# NEXT GENERATION INFRASTRUCTURE FOR AN INTELLIGENT MOBILITY FUTURE

**Dr Richard Yeo    Chief Operating Officer**

# Future Transport Landscape

# It's time for an Infrastructure "RESET"
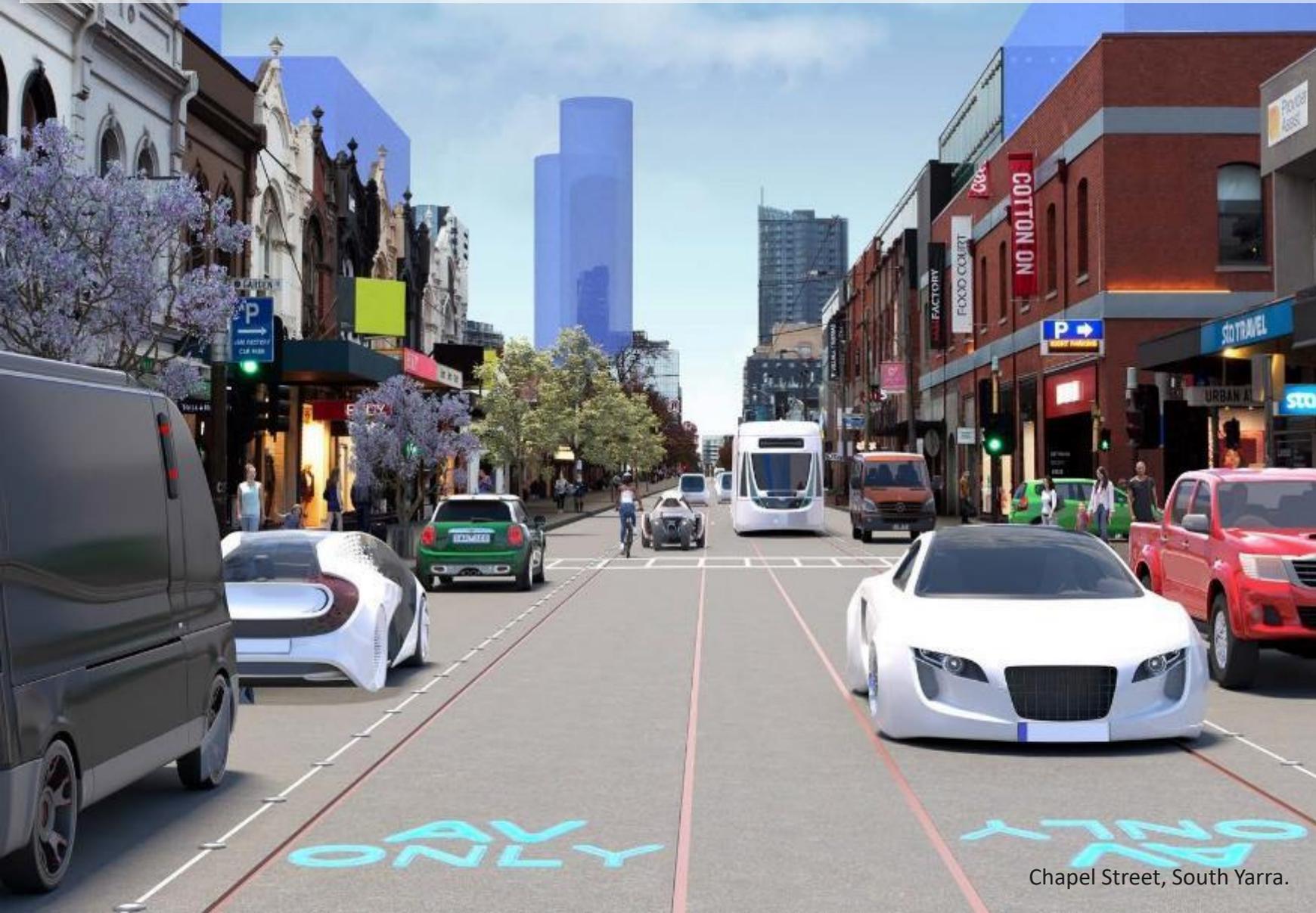


Chapel Street, South Yarra.

- Mobility as a Service
- Connected and Automated
- Shared spaces
- Innovative vehicles
- Last mile mobility
- Safety
- Sustainability
- New Economy

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New Journeys : New Vehicles

Connected Journeys

# Next Generation Transport Infrastructure

**PRIVATE**

**PUBLIC**

**COMMERCIAL**

Private car

Motorcycles

Buses

Light rail

Heavy Vehicles

Restricted Access Vehicles

Commercial hire car

Infrastructure

**ROAD USERS**

**JOURNEY TYPES**
(private, public, commercial)

**APPLICATIONS / SERVICES**

**CONNECTIVITY**

Infrastructure

**ROAD USERS**
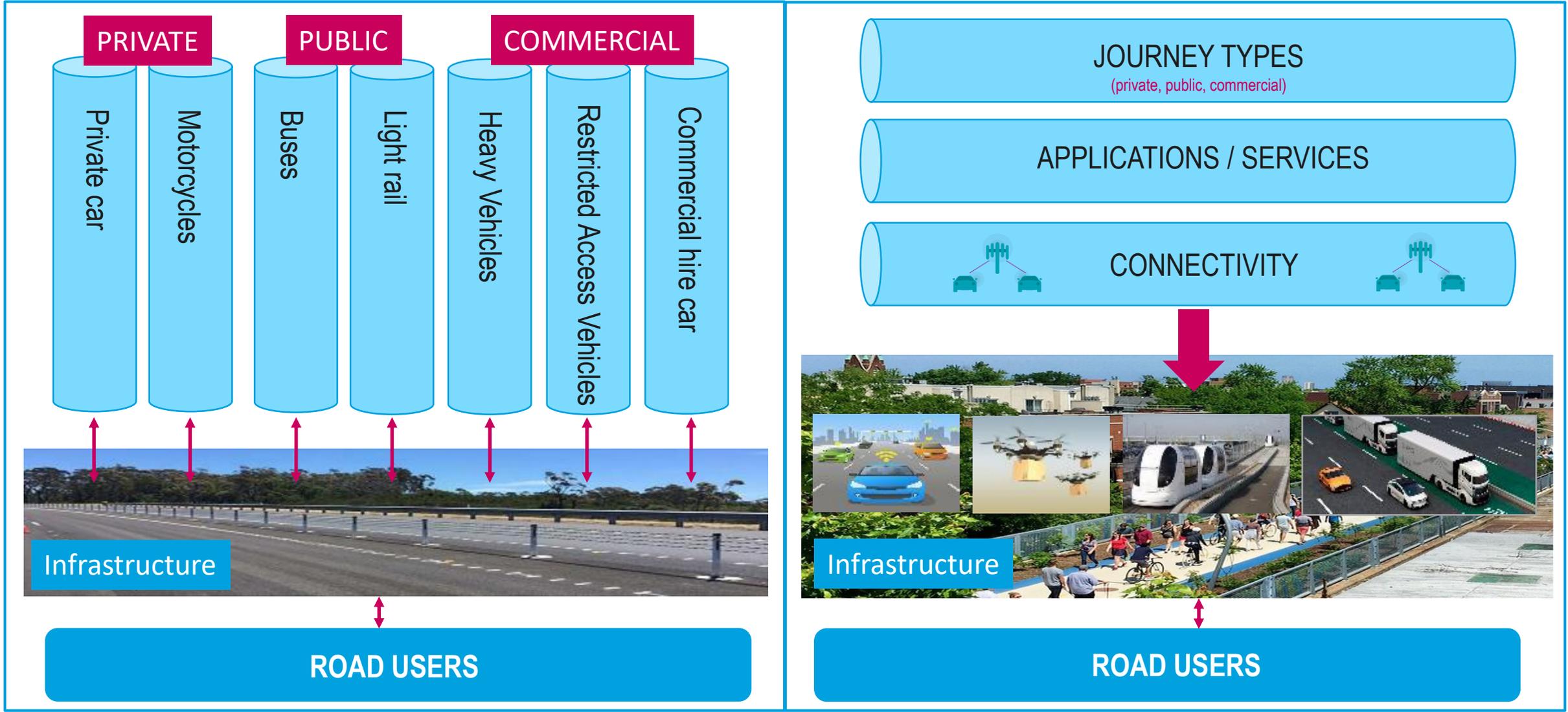
(adapted from "**Broken Concepts** – The Australian Communications Legislative Landscape, ACMA, August 2011, p7)

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**FUTURE TRANSPORT INFRASTRUCTURE**
- Research Labs
- Pavement & Materials
- Specifications
- Guidelines

**FUTURE TRANSPORT SYSTEMS**
- Smart Traffic Management
- Network Operations Planning
- Intelligent Transport Systems Assets
- Advanced Mobility Technologies

**TRANSPORT SAFETY**
- Transport Safety Policy
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- Safe Road Infrastructure
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**SUSTAINABILITY AND RESILIENCE**
- Resilient Transport Systems
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**ASSET MANAGEMENT**

**DATA COLLECTION AND ANALYSIS**
- Data Collection
- Infrastructure Performance
- Intelligent Asset Management
- Transport economics

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# New Facilities to Meet New Challenges

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# Future Transport Infrastructure

Full scale pavement performance testing – the Accelerated Loading Facility

Cost effective - all weather roads
Improved durability
Optimised resource use
Life cycle costing



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# What could **Transport 3.0** be?



Easter morning
1900

42nd Street
1918

42nd Street
11-Jan-2018

# New South Wales: George Street, Sydney

# Melbourne Victoria

# Victoria

ADVICE ON AUTOMATED AND ZERO EMISSIONS VEHICLES INFRASTRUCTURE

October 2018

INFRASTRUCTURE VICTORIA

## By the numbers

Depending on exactly how and when zero emissions and automated vehicle technology rolls out, Victoria could realise some huge benefits including:

UP TO **91%** of congestion reduced

**25%** of greenhouse gas emissions reduced

**$14.9 billion** increase in Gross State Product in 2046

UP TO **94%** of road accidents reduced

UP TO **50%** reduced car operating costs

UP TO **$735 million** worth of health benefits
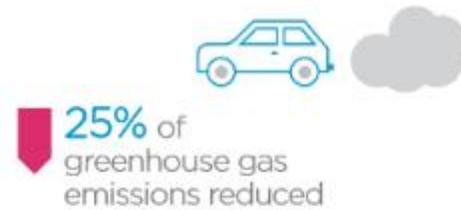
Realising these benefits would require some significant infrastructure investment from government and private sector including:

UP TO **$1.7 billion** to upgrade mobile networks

APPROXIMATELY **$250 million** for improved line markings on roads

AT LEAST **$2.2 billion** for energy network upgrades

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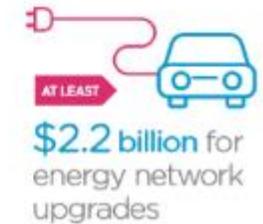
# Technology Implications

Current Monash Freeway (M1)

Slow Lane

Fleet Street
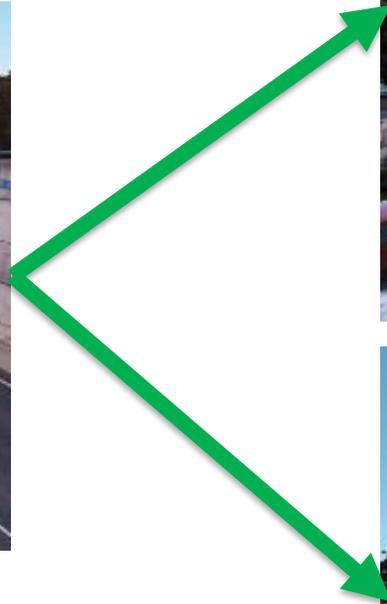
# Technology Implications
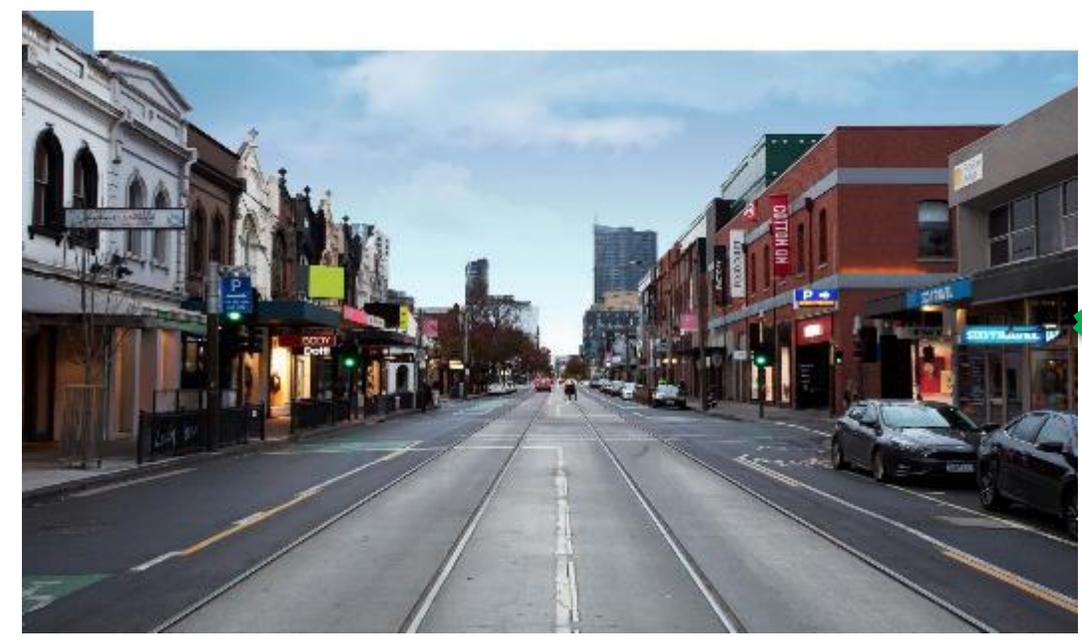
Current Inner City –
Chapel St, South Yarra

Slow Lane

Fleet Street

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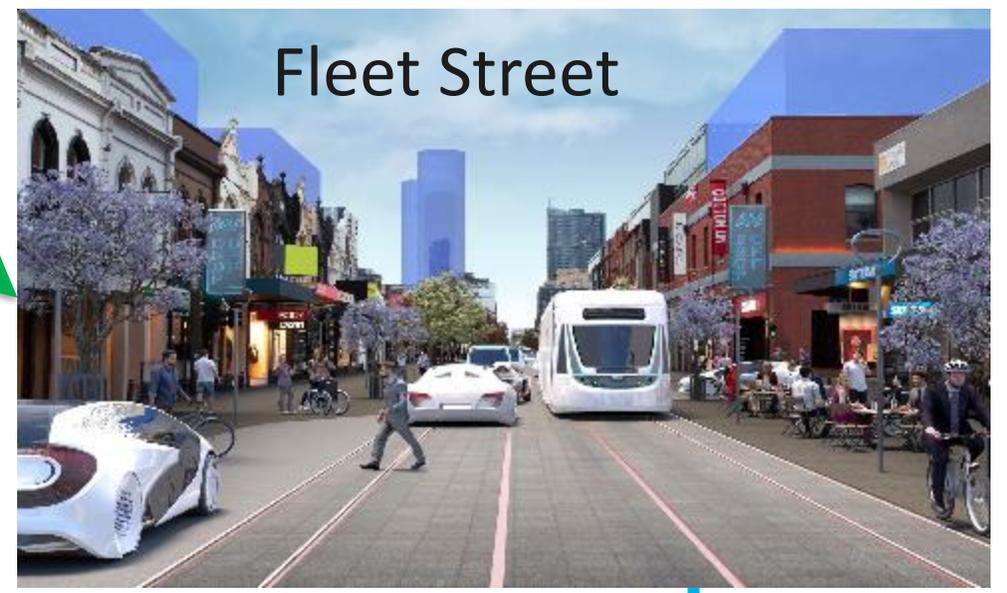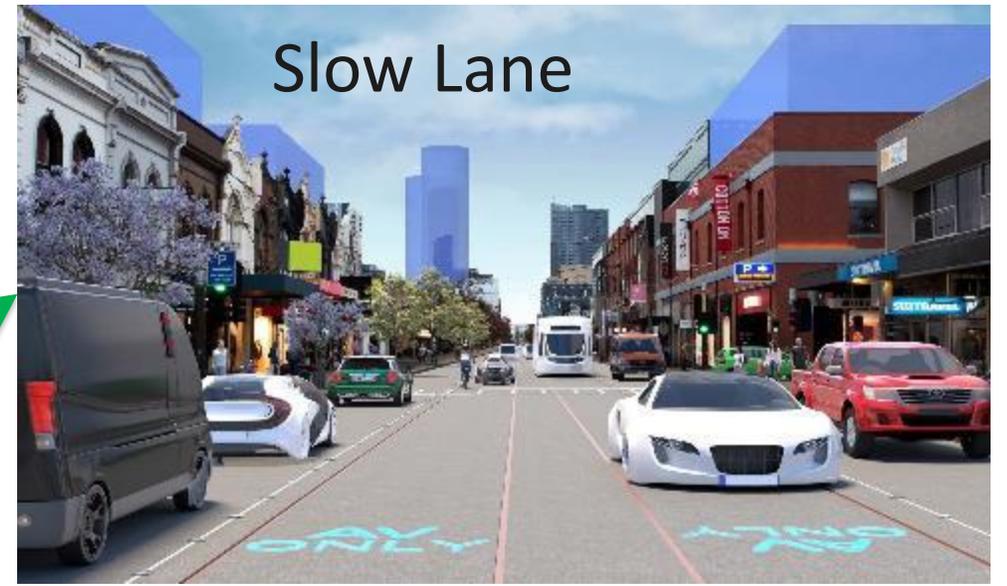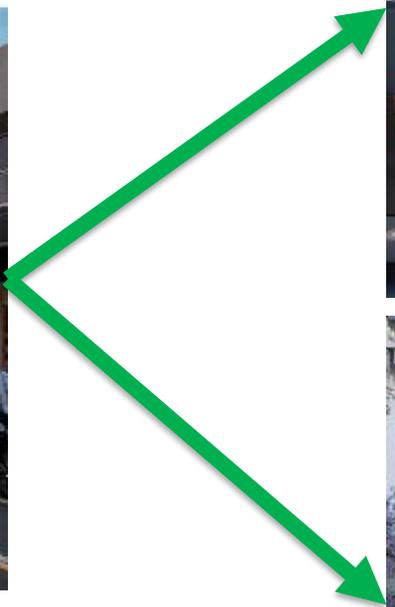
# Technology Implications

Current Urban - Ringwood

Slow Lane
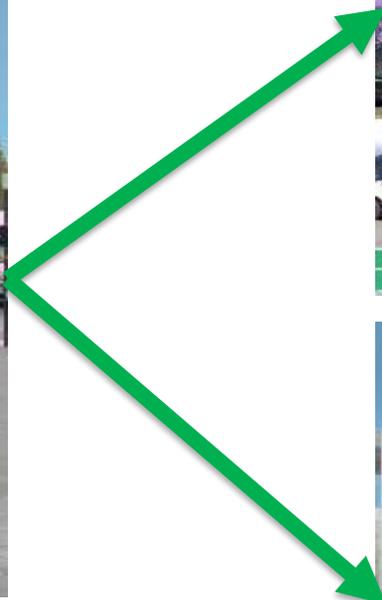
Fleet Street

Images Courtesy of Victorian Government

# Technology Implications

Current Suburbs - Yarraville



Slow Lane



Fleet Street

Images Courtesy of Victorian Government
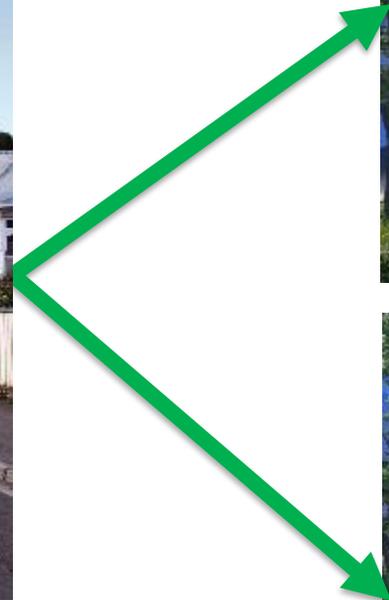
# Technology Implications

Current Intersection - Watergarden

Slow Lane

Fleet Street

# Need for system management

Electric

Shared

Connected

Data

Autonomy

**System management**

# National Transport Performance Centre

# We can tell a **personal story** with data

## ARRB's National Transport Performance Centre



Latest research shows surrounding road space & condition important factors with narrow & rough roads faring worst.

The Driver Frustration Index combines factors that ranks our worst performing roads.
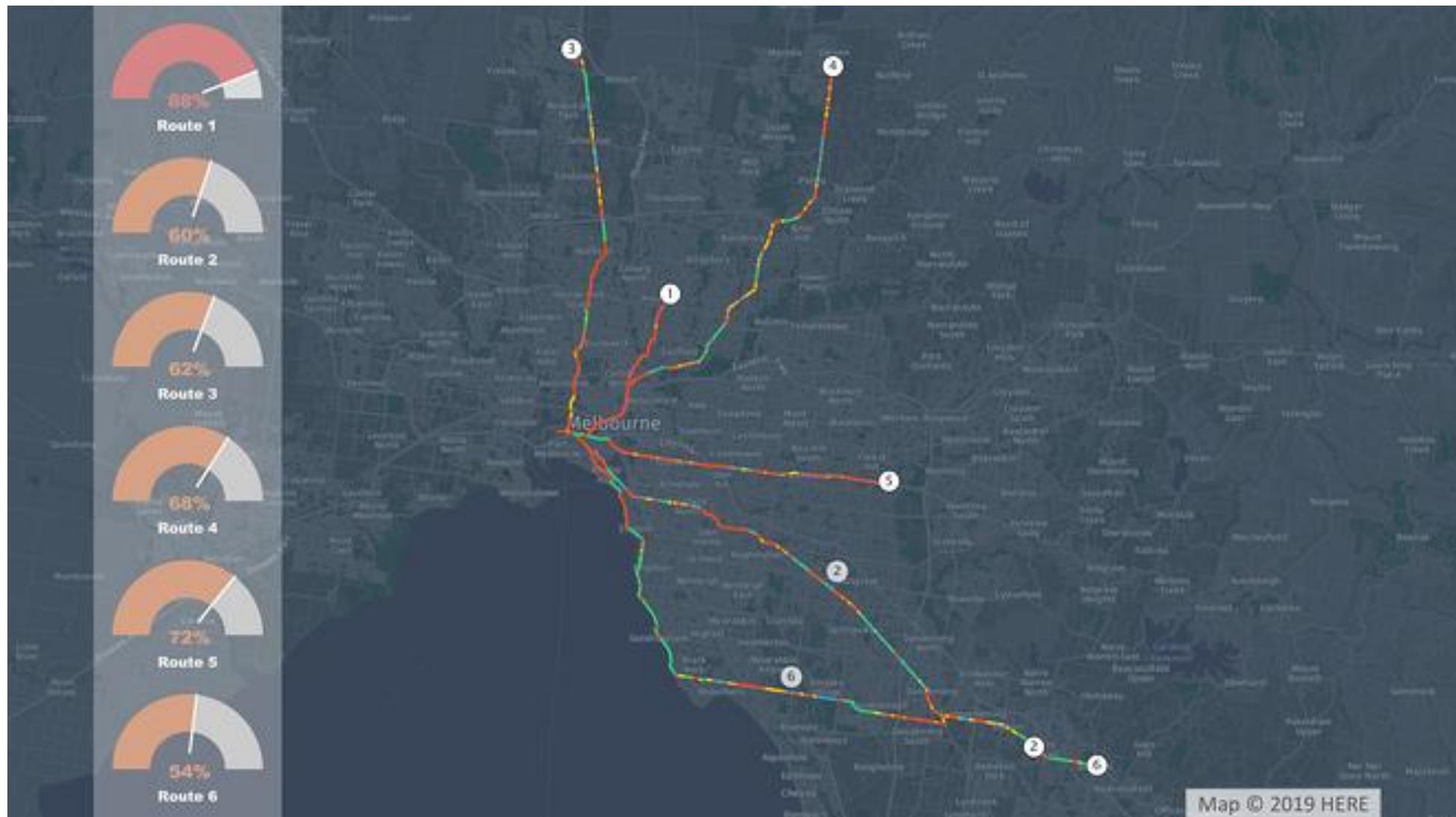
# CAV Readiness Road Survey



ARRB network survey vehicle with front facing cameras

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# CAV Readiness: Sample of Data Outputs

## Mobileye – data logger interface



## ARRB Video imagery interface
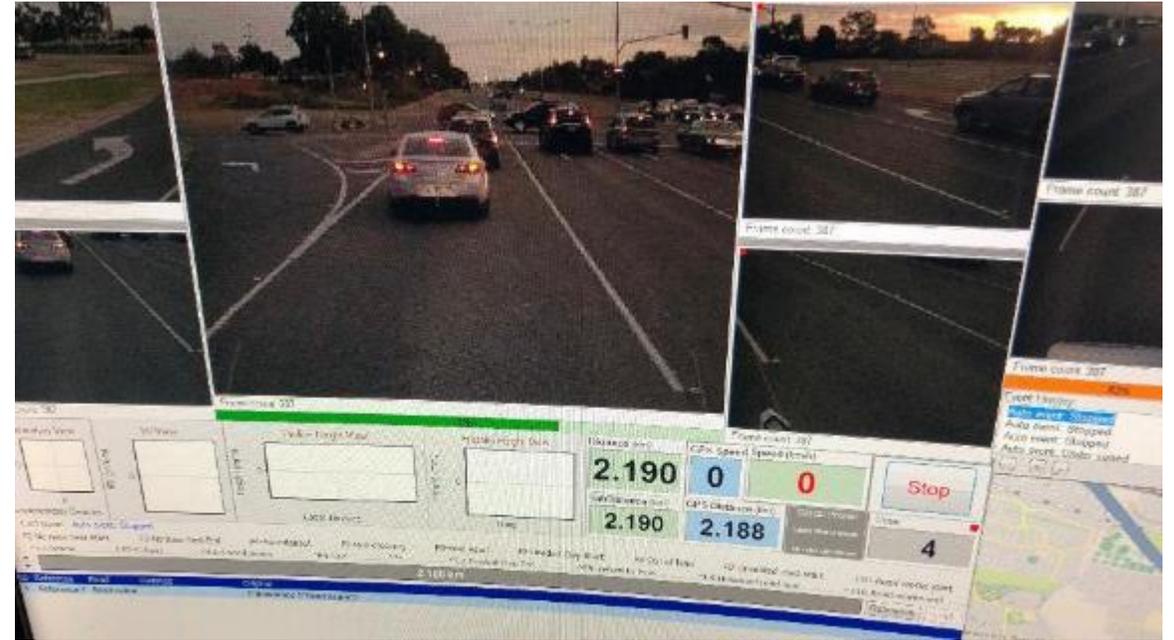


### GPS data

- Lat, long, time, distance, speed

### Line markings

- **Type:** 6 variations
- **Quality:** low or high
- **Width:** 1cm resolution

### Signs

- **Type:** 73 variations
- **Position:** x, y, z

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# Line Marking Map Based on Real-Time Data

**Quality**

**Lane Departure Warning availability**

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# National Strategy and Leadership

Keep up the good job!  We WILL reach zero fatalities by 2050. But we can do more!



1970 (28.9)

Peak of
Roaring 1920s

1971
Compulsory
seatbelts

1982
RBT

1950-60s
Rapid
motorisation

1930s
Depression

WW II

1990
RS 2000
Strategy

2000
Graduated
Licensing
Scheme

1991
Speed
cameras

1908 (7.6)

2014
(4.1)

Road Safety
Strategy 2012-21

Road deaths per 100,000 population

Century of fatality rate trends
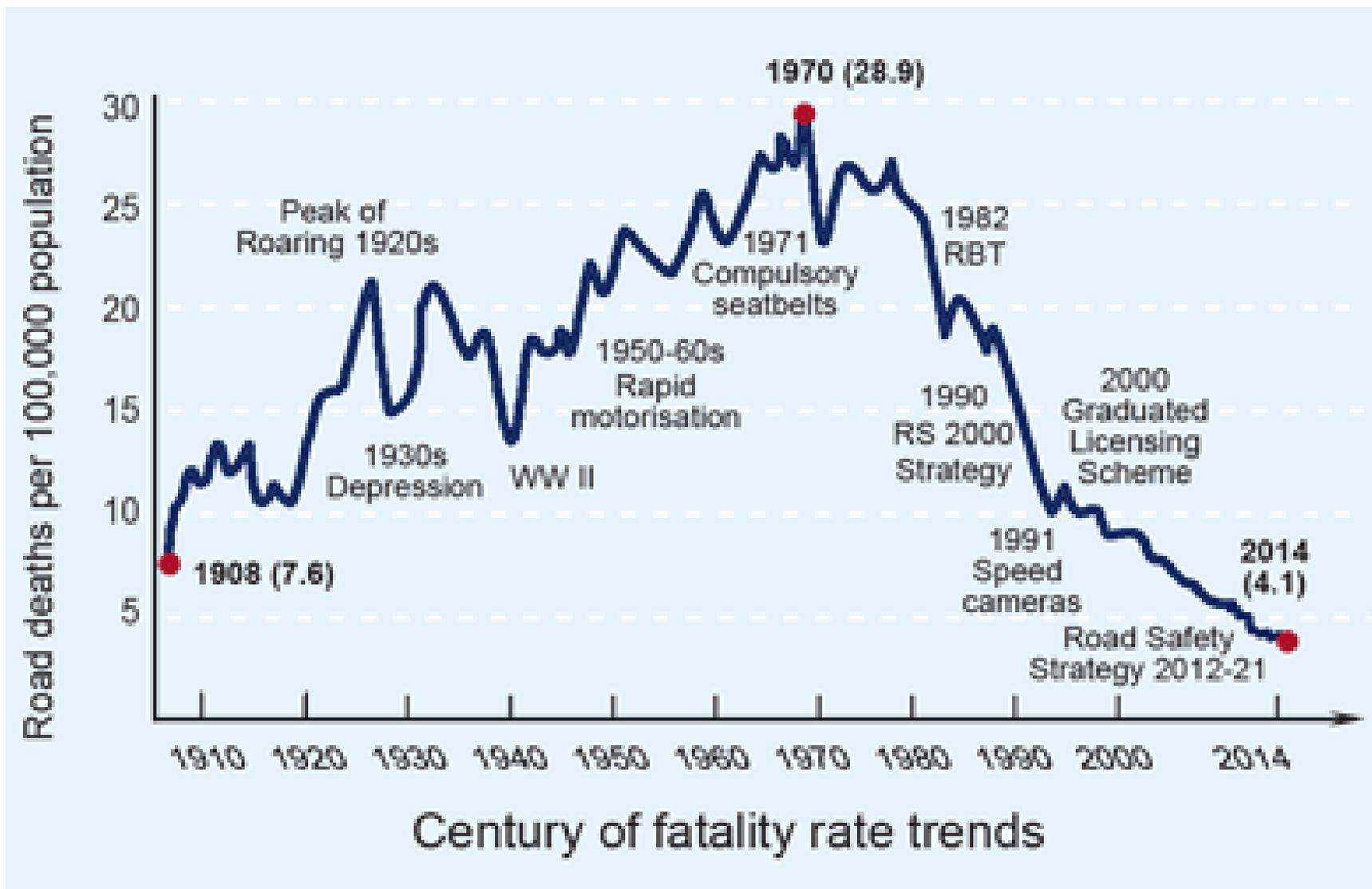
- Decline at this rate will still
  =12,000 people killed and
  360,000 admitted to hospital
  costing over $300 billion over
  next decade.

- New! National Road Safety
  Strategy = step change
  – National Safe System
    Framework
  – New! National Crash
    Investigation and
    Reporting Framework

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# National Strategy and Leadership

## Long term trends and projections for road deaths and hospitalised injuries
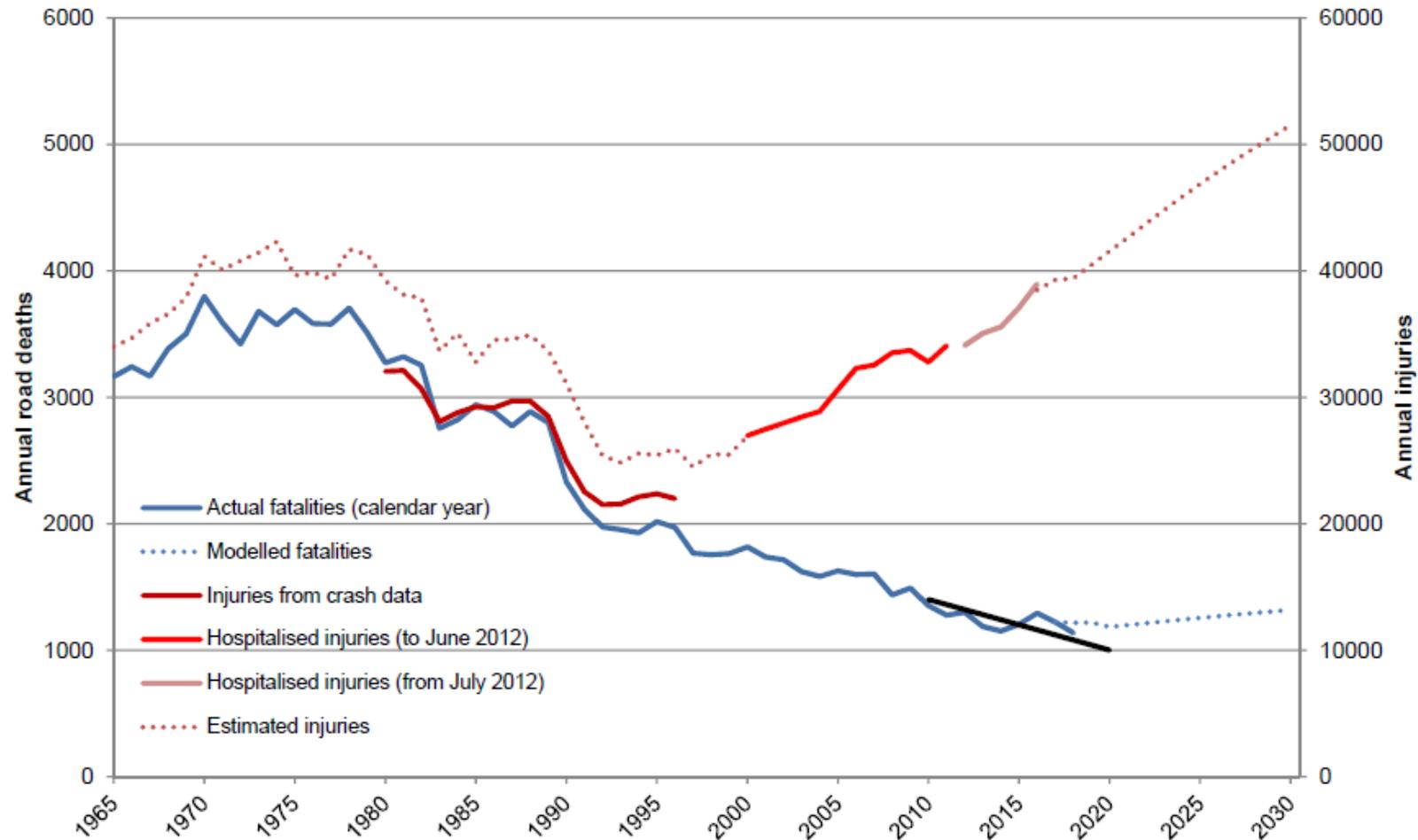


Source: BITRE 2019

- Road trauma targets not currently being met
- The Safe System framework is not being implemented in the field.
- Disconnect between noble intentions, resourcing and road safety practice.

- **Transformative approach** to road safety needed

[2018 Review of the National Road Safety Strategy 2011 – 2020]

# National Crash Data Collection >> Engineering Toolkits

**Roadside Design Improvement at Curves** — NEW

**Reduced Left-Turn Conflict Intersections** — NEW

**Systemic Application of Multiple Low Cost Countermeasures at Stop-Controlled Intersections** — NEW

**Leading Pedestrian Interval** — NEW

**Local Road Safety Plan** — NEW

**USLIMITS2** — NEW

**Enhanced Delineation and Friction for Horizontal Curves**

**Longitudinal Rumble Strips and Stripes on Two-Lane Roads**

**Median Barrier**

**Safety Edge**$_{SM}$

**Backplates with Retroreflective Borders**

**Corridor Access Management**

**Dedicated Left- and Right-Turn Lanes at Intersections**

**Roundabouts**

**Yellow Change Intervals**

**Medians and Pedestrian Crossing Islands in Urban and Suburban Areas**

**Pedestrian Hybrid Beacon**

**Road Diet**

**Walkways**

**Road Safety Audit**

**Roadside Design Improvements at Curves**

*Increasing the Clear Zone prevents crashes*

3.3 ft

16.7 ft

30 ft

**+22%** CRASH REDUCTION

**+44%** CRASH REDUCTION
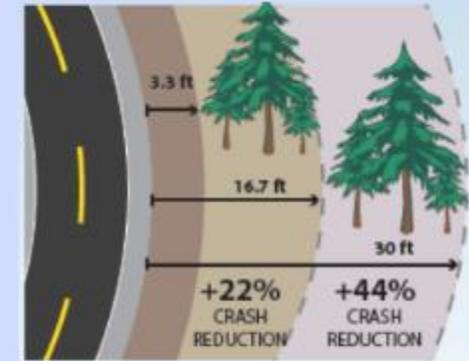
**27%** of all fatal crashes occur at cuves

**80%** of all fatal crashes at curves are roadway departure crashes

*Source: Fatality Analysis Reporting System (FARS)*

[Source: USA FHWA 2019, related to **ARRB-Austroads Road Safety Engineering Toolkit**]

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# Road network hierarchy



road network

road corridor
- major area of travel between two points

road link
- part of a corridor with homogenous characteristics

# Design principles

- Self explaining roads
- Safe system
- Road function movement and place
- Other
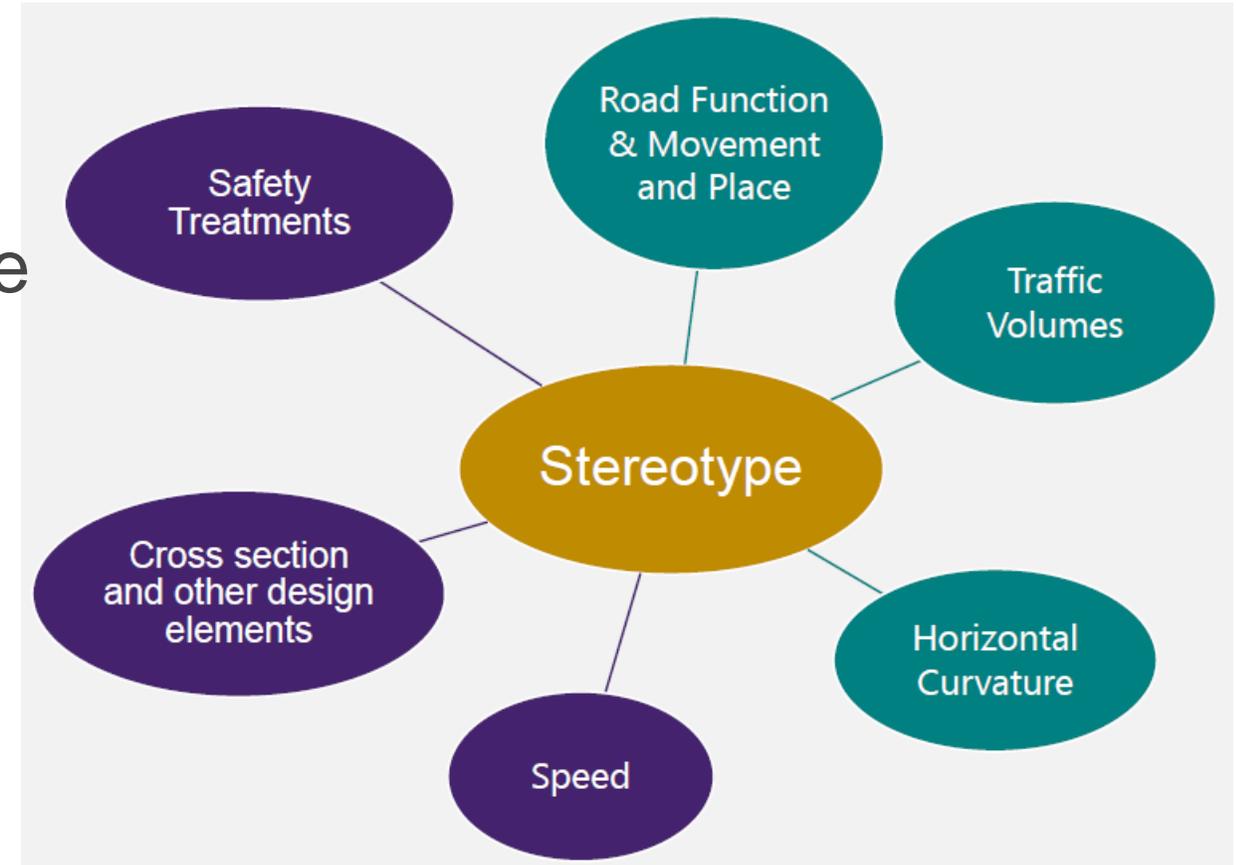
# Road stereotypes

**Thirteen midblock road stereotypes**

| Freeways/ motorways - rural | Rural highways | | | | Rural local road - collector | Rural local road -access | Rural roads, mountainous terrain |
|---|---|---|---|---|---|---|---|
| | Divided 100/110 km/h 4 000–14 000 | Undivided 100/110 km/h 4 000–14 000 | Undivided 80/100 km/h 1 000–4 000 | Undivided 80/100 km/h <1000 AADT | | | |

| Freeways/ motorways - urban | Arterial – divided | Arterial - undivided | Collector | Local roads |
|---|---|---|---|---|

# Road stereotypes

## Mid block cross section attributes:

- Formation
- Travel lane width
- Shoulder width
- Bicycle facilities
- Runout distance
- Batter slope
- Roadside safety barriers
- Centre/median safety barriers
- Wide centreline
- Medians

Used to determine the star rating for the road and the predicted number of fatal and serious injury (FSI) crashes per 100 million VKT

- iRAP
- ANRAM

# Road stereotype example
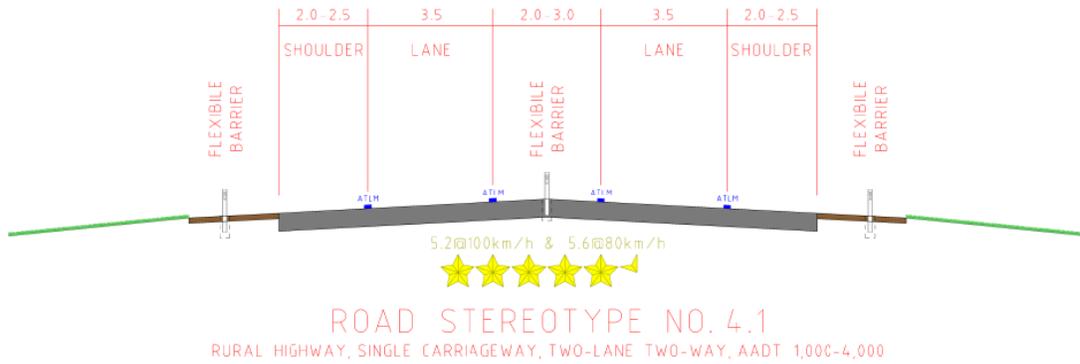


| | Star rating | Predicted FSIs |
|---|---|---|
| Proposed cross section | 5.2 | 0.02 |
| Existing cross section | 3.7 | 3.22 |

**Coding**

| | |
|---|---|
| (green) | 5.0-5.9 Stars |
| (yellow) | 4.0-4.9 Stars |
| (orange) | 3.0-3.9 Stars |
| (pink) | 2.0-2.9 Stars |
| (grey) | 1.0-1.9 Stars |
| (black) | 0.0-0.9 Stars |

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# Roads & Infrastructure
## SMART MATERIALS AND RECYCLED MATERIALS



- Life Cycle Assessment
- Geogrids
- Water capture storage and reuse
- Pollution prevention



- High % RAP
- Examples: Crumb rubber, Glass, Plastics, Fly ash, Slag
- Plastic, modular roads for lightly trafficked or active transport areas



- Self healing asphalt
- Perpetual pavements
- Next Generation Maintenance



- Pavement recycling
- Manufactured aggregates from by products i.e. light-weight aggregates from sintering
- Recycled glass

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# Value Capture and Creation

## Objective

For a given project brief, Council should be able to apply a consistent and thorough process to **identify** and **assess value creation and value capture opportunities**
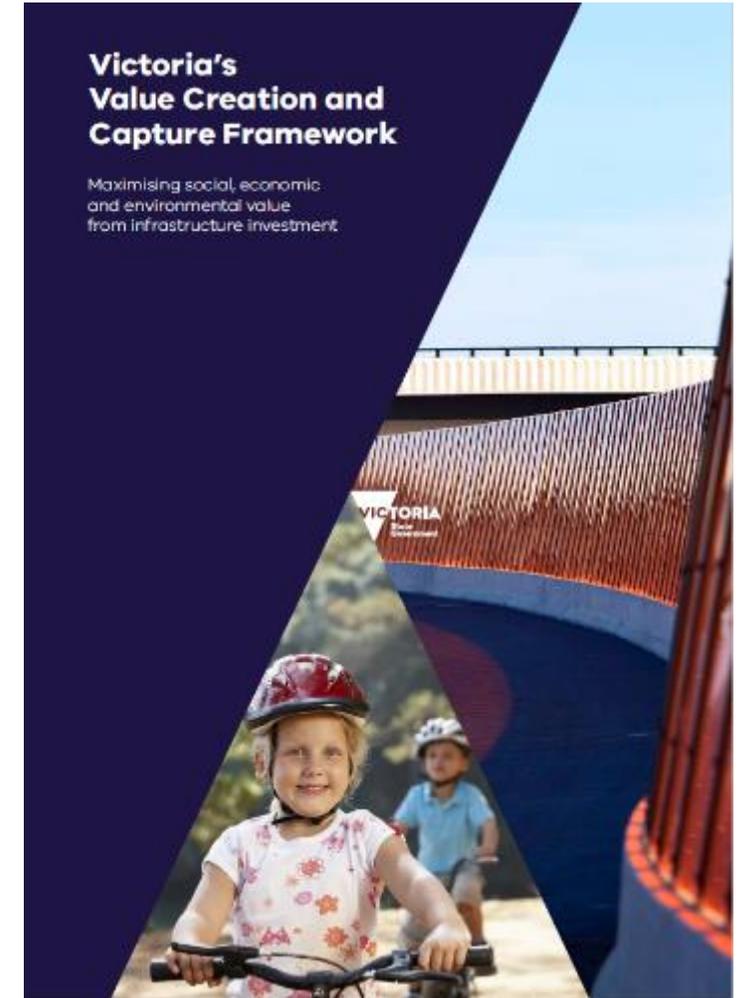


Victoria's
**Value Creation and
Capture Framework**

Maximising social, economic
and environmental value
from infrastructure investment

# Sustainable Urban Mobility Planning

## Step by step approach to tackle urban mobility, road safety and sustainability challenges

Balanced development of all relevant transport modes

Integrated set of technical, infrastructure, policy-based, and soft measures to improve performance and cost-effectiveness

*Successfully adopted by many European cities*



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# Sustainable Urban Mobility Planning

## Step by step approach to tackle urban mobility, road safety and sustainability challenges



*Better, more attractive and happier cities: satisfied voters*

- cross sectoral cooperation
- improved ROI for city projects
- successful city plans and projects
- reduced delays in projects
- increased road safety through planning and design

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# iPAVE—intelligent pavement assessment vehicle



- **Allows greater understanding of pavement condition above & below surface**
- **Data is successfully being used to manage road networks**
- **Definite safety benefits**
- **Network level assessment**

# iPAVE
# Efficient
# Infrastructure
# Mgt Tool

# iSSAVE - intelligent safety surface assessment vehicle

+ GNNS DGPS geospatial location

+ Digital imaging system

+ Rutting

+ Texture
Centre and Both wheel paths

+ Geometry
Cross fall, Grade, Horizontal and Vertical curvature

Continuous Friction Response

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# ARRB Local Government Guides
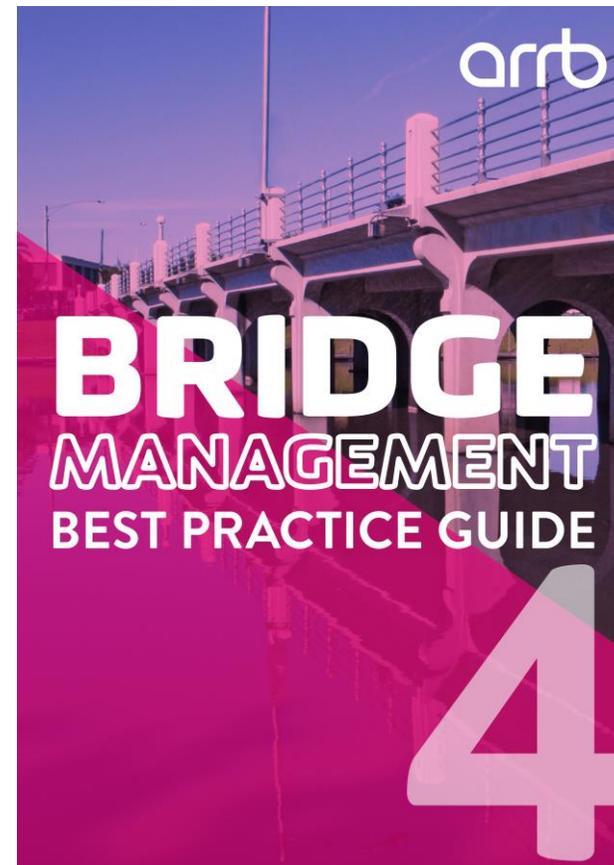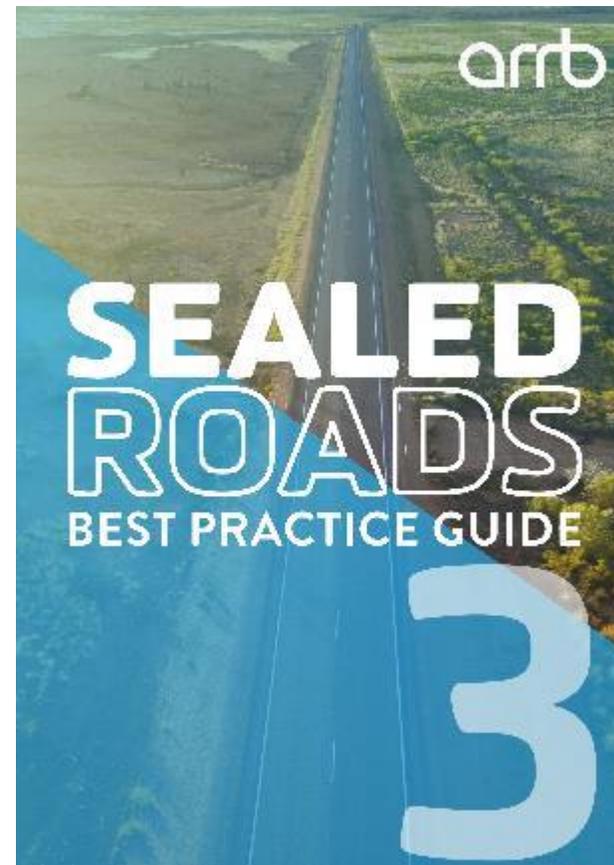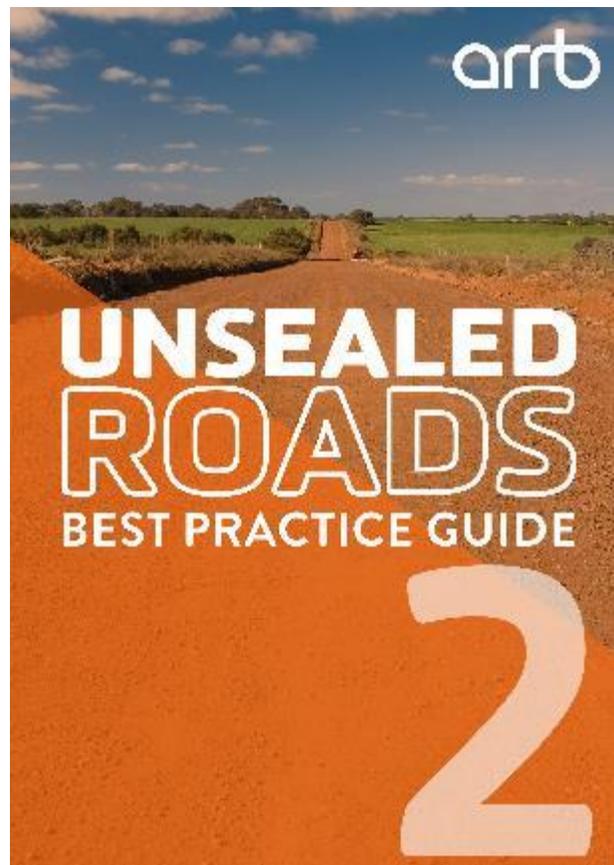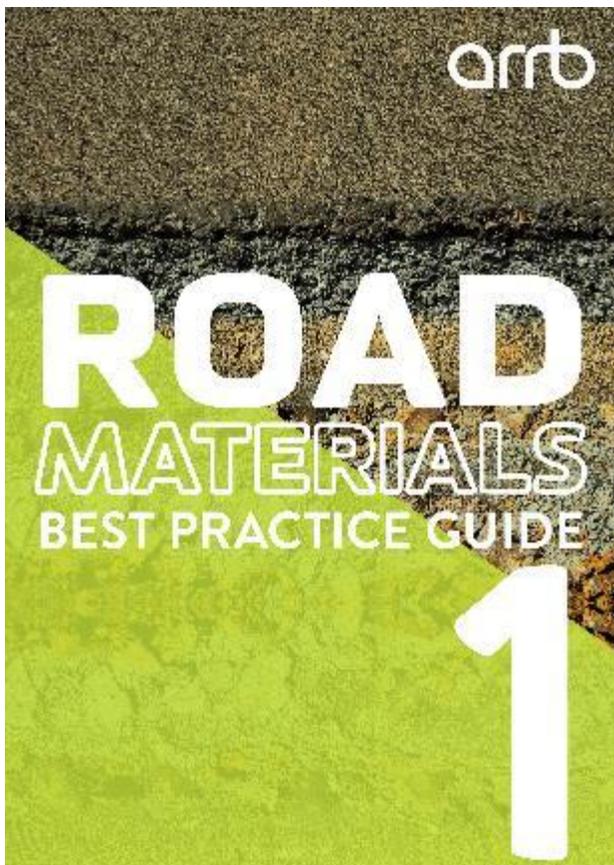
# ARRB Events – Webinars and Workshops



WEBINARS
FROM YOUR
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Imagining 2050 – A look back at how we arrived at Zero

by **Australian Road Research Board** on January 24, 2020

February 25, 2020



NEWS
FROM YOUR
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Drainage for Road Design

by **Australian Road Research Board** on March 5, 2019

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