Transport Professionals Association

Managed Motorways Decoded | Insights from QLD Practice Webinar

4 March 2026

SHAPING EVERY JOURNEY

FEATURED SPEAKERS

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Arcadis

Introduction

- Target Audience
- Managed & Smart Motorways Context
- Overview of key elements
- International and National Background
- Qld implementation of Smart motorways

Managed Motorway Definition - What makes a Motorway Smart

NSW

2.2 What is a 'Smart' Motorway?

A smart motorway utilises ITS technologies, within a road corridor, to monitor, provide intelligence and control the road network.

The key concepts in managing *any* type of network, including a road network, are active monit
The i
opera

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Managed Motorways are a proven approach with demonstrated benefits in Victoria and internationally. While the tools applied to a particular section of motorway may vary, the outcomes for road users are similar and are primarily seen in relation to improved throughput, capacity and travel speeds, more reliable travel times and safer traffic flows. There are also potential benefits for the environment and in relation to

WA

Smart Freeways concept

Smart Freeways make the best use of the existing freeway network, particularly during times of high demand and traffic incidents. We use ITS and operational strategies that enable dynamic network management and operation in real-time. Smart Freeways traffic management initiatives, complemented by appropriate mainline and ramp geometric improvements work together as an integrated system to achieve and maintain opti

UK

Smart motorways were introduced as they increase capacity without the disruption and environmental impact of physically widening the road. As of 2022, the 446 miles of smart motorway network carried around a third of all motorway traffic in England.

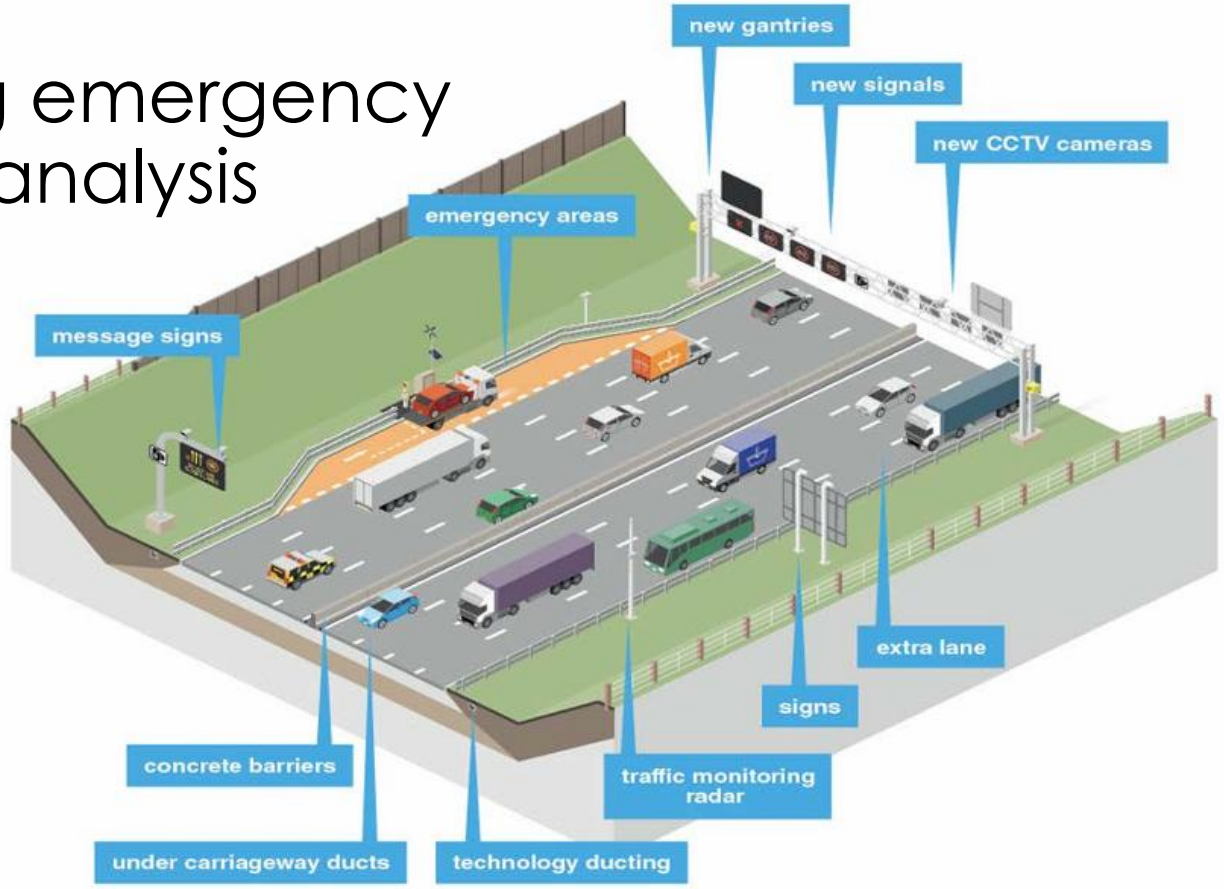
QLD

4 Definition of a managed motorway

A managed motorway is one that has the necessary infrastructure and ITS which enables upstream demand and operations to be managed to meet downstream capacity. The managed motorway standard allows the road operator to dynamically manage operations to minimise congestion due to flow breakdown. Background regarding managed motorway system performance is provided in Appendix A.

Smart Motorway Elements

- Geometry elements including emergency stopping bays and capacity analysis
  - Network Intelligence
  - Traffic Control
  - Traveler information
  - Enabling infrastructure



Source: DfT – Smart Motorway Safety

Level Up Smart

- Not all motorways are the same
- Not all tools in the toolbox may be needed

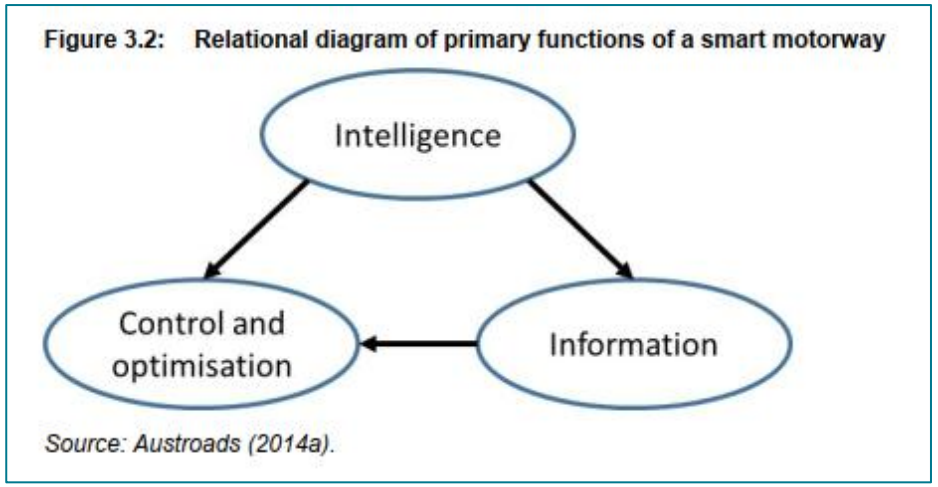


Table 3.4 Levels of active management – a Managed Motorways perspective

Target states:	Road operator understands performance	Travellers can make informed choices	Respond to changing conditions Keep the road open	A network of optimised routes	An optimised network
Multi-modal network optimisation and journey management **Control**					Wide area network optimisation assesses network optimum and guides motorway route optimisation and coordination activities
Route optimisation control **Control**				Adaptive control of mainline density and speed to avoid and recover from flow breakdown through continuous adjustments to ramp signals and mainline speed limits along a corridor	+ objective functions for route optimisation adjusted in real-time for required network role; interchanges between freeway routes are fully managed
Traffic management and control interventions **Control**			Lane availability and speeds set periodically to meet requirements (e.g. open lane for peak demand, close lane and reduce speed for incidents)	+ Changed signal settings on surrounding arterial roads; changes to freeway lane availability and speed limits cooperate with adaptive control algorithms	+ response rules and plans make full use of available freeway and arterial network; a response on one route changes operations also on other routes
Traveller information **Information**		Freeway users provided with freeway conditions, travel times and incident information	+ Freeway users provided with supporting information for changes in lane availability and speed limits	+ Freeway users provided with real-time information about alternate routes prior to entering the freeway	+ to assist users navigate the large volume of available information, information is personalised for a user's journey and provided proactively
Network monitoring and intelligence **Intelligence**	Collection of fundamental freeway data to analyse and understand traffic conditions	+ processing and calculation of freeway travel times, freeway conditions, identification of congested areas and performance reporting for near real-time use	+ near real-time detailed performance data to support intervention decisions presented on a graphical user interface	+ fine level real-time data on freeway, ramps and surrounding network as required by optimisation algorithms	+ real-time data available for other journey options, including alternate routes and modes

Source: DTP Managed Motorway Framework 2017

International and National History and Examples

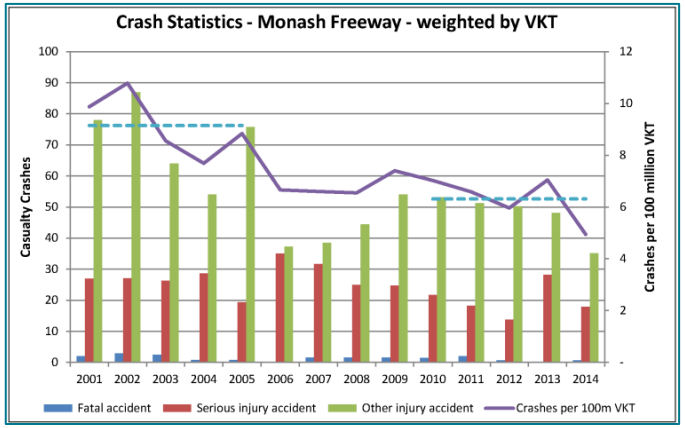
- Strong European Adoption and Development since <1995
- Controlled Motorways → Ramp Metering → HSR/ALR → 'Lean' Motorways

Image Source: DTP Managed Motorway Framework 2017

Image Source: ICE.org.uk

Smart Motorway Benefits

Benefit	Metric
Improved Traffic Flow	>15%⇧,
Reduced Congestion	~20 to 30% ⇩ at Peak
Enhanced Road Safety	⇩<55% PI , ⇩25% Casualties
Increased Road Capacity	⇧10 to 20%
Reduced Journey Time	⇩13%
Improved Predictability/Reliability	⇧20 to 40% at Peak
Lower Vehicle Emission	⇩<10%



Further Reading : Managed Motorway Framework March 2017

TMR Smart Motorways

- TMR's Engineering Policy EP149 Managed Motorways - minimum requirements for smart motorway elements
- TMR has agreed to adopt the standards published in Austroads Guide to Smart Motorways (AGSM) as part of national harmonisation. The department seeks to avoid duplicating information addressed in national guidance and has developed the Queensland Guide to Smart Motorways (QGSM) Supplement that provides Queensland-specific advice, while following the structure established in Austroads Guides.
- Smart Motorways technologies are used on some of QLD busiest motorways. They are currently in place on the following motorways:
    - Bruce Highway
    - Centenary Motorway
    - Cunningham Highway
    - Gateway Motorway
    - Ipswich Motorway
    - Logan Motorway
    - Pacific Motorway
    - Port of Brisbane Motorway
    - Sunshine Motorway
    - Ted Smout Bridge/Houghton Highway
    - Western Freeway

Intelligence – CCTV (traffic surveillance)

- Full CCTV coverage with PTZ camera capability
- Associated structures, electrical switchboard, mains power, comms cabinet and comms medium, field processor
- Traffic monitoring operations as well as assisting in lane use and incident management (mainline monitoring and monitoring of the ramp signaling)
- Monitoring of ramp queues and fine tuning the ramp signals' operations
- Identify driver behavior and operational issues
- Installation, placement, access, PoE camera and connection details
- Approval from the Department, or test certification from a NATA accredited test laboratory
- STREAMS compatibility

Intelligence – CCTV (traffic surveillance)

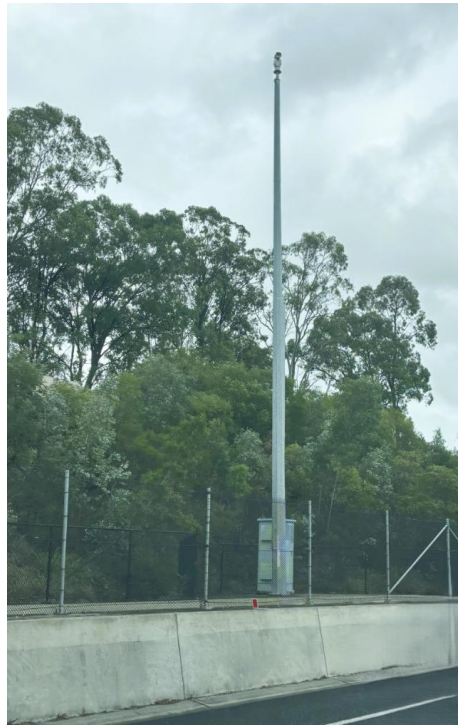
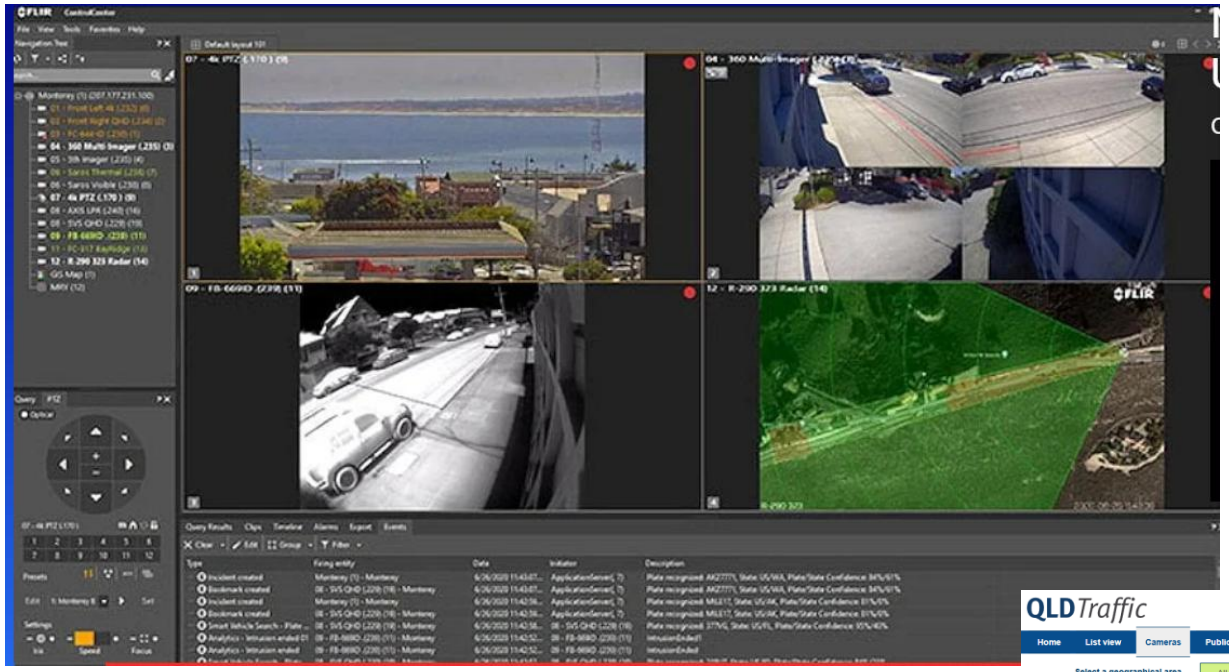
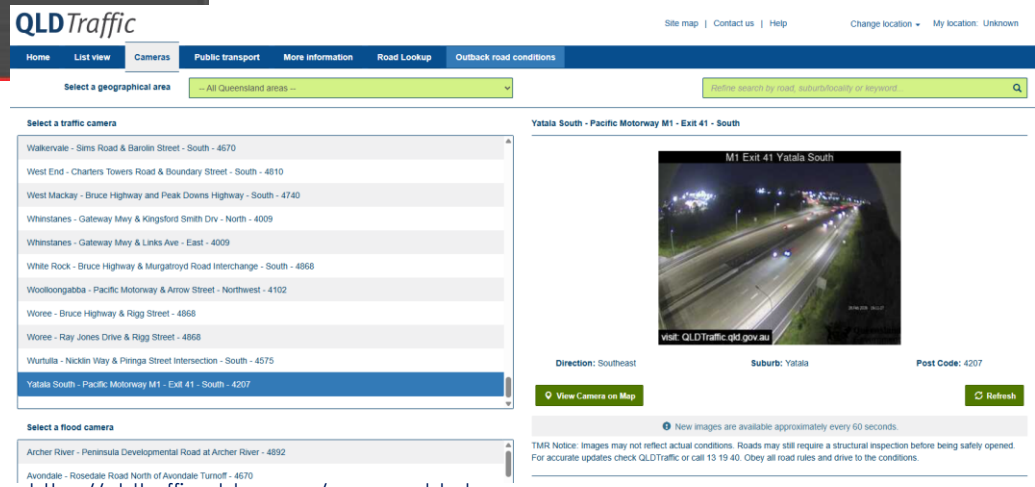


Image Source: TMR Roadside Installation



https://sen.news/new-integrations-for-flir-united-vms/



https://qldtraffic.qld.gov.au/cameras.html

Smart Motorways Technologies (Department of Transport and Main Roads)

Intelligence – Vehicle Detection System

- Loop Detectors, Radar Vehicle Detectors, and Infrared Vehicle Detectors
- Associated structures, electrical switchboard, mains power, comms cabinet and comms medium, field processor
- Vehicle volume and speed, lane occupancy, per direction average speed, per lane average speed and headway data
- Camera-detected offences (CDO), incident detection
- Average weekday peak-direction traffic volume exceeds 1200 pc/h/lane
- Dual loops installation, placement, and connection details
- Approval from the Department, or test certification from a NATA accredited test laboratory
- STREAMS compatibility, detector health checks

Intelligence – Vehicle Detection System

https://fastcut.com.au/traffic-detector-loops/

Overlay Installation – Preformed Inductive Detection Loops

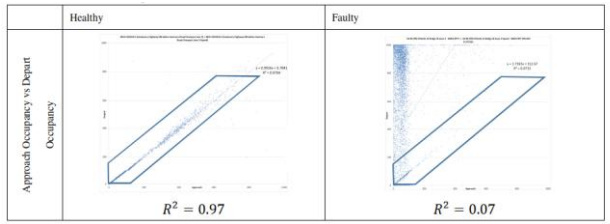
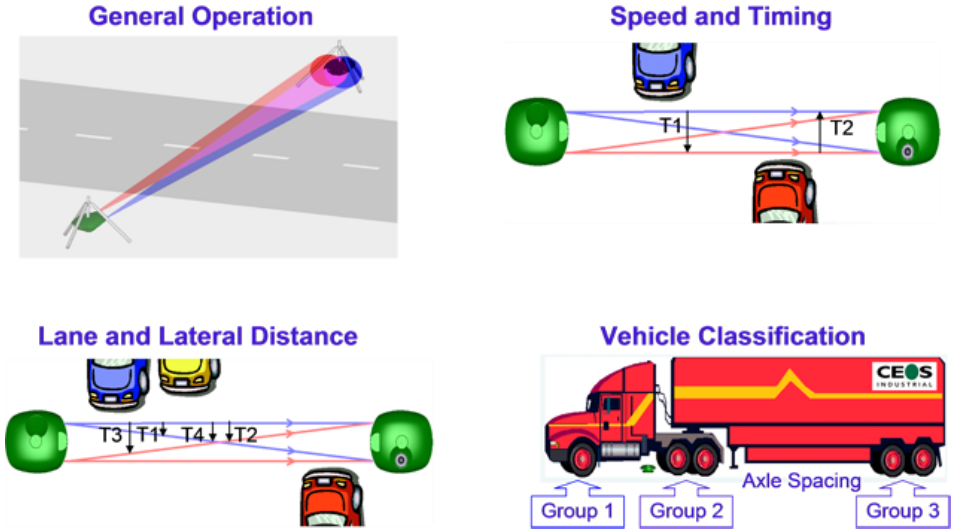
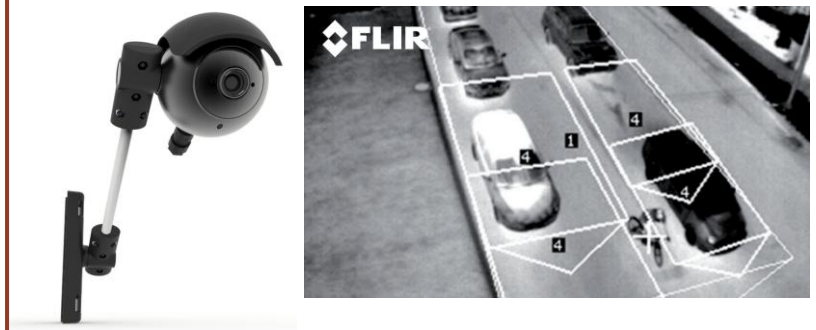


Figure 2 - Indicative plots to establish detector health

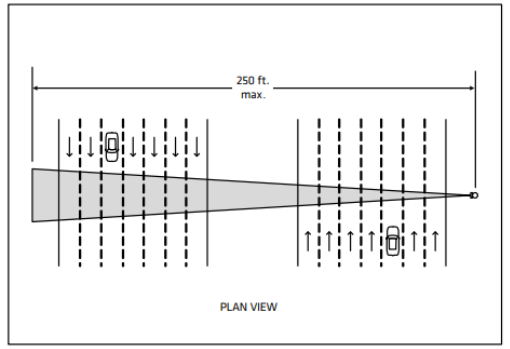
Installed TIRTL example - these are at ground level

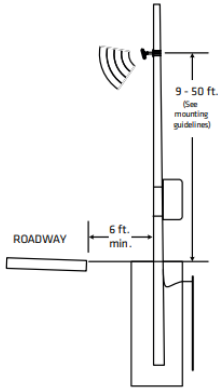


TIRTL - CEOS



FLIR Thermicam with its output





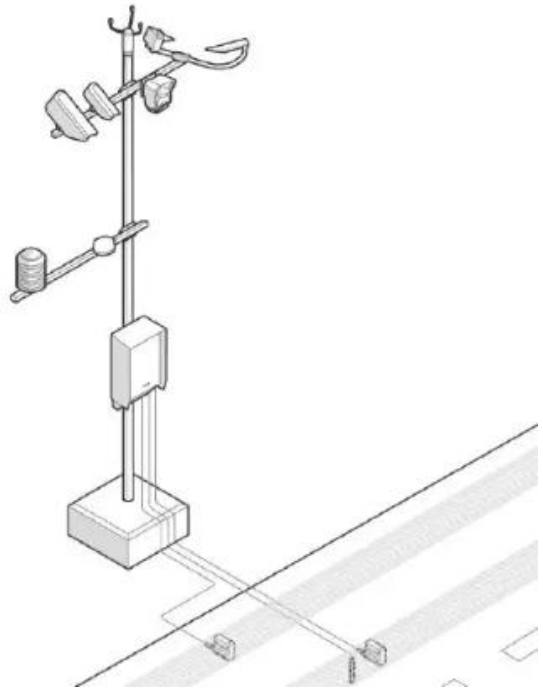
Wavetronix Smart Sensor HD

Intelligence – Environmental Monitoring

- The location vary depending on the weather conditions frequently experienced in the local area
- Input to VSL weather-based control algorithms and real-time traveler information systems
- Associated structures, electrical switchboard, mains power, comms cabinet and comms medium
- Wind speed, wind direction, rainfall intensity, visibility, surface friction indicator, temperature and humidity
- Weather detectors types
- Road sections such as bridges that are more vulnerable to inclement weather conditions
- Approval from the Department, or test certification from a NATA accredited test laboratory
- STREAMS compatibility

Intelligence – Environmental Monitoring

Smart Motorways Technologies (Department of Transport and Main Roads)



RWS200-M211608EN-M-Installation Manual | PDF | Electrical Connector | Electrical Wiring

Elements Lite | Vaisala

Intelligence – Incident Detection

- Automatically detect the occurrence of incidents on the motorway

- Stopped vehicle, wrong way vehicle, speed change, queuing vehicles, pedestrian or animal on the road, fallen objects or debris (smoke and flame detection)

- Associated structures, electrical switchboard, mains power, comms cabinet and comms medium, field processor

- Vehicle volume and speed, lane occupancy, and classification data

- Incident detection technologies (image processing systems and traffic data algorithms), radar-based systems

- High-risk area, or on a motorway route with no emergency lane. Full (100%) coverage of the motorway at all times, capability to immediately and accurately detect and report an incident. Vehicle detection and CCTV equipment support the incident detection

- Approval from the Department, or test certification from a NATA accredited test laboratory. STREAMS compatibility

Intelligence – Incident Detection

- Reliability of the detection of incident events (i.e., false alarm rate) and the timeliness of detection are important considerations
- Queue detection algorithms use incident detection radars and other intelligence to identify the back of a queue (BoQ) in real-time.
- Queue protection using the incident detection sensors detect, warn, and manage traffic approaching congested areas or roadworks.

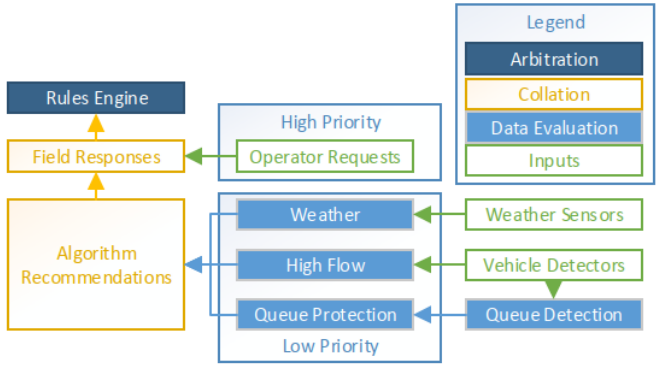


Figure 1 - Overall algorithm architecture

- Embedded dual AI Deep Learning
- Optical IP Camera with Embedded AI Deep
- Dual-vision camera

Intelligence – Help Phones

- Help phones provide road users with a method of directly contacting motorway operators to facilitate assistance or report incidents such as a crash or disabled vehicle

- Assist in decreasing the time taken to report incidents

- Located in emergency stopping bays

- Practitioners should refer to local jurisdictional policy and guidelines regarding requirements for installation of help phones on smart motorways

- Typically, a desirable spacing for urban motorways is 1km, providing a maximum walking distance of 500m

- Media Statement issued on 20th September 2024: Roadside Help Phones to be decommissioned across SEQ

Roadside Information - VMS

- Variable message sign is part of the overall traffic management system utilising STREAMS to manage traffic on the road network
- Shall allow variable graphical and textual information, 3 x display unit sizes
- Components are VMS controller, sign face, LEDs, LED matrix boards, pixel arrangements
- Capable of displaying 3 lines of 18 characters per line as specified in AS 4852.1 or capable of displaying 3 lines with the exception of only 8 characters per line compliant to AS 4852.1
- Associated structures, electrical switchboard, mains power, comms cabinet and comms medium
- VMS display shall be either be capable of displaying Monochrome (Yellow) or 4 Colour (Yellow, White, Red and Green) compliant with AS 4852.1
- Test certificates from a NATA accredited or NATA endorsed by Mutual Recognition laboratory
- Principles for VMS Message Displays, be conspicuous, legible, and comprehensible

Roadside Information - VMS

VMS Port Of Brisbane : Aldridge Electrical Industries

Roadside Information – Travel Time Calculation

- VMS displays travel time messages. This information is a 'snapshot' of travel time along the motorway based on the mainline speed data from each detector location

- A research by Austroads demonstrates information is considered to be useful to both regular road users (travel time information) and 'infrequent' road users (colour-coded information)

- A real-time information calculated in a number of ways:

1. using mean/average speed data from vehicle detectors, and detector spacing to provide segment length
2. using derived travel times from devices such as e-tag readers or Bluetooth readers

- Sites should be located as close as practical to the reference points

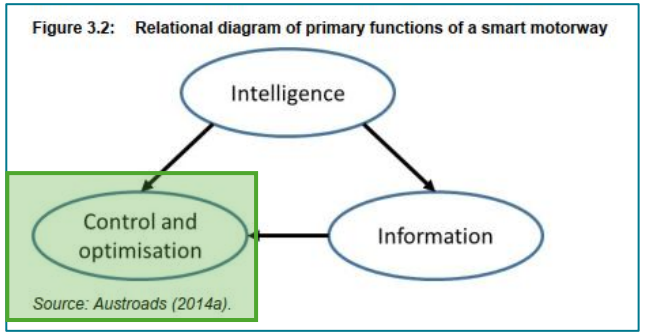
- Travel times for route segments are then amalgamated to calculate the following values between the sign location and the signed destinations: Nominal travel time (NTT) in minutes, Estimated travel time (ETT) in minutes, The motorway condition, The colours (green, yellow or red) of the displayed motorway condition and travel time values

Roadside Information – Travel Time Calculation

Image Source: TMR Roadside Installation

Control - Lane Use Management and Variable Speed Limit Signs

Primary Function of Smart Motorways



Typical QLD Permissible Frames

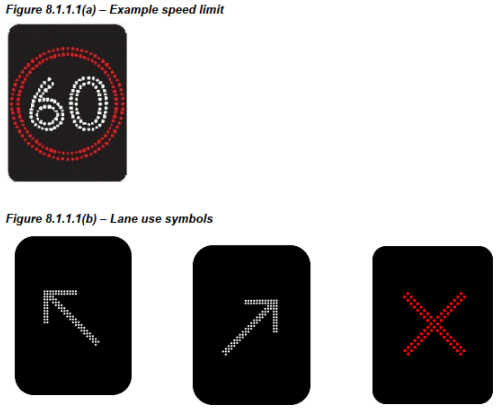


Image Source: MRTS206 July 2025

Typical QLD VSLS Installation

Image Source: https://www.tmr.qld.gov.au/travel-and-transport/road-and-traffic-info/smart-motorways/smart-motorways-technologies

Example QLD LUMS Installation

Image Source: QLD Roadside Installation of LUMS

Control – LUMS and VSLS

Figure 12.1.1 – Comparison of LUMS layout with typical worksite traffic management

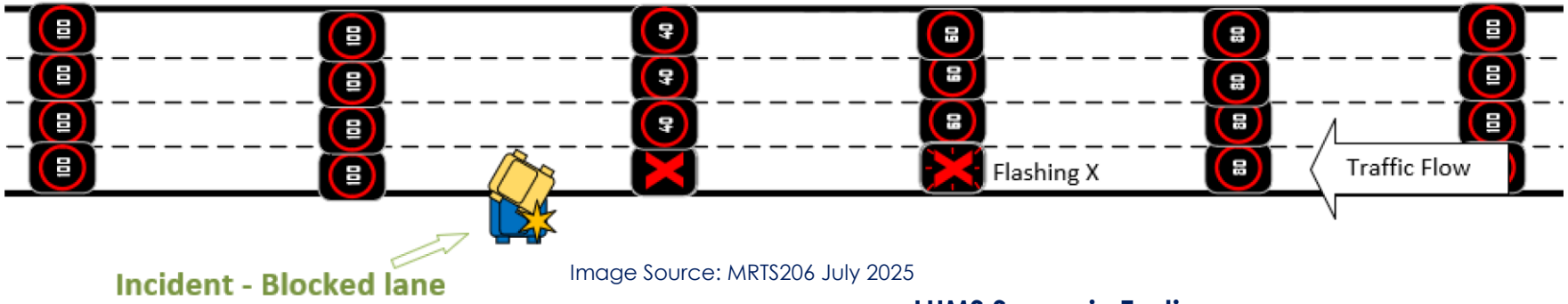


Image Source: MRTS206 July 2025

Example Permissible Frame Combinations

4.2.1 Table 3 – Standard Combinations

TEST	LANE 1	LANE 2	LANE 3
1	○	○	○
2	✕	✕	✕
3	✕	✕	#1
4	✕	#1	#1
5	#1	✕	✕
6	#1	#1	✕

Image Source: Project Example

LUMS Scenario Testing

Image Source: https://www.trafflec.com.au/wp-content/uploads/2019/06/Trafflec-portfolio.jpg

Control – Queue Detection/Queue Protection

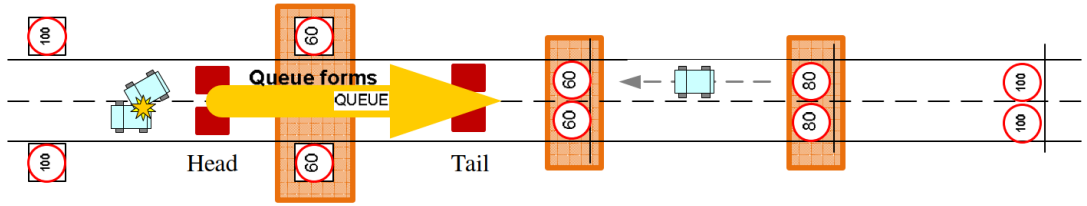


Figure 4 - QD/QP Operating Concept

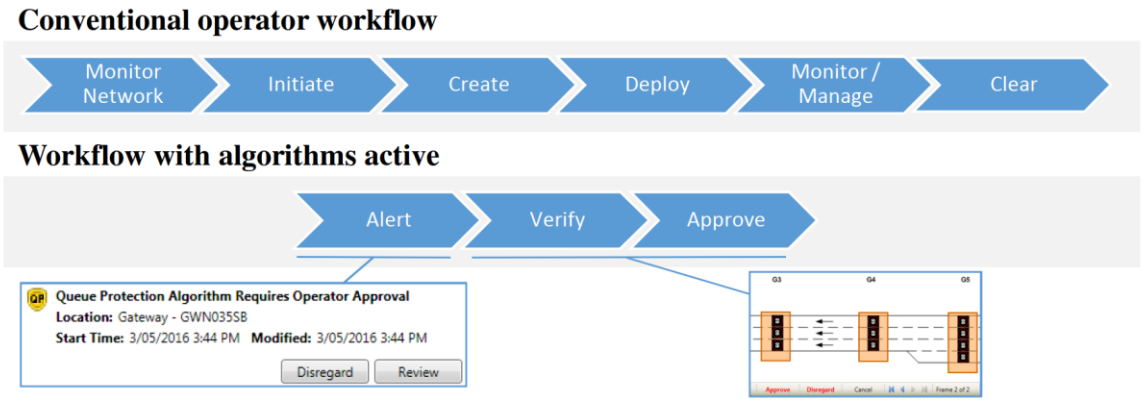


Figure 5 – Comparison of Workflow with and without algorithms active

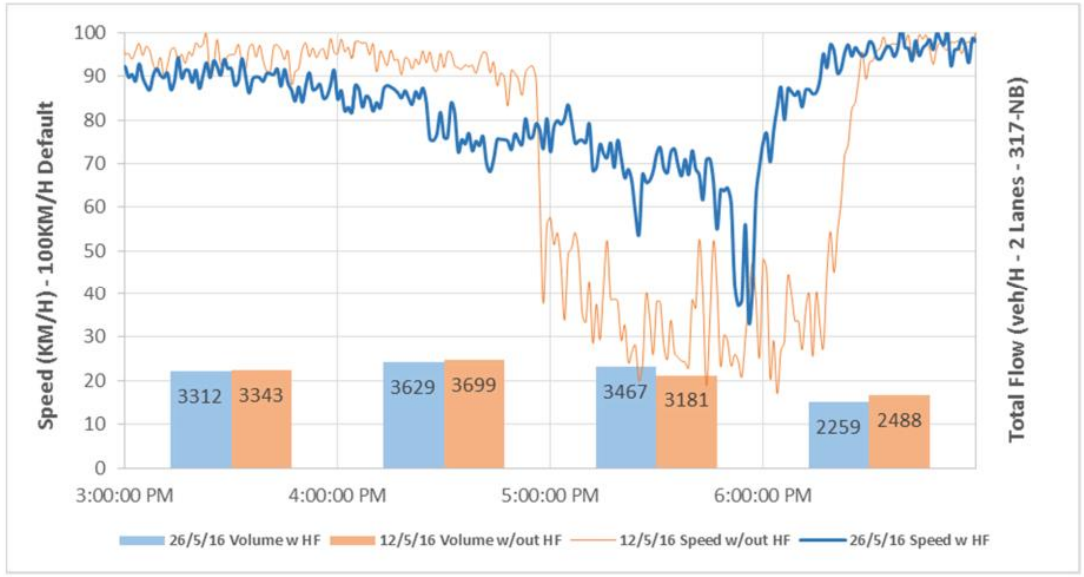


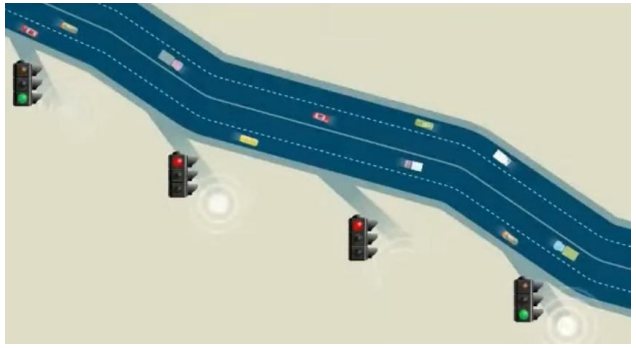
Figure 7: Indicative Speeds with High Flow Active Vs Regular Day

Images Source: Lee, Brook, Queue Detection and Queue Protection algorithms - Automating motorway queue management, 23rd ITS World Congress, Melbourne, Australia, 10–14 October 2016

Control - Ramp Signalling/Metering

Ramp Signalling Advanced Warning

Ramp Signalling Co-ordination



Ramp Signalling Benefits

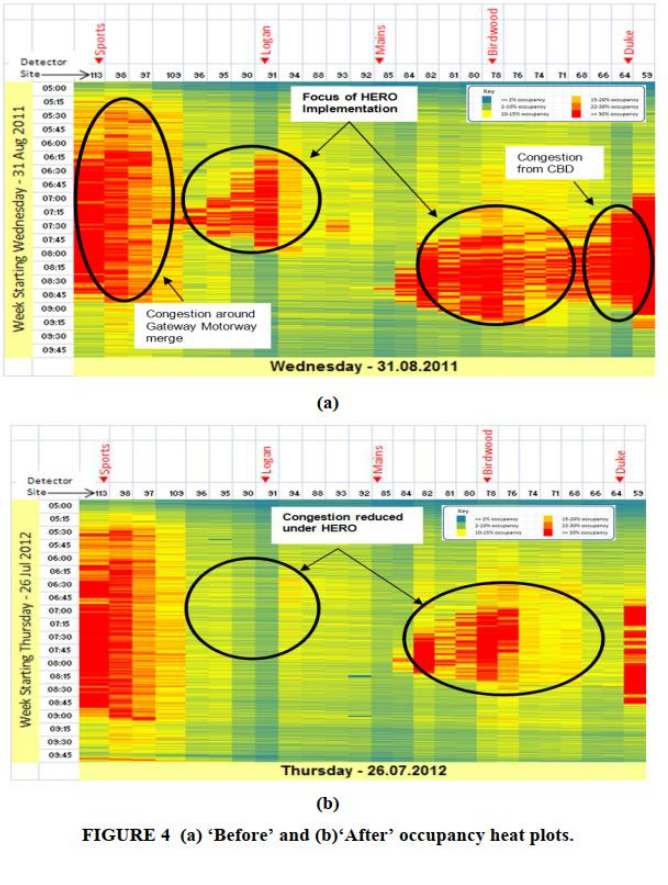
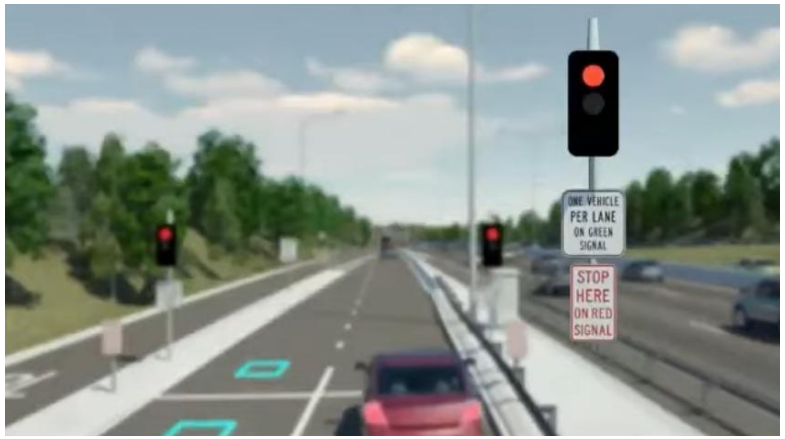


FIGURE 4 (a) 'Before' and (b)'After' occupancy heat plots.

Ramp Signalling Display



Ramp Signalling Installation

Image Source: https://www.tmr.qld.gov.au/travel-and-transport/road-and-traffic-info/smart-motorways/smart-motorways-technologies

Image Source: Faulkner, Dekker, Gyles, Papamichail and Papageorgiou, Evaluation of HERO Coordinated Ramp Metering Installation at the M1/M3 Freeway in Queensland, Australia

Control - Ramp Control Signs/Ramp Information Signs

Ramp Control Sign Layout

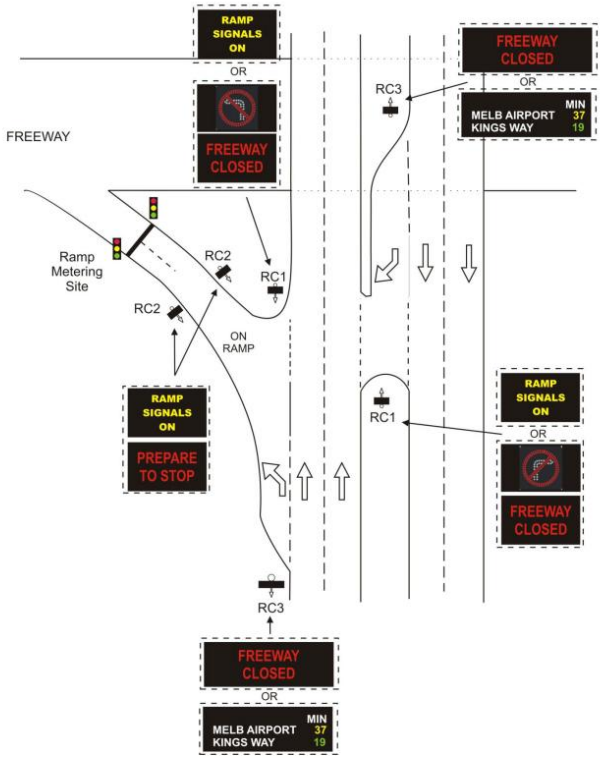


Figure 1.1 – Typical Layout for RC1, RC2, ad RC3 Signs, Arterial Road to Freeway

Image Source: Vicroads TCS003 2023

Example RC2 Sign

Image Source: Project Example

Example RC3 Sign

Image Source: Project Example

Enabling Infrastructure – Conduits, Pits and Cabinets

Image Source: https://astelec.com.au

Pit and Conduit Installations

Image Source: https://triunderground.com.au/

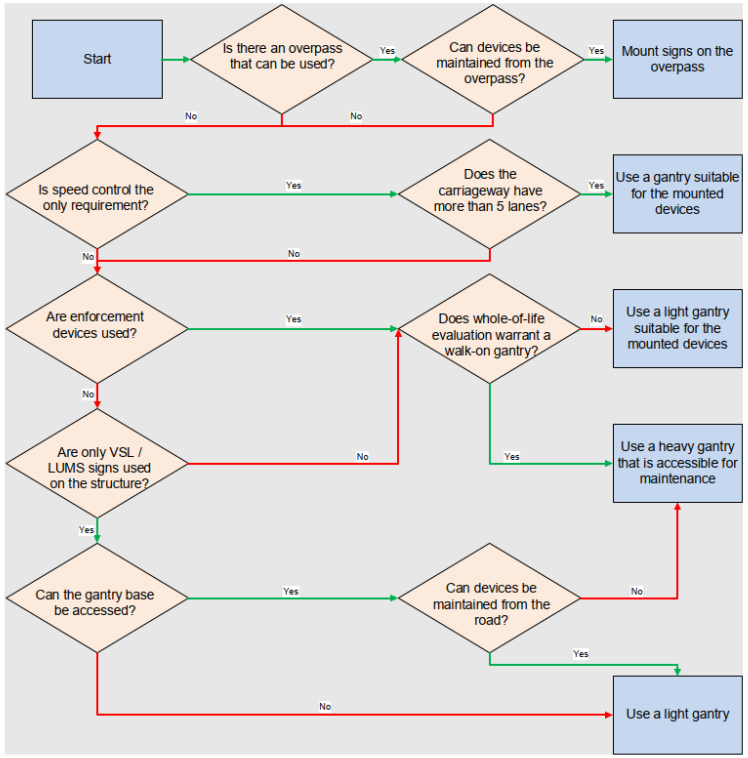
Image Source: Project Photo

Example Roadside Cabinet

Image Source: https://www.trafflec.com.au

Enabling Infrastructure – Structures

Figure 12.4.6 – Determination of Gantry Type for ITS Devices



Queensland Guide to Smart Motorways, Transport and Main Roads, March 2024 19

Mounted on Overpass

Heavy Gantry - Accessible

Lightweight - Cantilever

Lightweight - Shared

Lightweight – 5-lane

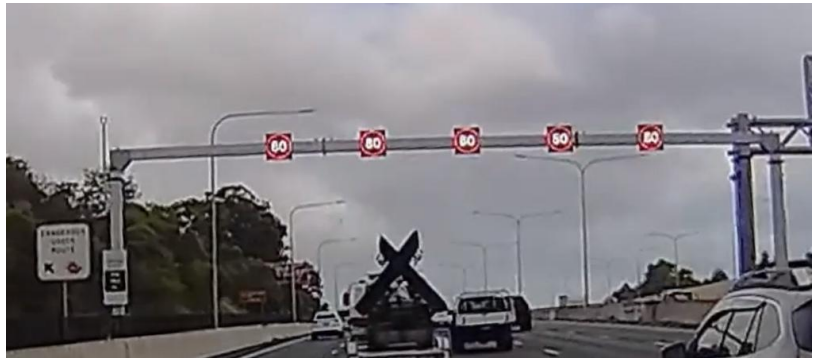


Image Source: TMR Roadside Installation of LUMS and https://www.tmr.qld.gov.au/travel-and-transport/road-and-traffic-info/smart-motorways/smart-motorways-technologies#video2

Foundation Infrastructure – Power and Communications

Fibre Optic Installation

Image Source: https://www.roccomms.au/optical-fibre-hauling/

Fibre Optic Breakout

Image Source: https://astelec.com.au

Fibre Optic Joint

Image Source: https://astelec.com.au

Communications Cabinet

Image Source: https://astelec.com.au

EQL Transformer and Pillar

Image Source: http://www.cb.com.au/urban-infrastructure

Uninterruptable Power Supply

Image Sourcehttps://www.logixeng.com.au/

Supporting Systems

Traffic Management Centre

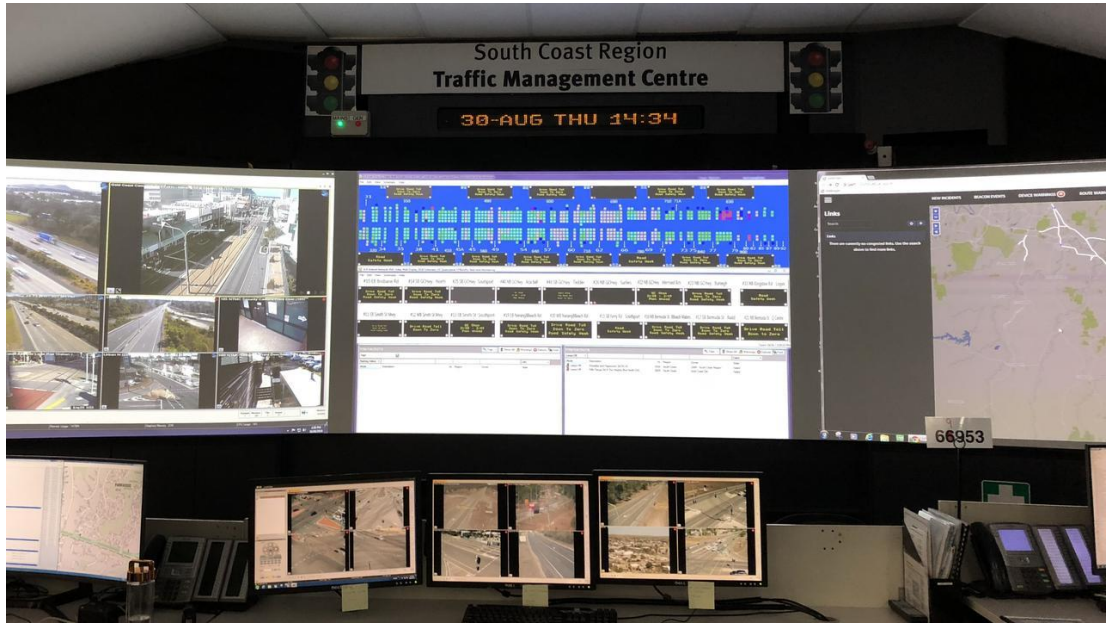


Image Source: Gold Coast Bulletin

Transmax STREAMS Schematic

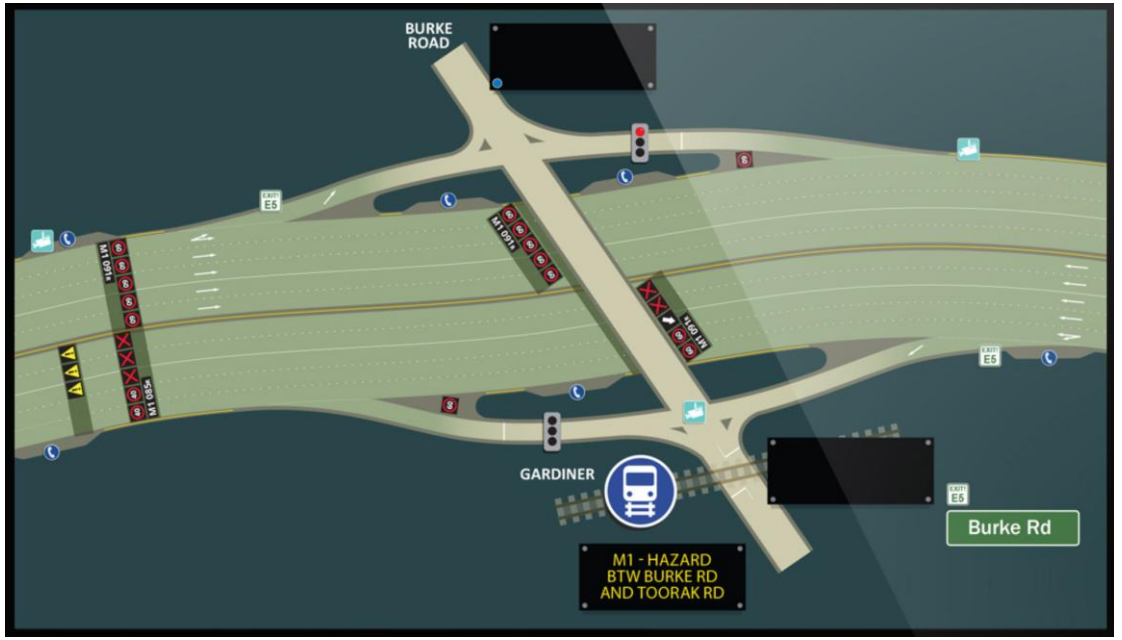


Image Source: https://transmax.com.au/

Future of Smart Motorways

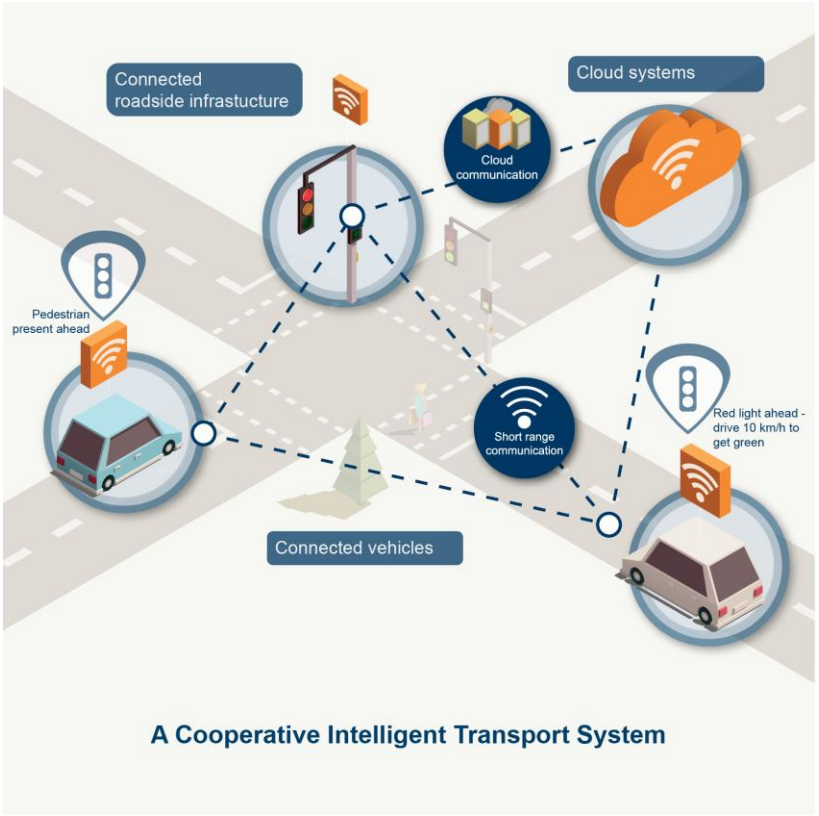
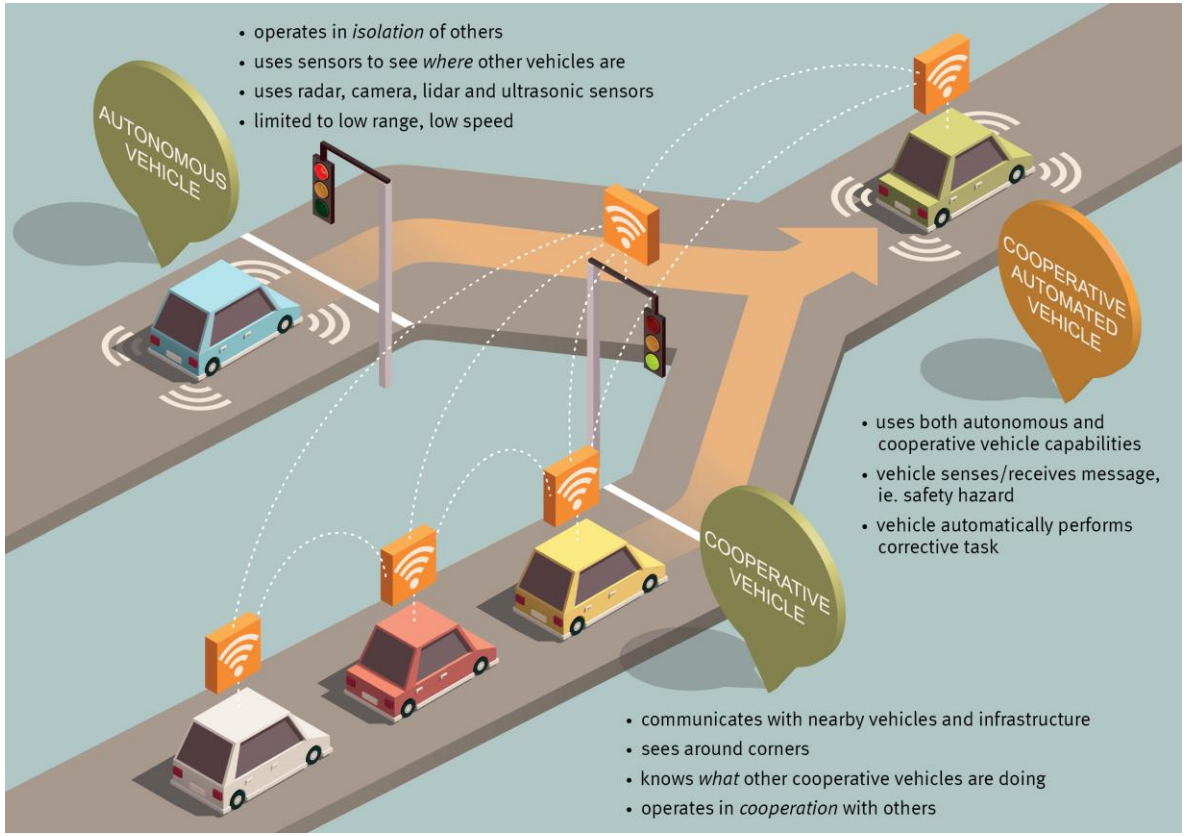


Image Source: https://www.qld.gov.au/transport/projects/cavi/connected-vehicles



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