



Automated vehicle (AV) technology holds many potential safety benefits. However, these vehicles currently possess several limitations. Of concern, findings from a survey conducted by the Traffic Injury Research Foundation (TIRF) showed drivers were not aware of their continued role in the driving task and the need to remain vigilant while behind the wheel.

A solid understanding and awareness of the functions of automated vehicle technology are especially important as research has demonstrated some drivers would be more likely to engage in risky behaviours when using AVs. These drivers tend to be young males, with high trust and acceptance of AVs.¹ It is anticipated this high-risk population may represent early adopters of the technology and education is paramount to increase knowledge and discourage risk-taking and over-reliance. Conversely, older drivers expressed a reluctance to adopt AVs, despite potential gains in health and mobility this technology offers. However, the study also revealed older drivers' knowledge and beliefs about such vehicles will influence the likelihood they will rely on this technology to improve their safety. Therefore, if they feel more knowledgeable about the technology, and understand its capabilities, they are more likely to use it, keeping limitations in mind. Further, TIRF's research showed they are receptive to educational strategies and tools

to help them learn to use these vehicles in ways that maximize safety benefits.²

These findings highlight the importance of implementing automated vehicle technology with effective, educational strategies to successfully integrate this technology into the driving fleet. In particular, a concerted effort to dispel myths or misconceptions drivers may have about capabilities of the technology, and increase understanding of limitations associated with it can positively shape driver behaviour and promote safety. In light of this, important topics regarding the use of automated vehicles, specifically common beliefs and misperceptions about the technology, are explored below in question and answer format.

Questions & Answers

What is the difference between a vehicle with full automation (Level 5) and lower levels of automation?

A vehicle with full automation (Level 5) theoretically requires no driver input beyond starting the engine, entering a destination



and turning it off at the end of a trip. Currently, these vehicles do not exist. The automated driving system (ADS) of this type of vehicle will be able to handle long-distance travel and make complex decisions such as navigation of unexpected hazards, adjustment to weather conditions, and respond to hazards caused by other road users to name a few. However, due to the challenges associated with achieving this level of automation, this technology is considered a long-term goal and it will be decades before these types of vehicles will be used by Canadians. Vehicles with high automation (Level 4) are capable of performing all the driving tasks under specific driving conditions and environments. These vehicles must be able to respond safely even when their operational limits are reached.³

Conversely, vehicles with conditional automation (Level 3) can assume the complete driving task under limited conditions, but the driver must remain attentive and engaged in order to be ready to resume driving at any point if the ADS hands over control.⁴ The predicted safety benefits of automated vehicles may be achieved with the use of vehicles with conditional automation (Level 3), however, this is dependent upon drivers' understanding of the capabilities of this technology and their preparedness to take over driving with limited notice. In other words, these vehicles require drivers to recognize the capabilities of the vehicle and, more importantly, the limitations of the technologies.

Are automated vehicles available today in Canada?

Vehicles with conditional automation (Level 3) or higher are not currently available for purchase in Canada. At this time, all vehicles require drivers to be attentive to the surrounding environment and responsible for all vehicle controls. Eventually, automation of the driving task in limited conditions will be possible when vehicles with conditional automation are available for public purchase. When these vehicles become available, drivers must still monitor vehicle control of all critical driving functions,

including monitoring the road, steering, as well as accelerating/braking, and must be prepared at all times to intervene on short notice.⁵ While these vehicles will monitor roadways and prompt drivers when they need to resume control, they will continue to rely upon input from drivers.

Will automated vehicle technology replace drivers?

No. For the foreseeable future, vehicles will require an attentive and engaged driver. Although higher levels of automation that minimize the need for direct driver input are in development, it will be decades before these vehicles are available for public purchase. As such, drivers will continue to be necessary as a safeguard in the event of technology malfunction and failure.⁶

Can I use automated vehicle technology to bring me anywhere I want to go?

Currently, the automated vehicle technology available today (Level 1 and 2) are designed to complement a driver's skill set and improve driver safety. Vehicles with full automation (Level 5) are theoretically the only level of automation that would be capable of this. This level of automation remains decades away, as many technological and logistical challenges need to be solved before this technology is available to the public. Testing of higher levels of automation are being done in extremely controlled environments that do not realistically replicate the real-world road environment.⁷ For example, tests are usually performed in ideal weather, or less challenging weather such as light rain and at speeds that may not exceed 64 kilometres per hour. Further, tests do not usually factor in unexpected navigational obstacles such as construction or road closures, although some facilities are being built specifically for this purpose.

Drivers will continue to be necessary for the foreseeable future as a safeguard in the event of technology malfunction and failure.



Automated vehicle technology has difficulty distinguishing between animals and small children, navigating construction hazards, handling wet roadways or roads covered in snow, and other environmental challenges.

Do I need to remain engaged at all times when using automated vehicle technology?

Yes. Vehicles with conditional automation (Level 3) or lower require an attentive and engaged driver. Even when the ADS has assumed the driving task, the driver must be aware and ready to take over at any point as the technology may not be able to navigate challenging road conditions such as inclement weather, potential road hazards or vulnerable road users the technology may not recognize, such as cyclists or pedestrians with strollers. Further, should it malfunction, drivers must be prepared to resume control of the vehicle with limited notice.

Can this technology function in complex road environments or hazardous situations?

Currently, vehicles with conditional automation (Level 3) remain in testing as they are challenged by complex road environments or hazardous situations. This includes difficulty distinguishing between animals and small children, navigating construction hazards, handling wet roadways or roads covered in snow, and other environmental challenges. In these situations, the vehicle would prompt drivers to resume control and navigate the hazard or condition since it cannot perform these tasks.

Will automated vehicle technology be safe to use? Will it help improve road safety?

Automated vehicle technology holds the potential to reduce driver error and improve road safety in general. However, findings from a national survey demonstrated drivers would be more likely to engage in risky behaviours with these vehicles, such as driving fatigued, distracted or impaired. It was also reported drivers may turn off self-driving capabilities to speed or run a red light. Similarly, a survey by Transport Canada found an increasing percentage of Canadians recognize the potential disadvantages of AV's, such as reduction in driver attention and driver skill.⁸

The benefits of automated vehicle technologies are entirely dependent upon drivers using the technology correctly and in the way it was meant to be used. The positive impact on road safety may be limited if drivers are unaware of the proper functions and limitations of their respective vehicles. Research indicates that



although drivers, particularly older drivers, are open to using automated technology, there will be a learning curve that will require education.⁹ This education will be crucial if automated vehicles are to have a positive impact on road safety.

Will this technology cost more to own? Will insurance and repairs be more expensive?

Yes. Generally, the more a vehicle is equipped with automated technologies the more likely that the cost is expected to increase, including the cost of repairs. It is currently unknown how insurance rates will be affected, however, the accrued safety benefits will likely have a positive impact and reduce rates in the long term if drivers use the technology safely and as intended.

According to some research studies and news articles,¹⁰ automated vehicles will enable drivers to rest during travel time and possible sleep during long trips. Is this accurate?

No. Although the full extent of acceptable driver behaviour when using higher levels of automation must be determined as the technology develops, only a vehicle with full automation (Level 5) would theoretically allow this. However, this level of automation is decades away from being available to the public as many technological and logistical challenges remain.

Vehicles with conditional automation (Level 3) can assume the complete driving task under limited

conditions, but the driver must be ready to resume driving at any point if the ADS hands over control. Therefore, drivers will still need to be fully engaged in the driving task as though they were still directly driving the car in case the technology suddenly malfunctions.¹¹ In the event of a malfunction, drivers would have a matter of seconds to resume control of their vehicle. This demonstrates that core driving skills will still be needed for the foreseeable future.

Conclusion

With the advent of vehicles with conditional automation (Level 3), driver involvement in the driving task will continue to be necessary and essential. Currently, attentive and alert drivers are a crucial component for the safe operation of automated functions in vehicles with Level 1 and 2 automation. Previous research highlights the importance of education regarding limits and capabilities of automated technology. Older drivers in particular are more likely to use it if they feel safe and knowledgeable about the technology.¹² Since older drivers are often very experienced drivers, they are an ideal population to begin the transition of drivers using this technology as their driving skills are firmly established. Moreover, older drivers can help shape education of all drivers regarding the safe use of automated vehicle technology.

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1,9,12 Robertson et al. 2018
 2 Anderson et al. 2010; Robertson et al. 2016
 3 Raven 2020; NHTSA 2017
 4,8 Robertson et al. 2016; Transport Canada 2021
 5 Lekach 2018; Karsten & West 2018; Robertson et al. 2016

6 Hedlund 2018; Robertson et al. 2016;
 7 Lekach 2018; Karsten & West 2018
 10 Cohen & Hopkins 2019; Rudgard 2018
 11 Robertson et al. 2016; Hedlund 2018; Lekach 2018; Karsten & West 2018



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Traffic Injury Research Foundation

The vision of the Traffic Injury Research Foundation (TIRF) is to ensure people using roads make it home safely every day by eliminating road deaths, serious injuries and their social costs. TIRF's mission is to be the knowledge source for safer road users and a world leader in research, program and policy development, evaluation, and knowledge transfer. TIRF is a registered charity and depends on grants, awards, and donations to provide services for the public. Visit www.tirf.ca.

Traffic Injury Research Foundation (TIRF)

171 Nepean Street, Suite 200, Ottawa, ON K2P 0B4
 Email: tirf@tirf.ca ISBN: 978-1-989766-18-7

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