



# Submission to Infrastructure Victoria: autonomous & zero emission vehicle infrastructure

## Introduction:

In October 2017, the Victorian Government requested Infrastructure Victoria to provide advice on the future infrastructure required to enable the integration of automated and zero emission vehicles in Victoria.

In early 2018, Infrastructure Victoria sought submissions from the community and industry to inform their investigations.

## The scope of advice required Infrastructure Victoria to investigate what infrastructure might be required:

- To enable the operation of automated vehicles
- In response to the ownership and market models that may emerge from the availability of automated vehicles
- For zero emissions vehicles as a high proportion of the Victorian fleet.

GTA was one of many organisations who provided a submission on this investigation to inform Infrastructure Victoria's response to the Victorian Government.

## GTA Consultants' Submission:

Although the precise nature and extent of their potential impact is as yet unclear, automated and electric vehicles are among a number of emerging technologies which are likely to have a profound and transformative impact on future transport systems. Transport and city planners around the world are beginning to grapple with the implications of these technologies for infrastructure.

GTA Consultants has been undertaking its own investigations into the future impacts of automated and electric vehicles, particularly in the context of emerging operating models such as 'Mobility-as-a-Service'. Our work so far indicates that there are considerable opportunities but also challenges ahead in leveraging the value of new technologies and operating models in terms of improved access and transport system efficiency.

The opportunities, as suggested by Infrastructure Victoria's own modelling for the 30-year strategy, are immense, but whether these opportunities can be realised will likely rely to a large degree on how well our transport infrastructure is configured and how our transport systems are managed.

## The need to apply an urban-systems lens in considering the implications of automated vehicle technology

GTA Consultants believes that understanding the broader context and implications of these disruptions requires taking an 'urban systems' approach, one that incorporates both transport and non-transport dimensions, and how systems evolve through time. This includes 'taking a step back' and considering a wide range of urban system issues, aspects and players, including a wide range of stakeholders (including differing levels of government), micro behaviours as well as macro trends such as evolving attitudes to car ownership and the emergence of the sharing economy.

By taking such an approach, transport and other planning agencies can provide leadership in facilitating an integrated and inclusive thought process, taking a system-level approach to identifying and defining linkages across organisational and functional boundaries.<sup>1</sup> There may be implications of this technology beyond the transport system per se. For instance, it is possible, if not likely, that improvements in vehicle safety could also reduce the need for traffic policing and emergency services and trauma medicine related to road accidents. Similarly, what has been described as a future 'internet of cars' could have profound implications for the social equity, the future of work, land use (e.g. in terms of city-shape) and the delivery of government and other services. We need to be alive to these broader implications when undertaking transport planning for such an automated and connected future, so that their full potential can be understood and potential opportunities and risks identified.

## The importance of scenario analysis in planning for resilience

Given the uncertainty about how a driverless transport 'ecosystem' may in future unfold, it is also essential that planners take an approach that incorporates scenario analysis. On this basis, GTA recommends using scenarios to explore differing operating models for these technologies and / or differing policy contexts.

Notable existing examples of the use of scenarios to explore the transformative potential of these technologies include (1) those developed by the New South Wales government as part of its Future Transport Strategy (My Car is King; We're all in this together; Super-commuting; Why travel so much?<sup>2</sup>), and (2) the scenarios developed by New York University as part of its 'Reprogramming Mobility' report (Atlanta: Google's plaything; Los Angeles: Self-Driving Gone Bad; New Jersey: Transit paradise; Boston: where walking is king)<sup>3</sup>.

GTA has itself developed narrative scenarios specifically to explore the potential implications of automation and electrification. Using the 'four squares' method, GTA identified two sets of divergent trends and how they might interact in the year 2038.

- a. Electric vehicles and vehicle automation:** electric automated vehicles are either owned by individuals OR by fleet operators
- b. Urban Consolidation models:** our cities continue to expand OR become more consolidated (involving an active program of densification within established areas)

On this basis GTA has developed four scenarios that describe what a future dominated by automated vehicles could look like and what it might mean both for infrastructure and land use. In short, the analysis found that there is potential for a range of outcomes in future decades depending on how the deployment of these technologies are regulated and supported by infrastructure, and the wider policy environment (e.g. for urban planning / land use). Further detail on the scenarios and associated analysis can be found in the attached appendix to this submission.

<sup>1</sup> For more detail, please consult GTA's Insight paper 'Scenario planning: AEV and Urban Consolidation', at <https://gtaconsultants.worldsecuresystems.com/ThoughtLeadership/AEV%20Urban%20Consolidation.pdf>

<sup>2</sup> <https://future.transport.nsw.gov.au/technology/roadmap/technology-scenarios/>

<sup>3</sup> Re-Programming Mobility: The Digital Transformation of Transportation in the United States, New York University <http://reprogrammingmobility.org/>

## Operational Issues and Implications - how will it all work?

To support its 30-year strategy Infrastructure Victoria undertook transport modelling of a range of transport interventions, including the building of new motorway and rail links, as well as the application of ITS-based traffic management technologies, the use of driverless vehicles and policy initiatives in the form of road pricing. This modelling found that the operation of driverless vehicle technology could potentially have an impact on metropolitan travel patterns that dwarfs that of the more conventional infrastructure measures such as the building of new roads and rail.

In particular, IV's modelling showed that automated vehicles have the potential to transform the role of our motorway network, in that they could enable it to potentially play a bigger role in moving people into the central city at peak times, easing the pressure both on the rail network but also on the arterial road network.

The key assumption in IV's modelling is that connected and automated vehicle (CAV) technology could enable future vehicles to drive with shorter following distances and at greater speed with similar or better levels of safety than currently possible.

However, what remains unclear is how a potential increase in road productivity could be achieved and maintained at a network-level, so as to genuinely achieve the accessibility benefits indicated in IV's modelling.

GTA's own investigations highlight a number of key issues which may have a bearing on how existing infrastructure should be managed or what infrastructure investments may be needed in future to take full advantage of connected and automated technologies.

- a. **How would a higher-capacity automated motorway interface with arterial road networks, specifically through motorway interchanges?** – i.e. could significantly higher vehicle volumes exiting a motorway be accommodated on receiving arterial roads without generating strong localised congestion and spill-backs onto the motorway?
- b. Where there may be a significant increase in the volume of vehicles exiting a motorway and converging on a destination (such as the CBD or other major activity centre) via an arterial network, **what would be the impact of this on network capacity and performance?** If this flow of vehicles were to be given more 'greentime' (priority) at arterial intersections, what would be the impact of reducing priority for other road users travelling on cross-routes, including pedestrians, cyclists and higher capacity passenger vehicles like buses and trams? Furthermore, if automated vehicles were, after delivering their passengers, to recirculate in traffic or return to their point of origin, what would be impact of this on road network capacity?
- c. Assuming significantly higher volumes of vehicles could be accommodated both on arterial as well as motorway networks, **what might be the traffic management and urban design challenges for vehicle loading and unloading (both for passengers and goods)?** What infrastructure might be needed to facilitate higher volumes of loading and unloading at specific locations (e.g. 'downtown' areas, activity centres, major shopping centres, etc.)?

Depending on the severity of these issues, they could represent a serious constraint to our ability to leverage, at a network level, the potential benefits of CAV technology, and they demand further consideration and investigation.



## Inadequacy of current tools for simulating the network operation of connected and automated vehicles

GTA believes that one of the key challenges currently facing planners is the gap at a global level when it comes to simulating the operation of CAVs. For example, strategic four-step models are particularly ill-equipped to simulate the operation of business models based on shared mobility. While activity-based Simulation models such as that recently developed for IV are a step forward, accessing empirical data on CAVs is critical challenge. These challenges in gathering evidence, data and simulating the impact of new disruptive technologies and their interdependencies will require a whole-of-system and whole-of-government approach and response.

“GTA believes that one of the **key challenges** currently facing planners is the **gap** at a global level when it comes to simulating the operation of CAVs.”

Access to additional submissions for this investigation can be found through the link:

<https://yoursay.infrastructurevictoria.com.au/vehicles-advice/vehicles-submissions>



APPENDIX A: SCENARIOS FOR 2038	DESCRIPTION / PREMISE	TRANSPORT OPERATING ENVIRONMENT	BENEFITS	DISBENEFITS / RISKS	POTENTIAL MITIGATION	PARKING	SUPPORTING INFRASTRUCTURE
<p>Scenario 1: Individual ownership + urban expansion</p> <p><b>- The Congested City</b> (similar to 'My Car is King')</p>	<p>In 2038, people will still own cars individually. Our metropolitan areas will have continued to develop along their historical trajectories and trip making will be largely as at present. Cities will have continued to expand and their centres and inner urban surrounds will continue to exert their magnetic attraction.</p> <p>This minimum change case will see people continue to use their vehicles for the trips they make now. So, in the absence of regulatory choices to the contrary many people will continue to commute to central areas in their own vehicles, which will park themselves. Similarly, trips to activity centres will be effectively the same, except that vehicles will park themselves.</p>	Competing modes: Mass transit / private cars	Business as Usual – no change required	Dispersed land use patterns, resulting in massively increased Vehicle Kilometres Travelled (more & longer trips, empty running, potential mode shift from PT) and severe congestion; Inefficient use of land (parking); less land available for farming	Demand-based road pricing to encourage more efficient mode choice (for longer-distance commuting); remote working via ICT; more longer-distance commuting by higher-capacity modes (or by air); more polycentric city; commuter cars could be used in peer-to-peer mobility services during the day instead of being stored	Increased need for parking, particularly at key activity centres (and if there is road pricing)	Substantial parking / car storage and high-capacity passenger loading and unloading facilities at key activity centres; better integrated motorway network and 'continuous flow' interchanges; increased suburban rail capacity; high-capacity, priority pathways for active and 'ride-on' transport
<p>Scenario 2: Individual ownership + urban consolidation</p> <p><b>- The Better City</b></p>	<p>By 2038, substantial areas of our cities will have been redeveloped more intensively. This intensification will have followed defined public transport corridors, creating a network of community spines throughout the city that act as the focus of public life for people, as well as provide local services, shops, and other facilities for the community.</p> <p>As in Congested City above, people will still largely own their own vehicles and drive them when required. However, the urban consolidation program will have changed the travel dynamic and many people will be able to satisfy their daily needs without needing to drive long distances or even drive at all.</p>	Competing modes: Mass transit / private cars	Reduced aggregate trip distances, more arable land available for farming	Some increased Vehicle Kilometres Travelled (more trips, empty running) and severe congestion; increased opportunity costs of using land for parking	Demand-based road pricing to encourage more efficient mode choice; remote working via ICT; commuter cars could be used in peer-to-peer mobility services during the day instead of being stored	Increased need for parking, particularly at key activity centres (and if there is road pricing)	Substantial parking / car storage and high-capacity passenger loading and unloading facilities at key activity centres; high-capacity, priority pathways for active and 'ride-on' transport
<p>Scenario 3: MaaS + urban expansion</p> <p><b>- The Legacy City</b></p>	<p>By 2038, Mobility as a Service (MaaS) and other vehicle sharing models will have become established and will have overtaken individual car ownership as the dominant mobility model in our cities. Almost all vehicle trips in this city will be made using shared-use vehicles; either serving single passengers or groups.</p> <p>Overall, whether this scenario results in more road-based travel than currently will depend on road user charging policy coming into action. What is clear is that problems of empty AVs clogging up streets will be mitigated by AVs moving on to the next trip rather than circulating empty or travelling unoccupied to a storage location.</p>	Integrated Network: Mass transit / local & citywide Demand Responsive Transport	Reduced fleet size (more efficient use of transport resources) and lessened impact of congestion; more efficient land use; better access for outer metro residents; more local active transport	Dispersed land use patterns, resulting in significantly increased Vehicle Kilometres Travelled (more & longer trips, empty running); less land available for farming	Demand-based road pricing to encourage more efficient mode choice (e.g. shared trips, active transport for first-last mile); more longer-distance commuting by higher-capacity modes (or by air); more polycentric city	Greatly decreased need for parking	High-capacity modal transfer facilities, (e.g. at rail stations); passenger loading/ unloading facilities at activity centres; 'continuous flow' motorway interchanges; CAV storage & recharging stations; increased suburban rail capacity
<p>Scenario 4: MaaS + urban consolidation</p> <p><b>- The Efficient City</b> (similar to the 'We're all in this together / Super-Commuting' scenarios)</p>	<p>By 2038, substantial areas of our cities will have been developed more intensively, with the benefits of access to local facilities clustered along a network of community spines. For many people, many daily activities will lie within reach without needing access to a motorised vehicle; for those trips do, options will revolve around the purchase of travel in a shared-use vehicle, either on a trip-by-trip basis or as a subscription.</p>	Integrated Network: Mass transit / local & citywide Demand Responsive Transport	Reduced aggregate trip distances and fleet size (more efficient use of transport resources); more efficient land use; significant active transport take-up = virtuous cycle' of land use and transport integration; more arable land available for farming	Some increased Vehicle Kilometres Travelled (more trips, empty running)	Demand-based road pricing to encourage more efficient mode choice (e.g. shared trips, active transport)	Greatly decreased need for parking	High-capacity modal transfer facilities, (e.g. at rail stations); passenger loading/ unloading facilities at activity centres; CAV storage & recharging stations; high-capacity, priority pathways for active and 'ride-on' transport