

**The Future of Autonomous Vehicles** An Interim Report based on Multiple Expert Discussions

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This document provides a half-time overview of the key insights on the future of AV. Based on output from 5 expert workshops, it shares primary views and highlights area of debate for the second phase of discussions taking place later this year.









## **A Wicked Problem**

The future of autonomous vehicles can be considered to be a complex 'wicked' problem. To address it, we need to understand and challenge the views of many different experts.



### **Five Expert Workshops**

To date we have run five expert workshops in key locations for AV which have identified major challenges, new opportunities and emerging issues for the next decade.



## **Initial Hosts**

Leading organisations involved in the hosting the first five events include a mix of transport agencies, universities, trade bodies and companies.

### FUTURE

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## WHERE WE HAVE COME FROM

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## **AV Development Timeline**

The possibility of developing an autonomous vehicle has been explored for many years. Since 1939, projects have been building momentum towards today's intensive activity.

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## THE WAY FORWARD



# **Global Insights**

This project is identifying where and what the key opportunities are by collectively challenging and sharing the future of AVs and the key drivers of change across a number of pivotal locations.

### FUTURE





# OPENING QUESTIONS



- 1. Where will be the key hot-spots for AV development and deployment?
- 2. Which sociopolitical forces may accelerate the adoption of full Level 4/5 automation?
- 3. Where is advanced regulation most likely to act as a catalyst for AV deployment?
- 4. What level of safety (crashes) is acceptable for the full launch of AV in the next decade?
- 5. Will AV increase or decrease total traffic flow and congestion?
- 6. Will automated mobility services replace, reduce or extend the reach of public transport?
- 7. Of all the technologies in the mix, which ones are in greatest need of further development before the benefits of AV can be realised?
- 8. What are the distinct benefits from AV that are not already coming from current and future-connected ADAS?
- 9. How important will international standards and commonly shared technologies be for AV adoption or will it be more regional?
- 10. Which will be the pivotal organisations, cities and governments that control adoption rates?
- 11. Who will lead on integrating all the varied systems needed to enable AV to operate?
- 12. Who will customers trust more to deliver a safe, reliable and comfortable AV experience?

# **Initial Perspective**

An initial perspective mapped the autonomous vehicle landscape and identified twelve key questions to explore via the research project.

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# INSIGHTS TO DATE



## **Six Macro Themes**

From the discussions, a number of key issues were prioritised, debated and explored in depth Within these, there are six pivotal high-level macro drivers of change are focus of greatest debate.



## **Priority Areas for Focus**

Underlying and connected to these six, there are another additional fourteen priority topics of focus. Together these 20 areas can all be considered pivotal for the future of AVs.

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## Impact of Regulation

The regions that gain most initially will be those where there is advanced regulation to act as a catalyst for AV deployment. Addressing information sharing, collaboration, and liability are critical.

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## **Crash Avoidance**

Reducing accidents and road deaths caused by humans is a political priority behind support for AV. While benefits can be gained from ADAS, the promise of significant safety improvements is pivotal.



## **Common Standards**

International standards and commonly-shared technologies may be essential for driving global rather than regional AV adoption. Without them a more fragmented approach will be taken.

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# **Environmental and Social Impact**

Ensuring that autonomous vehicles are cleaner than alternative options may be a pre-requisite in many cities while the benefit of AVs for wider society is a crucial issue for wider endorsement.





## **Less Congestion**

Decreasing congestion on the roads is a core ambition for AV advocates but many recognise that, with mixed fleets operating for several years, we many initially see an increase in urban traffic.

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### Less Traffic – Less Road – Less Parking

Effective deployment of AVs as part of integrated public transport systems may mean not only fewer vehicles on the roads, but also parking spaces can be removed and roads can become narrower.





### **Drones for Goods and People**

Investment in timely drone delivery services accelerates deployment in several locations, but the roll-out of air-taxis may not be as widespread as many hope. Large scale impact is limited.

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### **Rethinking Transport Planning**

For AV to have impact it may be necessary to rethink a more flexible approach to planning. Poor coordination between transit systems, urban planning and future solutions may delay the benefits.

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### **Public Transport Systems**

As autonomous buses are introduced, other mobility solutions will also have to be used to fill transportation gaps. Security, flexibility, reach and interconnectivity are primary criteria.





## First / Last Mile

Improving the inefficient first/last mile is a major opportunity with health, energy, and efficiency benefits. Scooters, bikes, and small autonomous robots in urban environments, all play a part.

![](_page_25_Picture_1.jpeg)

![](_page_25_Picture_2.jpeg)

## **Initial Users**

Although AVs may have significant benefit for those without access to affordable mobility – especially the young, elderly and disabled – from the start autonomy has to be attractive for all users.

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![](_page_26_Picture_2.jpeg)

## **Robo-Taxi Fleets**

Robo-taxis are increasingly seen as the way forward for passenger vehicles and could change both travel patterns and car ownership decisions. They are a core part of 'Mobility as a Service' offers.

![](_page_27_Picture_1.jpeg)

![](_page_27_Picture_2.jpeg)

### **Resistance to Sharing**

As many people value their personal space, support for a significant rise in ride-sharing may not be as high as some predict. Rethinking vehicle design for strangers travelling together is a priority.

![](_page_28_Picture_2.jpeg)

## **Automated Freight**

The significant automation of expressway trucks is of huge commercial interest. It will transform long-haul journeys and so is the principal focus for regulation and trials across all levels of AV.

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![](_page_29_Picture_2.jpeg)

## **Controlled Environments**

Controlled environments have demonstrated the early steps for AV and are growing steadily. Airports, port terminals, factories, mines and even dedicated highways all provide safe areas for development.

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![](_page_30_Picture_2.jpeg)

## **Data Sharing**

More and deeper data sharing are pivotal in enabling the AV ambition. Mobility brands eventually agree the protocols for V2X interaction and so support the use of open data sets.

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![](_page_31_Picture_2.jpeg)

## **Cyber Security**

With the threat of hacks, denial of service, vandalism and theft of data, organisations seek to make AV more secure through adopting common approaches for closed, collaborative systems.

![](_page_32_Picture_1.jpeg)

![](_page_32_Picture_2.jpeg)

### **Remote Support Centres**

Manned call centres provide oversight, support and emergency response for all AVs. In the absence of drivers, most public transport vehicles require remote human supervision.

![](_page_33_Picture_1.jpeg)

![](_page_33_Picture_2.jpeg)

# HALF-WAY REFLECTIONS

1. Safety is a pre-requisite: Expectations are high, but as many advances are already in process, improvements look likely.

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- 2. Fleets are now driving progress: In terms of the core business model the momentum is clearly behind the robo-taxi concept.
- **3.** Automated trucks are coming: Freight has much to gain in terms of efficiency, it has regulatory support and wide industry support.
- **4.** Congestion is a conundrum: While all aim for less congestion, and the role of connectivity will be pivotal, user behavior and TNC strategy could initially mean more.
- 5. Multiple options for the last mile: There are many alternatives in the mix all bridging different needs and location gaps.
- **6. First vs widespread deployment:** Where and why we see initial AV services may not necessarily align with where mass impact will occur.
- 7. Deeper collaboration will be needed: Moving from partnerships to long-term multi-party collaboration is seen as a critical enabler.
- 8. Standards may not be pivotal: Comprehensive global and regional standards may not be essential for AV: Rather standards will evolve based on business needs.
- **9. Regulators are influencing deployment:** Proactive regulation is attracting companies, but the balance of light vs. heavy approaches may impact this.

# **Nine Thoughts**

We can see nine key issues already emerging as significant - all of which are intricately inter-connected but collectively do indeed provide a highly 'wicked' problem.

![](_page_35_Picture_2.jpeg)

# ADDITIONAL QUESTIONS

- 1. What lessons can be learned from other sectors for example, mobile and healthcare?
- 2. How much will AVs be tied to EVs, and therefore intertwined with charging infrastructure roll-out etc.?
- 3. Will air-taxis have impact beyond a few niche locations?
- 4. How will drones used for parcel delivery integrate with drones for other purposes?
- 5. How will planning evolve to become a public/private partnership?
- 6. Will private companies contribute to the cost of the infrastructure, and will public sector agencies allow for this?
- 7. Will the growth of AVs mean more open/liveable/walkable urban public spaces?
- 8. How will cities adapt today's public transport systems in an era in which automated MaaS overlaps their mission?
- 9. How will designers overcome resistance to sharing rides with strangers?
- 10. For what types of routes and freight will Level 4 truck automation happen first?
- 11. How will supply chain approaches be transformed by Level 4 truck automation?
- 12. What effect will growth in AV urban/suburban parcel/grocery/food delivery have on other road users?

## **Further Exploration**

We have identified an additional 12 questions from the first tranche of workshops that we will seek to addresses in the second half of the project.

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![](_page_37_Picture_2.jpeg)

## **Next Steps**

In Q4 of 2019 will run more expert workshops and then produce the final report. If you would like to host an extra event or be involved do get in touch.

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