AUTOMATED VEHICLES

Potential Benefits & Limitations of Automated Vehicles

brainonboard.ca

Advances in vehicle technology have highlighted the potential benefits of automation in the driving fleet. In most modern vehicles, many Advanced Driver Assistance Systems (ADAS) are standard. These electronic safety systems assist drivers by preventing or mitigating road crashes. Although these systems are simply responsible for supporting drivers, they play a key role in the future development of automated driving features. With higher levels of automation, there is ample discussion surrounding the potential benefits, but drivers must understand how to use the technology properly, and not over-rely on it in situations it is incapable of handling.[1] It is essential to combine the discussion of potential benefits with full explanations and important caveats or nuances to the functioning of the technology, so drivers also understand the limitations of these features. Furthermore, potential disadvantages must be equally emphasized to help provide drivers with critical knowledge and realistic expectations of what to anticipate when using these technologies.

This fact sheet provides an overview of the potential benefits and limitations of automated vehicle (AV) technology and addresses important caveats for consideration when discussing its potential impact. This information can help drivers acquire a balanced understanding of how AV technology may impact driving specifically, and road safety more generally.

Questions & Answers

What are the potential benefits of AV technology?

Increased safety for road users. It is anticipated AV technology will reduce road fatalities, serious injuries and crashes if used as intended.[2] Specifically for vehicles with conditional automation (Level 3), drivers will continue to be essential to the driving task and must remain attentive and prepared to take over the driving task when prompted. Drivers will also not be able to rely on the technology in situations for which they were not designed (e.g., navigating construction zones, emergencies, snow, fog, heavy rain). As such, drivers must understand they remain integral to the driving task.

Of concern, survey results from the Traffic Injury Research Foundation (TIRF) highlighted common misconceptions about AV technology,

Your brain is your vehicle's most important safety feature.

showing over 16% of Canadians did not think they would need to pay attention when using automated vehicle technology, and 33% wanted to rely on it in emergencies or inclement weather.[3] In line with the efforts to make a safe and seamless rollout of automated vehicle technology, the Governors Highway Safety Association (GHSA) conducted research examining how automated vehicles can be best incorporated into the vehicle fleet without causing significant disruptions to the duties of first responders. New and evolving protocols have been developed to help reduce uncertainty and misconceptions regarding these technologies and identify how first responders and other public safety providers may best interact with then in the field.

Increased mobility. Vehicles with higher levels of automation (Level 3 and up) may increase mobility of older drivers, as well as those with restrictive medical conditions and disabilities. It is estimated approximately 4.6 million[4] Canadians aged 65 years or older will hold a valid driver's licence after 2021. Automation could increase the mobility of seniors and help aging drivers safely retain their driving privileges longer which is important to their health and wellbeing. Moreover, the technology could mitigate age-related declines in perceptual, cognitive, and physical capacities.[5] Automated functions could increase their confidence and safety on the road, ultimately increasing their capacity for mobility.[6] However, the likelihood older adults will be receptive to and adopt these technologies is dependent on the type and level of education they receive about these vehicles. Research shows older drivers are more likely to be more receptive to automated vehicle technology if they receive education and training accommodating their needs and comfort in using new technologies.[7]

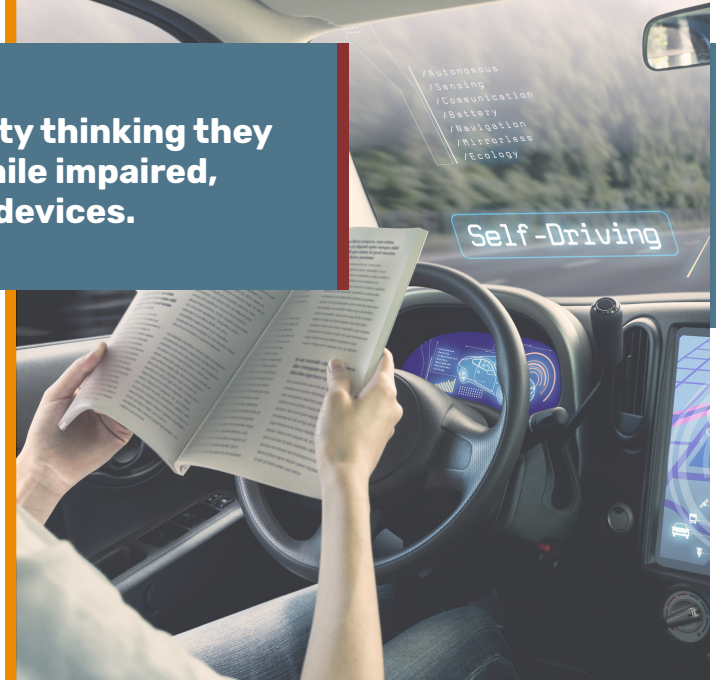
Increased efficiency in the trucking industry. The use of automated and connected vehicle technology (i.e., vehicles that are connected to a network and can communicate with other vehicles or infrastructure), would enable commercial trucks to form a platoon. Truck platooning is when a lead truck wirelessly communicates data about the driving environment with a string of trucks. Following closely to the lead truck, other trucks in the platoon use data from the lead truck as well as information from its sensors to inform the automated driving system.[8] Truck platooning can increase travel efficiency, reduce emissions, and increase highway safety for all drivers.

However, potential challenges with truck platooning must be considered. Public perception of truck platooning might be difficult to overcome, as it may be perceived as dangerous. Drivers may not be comfortable sharing the road with a large platoon of trucks. Moreover, drivers may cut off or cut in between trucks, creating additional risks for both drivers and reducing the following distance between platooning trucks.[9]

Reduced traffic congestion and fuel consumption. Vehicles with higher levels of automation (Level 3 and up) have the potential to reduce traffic congestion. Efficient use of traffic lanes and intersections, smaller gaps between vehicles, and intelligent route selection could significantly impact congestion.[10] Improvements in traffic congestion are also possible if this technology reduces road crashes, as it is estimated 25% of congestion is a result of traffic incidents, with crashes making up almost half of those incidents.[11] Reduction in fuel consumption is another potential benefit, as smoother traffic flow and more efficient braking and acceleration could lead to greater fuel savings. However, these benefits will depend on the capabilities of the technology

Vehicles with higher levels of automation are anticipated to be at greater risk for cybersecurity attacks.

Drivers may feel a false sense of security thinking they can use automated driving features while impaired, fatigued, or distracted by their mobile devices.



(e.g., vehicle-to-vehicle communications[12]) and how drivers use the technology. For example, a survey by TIRF demonstrated a significant proportion of drivers would turn off automated driving features to speed.[13] As such, incorrect use of the technology would reduce this potential benefit.

What are the potential limitations of AV technology?

Increased cost of ownership. Vehicles with higher levels of automation (i.e., Level 3 or higher) are anticipated to be associated with high ownership costs due to increased purchase price, greater cost of specialized vehicle repairs and maintenance, and potential increases to insurance premiums as vehicles that can assume the driving task under certain conditions are increasingly used.[14]

Potential for cyberattacks. Vehicles with higher levels of automation (i.e., Level 3 and up) are anticipated to be at greater risk for cybersecurity attacks, especially if equipped with connected vehicle technology such as vehicle-to-vehicle and vehicle-to-infrastructure communication.[15] These technologies create opportunities for hackers to obtain remote access into the system. Without proper safeguards, systems responsible for automated driving functions may become vulnerable to unauthorized access and malicious attacks, allowing hackers to take control of critical driving functions. System updates and unstandardized third-party software downloaded to the vehicle also increase the potential for malware to be installed.[16]

Over-reliance on automated technology. Over-reliance on automated driving functions could create additional safety concerns. If drivers over-rely on it, they may find themselves in a situation where the automated driving features fail and they have to navigate the vehicle in conditions where they may lack confidence (e.g., snowstorm, heavy rain, unexpected hazard). Over-reliance may also cause driving skills to degrade over time due to infrequent use, especially for less experienced drivers (e.g., novice drivers), or those who drive less frequently (e.g., older drivers). Over-reliance on automated driving features by impaired or inattentive drivers would be especially dangerous. Drivers may feel a false sense of security thinking they can use automated driving features while impaired, fatigued, or distracted by their mobile devices. Survey results in 2016 revealed 16% of Canadians strongly agreed it would be unnecessary to pay attention to the road environment when using AVs and 24% of drivers reported they would be willing to drive tired or fatigued. Furthermore, respondents reported willingness to engage in a non-driving activity (17%), sleep or nap (10%) or even drink and drive (9%).[17] However, vehicles equipped with conditional automation (Level 3) require an attentive and engaged driver that is capable of taking control of the vehicle.

Potential increase in vehicle miles travelled (VMT). Vehicles with higher levels of automation (Level 3 and up) may result in a significant increase in the number of trips per vehicle and vehicle miles travelled (VMT).

Hypothetical use of vehicles with full automation (Level 5) as an on-demand service and the eradication of personal use vehicles would also lead to increases in VMT since vehicles would be travelling to reach the user before beginning the intended trip. This could potentially offset benefits accrued in the reduction in congestion and vehicle emissions.

References

Albright, J., Bell, A., Schneider, J., & Nyce, C. (2015). Automobile insurance in the era of autonomous vehicles. Boston, MA: KPMG.

Bloom, C., Tan, J., Ramjohn, J., & Bauer, L. (2017). Self-driving cars and data collection: Privacy perceptions of networked autonomous vehicles. In Proceedings of the Thirteenth Symposium on Usable Privacy and Security (pp. 357-375). Berkeley, CA: Usenix.

Chong, J. (2016). Automated and Connected Vehicles: Status of the Technology and Key Policy Issues for Canadian Governments. Library of Parliament, Publication No. 2016-98-E

Fagnant, D., & Kockelman, K. (2015). Preparing a nation for autonomous vehicles: Opportunities, barriers, and policy recommendations for capitalizing on self-driven vehicles. Transportation Research Part A: Policy and Practice, 77, 167-181.

Federal Highway Administration (2005). Traffic Congestion and Reliability: Linking Solutions to Problems. Washington, D.C.

Governors Highway Safety Association (GHSA) (2021) Law Enforcement, First Responder and Crash Investigation Preparation for Automated Vehicle Technology. Retrieved from: **https://www.ghsa.org/resources/Preparation-for-Automated-Vehicle-Technology21**

Klavora, P., and Heslegrave, R. J. (2002). Senior Drivers: An Overview of Problems and Intervention Strategies. *Journal of Aging and Physical Activity*. 10. 322-335. 10.1123/japa.10.3.322.

Reimer, B. (2014). Driver assistance systems and the transition to automated vehicles: a path to increase older adult safety and mobility? *Public Policy & Aging Report*, 24(1), 27-31.

Robertson, R. D., Meister, S. R., Vanlaar, W. G., & Hing, M. M. (2017). Automated vehicles and behavioural adaptation in Canada. Transportation Research Part A: Policy and Practice, 104, 50-57.

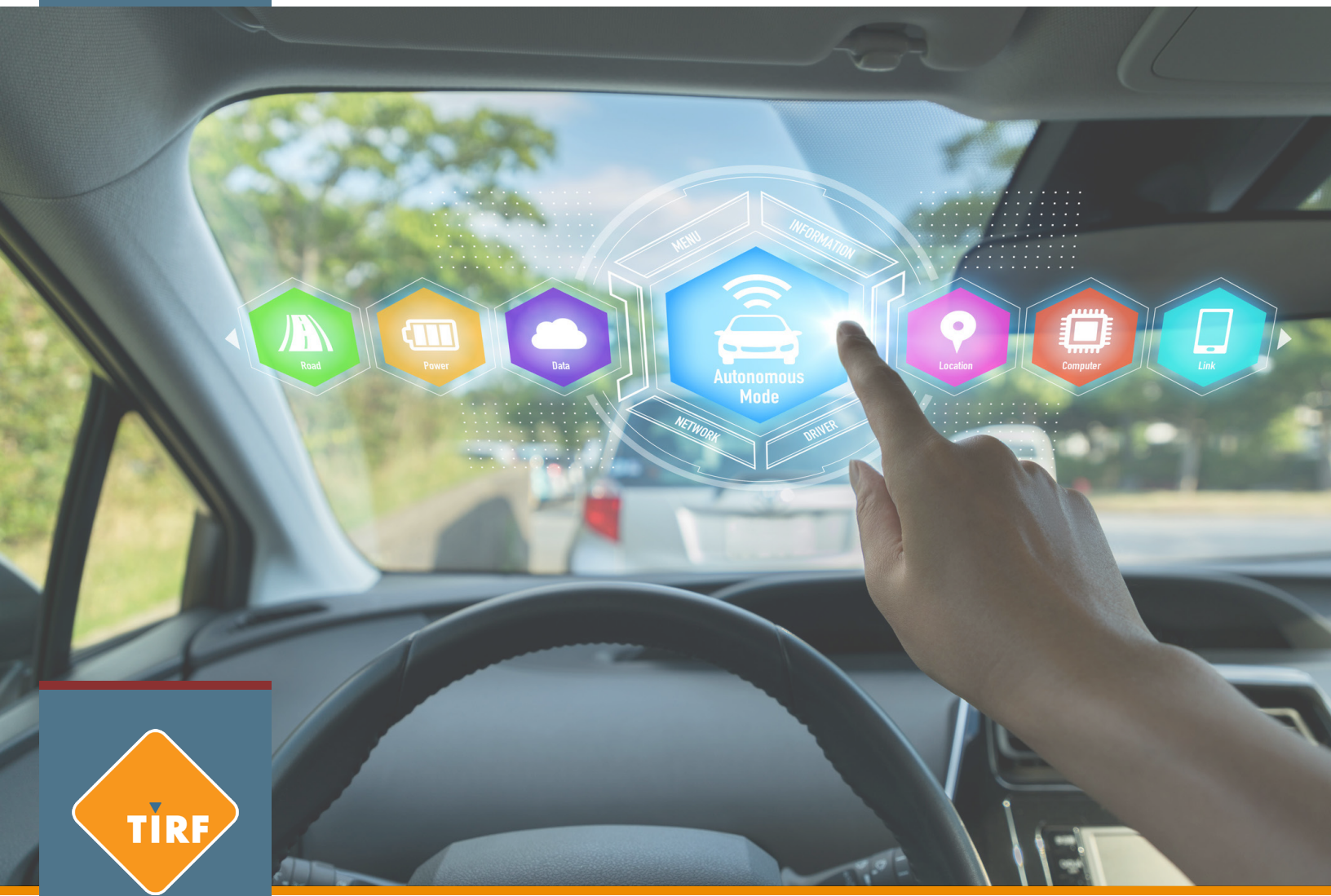
Robertson, R. D., Woods-Fry, H., Hing, M. M., & Vanlaar, W. G. (2018). Senior drivers and automated vehicles: Knowledge, attitudes and practices. Traffic Injury Research Foundation.

Statistics Canada (2015). Population Projections for Canada, Provinces and Territories, 2013 to 2063 (91-520-X)

Wang, M., van Maarseveen, S., Happee, R., Tool, O., & van Arem, B. (2019). Benefits and Risks of Truck Platooning on Freeway Operations Near Entrance Ramp. Transportation Research Record, 2673(8), 588-602.

Wood, J.M., Anstey, K.J., Kerr, G.K., Lacherez, P.F. and Lord, S, (2008). A multidomain approach for predicting older driver safety under in-traffic road conditions. *Journal of the American Geriatrics Society*, 56(6):986-93.

[1] Casner 2020
[2, 12] Fagnant and Kockelman 2015
[3, 17] Robertson et al. 2017
[4] Statistics Canada 2015
[5] Wood et al. 2008; Klavora and Heslegrave 2002
[6] Reimer 2014
[7] Robertson et al. 2018
[8] Transport Canada 2019
[9] Wang et al. 2019
[10] Fagnant and Kockelman 2015
[11] Federal Highway Administration 2005
[13] Robertson et al. 2016
[14] Albright et al. 2015
[15] Chong 2016
[16] Bloom et al. 2017



Want to learn more?

Visit **brainonboard.ca** to learn more about automated vehicles.

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: 978-1-989766-21-7

Acknowledgements

Production of this fact sheet was made possible with sponsorship from Desjardins and technical expertise from Greg Overwater & Andrew McKinnon, Global Automakers of Canada.

Desjardins

Global Automakers of Canada

Your brain is your vehicle's most important safety feature.