Legal Aspects of Autonomous Vehicles – an Overview

Legal aspects of autonomous vehicles – an overview*

Viktória Ilková
Faculty of Law
Comenius University in Bratislava
Slovak Republic
viktoria.ilkova1991@gmail.com

Adrian Ilka
Department of Signals and Systems
Chalmers University of Technology
Gothenburg, Sweden
adrian.ilka@chalmers.se

***Abstract*—The main goal of this article is to provide up-to-date information about legal regulation of autonomous vehicles (AVs) in Europe and the United States of America (U.S.). The legal overview is primarily intended for technical professionals for the purpose of giving them a holistic approach to AVs. The authors believe that technical professionals have to be aware of legal regulation of AVs as well in order to get the opportunity to discuss the feasibility of different legal statements.**

Besides the definition of AVs based on levels of automation, the article also contains answers to following questions: What are the greatest benefits of AVs? How does the general road traffic law need to be changed to allow the use of AVs on public roads? What are the differences between the current state of AV regulations in the U.S. and Europe? Finally, the paper draws attention to the most significant legal challenges that AVs address to lawmakers, insurance companies, consumers, and last but not least, car manufacturers.

Keywords—autonomous vehicle; traffic law; legal challenges; liability

I. INTRODUCTION

Artificial intelligence, robots, 3D tissue printing, autonomous vehicles. A few years ago we met these modern technical innovations only in science fiction movies. However, nowadays these inventions have become reality and in the near future they will surround us more and more, until they will be part of our lives [1], [2], [3], [4]. Though, the everyday use of autonomous vehicles might seem futuristic, prognoses predict their wide use in the near future [5].

According to the most general definition, an autonomous vehicle (AV) is such a vehicle that can guide itself without human conduction [6]. Use of the term "autonomous" in connection with motor vehicles has sometimes been misunderstood because in some areas of law the concept of "autonomy" is associated with broad philosophical concepts. In contrast, the word "autonomous" in a technical context simply means (more or less) that it works independently of human input while driving. An "autonomous system" is therefore a technical unit which fulfills certain tasks without being dependent regular human commands [7]. A more specific definition of AVs is provided by SAE International[1] through stating levels of automation. The extent of automation depends on the human driver's role in performing the dynamic driving task (see Chapter II.) [8].

According to statistical information provided by the Police Force of the Slovak Republic, there are on average 14 000 road traffic accidents in Slovakia per year causing over 7 000 personal injuries, from which ca 300 are fatalities[2] [9]. Developers of autonomous technology estimate that autonomous vehicles could reduce traffic fatalities by 90%, which would mean 270 saved lives per year in Slovakia [10]. The benefits do not stop with safety. Autonomous vehicles have the potential to transform personal mobility and open doors to people with disabilities, aging populations, and communities where car ownership is prohibitively expensive, or those who prefer not to drive or own a car. Cities will reconsider how space is utilized and how public transit is provided. Infrastructure capacity could be increased without pouring a single new truck load of concrete. Autonomous vehicles may also have the potential to save energy and reduce air pollution from transportation through efficiency and by supporting vehicle electrification [11].

In Europe, cities in Belgium, France, Italy and the UK are planning to operate transport systems for driverless cars, and Germany, the Netherlands, and Spain have allowed testing self-driving cars in traffic [12], [13]. The Swedish car manufacturer company, Volvo has started to test 100 of its autonomous cars on public roads driven in normal traffic by regular clients by 2017. The company announced a collaboration with Swedish legislators and transport authorities to test the cars on a 30-mile road section around Gothenburg by 2017, marking Volvo's first public pilot of fully autonomous vehicles. Analysts predict that completely autonomous cars will be for sale by 2025-2030 [14], [15].

As autonomous technology gradually erodes driver control, the law must be altered in its code and its implementation. It is a significant challenge; but not an insurmountable one. Therefore, any research question related to the legal regulation of autonomous vehicles is increasingly necessary and required, especially in Europe. One of the most important and considerable issues is liability of autonomous vehicles. The research within this topic is currently ongoing in U.S. and Europe as well. This has been reported recently in several publications [16], [17].

* This work was supported by the Chalmers Area of Advance Transportation, by Vinnova under the FFI project MultiMEC and by Vinnova under FFI project VCloud II, which is gratefully acknowledged.

[1] SAE International (Society of Automotive Engineers) is a global association committed to being the ultimate knowledge source for the engineering profession.

[2] The average values are calculated based on data from 2011 to 2016. Statistical information is available online, at the Slovak Ministry of Interior's webpage.

In a European context, a new project called AdaptIVe (Automated Driving Applications and Technologies for Intelligent Vehicles) [18], has been established. The project has many participants, mainly research institutions, including some legal research groups. One of the most significant participants is legal scholar Professor Eric Hilgendorf. At his research center, called "RobotRecht", he manages the Europe-wide research on legal implications of autonomous vehicle systems. As it is evident from the center's publications, the research also covers the issue of liability [19].

The significance of this research area is proved by numerous studies (as it can be seen in the references). Inter alia, in early 2014, IHS Automotive released "Emerging Technologies: Autonomous Cars – Not If, But When", a study projecting a global total of nearly 54 million autonomous cars by 2035, and predicting that almost all of the vehicles in use are likely to be autonomous cars or autonomous commercial vehicles sometime after 2050 [20]. The result will be a driving environment that is far safer than what we are accustomed to today.

II. Levels of Automation

Before dealing with any further research questions related to AVs, it is particularly necessary to acquire a sort of taxonomy stating clear and categorical distinctions between different modes (levels) of automation.

The mentioned taxonomy can significantly help to easily differentiate AVs depending on who is responsible for monitoring the driving environment.

Furthermore, stating clear levels of automation eliminates confusion and is useful across numerous disciplines (engineering, legal, media, and public discourse).

As mentioned in the Introduction, a global association of automotive engineers called SAE International carried out a report concerning levels of automation for defining driving automation in on-road motor vehicles (also known as standard J3016™) [8]. It has been adopted in September 2016 by the U.S. Department of Transportation in Federal Policy for safe testing and deployment of AVs [21]. Furthermore, the organization signed an agreement with the German Institute of Standardization, which fortifies the acceptance of SAE automation levels as the global standard [22]. Thus, it has become "the core reference and a guideline for all stakeholders in this transformational technology".[3]

The report defines six levels of driving automation span from no automation to full automation. Elements indicate minimum system capabilities for each level. A key distinction is between level 2, where the human driver performs part of the dynamic driving task, and level 3, where the automated driving system performs the entire dynamic driving task. The term "dynamic driving task" includes the operational (steering, braking, accelerating, monitoring the vehicle and roadway) and tactical (responding to events, determining when to change lanes, turn, use signals, etc.) aspects of the driving task, but not the strategic (determining destinations and waypoints) aspect of the driving task [8].

TABLE 1 SUMMARY TABLE ON LEVELS OF AUTOMATION (Copyright © 2014 SAE International).

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/ Deceleration	Monitoring of Driving Environment	Fallback Performance of Dynamic Driving Task	System Capability (Driving Modes)
***Human driver* monitors the driving environment**						
0	**No Automation**	the *full-time* performance by the *human driver* of *all aspects* of the dynamic driving task, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	**Driver Assistance**	the 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	Human driver and system	Human driver	Human driver	Some driving modes
2	**Partial Automation**	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	**System**	Human driver	Human driver	Some driving modes
***Automated driving system* ("system") monitors the driving environment**						
3	**Conditional Automation**	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*	System	**System**	Human driver	Some driving modes
4	**High Automation**	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	System	System	**System**	Some driving modes
5	**Full Automation**	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	System	System	System	**All driving modes**

[3] Quoted from David L. Schutt, PhD, Chief Executive Officer of SAE International.

III. Road Traffic Law in the United States and Europe

A. United States of America

Foremost, the United States (hereinafter U.S.) dealt with the issue of legalizing autonomous cars. In June 2011, the Nevada Legislature passed a law to authorize the use of autonomous cars. Nevada thus became the first jurisdiction in the world where autonomous vehicles might be legally operated on public roads [23], [24]. Nowadays, most of the U.S. states deal with the basic legal status of autonomous vehicles [25].

In terms of the form of government, the U.S. is federation; therefore it is important to distinguish between actions carried out by the federal government, and those that have been taken by individual states.

As for the federal road traffic regulation, the National Highway and Transportation Safety Administration (NHTSA) issued an updated guidance for the safe development of AVs in September 2016 [21]. The policy update has four parts: vehicle performance guidelines, model state policy, NHTSA's current regulatory tools and possible new regulatory actions NHTSA believes could be helpful in ensuring the safe deployment of AVs. For potential AV manufacturers, the policy includes a set of 15 best practices regarding the safe pre-deployment design as well as development and testing of AVs prior to commercial sale or operation on public roads. (For more details, the reader is referred to the Appendix).

Regarding state actions since 2012, nine states (California, Florida, Louisiana, Utah, Michigan, North Dakota, Tennessee, Nevada, and Virginia) and Washington D.C. have passed legislation pertaining to AVs. In December 2016, an online legislative database was created, which provides up-to-date, real-time information about state AV legislation [27].

September 2016 was a turning point in terms of the state legislature as well: California transportation authorities made two major changes in their policy on autonomous vehicles. The first change, a new bill signed into law, gives the Contra Costa Transportation Authority permission to test a pilot project on public roads without having a driver behind the wheel. Prior to this, the state only allowed public road testing if a human driver was in the driver's seat and "capable of taking immediate manual control of the vehicle in the event of an autonomous technology failure or other emergency."

The bill requires the autonomous vehicles to be insured for $5 million, for the self-driving automobiles to not exceed 35 miles per hour on the road, and for testing data to be shared with the government and while placing geographic restrictions. Testing can only take place at two locations: at a former Concord Naval Weapons Station and current AV testing facility, and at the San Ramon Bishop Ranch office park.

The second change, revised draft regulations released by California's department of motor vehicles, can potentially change how all self-driving vehicles are tested in the state by rolling out the privileges given to the aforementioned pilot program. If the law were pass (it is still under legislative procedure) it will allow car manufacturers to test vehicles deemed safe by the federal government on public roads without licensed drivers. Instead of having a driver in the vehicle, the newly proposed regulations require that a test driver has two-way communication with a vehicle [28].

B. Europe

Concerning Europe, an examination of legislation in European Union (hereinafter EU) member countries involving major automotive industry partners – France, Germany, Spain, Sweden, and the United Kingdom – reveals that none of these countries currently has pertaining legislation connected to autonomous vehicles. Tests, however, are being carried out continuously and are expected to take place in several EU countries under ad-hoc legal permits [26].

Almost all EU member countries (with the exception of Spain and the United Kingdom) have signed and ratified the Convention on Road Traffic, also known as the Vienna Convention [29]. It is a multilateral international treaty of the United Nations dealing with general traffic law. Until 23 March 2016, any legislation adopted by a signatory of the Convention had to require a human driver to be in control of the moving vehicle at all times (see Article 8 par. 1, 5 and Article 13 par. 1).[4] In 2016, a new paragraph called '5bis' was added to Article 8.[5] As a result, automated vehicles will be compliant with the Vienna Convention following the amendment, provided that the system can be overridden by the driver, or fulfils (future) requirements of the ECE regulations.[6] Sweden and Belgium made some further amendment proposals that are still waiting to be decided upon[7] [30].

While Europe has certainly not been left behind in the race of technical development of advanced autonomous vehicles, the pressure is now rising for lawmakers, insurance companies and manufacturers tasked with addressing legal and regulatory questions which, until recently, have been left unanswered.

---

[4] Article 8 paragraphs 1 and 5 of the Vienna Convention require that "[e]very moving vehicle or combination of vehicles shall have a [person] driver," and "[e]very driver shall at all times be able to control his vehicle." Article 13 paragraph 1 further requires that "[e]very driver of a vehicle shall in all circumstances have his vehicle under control so as to be able to exercise due and proper care and to be at all times in a position to perform all maneuvers required of him."

[5] It is worded as follows: "Vehicle systems which influence the way vehicles are driven shall be deemed to be in conformity with paragraph 5 of this Article and with paragraph 1 of Article 13, when they are in conformity with the conditions of construction, fitting and utilization according to international legal instruments concerning wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles (a footnote here refers to the ECE Agreement of 1958 and the GTR Agreement of 1998).
Vehicle systems which influence the way vehicles are driven and are not in conformity with the aforementioned conditions of construction, fitting and utilization, shall be deemed to be in conformity with paragraph 5 of this Article and with paragraph 1 of Article 13, when such systems can be overridden or switched off by the driver."

[6] ECE (Economics Commission for Europe) 1958 Agreement, and 1998 Agreement on Global Technical Regulations.

[7] The proposals call for a redesign of Article 8 paragraph 5bis as well as the addition of two further paragraphs - "5ter" and "5quater" – to Article 8. They intend to distinguish between automated driving functions that take over part of the task of driving, the complete task of driving for a certain section of the journey or the complete task of driving for the whole journey, from beginning to end.

IV. LEGAL CHALLENGES IN THE EUROPIAN KONTEXT

A. Administrative Law

Legal issues related to AVs belong to the scope of mainly three branches of law. One of them is administrative law, which includes especially road traffic law in general (it covers among others issues such as certification and licensing, technical controls, road traffic rules, etc). It deals with stating technical norms as well. The most important legal challenges related to autonomous driving in the area of administrative law are following:

- Does autonomous driving have to require special driving license? If so, shall it be national or international? Shall an AV driver ("user") be required to have a driving license at all? Do there have to be any age requirements for AV users? (Or a requirement to be sober?)
- Should autonomous driving be allowed everywhere (on all roads and every regions)? Should it be mandatory on special roads or dedicated lanes?
- Does autonomous driving have to follow all traffic rules? If an AV violates a traffic rule, does it have to self-report to authorities?
- Should there be an external indicator on the vehicle when autonomous driving is engaged?

The research focusing on these questions is currently ongoing as the main object of the first author's rigorous thesis.

B. Civil Law

Civil law covers a wide range of legal challenges related to AVs. The most significant challenge is connected with the issue of civil liability. It includes on the on hand liability for damage and/or injury, which is further connected with insurance issues, and on the other hand, there is product liability (a specific type of liability for damage and/or injury, caused by a defective product).

In this regard, an article from a German insurance journal is worth mentioning [5]. In the article, the author outlines two possible conceptual approaches that would contribute to reach clear liability rules pertaining to AVs and clear insurance coverage. Furthermore, it would result in minimization of litigation. The first approach is based on a compulsory motor third party liability (MPTL) insurance under the regime of strict liability by mandating AV manufacturers to contribute a portion of the insurance for each individual vehicle. However, manufacturers would be exempted from product liability for injury and damage that is covered under the compulsory MPTL insurance regime and that was caused by a product defect affecting AV functionality, unless the defect is the result of gross negligence. This approach is rather theoretical than pragmatic due to possible administration difficulties.

According the second approach, which suggests product liability to be further sharpened, the requirement of a product defect should be omitted. Instead, the manufacturer should be held liable for injury and damage caused by the way goods acted (i.e. the way of their actions and behavior; their effect; and the failure of the goods to act or to behave in a particular way, or to have a particular effect). The main argument for this approach is the following: while AVs will be much safer than conventional cars, the technology in the product is so complex that there is an uncontrollable residual risk of malfunctioning even when the product is free from defects. Hence, the legislation should introduce an irrefutable presumption of a defect in a highly or fully automated vehicle that causes an accident, unless the manufacturer can prove that the autonomous vehicle functionality was not the cause of the accident. The MTPL regime would in this alternative remain identical to the first approach, except that manufacturers would not be incorporated into the MTPL system.

C. Criminal Law

Autonomous driving-inspired legal challenges in the area of criminal law include especially the issue of criminal responsibility as well as protection against cybercrime and hackers. In general, research in this area is dealing with the following questions:

- What crimes may be committed in context of autonomous vehicles?
- Who should be held responsible in case when using an AV a crime is committed (the owner of the vehicle; the person who is sitting in the driver's seat – if there is any kind of it; the vehicle manufacturer; the mechanic who mounted the autonomous technology to the vehicle or another entity)?
- The incidents may happen under various circumstances. Will the responsible subject change depending on these circumstances and if so, how? What are basic model scenarios of incidents related to the use of autonomous vehicles?
- How should the law react, if the criminally responsible subject is a legal entity?

As for the criminal responsibility for harm caused by an AV, according to most European states' criminal codes, the driver (or vehicle owner) may be charged with negligence even if the AV was in control (in autonomous mode). If no negligence is proved, the criminally responsible entity is the manufacturer. Since in most cases, a vehicle manufacturer is a legal entity, it is highly important to consider the issue of corporate criminal responsibility. The European Union countries do not have an identical legislation in this area. Some countries' criminal codes (including the Slovak republic as well) are built on the idea of personal guilt. These codes would definitely need an amendment. Hence, any research questions focusing on corporate criminal responsibility are on high importance.

According to the relevant statements of the Slovak Criminal Code,[8] a vehicle driver (resp. owner) may be held criminally responsible for causing death, harm (or creating danger for another) by negligence, even if the autonomous vehicle was in control [31]. It means that the driver acted negligently, i.e. failed to exercise reasonable care. But what constitutes reasonable care for the driver? Checking the functioning of the elements of the car's autonomous systems at regular intervals? If so, the driver may be blamed because s/he failed to examine properly whether the sensors or the autonomous technology were functioning correctly before the car was starting a journey. May the law require the driver to

[8] Chapters 149, 157, 285 of Act of the Slovak republic No. 300/2005 Coll. Criminal Code, as amended.

look under the algorithm hood? This statement results in the following dilemma: autonomous systems are installed into the car to relieve the driver of various driving tasks; however, the driver remains responsible for monitoring that the autonomous system is performing the driving tasks correctly, and, where necessary, taking corrective actions. Therefore, the driver is not allowed to pursue other activities like reading an email or watching a film, let alone work or sleep at the same time he is 'in control' of the car. The potential utility of the autonomous system for the driver (but not for road safety in general) is therefore significantly reduced [7].

As mentioned above, by the use of autonomous vehicles, the most potential crimes that may arise are mainly crimes against life and health (especially unintentional offences, such as causing another's death, causing bodily injury or illness or creating danger to another). /In context of intention, it is also an interesting question, whether a fully AV can commit an intentional crime/. However, it must not be forgotten about a relatively new phenomenon, the cybercrime. Since AVs are governed by a kind of software facility, which can be an object of several hacker attacks, it is specifically important to ensure an adequate protection to vehicle users. This protection has two aspects: on the one hand, the criminal aspect – protection against cybercrime provided by criminal codes, and on the other hand, it is the development of appropriate security system regulated by technical norms and standards.

V. Conclusion

Legal regulation of autonomous vehicles is a fairly complex object of research, all the more exciting, though. The most significant benefit of autonomous vehicles is a much safer driving environment. Accidents, however, will always be an aspect of motor vehicle travel and it must be decided who is to be held responsible in such cases.

European Union countries have a legal framework that will be well equipped to address and adapt to all the mentioned challenges in legal regulation of autonomous vehicles that arise in the coming years. Some (not radical) legislative adjustments will probably be needed. However, having considered the massive reduction of injuries and fatalities caused by road accidents, and the other benefits of the autonomous technology, it is absolutely worth making those legal changes that will lead to clearer rules and practical reality.

This in turn requires a broad cooperation of lawmakers and technical professionals in order to achieve the most appropriate solutions. That is exactly what we attend to call for by the main contribution of the article which is giving a brief insight to some legal aspects of autonomous vehicles for technical professionals.

Appendix

Federal Automated Vehicles Policy issued by the U.S. National Highway Traffic Safety Administration (NHTSA)

1. Vehicle Performance Guidance for Automated Vehicles

It is a 15 point "Safety Assessment" for the safe design, testing and deployment of automated vehicles. The manu-facturer shall send in a statement addressing the 15 points below. There is no formal approval process.

- *Operational Design Domain:* How and where the highly automated vehicle (HAV) is supposed to function and operate;
- *Object and Event Detection and Response:* Perception- and response functionality of the HAV system;
- *Fall Back (Minimal Risk Condition):* Response and robustness of the HAV upon system failure;
- *Validation Methods:* Testing, validation, and verification of an HAV system;
- *Registration and Certification:* Registration and certification to NHTSA of an HAV system;
- *Data Recording and Sharing:* The HAV system's data recording for information sharing, knowledge building and for crash reconstruction purposes;
- *Post-Crash Behavior:* Process for how an HAV should perform after a crash and how automation functions can be restored;
- *Privacy:* Privacy considerations and protections for users;
- *System Safety:* Engineering safety practices to support reasonable system safety;
- *Vehicle Cybersecurity:* Approaches to guard against vehicle hacking risks;
- *Human Machine Interface:* Approaches for communicating information to the driver, occupant and other road users;
- *Crashworthiness:* Protection of occupants in crash situations;
- *Consumer Education and Training:* Education and training requirements for users of HAVs;
- *Ethical Considerations:* How vehicles are programmed to address conflict dilemmas on the road; and
- *Federal, State and Local Laws:*

2. Model State Policy

It contains recommended policy areas for states to consider, with a goal of generating a consistent national framework for the testing and deployment of HAVs. States can set up the following administrative structure and processes to administer requirements regarding the use of public roads for HAV testing and deployment in their states:

- Application by manufacturers or other entities to test HAVs on public roads;
- Jurisdictional permission to test;
- Testing by the manufacturer or other entities;
- Drivers of deployed vehicles;
- Registration and titling of deployed vehicles;
- Law enforcement considerations; and
- Liability and insurance.

The federal government is hoping that the states will adopt this policy. It would avoid a patchwork of state laws.

3. Current Regulatory Tools of the Department of Transportation (DOT) that can be used to accelerate the safe development of HAVs. The federal government will explore how the existing regulatory tools can be applied to the autonomous driving (AD) development.

- Interpretations;
- Exemptions;
- Rulemakings;
- Enforcements.

4. Modern Regulatory Tools

Considered New Authorities

NHTSA is looking into new ways to regulate the AD development, such as:

- *Safety Assurance:* Pre-market testing, data and analyses to DOT to demonstrate that organization's design, manufacturing and testing processes apply NHTSA's vehicle performance guidance.
- *Pre-Market Approval:* Pre-market approval authority, in which the government inspects and affirmatively approves new technologies, would be a departure from NHTSA's current self-certification system. The merits and challenges of implementing some form of a pre-market approval are discussed.
- *Cease and Desist:* Require manufacturers to take immediate action to mitigate safety risks that are so serious and immediate that they constitute "imminent hazards."
- *Expanded Exemptions:* Raising the cap on the number of vehicles subject to exemption and/or the length of time of exemptions, to facilitate the safe testing and introduction of HAVs.
- *Post-sale Regulation of Software Changes:* Regulate post-sale software changes in HAVs.

Considered New Tools

- *Variable Test Procedures:* Expand vehicle testing methods to create test environments more reflecting real-world environments.
- *Functional and System Safety:* Make mandatory the 15-point Safety Assessment envisioned in the first section (Vehicle Performance Guidance).
- *Regular Reviews:* Regular reviews of standards and testing protocols to keep current with the development of technology.
- *Additional Recordkeeping and Reporting:* Require additional reporting about HAV testing and deploy-ment.
- *Enhanced Data Collection:* Enhance data recorders and greater reporting requirements about the performance of HAVs.

REFERENCES

[1] J. L. le Moigne, "Advances in artificial intelligence-II," European Journal of Operational Research, vol. 36, no. 2, 1988, pp. 274-275.

[2] H. Cuayáhutil, K. Komatani, G. Skantze, "Introduction for Speech and language for interactive robots," Computer Speech & Language, vol. 34, no. 1, 2015, pp. 83-86.

[3] F. Pati et al., "Biomimetic 3D tissue printing for soft tissue regeneration," Biomaterials, vol. 62, September 2015, pp. 164-175.

[4] D. J. Fagnant and K. Kockelman, "Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations," Transportation Research Part A: Policy and Practice, vol. 77, July 2015, pp. 167-181.

[5] M. N. Schubert, "Autonomous cars - initial thoughts about reforming the liability regime", Gen Re Insurance Issues, Cologne, 2015.

[6] "Autonomous car definition." Available at https://www.techopedia.com/definition/30056/, (accessed 17 January 2017)

[7] E. Hilgendorf, "Autonomous cars and the law," http://cgd.swissre.com/global_dialogue/topics/Autonomous_cars/Autonomous_cars_and_the_law.html, 2015, (accessed 25 August 2015).

[8] "Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems", Standard J3016, SAE International, USA, 2014.

[9] "Statistical indicators of the Slovak Traffic Police," available at: http://www.minv.sk/?statisticke-ukazovatele-sluzby-dopravnej-policie, (accessed 16 January 2017).

[10] M. Bertoncello, D. Wee, "Ten ways autonomous driving could redefine the automotive world," McKinsey & Company, 2015.

[11] "Federal Automated Vehicles Policy. Accelerating the Next Revolution in Roadway Safety," U.S. Department of Transportation – National Highway Traffic Safety Administration, USA, September 2016.

[12] "Driverless cars take to the road, " http://cordis.europa.eu/result/rcn/90263_en.html , 2013, (accessed 24 August 2015).

[13] "UK to allow driverless cars on public roads in January," http://www.bbc.com/news/technology-28551069 , 2013, (accessed 24 August 2015).

[14] "Volvo to test autonomous cars with ordinary drivers on public roads by 2017," http://www.theguardian.com/technology/2015/feb/24/volvo-test-autonomous-cars-ordinary-drivers-public-roads-by-2017,2015, (accessed 24 August 2015).

[15] "Driverless Volvo S60 – car review," http://www.theguardian.com/technology/2014/jun/07/driverless-volvo-s60-car-review, 2014,(accessed 24 August 2015).

[16] N. Kalra, J. Anderson, M. Wachs, "Liability and Regulation of Autonomous Vehicle Technologies," California PATH Research Report, 2009.

[17] J. K. Gurney, "Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles," Journal of Law, Technology & Policy, vol. 2013, no. 2, 2013 pp. 247-277.

[18] "AdaptIVe. The Project", www.adaptive-ip.eu/index.php/objectives.html, (accessed 24 August 2015).

[19] E. Hilgendorf, "Autonomous cars and the law," http://cgd.swissre.com/global_dialogue/topics/Autonomous_cars/

[20] Press Release, IHS, 'Self-Driving Cars Moving into the Industry's Driver's Seat', available at http://press.ihs.com/press-release/automotive/self-driving-cars-moving-industrys-drivers-seat, (accessed 15 January 2016).

[21] "Federal Automated Vehicles Policy. Accelerating the Next Revolution in Roadway Safety," U.S. Department of Transportation – National Highway Traffic Safety Administration. USA, September 2016

[22] "SAE International and DIN Announce Agreement to Publish SAE Autonomous Vehicle Definition Standard in German," 15 August 2016. Available at http://www.prweb.com/releases/2016/08/prweb13615380.htm, (accessed 18 November 2016).

[23] "Assembly Bill No. 511, 2011,"(Committee on Transportation), http://cyberlaw.stanford.edu/files/blogs/AB511_EN.pdf, 2011, (accessed 24 August 2015).

[24] "Adopted Regulation of the Department of Motor Vehicles, LCB File No. R084-11," http://www.leg.state.nv.us/register/2011Register/R084-11A.pdf , 2012, (accessed 24 August 2015).

[25] "Automated Driving: Legislative and Regulatory Action," http://cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action 2012, (accessed 24 August 2015).

[26] M. K. Kim et al., "Comparative Analysis of Laws on Autonomous Vehicles in the U.S. and Europe," Atlanta Conference on Science and Innovation Policy, 2014.

[27] "Autonomous vehicles legislative database," available at: http://www.ncsl.org/research/transportation/autonomous-vehicles-legislative-database.aspx, (accessed 25 January 2017).

[28] "California Revises Draft Regulations for Autonomous Vehicles," available at: https://www.omm.com/resources/alerts-and-publications/alerts/california-revises-draft-regulations-for-autonomous-vehicles/, (accessed 15 January 2017).

[29] "United Nations, Vienna Convention on Road Traffic," 8 November 1968, United Nations, Treaty Series, vol. 1042.

[30] Report of the sixty-eighth session of the Working Party on Road Traffic Safety, 2014, available online at: http://www.unece.org/fileadmin/DAM/trans/doc/2015/wp1/ECETRANS-WP1-2015-8e.pdf, (accessed 4 December 2016).

[31] Act of the Slovak republic No. 300/2005 Coll. Criminal Code, as amended. Zákon č. 300/2005 Z.z. (Trestný zákon) v znení neskorších právnych predpisov.