Accelerating Revolution in Highly Automated Vehicles (HAVs) Policy for Roadway Safety **[1]**

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Revolution in technology is an integral part of new millennium. Changes in technology in modality of transportation in Australia and elsewhere have been witnessed in the recent past. It is for this reason that all modes of transport (such as: airplane, the automobile, the train, and the horse-drawn carriage) have introduced new opportunities (including new complications) to the safe movement of people and goods.

More specifically, today, all nations are living in the digital era. Stakeholders are increasingly reaching deeper into transportation. It is in this context that it is important for policy makers to ensure and keep not only pace, but also to ascertain public safety. Such a mechanism should aim to establish a scientific foundation based on which the rules of the road can be known, understood, and responded to by industry and the public.

Further, the emergence of self-driving car has raised more possibilities and more questions than any other transportation innovation. The automobile industry, today, is undergoing a technological transformation that holds promise to catalyse advances in safety on roads and highways across the regions of the globe. The development of advanced automated vehicle safety technologies,

including fully self-driving cars, may prove to be the greatest personal transportation revolution since the popularization of the *"personal automobile"*. *Furthermore*, the excitement around highly automated vehicles (HAVs) starts with safety.

It has been found that the HAVs have the potential to save energy and reduce air pollution through efficiency (and by supporting vehicle electrification). In terms of conceptual framework, an automated vehicle system is a combination of *'hardware'* and *'software'* (both remote and on-board) that performs a driving function. Also, it envisages with or without a human actively monitoring the driving environment. Experts and stakeholders opine that for all HAV systems, the manufacturer should address the cross-cutting items as a vehicle is designed and developed to ensure that: (a) the vehicle has data recording and sharing capabilities; and (b) it has applied appropriate functional safety and cybersecurity best practices. In addition to these cross-cutting items, for each specific HAV system, the manufacturer should clearly define the Operational Design Domain (ODD). The ODD (which may vary for each HAV system) will define the conditions in which that function is intended to operate with respect to:

(a) roadway types,
(b) geographical location,
(c) speed range,
(d) lighting conditions for operation (day and/or night),
(e) weather conditions, and
(f) other operational domain constraints.

In addition, a well-defined ODD is necessary to determine what Object and Event Detection and Response (OEDR) capabilities are required for the HAV to safely operate within the intended domain. The OEDR requirements are derived from an evaluation of normal driving scenarios, expected hazards (e.g., other vehicles, pedestrians), and unspecified events (e.g., emergency vehicles, temporary construction zones) that could occur within the operational domain.

Tests should be developed and conducted that can evaluate (through a combination of simulation, test track or roadways) and validate that the HAV system can operate safely with respect to the defined ODD and has the capability to fall back to a minimal risk condition when needed. The safety assessment should cover the significant areas, such as:

a) data recording and sharing,
b) privacy,

c) *system safety,*
d) *vehicle cybersecurity,*
e) *consumer education/training,*
f) *registration and certification, and*
g) *post-crash behaviour.*

The HAVs have great potential to use data sharing to enhance and extend safety benefits. Thus, each entity should develop a plan for sharing its event reconstruction and other relevant data with other entities. Such shared data would help to accelerate knowledge and understanding of HAV performance, and could be used to enhance the safety of HAV systems and to establish consumer confidence in HAV technologies. Manufacturers should take steps to ensure that data shared is in accordance with privacy and security agreements and notices applicable to the vehicle.

Data sharing is a rapidly evolving area that requires more research and discussion among stakeholders to develop consensus on data standards. For example, many manufacturers likely will want the ability to retrieve the data from vehicles they manufacture or sell, and store the data for some period of time. The industry as a whole should work together with relevant standards bodies to develop a uniform approach to address data recording and sharing. All manufacturers should participate in the *"early warning reporting program"*. Additionally, the data intended to be shared through a third party should not contain any personally identifiable information.

In terms of privacy, policies and practices should ensure:

a) *Transparency*: provide consumers with accessible, clear, meaningful data privacy and security notices/agreements which should incorporate the baseline protections outlined in the White House Consumer Privacy Bill of Rights and explain how Entities collect, use, share, secure, audit, and destroy data generated by, or retrieved from, their vehicles;
b) *Choice*: offer vehicle owners choices regarding the collection, use, sharing, retention, and deconstruction of data, including geo-location, biometric, and driver behaviour data that could be reasonably linkable to them personally (i.e., personal data);
c) *Respect for Context*: use data collected from production HAVs only in ways that are consistent with the purposes for which the data originally was collected (as explained in applicable data privacy notice/agreements);
d) *Minimization, De-Identification and R*etention: collect and retain only for as long as necessary the minimum amount of personal data required to

achieve legitimate business purposes, and take steps to de-identify sensitive data where practical, in accordance with applicable data privacy notices/agreements and principles;

e) *Data Security*: implement measures to protect data that are commensurate with the harm that would result from loss or unauthorized disclosure of the data;
f) *Integrity and Access*: implement measures to maintain the accuracy of personal data and permit vehicle operators and owners to review and correct such information when it is collected in a way that directly or reasonably links the data to a specific vehicle or person; and
g) *Accountability*: take reasonable steps, through such activities as evaluation and auditing of privacy and data protections in its approach and practices, to ensure that the entities that collect or receive consumers' data comply with applicable data privacy and security agreements/notices.

Manufacturers should follow a robust design and validation process based on a systems-engineering approach with the goal of designing HAV systems free of unreasonable safety risks. This process should encompass designing the intended functions such that the vehicle will be placed in a safe state even when there are electrical, electronic, or mechanical malfunctions, and/or software errors. The overall process should: (a) adopt and follow industry standards, such as the functional safety process standard for road vehicles; and (b) collectively cover the entire design domain of the vehicle. Manufacturers should follow guidance, best practices, design principles, and standards developed by established standards organizations such as International Standards Organization (ISO). *Most importantly*, the process should include a hazard analysis and safety risk assessment step for the HAV system. The process should describe design redundancies and safety strategies for handling cases of HAV system malfunctions.

Note: Views expressed above are personal of the contributor (and NOT of the S. N. D. T. Women's University, the contributor was employed previously).

References:

National Highway Traffic Safety Administration (NHTSA), U. S. Department of Transportation, accessed on November 27, 2020 from: https://www.ntc.gov.au/sites/default/files/assets/files/NTC%20Consultation%20RIS%20-%20In-service%20safety%20for%20automated%20vehicles.pdf.