Assessment of Key Road Operator Actions to Support Automated Vehicles
June 2017 Webinar – Questions and Answers

This document addresses questions regarding the Assessment of Key Road Operator Actions to Support Automated Vehicles (AVs) raised during a webinar broadcast in June 2017. The recording of the webinar can be accessed on the Austroads website.

What evidence are you seeing that road builders and governments are adapting their infrastructure and other factors (such as public transport networks) to the arrival of AVs? For instance, of the billions $$$ that are being spent on roads, how many are AV-ready? What is the cost to uplift them for an AV future?

Australian road operators are beginning to become aware of the future challenges on AVs on public road infrastructure. The findings of the Austroads report Assessment of Key Road Operator Actions to Support Automated Vehicles, will provide early guidance to those wanting to incorporate automated vehicle considerations in projects.

Readiness to support vehicle automation will also depend on the level of vehicle automation and the type of use case. Already many roads are likely to be able to support vehicles featuring lane keeping systems. However, more complex use cases, such as light and heavy vehicle platoons, small shuttle bus operations, and other emerging use cases requires more thinking.

In the research report, it was provided detail short, medium and long term guidance for road operators. Was action is required from road operators immediately in relation to the consideration of proposed guidelines given that short term response would be considered as 1-3 years?

In the next 1 to 3 years, it is important for road operators to consider which automated vehicle use-cases they will be supporting on their road networks. From this, a range of infrastructure dependencies can be determined.

As an example, if the road operator wishes to support vehicles with lane keeping assistance on high speed rural roads, then features such as consistent and well maintained line markings, and signs which can be easily read by the vehicle will be of importance. Whereas a low speed automated shuttle bus (such as that being trialled by RAC Western Australia) operation, may only require the road operator to ensure that the area of operation is suitable for a low speed vehicle to interact with other vehicles.

Austroads is seeking to provide this guidance through its project *CAV2107: Automated Vehicle Use Case Analysis*. This project will identify the forthcoming use-cases

In the interim, the Austroads report, can be used to guide program and project development.

In Australian media (e.g. The Australian magazine a few months ago) we often see Tesla owners proudly being 'driven' around with their hands well and truly (and deliberately) off the wheel- is this legal on Australian roads or is it a grey area?

This matter is being explored through the National Transport Commission's current consultation on Clarifying control of automated vehicles.

At this stage Australia's road rules require a driver to maintain 'proper control' of a motor vehicle. The interpretation of this rule is being discussed to ensure that safe control of vehicles can be maintained by both a human driver, and the vehicle's automated driving system.

Is New Zealand Transport Agency participating Austroads AV Trials?

Yes, the New Zealand Transport Agency is represented on Austroads projects through the Austroads' CAV Steering Committee. When it comes to trials, New Zealand is conducting its own range of trials, but Austroads will be seeking to learn from the outcomes through Austroads forthcoming Trials and Technical Working Group.

I would be interested to know if the AV would be able to read the temporary road signs like speed limit signs placed temporarily as a result of road pavement works etc, and take appropriate action.

The Austroads report identified that consistent and appropriate placement of signs within Austroads Traffic Management Guidelines (and other standards) as being of increased importance for vehicle automation. In particular, incorrect placement of traffic signs at roadworks has been identified as an early area of inconsistency. Austroads project *CAV6056: The Implications of Traffic Sign Recognition Systems on Road Operations* will explore this issue in more detail and make recommendations to resolve on-road traffic sign issues that cause interoperability issues with automated vehicles.

Will there be an opportunity to harmonise initial AV route certification with existing schemes such as the NHVR RAV maps?

Route certification is a concept that is slowly emerging, and is not an agreed policy of any Australian road operator. There are a range of approaches that could be used to ensure roads are suitable for AVs. These could include:

- Updates to guidelines and standards where there are higher levels of certainty around requirements (line markings and signs are a good example)
- road audits using frameworks such as ANRAM or iRAP
- enhanced data from in-vehicle sensors to identify sections of road which are suitable to support automated vehicle use cases.

Before determining a framework that could be used for deployment of automated vehicle, Austroads is determining the range of use cases that road operators are likely to support through the project *CAV2107: Automated Vehicle Use Case Analysis*. This project is due for completion in early 2018.

RAC in Western Australia has an AV. What's the status of their trial approach in the state?

The RAC in Western Australia is currently trialling a Navya shuttle bus with members of the public. Further information on the trial is available on the RAC website.

Will AV's automatically move off Clearways to minimise congestion? Will parked AV's automatically move off Clearways?

To date, we're not aware of automated driving systems which will automatically move on clearway once they have been parked. However, that's not to say this isn't possibly emerging in vehicle trials, globally. As discussed in the Q&A part of the webinar, several vehicle manufacturers have included systems which engage a 'minimal risk condition' if a driver is detected to be not-responding to vehicle requests. One system gradually slows the vehicle to a stop in the driving lane. Another system automatically moves the vehicle to an emergency lane on a freeway if one is available. Road operators will need to consider the implications of a variety of systems in how they operate on our roads into the future.

What would you say are the key points that construction and roads project managers need to consider as AVs start to roll on to the roads?

There is an emerging question of how roads should be future proofed for automated vehicles? This is a difficult question to answer as automated vehicles are still emerging. One approach proposed in Canada is to ask potential road project contractors to undertake an audit of how their design can cater for future vehicle technologies.

The Austroads report also provides a useful reference point as to the types of physical, digital and road infrastructure considerations that could be built into a project.

Austroads is also currently studying the range of use-cases (highway automation, platooning, shuttles etc) so that more detailed guidance can be provided to road operators on how to support each use-case.

Current sensor systems are well below those of a human driver. Hence the Telsa fatality. When will sensors good for 100's of metres and +30 degrees likely?

Sensors on vehicles are constantly evolving and improving in performance. While the Austroads report did provide a summarised view of a range of different on-board sensors that vehicle manufacturers are using, the report did not investigate the current or future performance of these sensors.

Does Austroads have any plan to develop Metadata Standard for Digital Infrastructure for AV operations in Australia and New Zealand?

Austroads Road Data Harmonisation Project seeks to enhance standards for public road infrastructure.

What are the arrangements made for the AV when it goes in to a Tunnel, where the satellite connection has a risk of disconnection?

Feedback from the automotive industry is that their vehicles will primarily rely on their on-board sensors to determine 'relative' position (i.e. the vehicle's position relative to objects and attributes around it). This is complimented by 'absolute' positioning, such as satellite positioning. Satellite positioning has known issues, such as the need for direct line of site, multipathing, urban canyoning, spoofing, etc. This is another reason why AVs will rely first and foremost on their on-board sensors for relative positioning. Dead-reckoning is used by many navigation systems to estimate absolute positioning during periods of no satellite coverage, however the further a vehicle travels without satellite coverage, the less accurate this can become.

As AV's increase accident rate will decrease. Media will focus on the accident rate and distort the real benefit. Is this being considered?

Yes, Commonwealth, State and Territory and Local Governments need to effectively communicate the benefits and limitations of automated vehicles. Currently each state is involved in real-world trial programs, many with the goal of building community and media understanding of road vehicle automation. A list of current trials can be found on the Austroads website.

On a length basis, the majority of Australian roads are unsealed and unmarked. Whilst they may only account for say 5% of travel AV systems still need to have a mechanism to handle these. What is proposed?

As discussed previously, there are a range of strategies emerging for vehicles to be able to accurately navigate a range of roads and on-road scenarios.

Different AVs will have differing levels of automated driving, and will support automated driving for different use cases and different road environments. At this point in time, the current thinking is that the onus is with automotive manufacturers to restrict automated driving capability to those road environments that their vehicle's automated driving system can support. For example, if a vehicle's sensors determine that it cannot drive in an automated mode (due to lack of road delineation, poor road condition, inclement weather, etc), then the vehicle should not allow it to continue in an automated driving mode.

Does Austroads have a programme to support asset management and road operation research projects for future AV operations?

Yes. Austroads future research program includes further work to support road operation changes due to AVs. A list of projects can be found on the Austroads website.

Usually it so happens that the reflectivity of the road line marking and/or the sign posts fades and needs maintenance. How does an AV manage if the lines and the signs are unreadable?

The experience with current market vehicles with lane keeping assist (LKA) is that where visible line markings are not available, many lane keep assist systems will not function, or may not operate as effectively as intended. However, this can vary from vehicle to vehicle. Austroads' project on harmonisation of line marking standards has recommended that all states adopt the EuroRAP/EuroNCAP proposed 150mm wide by 150 milli-candela standard for edge line markings to better support automated driving systems.

Many vehicle manufacturers have chosen to disable traffic sign recognition systems in Australia due to early experiences with road sign practices. This is rapidly changing, but issues remain where signs are not readable (potentially due to reflectivity, positioning on the roadside, or other issues such as refresh rates on electronic signs), which disrupts the accuracy and reliability of this technology.

In respect of safety, this is driven by injury crash research - to date the overall very high safety of driving by the 80% of responsible drivers is ignored. These drivers complete 99.999% of trips - average length 11.4 km - without a crash. Where is the evidence AV will do as well or better?

Early road safety research indicates that automated driving systems such as Automated Emergency Braking and Lane Keep Assist have significant road safety benefits where available.

Many road safety experts globally are predicting further reductions in road trauma rates with increasing availability of automated vehicles. Notwithstanding, there are a range of potential road safety issues that emerge including human factors issues with increasing in-vehicle technology. This area requires significant ongoing research to understand benefits and limitations as they emerge.

Austroads project *SS1867: Safety Benefits of Cooperative ITS and Automated Vehicles* (to be released in the third quarter 2017) will provide an overview of the main road safety benefits of automated vehicles.

Most of Australia has no cellular coverage - % of land mass. Even within covered areas there are blind spots. Would this require satellite communication? And if so could the satellite system handle the data carriage?

The comparatively low coverage of the Australian road network with cellular coverage is noted as an issue in the report. There are no known current plans to use communications satellites to support data exchange with automated vehicles, although this could well be an option that is explored in future.

The Australian Government has committed $220 million to the Mobile Black Spot Program to invest in telecommunications infrastructure to improve mobile coverage along major regional transport routes, in small communities and in locations prone to natural disasters. While this program was not designed to support automated vehicles, there are significant benefits in the transport sector if coverage is improved.

Current research shows on average it takes 9 seconds for a driver to resume control when required. Yet long term research shows that after 2 seconds the risk of crashes progressively increases as delay increases dramatically. What is proposed to deal with this issue?

Safe human-machine interface is important for vehicle automation to ensure new road safety risks are not created. To date, vehicle manufacturers have proposed or developed a range of vehicle-to-driver handover arrangements, and driver vigilance controls to ensure drivers are ready for requests to intervene. Likewise, vehicles are also being equipped with 'minimal risk condition' features which are capable of slowing a vehicle to a safe stop in the event of a driver failing to intervene.

This is likely to be a subject of future regulatory development, and has been identified as an area that vehicle manufacturers should consider in the United States Department of Transportation Federal Automated Vehicles Policy.

There are narrow lanes in some major roads to increase number of lanes, and narrow lanes to accommodate turning lanes - these can be 2.7 metres wide - narrower than the width across the mirrors of full width trucks and buses. How will this be managed?

The width of heavy vehicles was not a matter considered in this report, as vehicle width relates to other Australian law such as the Australian Design Rules, and National Heavy Vehicle Law.

As automated vehicles with lane keeping offer the potential to improve lane tracking, out-of-lane incidents as a result of narrowing lanes could be reduced, although this remains to be seen.

With heavy vehicle platooning how will light cars get through to take a run off ramp?

This is a key question of many heavy vehicle platooning trials globally and an issue that has been identified in this report. At this stage it is not clear how roads should be operated with platoons to ensure safe merging of other vehicles. Austroads project *NEF6029: Operations of Automated Heavy Vehicles in Remote and Regional Areas* will consider this issue in more depth.

Failure of electronics is also an emergency - what happens there? Vehicle capability will vary with each failure type.

Failure of electronics and other issues such as inclement weather, failure of other vehicle mechanical systems, are noted as scenarios where a driver may be given a request to intervene while an automated driving system is operating. This is matter for further policy exploration as part of the National Transport Commission's Regulatory reform project.

But is also important for road operations if vehicles become disabled on road-ways due to failure of electronic systems.

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