2012 SB 1298	Enacted 2012 SB 1298	Enacted 2016 AB 1592	Enacted 2012 SB 1298	
Florida	Enacted 2012 HB 1207			Enacted 2016 HB 7027	Enacted 2012 HB 1207
Louisiana	Enacted 2016 HB 1143				
Michigan	Enacted 2013 SB 169		Enacted 2013 SB 169		Enacted 2013 SB 663
Nevada	Enacted 2011 AB 511				Enacted 2013 SB 313
North Dakota	Enacted 2015 HB 1065				
Tennessee	Enacted 2015 SB 598	Enacted 2016 SB 1561			
Utah		Enacted 2016 HB 280	Enacted 2015 SB 373		
Washington, DC	Enacted 2013 DC B 19-0931				

According to a 2016 study by the RAND Corporation, all of the enacted regulations similarly define AVs as vehicles with the capability to self-drive without being actively controlled or monitored by a human operator. An operator is defined as the person who engages the technology. This excludes vehicles enabled with active safety systems or driver assistance systems, such as "blind spot" assistance or crash avoidance systems.

In anticipation of the future commercialization of driverless cars, Nevada's law (NAC-482A) requires the driver of an AV to obtain a "certificate of compliance," either from the manufacturer of the vehicle or from a state-certified technology certification facility, if the vehicle operates in non-testing mode. It is the only state to have done so, to date. The compliance certificate identifies the specific geographic location where the licensee can test the vehicle. It also requires

special temporary license plates for each AV and stipulates that two people must be in the car at all times.

Despite the progress made in passing legislation to speed up AV adoption, there are roadblocks. For example, following an unfavorable report while the bill was in committee, Maryland's proposed legislation to establish a task force on self-driving vehicles failed—twice. An additional 14 states are continuing to address the issues surrounding testing of the vehicles and determining liability (CyberLaw).

Since 2012, several of the state legislatures have considered bills that related to autonomous vehicles. These bills had varied experience in their passage toward becoming laws. The bills that have been passed are summarized in Table 1.

The bills can be evaluated on five criteria:

1. Did the bill encourage the development of autonomous vehicles? Did it assist in creating a climate for research and innovation?
2. Did the bill address safety standards related to the operation of autonomous vehicles?
3. Did the bill specifically allow testing of the vehicles being developed?
4. Did the bill allow operation or testing on public roads?
5. Did the bill speak to any specific insurance requirements related to autonomous vehicles?

California is the only state with a law that addresses all of these issues. Other states with successful legislative efforts related to one of these criteria are Florida, Michigan, Nevada, North Dakota, Tennessee and Utah. Few of the laws directly address insurance issues. Most of the laws encourage the development of autonomous vehicles and/or establish safety standards, with the safety standards usually being the requirement to have an "over-ride" system in the vehicle so that a human operator can take over in an emergency situation.

Although some of the laws allow the use of public roads for testing and/or regular operation, few included specific insurance standards. An interesting feature of many of the laws is products liability protection for the vehicle manufacturer. This applies in any case where the seller or user modifies a vehicle.

During 2015 and 2016, state legislatures in California, Georgia, Hawaii, Illinois, Maryland and Texas attempted to pass legislation. However, most of these efforts have failed. Two interesting provisions have appeared in a number of these bills. The first is prohibition of local governments from regulating AVs. The second concerns guidelines for punishment of persons who access the electronic system of an AV inappropriately. Bills attempted in 2016 are summarized in Table 2.

Regulators around the world are dealing with similar issues. The United Kingdom's (UK) Department of Transport released a review of its existing regulations for AV technologies and concluded that its legal and regulatory frameworks were not barriers to testing AVs on public roads (DOT, 2015). Germany and Sweden have reviewed their legislation as well.

Table 2:
2016 Attempted Legislative Activity

State	Legislative Focus				
	Encourages development, research, innovation	Sets safety standards	Establishes testing requirements	Authorizes testing on public roads	Involves insurance or liability
Alabama	Failed S 178				
Georgia	Failed S 113			Failed S 113	Failed S 113
Hawaii	Failed H 2687	Failed S 630			
Illinois	Passed House, in Senate H 3136				
Massachusetts	New draft pending H 4321/ S 1841				
Maryland	Failed H 8/S 126				

Driverless vehicles can legally be tested on public roads in the UK, providing a test driver is present and takes responsibility for the safe operation of the vehicle. Drivers are not limited to a test track, do not need certificates or permits, and are not required to provide a surety bond. They are required to have insurance. The report's findings declared that the country is "positioned to become a premium global location for the development of these technologies" (UK Dept. of Transport, 2015). The UK also has developed a Code of Practice for those testing driverless vehicles, published in 2015 (Department for Transport, 2015). It outlines general and safety requirements for vehicles and drivers.

Liability and Insurance-Related Regulation

The number of car crashes is expected to drop significantly as more crash avoidance technology becomes commonplace. However, the cost of replacing damaged vehicles is likely to rise due to the complexity of the electronics and other components needing repair. As such, the frequency of crashes will decline, but the severity costs remain unknown. Additionally, the advent of AVs brings an expectation that personal liability will decrease, since this technology can reduce human error, ultimately resulting in fewer vehicle crashes. But, exposure for manufacturers and product developers may increase if system failures are determined to be the cause of more and more accidents.

These changes in the distribution of crashes and who is responsible will likely affect how automobiles are insured in the future. It is easier to estimate costs of common occurrences rather than rare ones. Crashes involving AVs will be rare, and the data available to date is related to test-driving, not actual day-to-day operation. It may take decades to generate enough AV data to properly price coverage. However, insurance companies cannot wait decades to make coverage decisions related to AV technology as consumers, technology developers, car manufacturers and regulators may be looking for insurance solutions soon.

The 2016 RAND study suggested that the shift in responsibility from the driver to the manufacturer may make a case for a form of no-fault automobile insurance. Product-liability lawsuits are more expensive and time-consuming than car crash lawsuits, so a no-fault system that quickly compensates victims without assigning fault may be viable. Others foresee something akin to the federal National Childhood Vaccine Injury Act, a no-fault compensation program for vaccine recipients who suffer an adverse reaction. The 1986 legislation was in response to concerns that the availability of the life-saving vaccines would diminish because of the threat of injury claims.

Liability insurance is likely to evolve over time, as lawsuits make their way through the legal system and a precedence is set. Cusack (2016) suggests that there are numerous factors to consider in settling claims involving AVs, including whether there was a technology failure or an operator failure. With the lack of existing data and the continued advances in technology, it may be that more questions exist at this time than solutions. For example, how would a case be handled if a driver, one not operating an AV, causes an accident? Will we strengthen mandatory bodily injury liability and medical payments coverages so that "fault" is not at the core of recovery?

Additionally, uninsured motorist (UM) coverage may become obsolete. Physical damage coverage also may change. This coverage may become mandatory given the potential costs of repairs to expensive, critical systems that would be needed to get vehicles back on the roadway. An alternative would be to require "critical repair" coverage be included in the purchase costs of vehicles. Zelle and Whitehead (2014) describe a similar process with regard to developing new contracts and coverages for cyber liability exposure.

The Insurance Information Institute (III) notes the impact on insurance for driverless cars includes not just regulation and liability, but also underwriting criteria and repair costs (Driverless Car Market Watch, 2016). Many of the traditional underwriting criteria—such as number and kind of accidents an insured has had, the miles driven annually and where the car is garaged—will still apply. But the make, model and style of car may assume greater importance. The implications of where the car is garaged and driven might be different if there are areas set aside for automated driving, such as dedicated highway lanes.

Shared driving between human and machine will make the liability issues even more complicated. During the transition to fully automated driving, insurers may try to rely more on telematics, the "black boxes" that monitor driver activity. Use of telematics is forecasted to grow, and it has the advantage of using

individual and current driving behaviors, rather than relying on past trends (National Association of Insurance Commissioners, July 2016).

In terms of insurance regulation for autonomous vehicles, regulators may face some significant challenges similar to those can be restrictive or helpful. Though states can set their own rules, what is to be the framework? "Regulators will either let self-driving cars on U.S. roads or cede the testing to others" (Crovitz, 2016). Harrington (2016, p.33) decried "excessive conservatism" in getting new products and services to market. He suggested that insurance regulators focus on being helpful rather than being restrictive. Fier, et al (2014) made the similar argument in a paper on reforms of the federal flood insurance program.

When self-driving cars become mainstream, every driver ultimately will benefit since fewer car crashes and fatalities will lower the cost of insurance. But AVs will not eliminate the need for insurance; the shift in liability from the driver to the automaker or manufacturer of the AV technology raises the probability that insurance becomes a standard feature, part of the purchase price of a self-driving vehicle. Determining fault for a car accident will be less of an issue when AV technology is a witness that can sort it all out. However, the sales price of the AV must reflect this liability, which adds to the new-car purchase price and could slow down sales. States still have quite a bit of work to do in the meantime. Many have seen their entry into the AV realm curbed by trying to come up with a definition of the word "driver" in a future where that word is not about a human behind the wheel. *The Week*, quoting *The Wall Street Journal*, suggested that the decline might be as much as 80% of the current $200 billion in premiums for auto insurance. The article also noted that the auto insurance industry is spending substantial sums on research into autonomous cars and forming partnerships with auto manufacturers (Scism, July 2016). Does that create the possibility that auto insurance will come with the car?

Conclusion

The vast majority of automobile accidents are caused by human error. As driver assistance devices advances and support of self-driving automotive technology continues, an evolution to FAVs is on the horizon. While there are some clear advantages to FAVs, such as reduced accident frequency, there also may be some challenges.

Currently, Tesla and Google have invested millions as "first movers" and have gained a market advantage. Both are working to find the best guidance system, preferably one that minimizes human participation and driver error. Tesla and Google have been joined in the market by BMW, Ford, GM, Volvo and Uber.

The fact is the technology for the autonomous car is advancing faster than laws and regulations related to the "use, ownership and maintenance" of the car. This puts both the legal system and the regulatory structure in a reactive position. The tort system has proven to be an expensive place to test new technologies, but

the autonomous car will be judged there. Insurance regulators may have to work to catch up in an environment where each state can set its own rules.

The technology for the autonomous car is also advancing faster than operator ability and attitude. The "freedom of the road" is a core American value, and some operators want maximum opportunity to control the vehicle or, at least, some aspects of its operation. A preventable fatality involving a Tesla was related to driver error, something the designers hoped to minimize. This will involve continuous educational efforts—and time.

Finally, progress toward a world of self-driving cars will mean the automobile insurance industry may see a substantial change in how coverage is provided, which could ultimately affect premiums. Since auto insurance is the largest component of property and liability insurance premiums, insurer profits also may decline.

As far back as the 1950s, there was a dream of "pilotless" flying vehicles. As we approach perfecting the AV, will we move on the roadways with electronic sensors? Will the term "traffic engineer" take on a new meaning? The roadblock to manufacturers is a 50-state regulatory system that could, in essence, bring 50 different sets of rules that would be nearly impossible for auto manufacturers to comply with. Think of it as similar to a roadway infrastructure for self-driving cars that ends at the state line, another possible hazard to the process. The need for some consistency is clear.

Regulatory Issues Related to Autonomous Vehicles

Lynne McChristian*
Richard Corbett**

Abstract

Self-driving cars mean revolution and evolution. The revolution: Humans will leave the traditional rules of the road behind as they turn over the driving to a machine. The evolution: States will not be defining who a driver is but what a driver is, as the term will gradually change from a person steering the vehicle to a product doing so. Along the way, changes are inevitable to the traditional model of auto insurance. The National Highway Traffic Safety Administration (NHTSA) is working to create a national policy on automated vehicles, and the NHTSA is encouraging states to develop best practices while focusing on consistent regulatory objectives. This article looks at where the states are now in the regulatory process and presents the issues surrounding the expected shift in liability.

* Teaching Faculty and Executive Director, Florida State University Center for Risk Management Education & Research (CRMER), 821 Academic Way, Tallahassee FL, 32306-1110; *lmcchristian@business.fsu.edu*.

** Adjunct Professor and Professor Emeritus of Risk Management & Insurance, Florida State University, 821 Academic Way, Tallahassee FL, 32306-1110; *rcorbett@business.fsu.edu*.

Introduction

Americans are united by at least one characteristic: They all consider themselves to be above-average drivers. While that notion belies the definition of average, the fact is that human error is the root cause for about 94% of all traffic crashes (NHTSA, 2015). Most of the driving errors are due to inattentiveness or distractions. People drive too fast for conditions or fail to keep proper distance from the vehicle ahead. Drivers focused on an impending hazard become reflexive, causing them to overcorrect and lose control of their vehicles. Drivers also tend to misjudge what other drivers are doing or should be doing, and even those assumptions often prove wrong. This makes U.S. roadways dangerous. About 38,000 people were killed in traffic crashes in 2015, and more than 4 million are injured (National Safety Council, 2016). Taking humans out of this equation, by way of self-driving technology advances, should result in a reduction in accidents, leading to fewer automobile-related fatalities and injuries.

In early 2016, self-driving automotive technology got a boost when President Barack Obama proposed providing nearly $4 billion over 10 years for pilot programs to test connected vehicle systems in certain designated areas of the U.S. (Solomon, 2016). In addition, the U.S. Department of Transportation's (DOT) Smart City Challenge pledged up to $40 million to the one city that fully integrated innovative technologies into its transportation network, which includes self-driving cars, connected vehicles and smart sensors. The idea was to gain early adopters and role models. The seven finalist cities were Austin, TX; Columbus, OH; Denver, CO; Kansas City, MO; Pittsburg, PA; Portland, OR; and San Francisco, CA. Columbus was announced as the winner of the challenge in June 2016. It will use a combination of the challenge winnings, an additional $10 million provided by Paul G. Allen's Vulcan, Inc. and private funds of $90 million to "deploy three electric self-driving shuttles to link a new bus rapid transit center to a retail district, connecting more residents to jobs." The city also expects to develop better transportation options to improve access to health care for its residences (DOT, 2016).

These financial incentives and general increased interest in self-driving cars has led some to believe the innovation will become mainstream very soon. However, this is a common misconception, brought on by increasingly sophisticated computer power and futuristic safety features being engineered into some new car models (Driverless Car Watch, 2015). Today's technology is dominated by driver assistance devices, which operate in limited settings and for very limited times. For example, emergency braking systems are a last-second savior when a crash appears imminent. Auto-parking only lasts for a few seconds, with the driver required to pay close attention to the process. Lane warning devices, for when a car veers across highway lines, also lasts for a blink of the eye. While today's auto assistance systems are currently driver supervised, they cannot evolve into continuous driving without technological advances that are now mainly on the drawing board. As a result, a decade or more may pass before we

have a mass-produced, fully autonomous vehicle (FAV). A realistic prediction for a time frame when FAVs on the highway are the norm is around 2035, according to a survey of autonomous vehicle experts by the Institute of Electrical and Electronics Engineers (IEEE), a technical professional organization. That is the year experts expect that steering wheels, gas pedals and brakes will be removed from mass-produced cars (IEEE, 2014).

In this article, we discuss the advances in autonomous vehicle (AV) technology that have been made to date. We also provide information on some of the setbacks faced by companies and technology developers. Next, we review existing regulation as it relates to autonomous vehicles and outline some of the challenges faced by developers and manufacturers as it relates to liability. Finally, we provide some concluding statements.

The Transportation Revolution

There has been quite a bit of "hype" generated by the advances in AV technology. Developers, however, are generally taking a cautious approach and are moving slowly with getting these vehicles on the road. As a result, this provides time for other developers to enter the marketplace.

To date, Google has been one of the frontrunners in developing AVs. As the public face of self-driving cars in the U.S., Google has a prototype with a top speed of 25 mph. Google cars are already on the streets in Austin, TX, and Mountain View, CA, with test drivers on board ready to assume control. The company has said it wants to build a fleet of vehicles without a role for the driver, meaning without steering wheels, because its current technology cannot easily switch control from automated driving back to the driver (Markoff, 2014).

No developer of AVs is declaring that its vehicles are ready for the open highway, and some companies have experienced delays and/or setbacks. For example, General Motors (GM) announced in September 2014 that it would offer a Super Cruise system on its large sedans by 2016 to enable hands-free driving on freeways that had proper lane markings. That rollout has been delayed until 2017. In an article in early 2016, GM global product chief was quoted as saying: "Getting the technology right and doing it safely is most important" and "It will come out when it is ready" (Colias, 2016).

While Tesla's Autopilot system has a number of autonomous features, it is not a self-driving car, as the company stressed when it released the system in "public beta" form in October 2015 (Tesla, 2016). Tesla owners were reminded to keep their hands on the wheel and to remain alert at all times. The press kit on the Tesla software upgrade begins by noting that the model "is designed to keep getting better over time." That is the general theme for those whose focus is on deploying and adapting to the technology, not developing it, such as insurers, regulators and state transportation departments.

In May 2016, a fatal crash occurred in Florida involving a Tesla Model S while the vehicle was in self-drive mode. Tesla issued a press release stating, "Neither autopilot nor the driver noticed the white side of the tractor-trailer against a brightly lit sky, so the brake was not applied" (Vlasic and Boudette, 2016). It also indicated to the U.S. Senate Commerce Committee looking into the cause of that crash that it was the crash prevention system, not the assisted driving system or Autopilot, that failed to work properly. The distinction between the auto-braking system and Autopilot may be an important one going forward since technology is Tesla's brand, not auto manufacturing (Boudette, 2016).

Almost immediately after the Tesla incident, BMW announced it would enter the AV market, with a focus on driverless cars for ride sharing. The announcement was called a "radical departure" for mainstream automakers, which have generally let the technology companies take the lead. The time frame for BMW's rollout: 2021 (Marshall, 2016).

The Regulatory Response

In a 2016 article in *The New York Times*, the authors point out the anomaly that a new driver has to pass a licensing exam, but a new computer-controlled vehicle does not face the same hurdle (Sivak and Schoettle, 2016). They recommended a "go slow" approach to the adoption of these vehicles. They were especially adamant that the pattern-recognition software in the vehicles be tested extensively. They also recommended comprehensive standardized tests for new vehicles entering the market. This sentiment seems to be echoed by others.

The NHTSA has begun to provide some guidelines as it relates to autonomous vehicles. In its "Preliminary Statement of Policy Concerning Automated Vehicles" released in 2013, it cited instances in which its research on new technology has led to regulatory requirements. For example, its findings as it related to electronic stability control (ESC) resulted in an industry standard or requirement that ESC now be included on all new light vehicles. These guidelines were updated in early 2016.

The NHTSA's goal is to create a consistent national policy to let innovation thrive and to work with partners to develop a model state policy on automated vehicles, keeping public safety at the core. In September, the NHTSA released the "Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety," which outlined five different levels of automation based on the SAE International definitions. Level 0 is no automation or instances in which the human driver is in full control. Level 1 is the lowest level of automation, which includes vehicles that contain automation systems that can "sometimes assist the human driver conduct some parts of the driving task," while Level 5 is the highest level of automation and involves automation systems that "can perform all driving tasks, under all conditions that a human driver could perform them" (DOT, 2016).

In addition to providing information on the varying levels of automation, the most recent NHTSA publication discusses the federal and state roles as it relates to vehicles, sets forth specific model state policy and provides some regulatory tools. The federal responsibilities are related to establishing and enforcing vehicle safety standards, reviewing and overseeing any vehicle recalls, and educating people about vehicle safety. The primary state responsibilities include managing motor vehicle registrations, managing driver licensing and regulating insurance.

The document suggests that states should "evaluate their current laws and regulations to address unnecessary impediments to the safe testing, deployment and operation of highly automated vehicles (HAVs), and update references to a human driver as appropriate. States may still wish to experiment with different policies and approaches to consistent standards, and in that way contribute to the development of the best approaches and policies to achieve consistent regulatory objectives." Very importantly, the policy also indicates that states should work to create consistency as it relates to "laws and policies to avoid a patchwork of inconsistent state laws that could impede innovation and the expeditious and widespread distribution of safety-enhancing automated vehicle technologies" (DOT, 2016).

As it relates to policy, the document outlines several important areas of consideration including:

1. Administration: Identification of the lead agency that will manage the testing of automated vehicles and the development of a "jurisdictional automated safety technology committee" that is created by the lead agency.
2. Testing: Application process for the testing of automated vehicles. Applications must be approved by the lead agency.
3. Deployed Vehicles: Review of existing regulations related to human drivers (such as safety, crash reporting, liability and environmental impacts) should be conducted and "gaps" identified. Registration and titling of AVs should be developed.
4. Liability/Insurance: A determination should be made regarding allocation of liability among various parties (such as owners, operators, guest passengers, manufacturers and others) and insurance requirements.

Over the past few years, the number of states passing legislation related to AVs has increased, with 16 states introducing legislation related to autonomous vehicles in 2015. This is up from 12 states in 2014, nine states and Washington, DC, in 2013, and six states in 2012.[1] In 2011, Nevada became the first state to authorize AV operation. Since then, five other states—California, Florida, Michigan, North Dakota and Tennessee (plus Washington, DC)—have passed

1. National Conference of State Legislatures, *"Autonomous Vehicles,"* May 26, 2016. *www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx*.

legislation related to AVs. Arizona's governor issued an executive order related to AVs.

Table 1 provides a summary of recent legislative activity. Today's laws on driverless cars deal primarily with testing them, and, according to one expert, it is not even clear that such legislation is necessary (Smith, 2016). Several states have attracted research activities for self-driving cars without specific legislation. In fact, while Google pushed for legislation to get things rolling in Nevada and California, it has pulled away from getting involved in the legislative process in other states due to restrictions imposed.

Table 1:
Synopsis of Self-Driving Car Legislation

State	Legislative Focus				
	Encourages development, research, innovation	Sets safety standards	Establishes testing requirements	Authorizes testing on public roads	Involves insurance regulation or liability
California	Enacted 2012 SB 1298	Enacted 2012 SB 1298	Enacted 2016 AB 1592	Enacted 2012 SB 1298	
Florida	Enacted 2012 HB 1207			Enacted 2016 HB 7027	Enacted 2012 HB 1207
Louisiana	Enacted 2016 HB 1143				
Michigan	Enacted 2013 SB 169		Enacted 2013 SB 169		Enacted 2013 SB 663
Nevada	Enacted 2011 AB 511				Enacted 2013 SB 313
North Dakota	Enacted 2015 HB 1065				
Tennessee	Enacted 2015 SB 598	Enacted 2016 SB 1561			
Utah		Enacted 2016 HB 280	Enacted 2015 SB 373		
Washington, DC	Enacted 2013 DC B 19-0931				

According to a 2016 study by the RAND Corporation, all of the enacted regulations similarly define AVs as vehicles with the capability to self-drive without being actively controlled or monitored by a human operator. An operator is defined as the person who engages the technology. This excludes vehicles enabled with active safety systems or driver assistance systems, such as "blind spot" assistance or crash avoidance systems.

In anticipation of the future commercialization of driverless cars, Nevada's law (NAC-482A) requires the driver of an AV to obtain a "certificate of compliance," either from the manufacturer of the vehicle or from a state-certified technology certification facility, if the vehicle operates in non-testing mode. It is the only state to have done so, to date. The compliance certificate identifies the specific geographic location where the licensee can test the vehicle. It also requires

special temporary license plates for each AV and stipulates that two people must be in the car at all times.

Despite the progress made in passing legislation to speed up AV adoption, there are roadblocks. For example, following an unfavorable report while the bill was in committee, Maryland's proposed legislation to establish a task force on self-driving vehicles failed—twice. An additional 14 states are continuing to address the issues surrounding testing of the vehicles and determining liability (CyberLaw).

Since 2012, several of the state legislatures have considered bills that related to autonomous vehicles. These bills had varied experience in their passage toward becoming laws. The bills that have been passed are summarized in Table 1.

The bills can be evaluated on five criteria:

1. Did the bill encourage the development of autonomous vehicles? Did it assist in creating a climate for research and innovation?
2. Did the bill address safety standards related to the operation of autonomous vehicles?
3. Did the bill specifically allow testing of the vehicles being developed?
4. Did the bill allow operation or testing on public roads?
5. Did the bill speak to any specific insurance requirements related to autonomous vehicles?

California is the only state with a law that addresses all of these issues. Other states with successful legislative efforts related to one of these criteria are Florida, Michigan, Nevada, North Dakota, Tennessee and Utah. Few of the laws directly address insurance issues. Most of the laws encourage the development of autonomous vehicles and/or establish safety standards, with the safety standards usually being the requirement to have an "over-ride" system in the vehicle so that a human operator can take over in an emergency situation.

Although some of the laws allow the use of public roads for testing and/or regular operation, few included specific insurance standards. An interesting feature of many of the laws is products liability protection for the vehicle manufacturer. This applies in any case where the seller or user modifies a vehicle.

During 2015 and 2016, state legislatures in California, Georgia, Hawaii, Illinois, Maryland and Texas attempted to pass legislation. However, most of these efforts have failed. Two interesting provisions have appeared in a number of these bills. The first is prohibition of local governments from regulating AVs. The second concerns guidelines for punishment of persons who access the electronic system of an AV inappropriately. Bills attempted in 2016 are summarized in Table 2.

Regulators around the world are dealing with similar issues. The United Kingdom's (UK) Department of Transport released a review of its existing regulations for AV technologies and concluded that its legal and regulatory frameworks were not barriers to testing AVs on public roads (DOT, 2015). Germany and Sweden have reviewed their legislation as well.

Table 2:
2016 Attempted Legislative Activity

State	Legislative Focus				
	Encourages development, research, innovation	Sets safety standards	Establishes testing requirements	Authorizes testing on public roads	Involves insurance or liability
Alabama	Failed S 178				
Georgia	Failed S 113			Failed S 113	Failed S 113
Hawaii	Failed H 2687	Failed S 630			
Illinois	Passed House, in Senate H 3136				
Massachusetts	New draft pending H 4321/ S 1841				
Maryland	Failed H 8/S 126				

Driverless vehicles can legally be tested on public roads in the UK, providing a test driver is present and takes responsibility for the safe operation of the vehicle. Drivers are not limited to a test track, do not need certificates or permits, and are not required to provide a surety bond. They are required to have insurance. The report's findings declared that the country is "positioned to become a premium global location for the development of these technologies" (UK Dept. of Transport, 2015). The UK also has developed a Code of Practice for those testing driverless vehicles, published in 2015 (Department for Transport, 2015). It outlines general and safety requirements for vehicles and drivers.

Liability and Insurance-Related Regulation

The number of car crashes is expected to drop significantly as more crash avoidance technology becomes commonplace. However, the cost of replacing damaged vehicles is likely to rise due to the complexity of the electronics and other components needing repair. As such, the frequency of crashes will decline, but the severity costs remain unknown. Additionally, the advent of AVs brings an expectation that personal liability will decrease, since this technology can reduce human error, ultimately resulting in fewer vehicle crashes. But, exposure for manufacturers and product developers may increase if system failures are determined to be the cause of more and more accidents.

These changes in the distribution of crashes and who is responsible will likely affect how automobiles are insured in the future. It is easier to estimate costs of common occurrences rather than rare ones. Crashes involving AVs will be rare, and the data available to date is related to test-driving, not actual day-to-day operation. It may take decades to generate enough AV data to properly price coverage. However, insurance companies cannot wait decades to make coverage decisions related to AV technology as consumers, technology developers, car manufacturers and regulators may be looking for insurance solutions soon.

The 2016 RAND study suggested that the shift in responsibility from the driver to the manufacturer may make a case for a form of no-fault automobile insurance. Product-liability lawsuits are more expensive and time-consuming than car crash lawsuits, so a no-fault system that quickly compensates victims without assigning fault may be viable. Others foresee something akin to the federal National Childhood Vaccine Injury Act, a no-fault compensation program for vaccine recipients who suffer an adverse reaction. The 1986 legislation was in response to concerns that the availability of the life-saving vaccines would diminish because of the threat of injury claims.

Liability insurance is likely to evolve over time, as lawsuits make their way through the legal system and a precedence is set. Cusack (2016) suggests that there are numerous factors to consider in settling claims involving AVs, including whether there was a technology failure or an operator failure. With the lack of existing data and the continued advances in technology, it may be that more questions exist at this time than solutions. For example, how would a case be handled if a driver, one not operating an AV, causes an accident? Will we strengthen mandatory bodily injury liability and medical payments coverages so that "fault" is not at the core of recovery?

Additionally, uninsured motorist (UM) coverage may become obsolete. Physical damage coverage also may change. This coverage may become mandatory given the potential costs of repairs to expensive, critical systems that would be needed to get vehicles back on the roadway. An alternative would be to require "critical repair" coverage be included in the purchase costs of vehicles. Zelle and Whitehead (2014) describe a similar process with regard to developing new contracts and coverages for cyber liability exposure.

The Insurance Information Institute (III) notes the impact on insurance for driverless cars includes not just regulation and liability, but also underwriting criteria and repair costs (Driverless Car Market Watch, 2016). Many of the traditional underwriting criteria—such as number and kind of accidents an insured has had, the miles driven annually and where the car is garaged—will still apply. But the make, model and style of car may assume greater importance. The implications of where the car is garaged and driven might be different if there are areas set aside for automated driving, such as dedicated highway lanes.

Shared driving between human and machine will make the liability issues even more complicated. During the transition to fully automated driving, insurers may try to rely more on telematics, the "black boxes" that monitor driver activity. Use of telematics is forecasted to grow, and it has the advantage of using

individual and current driving behaviors, rather than relying on past trends (National Association of Insurance Commissioners, July 2016).

In terms of insurance regulation for autonomous vehicles, regulators may face some significant challenges similar to those can be restrictive or helpful. Though states can set their own rules, what is to be the framework? "Regulators will either let self-driving cars on U.S. roads or cede the testing to others" (Crovitz, 2016). Harrington (2016, p.33) decried "excessive conservatism" in getting new products and services to market. He suggested that insurance regulators focus on being helpful rather than being restrictive. Fier, et al (2014) made the similar argument in a paper on reforms of the federal flood insurance program.

When self-driving cars become mainstream, every driver ultimately will benefit since fewer car crashes and fatalities will lower the cost of insurance. But AVs will not eliminate the need for insurance; the shift in liability from the driver to the automaker or manufacturer of the AV technology raises the probability that insurance becomes a standard feature, part of the purchase price of a self-driving vehicle. Determining fault for a car accident will be less of an issue when AV technology is a witness that can sort it all out. However, the sales price of the AV must reflect this liability, which adds to the new-car purchase price and could slow down sales. States still have quite a bit of work to do in the meantime. Many have seen their entry into the AV realm curbed by trying to come up with a definition of the word "driver" in a future where that word is not about a human behind the wheel. *The Week*, quoting *The Wall Street Journal*, suggested that the decline might be as much as 80% of the current $200 billion in premiums for auto insurance. The article also noted that the auto insurance industry is spending substantial sums on research into autonomous cars and forming partnerships with auto manufacturers (Scism, July 2016). Does that create the possibility that auto insurance will come with the car?

Conclusion

The vast majority of automobile accidents are caused by human error. As driver assistance devices advances and support of self-driving automotive technology continues, an evolution to FAVs is on the horizon. While there are some clear advantages to FAVs, such as reduced accident frequency, there also may be some challenges.

Currently, Tesla and Google have invested millions as "first movers" and have gained a market advantage. Both are working to find the best guidance system, preferably one that minimizes human participation and driver error. Tesla and Google have been joined in the market by BMW, Ford, GM, Volvo and Uber.

The fact is the technology for the autonomous car is advancing faster than laws and regulations related to the "use, ownership and maintenance" of the car. This puts both the legal system and the regulatory structure in a reactive position. The tort system has proven to be an expensive place to test new technologies, but

the autonomous car will be judged there. Insurance regulators may have to work to catch up in an environment where each state can set its own rules.

The technology for the autonomous car is also advancing faster than operator ability and attitude. The "freedom of the road" is a core American value, and some operators want maximum opportunity to control the vehicle or, at least, some aspects of its operation. A preventable fatality involving a Tesla was related to driver error, something the designers hoped to minimize. This will involve continuous educational efforts—and time.

Finally, progress toward a world of self-driving cars will mean the automobile insurance industry may see a substantial change in how coverage is provided, which could ultimately affect premiums. Since auto insurance is the largest component of property and liability insurance premiums, insurer profits also may decline.

As far back as the 1950s, there was a dream of "pilotless" flying vehicles. As we approach perfecting the AV, will we move on the roadways with electronic sensors? Will the term "traffic engineer" take on a new meaning? The roadblock to manufacturers is a 50-state regulatory system that could, in essence, bring 50 different sets of rules that would be nearly impossible for auto manufacturers to comply with. Think of it as similar to a roadway infrastructure for self-driving cars that ends at the state line, another possible hazard to the process. The need for some consistency is clear.

References

Anderson, J., *et al.*, 2016. "Autonomous Vehicle Technology: A Guide for Policymakers," RAND Corporation.

"Automated Driving: Legislative and Regulatory Action," accessed at *http://cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action.*

"Autos: Self-Driving Cars Cause Their First Fatality," 2016. *The Week*, online edition.

Boudette, N.E., 2016. "Tesla Faults Brakes, but Not Autopilot, in Fatal Crash," *The New York Times*, accessed at *www.nytimes.com/2016/07/30/business/tesla-faults-teslas-brakes-but-not-autopilot-in-fatal-crash.html*.

Colias, M., 2016. Automotive News, January 12, 2016. "GM Delays Super Cruise Rollout," *Automotive News*, accessed at *www.autonews.com/article/20160112/OEM04/160119857/gm-delays-super-cruise-rollout*.

Crovitz, L., 2016. "Humans: Unsafe at Any Speed," *The Wall Street Journal*, online edition.

Cusack, D., 2016. "Autonomous Vehicles: A Case Study of Liability and Insurance," Farella Braun + Martell LLP, accessed at *http://www.farellacoveragelaw.com/2016/07/autonomous-vehicles-case-study-liability-insurance.html/*.

Driverless Car Market Watch, 2015. "Top Misconceptions of Autonomous Cars and Self-Driving Vehicles," accessed at *www.driverless-future.com/?page_id=774*.

Fier, S., K. Gatzlaff, and D. Pooser, 2014. "The State of the National Flood Insurance Program: Treading Water or Sinking Fast?" *Journal of Insurance Regulation*, 33 (5): 1–40.

Gomes, L., 2016. "Silicon-Valley Driven Hype for Self-Driving Cars," *The New York Times*, accessed at *http://nyti.ms/29KiYbY*.

Harrington, S., 2015. "The Economics and Regulation of Captive Reinsurance in Life Insurance," *Journal of Insurance Regulation*, 34(10): 1–37.

IEEE, 2014. "IEEE Survey Reveals Mass-Produced Cars Will Not Have Steering Wheels, Gas/Brake Pedals, Horns, or Rearview Mirrors by 2035," accessed at *https://www.ieee.org/about/news/2014/14_july_2014.html*.

Marshall, A., 2016. "BMW's Bold Plan to Make a Fully Self-Driving Car by 2021," *Wired*, accessed at *https://www.wired.com/2016/07/bmws-bold-plan-make-fully-self-driving-car-2021/*.

Markoff, J., 2014. "Google's Next Phase in Driverless Cars: No Steering Wheel or Brake Pedals," accessed at *www.nytimes.com/2014/05/28/technology/googles-next-phase-in-driverless-cars-no-brakes-or-steering-wheel.html*.

National Conference of State Legislatures, 2016. "Autonomous/Self-Driving Vehicle Legislation," *accessed at www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx.*

National Highway Traffic Safety Administration, 2015. "Traffic Safety Facts," accessed at *www-nrd.nhtsa.dot.gov/pubs/812115.pdf*.

National Association of Insurance Commissioners, 2016. "Usage-Based Insurance and Telematics," accessed at *www.naic.org/cipr_topics/topic_usage_based_insurance.htm*.

National Safety Council, 2016. "NSC Motor Vehicle Fatality Estimates," accessed at *www.nsc.org/NewsDocuments/2016/mv-fatality-report-1215.pdf*.

Scism, L., 2016. "Driverless Cars Threaten to Crash Insurers' Earnings," *The Wall Street Journal*, accessed at *www.wsj.com/articles/driverless-cars-threaten-to-crash-insurers-earnings-1469542958*.

Smith, B.W., 2016. "How Governments Can Promote Automated Driving," University of South Carolina, School of Law.

Solomon, B., 2016. "Obama Boosts Self-Driving Cars With $4 Billion Investment," *Forbes*, accessed at *www.forbes.com/sites/briansolomon/2016/01/14/obama-boosts-self-driving-cars-with-4-billion-investment/#4db411ce4eda*.

Tesla Motors Press Kit, Model S Software Version 7.0, accessed at *https://www.tesla.com/presskit/autopilot*.

The RAND Corporation, 2016. "Autonomous Vehicle Technology: A Guide for Policymakers," accessed at *www.rand.org/pubs/research_reports/RR443-2.html*.

UK Department of Transport, 2015. "Code of Practice for Testing of Automated Vehicle Technology," accessed at *https://www.gov.uk/government/publications/automated-vehicle-technologies-testing-code-of-practice*.

U.S. Department of Transportation, (NHTSA 14-13), 2013. "Policy on Automated Vehicle Development," accessed at *www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Automated+Vehicle+Development*.

U.S. Department of Transportation, 2016. "Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety," accessed at *https://www.transportation.gov/AV/federal-automated-vehicles-policy-september-2016*.

U.S. Department of Transportation, 2015. "The Pathway to Driverless Cars: A Detailed Review of Regulations for Automated Vehicle Technologies," accessed at *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401565/pathway-driverless-cars-main.pdf*.

U.S. Department of Transportation, 2016. "U.S. Department of Transportation Announces Columbus as Winner of Unprecedented $40 Million Smart City Challenge," Briefing Room, accessed at *https://www.transportation.gov/briefing-room/us-department-transportation-announces-columbus-winner-unprecedented-40-million-smart*.

Vlasic, B. and N.E. Boudette, 2016. "Self-Driving Tesla Was Involved in Fatal Crash, U.S. Says," *The New York Times*, accessed at *www.nytimes.com/2016/07/01/business/self-driving-tesla-fatal-crash-investigation.html*.

Quain, J., 2016. "Not Everyone's Ready to Give Up the Wheel," *The New York Times*, B4.

Sivak, S., and B. Schoettle, 2016. "A 16-Year-Old Needs a License. Shouldn't a Self-Driving Car?" *The New York Times*, accessed at *http://nyti.ms/29AmPpF*.

Zelle, A., and S. Whitehead, 2014. "Cyber Liability: It's Just a Click Away," *Journal of Insurance Regulation*, 33(6): 1–34.

Journal of Insurance Regulation

Guidelines for Authors

Submissions should relate to the regulation of insurance. They may include empirical work, theory, and institutional or policy analysis. We seek papers that advance research or analytical techniques, particularly papers that make new research more understandable to regulators.

Submissions must be original work and not being considered for publication elsewhere; papers from presentations should note the meeting. Discussion, opinions, and controversial matters are welcome, provided the paper clearly documents the sources of information and distinguishes opinions or judgment from empirical or factual information. The paper should recognize contrary views, rebuttals, and opposing positions.

References to published literature should be inserted into the text using the "author, date" format. Examples are: (1) "Manders et al. (1994) have shown. . ." and (2) "Interstate compacts have been researched extensively (Manders et al., 1994)." Cited literature should be shown in a "References" section, containing an alphabetical list of authors as shown below.

Cummins, J. David and Richard A. Derrig, eds., 1989. *Financial Models of Insurance Solvency*, Norwell, Mass.: Kluwer Academic Publishers.

Manders, John M., Therese M. Vaughan and Robert H. Myers, Jr., 1994. "Insurance Regulation in the Public Interest: Where Do We Go from Here?" *Journal of Insurance Regulation*, 12: 285.

National Association of Insurance Commissioners, 1992. *An Update of the NAIC Solvency Agenda*, Jan. 7, Kansas City, Mo.: NAIC.

"Spreading Disaster Risk," 1994. *Business Insurance,* Feb. 28, p. 1.

Footnotes should be used to supply useful background or technical information that might distract or disinterest the general readership of insurance professionals. Footnotes should not simply cite published literature — use instead the "author, date" format above.

Tables and charts should be used only if needed to *directly support* the thesis of the paper. They should have descriptive titles and helpful explanatory notes included at the foot of the exhibit.

Papers, including exhibits and appendices, should be limited to 45 double-spaced pages. Manuscripts are sent to reviewers anonymously; author(s) and affiliation(s) should appear only on a separate title page. The first page should include an abstract of no more than 200 words. Manuscripts should be sent by email in a Microsoft Word file to:

Cassandra Cole and Kathleen McCullough
jireditor@gmail.com

The first named author will receive acknowledgement of receipt and the editor's decision on whether the document will be accepted for further review. If declined for review, the manuscript will be destroyed. For reviewed manuscripts, the process will generally be completed and the first named author notified in eight to 10 weeks of receipt.