TRAFFIC INJURY RESEARCH FOUNDATION

AUTOMATED VEHICLES: DRIVER KNOWLEDGE, ATTITUDES, & PRACTICES

EXECUTIVE SUMMARY

The knowledge source for safe driving

The Traffic Injury Research Foundation

The mission of the Traffic Injury Research Foundation (TIRF) is to reduce traffic-related deaths and injuries. TIRF is an independent, charitable road safety research institute. Since its inception in 1964, TIRF has become internationally recognized for its accomplishments in identifying the causes of road crashes and developing programs, and policies to address them effectively.

This study was made possible by a charitable contribution from the Toyota Canada Foundation.

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ISBN: 978-1-926857-76-3

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Human drivers have always been an essential requirement in the operation of a motor vehicle. At the same time, research has repeatedly demonstrated that driver error plays a role in more than 90% of road crashes (NHTSA 2008; Blanco et al. 2016). As such, in the past two decades, vehicle manufacturers have designed new and increasingly sophisticated features that provide more assistance to drivers to help mitigate such errors. Such features are an important precursor to the development of automated vehicles and, currently, expectations are high that the advent of semi- or fully- automated vehicles will dramatically reduce road crashes.

Despite their potential benefits, automated vehicles currently possess a number of limitations that technology has not yet been able to overcome. Most notably, semi-automated vehicles are not able to drive in more complex or challenging road conditions or environments, nor are they able to make ethical decisions; instead they must rely on capable drivers to take control. Vehicles are also unable to navigate in poor weather conditions such as rain and snow, are tested at low speeds, and are programmed to obey rules of the road such as traffic signs and speed limits. Most notably, these vehicles are ill-prepared to react to 'the unexpected', which may happen on the road every day.

While anticipated crash reductions are perhaps the greatest promise offered by automated vehicles, their realization will ultimately depend on driver knowledge and understanding of the functionality and limitations of semi- and fully-automated vehicles. Today, technology is advancing more quickly than our knowledge of how people will interact with and react to them.

To address this issue, the Traffic Injury Research Foundation (TIRF), with funding from the Toyota Canada Foundation, conducted a national survey in 2016 to examine driver knowledge, attitudes, perceptions, and practices related to emerging automated vehicles. The survey was augmented with four focus groups that involved drivers and non-drivers representing several age groups. The primary focus of the study was on limited, self-driving, semi-automated vehicles (LSDVs) and fully-automated self-driving vehicles (FSDVs), and explored the following issues:

- driver knowledge, attitudes, and perceptions; and,
- driver practices in terms of acceptance and perceived ease of use, trust, and behavioural adaption.

It also investigated ethical and liability issues related to automated vehicles (AVs), and perceptions about manufacturers of these vehicles.

Driver knowledge, attitudes and perceptions

- Almost two-thirds (63%) of respondents strongly agreed that they were familiar with AV technology in general, such as cruise control or lane keeping, but a much smaller proportion (39%) strongly agreed that they were familiar with technology specifically used to develop FSDVs. Males were more likely to report familiarity with FSDVs.
- A majority of respondents (69%) strongly agreed that they enjoyed driving. And drivers that were male, older and that drove longer distances were more likely to report enjoyment.
- Few respondents (22%) reported that they believed it would be relaxing to use SDVs, but almost half (41%) of them noted it would be very stressful. Males were more likely to believe it would be relaxing whereas older persons and females were more likely to find it stressful.

- Two-thirds of respondents (67%) reported they preferred to use vehicles with standalone safety features which are available today, or vehicles that combine select safety features to work in tandem such as lane monitoring and forward collision warning systems. Conversely, just one-fifth (20%) of respondents reported they would prefer to use a limited self-driving vehicle; just 14% preferred fully self-driving vehicles. Respondents that preferred FSDVs were more likely to be male and were younger.

- Less than one-quarter (23%) of respondents strongly agreed that they would use an LSDV today, and less than one-fifth (17%) strongly agreed that they would use FSDVs. Drivers who drove longer distances were more likely to report they would use an SDV today, and focus group results revealed that trust and confidence in their safety would be essential.

- When unavoidable collisions occur, almost two-thirds (63%) of Canadians strongly agreed that SDVs should be programmed to prioritize the safety of vehicle occupants over other road users. More than half of respondents strongly agreed that the safety of groups of people should be prioritized over individuals, or that pedestrians and cyclists should be prioritized. These latter respondents were more likely to be older.

Driver practices: Acceptance, trust, and behaviour related to SDVs

- Between 30% and 40% of Canadian drivers believed that they currently possess sufficient knowledge of vehicles and driving to operate a LSDV or a FSDV, and that new knowledge or skills for drivers would be unnecessary. This means that some drivers expect to take possession of SDVs without any additional instruction about their new features, including self-driving. Males were more likely to believe that their current level of knowledge was sufficient to use SDVs, and that they would be easy to use.

- One-third of drivers who used public transportation and 15% of persons who cycled or walked reported they would switch to SDVs to commute. These findings have important implications for public transportation and public health.

- Perceived benefits of SDVs included using them for errands, deliveries, shopping, and picking up/dropping off children for various activities. Other benefits were that SDVs would provide greater independence and mobility to persons who were unable to drive. However, perceived drawbacks related to the negative impact of SDVs on family interactions, employment for professional drivers, as well as the environment.

- More respondents strongly agreed that they would trust LSDVs made by a partnership between traditional automakers and technology companies (41%). Smaller proportions (35%) would trust LSDVs built by traditional automakers alone versus technology firms (25%).

- Less than one-third of Canadian drivers strongly agreed that they would feel safe using LSDVs (28%) and less than one-quarter reported they would feel safe using FSDVs (21%).

- Driver confidence in technology to perform safely in high-risk situations was quite low. A majority of Canadians did not agree that LSDVs will perform better than drivers. Just 16% of drivers strongly agreed that SDVs would make them better drivers and only 24% strongly agreed that LSDVs would respond better to pedestrians and cyclists, hazards (26%), and poor driving conditions (29%). Of concern, focus group results suggested that Canadians would most want to rely on automated technology in these high-risk conditions.

> Of concern, 16% of Canadians strongly agreed that it would be unnecessary to pay attention to the road environment when using the self-driving feature of an LSDV. Drivers that were most likely to be inattentive were younger and drove longer distances. Concerning proportions of drivers reported they would be willing to drive tired or fatigued (24%); engage in a non-driving activity (17%), sleep or nap (10%) or drink and drive (9%).

Comparison of what drivers report currently doing and what they think they will do using LSDVs

	Currently do this	Would do this using LSDV	Difference
Continue to watch road		77%	
Drive tired or fatigued	5%	24%	19%*
Do a non-driving activity / distracted	4%	17%	13%*
Sleep or nap		10%	
Set vehicle to drive over speed limit	8%	9%	1%
Drink and drive	3%	9%	6%*
*Difference is significant p<0.001			

> One-fifth of drivers (21%) reported they would disengage the self-driving feature to drive faster in poor road and weather conditions; 14% would disengage self-driving features to run a red-light under similar conditions.

Conclusions

Three critical priorities emerged from this study that demand concerted attention in the next five years. First, there is a clear need to educate Canadians about AV technology to overcome common misperceptions about its capabilities and increase understanding of its limitations. Driver assistance systems have dramatically improved to help drivers respond to unpredictable road environments and compensate for human errors. But automated vehicle technology is not ready for deployment beyond enhanced safety and enhanced driver control. In particular, drivers must recognize that continued and sustained attention to the driving task is essential to avoid increases in crash risk. In other words, a driver is still necessary. It is incumbent on manufacturers to be cautious in marketing automated features and demonstrate due diligence to protect the safety of consumers who purchase their products. Government also plays an important role to ensure responsibility in advertising and to raise public awareness about ways that new vehicles are tested and made available to consumers. Transparency regarding how safety standards are set and met is indispensable so drivers can make informed purchasing decisions.

Second, younger male drivers demonstrated greater acceptance of and trust in SDVs as compared to other age categories, and were more willing to rely on these vehicles to drive. This means that there is evidence that early adopters of SDVs may be more representative of drivers who are less safety-conscious and more crash-involved. This issue warrants attention as their initial experiences with SDVs will have profound implications for widespread uptake and use, and targeted education to ensure that early adopters are well-informed about the limitations of technology is paramount. Conversely, older populations of drivers and women were much more reticent and less likely to rely on SDVs until the level of safety offered by these vehicles is more concretely demonstrated in real world conditions.

Finally, there is clear evidence that the ability of drivers to 'turn off' technology designed to improve safety will influence the size of crash reductions that are ultimately achieved. At least a proportion of drivers will want to turn off automated features, and thereby potentially turn off safety. As such, policy decisions by government to regulate the use of features, or permit drivers to choose when and in what conditions these features are used will play a critical role in shaping experiences with automated vehicles, and acceptance of SDVs on public roadways.

In closing, the significant influence of driver behaviour on road safety should not be under-estimated or overlooked. Strategies to introduce and expand the presence of limited- and fully-automated vehicles on Canadian roadways must strike a careful balance between incentives and controls to maximize safety.

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