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From the testing to the deployment of self-driving cars: Legal challenges to policymakers on the road ahead

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ABSTRACT

Keywords:

Self-driving car
Automated driving
Driver
Traffic law
Liability
Insurance

Self-driving cars and self-driving technology are tested on public roads in several countries on a large scale. With this development not only technical, but also legal questions arise. This article will give a brief overview of the legal developments in multiple jurisdictions – California (USA), United Kingdom, and the Netherlands – and will highlight several legal questions regarding the testing and deployment of self-driving cars.

Policymakers are confronted with the question how the testing of self-driving cars can be regulated. The discussed jurisdictions all choose a different approach. Different legal instruments – binding regulation, non-binding regulation, granting exemptions – are used to regulate the testing of self-driving cars. Are these instruments suitable for the objectives the jurisdictions want to achieve?

As technology matures, self-driving cars will at some point become available to the general public. Regarding this post-testing phase, two pressing problems arise: how to deal with the absence of a human driver and how does this affect liability and insurance? The Vienna Convention on Road Traffic 1968 and the Geneva Convention on Road Traffic 1949, as well as national traffic laws, are based on the notion that only a human can drive a car. To what extent a different interpretation of the term ‘driver’ in traffic laws and international Conventions can accommodate the deployment of self-driving cars without a human driver present will be discussed in this article.

When the self-driving car becomes reality, current liability regimes can fall short. Liability for car accidents might shift from the driver or owner to the manufacturer of the car. This could have a negative effect on the development of self-driving cars. In this context, it will also be discussed to what extent insurance can affect this development.

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1. Introduction

In May 2016 on a road in Florida, USA, a car and a tractor trailer collided, killing the person in the car. Although accidents like these happen every day¹, this accident was different.² The car involved was a Tesla Model S, equipped with the so-called ‘Autopilot’, a technical feature allowing the car to drive itself under the supervision of the conventional driver. The ‘Autopilot’ was turned on at the time of the accident. The person in the car overlooked the truck, but so did the ‘Autopilot’.³ This fatal crash sparked a discussion on the safety of self-driving technology.⁴ Currently self-driving cars and self-driving technology (like Tesla’s Autopilot) are tested on public roads in several countries on a large scale.⁵ With this development not only technical,

¹ Every year over 1,2 million people die in road traffic: World Health Organization, *Global Status Report on Road Safety*, 2015 (World Health Organization 2015) <www.who.int/violence_injury_prevention/road_safety_status/2015/en/> accessed 18 April 2017.

² Anjali Singhvi and Karl Russel, ‘Inside the Self-Driving Tesla Fatal Accident,’ *The New York Times* (New York City, 12 July 2016) <www.nytimes.com/interactive/2016/07/01/business/inside-tesla-accident.html?_r=0> accessed 30 March 2017. See for a more extensive legal contemplation of the accident: Lennart S. Lutz, ‘Unfälle mit dem Tesla Autopiloten: Implikationen für das automatisierte Fahren?’ [2016] *Deutsches Autorecht* 506. The police report of the accident is available at <<http://documents.latimes.com/tesla-accident-report/>> accessed 3 May 2017.

³ The Tesla Team, ‘A Tragic Loss’ (30 June 2016) <www.tesla.com/blog/tragic-loss?redirect=no> accessed 30 March 2017. The American National Highway Traffic Safety Administration started an investigation into this accident: <www.documentcloud.org/documents/2991479-NHTSA-letter-to-Tesla.html> (last visited 29 November 2016). The final report is available at <<https://static.nhtsa.gov/odi/inv/2016/INCLA-PE16007-7876.PDF>> accessed 9 February 2017.

⁴ Anjali Singhvi and Karl Russel, ‘Inside the Self-Driving Tesla Fatal Accident,’ *The New York Times* (New York City, 12 July 2016) <www.nytimes.com/interactive/2016/07/01/business/inside-tesla-accident.html?_r=0> accessed 30 March 2017, Danny Yadron and Dan Tynan, ‘Tesla driver dies in crash while using autopilot mode,’ *The Guardian* (London, 1 July 2016) <www.theguardian.com/technology/2016/jun/30/tesla-autopilot-death-self-driving-car-elon-musk> accessed 30 March 2017, Larry Greenemeier, ‘Deadly Tesla Crash Exposes Confusion over Automated Driving. Amid a federal investigation, ignorance of the technology’s limitations comes into focus’ (*Scientific American*, 8 July 2016) <www.scientificamerican.com/article/deadly-tesla-crash-exposes-confusion-over-automated-driving/> accessed 4 April 2017, Bill Vlasic and Neal E. Boudette, ‘Self-Driving Tesla Was Involved in Fatal Crash, U.S. says,’ *The New York Times* (New York City, 30 June 2017) <www.nytimes.com/2016/07/01/business/self-driving-tesla-fatal-crash-investigation.html?_r=0> accessed 11 April 2017, Letter from the Federation of European Motorcyclists’ Associations (FEMA), Koninklijke Nederlandse Motorrijders Vereniging (KNMV) and Motorrijders Actie Groep (MAG) to the Dutch Vehicle Authority (RDW) of 14 October 2016, <www.fema-online.eu/website/wp-content/uploads/RDW_141016_EN.pdf> accessed 11 April 2017, ‘Tesla soll in Deutschland nicht mehr mit “Autopilot” werben’ (*heise online*, 16 October 2016) <www.heise.de/newsticker/meldung/Tesla-soll-in-Deutschland-nicht-mehr-mit-Autopilot-werben-3351230.html> accessed 11 April 2017.

⁵ On the public roads of California alone, Google’s self-driving car company Waymo had a fleet of 60 self-driving cars driving over 600,000 miles on Californian public roads (50% more miles than

but also legal questions arise. Policymakers are confronted with the question how this development can be regulated. For the short term, the main question that rises is how trials with self-driving cars should be regulated.

This article will first describe the current state of technological developments (Section 2) and will look into the interests at stake and actors involved (Section 3). Before taking a closer look at the legislative developments in different jurisdictions, the legal consistency across different jurisdictions will be discussed (Section 4). Subsequently, how trials with self-driving cars are regulated in different jurisdictions will be studied (Section 5). The jurisdictions that will be discussed – California (USA), United Kingdom, and the Netherlands – all choose a different approach. Are these approaches suitable for the objectives the jurisdictions want to achieve? As technology matures, self-driving cars will at some point become available to the general public. Regarding this post-testing phase, two pressing problems arise: how to deal with the absence of a human driver and how does this affect liability and insurance? Besides addressing these questions, recommendations will be made regarding these topics (Sections 6 and 7).

2. Terminology and technology

In the media and literature several terms are used to describe a vehicle that can operate without a human driver, either under certain circumstances or for the complete trip. Terms like self-driving car, driverless car, and autonomous car are all commonly used terms but do not necessarily have the same meaning in every context. In this article these three terms – self-driving car, driverless car, and autonomous car – are used to describe a motor vehicle that can operate during a whole trip without human interference; it does not require a user to intervene when a problem occurs.⁶

The degree to which a car is able to drive independently, without human interference, is described by the SAE International.⁷ The level of automation is described on a scale from 0 (no automation) to 5 (full driving automation):

- Level 0: no driving automation. The whole dynamic driving task (the lateral and longitudinal vehicle motion control,

in 2015): Report on Autonomous Mode Disengagements For Waymo Self-Driving Vehicles in California December 2016 <www.dmv.ca.gov/portal/wcm/connect/946b3502-c959-4e3b-b119-91319c27788f/GoogleAutoWaymo_disengage_report_2016.pdf?MOD=AJPERES> accessed 11 April 2017. An overview of trials across the globe is available at <<http://knowledgeagenda.connekt.nl/engels/2017/03/09/overview-roadmaps-and-pilots/>> accessed 9 March 2017.

⁶ Level 5 of SAE International, *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles*. Standard J3016 (revised September 2016).

⁷ SAE International, *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles*. Standard J3016 (revised September 2016). Other descriptions are available, see for instance National Highway Traffic Safety Administration, ‘Preliminary Statement of Policy Concerning Automated Vehicles’, 2013, and Tom M. Gasser (Projektgruppenleitung) and others, *Bericht zum Forschungsprojekt F1100.5409013.01 des Arbeitsprogramms der Bundesanstalt für Straßenwesen: Rechtsfolgen zunehmender Fahrzeugautomatisierung* (Bundesanstalt für Straßenwesen 2012).

the detection of and response to objects and events) is performed by the human driver.

- Level 1: driver assistance. A driving automation system performs either the lateral or the longitudinal vehicle motion control under specific conditions; the human driver performs the remainder of the dynamic driving task.
- Level 2: partial driving automation. Under specific conditions, the driving automation system is able to perform both the lateral and the longitudinal vehicle motion control. The human driver has to supervise the system and performs the remainder of the dynamic driving task (that is, detection of and response to objects and events).
- Level 3: conditional driving automation. The automated driving system performs the complete dynamic driving task under certain conditions. The user has to be able to take over the driving and respond appropriately to a request of the system to intervene.
- Level 4: high driving automation. The automated driving system performs the complete dynamic driving task under certain conditions, without the expectation that a user will respond to a request to intervene.
- Level 5: full driving automation. The automated driving system performs the complete dynamic driving task under all conditions, without the expectation that a user will respond to a request to intervene.⁸

An important difference to point out is the difference between level 2 and level 3: from level 3 upwards the complete dynamic driving task is performed by the automated driving system. In cars where a human is still expected to stay alert and to be ready to intervene when necessary (SAE level 3 and lower), distraction of the person in the car might become a problem. When the person hands over control to the car, chances are that the person gets distracted and no longer stays alert. Ford, among others, has already seen this happen during trials with its self-driving cars: Ford's engineers monitoring the car started dozing off. For that reason Ford, but also Waymo, decided to skip these lower levels of automation and immediately aim for cars of SAE level 4 and higher.⁹ This issue will

not be discussed further as this article will focus on level 5, full driving automation.¹⁰

Although level 5 is far more advanced than the currently commercially available cars, Ford has already announced the intention to make level 4 vehicles available for commercial mobility services by 2021¹¹ and Tesla announced all its cars produced from October 2016 onwards have full self-driving hardware.¹² "Full self-driving capability" should become available in 2017.¹³ Not only the hardware, but also the capabilities of the software, is of great importance.¹⁴ This can be illustrated by the Tesla accident described above: the software of the car was not to blame, as it was not designed for the prevention of these kinds of accidents. It was designed to avoid or mitigate rear-end collisions.¹⁵

A self-driving car is not necessarily the same as a connected car.¹⁶ The term 'connected car' refers to a car that is able to communicate with its surroundings, e.g. another car or the infrastructure.¹⁷ So, a connected car can 'contact' a traffic light to 'tell' the traffic light that it is approaching this traffic light. A self-driving car might have this ability as well, but is not depending on it.¹⁸ A self-driving car can truly drive itself

¹⁰ Several jurisdictions have formulated a roadmap to indicate how the transition to level 5 will be shaped. An overview of these roadmaps is available at <<http://knowledgeagenda.connekt.nl/engels/2017/03/09/overview-roadmaps-and-pilots/>> accessed 9 March 2017.

¹¹ 'Ford Targets Fully Autonomous Vehicle for Ride Sharing in 2021; Invests in New Tech Companies, Doubles Silicon Valley Team' <<https://media.ford.com/content/fordmedia/fna/us/en/news/2016/08/16/ford-targets-fully-autonomous-vehicle-for-ride-sharing-in-2021.html>> (16 August 2016) accessed 11 April 2017.

¹² The Tesla Team, 'All Tesla Cars Being Produced Now Have Full Self-Driving Hardware' (19 October 2016) <www.tesla.com/blog/all-tesla-cars-being-produced-now-have-full-self-driving-hardware> accessed 11 April 2017.

¹³ Alan Ohnsman, 'Musk Wants To Begin Shifting Teslas To "Full" Self-Driving Capability Within 6 Months' (*Forbes*, 24 January 2017) <www.forbes.com/sites/alanohnsman/2017/01/24/elon-musk-targets-full-self-driving-capability-for-teslas-within-6-months/#7808d76c79ee> accessed 11 April 2017, Fred Lambert, 'Tesla's software timeline for "Enhanced Autopilot" transition means "Full Self-Driving Capability" as early as next year' (*Electrek*, 20 October 2016) <<https://electrek.co/2016/10/20/tesla-enhanced-autopilot-full-self-driving-capability/>> accessed 11 April 2017.

¹⁴ Stephen Mason, 'The presumption that computers are "reliable"', in Stephen Mason and Daniel Seng (eds), *Electronic Evidence* (fourth edition, Institute of Advanced Legal Studies for the SAS Humanities Digital Library, School of Advanced Study, University of London, 2017) available at <<http://humanities-digital-library.org/index.php/hdl/catalog/view/electronicEvidence/16/93-1>> accessed 4 May 2017. See also Stephen Mason and Peter B. Ladkin to *Financial Times* 'Decision algorithms of driverless cars recall the trolley problem.' *Financial Times* (7 October 2016) <<https://www.ft.com/content/3e9a8832-898c-11e6-8aa5-f79f5696c731>> accessed 10 May 2017.

¹⁵ NHTSA report Investigation PE 16-007 <<https://static.nhtsa.gov/odi/inv/2016/INCLA-PE16007-7876.PDF>> accessed 9 February 2017.

¹⁶ Bryant W Smith, 'A Legal Perspective on Three Misconceptions in Vehicle Automation,' in Gereon Meyer and Sven Beiker (eds.), *Road Vehicle Automation, Lecture Notes in Mobility* (Springer International Publishing, Switzerland, 2014), 89–90.

¹⁷ Hod Libson and Melba Kurman, *Driverless: intelligent Cars and the Road Ahead* (The MIT Press, 2016), 17.

¹⁸ See for instance 'Googles autonome Autos sind nicht immer online' (*heise online*, 16 January 2017) <www.heise.de/newsticker/meldung/Googles-autonome-Autos-sind-nicht-immer-online-3592661.html> accessed 13 January 2017.

⁸ SAE International, *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles*. Standard J3016 (revised September 2016).

⁹ See Keith Naughton, 'Google's Driverless Car Czar on Taking the Human Out of the Equation. How John Krafcik went from mechanical to digital and why he thinks you have to go fully autonomous.' *Bloomberg Businessweek* (4 August 2016) <www.bloomberg.com/features/2016-john-krafcik-interview-issue/> accessed 4 May 2017, Keith Naughton, 'Ford's Dozing Engineers Side With Google in Full Autonomy Push,' *Bloomberg Technology* (17 February 2017) <www.bloomberg.com/news/articles/2017-02-17/ford-s-dozing-engineers-side-with-google-in-full-autonomy-push> accessed 4 May 2017, Jamie Condliffe, 'Semi-Autonomous Cars Could Increase Distracted Driving Deaths,' *MIT Technology Review* (21 September 2016) <www.technologyreview.com/s/602441/semi-autonomous-cars-could-increase-distracted-driving-deaths/> accessed 4 May 2017, Alex Davies, 'The very human problem blocking the path to self-driving cars,' *Wired* (1 January 2017) <www.wired.com/2017/01/human-problem-blocking-path-self-driving-cars/> accessed 4 May 2017.

without the need to communicate with other vehicles or the infrastructure. Contrary to a self-driving car, a connected car cannot drive independently. The connected car will not be discussed any further in this article.

3. Interests at stake and actors involved

Hopes are high for self-driving cars. They could potentially ease road congestion and reduce emission.¹⁹ The major benefit of self-driving cars however is the expected decrease in accidents. Every year over 1,2 million people die on the world's roads.²⁰ In around 90% of the accidents, human error caused (at least in part) to the accident.²¹ In the literature, expectations are expressed that self-driving cars will eliminate human error, and therefore self-driving cars are expected to significantly improve road safety.²² However, this expectation is yet to be proven.²³

¹⁹ See for instance Zia Wadud, 'Self-driving cars: will they reduce energy use?' (University of Leeds, Mobility and Energy Futures Studies) <www.its.leeds.ac.uk/fileadmin/documents/research/MobilityEnergyFutures_-_SelfDrivingCars.pdf> accessed 18 April 2017. Hod Libson and Melba Kurman, *Driverless: intelligent Cars and the Road Ahead* (The MIT Press, 2016), 15.

²⁰ World Health Organization, *Global Status Report on Road Safety 2015* <www.who.int/violence_injury_prevention/road_safety_status/2015/en/> accessed 11 April 2017.

²¹ Bryant W. Smith, 'Human error as a cause of vehicle crashes' (Blog of The Center for Internet and Society, Stanford Law School, 18 December 2013) <<http://cyberlaw.stanford.edu/blog/2013/12/human-error-cause-vehicle-crashes>> accessed 9 March 2017.

²² European Transport Safety Council, 'Prioritising the Safety Potential of Automated Driving in Europe' (Briefing, April 2016), para 2, James M Anderson and others, *Autonomous Vehicle Technology. A Guide for Policymakers* (RAND Corporation, 2016), 12–16. See also Brandon Schoettle & Michael Sivak, 'A Preliminary Analyses of Real-World Crashes Involving Self-Driving Vehicles' (The University of Michigan Transportation Research Institute, Ann Arbor, October 2015) <<http://umich.edu/~umtristwt/PDF/UMTRI-2015-34.pdf>> accessed 18 April 2017 and Myra Blanco and others, 'Automated Vehicle Crash Rate Comparison Using Naturalistic Data,' Virginia Tech Transportation Institute January 2016 <www.vtti.vt.edu/PDFs/Automated%20Vehicle%20Crash%20Rate%20Comparison%20Using%20Naturalistic%20Data_Final%20Report_20160107.pdf> accessed 18 April 2017.

²³ Letter from Martyn Thomas to Financial Times 'Future with the driverless car needs careful planning,' *Financial Times* (30 September 2016) <www.ft.com/content/df918048-83ff-11e6-a29c-6e7d9515ad15> accessed 28 April 2017, Brandon Schoettle and Michael Sivak, 'A Preliminary Analyses of Real-World Crashes Involving Self-Driving Vehicles' (The University of Michigan Transportation Research Institute, Ann Arbor, October 2015) <<http://umich.edu/~umtristwt/PDF/UMTRI-2015-34.pdf>> accessed 18 April 2017 and Myra Blanco and others, 'Automated Vehicle Crash Rate Comparison Using Naturalistic Data,' Virginia Tech Transportation Institute January 2016 <www.vtti.vt.edu/PDFs/Automated%20Vehicle%20Crash%20Rate%20Comparison%20Using%20Naturalistic%20Data_Final%20Report_20160107.pdf> accessed 18 April 2017. See also the letter from Stephen Mason and Peter B. Ladkin to Financial Times 'Decision algorithms of driverless cars recall the trolley problem,' *Financial Times* (7 October 2016) <<https://www.ft.com/content/3e9a8832-898c-11e6-8aa5-f79f5696c731>> accessed 10 May 2017, the letter from John Boothman to the Financial Times 'Driverless cars can steer us into a safe and sophisticated future,' *Financial Times* (23 September 2016) <www.ft.com/content/1199ec78-7ff6-11e6-8e50-8ec15fb462f4>

There are several actors who could benefit from the development of self-driving cars: manufacturers, governments and consumers could possibly all benefit from the self-driving car. Manufacturers can benefit from producing and selling self-driving cars. For governments the self-driving cars can offer a solution to several problems: road congestion, traffic deaths, emissions, etc.²⁴ Consumers will benefit from safer cars which will most likely lead to lower insurance premiums.²⁵ An increase in mobility is also expected.²⁶

However, the self-driving car also has disadvantages that should not be disregarded. There will be a significant impact on the job market: truck drivers, bus drivers, and taxi drivers will no longer be needed as the car takes over their work.²⁷ Moreover, self-driving cars might pose new risks, such as hacking.²⁸ Software will be fallible.²⁹ Furthermore, it is not clear

accessed 28 April 2017, 'The future of self-driving cars is in human hands. Clear rules are instrumental to the transition towards a driverless era,' *Financial Times* (16 September 2016) <www.ft.com/content/abf1738a-7bec-11e6-ae24-f193b105145e> accessed 28 April 2016, Stephen Mason, 'The presumption that computers are "reliable",' in Stephen Mason and Daniel Seng (eds), *Electronic Evidence* (fourth edition, Institute of Advanced Legal Studies for the SAS Humanities Digital Library, School of Advanced Study, University of London, 2017) available at <<http://humanities-digital-library.org/index.php/hdl/catalog/view/electronicEvidence/16/93-1>> accessed 4 May 2017.

²⁴ See for instance Rex Merrifield, 'Choreographing automated cars could save time, money and lives' (*Horizon*, 14 March 2017) <https://horizon-magazine.eu/article/choreographing-automated-cars-could-save-time-money-and-lives_en.html> accessed 11 April 2017. Self-driving cars can, however, have disadvantages for governments as well. For instance, fewer traffic tickets means less revenues: Sam Tracy, 'Autonomous Vehicles Will Replace Taxi Drivers, But That's Just the Beginning' (*Huffington Post*, updated 10 June 2016) <www.huffingtonpost.com/sam-tracy/autonomous-vehicles-will-replace-taxi-drivers-but-thats-just-the-beginning_en.html> accessed 30 March 2017.

²⁵ James M. Anderson and others, *Autonomous Vehicle Technology. A Guide for Policymakers* (RAND Corporation, 2016), 18, 114, 118, Daniel J. Fagnant and Kara Kockelman, 'Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations' (2015) 77 *Transportation Research Part A: Policy and Practice* 167. See also 'Autonomous Vehicles. Considerations for Personal and Commercial Lines Insurers' Munich Reinsurance America, Inc., 2016.

²⁶ See for instance Daniel J. Fagnant and Kara Kockelman, 'Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations' (2015) 77 *Transportation Research Part A: Policy and Practice* 167, para 2.3.

²⁷ See for instance Sam Tracy, 'Autonomous Vehicles Will Replace Taxi Drivers, But That's Just the Beginning' (*Huffington Post*, updated 10 June 2016) <www.huffingtonpost.com/sam-tracy/autonomous-vehicles-will-replace-taxi-drivers-but-thats-just-the-beginning_en.html> accessed 30 March 2017.

²⁸ Hacking, however, is also a risk to conventional cars: Andy Greenberg, 'Hackers remotely kill a Jeep on the highway – with me in it' (*Wired*, 21 July 2015) <www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/> accessed 9 March 2017. See also SAFEtec, a project funded by the EU, at <http://cordis.europa.eu/project/rcn/207209_en.html> and Steve Gillman, 'Hackers could blackmail owners of self-driving cars – Dr Alexander Köller, TomTom' (*Horizon*, 16 March 2017) <https://horizon-magazine.eu/article/hackers-could-blackmail-owners-self-driving-cars-dr-alexander-koeller-tomtom_en.html?utm_source=HORIZON&utm_campaign=c7f3d2c038-News_Alert_20170217&utm_medium=email&utm_term=0_bdc6f64ca-c7f3d2c038-105634345> accessed 11 April 2017 and Stephen Mason, 'The presumption that computers are

yet how self-driving cars will behave under all weather conditions, and in all situations. Therefore, testing the self-driving cars in real traffic is pivotal to improving the technology and reaching its full potential.

During the test phase, when the technology has not yet reached its full potential, the self-driving car can compromise road safety.³⁰ In order to benefit from the road safety improvements of self-driving cars in the long run, however, the further development of the technology and thus the testing on public roads is essential. This testing should be conducted in a safe manner, but should also provide enough opportunities for further innovation. Manufacturers, but also testing and research organisations, such as universities, can be involved in the testing.³¹ To ensure road safety, a very strict regulatory regime might seem the best way to go. However, overregulation can inhibit developments.³² Regulation that can keep pace with new technological developments, flexible regulation, can stimulate innovation.³³ From this innovation, the general public will profit in the long run through improved road safety. So the legislator will have to strike a balance between all these interests.³⁴

4. Legal consistency

Because road safety will most likely improve significantly due to self-driving cars³⁵, countries want to be at the forefront of this development. A general look at the legal developments in

“reliable”, in Stephen Mason and Daniel Seng (eds), *Electronic Evidence* (fourth edition, Institute of Advanced Legal Studies for the SAS Humanities Digital Library, School of Advanced Study, University of London, 2017) available at <<http://humanities-digital-library.org/index.php/hdl/catalog/view/electronicEvidence/16/93-1>> accessed 4 May 2017, 136ff.

²⁹ See for instance Stephen Mason, ‘The presumption that computers are “reliable”’, in Stephen Mason and Daniel Seng (eds), *Electronic Evidence* (fourth edition, Institute of Advanced Legal Studies for the SAS Humanities Digital Library, School of Advanced Study, University of London, 2017) available at <<http://humanities-digital-library.org/index.php/hdl/catalog/view/electronicEvidence/16/93-1>> accessed 4 May 2017.

³⁰ See for example Chris Ziegler, ‘A Google self-driving car caused a crash for the first time. A bad assumption led to a minor fender-bender’ (*The Verge*, 29 February 2016) <www.theverge.com/2016/2/29/11134344/google-self-driving-car-crash-report> accessed 11 April 2017.

³¹ See for instance Mcity of the University of Michigan, an enclosed test track simulating urban and suburban environments: <www.mtc.umich.edu/test-facility>.

³² Jonathan B Wiener, ‘The regulation of technology, and the technology of regulation’ (2004) 26 *Technology in Society* 483.

³³ Michiel A Heldeweg, *Smart rules & regimes: publiekrechtelijk(e) ontwerpen voor privatisering en technologische innovatie* (extended version of inaugural lecture Universiteit Twente, of 24 september 2009, Universiteit Twente 2010), 99.

³⁴ Michiel A Heldeweg, *Smart rules & regimes: publiekrechtelijk(e) ontwerpen voor privatisering en technologische innovatie* (extended version of inaugural lecture Universiteit Twente, of 24 September 2009, Universiteit Twente 2010), 74–77. See also European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)), section 24–29.

³⁵ European Transport Safety Council, ‘Prioritising the Safety Potential of Automated Driving in Europe’ (Briefing, April 2016), para 2.

different jurisdictions unveils that jurisdictions choose their own route to a future of self-driving cars.³⁶ Both the European Union and the US federal government acknowledge this as an unwanted development.³⁷ Manufacturers and consumers should not be confronted with different legal requirements in different jurisdictions as this could hinder innovation.³⁸ The Model State Policy of the US Federal Automated Vehicles Policy should prevent the rise of such a patchwork of different legislation in different jurisdictions.³⁹ Under the presidency of the Netherlands (January–June 2016), the EU member states signed a Declaration on more cooperation in the field of connected and automated driving.⁴⁰ With this Declaration the Member States acknowledge the importance of a coordinated approach in order to facilitate the cross-border use of connected and automated vehicles.⁴¹ One of the objectives of the Member States is to “(. . .) work towards a coherent European framework for the deployment of interoperable connected and automated driving (. . .).”⁴² Legal consistency will be promoted, recognizing the importance of sufficient flexibility of a legal framework in order to facilitate the introduction and cross-border use of automated and connected vehicles.⁴³

5. Testing: legal framework of four jurisdictions

To provide for safe testing of self-driving cars, the USA, California, the Netherlands, and the UK all choose a different route.

³⁶ See also the different roadmaps used: <www.dropbox.com/s/ji5qz5rtkkgf8jn/Overview%20Roadmaps%20Automated%20Driving_final_withoutaspect.pdf?dl=0>.

³⁷ See also Testimony of Dr. Chris Urmson (Director, Self-Driving Cars, Google [x]) before the Senate Committee on Commerce, Science and Technology Hearing: ‘Hands Off: The Future of Self-Driving Cars’ (15 March 2016), James Hedlund, *Autonomous Vehicles Meet Human Drivers: Traffic Safety Issues for States* (Governors Highway Safety Association) available at <<http://src.bna.com/IVF>> accessed 10 February 2017.

³⁸ International Transport Forum, Corporate Partnership Board, ‘Automated and Autonomous Driving. Regulation under uncertainty’ (OECD/ITF 2015), para 3.

³⁹ U.S. Department of Transportation/National Highway Traffic Safety Administration, *Federal Automated Vehicles Policy*, September 2016, available at: <www.transportation.gov/AV/federal-automated-vehicles-policy-september-2016>, 37. See also Fact Sheet: AV Policy Section II: Model State Policy.

⁴⁰ Declaration of Amsterdam on Cooperation in the field of connected and automated driving, 14–15 April 2016, available at <<https://english.eu2016.nl/documents/publications/2016/04/14/declaration-of-amsterdam>> accessed 11 April 2017 (Declaration of Amsterdam 2016).

⁴¹ Declaration of Amsterdam, 2016.

⁴² Declaration of Amsterdam, 2016, Shared objectives, I.a. and Action by the European Commission, IV.c.

⁴³ Declaration of Amsterdam, 2016, Joint agenda, II.a. See also Erica Palmerini and others, Robolaw, ‘Regulating Emerging Robotic Technologies in Europe: Robotics facing Law and Ethics: Guidelines on Regulating Robotics’ (2014) <www.robolaw.eu/RoboLaw_files/documents/robolaw_d6.2_guidelinesregulatingrobotics_20140922.pdf> accessed 6 February 2017 (Robolaw, 2014), 67–68 and Maurice Schellekens, ‘Self-driving cars and the chilling effect of liability’ (2015) 31(4) *Computer Law & Security Review* 506, para 4.2.1.4.

The different legal instruments used by these jurisdictions – binding regulation, non-binding regulation, granting exemptions – will be addressed below (Sections 5.1–5.3). How suitable these legal instruments are for the aims the jurisdictions strive for will be discussed in Section 5.4.

5.1. Binding regulation: California

One of the US States at the forefront of legal developments is California.⁴⁴ Since 2012 California has legislation in place to accommodate for the testing of self-driving cars.⁴⁵ Division 16.6, Section 38750 of the California Vehicle Code is devoted to autonomous vehicles. This section entails definitions, requirements on insurance, the operator, how to act in case of a failure, etc. As follows from the California Code of Regulations, a so-called Manufacturer's Testing Permit is needed for testing self-driving vehicles on public roads.⁴⁶ A Testing Permit will only be issued when all requirements laid down in the California Code of Regulations and California Vehicle Code are met and all testing completed to satisfy the Department for Motor Vehicles the vehicles are safe to operate on public roads.⁴⁷ The form that needs to be submitted to the Department for Motor Vehicles entails the details of the vehicle tester, the vehicles to be tested and the driver/operator.⁴⁸ However, the roads on which the vehicle will be tested and the weather conditions

under which the vehicle will be tested are not requested in the form. Neighbouring State Nevada does limit the testing of self-driving cars to certain roads.⁴⁹ Also, to get a testing permit (or 'license') in Nevada an "(...) applicant must further provide proof that such autonomous vehicle or vehicles of the applicant have been driven in various conditions for a number of miles that demonstrates the safety of the vehicle or vehicles in those conditions. Such conditions include, without limitation, operating the autonomous vehicle in various weather conditions, on various types of roads and during various times of the day and night".⁵⁰

5.2. Non-binding regulation: USA and UK

Flexibility, i.e. the ability to keep up with the technological developments, can be offered by non-binding regulation. If new technology emerges, non-binding regulation can be adjusted without going through an often time-consuming legislative process. Both the federal government of the United States and the government of the United Kingdom favour this route, for now.⁵¹

5.2.1. United States: federal level

The US Department of Transportation⁵² and National Highway Traffic Safety Administration (NHTSA) have formulated a Federal Automated Vehicles Policy.⁵³ This Policy is divided into four sections. The first section consists of the Vehicle Performance Guidance for Automated Vehicles (hereinafter: NHTSA Guidance) which is intended for the pre-deployment stage of designing, developing and testing automated vehicles.⁵⁴ Although the NHTSA Guidance is not mandatory, it should be considered by everyone involved in manufacturing, designing,

⁴⁴ Although self-driving cars are being tested on the roads of Austin, Texas and Phoenix, Arizona, both states currently do not have regulated this (see for example <<https://waymo.com/ontheroad/>> accessed 12 April 2017>). In 2015, four bills were considered but not passed by the Texas Legislature (SB 1167, HB 4194, HB 3690, and HB 933). On inquiry, the Arizona Department of Transport stated "MVD [Motor Vehicle Department, NEV] does not have any policy regarding autonomous vehicles at this time" (September 20, 2016). Through an Executive Order (2015-09) certain pilot programs are allowed in Arizona. An operator with the ability to "direct the vehicle's movement if assistance is required" is required (Executive Order 2015-09). See for an overview of the legislative developments: <www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx> (accessed 22 December 2016) and Gabriel Weiner and Bryant W Smith, 'Automated Driving: Legislative and Regulatory Action' <cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action> (accessed 12 April 2017).

⁴⁵ Senate Bill 1298.

⁴⁶ 13 CCR §227.04 (d), §227.24. Recently, Uber challenged this: Anthony Levandowski, 'Statement from Anthony Levandowski on Self-Driving in San Francisco' (16 December 2016) <<https://newsroom.uber.com/statement-from-anthony-levandowski-on-self-driving-in-san-francisco/>> accessed 22 December 2016, Heather Somerville, 'Uber removes self-driving cars from San Francisco roads' (Reuters, 22 December 2016) <www.reuters.com/article/us-uber-selfdriving-idUSKBN14B04Z> accessed 22 December 2016. See also Bryant W. Smith, 'Uber vs. the Law' (Blog of The Center for Internet and Society, Stanford Law School, 17 December 2016) <<https://cyberlaw.stanford.edu/blog/2016/12/uber-vs-law>> accessed 22 December 2016.

⁴⁷ California Vehicle Code section 38750 (e)(1). See also 13 CCR §227.04, §227.26, §227.28, and <www.dmv.ca.gov/portal/dmv/detail/vehindustry/ol/auton_veh_tester> accessed 12 April 2017.

⁴⁸ 13 California Code of Regulations (CCR) §227.26, §227.28. The form is available at <www.dmv.ca.gov/portal/wcm/connect/f8eb6c00-6039-4e4c-82b0-2e9c4b18c38b/ol311.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=f8eb6c00-6039-4e4c-82b0-2e9c4b18c38b> accessed 20 December 2016. See also the new the

draft form OL311, available at <www.dmv.ca.gov/portal/wcm/connect/3339d9b1-f033-44a8-8c7e-40a31e809b31/ol311draft.pdf?MOD=AJPERES> accessed 10 April 2017.

⁴⁹ Nevada Administrative Code (NAC) 482A.120. See on the possibilities in Arizona n37.

⁵⁰ NAC 482A.110(3)(b).

⁵¹ The UK Department for Transport and the Centre for Connected and Autonomous Vehicles already published a set of proposals for reforming existing legislation: Department for Transport and the Centre for Connected and Autonomous Vehicles, 'Pathway to Driverless Cars: Proposals to support advanced driver assistance systems and automated vehicle technologies,' 2016.

⁵² The US Department of Transportation recently established a Federal Committee on Automation: 'USDOT Announces New Federal Committee on Automation' (11 January 2017) <<https://content.govdelivery.com/accounts/USDOT/bulletins/17fb003#.WHa9qqkV59c.twitter>> accessed 13 January 2017.

⁵³ U.S. Department of Transportation/National Highway Traffic Safety Administration, *Federal Automated Vehicles Policy*, September 2016, available at: <www.transportation.gov/AV/federal-automated-vehicles-policy-september-2016> accessed 18 April 2017 (Federal Policy 2016). Up until September 2016 the federal involvement on this topic was relatively limited; the NHTSA had only published a Preliminary Statement of Policy Concerning Automated Vehicles (2013) and an Update of that statement (2016). See also Testimony of Dr. Chris Urmson (Director, Self-Driving Cars, Google [x]) before the Senate Committee on Commerce, Science and Technology Hearing: 'Hands Off: The Future of Self-Driving Cars' (15 March 2016).

⁵⁴ Federal Policy 2016, 6.

testing and possibly selling self-driving vehicles.⁵⁵ The NHTSA Guidance sets expectations for manufacturers developing and deploying automated vehicle technology.⁵⁶ It is intended for the testing and deployment of automated vehicles on public roads.⁵⁷ This NHTSA Guidance should ensure “that when a self-driving car crosses from Ohio into Pennsylvania, its passengers can be confident that other vehicles will be just as responsibly deployed and just as safe.”⁵⁸ The NHTSA Guidance outlines 15 safety assessment areas.⁵⁹ This 15-point Safety Assessment covers various topics regarding automated driving on failures, crashworthiness, privacy, cybersecurity, etc.⁶⁰ Manufacturers (or other entities involved) can voluntarily provide reports on how the NHTSA Guidance has been met.⁶¹ This, together with public input, might lead to a revision of the guidance.⁶²

The second section of the Federal Automated Vehicles Policy is the Model State Policy. As multiple States have already passed laws concerning (the testing of) automated vehicles, this Model State Policy should prevent – although it might be too late to prevent such a development given the legislative efforts already undertaken by multiple states – the rise of a patchwork⁶³ of inconsistent laws and regulations among all the jurisdictions involved.⁶⁴ Again, public feedback is requested in order to refine the Policy.⁶⁵ It sets forth the responsibilities of the State and the Federal responsibilities regarding automated driving and provides model procedures and requirements for State laws.⁶⁶ The Model State Policy covers several subjects, including registration of vehicles, law enforcement considerations, liability and insurance, and administrative matters. The Model State Policy also recommends each jurisdiction to examine its legislation to identify possible barriers to the safe testing, deployment and operation of self-driving cars (SAE level 3–5).⁶⁷

⁵⁵ Federal Policy 2016, 11.

⁵⁶ Fact Sheet AV Policy Section I: Vehicle Performance Guidance for Automated Vehicles, Bryant W Smith, ‘US Department of Transportation’s Automated Driving Guidance’ (*Blog of The Center for Internet and Society, Stanford Law School*, 19 September 2016) <<https://cyberlaw.stanford.edu/blog/2016/09/us-department-transportations-automated-driving-guidance>> accessed 12 April 2017.

⁵⁷ Federal Policy 2016, 12.

⁵⁸ Barack Obama, ‘Barack Obama: Self-driving cars, yes, but also safe. New technologies and regulations will be explored at a White House conference in Pittsburgh’ (*Pittsburgh Post-Gazette*, 19 September 2016) <www.post-gazette.com/opinion/Op-Ed/2016/09/19/Barack-Obama-Self-driving-yes-but-also-safe/stories/201609200027> accessed 10 April 2017.

⁵⁹ Federal Policy 2016, 34.

⁶⁰ For a brief overview: Fact Sheet AV Policy Section I: Vehicle Performance Guidance for Automated Vehicles.

⁶¹ Federal Policy 2016, 15.

⁶² Fact Sheet AV Policy Section I: Vehicle Performance Guidance for Automated Vehicles, Federal Policy 2016, 11, 34–36.

⁶³ See Testimony of Dr. Chris Urmson (Director, Self-Driving Cars, Google [x]) before the Senate Committee on Commerce, Science and Technology Hearing: ‘Hands Off: The Future of Self-Driving Cars’ (15 March 2016).

⁶⁴ Federal Policy 2016, 37. See also Fact Sheet: AV Policy Section II: Model State Policy.

⁶⁵ Federal Policy 2016, 37.

⁶⁶ Federal Policy 2016, 37, 39.

⁶⁷ Federal Policy 2016, 40.

Gaps in laws and regulations (e.g. gaps concerning motor vehicle insurance, liability, occupant safety, education and training, environmental impact, etc.) should be identified and addressed by the State.⁶⁸

The other two sections of the Federal Automated Vehicles Policy cover regulatory tools of the NHTSA, both current regulatory tools and potential new tools.⁶⁹ One of the existing regulatory tools is the letter of interpretation. In such a letter the NHTSA gives its view on the meaning of existing regulation.⁷⁰ This tool has already been used to interpret some Federal Motor Vehicle Safety Standards, after a request by Google.⁷¹

5.2.2. United Kingdom

The UK Department for Transport issued a Code of Practice to provide guidance for anyone wanting to conduct testing of (highly) automated vehicles on public roads.⁷² The Code of Practice is non-statutory and although non-compliance with the Code of Practice might be relevant to liability, it does not guarantee immunity from liability in legal proceedings.⁷³ Like the NHTSA Guidance, the Code of Practice deals with failure warning, privacy, cybersecurity. However, the Code of Practice also addresses requirements regarding the test driver (the Code states that “a suitably licenced and trained test driver or test operator should supervise the vehicle at all times and be ready and able to over-ride automated operation if necessary”).⁷⁴ The US Federal Policy lacks these requirements for (test) drivers as this falls within the competence of the States, not the federal government. The States are responsible for traffic laws and enforcement, vehicle license and registration, and motor vehicle insurance and liability regimes, whereas the US federal government bears responsibility for setting and enforcing compliance with safety standards, educating the public about motor vehicle safety issues, and issuing guidance to achieve national goals.⁷⁵

⁶⁸ Federal Policy 2016, 44.

⁶⁹ See for a brief overview: Fact Sheet: AV Policy Section II: Current Regulatory Tools and Fact Sheet: AV Policy Section IV: Modern Regulatory Tools.

⁷⁰ Federal Policy 2016, 48.

⁷¹ Letter from the NHTSA responding to a letter from Dr. Chris Urmson (Director of the Self-Driving Car Project, Google, Inc.), 4 February 2016, <<http://search.nhtsa.gov/files/Google%20-%20compiled%20response%20to%2012%20Nov%20%2015%20interp%20request%20-%20204%20Feb%2016%20final.htm>> accessed 20 December 2016.

⁷² Department for Transport, ‘The Pathway to Driverless Cars: A Code of Practice for testing,’ 2015 (Code of Practice for testing 2015), para 2.1, 2.3. The definition the Code of Practice for testing 2015 uses for highly automated vehicle is: “A vehicle in which a driver is required to be present and can take manual control at any time. However in certain situations, the vehicle can offer an automated mode which allows the driver to ‘disengage’ from the driving task and undertake other tasks” (para 2.6). Fully automated vehicle: “a vehicle in which a driver is not necessary. The vehicle is designed to be capable of safely completing journeys without the need for a driver in all traffic, road and weather conditions that can be managed by a competent human driver” (para 2.8).

⁷³ Code of Practice for testing 2015, para 1.5.

⁷⁴ Code of Practice for testing 2015, para 4.1.

⁷⁵ Federal Policy 2016, 7, 38 and Fact Sheet: AV Policy Section II: Model State Policy. See also Lauren Isaac, ‘Driving Towards Driverless: a guide for government agencies,’ WSP/Parsons Brinckerhoff, 2016.

5.3. Granting exemptions: The Netherlands

The Dutch choose another route; instead of drafting extensive new laws or formulating non-binding regulations, the Dutch Vehicle Authority (RDW) has been given the competence to grant exemptions from certain laws if these exemptions are useful for the testing of automated vehicle functions.⁷⁶ Exemptions can be granted regarding chapters 3 and 5 of the *Regeling voertuigen* and, if necessary, the *Reglement Verkeersregels en verkeerstekens* 1990 (hereinafter RVV 1990). Chapters 3 and 5 of the *Regeling voertuigen* contain rules on type approval and certain technical requirements, whereas the RVV 1990 outlines traffic rules (e.g. speed limits (Article 19–22), giving way (Article 15), how to overtake (Article 11), etc.). The RDW will decide where and under what circumstances the testing can be carried out.⁷⁷ First, the RDW will analyse the application, the testing plan and the test results that are available at that time. If this analysis is satisfactory, all functionalities that the applicant wants to test on public roads will be tested on an enclosed test track. The exemption will only be granted if these tests are passed as well.⁷⁸ The conditions of the exemption will be decided upon by the RDW. Possible conditions are the type of road and the weather conditions under which testing is allowed, but a condition of the exemption can also be additional insurance.⁷⁹

An in 2016 published draft for an ‘*experimenterwet*’, i.e. an Act concerning experiments or trials, would enlarge the scope of the existing exemption powers of the RDW.⁸⁰ The draft opens up the possibility to grant exemptions from the *Wegenverkeerswet* 1994 (hereinafter WVW 1994). The WVW 1994 imposes certain tasks on the driver, e.g. not leaving the place of an accident (Article 7).⁸¹ Therefore granting exemptions from the WVW 1994 is necessary to enable the testing autonomous cars without a (test) driver in the car.⁸² The aim is for the ‘*experimenterwet*’ to enter into force on 1 January 2018.⁸³

⁷⁶ Besluit van 15 juni 2015 tot wijziging van het Besluit ontheffingverlening exceptionele transporten (ontwikkeling zelfrijdende auto), Staatsblad 2015/248 (hereinafter: Het Besluit, Staatsblad 2015/248). See also *Kamerstukken II* 2014/2015, 31305, 210.

⁷⁷ Nota van Toelichting, Het Besluit, Staatsblad 2015/248.

⁷⁸ Besluit van 15 juni 2015 tot wijziging van het Besluit ontheffingverlening exceptionele transporten (ontwikkeling zelfrijdende auto), Staatsblad 2015/248, 4–5.

⁷⁹ Besluit van 15 juni 2015 tot wijziging van het Besluit ontheffingverlening exceptionele transporten (ontwikkeling zelfrijdende auto), Staatsblad 2015/248, 5.

⁸⁰ ‘Draft for Internet consultation, Amendment of the Road Traffic Act 1994 in connection with the enabling of experiments with automated systems in vehicles’ (published July 2016) <www.internetconsultatie.nl/experimenterwet_zelfrijdendeauto> accessed 11 January 2017, (also available in English), Explanatory Memorandum (hereinafter: Draft, Explanatory Memorandum).

⁸¹ Draft, Explanatory Memorandum, para 2.2, Nynke E. Vellinga, Wim H. Vellinga, Kiliaan APC van Wees, ‘Testen van autonome of zelfrijdende auto’s op de openbare weg’ (2016) 64 *Verkeersrecht* 218. See also Kiliaan APC van Wees, ‘Enkele juridische aspecten van de (deels) zelfrijdende auto’ [2015] *Computerrecht* 313.

⁸² Draft, Explanatory Memorandum, para 2.5.

⁸³ ‘Reacties op de internetconsultatie *Experimenterwet zelfrijdende auto*’, available at <www.internetconsultatie.nl/experimenterwet_zelfrijdendeauto> accessed 12 January 2017.

5.4. Evaluating the legal instruments

The choice for the right legal instrument is of great importance as it can stimulate or inhibit further technological development.⁸⁴ To benefit from the newest technological developments the legal instrument will need to be flexible, i.e. it will need to have the ability to keep pace with these technological developments. This is beneficial for the manufacturers, but manufacturers will also want to have some degree of legal certainty; they need to know what requirements the self-driving car they are developing needs to fulfil in order to be allowed on public roads.⁸⁵ Other road users also will need a certain level of legal certainty: what can they expect and if an accident happens, how will they be compensated for the damages suffered? The chosen legal instrument will need to offer possibilities for the government to ensure road safety, either by setting requirements for trials or by the possibility to intervene if safety gets compromised. The jurisdictions discussed above all take a different approach to accommodate the testing of self-driving cars, although they all strive for safe testing and they all want to benefit from the newest available technology. The discussed jurisdictions all use different legal instruments to achieve these goals: California has chosen binding regulation, non-binding regulation is preferred by the federal US government and the government of the UK, and the Dutch government has chosen exemptions under conditions. Are the instruments chosen by the described jurisdictions suitable to achieve their objectives?

For achieving safe testing the safety requirements set by the legislator in a legal instrument are of great importance. Both binding regulation and an exemption under conditions are legally binding, so the requirements need to be fulfilled by, for example, the manufacturer or the testing organisation. These instruments are therefore suitable for a government that wants to keep the testing in check. Both instruments are also suitable for upholding road traffic safety. If road safety is compromised during testing, if the conditions of the exemption are violated, the exemption can be withdrawn. If safety requirements in binding law are violated this can constitute a criminal offence, entitling the police to intervene. This way road safety is ensured. More supervision can be exercised through the safety requirements in binding regulation or conditions of the exemption. For instance, the reporting and recording (e.g. using a ‘black box’ that records all data a car collects prior to an incident) of incidents can be used to assess the risks the self-driving car poses on road safety.⁸⁶

⁸⁴ Jonathan B Wiener, ‘The regulation of technology, and the technology of regulation’ (2004) 26 *Technology in Society* 483, *Kamerstukken II* 2014/15, 33009, nr. 10, Bryant W Smith, ‘How Governments Can Promote Automated Driving’ (2016) *New Mexico Law Review* (forthcoming), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016, 7. See also International Transport Forum, Corporate Partnership Board, ‘Automated and Autonomous Driving. Regulation under uncertainty’ (OECD/ITF 2015), para 3.

⁸⁵ See for instance Testimony of Dr. Chris Urmson (Director, Self-Driving Cars, Google [x]) before the Senate Committee on Commerce, Science and Technology Hearing: ‘Hands Off: The Future of Self-Driving Cars’ (15 March 2016).

⁸⁶ See on recording data and accidents: ACE Spek, ‘Over toelating van autonome testvoertuigen op de weg en het onderzoek van

The manufacturer or testing organisation will also want to know what safety requirements he has to fulfil, so he can adjust the design or the testing procedure in order to meet the requirements. An exemption – that can be tailored to every individual situation – does not provide the manufacturer or testing organisation with legal certainty on the testing requirements prior to applying for such an exemption. Both binding and non-binding regulations offer legal certainty. However, because it is legally not binding, non-binding regulation can be ignored. Yet this can have consequences if for instance the self-driving car causes an accident during a trial.⁸⁷ The non-compliance with non-binding regulations can contribute to negligence in liability procedures. If that is the case, this is an incentive for the manufacturer or testing organisation to comply with the non-binding regulation.

Non-binding regulation has an advantage over binding regulation: non-binding regulation can be easily updated without having to go through an often time-consuming legislative process.⁸⁸ This makes non-binding regulation more suitable to keep up with the fast developing self-driving technology.⁸⁹ Exemptions are suitable for this as well: every exemption can be tailored to the testing of the newest technological abilities.⁹⁰ The flexibility of these instruments, their ability to keep up with the technological developments, is important given the aim of the jurisdictions to benefit from the newest technological developments.⁹¹

ongevallen' (2016) 64 Verkeersrecht 2 and Kiliaan APC van Wees, 'Over zwarte dozen in auto's en wie er in mag kijken; verkennende beschouwingen over EDR en de exhibitieplicht' (2011) 59 Verkeersrecht 337, Brandon Schoettle & Michael Sivak, 'A Preliminary Analyses of Real-World Crashes Involving Self-Driving Vehicles' (The University of Michigan Transportation Research Institute, Ann Arbor, October 2015) <<http://umich.edu/~umtristwt/PDF/UMTRI-2015-34.pdf>> accessed 18 April 2017 and Myra Blanco and others, 'Automated Vehicle Crash Rate Comparison Using Naturalistic Data,' Virginia Tech Transportation Institute January 2016 <www.vtti.vt.edu/PDFs/Automated%20Vehicle%20Crash%20Rate%20Comparison%20Using%20Naturalistic%20Data_Final%20Report_20160107.pdf> accessed 18 April 2017. See also <www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/disengagement_report_2016> accessed 12 April 2017. See for the UK: Code of Practice for testing 2015, para 5.6, Department for Transport, 'The Pathway to Driverless Cars: A detailed review of regulations for automated vehicle technologies,' 2015, para 14.12–14.15.

⁸⁷ An example of this is the UK Code of Practice 2015.

⁸⁸ For example: Van den Heuvel, 'Wetten moeten meeademen met snelheid technologie,' *Het Financieële Dagblad* (8 January 2016) <<https://fd.nl/opinie/1134451/wetten-moeten-meeademen-met-snelheid-technologie>> accessed 12 April 2017.

⁸⁹ Michiel A. Heldeweg, *Smart rules & regimes: publiekrechtelijk(e) ontwerpen voor privatisering en technologische innovatie* (extended version of inaugural lecture Universiteit Twente, of 24 september 2009, Universiteit Twente 2010), 80–81, 99.

⁹⁰ Kamerstukken 2014/15, 31305, nr. 212, Bryant W Smith, 'How Governments Can Promote Automated Driving' (2016) New Mexico Law Review (forthcoming), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016, 39.

⁹¹ Michiel A. Heldeweg, *Smart rules & regimes: publiekrechtelijk(e) ontwerpen voor privatisering en technologische innovatie* (extended version of inaugural lecture Universiteit Twente, of 24 september 2009, Universiteit Twente 2010), 76–77, 99. See also Bryant W Smith, 'How Governments Can Promote Automated Driving' (2016) New Mexico

When looking at the ability to keep up with the technological developments, the Dutch approach of granting exemptions subject to conditions for each project provides the optimal possibility to cater for each project individually.⁹² Weather conditions, different types of roads, traffic intensity, all can be excluded or included in the exemption. Although this approach is very flexible, it might be time-consuming to maintain if more and more applications for trials are filed. More importantly, it does not provide much legal certainty for the testing institutions or manufacturer.⁹³ From this perspective the approach of California, with new legislation specifically for (the testing of) self-driving cars, provides more legal certainty. This legal certainty, however, limits (to a certain extent) the ability to keep pace with technical developments. A good middle ground could be non-binding regulation, as seen in the UK and on a federal level in the US. This non-binding regulation can provide guidelines to the manufacturers and testing institutions, without losing the possibility to deviate from the regulation. Given the status of the non-binding US Federal Automated Vehicles Policy and the UK Code of Practice, they can relatively easily be kept up to date as they do not have to go through an often time-consuming legislative process. Guidelines like the UK Code of Practice can give manufacturers and other parties involved in testing self-driving cars certainty on what they can expect and which requirements they need to fulfil. For a government wanting to keep the testing of self-driving cars in check, combining the guidelines with a system of granting exemptions from existing binding regulations (which exemptions can be subject to conditions) would give the government power to control trials and withdraw exemptions when the safety of the public is compromised. Adapting to new, often difficult to foresee,⁹⁴ technical developments can be done either by adjusting the guidelines or – for a small number of trials – granting exemptions that allow the testing of the newest possibilities.⁹⁵ If this new technology matures and it has proven

Law Review (forthcoming), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016, 38–39.

⁹² See also Bryant W Smith, 'How Governments Can Promote Automated Driving' (2016) New Mexico Law Review (forthcoming), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016, 39.

⁹³ See also Nynke E. Vellinga, Wim H. Vellinga, Kiliaan APC van Wees, 'Testen van autonome of zelfrijdende auto's op de openbare weg' (2016) 64 Verkeersrecht 218.

⁹⁴ Surden and Williams advice design regulations to be broadly stated at a high level of abstraction as the technological developments are difficult to predict: Harry Surden and Mary-Anne Williams, 'Self-Driving Cars, Predictability, and Law' (2016) 38 Cardozo Law Review 121, 174–78. See also Bryant W Smith, 'How Governments Can Promote Automated Driving' (2016) New Mexico Law Review (forthcoming), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016, 38–39. The Governors Highway Safety Association urges states not to rush with legislation for self-driving vehicles as it could hinder the development of self-driving vehicles and may be soon out of date: James Hedlund, *Autonomous Vehicles Meet Human Drivers: Traffic Safety Issues for States* (Governors Highway Safety Association) available at <<http://src.bna.com/IVf>> accessed 10 February 2017.

⁹⁵ Smith also acknowledges the flexibility exemptions can offer: Bryant W Smith, 'How Governments Can Promote Automated Driving' (2016) New Mexico Law Review (forthcoming), available at

to be safe in trials, the guidelines can be adjusted. This way it would be possible to slowly transfer from testing with a human driver inside the testing vehicle to testing without a human driver. By combining non-binding regulation with a system of granting exemptions, the interests of the government, the manufacturer, testing organisation, and the general public are provided for. Therefore, this combination is preferred over the other discussed legal instruments.

6. Post testing: the driver in international and national traffic laws

As described above, legislators are already taking steps to accommodate the testing of self-driving cars. But as technology develops further, from a technical perspective a human driver will become redundant. Therefore for many legislators the question arises: are cars without human drivers⁹⁶ allowed on public roads? The answer to this question is not only determined by national law, but also by international law. Both the 1949 Geneva Convention on Road Traffic and the 1968 Vienna Convention on Road Traffic are relevant in this respect. So before taking a closer look at national laws (Section 6.2), the Conventions will be discussed (Section 6.1). If cars without human drivers are allowed on public roads, no legislative action is needed. However, if cars without human drivers are not allowed to drive on public roads, legislative measures will be necessary (Section 6.3).

6.1. The driver in international law: Vienna Convention on Road Traffic 1968 and the Geneva Convention on Road Traffic 1949

The Geneva Convention has over 90 Contracting Parties; the Vienna Convention has over 60 Contracting Parties. So both Conventions greatly influence the traffic laws across the globe.⁹⁷ Out of the countries discussed above, the Netherlands is the only country that is a party to both the 1949 Geneva Convention and the 1968 Vienna Convention.⁹⁸ The US and the UK have ratified the 1949 Geneva Convention on Road Traffic.⁹⁹ The UK has signed but has not ratified the 1968 Vienna Convention,

whereas the United States has neither signed nor ratified the Vienna Convention.

Discussions on both Conventions are mainly held by Global Forum for Road Traffic Safety, or Working Party 1, of the United Nations Economic Commission for Europe Inland Transport Committee. The primary function of Working Party 1 is “to serve as guardian of the United Nations legal instruments aimed at harmonizing traffic rules.”¹⁰⁰ Working Party 1, open to participation from all countries, meets twice a year.¹⁰¹ As Working Party 1 focusses on the improvement of road safety, automated driving is relevant for the Working Party. The Working Party has an Informal Group of Experts on Automated Driving. The attention of the Working Party is mainly directed at the 1949 Geneva Convention and the 1968 Vienna Convention as both Conventions might pose obstacles with regards to automated driving.

The Geneva Convention and the Vienna Convention both have a similar requirement with regards to the requirement of a driver¹⁰² in a vehicle. Article 8 paragraph 1 of the Geneva Convention demands that “Every vehicle or combination of vehicles proceeding as a unit shall have a driver”, whereas Article 8 paragraph 1 of the Vienna Convention has a different formulation: “Every moving vehicle or combination of vehicles shall have a driver.” Both Conventions also demand the driver to be in control of his vehicle.¹⁰³

With the emergence of Advanced Driver Assistance Systems or ADAS, the question arose if a driver can still be in control of his vehicle when part of the driving task is performed by an assistance system.¹⁰⁴ To provide clarity, amendments to both Conventions were proposed. The proposed amendments to the Geneva Convention¹⁰⁵ were not accepted by the contracting parties. The very similar amendments to the Vienna Convention, however,¹⁰⁶ were adopted and entered into force in March

<https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016, 39.

⁹⁶ Smith argues for establishing a clear legal distinction between a driver and a passenger of a vehicle: Bryant W. Smith, ‘How Governments Can Promote Automated Driving’ (2016) New Mexico Law Review (forthcoming), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016, 29.

⁹⁷ List of Contracting Parties available at: <<https://treaties.un.org/doc/Publication/MTDGS/Volume%20I/Chapter%20XI/xi-b-1.en.pdf>> accessed 12 April 2017 (Geneva Convention), <http://www.unece.org/fileadmin/DAM/trans/conventn/CP_Vienna_convention.pdf> accessed 12 April 2017 (Vienna Convention, 1 February 2007).

⁹⁸ List of Contracting Parties to the Convention on Road Traffic Vienna, 8 November 1968, 1 February 2007: <www.unece.org/fileadmin/DAM/trans/conventn/CP_Vienna_convention.pdf>. On the Netherlands: Tractatenblad 2008, 76.

⁹⁹ Available at <<https://treaties.un.org/doc/Publication/MTDGS/Volume%20I/Chapter%20XI/xi-b-1.en.pdf>> accessed 12 April 2017.

¹⁰⁰ <www.unece.org/trans/roadsafe/rsabout.html> accessed 1 December 2016.

¹⁰¹ <www.unece.org/trans/roadsafe/rsabout.html> accessed 1 December 2016. Documents relating to those meetings can be accessed through this website.

¹⁰² The definition of ‘driver’ is given in Article 4 paragraph 1 Geneva Convention and Article 1 (v) Vienna Convention.

¹⁰³ Article 8 paragraph 4 Geneva Convention, Article 8 paragraph 5 Vienna Convention. The formulations of both Conventions differ. Article 10 Geneva Convention and Article 39 paragraph 1 Vienna Convention further elaborate on the control a driver should have over his vehicle. See also Lennart S. Lutz, ‘Anforderungen an Fahrerassistenzsysteme nach dem Wiener Übereinkommen über den Straßenverkehr’ [2014] Neue Zeitschrift für Verkehrsrecht 67.

¹⁰⁴ See for instance Lennart S. Lutz, ‘Die bevorstehende Änderung des Wiener Übereinkommens über den Straßenverkehr: Eine Hürde auf dem Weg zu (teil-) autonomen Fahrzeugen ist genommen!’ [2014] Deutsches Autorecht 446, 447–48. See also Walter Frenz and Erika Casimir-van den Broek, ‘Völkerrechtliche Zulässigkeit von Fahrerassistenzsystemen’ [2009] Neue Zeitschrift für Verkehrsrecht 529, Frank Albrecht, ‘Fährt der Fahrer oder das System?’ – Anmerkungen aus rechtlicher Sicht’ [2005] Straßenverkehrsrecht 373.

¹⁰⁵ ECE/TRANS/WP.1/2014/4, ECE/TRANS/WP.1/2014/4/Rev. 1.

¹⁰⁶ The reason for this probably lies in the higher threshold for accepting amendments to the Geneva Convention (see Economic Commission for Europe, Inland Transport Committee, Seventy-third session, Automated Driving, Informal document No. 2, submitted by the WP.1 Chair, 11 July 2016), Article 31 paragraph 3 Geneva Convention, see for the procedure to amend the Vienna Convention Article 49 of the Vienna Convention.

2016.¹⁰⁷ These amendments should take away any doubt there might be regarding the compliance of driver assistance systems that are already available to the general public with the Vienna Convention.¹⁰⁸ There needs to be a possibility for the driver to override these systems and there should be a possibility for the driver to switch off the driver assistance system.¹⁰⁹ However, not all systems that cannot be switched off or overridden by the driver are inconsistent with the Vienna Convention. Systems like brake assist that supports the driver when making an emergency stop by maximizing braking deceleration are deemed to be in conformity with the Vienna Convention as these systems help the driver to maintain his vehicle under control.¹¹⁰

These amendments, however, do not seem to address the completely self-driving car, allowing a 'driver' to be involved in other tasks than driving.¹¹¹ The amendments have not affected the requirement that every moving vehicle should have a driver.¹¹²

In order to help legislative developments along, Sweden proposed to make automated driving a new work item on the agenda of Working Party 1.¹¹³ Since then, automated driving has been getting more and more attention of the Working Party. Together the governments of Belgium and Sweden proposed an amendment to Article 8 of the Vienna Convention.¹¹⁴ The

proposed amendments have opened up a discussion on if, how and in what way the Vienna Convention and the Geneva Convention should evolve given the development of self-driving cars. A wider interpretation of the current provisions of the Conventions is one of the options that is being explored.¹¹⁵ Current trials of self-driving cars with a human driver are allowed under the Vienna Convention: exemptions from Annex 5, regarding technical conditions of vehicles, can be granted for experiments with the purpose to keep up with technical developments and to improve road safety.¹¹⁶ Deviating from the traffic rules of the Vienna Convention is most likely allowed as well, as long as this is not inconsistent with the objectives and scope of the Vienna Convention.¹¹⁷

6.2. The driver in national law: the Netherlands, California, United Kingdom

As mentioned above, the Conventions greatly influence national traffic laws. So it is no surprise that these traffic laws are based on the notion that only a human can drive a car. For the purpose of testing self-driving cars, the Netherlands and California are taking steps to accommodate testing without a human driver inside of the vehicle.

As follows from the above mentioned legal situation in the Netherlands, test driving autonomous vehicles on public roads without a human driver inside the vehicle is not yet allowed in the Netherlands. However, this will change if, probably in 2018, the '*experimenterwet*' will enter into force.¹¹⁸

California is ahead of the Netherlands in this respect:¹¹⁹ the governor of California has recently signed off a new bill that

¹⁰⁷ ECE/TRANS/WP.1/2014/3, ECE/TRANS/WP.1/145 and ECE/TRANS/WP.1/145/Corr. 1, announcement available at <<https://treaties.un.org/doc/Publication/CN/2014/CN.569.2014-Eng.pdf>> accessed 7 December 2016.

¹⁰⁸ ECE/TRANS/WP.1/2014/3, ECE/TRANS/WP.1/145, 11 under 2 and 3.

¹⁰⁹ ECE/TRANS/WP.1/2014/3, ECE/TRANS/WP.1/145, 11 under 4 and 6. Bryant W. Smith, 'Automated Vehicles Are Probably Legal in the United States' (2014) 1 Tex. A&M L. Rev. 411, 440.

¹¹⁰ ECE/TRANS/WP.1/2014/3, ECE/TRANS/WP.1/145, 11 under 5.

¹¹¹ Economic Commission for Europe, Inland Transport Committee, Seventy-third session, Automated Driving, Informal document No. 4, 14 September 2016, para 3, Lennart S Lutz, 'Die bevorstehende Änderung des Wiener Übereinkommens über den Straßenverkehr: Eine Hürde auf dem Weg zu (teil-) autonomen Fahrzeugen ist genommen!' [2014] Deutsches Autorecht 446, 449–450, Kiliaan APC van Wees, 'Zelfrijdende auto's en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,' Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 4.7, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>> accessed 13 March 2017, Benjamin von Bodungen, Martin Hoffmann, 'Das Wienerübereinkommen über den Straßenverkehr und die Fahrzeugautomatisierung (Teil 1). Wege Aus dem Zulassungsdilemma' [2016] Straßenverkehrsrecht 41, C.II, Benjamin von Bodungen, Martin Hoffmann, 'Das Wienerübereinkommen über den Straßenverkehr und die Fahrzeugautomatisierung (Teil 2). Wege Aus dem Zulassungsdilemma' [2016] Straßenverkehrsrecht 93. Lutz expresses less doubt regarding the scope of the amendments: Lennart S Lutz, 'Autonome Fahrzeuge als rechtliche Herausforderung' [2015] Neue Juristische Wochenschrift 119.

¹¹² Art. 8 paragraph 1 Vienna Convention ("Every moving vehicle or combination of vehicles shall have a driver").

¹¹³ ECE/TRANS/WP.1/2014/7.

¹¹⁴ ECE/TRANS/WP.1/2015/8. See also Economic Commission for Europe, Inland Transport Committee, Seventieth session, Autonomous Driving, Informal document No. 2, 12 March 2015. See for an analysis of the proposed amendment Benjamin von Bodungen, Martin Hoffmann, 'Belgien und Schweden schlagen vor: Das Fahrsystem soll Fahrer werden!' [2015] Neue Zeitschrift für Verkehrsrecht 521.

¹¹⁵ Economic Commission for Europe, Inland Transport Committee, Seventy-third session, Automated Driving, Informal document No. 4, 14 September 2016, Economic Commission for Europe, Inland Transport Committee, Seventy-fourth session, Automated Driving, Informal document No. 2, 14 March 2017 and ECE/TRANS/WP.1/156. See on the interpretation of Article 8 of both Conventions: Bryant W Smith, 'Automated Vehicles Are Probably Legal in the United States' (2014) 1 Tex. A&M L. Rev. 411. See also European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)), section 61–62.

¹¹⁶ Art. 60(c) Annex 5, Vienna Convention.

¹¹⁷ Kiliaan APC van Wees, 'Zelfrijdende auto's en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,' Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 4.8, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>>, Walter Frenz and Erika Casimir-van den Broek, 'Völkerrechtliche Zulässigkeit von Fahrerassistenzsystemen' [2009] Neue Zeitschrift für Verkehrsrecht 529.

¹¹⁸ 'Reacties op de internetconsultatie *Experimenterwet zelfrijdende auto*,' available at <www.internetconsultatie.nl/experimenterwet_zelfrijdendeauto> accessed 12 January 2017.

¹¹⁹ This being said, California is not the first state with legislation enabling the testing of self-driving vehicles without a test driver inside the vehicle. In Michigan, it is now allowed to test self-driving cars without a human driver and without steering equipment like a steering wheel and brake paddle (Senate Bill 995, 996, 997, 998, Senate Journal Number 77, 13 December 2016). Even though there is some discussion on how to interpret this legislation, it is clear that this is allowed (see for instance Kristen Korosec, 'Michigan Just Passed the Most Permissive Self-Driving Car Laws in the Country' (Fortune, 9 December 2016) <<http://fortune.com/2016/12/09/michigan-self-driving-cars/>> accessed 21 December 2016,

permits testing of autonomous vehicles without equipment like a brake paddle, steering wheel and accelerator in the car.¹²⁰ However, the bill is for just one pilot project.¹²¹ Although at the moment this project is the first Californian project which will actually be without a human driver, other projects might follow because the Californian Department of Motor Vehicles has proposed new legislation.¹²²

These so-called Autonomous Vehicles Express Terms would open up the possibility for a manufacturer to apply for a Permit to Deploy Autonomous Vehicles on Public Roads, which entails operation of autonomous vehicles by members of the public.¹²³ Several requirements need to be fulfilled. For instance, the vehicle needs to be equipped with a technology data recorder.¹²⁴ There should be a communication link between the vehicle and a remote operator, if any, that allows two-way communication between the remote operator and any passengers in case a failure occurs that would endanger the safety of either the passengers or other road users.¹²⁵ A copy of the safety assessment letter which can be submitted voluntarily to the NHTSA¹²⁶ needs to be submitted to the Department for Motor Vehicles.¹²⁷ There is also a special subsection on cybersecurity: “A certification that the autonomous vehicles have self-diagnostic

capabilities that meet current industry best practices for detecting and responding to cyber-attacks, unauthorized intrusions, and false or spurious messages or vehicle control demands” should be submitted and approved by the Department of Motor Vehicles.¹²⁸ A vehicle demonstration test conducted by an independent third party, to assess the vehicle’s performance and capabilities, was not included in the Autonomous Vehicles Express Terms because of the inability to formulate pass/fail criteria that would be used by the independent third party demonstration testers.¹²⁹ It is yet unknown if and when the Autonomous Vehicles Express Terms are expected to enter into force.

The UK government has not only published the Code of Practice, described above, but also a review of the regulations for automated vehicle technologies.¹³⁰ This review entails several topics, e.g. roadworthiness and maintenance, standards for new vehicles, road infrastructure standards, driver behaviour, event or collision data recorders, etc.¹³¹ An important finding of the review is that “(. . .) there are no barriers in road traffic law that would stop the testing of automated vehicles on public roads, provided a test driver supervises the actions of the vehicle sufficiently to take control in time to operate the vehicle safely and to a ‘proper’ standard.”¹³² This finding has been translated into a requirement in the Code of Practice stating that a trained test driver or test operator¹³³ should always supervise the vehicle and be able to override the automated driving system when needed.¹³⁴ The responsibility for ensuring the safe operation of the vehicle at all times, regardless of whether it is driving in automated mode or manual mode, rests with the test driver or the test operator.¹³⁵ Contrary to California, the UK government has not yet taken steps to allowing vehicles without a human driver on public roads, neither for testing purposes nor for deployment.¹³⁶

Aarian Marshall, ‘Michigan just embraced the driverless future’ (Wired, 9 December 2016) <www.wired.com/2016/12/michigan-just-embraced-driverless-future/> accessed 21 December 2016, Bryant W Smith, ‘Michigan’s automated driving bills’ (Blog of The Center for Internet and Society, Stanford Law School, 6 September 2016) <<https://cyberlaw.stanford.edu/blog/2016/09/michigans-automated-driving-bills>> accessed 7 February 2017.

¹²⁰ Assembly Bill No. 1592, September 29, 2016. Ford has the intent to bring such a vehicle to the market no later than 2021: ‘Ford Targets Fully Autonomous Vehicle for Ride Sharing in 2021; Invests in New Tech Companies, Doubles Silicon Valley Team’ <<https://media.ford.com/content/fordmedia/fna/us/en/news/2016/08/16/ford-targets-fully-autonomous-vehicle-for-ride-sharing-in-2021.html>> (16 August 2016) accessed 11 April 2017.

¹²¹ Section 38755 (a).

¹²² Autonomous Vehicles Express Terms, released March 2017, available at <www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/auto>. See also the Revised Draft Deployment Regulations, released September 2016 and Draft Deployment Regulations, released December 2015.

¹²³ §228.06 Autonomous Vehicles Express Terms, Initial Statement of Reasons, March 2017, available at <www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/auto>. The previous Draft Deployment Regulations originally required a licensed operator in the vehicle who can resume control of the vehicle at all times. This led to critique from (amongst others) Google (Chris Urmson, ‘The View from the Front Seat of the Google Self-Driving Car, Chapter 3’ (17 December 2015) <https://medium.com/@chris_urmson/the-view-from-the-front-seat-of-the-google-self-driving-car-chapter-3-476ea9deed9a#wqzn8phbb> accessed 6 January 2017, see also <www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/auto> accessed 12 April 2017).

¹²⁴ §228.06 (a)(5) Autonomous Vehicles Express Terms.

¹²⁵ §228.06 (b)(1) Autonomous Vehicles Express Terms. See also Nissan’s recently introduced Seamless Autonomous Mobility (SAM): Eric Abent, ‘Nissan debuts Seamless Autonomous Mobility system based on NASA tech’ (Slashgear, 5 January 2017) <www.slashgear.com/nissan-debuts-seamless-autonomous-mobility-system-based-on-nasa-tech-05470542/> accessed 6 January 2016.

¹²⁶ Federal Policy 2016, 15.

¹²⁷ §228.06 (d) Autonomous Vehicles Express Terms.

¹²⁸ §228.06 (a)(9) Autonomous Vehicles Express Terms.

¹²⁹ Initial Statement of Reasons, March 2017, available at <<http://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/auto>>. See also §228.08 Autonomous Vehicles Express Terms.

¹³⁰ Department for Transport, ‘The Pathway to Driverless Cars: A detailed review of regulations for automated vehicle technologies,’ 2015 (Review of regulations 2015).

¹³¹ Review of regulations 2015.

¹³² Review of regulations 2015, para 5.15. See also para 5.12–5.14, 5.18, 10.23. Because trials need to be in line with existing laws, a driver needs to be present.

¹³³ Definition of test operator: “A test operator is someone who oversees testing of an automated vehicle without necessarily being seated in the vehicle, since some automated vehicles might not have conventional manual controls and/or a driver’s seat. In this case it is expected that a ‘test operator’ would still be able to override automated operation of the vehicle at any time.” Code of Practice for testing 2015, para 2.11.

¹³⁴ Code of Practice for testing 2015, para 4.1. See also para 2.10–2.11, 4.3, 4.15, 5.17, Review of regulations 2015, para 5.15.

¹³⁵ Code of Practice for testing 2015, para 4.2. See also Review of regulations 2015, para 5.13–5.14.

¹³⁶ Centre for Connected & Autonomous Vehicles, ‘Pathway to Driverless Cars: Proposals to support advanced driver assistance systems and automated vehicle technologies,’ July 2016, p. 8 and para 3, Centre for Connected & Autonomous Vehicles, ‘Pathway to Driverless Cars: Consultation on proposals to support Advanced Driver Assistance Systems and Automated Vehicles, Government Response,’ January 2017.

6.3. The interpretation of ‘driver’

As described above, the Vienna and Geneva Conventions as well as national laws are, at least for now, adhering to the thought that a car needs a human driver. So if a human driver becomes redundant, traffic laws will need to adapt. In California, the draft Autonomous Vehicles Express Terms would open up the possibility to deploy cars that do not need a human driver on public roads. Drafting new regulations to open up such a possibility is one way to go, but there is another route that legislators can take. Interpretation of the term ‘driver’ can lead to the conclusion that a driver is not necessarily a human¹³⁷ but could also be the self-driving car’s system.¹³⁸ The NHTSA has already interpreted the term ‘driver’ in this way: for certain Federal Motor Vehicle Safety Standards the NHTSA is of the opinion that the ‘driver’ in these specific standards can also be the self-driving system.¹³⁹ Working Party 1 also explores a broader interpretation of the Conventions.¹⁴⁰ However, especially in the stage of development where a completely self-driving car is not yet available and therefore the driving task is shared between the human driver and the self-driving system, this can lead to interesting outcomes. For instance Article 8 paragraph 6 of the Vienna Convention (“A driver of a vehicle shall at all times minimize any activity other than driving(. . .)”), aiming to prevent distracted driving, is clearly directed at the human driver but does not seem relevant when the self-driving system is the driver of the car. Certain rules of conduct will also have consequences for the design of the vehicle if the self-driving system can be regarded as driver. An example from Dutch traffic law can illustrate this: Article 160 WvW 1994¹⁴¹ (in brief) states that the driver should stop his vehicle immediately when instructed to do so by authorized officials (e.g. a police officer). So a self-driving car driven by the self-driving system should be able to understand the instructions of a person, and it should be able to identify that person as an

authorized official.¹⁴² That seems quite a challenging task for a self-driving system.

Another obstacle for a broader interpretation is the definition of a driver in Article 1(v) of the Vienna Convention: “‘Driver’ means any person who drives a motor vehicle or other vehicle (including a cycle), or who guides cattle, singly or in herds, or flocks, or draught, pack or saddle animals on a road.” This definition of driver is an obstacle for interpreting ‘driver’ so extensively that the self-driving system could be regarded as ‘driver’ because a self-driving system can hardly be regarded to be a person. However, it has been argued that the ‘person’ referred to in Article 1(V) of the Vienna Convention is not necessarily a human person, but could also be a legal person.¹⁴³ In this context, the discussion on assigning robots legal personality could be of relevance.¹⁴⁴

7. Post-testing: liability and insurance

Although a significant decline in road accidents is expected,¹⁴⁵ self-driving cars will not be infallible. With the occurrence of accidents also come questions on liability and insurance. At the current stage, most jurisdictions have not adopted a new liability regime regarding self-driving cars. However, some jurisdictions have supplementary provisions on liability and insurance. Below, some issues regarding liability and insurance will be highlighted.

7.1. Current developments

In the US the States, not the federal government, are responsible for motor vehicle insurance¹⁴⁶ and liability regimes (mainly based on negligence).¹⁴⁷ American legal literature mainly

¹³⁷ Bryant W Smith, ‘Automated Vehicles Are Probably Legal in the United States’ (2014) 1 Tex. A&M L. Rev. 411, 434, 440–41.

¹³⁸ In a different context: Paul T Schrader, ‘Haftungsrechtlicher Begriff des Fahrzeugführers bei zunehmender Automatisierung von Kraftfahrzeugen’ [2015] Neue Juristische Wochenschrift 3537, V.2, and Paul T Schrader, ‘Haftungsfragen für Schäden beim Einsatz automatisierter Fahrzeuge im Straßenverkehr,’ Deutsches Autorecht 242, V.1.

¹³⁹ Letter of the NHTSA to Dr. Urmson, Director, self-driving car project, Google Inc., 4 February 2016, available at <<https://isearch.nhtsa.gov/files/Google%20-%20compiled%20response%20to%2012%20Nov%20%2015%20interp%20request%20-%204%20Feb%2016%20final.htm>> (accessed 3 February 2017). See also Françoise Gilbert and Raffaele Zallone, ‘Connected cars. Recent legal developments’ (2016) available at <http://robots.law.miami.edu/2016/wp-content/uploads/2015/07/GILBERT-ZALLONE-Connected-Cars-REVISED_2016-03-29.pdf>, 9–11 (last accessed 3 February 2017). However, Smith points out that the driver is not seen as a legal entity in the Federal Motor Vehicle Safety Standards: Bryant W. Smith, ‘Michigan’s automated driving bills’ (Blog of The Center for Internet and Society, Stanford Law School, 6 September 2016) <<https://cyberlaw.stanford.edu/blog/2016/09/michigans-automated-driving-bills>> accessed 7 February 2017.

¹⁴⁰ ECE/TRANS/WP.1/155, under 19.

¹⁴¹ The Vienna Treaty has a similar provision in art.6 paragraph 2, but this is directed to ‘road-users’.

¹⁴² Nynke E. Vellinga, Wim H. Vellinga, Kiliaan APC van Wees, ‘Testen van autonome of zelfrijdende auto’s op de openbare weg’ (2016) 64 Verkeersrecht 218.

¹⁴³ Economic Commission for Europe, Inland Transport Committee, Seventy-third session, Automated Driving, Informal document No. 4, 14 September 2016.

¹⁴⁴ See for instance: Nevejans, *European Civil Law Rules in Robotics. Study* (Directorate-General For Internal Policies Policy Department C: Citizens, Rights and Constitutional Affairs, Legal Affairs, 2016), SM Solaiman, ‘Legal personality of robots, corporations, idols and chimpanzees: a quest for legitimacy,’ *Artif Intell Law* (2016), European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)), section 59f.

¹⁴⁵ However, it is not yet proven that self-driving cars will indeed reduce road traffic accidents. See the letter from Martyn Thomas to *Financial Times* ‘Future with the driverless car needs careful planning,’ *Financial Times* (30 September 2016) <www.ft.com/content/d918048-83ff-11e6-a29c-6e7d9515ad15> accessed 28 April 2017.

¹⁴⁶ Twelve states have no-fault auto insurance laws: Insurance Information Institute, <www.iii.org/issue-update/no-fault-auto-insurance> accessed 12 April 2017.

¹⁴⁷ Federal Policy 2016, p. 45, Dorothy J. Glancy, Robert W. Peterson, Kyle F. Graham, *A Look at the Legal Environment for Driverless Vehicle* (Legal Research Digest 69, Transportation Research Board 2016). See also Gary E. Marchant, Rachel E. Lindor, ‘The Coming Collision Between Autonomous Vehicles and the Liability System’ (2012) 52 Santa Clara L. Rev. 1321.

focusses on product liability.¹⁴⁸ The Californian draft Autonomous Vehicles Express Terms contain a provision, stating that the manufacturer will have to have in place and prove its ability to “respond to a judgment or judgments for damages for personal injury, death, or property damage arising from collisions or accidents caused by the autonomous vehicles produced by the manufacturer in the form of an instrument of insurance, a surety bond, or proof of self-insurance.”¹⁴⁹ In the case of a SAE level 5 vehicle, the manufacturer is at all times responsible for the safe operation of this vehicle, including compliance with all traffic laws.¹⁵⁰

In the Netherlands, the current liability (fault liability, but a strict liability regime applies if more vulnerable road users are injured by a motor vehicle)¹⁵¹ and insurance regime applies, but it is possible that exemptions granted for testing are bound to certain conditions regarding insurance.¹⁵² For instance, additional insurance can be a condition of the exemption.¹⁵³ The overall opinion expressed in Dutch legal literature is that the current liability regime is sufficient; a victim of a crash will be able to get compensation.¹⁵⁴ However, some remarks are made.

¹⁴⁸ See, among others, Kevin Funkhouser, ‘Paving the road ahead: autonomous vehicles, products liability, and the need for a new approach’ (2013) Utah L. Rev. 437, Jeremy Levy, ‘No Need to Reinvent the Wheel: Why Existing Liability Law Does Not Need to Be Preemptively Altered to Cope with the Debut of the Driverless Car’ (2016) 9 J. Bus. Entrepreneurship & L 355, Gary E. Marchant, Rachel E. Lindor, ‘The Coming Collision Between Autonomous Vehicles and the Liability System’ (2012) 52 Santa Clara L. Rev. 1321, Stephen S. Wu, ‘Unmanned Vehicles and US Product Liability’ (2012) 21(2) Journal of Law, Information, and Science 234, Andrew P. Garza, “Look Ma, No Hands!": Wrinkles and Wrecks in the Age of Autonomous Vehicles’ (2012) 46 New England Law Review 581, Jeffrey K. Gurney, ‘Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles’ (2013) University of Illinois Journal of Law, Technology & Policy 247, Dorothy J. Glancy, Robert W. Peterson, Kyle F. Graham, A Look at the Legal Environment for Driverless Vehicle (Legal Research Digest 69, Transportation Research Board 2016), James M. Anderson and others, *Autonomous Vehicle Technology. A Guide for Policymakers* (RAND Corporation, 2016), 118.

¹⁴⁹ §228.04 (a)(1) Autonomous Vehicles Express Terms. Such an instrument has to be in the amount of five million dollars: see §228.04 (a)(1) in conjunction with §227.10, §227.08, §227.14 Autonomous Vehicles Express Terms and in conjunction with California Vehicle Code section 38750, subdivision b, 3.

¹⁵⁰ §228.28 (b) Autonomous Vehicles Express Terms. See §228.28 (b) for a SAE level 4 vehicle, see §228.28 (a) for a SAE level 3 vehicle.

¹⁵¹ Cees van Dam and Gerrit van Maanen, ‘The development of traffic liability in the Netherlands,’ in Wolfgang Ernst (ed), *The development of traffic liability* (Volume 5, Cambridge University Press, 2010). See also Erik FE Tjong Tjin Tai, Sanne Boesten, ‘Aansprakelijkheid, zelfrijdende auto’s en andere zelfsturende objecten’ (2016) 10 Nederlands Juristenblad 656.

¹⁵² Nota van Toelichting, Besluit van 15 juni 2015 tot wijziging van het Besluit ontheffingverlening exceptionele transporten (ontwikkeling zelfrijdende auto), Staatsblad 2015/248. See also Draft, Explanatory Memorandum, 2.5.

¹⁵³ Besluit van 15 juni 2015 tot wijziging van het Besluit ontheffingverlening exceptionele transporten (ontwikkeling zelfrijdende auto), Staatsblad 2015/248, p. 5.

¹⁵⁴ Erik FE Tjong Tjin Tai, Sanne Boesten, ‘Aansprakelijkheid, zelfrijdende auto’s en andere zelfsturende objecten’ (2016) 10 Nederlands Juristenblad 656, Kiliaan APC van Wees, ‘Zelfrijdende auto’s en het Verdrag van Wenen inzake het wegverkeer. Een

For instance, a concern has been expressed that it might be that although the manufacturer can call on the state of the art-defense¹⁵⁵ to avert liability, the possessor¹⁵⁶ of the self-driving car cannot invoke that defense.¹⁵⁷ The possessor would then be strictly liable for the development risks, even though the possessor is not involved in the development.¹⁵⁸

Under English law, liability is mainly based on the tort of negligence, although negligence is interpreted rather strict.¹⁵⁹ Compulsory liability insurance was first introduced by the Road Traffic Act 1930 and went through several changes.¹⁶⁰ Now, the compulsory liability insurance will undergo more changes because of the development of self-driving cars. The UK Department for Transport and the Centre for Connected and Autonomous Vehicles took the next step towards self-driving cars by issuing proposals to update the legal framework and consulting the public.¹⁶¹ These proposals are divided into three categories, one of which is Insurance.¹⁶² After consulting the

verkennde analyse’ Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>> (13 February 2016), Esther FD Engelhard, ‘Wetgever, pas op! De (vrijwel) autonome auto komt eraan’ (2017) (3) Ars Aequi 230, Kiliaan APC van Wees, ‘Enkele juridische aspecten van de (deels) zelfrijdende auto’ [2015] Computerrecht 313, Kiliaan APC van Wees, ‘Over intelligente voertuigen, slimme wegen en aansprakelijkheid’ (2010) 58 Verkeersrecht 33, Nynke E. Vellinga, ‘De civielrechtelijke aansprakelijkheid voor schade veroorzaakt door een autonome auto’ (2014) 62 Verkeersrecht 151, Kees NJ De Vey Mestdagh and Jeroen Lubbers, “Nee hoor, u wilt helemaal niet naar Den Haag. . .” Over de techniek, het recht en de toekomst van de zelfrijdende auto’ (2015) 4 Ars Aequi 267, Kiliaan APC van Wees, ‘Zelfrijdende auto’s, aansprakelijkheid en verzekering; over nieuwe technologie en oude discussies’, (2016) (2) Tijdschrift voor Vergoeding Personenschade 29, Kiliaan APC van Wees, ‘Aansprakelijkheidsaspecten van (deels) zelfrijdende auto’s’ (2015) (5) Aansprakelijkheid, Verzekering & Schade 170, AI Schreuder, ‘Aansprakelijkheid voor “zelfdenkende” apparatuur,’ (2014) (5/6) Aansprakelijkheid, Verzekering & Schade.
¹⁵⁵ Art. 6:185 Burgerlijk Wetboek, Directive 85/374/EEC.
¹⁵⁶ Art. 6:173 Burgerlijk Wetboek. See also Article 3:107 Burgerlijk Wetboek.

¹⁵⁷ Erik FE Tjong Tjin Tai, Sanne Boesten, ‘Aansprakelijkheid, zelfrijdende auto’s en andere zelfsturende objecten’ (2016) 10 Nederlands Juristenblad 656, para 4.5. Van Wees does not share this view: Kiliaan APC van Wees, ‘Zelfrijdende auto’s en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,’ Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 7.5, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>> (accessed 13 February 2016). See also Esther FD Engelhard, ‘Wetgever, pas op! De (vrijwel) autonome auto komt eraan’ (2017) (3) Ars Aequi 230.

¹⁵⁸ Erik FE Tjong Tjin Tai, Sanne Boesten, ‘Aansprakelijkheid, zelfrijdende auto’s en andere zelfsturende objecten’ (2016) 10 Nederlands Juristenblad 656, para 4.5. See also Kiliaan APC van Wees, ‘Aansprakelijkheidsaspecten van (deels) zelfrijdende auto’s’ (2015) (5) Aansprakelijkheid, Verzekering & Schade 170.

¹⁵⁹ Cees van Dam, *European Tort Law* (Oxford University Press, 2013).

¹⁶⁰ Roderick Bagshaw, ‘The development of traffic liability in England and Wales,’ in Wolfgang Ernst (ed), *The development of traffic liability* (Volume 5, Cambridge University Press, 2010).

¹⁶¹ Centre for Connected & Autonomous Vehicles, ‘Pathway to Driverless Cars: Proposals to support advanced driver assistance systems and automated vehicle technologies,’ July 2016 (Proposals 2016).

¹⁶² Proposals 2016, 8. See also Proposals 2016, 16.

public, the government response was published.¹⁶³ The proposal concerning insurance was agreed upon by government and is now part of the Vehicle Technology and Aviation Bill (HC Bill 143) that is before Parliament.¹⁶⁴ Although the option of a first party insurance (enabling the victim of a collision, regardless of liability, to claim directly from the insurer of the vehicle he is travelling in) is discussed in the proposal,¹⁶⁵ the proposal does not entail significant changes in liability rules as “(. . .) a fault based approach combined with existing product liability law, rather than a new strict liability regime, is the best approach for our legal system. (. . .) the existing common law on negligence should largely be able to adapt to this new technology.”¹⁶⁶ The bill, however, does contain the extending of compulsory insurance¹⁶⁷ requirements for automated vehicles.¹⁶⁸ A single insurer model is proposed, where an insurer covers the driver’s use of the self-driving car and the self-driving technology.¹⁶⁹ An innocent victim, regardless of whether he is inside or outside of the vehicle, can claim from this insurer if at the time of the collision the self-driving technology was active.¹⁷⁰ The insurer can recover the costs from the manufacturer, if the manufacturer is found to be liable.¹⁷¹ The aim of the bill is to ensure that victims of a collision would be in a no worse position if they are injured by an automated vehicle than if they are injured by a conventional vehicle.¹⁷²

7.2. The effects of liability law and the influence of insurance

Given the current state of technical and legal developments, a human driver is still indispensable. Therefore, current liability regimes do not fall short. When the truly self-driving car

becomes reality, however, gaps in the liability regimes can develop.¹⁷³ If liability for car accidents would shift from the human driver or owner of the car to the manufacturer of the self-driving car, this might have a negative effect on the development of the self-driving car.¹⁷⁴ However, Volvo announced it will accept “full liability” if one of its cars causes an accident whilst driving in autonomous mode.¹⁷⁵

Although such an inhibiting effect of liability law should be considered, it is of greater importance that the victim of a self-driving car accident is not worse off than a victim of conventional car accidents. From that point of view, a first-party insurance regime is worth considering as it would mean that the victim of a collision with a self-driving car is not confronted with questions concerning proving fault of a party involved.¹⁷⁶ The victim would be compensated by the first-party insurer, which insurer can then take recourse against another party (the user of the vehicle, the owner of the vehicle,

¹⁷³ See also European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)).

¹⁷⁴ Melinda F. Lohmann, *Liability Issues Concerning Self-Driving Vehicles*, 7 Eur. J. Risk Reg. 335, Robolaw 2014, 58–60, Gary E. Marchant, Rachel E. Lindor, ‘The Coming Collision Between Autonomous Vehicles and the Liability System’ (2012) 52 Santa Clara L. Rev. 1321, James M. Anderson and others, *Autonomous Vehicle Technology. A Guide for Policymakers* (RAND Corporation, 2016), 118–19. Garza, however, is of the opinion that a possible increase in liability will not be of great concern to manufacturers: Andrew P. Garza, “‘Look Ma, No Hands!’: Wrinkles and Wrecks in the Age of Autonomous Vehicles” (2012) 46 New England Law Review 581, 606, Maurice Schellekens, ‘Self-driving cars and the chilling effect of liability’ (2015) 31(4) Computer Law & security Review 506.

¹⁷⁵ Reportedly, so would Mercedes-Benz and Google: Jim Gorzelany, ‘Volvo Will Accept Liability For Its Self-Driving Cars’ (*Forbes*, 9 October 2015) <www.forbes.com/sites/jimgorzelany/2015/10/09/volvo-will-accept-liability-for-its-self-driving-cars/#54e7c3d43d80> accessed 2 February 2017, Miles Branman, ‘Volvo, Google, and Mercedes-Benz will accept liability in self-driving car accidents’ (*Digital Trends*, 8 October 2015) <www.digitaltrends.com/cars/automaker-responsibility-in-self-driving-car-accidents-news/> accessed 2 February 2017.

¹⁷⁶ Kiliaan APC van Wees, ‘Enkele juridische aspecten van de (deels) zelfrijdende auto’ [2015] Computerrecht 313, Kiliaan APC van Wees, ‘Zelfrijdende auto’s en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,’ Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 12.5, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>>, Van Wees, Vellinga and Vellinga in Van den Acker, Visies op de autonome auto (2015) 63 Verkeersrecht, Maurice Schellekens, ‘Self-driving cars and the chilling effect of liability’ (2015) 31(4) Computer Law & Security Review 506, para 4.2.5, Kiliaan APC van Wees, ‘Zelfrijdende auto’s, aansprakelijkheid en verzekering; over nieuwe technologie en oude discussies’ (2016) (2) Tijdschrift voor Vergoeding Personenschade 29. De Schrijver and Van Fraeyenhoven also point out the need to restructure insurance in Belgium: De Schrijver and Van Fraeyenhoven, ‘Self-driving cars in Belgium: a clash between innovation and liability?’ <http://astrealaw.be/backend/admin/sites/default/files/wwl_tmt_2016_-_article.pdf> accessed 2 February 2017. See also Reactie ANWB, ‘Wetsvoorstel Verkeersongevallen’ (1998) 46 Verkeersrecht 33. Dutch insurers are exploring the option of first-party insurance: Verbond van Verzekeraars, *Toekomstvisie Automotive. Onderweg naar morgen*, available at <www.verzekeraars.nl/actueel/nieuwsberichten/Documents/2015/November/Onderweg%20naar%20morgen.pdf> accessed 12 April 2017.

¹⁶³ Centre for Connected & Autonomous Vehicles, ‘Pathway to Driverless Cars: Consultation on proposals to support Advanced Driver Assistance Systems and Automated Vehicles, Government Response,’ January 2017 (Government Response 2017).

¹⁶⁴ The Bill is available at <www.publications.parliament.uk/pa/bills/cbill/2016-2017/0143/cbill_2016-20170143_en_2.htm> accessed 12 April 2017.

¹⁶⁵ Proposals 2016, para 2.34–2.39.

¹⁶⁶ Proposals 2016, para 2.20. See also para 2.21–2.22. See also the Response of the Association of British Insurers: <www.abi.org.uk/~media/Files/Documents/Consultation%20papers/2016/09/090916_ABI_Thatcham_response_CCAV_Automated_Driving_Consultation.pdf> accessed 10 January 2017.

¹⁶⁷ See Road Traffic Act 1988, section 143–145.

¹⁶⁸ Vehicle Technology and Aviation Bill HC Bill (2016–17) [143] cls 1–7, Proposals 2016, para 2.9. See also Review of regulations 2015, ch13 on insurance.

¹⁶⁹ Vehicle Technology and Aviation Bill HC Bill (2016–17) [143] cl 2(1), Government Response 2017, para 3.11. Smith points out the important role of insurance companies in establishing the safety and desirability of self-driving vehicles: Bryant W Smith, ‘How Governments Can Promote Automated Driving’ (2016) New Mexico Law Review (forthcoming), available at <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375> accessed March 2016.

¹⁷⁰ Vehicle Technology and Aviation Bill HC Bill (2016–17) [143] cl 2(3), Government Response 2017, para 3.12.

¹⁷¹ Vehicle Technology and Aviation Bill HC Bill (2016–17) [143] cl 5, Government Response 2017, para 3.14.

¹⁷² Proposal 2016, para 2.12.

or the manufacturer) to recover the costs.¹⁷⁷ Such a first-party insurance, or traffic insurance, was discussed in the UK proposals but is already in place in Sweden.¹⁷⁸ Since 1975 Sweden has this first-party insurance system.¹⁷⁹ The injured party only has to prove his injury is caused by a motor vehicle in traffic in order for the first-party insurer to pay compensation.¹⁸⁰ For such a first-party insurance it is irrelevant whether or not the injured party was a passenger of the vehicle.¹⁸¹ In case no party can be held liable – for instance in case of an unavoidable accident – the first-party insurer will also cover the damages.¹⁸²

However, the higher the risks concerning self-driving cars are, the less likely it becomes that insurance companies will be willing to insure such a high risk. As the self-driving car is still a recent innovation, some risks are known, such as hacking, others are not yet known.¹⁸³ Therefore, the overall risk related to self-driving cars might be so high, insurance companies can be hesitant in insuring this risk. This would inhibit the development of self-driving cars.¹⁸⁴

An option to ensure insurability of self-driving cars is to limit the amount of damages one can claim. Take a look for

instance at the insurance of ships: there often is a maximum amount of damages one can claim. The 1976 Convention on limitation of liability for maritime claims¹⁸⁵ sets limits to liability based on tonnage of the ship.¹⁸⁶ Otherwise the risks would become so high, no insurance company would consider insuring it or the insured will not be able to pay the high premium.¹⁸⁷ If for instance a ship sails into a railway bridge, the damages do not only consist of the damage done to the bridge and the ship, but also entail the costs of the cancellation of rail traffic for a certain period of time and the damage to the cargo. So the amount of compensation would be so high, it is very unlikely an insurance company will be willing to take on such a risk. The premium has to be acceptable from an economic point of view to keep the ship exploitable.¹⁸⁸

To stimulate insurance companies to insure self-driving cars despite the unknown risk, the government could consider serving as a reinsurer.¹⁸⁹

So, insurance can affect the development of self-driving cars.¹⁹⁰ The insurability, however, can be influenced by the government. If governments set safety requirements for self-driving cars, and these requirements are set to a high standard, the risk regarding insuring this innovation can decrease. Consulting insurers on setting these requirements is of importance as they can indicate when they consider insuring the risk is economically viable.

¹⁷⁷ See also Kiliaan APC van Wees, 'Zelfrijdende auto's en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,' Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 12.5, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>>, Verbond van Verzekeraars, Toekomstvisie Automotive. *Onderweg naar morgen*, available at <www.verzekeraars.nl/actueel/nieuwsberichten/Documents/2015/November/Onderweg%20naar%20morgen.pdf> accessed 12 April 2017, Kiliaan APC van Wees, 'Zelfrijdende auto's, aansprakelijkheid en verzekering; over nieuwe technologie en oude discussies' (2016) (2) Tijdschrift voor Vergoeding Personenschade 29.

¹⁷⁸ See for a more extensive consideration of the Swedish traffic insurance: Robolaw 2014, 64–65, Maurice Schellekens, 'Self-driving cars and the chilling effect of liability' (2015) 31(4) Computer Law & security Review 506, para 4.2.5, Sandra Friberg and Bill W Dufwa, 'The development of traffic liability in Sweden,' in Wolfgang Ernst (ed), *The development of traffic liability* (Volume 5, Cambridge University Press, 2010) (Friberg and Dufwa 2010).

¹⁷⁹ Friberg and Dufwa 2010.

¹⁸⁰ Friberg and Dufwa 2010, 218.

¹⁸¹ Kiliaan APC van Wees, 'Zelfrijdende auto's, aansprakelijkheid en verzekering; over nieuwe technologie en oude discussies' (2016) (2) Tijdschrift voor Vergoeding Personenschade 29, Esther FD Engelhard, 'Wetgever, pas op! De (vrijwel) autonome auto komt eraan' (2017) (3) *Ars Aequi* 230.

¹⁸² Kiliaan APC van Wees, 'Zelfrijdende auto's en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,' Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 12.5, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>>, Esther FD Engelhard, 'Wetgever, pas op! De (vrijwel) autonome auto komt eraan' (2017) (3) *Ars Aequi* 230. Schreuder proposes a strict liability for the possessor of the vehicle in case of such an unavoidable accident: Al Schreuder, 'Aansprakelijkheid voor "zelfdenkende" apparatuur' (2014) (5/6) *Aansprakelijkheid, Verzekering & Schade*.

¹⁸³ See also Corien Prins, 'Schadelijke bestjes' (2017) (8) *Nederlands Juristenblad* 507.

¹⁸⁴ See also Kiliaan APC van Wees, 'Zelfrijdende auto's en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,' Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 10, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>>.

¹⁸⁵ See also United Nations Convention on the Carriage of Goods by Sea (Hamburg, 1978) (the "Hamburg Rules"). See also James M. Anderson and others, *Autonomous Vehicle Technology. A Guide for Policymakers* (RAND Corporation, 2016), 131 and Jeremy Levy, 'No Need to Reinvent the Wheel: Why Existing Liability Law Does Not Need to Be Preemptively Altered to Cope with the Debut of the Driverless Car' (2016) 9 J. Bus. Entrepreneurship & L 355, 369–72.

¹⁸⁶ See Article 2, 6 of the Convention on limitation of liability for maritime claims, 1976.

¹⁸⁷ Leslie J. Buglass, 'Limitation of liability from a maritime insurance viewpoint' (1978–1979) 53 Tul. L. Rev. 1364, 1364–1365, Jeremy Levy, 'No Need to Reinvent the Wheel: Why Existing Liability Law Does Not Need to Be Preemptively Altered to Cope with the Debut of the Driverless Car' (2016) 9 J. Bus. Entrepreneurship & L 355, 373–74. See in a different context: Verbond van Verzekeraars, Toekomstvisie Automotive. *Onderweg naar morgen*, 10, available at <www.verzekeraars.nl/actueel/nieuwsberichten/Documents/2015/November/Onderweg%20naar%20morgen.pdf> accessed 12 April 2017.

¹⁸⁸ Leslie J. Buglass, 'Limitation of liability from a maritime insurance viewpoint' (1978–1979) 53 Tul. L. Rev. 1364, 1364–1365, 1393–1394, Niels Frenk, 'Utopische wetgeving en verzekeraarheid' (2006) (4) *Aansprakelijkheid, Verzekering & Schade*, para 3.

¹⁸⁹ Corien Prins, 'Schadelijke bestjes' (2017) (8) *Nederlands Juristenblad* 507, T Vanden Borre, 'Kanaliseren in het debat betreffende de verzekeraarheid van risico' (2001) (6) *Aansprakelijkheid, Verzekering & Schade* 175, para 3.2, Jeremy Levy, 'No Need to Reinvent the Wheel: Why Existing Liability Law Does Not Need to Be Preemptively Altered to Cope with the Debut of the Driverless Car' (2016) 9 J. Bus. Entrepreneurship & L 355, 373–74.

¹⁹⁰ See also James M. Anderson and others, *Autonomous Vehicle Technology. A Guide for Policymakers* (RAND Corporation, 2016), 132, European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)) section 57–59, Jeremy Levy, 'No Need to Reinvent the Wheel: Why Existing Liability Law Does Not Need to Be Preemptively Altered to Cope with the Debut of the Driverless Car' (2016) 9 J. Bus. Entrepreneurship & L 355.

This being said, if the self-driving cars indeed prove to be a lot safer than human driven cars, this can be enough to make it attractive for insurance companies to insure such a new technology. The risk of accidents would be more limited than the risk of accidents with a conventional car. The unknown risks of the new technology could be outweighed by the lower risks of accidents. If accidents rates decline, consumers will benefit from lower premiums.¹⁹¹

8. Conclusion

Several months after the accident with the Tesla Autopilot, Tesla upgraded the software for its cars. From now on the radar will no longer be used as a supplementary sensor but as a primary control sensor.¹⁹² This probably would have avoided the accident in May 2016 in Florida.¹⁹³ Although technology is developing fast, legal developments seem to be catching up slowly.

Regarding the regulation of the testing phase of self-driving cars, different legal instruments – binding regulation,

non-binding regulation, granting exemptions – are used by the discussed jurisdictions (Section 5). With regard to the legal framework for testing, a framework combining both a system of exemptions from existing laws and providing a non-binding guidance is preferred. Such a framework can provide sufficient flexibility to keep up with rapid technological developments as well as provide enough control for governments to set conditions for trials and withdraw exemptions in case public safety cannot be guaranteed.

Two pressing legal problems regarding the post-testing phase need to be addressed: how to deal with the absence of a human driver (Section 6) and the consequences this has for liability and insurance (Section 7). A possible line of thought is to widely interpret the notion of ‘driver’ in current traffic laws and conventions. To what extent the broader interpretation of the term ‘driver’ in traffic laws can accommodate the deployment of self-driving cars without a human driver present is a sufficient solution needs further research.

Regarding liability and insurance, the influence insurance has on the development self-driving cars should not be disregarded. The government has to take this affect into account when drafting regulation for self-driving cars.

¹⁹¹ James M Anderson and others, *Autonomous Vehicle Technology. A Guide for Policymakers* (RAND Corporation, 2016), 114–15, James M. Anderson, Paul Heaton and Stephen J. Carroll, *The U.S. Experience with No-Fault Automobile Insurance A Retrospective* (RAND Corporation, 2010), 141–42. See also Kiliaan APC van Wees, ‘Zelfrijdende auto’s en het Verdrag van Wenen inzake het wegverkeer. Een verkennende analyse,’ Amsterdam Centre for Comprehensive Law, Vrije Universiteit Amsterdam, March 2015, para 10, available at <<http://knowledgeagenda.connekt.nl/bibliotheek/>>.

¹⁹² The Tesla Team, ‘Upgrading Autopilot: Seeing the World in Radar (11 September 2016) <www.tesla.com/de_DE/blog/upgrading-autopilot-seeing-world-radar?redirect=no> accessed 12 January 2017.

¹⁹³ ‘Nach tödlichem Crash: Tesla verspricht Verbesserung der “Autopilot”-Funktion’ (*Der Spiegel Online*, 12 September 2016) <www.spiegel.de/auto/aktuell/tesla-motors-verspricht-verbesserung-der-autopilot-funktion-a-1111949.html> accessed 12 January 2017. However, the NHTSA did not identify a safety-related defect: <<https://static.nhtsa.gov/odi/inv/2016/INCLA-PE16007-7876.PDF>> accessed 9 February 2017.