



**John Wall**

Program Manager

Future Vehicles & Technology

## *Are we there yet?*

Infrastructure supporting

- Safe
- Accessible
- Sustainable

CAV Operations

# Who is Austroads?

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- Peak organisation of Australasian road transport and traffic agencies.
- 900,000 kilometres of roads valued at more than \$250 billion
- The single largest community asset in Australia and New Zealand.



# Future Vehicles & Technology Program

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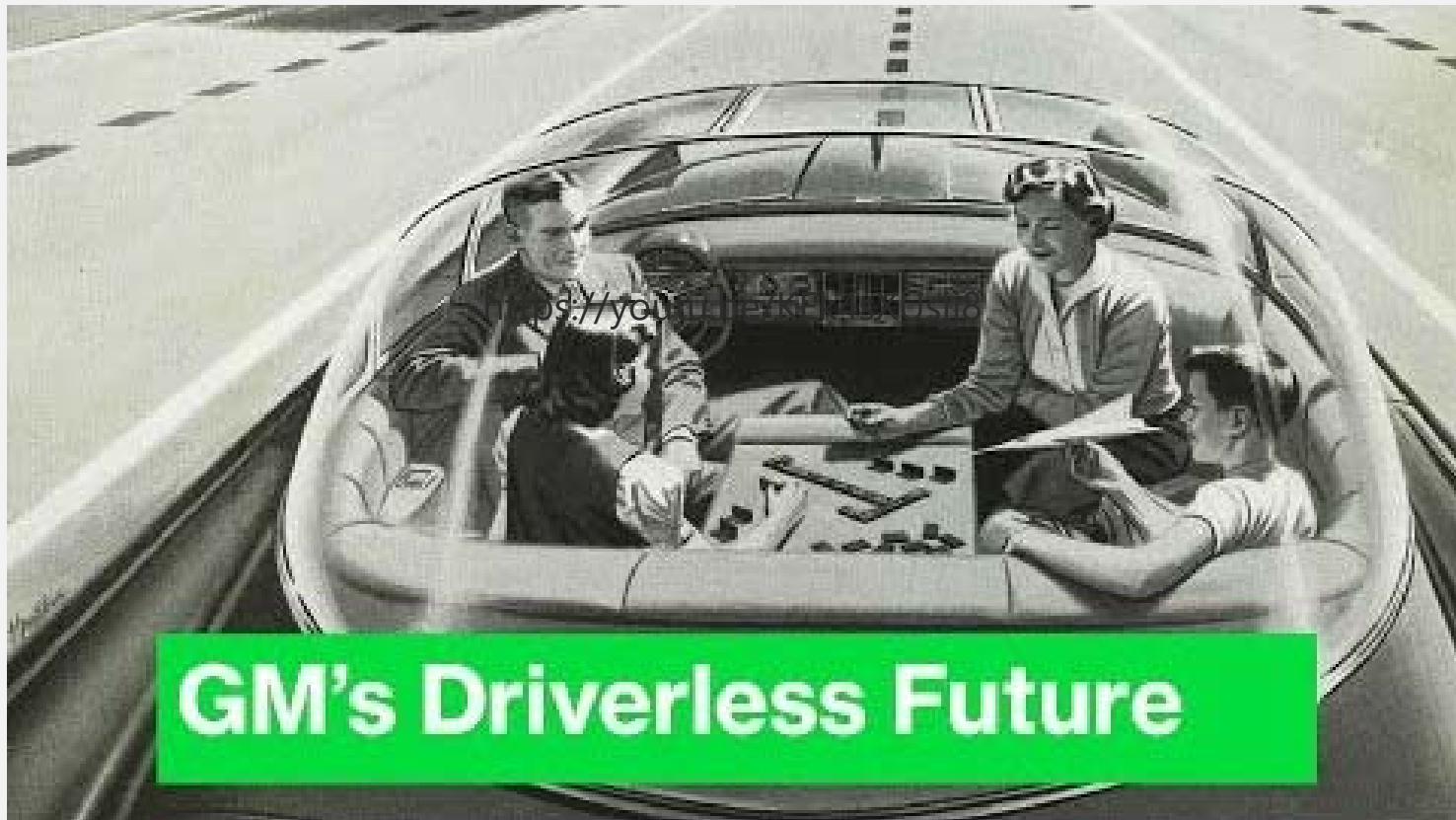
## Vision

All employees of our members have an understanding of how future vehicles can be used to improve the capacity of their organisation to deliver services that improve the lives of the communities they serve.



# Driverless cars – Are we there yet?

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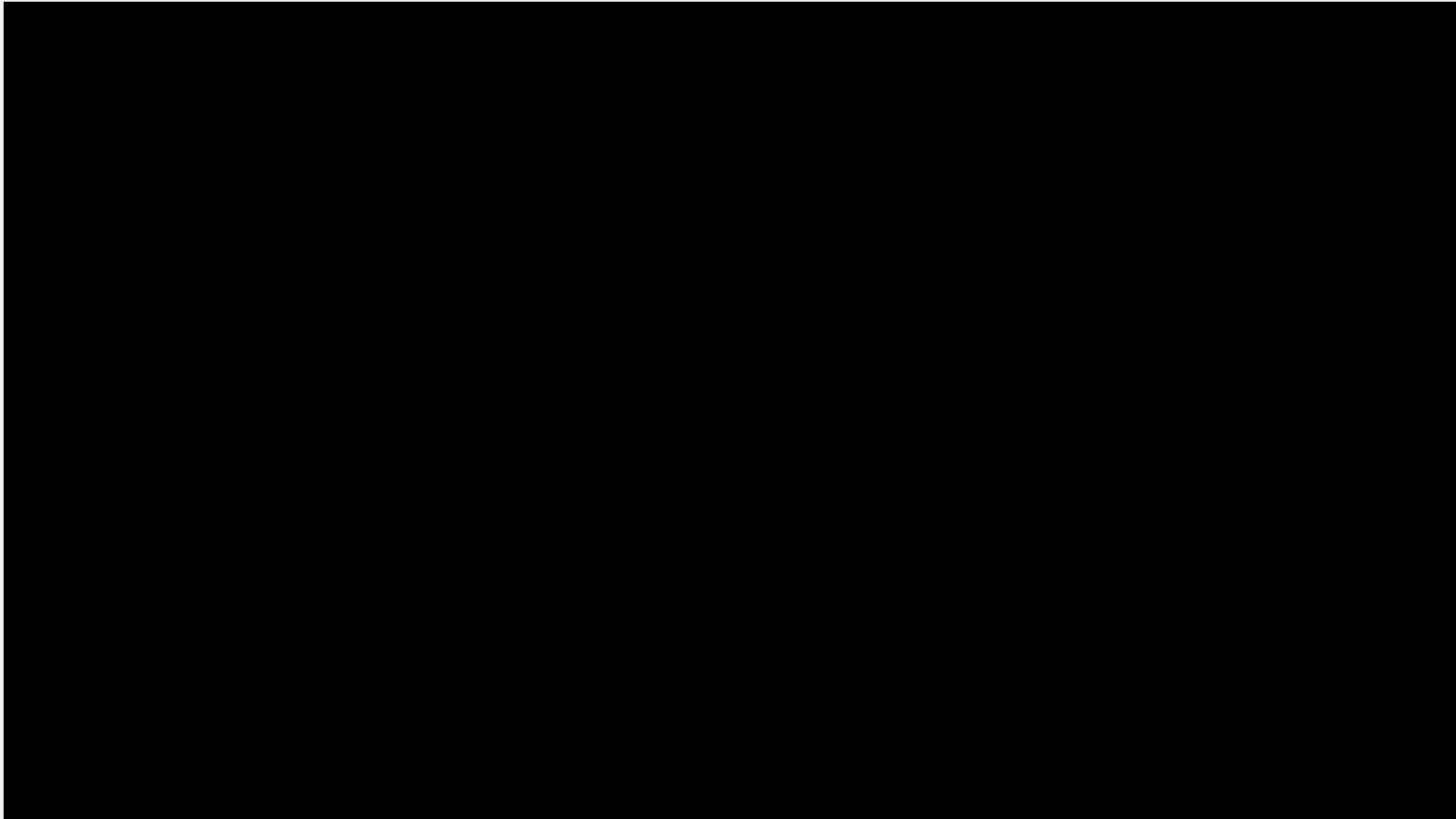


<https://youtu.be/KEk4sXU5jj8>



# Driverless cars – Are we there yet?

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# The Automated Vehicle Promise



sciencealert\* Trending



Google

TECH

## Driverless Cars Could Reduce Traffic Fatalities by Up to 90%, Says Report

BEC CREW 1 OCT 2015

A new report has analysed the impact of driverless cars on the incidence of fatal traffic accidents, and say that simply by taking human emotions and errors out of the equation, we could reduce deaths on the road by 90 percent. That's almost 300,000 lives saved each decade in the US, and a saving of US\$190 billion each year in healthcare costs associated with accidents.

"By midcentury, the penetration of AVs (autonomous vehicles) and other ADAs (advanced driver-assistance system) could ultimately cause vehicle crashes in the US to fall from second to ninth place in terms of their lethality ranking among accident types," the report, from US consulting firm, McKinsey & Company, concludes.

7 NEWS LOCATION: Kiama, NSW Change

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## Driverless cars 'could be on roads by 2020', Volvo predicts ahead of first Australian trial

Updated 7 Nov 2015, 12:41pm



Q15: The vehicle is controlled by driverless software

# Automated Vehicles



For on-road vehicles



		Steering and acceleration/ deceleration	Monitoring of driving environment	Fallback when automation fails	Automated system is in control
Human driver monitors the road	<b>0</b> NO AUTOMATION				N/A
	<b>1</b> DRIVER ASSISTANCE				SOME DRIVING MODES
	<b>2</b> PARTIAL AUTOMATION				SOME DRIVING MODES
Automated driving system monitors the road	<b>3</b> CONDITIONAL AUTOMATION				SOME DRIVING MODES
	<b>4</b> HIGH AUTOMATION				SOME DRIVING MODES
	<b>5</b> FULL AUTOMATION				

# Automated Vehicles – SAE Level 0

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# Automated Vehicles – SAE Level 1

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# Automated Vehicles – SAE Level 2

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# Automated Vehicles – SAE Level 3

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# Automated Vehicles – SAE Level 4

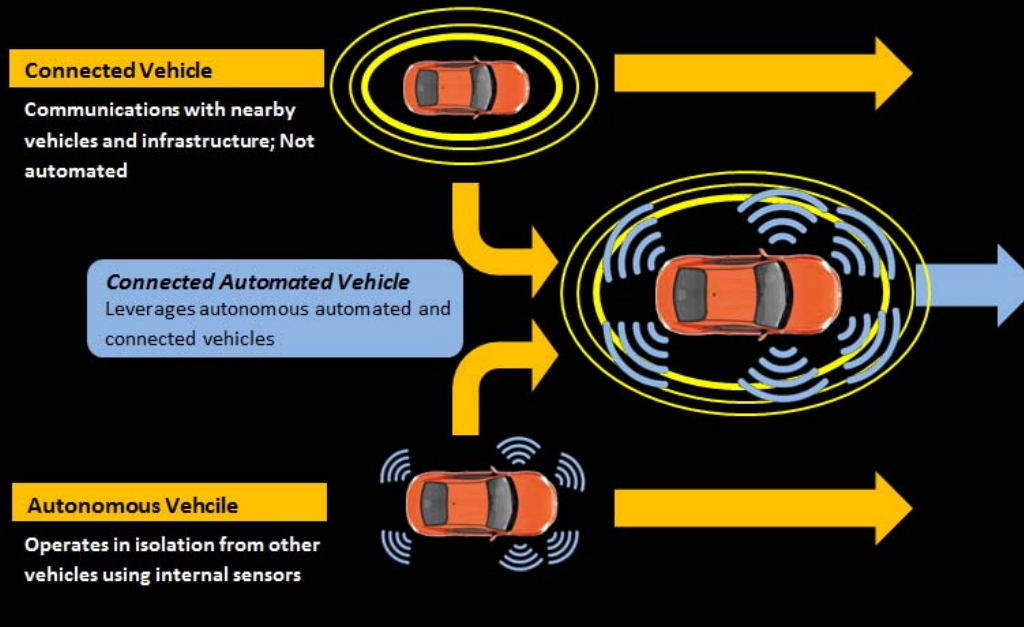
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# What is a CAV?

## Connected and Automated Vehicles

The path toward connected vehicles will ultimately lead to automated vehicles.



Source: TfNSW



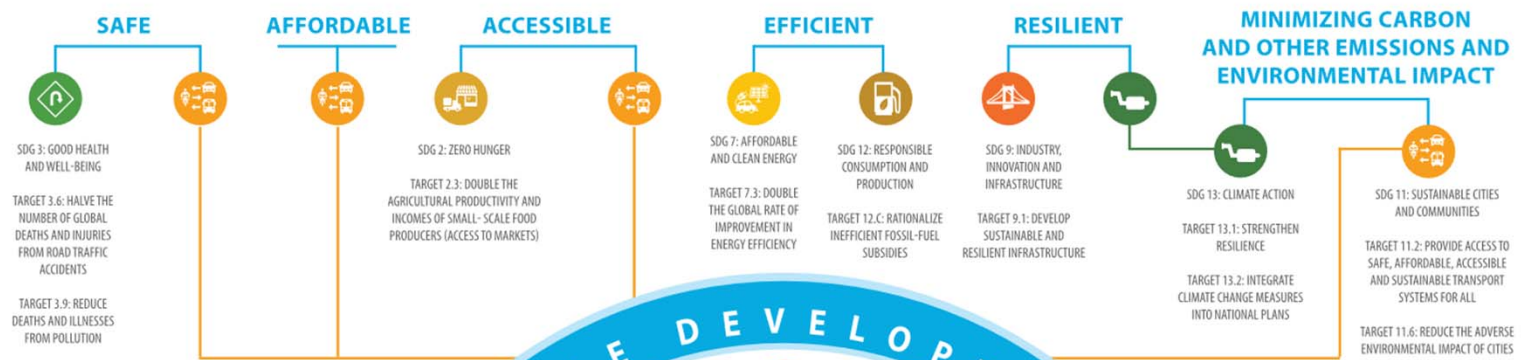
# United Nations Sustainability Goals



Source: [www.un.org](http://www.un.org)

# Sustainable transport

## SUSTAINABLE TRANSPORT IS:



**SUSTAINABLE TRANSPORT IMPACTS ON ACHIEVING THE SDGs**



# Infrastructure supporting safety

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# How safe is safe enough?

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# As safe as a human driver?

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# Safer than a human driver?

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# Must operate within a safe system



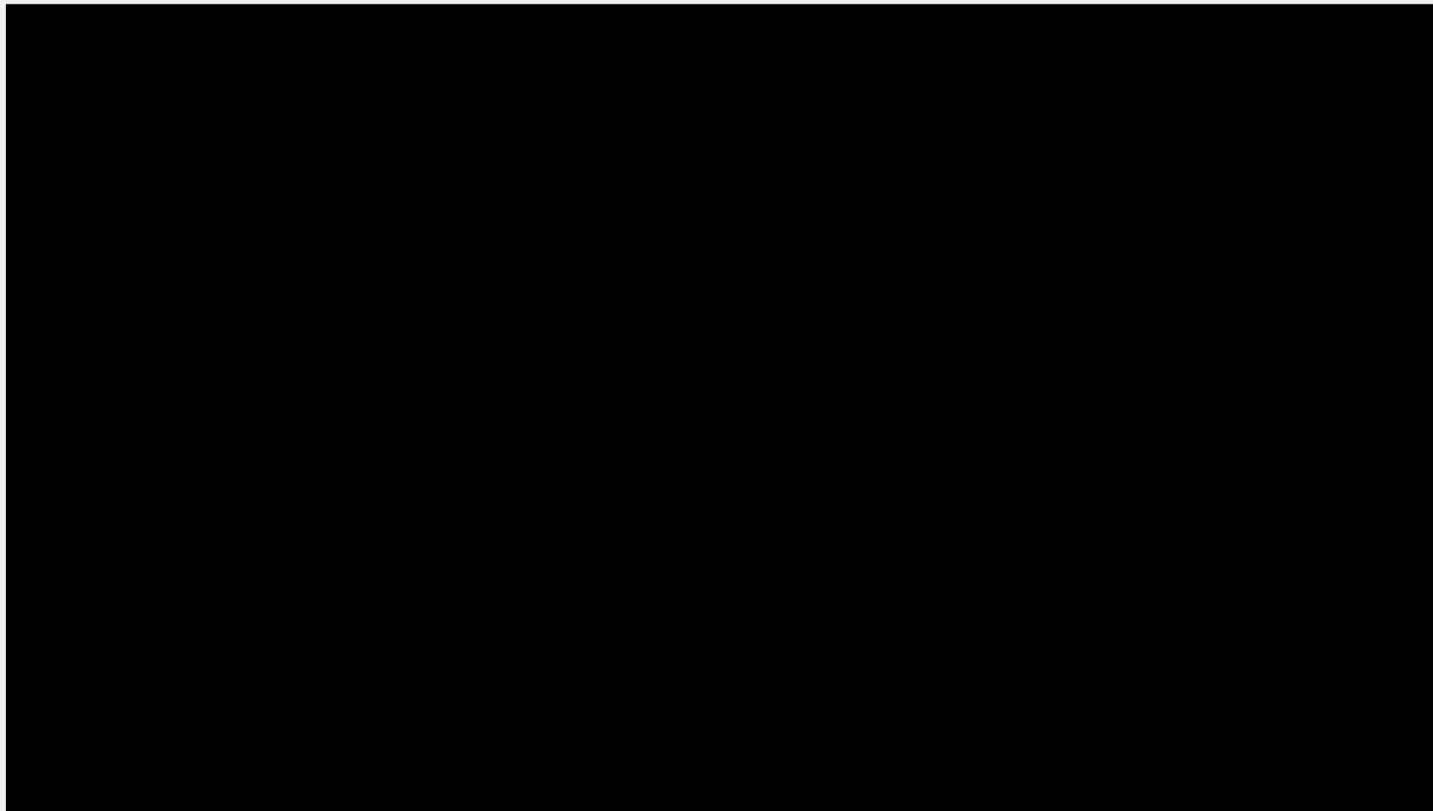
# Infrastructure supporting lower carbon emissions

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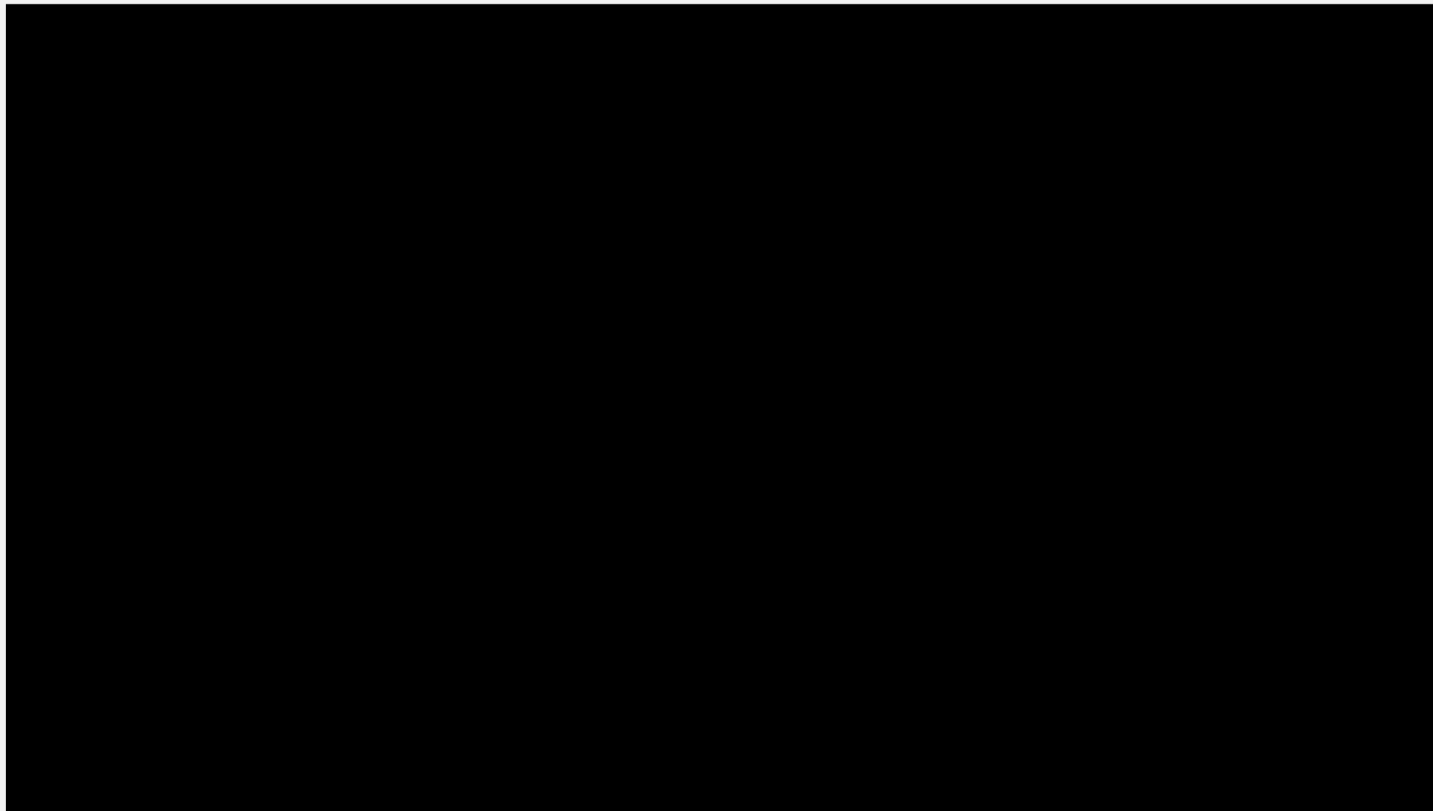
# Infrastructure supporting affordability & accessibility

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# Infrastructure supporting affordability & accessibility

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# Current Research Projects

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Austroads Project	Number
Automated vehicle / infrastructure requirements on rural and metropolitan freeways and highways	FSP6088
Automated steering functions	FPI6119
Assessment of Key Road Operator Actions to Support Electric Vehicles	FLI6171
Road Authority Data for Connected & Automated Vehicles	FDI6216
Vehicles and Technology Future State 2030	FCA6239



Dxvwurdgw

**FSP 6088**

**Infrastructure changes to support  
Avs on rural & metropolitan  
highways & freeways**



# Infrastructure requirements for a highway or freeway to be ready for AVs

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- For *active safety systems* key infrastructure attributes included:
  - Line marking – including interest in line types, line quality, curve radius
  - Traffic signs – position as well as types
- For *automated driving* the key attributes include those for *active safety systems* plus additionally:
  - Availability of high definition mapping;
  - Availability of continuous data connectivity (particularly cellular networks)



# Classifying Infrastructure Suitability



Unlikely to be suitable

**Lower  
threshold  
value**

May be suitable

**Upper  
threshold  
value**

Very likely to be  
suitable



# Focus on quality not design



Sign design:  
Layout  
Content  
Placement (relative to road)

Sign quality:  
(in scope)  
Retroreflectivity  
Degradation  
Obscuration  
Size



Line design:  
Arrangement  
Skip pattern (stripe and gap)

Line quality:  
(in scope)  
Width  
Retroreflectivity  
Luminance  
Contrast ratio  
Presence of both edge line and centreline

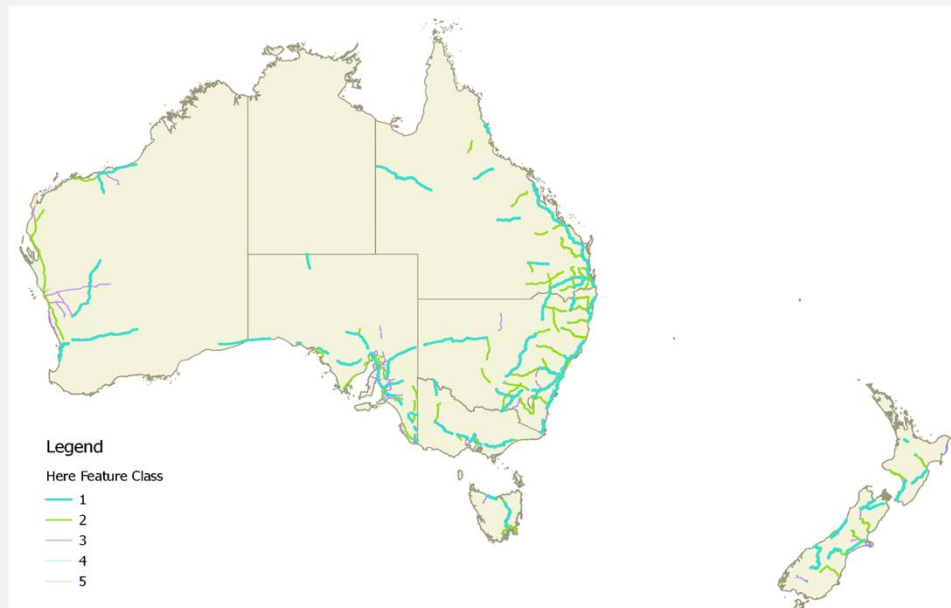


# How ready are Australian and NZ roads?



## Field Audit

Map links (lines)	Total lines assessed	Total signs assessed	Total survey (km)
90,216	8,442,006	8,354	25,106



# Line marking results (post processing)



Jurisdiction	No. links	Length (km)	No. lines	Percentage of lines					
				High contrast	Medium contrast	Low contrast	High width	Medium width	Low width
Australian Capital Territory	231	31	11,640	2%	81%	17%	58%	42%	0%
New South Wales	27,633	6,591	1,924,377	2%	18%	80%	61%	39%	0%
Queensland	21,484	4,854	1,478,899	0%	14%	86%	67%	33%	0%
South Australia	14,457	4,379	2,388,082	7%	88%	5%	67%	33%	0%
Tasmania	3,703	561	165,276	0%	9%	91%	64%	36%	0%
Victoria	10,730	1,584	506,998	2%	86%	12%	59%	41%	0%
Western Australia	5,853	4,920	1,349,483	0%	51%	49%	67%	34%	0%
NZ	8,074	2,313	696,210	0%	6%	94%	61%	39%	0%

# Line marking results (real time processing)



Functional class	No. links	Length (km)	No. lines	Percentage of lines						
				High quality	Medium quality	Low quality	High width	Medium width	Low width	Missing lines
1 (high)	2,853	580	1,057,637	97%	3%	0%	28%	69%	3%	1%
2	1,957	207	411,668	88%	11%	1%	25%	67%	8%	7%
3	3,371	352	690,616	78%	20%	2%	9%	71%	20%	15%
4	385	28	72,897	73%	25%	2%	9%	73%	19%	23%
5 (low)	180	18	20,454	48%	45%	7%	24%	40%	39%	76%



# Operability of lane departure warning



Functional class	No. links	Length (km)	Lane Departure Warning (LDW) function was available
1 (high)	2,853	580	98% of the distance surveyed
2	1,957	207	90%
3	3,371	352	77%
4	385	28	66%
5 (low)	180	18	12%

# Audit findings for road signs (manual survey)



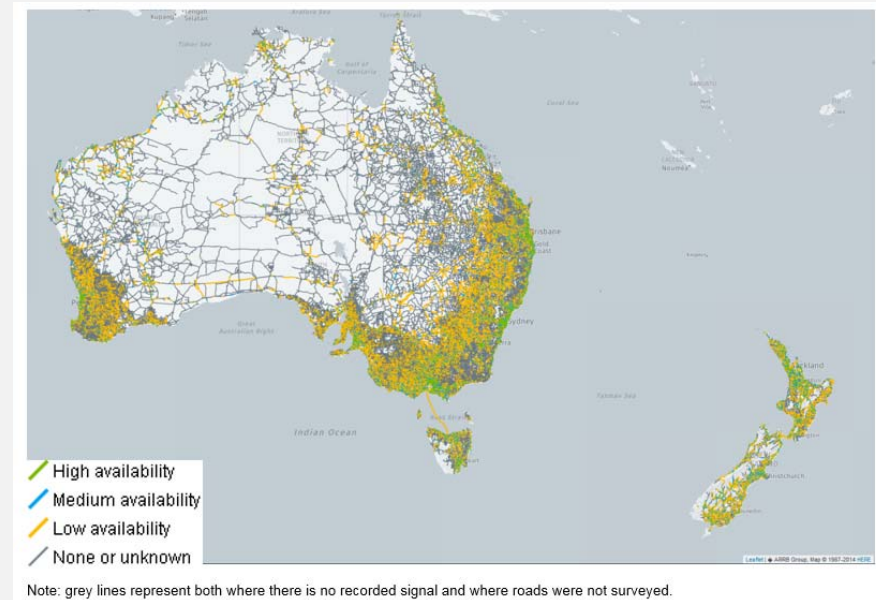
Jurisdiction	Percentage of signs					
	Readable	Not obstructed	Expected position	High condition	Medium condition	Low condition
Australian Capital Territory	100%	84%	100.0%	95%	5%	0%
New South Wales	99%	98%	99.9%	98%	1%	1%
Queensland	97%	93%	99.9%	93%	1%	6%
South Australia	100%	99%	99.7%	99%	1%	0%
Tasmania	96%	94%	99.5%	94%	1%	6%
Victoria	100%	98%	99.9%	98%	2%	0%
Western Australia	100%	98%	100%	99%	0%	1%
NZ	95%	97%	100%	97%	3%	0%



# Other attributes investigated



- Availability of High Definition Maps
- Availability of mobile data networks
- Frequency of temporary condition
  - Accidents and disabled vehicles
  - Construction (and maintenance) road works
  - Planned events and other disruptions
  - Road hazards and lane and road closures
- Opportunities for new data sources for asset management



# Preliminary findings

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- There is a reasonable but not universal level of readiness for *active safety systems*
- It is more challenging to achieve readiness for *automated driving* and fewer roads are fully suitable for this.

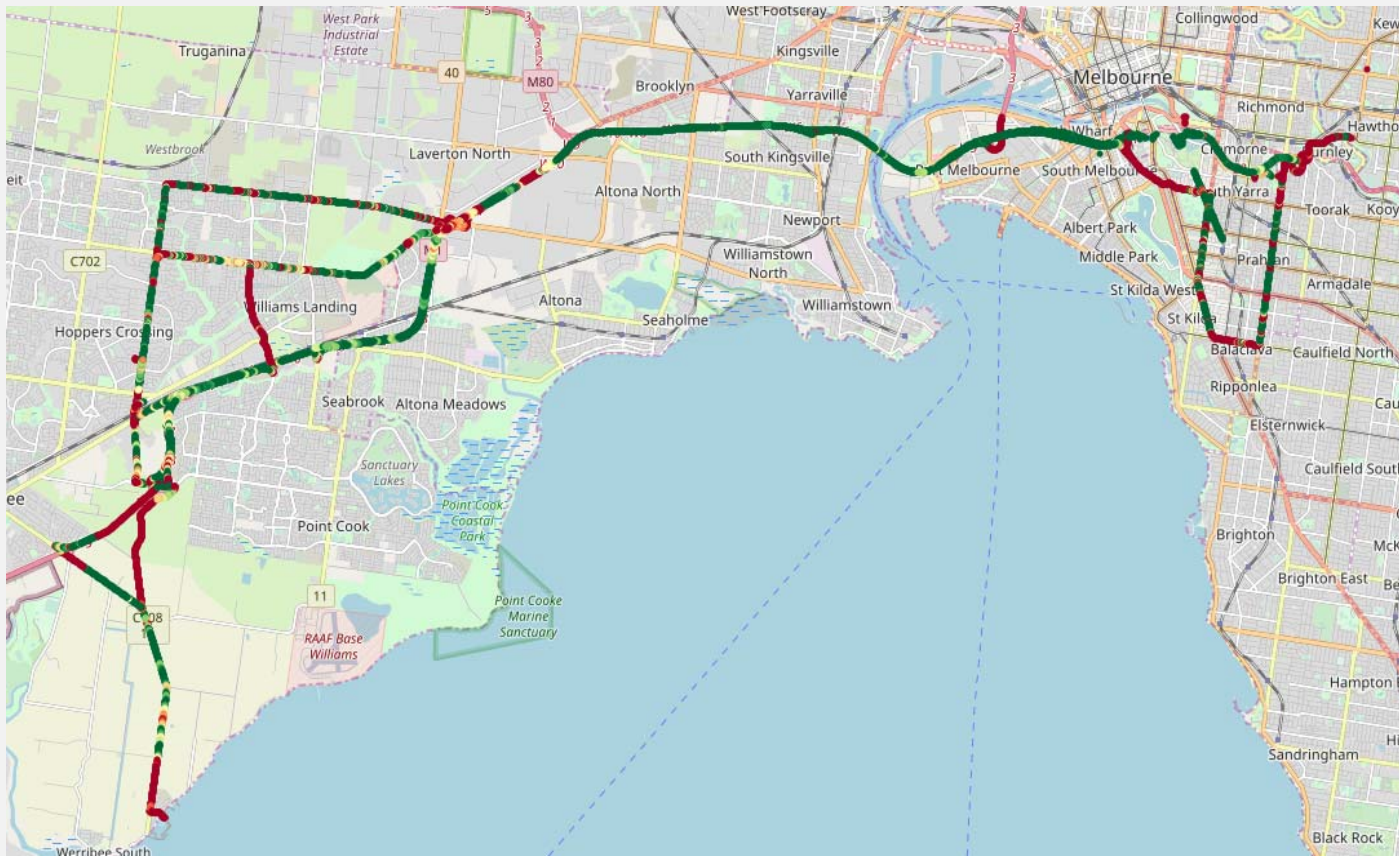


Dxvwdrgv

A black and white photograph of a person driving a car, viewed from the passenger side. The driver is wearing a light-colored top and jeans. The car's interior, including the steering wheel and dashboard, is visible. An orange semi-transparent rectangular overlay is placed over the center of the image, containing the title text.

# FSP 6119 Automated Steering Functions

# Automated Steering Functions



# Sample video representation

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# New projects underway

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1. RADCAV – Road Operator Data for CAVs
2. Future State 2030
3. Connected Vehicle Data Sandbox



# Providing Dynamic Road Agency Data to CAVs

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The Research question:

- How should we provide road agency-owned data to map makers, CAVs and C-ITS devices?

# Focus on dynamic data needs

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Signal phase and timing



Incidents



Roadworks



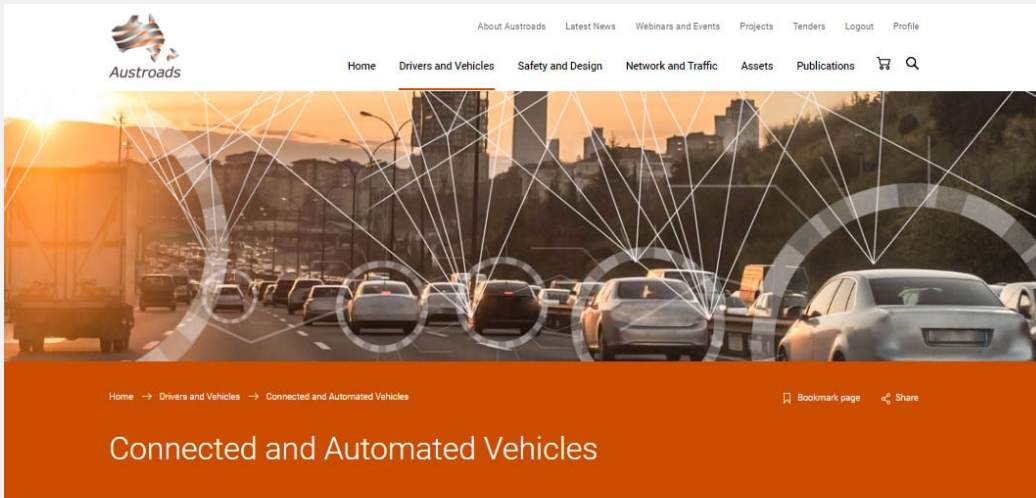
Variable speed limits  
&  
lane use signals

# Issues to investigate

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- Business perspectives:
  - Providing awareness of events and devices (incidents and roadworks)
  - Road work practice standards
  - Jurisdictional consistency across Australia
  - Organisation capabilities
- Technical perspectives:
  - Data quality (availability, completeness and consistency)
  - Technical standards
  - Systems architecture
  - Sharing across Australia
- **Cost impacts of implementation**

# Australian FVaT activities and research at [austroads.com.au](http://austroads.com.au)



## Connected and Automated Vehicles

Our Connected and Automated Vehicles projects are helping establish the regulatory and operational frameworks required to realise the benefits of this emerging technology.

### Latest publications and webinars



Webinar: C-ITS Compliance Assessment Framework for Australia and New Zealand →

This webinar, presented on 11 December 2018, provides an overview of Austroads' assessment of options for the development of a C-ITS Compliance →

### Projects

The Austroads research program runs from 2016-20, in line with the Strategic Plan. Current connected and automated vehicle projects include:

CAV6060 ● Status: Active, On Track  
Strategic direction for security in C-ITS



### Program Overview →

Austroads' Connected and Automated Vehicles program is working closely with key government and industry stakeholders to establish the frameworks to support the introduction of vehicles with increased level of wireless connectivity and automated driving capability.



### Trials →

This map indicates where connected and automated vehicle trials are taking place and are planned in Australia and New Zealand.



### Projects →

Link to Austroads' Connected and Automated Vehicle projects.



The map above indicates where connected and automated vehicle trials are taking place and are planned in Australia and New Zealand.

Austroads' Connected and Automated Vehicles program is working closely with key government and industry stakeholders to establish the frameworks to support the introduction of vehicles with increased level of wireless connectivity and automated driving capability.



# Thank you

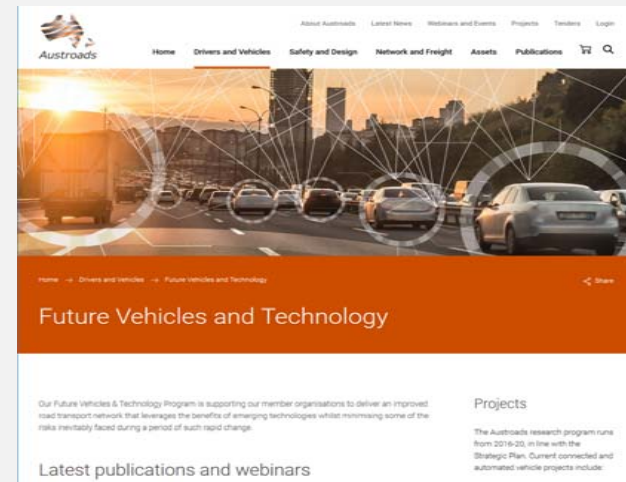
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