HERE Submission: Australia Automated Vehicle Safety Law

HERE welcomes the ongoing program by the Department of Infrastructure, Transport, Regional Development, Communications, and the Arts (DITRDCA) and the National Transport Commission (NTC) to set up end-to-end regulation for automated vehicles. HERE is fully committed to contribute to enable Australia to access the potential benefits of Automated Vehicles (AVs).

AVs offer the potential to improve road safety, mobility and accessibility. The safety of automated driving vehicles is one of the most important factors to consider when deploying AVs on Australian roads.

Vehicles today are more intelligent and more connected than ever before, and their role is becoming far more complex than that of a simple transportation tool. In addition, AVs will go far beyond being merely transportation methods and will enable the development of entirely new and unimagined business models and applications that provide mobility to everyone.

The AV integrates four components: the vehicle, the infrastructure, the management system, and the driver. Location technology, or maps, are at the heart of this technological change. By using a combination of radar, lidar, camera sensors and advanced algorithms, vehicles can accurately interpret their environment and execute specific actions. These technologies work in unison, and the combined data are crucial, not only increasing efficiency but also ensuring safety. As the systems process data from various sensors to comprehensively understand the vehicle's environment, such as object detection, classification and tracking algorithms to identify and monitor obstacles, road conditions and traffic participants, the map provides the context and reference points for what the sensors see, and sees what sensors cannot see. Importantly, the map allows for sensor redundancy, in scenarios where sensor(s) fail or network connectivity is unavailable; an onboard map can provide correct contextual location intelligence and enable safer operation of AVs.

A digital map enables safer operation by human users/drivers as a map can inform the user/driver when automation is available or upcoming on a journey, and importantly when automation is coming to an end so the user/driver can prepare accordingly. This is important should the legal framework restrict operation of AVs to selected parts of the road network, such as on National or Arterial roads v's Access roads or Local streets.

A digital map empowers vehicles to "see" further ahead in all conditions and can serve as an additional set of input data for AV control functions, improving the safe and efficient operation of AVs. For example, it provides information to inform a vehicle of an upcoming lane closure and reduced speed limit associated with construction activity. Without maps, we do not believe, an AV can exist safely in an ecosystem of AVs and non-AVs on the road network The map gives the vehicle precise information about its position and the surrounding road environment to understand their position on the road, maneuver effectively and safely, and plan routes.

AVs can share and validate information on the road networks back to the regulator(s), relevant authorities and industry for awareness of usage and conditions, a framework that the vehicle will understand and interpret. The concept of “Electronic Horizon” allows the car to anticipate events which are unperceivable by sensors, and thereby allows the car to “see around the corner”. It enables an automated or self-driving vehicle to plan beyond sensor visibility, apply contextual awareness of its environment, and process local road rules to make safer and more pro-active driving decisions.

The map can be considered as an extended sensor. Sensors and live maps must go hand-in-hand if we want to ensure the deployment of safe automated driving in Australia. For a map to update quickly enough to guide AVs, it needs input from as many sources as possible, as quickly as possible. A live map combines sensor data from a variety of sources, including the vehicle, and multiple car manufacturers across the globe. The live map is updated in near-real time as fresh data is received, based in a cloud in which data will be aggregated and incorporated to update the map.

There are six areas where a live map provides benefits:

1. **Precise Localization** - A live map helps to determine a vehicle’s precise position in the world. This is critical to automated driving because for an automated system to execute a right-turn it first must know whether it is traveling in the right-most-lane already or needs to switch lanes before making the turn.

Photo: How does an automated vehicle get off ramp? For an automated system to execute a right-turn it first must know whether it is traveling in the right-most-lane already or needs to switch lanes before making the turn.

2. Complement Perception – A live map is like bifocals for automated perception systems — enhancing an AV's perception for both near and far. It empowers vehicles to "see" further ahead in all conditions and can serve as an additional set of input data for automated vehicle control functions, improving the safe and efficient operation of AVs.

Photo: An automated system can be taught to identify an object like a traffic light in a busy street, but the system performance of identifying the light is greatly improved if a live map first tells the system where the traffic light is expected to be located.

AVs need to understand the road network and see what sensors cannot see. Sensors cannot see ahead or around corners e.g. lane closures, or read complex, obstructed or damaged road signs.

Photo: Speed sign obstructed by a tree.

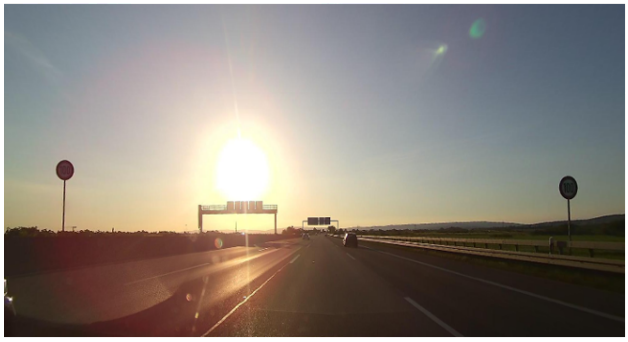


Photo: Signs obscured by sunlight

3. Vehicle Handling – Just as navigation maps have helped human drivers to know about an upcoming turn, to determine the legal speed limit, understand one-way streets, and areas where certain driving maneuvers are restricted. A map provides this same information to automated driving systems to help with path planning and regulatory compliance.

Photo: A map provides information to the automated vehicle to anticipate junctions, curvature of the road or changes in elevation. It allows the vehicle to adapt its speed according to road curvature, slope and junctions.

Photo: A map which is highly detailed gives the vehicle precise information about its position and the surrounding road environment to maneuver effectively and safely e.g. complex signs and intersections.

4. Implicit Rules – Not all critical road information is observable to a sensor. Local rules of the road are often implicit without being explicitly posted on signs e.g. state and territory differences, road type, pavement, weather dependent rules. Awareness of legal regulations is critical for a driver function to make safe, pro-active driving decisions.

Photo: Implicit rules on school zones

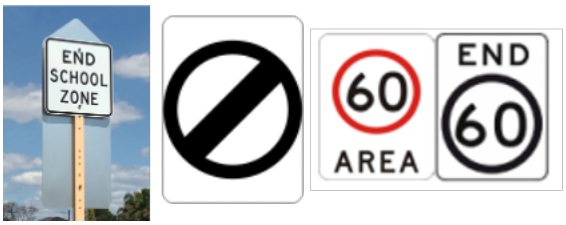


Photo: Implicit zone speed limit signs

Photo: Implicit speed advisory signs

5. Other Actor Interactions – Automated systems are constantly monitoring the other road users in the vehicles vicinity to predict what those other actors are going to do next.

Photo: A live map can contain information such as crosswalks or bicycle lanes that can serve as input to an AV system about the expected behavior and trajectory of other road users. This is critical to the safety of vulnerable road users like pedestrians, cyclists and persons with disabilities or reduced mobility and orientation.

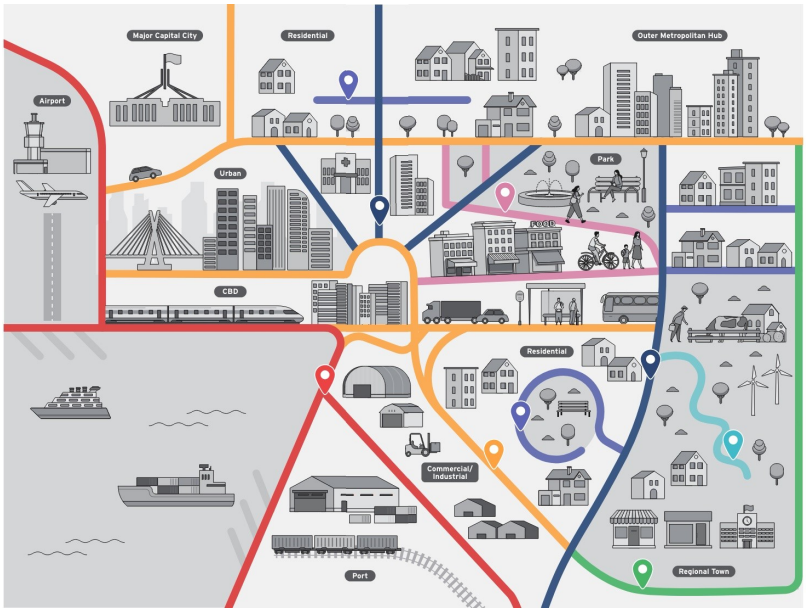
6. Operational Design Domain (ODD) Management - ODD is an area where a vehicle is allowed to operate autonomously, as defined by a certain set of conditions. AV systems are designed to operate under these strict conditions and a live map is used to communicate those restrictions to the system for safe operation. In situations where these conditions are no longer met, including while on an active journey, the user takes back control. For example, if a section of a highway is no longer permitted to be engaged in L3-L5 automation, the AV system will know in advance when travelling through and prepare the vehicle to be disengaged, informing the user/driver ahead of time to take back control of the vehicle in a safe manner.

Regulators around the world are increasingly recognising the role of the map as a critical safety features in Automated Driving Systems, e.g.:

- The European Union has mandated that new passenger vehicles, light commercial vehicles, buses and trucks be equipped with Intelligent Speed Assistance (ISA) systems, which aid the driver in maintaining the appropriate speed limit. ISA is an important stepping stone for the consumer adoption of drive automation systems. In the ISA regulation, we can read under Recital 14 that systems employing a combination of a camera system and up-to-date digital maps are considered the state-of-the art systems with the greatest real-world performance and reliability. Moreover, considering the ISA performance requirement of 90% in the EU, coupled with the mandatory detection of at least three different implicit road signs, maps become an essential component of the ISA system, allowing vehicle manufacturers to pass the type-approval tests and put vehicles on the EU market.

- The California Senate has also passed an ISA-equivalent bill requiring speed warnings - called passive speed limiters - in all new cars manufactured or sold in California beginning in 2032, with a 50% phase-in by 2029. California will be the first state in the US to enact this safety requirement. The bill prescribes that the integrated vehicle system uses, at minimum, the GPS location of the vehicle compared with a database of posted speed limits, which confers to the map the primary role in speed limits detection.

During roll-out, automated vehicle regulation should consider the road classification e.g. national roads, arterial roads, regional roads, connector roads, access roads, local streets, significant places (see photo[1] below). The further the automated vehicle gets from the highway, the more roadblocks for urban driving, and additional edge cases start to creep into the automated driving space. A digital map provides information to the automated vehicle about which type of road it is on, which sensors cannot. This is critically important for safer operation by humans users/drivers as a map can inform the user/driver when automation is available or upcoming on a journey, and when automation is coming to an end so the user/driver can prepare accordingly.



As automated systems begin to make their way to public roads, a map will enable regulators and relevant authorities to communicate compliance to all AV systems operating within their jurisdictions. Further, a map can enhance the quality and uptake of the Australia National Datahub by feeding data and sensor alerts back to the community and authorities for road network safety programs.

About HERE Technologies

HERE has been a pioneer in mapping and location technology for almost 40 years. Today, HERE's location platform is recognized as the most complete in the industry, powering location-based products, services and custom maps for organizations and enterprises across the globe. From autonomous driving and seamless logistics to new mobility experiences, HERE allows its partners and customers to innovate while retaining control over their data and safeguarding privacy. Find out how HERE is moving the world forward at here.com.