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Brave New World of Self-Driving Cars

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BRAVE NEW WORLD OF SELF-DRIVING CARS

I. Introduction and Background

A. Framework of the Presentation

This presentation will examine the state of autonomous vehicles in Canada. It will outline where technology presently stands and where it is likely to go. It will also examine the status of regulation of autonomous vehicles in British Columbia and Canada as a whole. Questions will be raised and addressed relating to how increasingly autonomous vehicles—and eventually fully autonomous vehicles—will impact the insurance industry and the liability of relevant parties. Finally, this presentation will examine concerns relating to the issue of cybersecurity. A Canadian Bar Association (CBA) presentation was given in September 2017 which discussed the contemporary legal landscape of autonomous vehicles in Canada.[1] This presentation will offer

1 Erika A. Carrasco, "Autonomous Vehicles: The Current Legal Landscape" *Field Law* (Presentation delivered at the Canadian Bar Association Public Sector Teleconference, 13 September 2017).

an updated view of the legal landscape nearly two years later and will delve into a number of different topics.

B. Definitions and Context

It is important to begin by defining terms that have the potential to be misused. Most cars and other vehicles manufactured today have some level of automation that gives them a certain degree of autonomy. Self-parking, cruise control, and lane-change assist are just a few of the many automated features available in many cars currently being manufactured.

The Society of Automotive Engineers (SAE) International has created a universally accepted ranking system which classifies the various levels of vehicle autonomy into levels zero through five. Level zero indicates no autonomy, while level five indicates that a vehicle is capable of not requiring a human driver. Most cars manufactured today would be classified as level one or two. Level three autonomy means that the vehicle can take control of the vehicle's speed and lane position in certain situations. Level four means that in select conditions the vehicle is capable of being in full control for the entirety of a trip.[2]

There is not a complete consensus on how the term "autonomous vehicle" (also known as "AV") should be defined. However, this term frequently intends to describe a vehicle that requires little or no human interaction to drive. Therefore, the term AV tends to describe vehicles with levels of autonomy three through five. Thus, an AV may or may not have a steering wheel or a brake pedal. Vehicles which have a certain level of autonomy but are not fully autonomous may be referred to as automated or semiautonomous vehicles.

C. Social Impact

The potential for the widespread adoption of AVs brings with it both momentous challenges and exciting opportunities. They will have a number of societal impacts. For example, AVs will offer increased mobility to individuals who would otherwise face restricted access to transportation, such as the elderly, the blind, and the physically disabled.[3] AVs could also decrease fuel consumption and improve traffic congestion by operating more efficiently.

AVs will also reduce the likelihood of accidents and thus improve the safety of those on the road. Car accidents are a significant cause of death in Canada and around the world. Nearly 2,000 Canadians and 1.3 million people worldwide are involved in fatal car accidents each year.[4] Up to 94% of collisions in Canada result from human error.[5] However, while autonomous vehicles have the potential of drastically reducing this figure, accidents could occur in these vehicles due to problems arising from software glitches, improper vehicle maintenance,

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2 Insurance Bureau of Canada, "Auto Insurance for Automated Vehicles: Preparing for the Future of Mobility" (2018), 5.

3 Jill G. Okun & Ryan J. Rawlings, "Mitigating Potential Liability Posed by Autonomous Vehicle Crash Optimization Systems" (November 2018) 60:11 For the Defense, 63.

4 Policy and Planning Support Committee (PPSC) Working Group on Automated and Connected Vehicles, "Automated and Connected Vehicles Policy Framework for Canada" (21 January 2019), 7.

5 *Ibid.,* 3.

extreme weather, and unavoidable accidents—such as a pedestrian running onto the road at the last moment. The theory of liability in crashes of fully and semiautonomous cars is a developing area of the law and will be addressed later in more detail.

AVs have the potential to impact a vast number of industries ranging from the obvious such as transportation and technology, to the less obvious such as policing, healthcare, air & rail, media & advertising, power generation, and urban planning.[6] The loss of jobs in some of these affected industries will likely have political and social impacts. However, while there will be inevitable job losses as careers involving driving disappear, the introduction of AVs will also likely lead to the creation of new jobs. For example, in 2017 it was predicted that AVs would contribute to the creation of more than 34,000 high-quality jobs in Canada over the next five years.[7] Thus, perhaps the more relevant concerns should be those relating to the impact of job displacement, rather than purely job loss.

II. Technology

A. Where Are We Now?

Technology with respect to AVs is progressing rapidly. Companies working on developing AVs include Apple, Google, Uber, Lyft, and Tesla. Nearly every traditional automobile manufacturer is committed to transitioning to AVs as well.[8] Google's subsidiary "Waymo" is working towards a self-driving taxi service wherein users can order a fully autonomous car on their phone, similar to the business model of Uber and Lyft. Waymo is currently servicing nearly 400 people in Phoenix, Arizona as part of a test-run. However, there are still what they call "safety operators" seated in the autonomous car who are available to take control over the vehicle if necessary.[9]

Some companies are working to make autonomous driving technology available to already-manufactured non-autonomous vehicles. For example, Magna International, a Canadian automobile parts manufacturer, unveiled an autonomous driving platform known as MAX4 which can be added into any vehicle. Magna's MAX4 allows the vehicle to reach up to level four autonomy, meaning that the vehicle is able to perform autonomously in most driving scenarios.[10]

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6 KPMG, "Autonomous Vehicle Readiness Index" (2018), 1.

7 Alexandra Cutean, Information and Communications Technology Council (ICTC), "Autonomous Vehicles and the Future of Work in Canada" (2017), 4.

8 Kevin LaRoche & Robert Love. "Autonomous Vehicles: Revolutionizing Our World" (2016) Borden Ladner Gervais, 14.

9 Alex Davies, "Waymo's So-Called Robo-Taxi Launch Reveals a Brutal Truth," *Wired* (12 May 2018), online: <https://www.wired.com/story/waymo-self-driving-taxi-service-launch-chandler-arizona/>.

10 Magna, "MAX4: Magna's Formula for Winning the Self-Driving Car Race," online: <https://www.magna.com/insights/article/max4-magna-s-formula-for-winning-the-self-driving-car-race>.

B. Where Are We Headed?

Experts disagree on how quickly the change to self-driving cars will occur. For example, the Boston Consulting Group predicts that autonomous vehicles will make up 25% of the worldwide market by 2035.[11] In contrast, a transportation scholar at the University of Minnesota believes that by 2030 every car on the road will be driverless.[12] However, factors which will likely influence how quickly this technology is embraced by consumers are still undetermined. For example, laws that allocate liability will likely play a role in determining how quickly autonomous vehicles become more prevalent.

III. The State of Regulation in Canada

In Canada, regulation of motor vehicle transportation is a shared responsibility between the federal, provincial, and territorial governments. The Canadian Motor Vehicle Safety Standards (CMVSS) set out the minimum performance levels vehicles and equipment must meet. A number of these standards include required human interfaces that must be available to a human driver—such as a brake pedal. Therefore, as AV technology progresses it may be necessary for several of the standards laid out in the CMVSS to be amended.[13]

Likewise, the Vienna Convention on Road Traffic, an international treaty signed by Canada, requires a human driver to always be in control of the vehicle.[14] This convention will have to be amended in order to accommodate the future of AVs.

The Government of Ontario launched its "Automated Vehicle Pilot Program" in 2016. It allows for on-road testing of vehicles at levels three, four, and five autonomy. This means that completely driverless cars may be tested on public roads in Ontario. However, there must still be either a passenger in the vehicle or a remote operator monitoring the vehicle. Under this program, test participants must submit an application and be approved before they can operate vehicles at those levels of automation.[15]

In January 2019, Ontario updated its program to allow for the general public use of level three autonomous cars. As mentioned previously, level three autonomy allows the vehicle to make informed decisions itself and perform a variety of tasks fully autonomously, such as overtaking slower moving vehicles. Level three autonomy still requires the driver to be ready at all times. However, the Ontario program stipulates that cars with level three autonomy must be available for public purchase in Canada before they can be legally driven by the public on Ontario roads. Moreover, cars with external technology that allow them to operate at level three, added after manufacturing, are not allowed for public use.[16]

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11 Boston Consulting Groups, "Revolution in the Driver's Seat: The Road to Autonomous Vehicles" (April 2015), 18.

12 Insurance Information Institute, "Background on: Self Driving Cars and Insurance" (July 2018), 1.

13 Transport Canada, *Canada's Safety Framework for Automated and Connected Vehicles* (February 2019), 13.

14 Convention on Road Traffic, Vienna, 8 November 1968, United Nations Treaty Series, vol. 125, p. 3.

15 Ontario, Ministry of Transportation, *Automated Vehicle Pilot Program* (2016).

16 Ibid.

Level three vehicles are not yet available for purchase in Canada. Cars sold today, such as the 2019 Audi A8, are capable of level three autonomy, but models for sale in Canada do not contain the technology. In the US, the 2019 Audi A8 with level three autonomy is available to purchase, but the technology may not be turned on and used.[17]

B.C. laws do not currently allow driverless vehicles to be used by members of the public on public roads. They also do not expressly allow for the operation of vehicles with level three autonomy by members of the public. However, the University of British Columbia launched a program in late 2018, funded by Transport Canada, known as AURORA. In working towards its goal of developing safe and smart transportation in BC, the AURORA program is testing automated vehicles, connected cameras, and roadside technologies in the province.[18]

The City of Vancouver's "Transportation 2040" plan does not mention autonomous vehicles, despite the considerable impact they will have on urban planning.[19] For example, AVs will likely reduce the need for parking lots in cities because it may be cheaper to send AVs to be parked in suburban lots. The need for parking will also be reduced as a result of shared vehicle services becoming more common.[20]

In contrast with the City of Vancouver's lack of forward thinking in regard to AVs, the City of Ottawa's economic development agency known as Invest Ottawa recently launched an autonomous vehicle test site. The site will eventually include 16 kilometres of paved roads in a controlled area for companies to test vehicles with full or partial autonomy. The property will eventually also include a high-speed track.[21] Ottawa may be an ideal place to test AVs, as it will allow companies to evaluate their cars in extremely cold weather in the winter and heat in the summer.

The Government of Quebec enacted Bill 165 entitled *An Act to Amend the Highway Safeway Code and Other Provisions* in April 2018. This act defined and set certain rules for AVs in Quebec. The act banned the public use of vehicles with levels four and five autonomy on public roads in Quebec. However, it allows for the use of vehicles with level three autonomy that are available for purchase in Canada on public roads. Additionally, the Act acknowledges that the Ministry of Transportation has the ability to establish and undertake pilot projects with respect to cars with level four and five autonomy.[22]

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17 Automotive News, "Level 3 Autonomous Vehicles Now Allowed on Ontario Roads" (23 January 2019), online: <https://canada.autonews.com/technology/level-3-autonomous-vehicles-now-allowed-ontario-roads>.

18 University of British Columbia, "UBC Launches Connected-Vehicle Test Facility on Campus" (15 November 2018), online: <https://engineering.ubc.ca/news/2018/11/ubc-launches-connected-vehicle-test-facility-on-campus>.

19 City of Vancouver, "Transportation 2040." (31 October 2012), online: <https://vancouver.ca/files/cov/transportation-2040-plan.pdf>.

20 Impark, "Autonomous Vehicles: Where We Are, Where We're Going, and What it Means for Parking" (29 January 2018), online: <https://www.impark.com/parking-insight/autonomous-vehicles-parking/>.

21 Kate Porter, " 'Mini-city' for self-driving vehicles launches in Greenbelt." *CBC News* (18 May 2019), online: <https://www.cbc.ca/news/canada/ottawa/autonomous-vehicle-test-track-launch-1.5140703>

22 *An Act to Amend the Highway Safety Code and Other Provisions* R.S.Q. 2018, c. 7.

KPMG has come out with an "autonomous vehicle readiness index" which assesses the preparedness of countries around the world for autonomous vehicles. Canada ranked seventh in 2018 but fell to twelfth place in 2019.[23] In a report on the future of autonomous vehicles in Canada released in 2018, the Senate Standing Committee on Transport and Communications stated that "Canada is ill-prepared for the fast-approaching future of transportation." The committee expressed concerns relating to issues of cybersecurity, erosion of personal privacy, job loss, and an absence of regulation.[24]

In the US, Arizona has proven to be a popular state for manufacturers experimenting with autonomous vehicles. Car companies such as Ford, Toyota, Chrysler, and GM currently conduct testing in the desert surrounding Phoenix. Arizona's consistent weather, low wind speed, and minimal rainfall make it an optimal location for the testing of AVs. The desert environment also allows car manufacturers to conduct testing of new technology in a relatively private setting.[25]

IV. Liability and Insurance

A. Increasingly Automated Vehicles

1. Movement Towards Product Liability

The theory of liability in crashes of autonomous and highly automated cars is a developing area of the law. As we progress to full automation, it is likely that claims relating to personal liability will decrease while product liability claims will increase.

If an accident is caused purely by the vehicle—whether it be due to a software or manufacturing defect—it would not make sense to find the vehicle operator liable. Volvo, for example, plans on unveiling its fully autonomous IntelliSafe Autopilot system in 2020, and the company has stated that it will pay for any injuries or property damage caused by the autopilot system.[26]

While fully autonomous cars will become the norm at some point, there will be a transition period wherein the operator will still be responsible for overseeing the safe operation of the vehicle. It is possible that an operator could still be found to be negligent and thus held liable in these circumstances. For example, if an operator of a highly automated or autonomous vehicle has the ability to take control in an emergency situation and fails to do so in an appropriate

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23 KPMG, *supra* note 6 at 3.

24 Standing Senate Committee on Transport and Communications, "Driving Change: Technology and the Future of the Automated Vehicle" (29 January 2018), 9.

25 Ottavia Zappala, "Why Automakers Flock to Arizona to Test Driverless Cars," *USA Today* (26 December 2017), online: <https://www.usatoday.com/story/money/cars/2017/12/26/why-automakers-flock-arizona-test-driverless-cars/981840001/>.

26 Corinne Iozzio, "Who is Responsible When a Self-Driving Car Crashes?" (1 May 2016), online: *Scientific American* <https://www.scientificamerican.com/article/who-s-responsible-when-a-self-driving-car-crashes/?redirect=1>.

manner, the operator may be considered negligent if he/she did not act quickly enough to prevent an avoidable accident.[27]

Another way in which human operators could face liability during an accident in an AV is if the accident is a result of their failure to take reasonable care in maintaining their vehicle or updating its operating system.[28]

In Ontario's AV pilot program, participants are required to accept liability where there is an at-fault collision caused by the technology. All of the participating vehicles must be insured with a minimum of $5 million in liability coverage. Moreover, a driver or overseer is required to monitor the vehicle's operation at all times and is required to take over control if necessary.[29]

2. Lower Insurance Premiums, Higher Vehicle Cost

As automobile manufacturers take responsibility for liability, a portion of the cost associated with the assumption of liability of the vehicle manufacturer will likely be passed on to the consumer by way of a higher purchase price. Lawyer Jeffery Gurney notes that,

> People would probably be willing to pay more for autonomous cars knowing that the manufacturer will be liable for accidents caused while the vehicle is in autonomous mode. This is because the consumer's insurance premiums would decrease since they would no longer be at fault for accidents caused in autonomous mode; presumably, there would be fewer accidents when people no longer drive.[30]

The transition to autonomous vehicles will also likely cause the price of insurance coverage to decrease. KPMG predicts that autonomous vehicles could reduce crashes by 80% by 2040. This would result in a dramatic reduction in insurance claims.[31] This will inevitably result in premiums from auto insurance policies to fall. However, product liability coverage and cyber-policies may become more popular.[32]

3. Tailored and Accurate Coverage

During the transition to fully autonomous cars, insurance companies may begin to offer different rates depending upon how frequently the autopilot function of the vehicle is used. Given that the use of autonomous features reduces the probability of an accident occurring, insurance companies will likely acknowledge this by offering lower rates for drivers who regularly use this feature.

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27 Jeffrey Gurney, "Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles" (November 2013) U. Ill. J.L. Tech. & Pol'y, 256-258.

28 Julia A. Molander & Yevgenia A. Wiener, "Driverless Vehicles and the Effect on Insurance" (May 2016) 58:5 For the Defense, 19-20.

29 Ontario, Ministry of Transportation, *Automated Vehicle Pilot Program* (2016).

30 Gurney, *supra* note 27 at 273.

31 KPMG, "Marketplace of Change: Automobile Insurance in the Era of Autonomous Vehicles" (October 2015), 26.

32 Molander & Wiener, *supra* note 28 at 16.

Tesla is getting ready to offer its own car insurance program by leveraging the internal data to which it has access from its cars. That data will indicate how often the vehicle is on Autopilot and allow Tesla to reduce or increase rates depending upon the frequency of its use.[33]

Other insurers may also wish to use the data collected by AVs in order to come up with accurate insurance premiums based upon the behavior of the driver. For example, AVs can provide data about braking distances, adherence to traffic laws, and acceleration. Insurers can also collect accurate data regarding how often the insured drives. This information can be used in order to charge customers different rates depending upon the likelihood of claims based upon their driving habits.[34]

The transition to autonomous vehicles may provide a more accurate analysis of insurance claims, as the internal data of the vehicle will likely assist in determining who is at fault and whether any contributory negligence is present. This will also result in a decrease in insurance fraud.[35]

4. Canada Compared to Other Jurisdictions

The British Parliament passed the *Automated and Electric Vehicles Act* in 2018, which partially addresses liability when AVs are involved in accidents. The act adopts what is frequently termed a "single policy" approach to insurance. This means that insurance coverage will still apply to the operator of an automated vehicle regardless of whether the vehicle was in automated mode. Therefore, this act prevents a shift away from automobile insurance claims towards a product liability model of recovery. However, the Act does allow insurers to exclude or limit liability if the accident was a direct result of either prohibited software alterations or a failure to install necessary software updates.[36]

In November 2018, the Insurance Bureau of Canada published a report which encourages the adoption of the single policy approach in Canada. It also recommends that the single insurance policy would compensate people who are injured as a result of a cyber-breach of the vehicle.[37]

B. Fully Autonomous Vehicles

Fully autonomous vehicles will significantly alter the insurance industry and have the potential to eventually eliminate the automobile insurance industry altogether. As previously described, when fully autonomous vehicles—perhaps without steering wheels or brake pedals—are involved in accidents, it is likely that product liability will come into play. Product liability claims can be made under British Columbia's *Sale of Goods Act*.[38]

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33 Michael Martinez, "How Tesla Plans to Cut Customer's Insurance Costs: Tap Autopilot" (13 May 2019), online: *Automotive News* <https://www.autonews.com/finance-insurance/how-tesla-plans-cut-customers-insurance-costs-tap-autopilot>.

34 Cutean, *supra* note 7 at 25.

35 Insurance Bureau of Canada, *supra* note 2 at 12-13.

36 *Automated and Electric Vehicles Act 2018* (U.K.), 2018, c. 18.

37 Insurance Bureau of Canada, *supra* note 2 at 11.

38 *Sale of Goods Act*, R.S.B.C. 1996, c. 410.

Product liability traditionally focuses on the designer, manufacturer, or distributor of the product. When autonomous vehicles are involved, accidents may result from a problem stemming from the hardware, software, vehicle provider, or the company that services the vehicle.[39] Questions may arise as to what the term "product" includes. For example, will the term "product" include all forms of software and data? Product liability laws may need to be altered in order to offer more certainty in this area.

The three main categories of defects in AVs that could result in claims are manufacturing, design, and warning defects. Design defect claims may be the most common form of product liability claim when an accident involving a crash optimization system occurs.[40]

AVs are equipped with crash avoidance systems which seek to prevent accidents in the first place. But, sometimes an accident will not result from a defect in the car but an unavoidable occurrence such as black ice, or a pedestrian suddenly running onto the street.[41]

When an unavoidable accident is about to occur, an AV relies on a different safety system known as a crash optimization system. This system is designed to analyze the circumstances of an impending collision and to take actions to minimize its severity.[42]

The design of a crash optimization system may be the subject of a design defect claim when the system performs as intended but presents an undue risk of harm. For example, a plaintiff may argue that there was a different course of action that the vehicle should have taken that would have minimized his or her damages. A crash optimization system generally attempts to pursue the course of action that results in less serious injury in order to prevent more serious injury. However, a tension exists between whether the vehicle should prefer the safety of the occupants of the vehicle or the safety of bystanders in an unavoidable accident.[43]

A sound principle may be that crash optimization systems should be designed to reduce claims and potential liability. American courts have applied one of two tests when determining whether a product is negligently designed. These tests are known as the consumer expectation test and the risk-utility test.[44]

The consumer expectation test dictates that for a product to be defective, it "must be dangerous to an extent beyond that which would be contemplated by the ordinary consumer." This test would essentially require AVs to perform at the standard of a reasonable human driver.[45] Currently, a driver is held to a reasonable standard of care—not a standard of perfection. For example, in an emergency situation a driver who fails to act with perfect judgment will likely not be found liable.

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39 Juliana K. O'Brien, "The Impact of Integrated Technology on Investigations and Liability" (April 2019) 61:4 For the Defense, 63.

40 Okun & Rawlings, *supra* note 3 at 64-65.

41 *Ibid.*

42 *Ibid.*

43 *Ibid.*

44 *Ibid.,* at 65-66.

45 *Ibid.*

However, if a car is autonomous, it is dependent upon its sensors and software, with little or no human input. A question that arises relating to this test is whether AVs should be expected to perform to a higher standard than human drivers. For example, by the time all vehicles (or almost all vehicles) on the road are AVs, the standard of a reasonable human driver may be considered far too low.[46] Given that AVs have the potential to be much safer than human drivers, it may become the norm to have higher expectations for one's safety in an AV. Elon Musk of Tesla has said that in the future, human drivers may be outlawed because they will be considered overly dangerous.[47] Thus, it is possible that a vehicle manufacturer or software designer may eventually be liable even when the vehicle performs at the standard of a human.

Under the risk-utility test, a product is defective if the risks associated with its design exceed its benefits.[48] Vehicle manufacturers and software developers should design crash optimization systems with these tests in mind in order to reduce successful claims. Eventually, a clear and consistent national standard should result.

AVs may also expand the scope of liability beyond just vehicle manufacturers and software developers. AVs will likely rely heavily on weather reporting and global positioning systems. AVs may even eventually be integrated with traffic lights and advance turn signals.[49] In the absence of legislation addressing the liability of these additional parties, liability will likely be imposed based upon the standard test for establishing a duty of care.

Questions have been raised regarding the potential for criminal liability on the part of either an operator or manufacturer of an AV. If someone is killed as a result of the operator abdicating his/her duty to monitor an AV, the operator may be charged with criminal negligence causing death. It is also conceivable that a vehicle manufacturer could be charged with criminal negligence causing death if it is shown that the company showed wanton or reckless disregard for the lives or safety of other persons, which resulted in a fatal defect.[50]

C. Shared Autonomous Vehicles (SAVs)

Joint ventures between ride sharing companies and car manufactures, such as the partnership between Lyft and GM, may eventually make car ownership obsolete. Under this sort of system, customers will be able to order autonomous cars on their phones and thus would neither own nor operate the car. They would therefore also have no insurable interest in the vehicle.[51] Tesla has indicated that it will be soon be introducing a program that will allow Tesla owners to

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46 *Ibid.* at 66-67.

47 Peter Holly, "Elon Musk: Human-Driven Cars May Be Outlawed Because They're 'Too Dangerous,' " *Washington Post* (March 18, 2015), online: <https://www.washingtonpost.com/news/the-switch/wp/2015/03/18/elon-musk-human-driven-cars-may-be-outlawed-because-theyre-too-dangerous/?utm_term=.0ccbe8b8ab16>.

48 Okun & Rawlings, *supra* note 3 at 67.

49 LaRoche & Love, *supra* note 8 at 16.

50 *Criminal Code*, R.S.C. 1985, c.46, s. 219 and 220.

51 Molander & Wiener, *supra* note 28 at 20.

effectively rent-out their cars whenever they like by adding them to an autonomous Tesla ride-sharing fleet.[52]

Vehicle manufacturers may also choose to maintain ownership over their vehicles and instead rent them out. Once again, passengers would have no insurable interest in the vehicle.[53] This system may take the form of a subscription based model similar to that of Netflix and Spotify. Customers may be able to pay for a certain number of kilometres per month and have the ability to utilize any car from a fleet of vehicles. Car manufacturers may prefer this because if there is a defect in a certain model of car, the recall and repair process may be much simpler. For example, proof of a defect in an individual car may also be proof of a defect in all other cars of the same model. This example, along with the susceptibility of AVs to hacking, may make AVs opportune for class action lawsuits.[54]

The parking industry will be greatly affected by SAVs. A shift to multi-user, multi-stop journeys will cause a decrease in the demand for parking spaces in urban areas. Instead of people driving to work and leaving their car in a parking lot, they may instead take a shared autonomous vehicle which will service other users during working hours.[55]

The Institute for Transportation and Development Policy, a non-governmental organization, published its Shared Mobility Principles for Livable Cities in late 2017. Since then, many companies have signed onto these principles which seek to promote "the best outcome for all" in regard to transportation technology. The tenth principle states that "autonomous vehicles (AVs) in dense urban areas should be operated only in shared fleets." The rationale for this policy proposal is that shared fleets are more equitable and affordable than individually owned AVs. The organization also believes that because maintenance and software upgrades of vehicles in shared fleets will be managed by professionals, the widespread use of fleet vehicles would ultimately increase public safety and lowers emissions. Contrasted with individually owned autonomous vehicles, the use of shared autonomous vehicles would likely reduce the number of vehicles in circulation, the need for parking, and traffic congestion.[56]

V. Cybersecurity

There are many concerns relating to the cybersecurity of AVs. The potential for AVs to be remotely operated by hackers, and the possibility for hackers to gain control of the operator's private data, will be briefly examined.

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52 Neal Boudette, "Elon Musk Predicts Tesla Driverless Taxi Fleet Next Year," *New York Times* (22 April 2019), online: <https://www.nytimes.com/2019/04/22/business/elon-musk-tesla-autopilot.html>.

53 *Ibid.*

54 *Ibid.,* at 18.

55 Impark, *supra* note 20.

56 Shared Mobility Principles for Livable Cities, "Why Principle 10" (19 October 2017), online <https://www.sharedmobilityprinciples.org/>.

A. Concern with Remote Operation

The automated functioning of AVs allows them to be remotely hacked and operated by a third party. Researchers have shown that AVs are susceptible to being hacked in a manner that allows a third party to gain either complete or partial control of the vehicle.[57] Given that certain models or even entire makes of vehicles may contain the same software defect that makes them vulnerable to hacking, it is possible that fleets of vehicles could be hacked at once.

A question that arises relates to who is liable if a car is hacked and damages ensue. For example, a hacker could either steal the vehicle when it is not in use or cause an accident when the operator is in the vehicle. The hacker may be criminally charged and held civilly liable with having committed an intentional tort.

The manufacturer that produced the vehicle with the potential to be hacked may be held civilly responsible as well. A product liability claim may be made under British Columbia's *Sale of Goods Act*.[58] The operators of the vehicle may also be held civilly responsible if they acted negligently in not completing a required vehicle software update. Car manufacturers or car owners may wish to purchase cyber insurance in order to protect themselves from liability.

Concerns relating to cyberterrorism have been expressed as well.[59]

B. Conern with Data Access

The second concern relating to the cybersecurity of AVs is the potential for their data to be hacked.

As mentioned previously, AVs will store data relating to all aspects of their operation including information on speed, current location, and future destinations.[60] Access to just this information may allow hackers to determine an individual's home address and the time of day in which he/she regularly arrives and departs.

However, in addition to becoming increasingly autonomous, vehicles are also becoming progressively connected. They are becoming more connected with their operators, other cars, wireless networks, global positioning systems, personal electronic devices, and eventually public infrastructure.[61] The storage of this data makes AVs prime targets for hacking.

An AV is vulnerable to hacking in the way it collects, shares, and stores data. Data that AVs collect may be stored to the vehicle's computer, a central hub controlled by the manufacturer, and the cloud. AVs may then transmit this data through wireless networks and broadcasting sensors.[62]

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57 Philippa Lawson et al., "The Connected Car: Who is in the Driver's Seat" *BC Freedom of Information and Privacy Association* (2015), 5.

58 Sale of Goods Act, supra note 38.

59 Standing Senate Committee on Transport and Communications, supra note 24 at 10

60 LaRoche & Love, supra note 8 at 6.

61 Philippa Lawson et al., supra note 57 at 16.

62 Geoff Moysa & Mitch Koczerginski. "The Cybersecurity Implications of Driverless Cars" Cybersecurity Article Series (December 2016) McMillan LLP, 3.

Communication between cars in real time is frequently referred to as vehicle-to-vehicle (V2V) communication. Autonomous cars require this interaction in order to gain a full understanding of their surroundings and thus operate safely.[63] Communication between cars and public infrastructure is commonly referred to as vehicle-to-infrastructure (V2I) communication. V2I communication is also designed to enhance safety and improve efficiency.

Vehicles are becoming increasingly connected to other electronic devices, such as smartphones. AVs may eventually utilize much of the information available on one's phone for convenience, safety, and entertainment purposes. Biometric data available on smartphones, such as fingerprint identification, may eventually be available for use in one's car. Other biometric data such as height and weight, whether entered directly in an AV or through one's phone, will also likely be used by AVs in order to improve safety and optimize functionality.[64]

The Personal Information Protection and Electronic Documents Act (PIPEDA) and British Columbia's *Personal Health Information Access and Protection of Privacy Act* govern the protection of personal information that may be stolen by hackers.[65] If caught, the hackers could be criminally charged with mischief in relation to data.[66]

A number of recent cases where data has been stolen demonstrate that courts are highly sensitive to breaches of consumers' privacy. Courts have demonstrated this concern by awarding high damages when breaches of consumers' confidential information occur.[67]

Transport Canada is currently conducting research and testing the cybersecurity of AVs in order to better understand and identify potential threats.[68]

VI. Conclusion

Many commentators have predicted that the shift towards autonomous vehicles will be the greatest disruption to the automotive industry since Henry Ford introduced the moving assembly line in 1913. However, this statement does not capture the scope of the many different industries that will be affected by this technology. As explained, the inevitable proliferation of autonomous vehicles will greatly alter and likely eventually eliminate the automobile insurance industry as we know it. The Government of British Columbia is lagging behind several other provinces in regulating AVs. And, while not significantly behind, Canada is being outpaced by other countries in terms of study and regulation of autonomous vehicles.

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63 Philippa Lawson et al., supra note 57 at 15.

64 Ibid., 41.

65 *Personal Health Information Access and Protection of Privacy Act*, S.B.C. 2008, c. 38; *Personal Information Protection and Electronic Documents Act*, S.C. 2000, c. 5.

66 *Criminal Code*, R.S.C. 1985, c.46, s. 430 (1.1).

67 Ponemon Institute, "Cost of a Data Breach" *Ponemon Institute* (2018).

68 Transport Canada*, supra* note 13 at 17.