Autonomous vehicles

Date	2 June 2022
Attention	New Minister of Transport

Purpose of this briefing

1. You asked us to investigate the option of autonomous vehicles (AVs) and report back on their potential wellbeing implications for people in our cities, plus their risks and benefits for creating highly liveable cities.

Background

2. AVs stand to be the next big advancement in transport, with some predicting we may share the road with fully automated vehicles by 2025.[1]

3. In fact, we are already surrounded by lower-level AVs. Many cars on the market today can perform automated tasks such as blind spot monitoring and emergency braking. Figure 1 explains the different levels of driving automation.[2, 3]

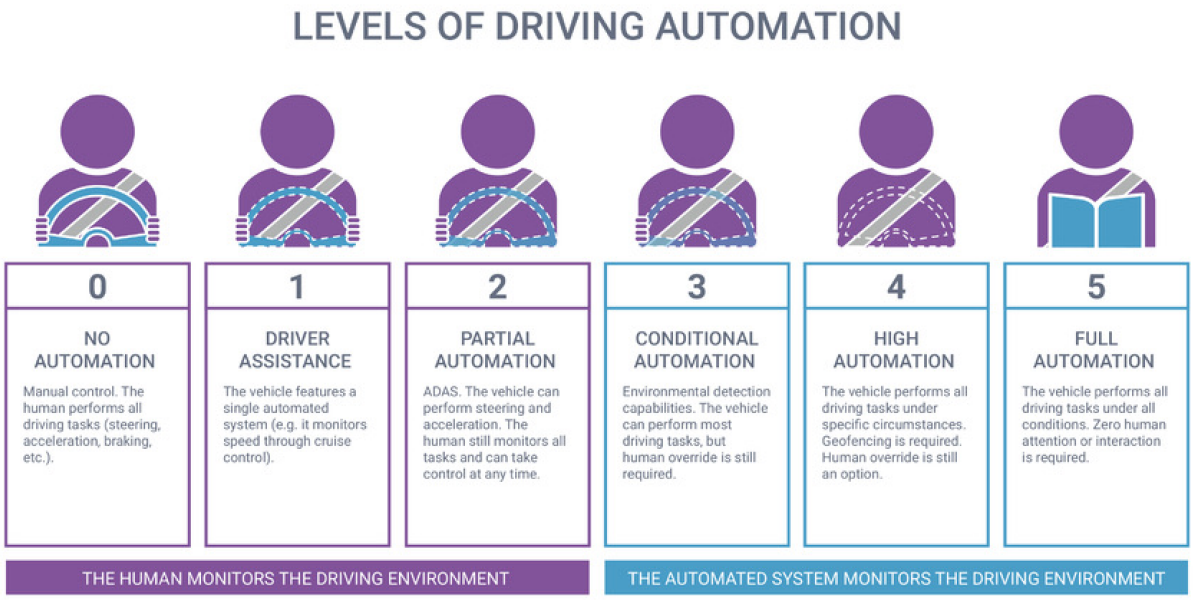

Figure 1: Levels of driving automation.

4. While AVs above Level 4 are not yet present on Aotearoa roads, technology development and trials are ongoing which could soon change that:[4]

   4.1. Ohmio is an Aotearoa-based company who have developed a Level 4+ electric shuttle for Christchurch International Airport. They are also contributing to the Paerata Rise "smart village" development in Auckland with a shuttle that will keep the development connected via on-demand Hail technology.[5]

   4.2. Aotearoa is home to Tesla vehicles which may not have been above Level 4 at the time of purchase, but are equipped with the necessary hardware to become more autonomous through the opt-in software updates "Autopilot" and "Full Self-Driving". Tesla claims that these updates "do not make the vehicle autonomous" and "are intended for use with a fully

attentive driver", however future updates are planned which could eventually enable full autonomy.[6]

5. AV trials overseas provide examples of situations and applications that could inform progress in Aotearoa.

    5.1. Waymo - originally the Google self-driving car project - is a United States-based company providing various AV solutions. Waymo One is a ride-hailing service which is fully functional within Phoenix, Arizona, while Waymo Via looks at using AVs for goods transport and delivery.[7]

6. We will focus on public applications for AVs, as we believe that they could play a vital role in future-proofing the public transport systems of our cities.

Autonomous vehicles for public transport

7. Public transport usage is low in Aotearoa, comprising 3% of trips compared to 79% by car.[8] Addressing this issue is a key focus of the Emissions Reduction Plan, which aims to reduce the kilometres travelled by car by 20% by 2035 through actions including improvement of public transport systems.[9]

8. One factor which is impeding the success of Aotearoa's public transport is a driver shortage, reducing the frequency and reliability of services across the country. This is where high-level AVs come in, as the lack of a driver is their main feature.

9. AV technology can be applied to various modes. Options include:

    9.1. *Light/metro rail*: Trains have a different automation classification, explained in Figure 2.[10] Increasing the rail network in Aotearoa has proved challenging, however automating the existing network may be an easy way of introducing AV technology as trains already operate on a fixed and separate route.

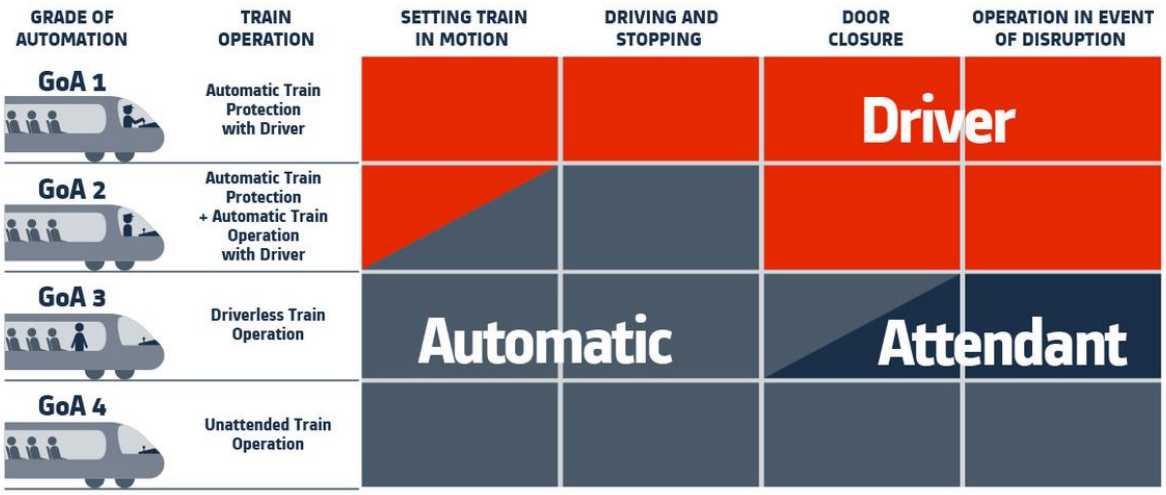

Figure 2: Train grades of automation.

    9.2. *Trolley bus/streetcar/tram*: These modes form a midpoint between trains and buses - they tend to still require infrastructure such as tracks or wires, yet they share their route with other vehicles, and therefore have more hazards to be aware of.

    9.3. *Bus*: Buses are the main form of public transport in Aotearoa.[11] Multiple trials of autonomous buses are underway overseas, including in Spain and Scotland.[12] While hazards

are more of a concern as buses are not confined to a fixed route, this also makes them more adaptable.

9.4. *On-demand*: Automating shared ride-hailing services like Timaru's MyWay[13] could increase their efficiency and viability. While such vehicles have a lower capacity, they are more flexible than other modes. Variability in routes and destinations means that they would need to be familiar with a large, geo-fenced area.

Potential wellbeing implications

10. If AVs are successfully integrated into the public transport system, they may reduce the uptake of active transport modes and divert funding away from active transport. This could interfere with the Emissions Reduction Plan's aim to promote active transport.[9] While both public and active transport are vital to reducing car dependency, active transport does have more added health benefits.

11. The unfamiliarity and uncertainty of AVs may be disconcerting to passengers and other road users. For example, only 20% of Americans say they would feel comfortable in an AV.[14]

12. However, on-demand AVs may feel safer and more comfortable to some groups, especially women, as they do not have to be alone with a taxi driver or in close proximity to strangers on mass public transport.

Risks

13. AVs must be kept updated and capable of operating safely in their environment. Rigorous testing and monitoring will be necessary to ensure the technology is functioning as intended.

14. It is inevitable that AV accidents will occur. In these situations AVs rely on "ethical crashing algorithms", which require controversial and difficult decisions to be made.[15]

15. As technology advances, AV systems are likely to become more vulnerable to cyber-attacks which could compromise safety and privacy.[16]

16. Current legislation was not drafted with AVs in mind. Consequently there are several grey areas, particularly regarding liability. Other regulations also require updating, such as insurance policies.[4]

17. The "smart" technology behind AVs can reduce their emissions by up to 60%.[14] This may give the illusion that fossil-fuelled AVs are contributing fully to Targets 2 and 3 of the Emissions Reduction Plan[9] when low- or zero-emission AVs would be better.

Benefits

18. Aside from the aforementioned emissions reduction which aligns with the "environmental sustainability" area of the Transport Outcomes Framework, AVs are cheaper to run and more reliable, aligning with the "inclusive access" area.[17]

19. Because AVs are not liable to human error, they could avoid 90% of accidents.[14] This aligns with the Road to Zero strategy as well as the "healthy and safe people" area of the Transport Outcomes Framework.[17]

20. AVs may also contribute to the "resilience and security" area of the Transport Outcomes Framework,[17] as their reliability and adaptability means they can achieve feats such as being

available 24/7. Even if just used to connect to other public transport modes, AVs complement and strengthen the public transport systems of our cities.

Recommendations

21. We recommend that you:

    (a) continue to monitor AV developments and come up with regulations that keep up with their capabilities;

    (b) consider the implementation of AVs in any future additions to urban public transport systems;

    (c) evaluate current urban public transport systems to determine whether AV implementation could be feasible and beneficial;

    (d) prioritise the implementation of AVs which are low- or zero-emission.

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