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DATA PROTECTION & CYBERSECURITY SERVICES

AUTONOMOUS VEHICLES IN SINGAPORE – LAWS AND LIABILITY

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AUTONOMOUS VEHICLES IN SINGAPORE – LAWS AND LIABILITY

Overview

Autonomous vehicles (or self-driving vehicles) (“AVs”) are increasingly seen on roads all over the world. Singapore has also embraced autonomous vehicles, conducting trials for autonomous cars and buses. At present, Singapore does not have widespread deployment of AVs. Our approach to AVs is an incremental one, where trials have started start on lightly-used roads like at one-north, with the intention to trial them in more complex environments when the technology advances.¹

There is huge potential for the use of autonomous vehicles in Singapore, given our well-maintained roads, and the public authorities’ drive to improve our first-and-last mile connectivity (connecting people to destinations which may not have a direct public transport link).² The Government has publicly stated that Singapore would be “adopting a balanced, light-touch regulatory stance that protects the safety of passengers and other road users, and yet ensures that these technologies can flourish”.³

This article will address the following key issues surrounding the use of autonomous vehicles:

- (a) what are autonomous vehicles;
- (b) laws in Singapore governing the use of autonomous vehicles;
- (c) potential issues with respect to liability for accidents and the role of insurance (drawing a distinction between AVs requiring a driver to take control under certain conditions, and AVs that are fully autonomous with zero driver involvement);
- (d) what does the future hold for AVs in Singapore in light of international developments and trends.

What are autonomous vehicles?

An autonomous vehicle is capable of monitoring its surroundings and making a driving decision, instead of a human monitoring the surroundings and then making a driving decision. It relies on sensors and cameras to gather information about its surroundings, which is then combined with other data, such as maps of the area, in order to navigate the road, as well as obstacles and signages. Artificial intelligence, in particular machine learning and deep learning is used in the development of AV technology, so that the vehicle need not be trained for every possible route, but “learns” how to read traffic lights, detect obstacles, follow the curvature of the road and so on.

The Society of Automotive Engineers (SAE) sets out 6 levels of driving automation. Many of us already drive with some level of assistance today, such as adaptive cruise control and lane centering. However, for the purpose of calling a vehicle an “autonomous vehicle”, we are looking at vehicles of Level 3 and above. Level 3 and 4 vehicles require the driver to take control in certain circumstances (which would give rise to more complex issues of liability), whereas Level 5 vehicles would be akin to you taking a taxi.

¹ See the Second Reading Speech for the Road Traffic (Amendment) Act 2017 introducing the provisions for autonomous vehicles – *Singapore Parliamentary Debates, Official Report* (7 February 2017) vol 94 (Ng Chee Meng, Second Minister for Transport). See also the Written Reply to Parliamentary Question on Timeline and Milestones Towards Achieving Islandwide Full Operational Deployment of Autonomous Vehicles (5 July 2022) at <https://www.mot.gov.sg/news/details/written-reply-to-parliamentary-question-on-timeline-and-milestones-towards-achieving-islandwide-full-operational-deployment-of-autonomous-vehicles>.

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https://www.lta.gov.sg/content/ltagov/en/industry_innovations/technologies/autonomous_vehicles.html#:~:text=In%20Singapore%2C%20all%20AVs%20must,input%20from%20the%20Traffic%20Police.

³ *Singapore Parliamentary Debates, Official Report* (7 February 2017) vol 94 (Ng Chee Meng, Second Minister for Transport).

Society of Automotive Engineers (SAE): 6 levels of driving automation	
Level 0	No automation
Level 1	Driver assistance
Level 2	Partial Driving Automation
Level 3	Conditional Driving Automation Vehicle can perform most driving tasks but human must take over when required
Level 4	High Driving Automation Vehicle performs all driving tasks under specific circumstances; human override is an option
Level 5	Full Driving Automation No human attention required

Laws in Singapore governing the use of autonomous vehicles

Autonomous vehicles are currently regulated under the Road Traffic Act 1961 (“**RTA**”), with the relevant sections inserted by the Road Traffic (Amendment) Act 2017 as follows:

- (a) section 2(1), which sets out the definition of “automated vehicle technology”, “autonomous motor vehicle” and “autonomous system”;
- (b) section 6C, which empowers the Minister for Transport to make rules to provide for the trial and use of autonomous motor vehicles;
- (c) section 6D, which provides a power to exempt from or modify the application of laws to approved autonomous vehicle trials and special uses;
- (d) section 6E, which makes it an offence to interfere with autonomous motor vehicle trials.

Much of Singapore’s AV regulatory regime is by way of subsidiary legislation, as its ease of promulgation and amendment offers maximum flexibility to deal with this evolving area of technology. Our present regime is geared towards testing and trials, rather than widespread deployment. The Road Traffic (Autonomous Motor Vehicles) Rules 2017 (“**Rules**”) are made under sections 6C and 6D of the Road Traffic Act 1961. Generally, the Rules prohibit the trial or use of an autonomous motor vehicle without authorisation, set out the application process (for authorisation), the conditions of authorisation⁴, and the requirement for liability insurance or security in lieu of liability insurance (so that any injured parties are not left without remedy).

Practically, the key requirements to operate an AV on Singapore roads at present are:

- (a) the AV must have passed a test before it is deployed on the road to show that it is roadworthy⁵ - the test will assess features such as the AV’s ability to detect obstacles, distance required for it to come to a stop upon detecting an obstacle, etc.;
- (b) there must be a safety driver in the vehicle ready to take over operation if necessary if failure of the autonomous system or other emergency is detected;
- (c) there must be a policy of insurance indemnifying the owner and any authorised driver or operator of the vehicle in relation to death or bodily injury or damage to property caused by, or arising out of,

⁴ Such as requiring a qualified safety driver to be seated in the autonomous motor vehicle to monitor the operation of the vehicle and take over operation if necessary, stating the geographical area in which the approved trial may be undertaken, and prohibiting the vehicle from carrying passengers.

⁵ <https://www.channelnewsasia.com/cna-insider/autonomous-vehicles-driverless-trials-safety-south-korea-singapore-3187291>

- the use of the vehicle, and if there is no liability insurance, a security deposit of not less than \$1.5 million must be placed with the Land Transport Authority (“LTA”); and
- (d) there must be a data recorder installed in the AV that is capable of storing information when the vehicle is being used, which must capture information including but not limited to the speed of the vehicle, the status of the vehicle (e.g. whether it is operating manually or in autonomous mode), and camera or video footage.

The Rules also require the person authorised to undertake the approved trial or special use to notify the LTA of any incident or accident involving the AV.

However, this is not to say that AVs only started plying Singapore’s roads in 2017. Prior to the 2017 amendments to the RTA, trials could still be conducted, with the vehicles exempted from certain requirements in the RTA and having to comply with certain conditions as well.⁶

Where the AV does not operate on the road, but on areas such as footpaths, exemptions under the relevant legislation are made, with exemption conditions aligned to the authorisation conditions in the Road Traffic (Autonomous Motor Vehicle) Rules 2017.⁷

Lastly, there is TR 68, a Technical Reference for Autonomous Vehicles issued by the Singapore Standards Council. It is available in 4 parts, covering (a) fundamental behaviours AVs should exhibit while driving on public roads to ensure the safety of other road users, (b) safety guidelines for AVs deployed on public roads in design and production quality and the competencies of the various actors such as the vehicle developer and system operator, (c) cybersecurity principles and cybersecurity assessment framework, and (d) guidelines on standardised services and data exchange formats for interoperability across multiple parties in the AV ecosystem.⁸

Potential issues with respect to liability for accidents and the role of insurance

AVs pose interesting questions with respect to liability when involved in road accidents. This was discussed in Parliament during the 2017 amendments to the RTA, where the then-Second Minister for Transport responded that:

“the traditional basis of claims for negligence may not work so well...where there is no driver in control of a vehicle. When presented with novel technologies, courts often try to draw analogies to legal constructs in other existing technologies. In the case of AVs, the courts have autopilot systems for airplanes and autopilot navigational systems for maritime vessels, and product liability law to draw references from. **As with accidents involving human-driven vehicles, it is likely that issues of liability for AVs will be resolved through proof of fault, and existing common law. We will require all test AVs to log travel data to facilitate accident investigations and liability claims.**”⁹

There are many potential defendants where an AV accident happens – for example, the manufacturer of the vehicle, the driver/safety driver inside the vehicle, and the owner of the vehicle. And in relation to the manufacturer, there are also many parties, such as the person who manufactured a component of the AV, the person who programmed the AV, the person who trained the AV to recognise obstacles, etc.

Therefore, for the purposes of discussing liability, we find it helpful to split the cases into 2 categories – those with driver involvement (Levels 3 and 4) and those where the vehicle is fully autonomous (Level 5). We will explore the position in Singapore and in other jurisdictions – who should be liable, and what

⁶ See, for example, the Road Traffic (SMART-NUS Autonomous Golf Carts Trial) (Exemption Order 2013 (G.N. No. S 560/2013) and the Road Traffic (INDUCT-NTU NAVIA Trial) (Exemption) Order 2014.

⁷ See, for example, the Active Mobility (Gardens by the Bay – Exemption) Order 2020.

⁸ Summary available at <https://cetran.sg/tr68/>.

⁹ *Singapore Parliamentary Debates, Official Report* (7 February 2017) vol 94 (Ng Chee Meng, Second Minister for Transport).

standard should apply (negligence, strict liability, or no-fault liability). It is important to note that the 2017 amendments to the RTA and the Rules do not set out who is liable in the event an AV is involved in an accident, but instead set out the principles concerning authorisation for use and testing.

Summarily, our view is that in the absence of special liability rules being introduced, all accidents will continue to be addressed by existing legal principles/common law, and in Singapore, this would be the tort of negligence. The key guiding principle should be to ensure that the injured party is not left without a remedy. In Singapore, this will be covered in light of the requirement for insurance or a security deposit from the person authorised to conduct the trial or use of the AV.

Scenario 1: driver involvement – liability for driver/manufacture depends on the facts of the case

How should liability be apportioned where a human is partly in control of the AV? We discuss 2 cases to set the context.

In March 2018, the first recorded case of a pedestrian fatality involving an AV occurred. An Uber self-driving car collided into a pedestrian as she wheeled her bicycle across the road (but not at a pedestrian crossing) at night. The safety driver was supposed to take control of the vehicle in the event of an emergency, but she was distracted – the prosecution claims she was watching “The Voice” (a talent show) at the material time, but the safety driver claims she was checking work messages on her phone. At the same time, the US National Transportation Safety Board found that the car’s “system design did not include a consideration for jaywalking pedestrians”¹⁰ so it was unable to identify what the victim was, and Uber had also programmed the car to delay hard braking for one second to allow the system to verify the emergency, avoid false alarms, and for the human to take over – the impact may have been less severe if the emergency braking was not suppressed.¹¹

Prosecutors ruled (in March 2019) that Uber was not criminally liable for the pedestrian’s death. Guidance from the courts on the manufacturer’s civil liability is not available because Uber made a private settlement with the deceased pedestrian’s family. However, the safety driver was charged with negligent homicide in September 2020, and her case is presently ongoing.

Closer to home, Singapore also has had AV accidents, although fortunately no one was injured. The first reported case was where an AV with 2 engineers on board (one was behind the wheel as a safety driver) collided into a lorry, and investigations showed that it was due to a software issue which affected how the vehicle detected and responded to other vehicles. There was no reported criminal or civil outcome, and vehicular trials resumed when the software issue was fixed.¹²

Having a person inside the AV whose duty is to keep a lookout and take over control if necessary at first blush resolves the issue of liability, as the safety driver is penalised for failing to pay attention. We could say that it is no different from a regular driver in a regular, non-autonomous vehicle, who has to keep a lookout and is liable for accidents unless there was mechanical failure of the vehicle, or contributory negligence on the part of the victim (like a pedestrian who suddenly dashed across the road).

However, the reality (and key difference from a non-autonomous vehicle) is that a safety driver would need a certain amount of reaction time after receiving a prompt from the AV system (at least 1.5 seconds)¹³, and this would also vary depending on the age and physical condition of the driver. Studies have also shown that persons cannot be expected to pay full attention to their surroundings when they are not actively driving.¹⁴ A safety driver could raise a defence that he/she was not prompted to take over (although if there was a recorder in the vehicle this could be verified), or that there was not enough

¹⁰ Report available at <https://www.nts.gov/investigations/accidentreports/reports/har1903.pdf>

¹¹ <https://www.wired.com/story/uber-self-driving-car-fatal-crash/>

¹² <https://www.straitstimes.com/singapore/autonomy-resumes-driverless-car-trials-in-one-month-after-accident>

¹³ <https://news.mit.edu/2019/how-fast-humans-react-car-hazards-0807>

¹⁴ <https://www.wired.com/story/uber-self-driving-car-fatal-crash/>

time for him/her to react after the prompt. In such cases, should liability fall on the manufacturer instead? This is still open to debate.

The safety driver may also allege that there was a fault with the vehicle, shifting liability to the manufacturer. A hardware issue (brake failure, camera failure) would be more straightforward to examine and prove than a software issue, because with the latter we would be looking into how the vehicle was programmed and what data it was trained on, and whether it has a self-learning function. We will discuss the liability of the manufacturer (whether it is in negligence or product liability/strict liability) together with *Scenario 2* below, as the same principles will apply once a vehicle fault is alleged.

Scenario 2: fully autonomous vehicle with no driver involvement – manufacturer liable

Where the vehicle is fully autonomous (akin to the driver taking a taxi), the emerging position in many jurisdictions is that the manufacturer will be liable.

For example, in the UK – it is proposed¹⁵ that the Authorised Self-Driving Entities (“**ASDE**”) (likely to be vehicle manufacturer or software developer, or a partnership between the two) will be held responsible when the vehicle is driving itself. If the AV breaks traffic laws when driving itself, the ASDE will be responsible and could be subject to regulatory sanctions¹⁶. However, the human is still responsible for other legal requirements such as vehicle insurance and roadworthiness.¹⁷

In Shenzhen, regulations have been passed that if the AV has a driver behind the wheel, the driver is liable in the event of an accident; but if the AV is driverless, the owner of the vehicle will be liable, but the owner can seek compensation from the manufacturer if a defect in the AV causes an accident.¹⁸

However, the issue is what liability rules should apply to a manufacturer. Negligence is the present framework that is applied in Singapore – any others (strict liability or no-fault liability) will require a policy shift and perhaps even legislative changes. We will thus examine 3 possible frameworks of liability for the manufacturer, drawing on the frameworks set out by the Singapore Academy of Law’s Law Reform Committee in their *Report on the Attribution of Civil Liability for Accidents Involving Autonomous Cars* (published September 2020) (“**SAL Report**”).

(1) Negligence

Negligence is a form of fault-based liability, where the claimant must show the defendant owed them a duty of care, there was a breach of the duty of care (i.e. the defendant fell below the standard of care), and that the damage the claimant suffered was caused by the defendant’s breach of duty.

However, proving that there was a software issue with the AV will be more complex than proving that there was a hardware issue. The SAL Law Reform Committee has highlighted that the difficulty will be in showing that the programming of the software fell below the standard of care, because the nature of a machine learning algorithm means that we must go beyond examining the code – its results are heavily dependent on the data it is trained on, which thus also requires looking into the quality and quantity of the datasets and the nature of the training – the inquiry will be very extensive and require specialist skills.¹⁹

¹⁵ See the following report: *Connected and Automated Mobility 2025: Realising the benefits of self-driving vehicles in the UK* (published August 2022), presented to Parliament by the Secretary of State for Transport and the Secretary of State for Business, Energy and Industrial Strategy (“**CAM 2025 report**”).

¹⁶ See pages 37 and 41 of the CAM 2025 report — these will range from an informal warning through to a compliance order, and a civil penalty to suspension of authorisation.

¹⁷ See page 40 of the CAM 2025 report.

¹⁸ <https://www.reuters.com/technology/shenzhen-accelerates-chinas-driverless-car-dreams-2022-08-01/>

¹⁹ See paragraphs [5.9] and [5.10] of the SAL Report.

(2) Product liability/strict liability

In the alternative, a product liability claim could be made against the manufacturer, which imposes strict liability for injury or damage caused by a defective product (i.e. there is no defence of having taken reasonable care for the manufacturer). However, Singapore does not have product liability legislation similar to UK's Consumer Protection Act 1987, the EU's Product Liability Directive, or product liability laws in the US — our product liability laws are generally in tort and contract, as well as some statutory protections such as the Consumer Protection (Fair Trading) Act 2003.

Under the UK/EU laws, the claimant generally still has to show some fault on the manufacturer's part, so it has the same difficulties as negligence when demonstrating a defect with the software (as opposed to the hardware).²⁰ Nevertheless, unlike negligence, the manufacturer showing that it took reasonable care would not defeat liability.

(3) No-fault liability

No-fault liability is such that so long as the victim can show that harm was suffered due to the accident, the victim will receive compensation (whether through insurance or a fund set up for such purpose) — there is no need to show that the tortfeasor was at fault (in that the tortfeasor was negligent or the product was defective).²¹ In essence, it is a “no questions asked” regime, where the victim is compensated so long as harm is suffered.²²

In the UK, under the Automated and Electric Vehicles Act 2018 (“AEVA”), to ensure that the victim has a speedy remedy, the insurer will be liable for the damage to the victim caused by an AV (section 2(1)). However, the insurer can subsequently claim against the “person responsible for the accident”²³, such as the manufacturer of the self-driving car. The insurer may also recover the amount paid to the victim from the person who did not install safety-critical software updates before operating the AV, or who tampered with the software.²⁴ The insurer may also exclude its liability if the accident was caused by the person in charge of the vehicle allowing the vehicle to begin driving itself when it was not appropriate to do so.²⁵

What does the future hold for AVs in Singapore in light of international developments and trends?

There is huge potential for AVs because they are purportedly a safer driver than most humans — AVs do not get tired, distracted, check their phone, operate under the influence of drink or drugs, or be prone to road rage. With all the sensors and cameras installed in the AV, AVs could also be said to have more than one pair of eyes on the road (compared to a human driver). Will we thus see arguments in the future that the AV should have been able to avoid the accident because of all its sensors?²⁶

However, whether AVs will catch on is highly dependent on the state of technology for such vehicles, the right road infrastructure²⁷, and a supportive regulatory environment for testing. The laws governing the use of AVs will adapt accordingly, balancing between apportioning risk and ensuring that manufacturers still have an incentive to develop the technology (as it would not make sense to develop AVs if it results in more lawsuits against them).

²⁰ See para [5.17] – [5.18] of the SAL Report.

²¹ See para [20] of the SAL Report.

²² See para [5.23] of the SAL Report.

²³ See the section heading of section 5 of the AEVA.

²⁴ See section 4(4) of the AEVA.

²⁵ See section 3(2) of the AEVA.

²⁶ Gary Marchant, "Autonomous Vehicles, Liability and Private Standards", available at: <https://www.youtube.com/watch?v=8w1fQb7FUw4>

²⁷ LTA has also mentioned that when AVs are fully deployed across Singapore, new towns must be designed for autonomous vehicles, and existing towns retrofitted for them.

Internationally, as companies want to export their AVs to overseas markets, there is likely to be greater co-operation in the development and harmonisation of rules and standards. In October 2022, China led the introduction of a series of 5 ISO standards concerning a common set of test scenarios for the testing of AVs.²⁸ This is useful as the safety of an AV can be assessed against an agreed international standard instead of just the manufacturer's claims that it is safe. Having more standards in the future also provides more certainty to manufacturers as to what they will be liable for in the event an AV is involved in an accident. Having industry standards on the manufacture and testing of AVs, and complying with such standards, will not be an absolute shield from liability, but it will help manufacturers show that they acted in accordance with a widely-accepted standard of care.²⁹

Going forward, it is also prudent for car manufacturers to exercise caution in their advertising materials about the ability of the AV (e.g. not to call it "self-driving" or "autopilot" if it is not fully autonomous), so that consumers do not have unrealistic expectations about how much or how little they have to monitor the AV when it is in operation.³⁰

Finally, aside from legal liability, autonomous vehicles also pose a moral issue, as decisions such as whether the vehicle will, in the event of a collision, prioritise the lives of its occupants or the persons outside, are 'pre-programmed' by a group of persons outside of the emergency situation, instead of a reaction of the driver in the 'agony of the moment'. The debate continues for this, independent of the legal rules on liability – there is no right answer to those questions, and perhaps the solution lies in engineering instead, to continually improve on the safety and construction of AVs.

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²⁸ ISO 34501:2022 (defining terms in the context of test scenarios) and ISO 23402 (scenario-based safety evaluation framework for automated driving systems) have been published; the other 3 (specification for operational design domain, scenario categorisation, and a methodology to evaluate the test scenarios) are under development.

²⁹ Gary Marchant, "Autonomous Vehicles, Liability and Private Standards".

³⁰ <https://www.bbc.com/news/business-44159581>

DREW DATA PROTECTION & CYBERSECURITY ACADEMY

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