Managed Freeway Guidelines

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1. About these Guidelines

These guidelines accompany internal policies for managed freeways, providing more detailed information about managed freeway tools and when they are best applied.

2. What is a Managed Freeway?

The managed freeway of today brings together complementary technologies to achieve the best performance from the road infrastructure. The following series of graphics shows how the suite of managed freeway tools contributes to a fully managed environment combining intelligence, control and information.

Note that the series of images do not relate to the same situation, but illustrate a range of capabilities of the tools.

Refer to the following figures.

Figure 2.1: On approach to the freeway, the road user is able to make an informed decision about route choice.
Figure 2.2: Freeway Ramp Signals control access to the freeway to minimise the risk of congestion due to flow breakdown. Vehicle detectors enable adaptive operation of the ramp signals and CCTV cameras allow for monitoring of traffic conditions.

Figure 2.3: Variable Message Signs on the freeway provide information to road users; in this case the reason for reduced speed limits and the action required (merge right).
2.1. Designing, Operating and Maintaining Managed Freeways

‘Planning for Operations’ is the key principle behind this guideline, focusing on improving traffic flow reliability. The principle is achieved through:

- understanding network demands;
- understanding network capacity and constraints;
- considering lane balance and configuration relative to segment level demands;
- adopting design features for lower speed peak period operations;
- providing sufficient queue storage where entry-ramp demand is restrained;
- improving access to travel information;
- affording priority to special users;
- understanding the safety, community and economic priorities for trip types, mode and access;
- developing and testing operational strategies; and
- identifying local constraints and limitations that warrant the provision of additional road space or infrastructure works.

The active management of urban freeways requires a commitment to ongoing operational efforts to manage and optimise the performance of the freeway. These operational efforts are central to sustaining and building upon the benefits achieved through the application of managed freeway tools.

Note that not every freeway needs to have every component of managed freeways, for instance lane use management may not be required on some sections of freeway in the short and medium term. There are some dependencies, particularly with regards to real-time data availability. These dependencies are set out in the relevant sections of this document.

Sustainable asset management is essential for the ongoing success of a managed freeway. In specifying assets and their installation, whole of life costs need to be considered in both financial and economic (road user impacts) dimensions. Occupational Health and Safety also needs to be considered, as part of the design of a safe workplace for maintenance staff.

Project costs associated with managed freeways must include operational and maintenance costs.

Figure 2.4: Integrated speed and lane use management assists safe operation that maximises efficiency and productivity of the freeway.
2.2. Intelligence

The intelligence function is the foundation of the managed freeway, informing the control and information functions as well as performance monitoring (including outcome monitoring).

**Vehicle detection equipment (Freeway Data Station – FDS)**

Vehicle detection equipment provides volumes, speed, occupancy (density) and vehicle classification on a lane by lane basis. The information is the basis of monitoring and control for the freeway and is made available to third parties for incorporation in commercial applications.

**CCTV**

CCTV provides vision of the freeway, enabling more detailed assessment of conditions than provided by vehicle detection equipment. This is particularly useful for managing unusual conditions such as incidents and planned events. This is also a useful tool in congestion management, such as for the assessment of queue lengths and conditions on arterial roads on the approach to the freeway as well as the ongoing optimisation of tools such as coordinated freeway ramp signals. CCTV images are also shared with key incident and emergency management partners.

**Incident detection capabilities**

This can take the form of either direct detection of incidents (e.g. image processing systems) or algorithms applied to traffic data.

**Help phones**

Help Phones enable motorists to advise the Traffic Management Centre of incidents or broken down vehicles. As many drivers have access to mobile phones, the standards now require fewer help phones than previously provided.

**Environmental Monitoring**

This equipment monitors environmental conditions such as temperature, wind speed and water levels. Where appropriate it can also directly activate equipment such as pumps and warning signs.

**Travel time tracking equipment**

This equipment tracks vehicle movements for travel time calculations. It is also useful for determining origin-destination patterns.

Data derived from the intelligence function has maximum benefit when used in conjunction with data from other sources, such as weigh-in-motion (WIM) and arterial road data. Storage, access and integration of data therefore require a coordinated approach and are to be considered as part of the Central Systems and Infrastructure function (Section 4).

2.3. Control

The control function uses the information from the intelligence function to optimise freeway performance, maximising safety, reliability and capacity.

**Freeway Ramp Signals (FRS)**

Freeway Ramp Signals (FRS) manage access to the freeway, to prevent capacity being exceeded (and subsequent flow breakdown), by breaking-up platoons of entering vehicles to avoid overload of the merge area. FRS are most effective when implemented as a corridor-wide adaptive system (coordinated ramp signals), providing full control of the freeway and allowing effective management of queues at entry ramp signals.

**Variable Speed Limits (VSL)**

Variable Speed Limits (VSL) can assist in maximising safety in adverse conditions, such as high winds, roadworks and incidents. VSL can also assist in maximising capacity during heavy demand – this is best achieved in conjunction with Freeway Ramp Signals. Careful coordination of FRS and VSL is required to achieve optimum outcomes and FRS will perform the primary control function. VSL can also be provided as part of an integrated Speed and Lane Use Management System.

**Lane Use Management**

Lane Use Management of urban freeways refers to the allocation and management of available road space to achieve desired performance outcomes. The most common application for urban freeways is expected to be Integrated Speed and Lane Use Management; other applications can include dynamic use of the shoulder for exit queue storage and priority applications for specified road user classes.

2.4. Information

The information function assists road users with making informed decisions about their travel, for instance route choice and time of travel. Field provision of information is particularly important during unusual conditions such as incidents. An overall traveller information strategy for potential freeway users should consider three time periods for the provision of information:

- pre-trip (e.g. before leaving home or work)
- en-route but before entering the freeway
- en-route, after entering the freeway.

**Real Time Information Signs (RTIS)**

Real Time Information Signs (RTIS) are variable message signs located on arterial roads on the approach to freeway entry ramps. These signs provide travel times and other freeway condition information and enable motorists to make route choice decisions before entering the freeway.
Variable Message Signs (VMS)

Variable message signs (VMS) allow information to be conveyed to motorists once on the freeway. This information can warn them of hazards or disruptions and detail action for them to take (e.g. merge left). VMS can also assist road users to make informed decisions on route choice based on real-time conditions and future significant events. VMS on arterial roads can also be used to provide details of freeway conditions to motorists before they enter the freeway.

DriveTime Information

DriveTime Information is a VicRoads format for travel time information. Once on the freeway, this is provided on both VMS and a specialised form of VMS (Trip Information Signs and Trip Condition Signs).

Freeway Condition Information

Freeway Condition Signs are single word electronic signs indicating traffic conditions or closures on the freeway and are inserted into direction signs. These provide en-route information before drivers enter the freeway. RTIS and Advance RTIS also provide freeway condition information, and are now current practice, replacing Freeway Conditions Signs.

Website

Website travel information is generally for the pre-trip stage and should form part of a broader network-wide travel information strategy.

Radio

Radio messages can reach road users both before and during the trip. This makes them a powerful communication tool, but VicRoads has limited control over the content and timing of messages. Tunnel environments in Melbourne already have radio re-broadcast facilities, enabling the control room to take over the broadcast when necessary.

In-car systems

The use of in-car navigation systems with dynamic routing information is growing: within five to ten years (e.g. 2020) this technology is expected to have a high penetration rate within Australia.

CCTV on Website

Images on the VicRoads website from a network of dedicated fixed CCTV cameras provide a visual indication of freeway conditions at selected locations.

2.5. Foundation Systems and Infrastructure

The foundation systems and infrastructure are necessary to permit the successful implementation of the managed freeway.

The move towards fully managed freeways throughout the urban area provides important guidance for the provision of enabling infrastructure. Where changes to the control system or additions to communications or power systems are required, these should be made keeping in mind the longer term requirements for the system or the corridor.

Control System

The functionality of the managed freeway relies on the ITS control system (i.e. software). An integrated software platform becomes particularly important as the number of tools increases along with their interdependency. VicRoads has committed to an ITS platform based on the principles of Service Oriented Architecture. Many of the functions referred to in this document will already be provided for within the software procured by VicRoads, but some may require further software development activity.

Communications System

Communications underpins ITS as it does much other information technology. With increasing density of ITS assets in freeway corridors and as we build towards fully managed freeways, it becomes increasingly beneficial to have high quality communications such as fibre optic cable within the freeway corridor. High-capacity communications infrastructure is also a key enabler for future Vehicle Infrastructure Integration initiatives (communication between vehicles and the roadsides).

Power System

A reliable power supply is necessary for the successful operation of ITS. Similar to communications, the increasing density of ITS assets in freeway corridors means that power supply should be considered on the basis of the freeway corridor in addition to the option of individual connections.

Traffic Management Centre

The Traffic Management Centre (TMC) plays a key role in active management of the freeway network and interacts with all the management tools. Expansions of managed freeways need to consider impacts on the TMC, including the capabilities and resources needed for ongoing management and optimisation of these facilities.
3. Field Infrastructure for Managed Freeways

The provision of field infrastructure for managed freeways needs to prioritise management tools to locations where most needed. For existing freeways, it is recognised that the addition of management tools is constrained by available funding. Prioritisation of rollout of the field infrastructure should be based on maximising the return on available funding.

3.1. Foundation Systems and Infrastructure

The provision of supporting infrastructure such as conduits for communications and power are long term investments where the cost of retrofitting is much higher than provision during initial construction or a major reconstruction. Accordingly, this supporting infrastructure is recommended for all urban freeways. The limits of urban freeways are considered to be as follows.

- M1 Princes Freeway West: C109 Geelong Rd in Little River
- M1 Princes Freeway East: C422 Healesville – Koo Wee Rup Rd, Pakenham
- M2 (43) Tullamarine Freeway: wholly within urban limits
- M3 Eastern Freeway and EastLink: wholly within urban limits
- M3 Frankston Freeway: wholly within urban limits
- M8 Western Freeway: Brooklyn/Harkness Rd, West Melton
- 11 Mornington Peninsula Freeway/Peninsula Link: Frankston-Flinders Road in Baxter
- M31 Hume Freeway: B75 Northern Highway, Wallan
- M79 Calder Freeway: Gap Rd, Sunbury
- M420 South Gippsland Freeway: wholly within urban limits
- M780 Western Port Highway: North Road, Langwarrin.

These limits are based on the Metropolitan Urban Boundary. As a guide, freeways that are likely to be urban within 20 years or are likely to carry an average weekday peak direction traffic volume exceeding 1200 pcu/h/lane within 20 years (even if non-urban) should incorporate conduits along the main carriageway to enable provision of fibre optic communications and electric supply.

Freeways that are likely to be urban within 20 years or are likely to carry an average weekday peak direction traffic volume exceeding 1700 pcu/h/lane within 20 years should incorporate a geometric design suitable for ramp signals, all lane running (including stopping lanes as running lanes), and managed freeway operation.

The conduit network should also include a second physical path along the main carriageway if Lane Use Management is likely to be installed.

3.2. Vehicle Detection Equipment – Freeway Data Stations (FDS)

Freeway Data Stations (FDS) provide volumes, speed, occupancy (density) and classification data on a lane by lane basis. The information is the basis of monitoring and control for the freeway. Details related to detector accuracy are given in VicRoads Freeway Ramp Signals Handbook.

For all freeways with an average weekday peak direction traffic volume that exceeds 1200 pcu/h/lane, or where freeway ramp signals are installed, FDS are recommended with detectors in all lanes at specific locations (including entry and exit ramps); based on operational experience, the following locations have been found to provide the data required to enable real-time control:

- just upstream of all entry ramp noses (separate detectors for ramp and mainline traffic);
- just downstream of all exit ramp noses (separate detectors for ramp and mainline traffic);
- at the end of all entry ramp merges (generally 320m downstream of the nose for a single lane merge); this is the primary mainline site for ramp metering control;
- potential bottleneck locations where traffic flow needs to be managed, such as just downstream of lane drops, on steep upgrades, tight curves and road narrowing, e.g. no shoulder, narrow lanes or at bridges; and
- remaining locations typically to ensure spacing not exceeding 500m (approx) along the full length of the freeway.

For other freeways where the average weekday peak direction traffic volume exceeds 600 pcu/h/lane, FDS are recommended with detectors in all lanes for performance monitoring at all entry and exit locations and at an average spacing of 2km. This reduced level of provision provides for performance and outcome monitoring, travel time information, and a level of problem identification/incident detection but is not suitable for real-time control. At entry and exit locations, FDS are to be installed:

- just upstream of all entry ramp noses (separate detectors for ramp and mainline traffic); and
- just downstream of all exit ramp noses (separate detectors for ramp and mainline traffic).

New installations of FDS should be based on technologies which minimise whole of life costs, including traffic management costs of installation and maintenance.

FDS should also be installed on entry ramps and main carriageways as required, for Freeway Ramp Signals/Coordinated Ramp Signals, and considered for exit tapers and ramps where traffic may queue back into the freeway main line.
3.3. CCTV

For all freeways with an average peak direction traffic volume that exceeds 1200 pcu/h/lane, CCTV cameras are recommended to provide full coverage of the freeway. The cameras should provide full overlapping coverage of both carriageways and also aim to incorporate video coverage at any key freeway interchange and of ramps with Freeway Ramp Signals, including arterial road approaches to the ramps.

A camera spacing of approximately 1.5km to 2.0km will generally fulfil the requirements for CCTV cameras on straight freeways, however cameras should be located to ensure that coverage is complete and unobstructed. A closer spacing will be required on freeways with curved alignments or where enhanced monitoring is required. Note that this camera spacing is based on the use of cameras that are capable of full pan, tilt and zoom (PTZ) operation. CCTV cameras should also be placed within 200m of each Variable Message Sign for reviewing messages.

For other freeways where the average weekday peak direction traffic volume exceeds 600 pcu/h/lane, CCTV cameras are recommended to be provided at interchanges.

Refer to the following figures.
3.4. Help Phones

Help phones may be installed to provide motorists with an alternative mean to contact the VicRoads Traffic Management Centre or road operator for assistance where ready access to public phone is not available. When help phones are provided, the following guideline is recommended.

Help phones nominal spacing:

(a) 3 km on urban freeways with full CCTV coverage
(b) 2 km on urban freeways without full CCTV coverage
(c) 5 km on rural freeways
(d) 120 m in tunnels.

The average spacing along a length of freeway should achieve this nominal spacing within a tolerance of 10%.

Apart from tunnels, individual spacing may be up to 1 km more or less than the nominal in order to minimise the need for pedestrians to cross ramps to get to a Phone, or to avoid other practical restrictions on placement of the Phones.

Help phones should be installed in pairs, directly opposite each other in the following configuration:

- install phones on the left hand side of the carriageway only where there are up to two full-time running lanes per carriageway
- install phones on the left and right (median) sides of the carriageway where there are three or more full-time running lanes per carriageway
- locate phones such that a pedestrian may access a telephone without the need to cross a freeway ramp
- space phones in tunnels at intervals of 100-150 metres to provide a higher level of service. Both left and right-hand installations are required to avoid the need for pedestrians to cross running lanes
- locate phones so that a road user would not be standing closer than 3.0m to the traffic lane to use the phone (e.g. no emergency stopping lane), and consider widening the area to provide for greater safety and access for mobility impaired persons (refer Standard Drawing SD2091)
- provide phones for all permanent Emergency Stopping Bays.

It is recommended that communications solutions for new help phones be designed to minimise whole-of-life costs and reflect the low frequency of calls from most of these phones.
3.5. Environmental Monitoring

In certain circumstances, environmental monitoring and control systems may be appropriate because of the prevailing weather conditions at the location. On certain freeways in Victoria, ice detection and warning systems and weather stations have been implemented to advise drivers of possible traffic hazards (such as fog, ice, high winds and/or flooding) and to improve road safety. The West Gate Bridge has an environmental monitoring system which includes monitoring of wind speeds and is an example where environmental conditions are an input to a control function, in this case variable speed limits.

Given the breadth of applications, limited general guidance is available for environmental monitoring systems, and provision is to be on the basis of benefits and costs of individual proposals. Proposals related to ice must consider the Black Ice Management Policy.

3.6. Travel Time Tracking Equipment

This equipment tracks vehicle movements for travel time calculations. It is also potentially useful for determining origin-destination patterns and hence understanding the patterns of demand on the freeway and road network. It is possible that this equipment will leverage assets already provided as part of Freeway Data Stations.

A number of technology options are available however this tool is still in development for the context of a managed freeway and is considered a possible future requirement.

3.7. Freeway Ramp Signals (FRS)/Coordinated Ramp Signals (CRS)

Freeway Ramp Signals or Coordinated Ramp Signals are traffic lights that manage freeway traffic flow by metering the flow of traffic entering a freeway. The use of ramp signals is known as ramp metering and provides an effective means of managing and optimising freeway flow to minimise the likelihood of mainline traffic congestion and to provide stable and reliable travel. This stable traffic flow and improved merge conditions contribute to improved safety. Ramp signals necessitate freeway data stations and CCTV along the freeway.

Importantly, the efficiency benefits achieved through the avoidance of flow breakdown mean that total journey times should be lower than in the unmetered situation. At locations where ramp queues formed prior to the installation of metering, ramp waiting times may also reduce although public perceptions may not reflect this.

There are two types of ramp signals installation:
- isolated metering of a single entry ramp
- coordinated route-based treatment, providing effective control of the freeway by metering all entry ramps and allowing effective management of space available for queue storage.

Isolated metering has only limited applicability in the Melbourne urban environment, and a route based treatment will be required:
- where the congestion and flow breakdown is occurring over a length of freeway; or
- where flow breakdown occurring at a particular location cannot be addressed by an isolated ramp meter, i.e. the freeway flow causing the flow breakdown results from a combination of a number of upstream entry ramps.

It is important to note that in a route based treatment, even those individual entry ramps that do not meet the criteria for isolated ramp signals require metering. If this complete treatment is not provided, access equity cannot be achieved and rat-running behaviour will be encouraged. Access equity is the balancing of queues across ramps and efficient utilisation of available storage space.

Ramp signals are recommended for provision:
- to complete route-based treatments where upstream or downstream ramps along the freeway are currently metered;
- where the average weekday peak direction traffic volumes are 1700 pcu/h/lane or more for the freeway mainline between interchanges; or
- where analysis indicates that flow breakdown already occurs on the freeway regularly (once per week) and traffic volumes are less than 1700 pcu/h/lane.

The Freeway Ramp Signals Handbook shall be used for the design of ramp signals installations. Ramp signals sites include ramp control signs to advise motorists of the status of the signals and to restrict access to the freeway if necessary.
3.7.1. Freeway to Freeway Ramps

Ideally new freeways and freeway upgrades should incorporate balanced carriageway capacities - so that freeway to freeway connections have adequate capacity, taking into account flows entering from arterial road ramps controlled by ramp signals. In this ideal situation, freeway to freeway connections, either as main carriageway merges or as entry ramps from other freeways, should be able to operate as free-flow, without ramp signals.

The ideal situation is not always achievable due to limited carriageway widths or very high freeway to freeway ramp flows. Where ramp signals on arterial road entry ramps alone cannot keep main carriageway flows below levels likely to cause flow breakdown, ramp signals on entries from other freeways may be necessary. Ramp signals on freeway (and arterial) entries are required when the peak traffic volume on the carriageway downstream of the entry ramp exceeds 1700 pcu/hr/lane or the freeway regularly (once per week or more) experiences flow breakdown. Hence freeway to freeway ramps have the same provision requirements for metering as any other ramp, as detailed in VicRoads Freeway Ramp Signals Handbook - Section 4.

As with coordinated ramp signals generally, freeway to freeway ramp signals must operate in concert with other ramp signals and only when necessary, to prevent main carriageway flow breakdown.

Factors relevant to freeway to freeway connections include:
- the range of flows likely to occur on the connection, and the number of stand-up lanes needed to accommodate these if ramp signals are installed;
- the storage needed at freeway to freeway ramp signals to prevent queues from backing onto the upstream main carriageway;
- provision of variable speed limits and advisory signs approaching freeway to freeway ramp signals to control speeds and to prepare drivers to stop;
- using geometric controls to limit freeway to freeway flows to available main carriageway capacities, or lane use management to provide extra capacity downstream of the connection (e.g. all lane running).

The Managed Freeways: Freeway Ramp Signals Handbook provides guidance relating to freeway to freeway connections.
3.8. Variable Speed Limits (VSL)

Variable Speed Limit (VSL) systems can improve road safety and traffic flow by displaying suitable safe regulatory speed limits under different conditions. These conditions can relate to environmental conditions such as wind or rain, incident/event or roadworks conditions, or the density of traffic flow. The use of VSL for roadworks and incident conditions assists in the provision of a safe working environment, but does not remove requirements for additional signs and traffic management measures.

VSL are communicated to motorists by a series of roadside electronic variable speed limit signs. All VSL installations are to have variable signs mounted on the entry ramps to advise entering motorists of the applicable speed limit in the merge area.

VSL can be provided on freeways subject to a business case identifying:
- enhanced safety
- enhanced incident response
- improved capacity.

Overhead mounting of VSL should be considered when the carriageway has:
- four or more lanes, or
- three lanes and a high truck volume (say, more than 1000 trucks/h).

On sections of urban freeway with both VSL and ramp signals, it is expected that ramp signals will play a greater role in optimising productivity, with VSL assisting. VSL would play a primary role in the provision of safe conditions, supported by ramp signals.

3.9. Lane Use Management

Lane use management of urban freeways refers to the allocation and management of available road space to achieve desired performance outcomes.

3.9.1. Priority Facilities

A managed freeway environment includes the objective of stable, efficient traffic flow on the freeway. Consideration should be given to providing separate signalised lanes on entry ramps for priority vehicles, such as public transport, trucks, and high occupancy vehicles on preferred or designated routes, to reduce queuing delays to these vehicles. These priority access lanes can provide significant real (as well as perceived) priority for these road user classes without adversely affecting the overall productivity of the freeway. When freeways terminate on arterial roads which have a capacity deficit (e.g. the Eastern Freeway at Hoddle Street), priority lanes can be considered on the freeway as a form of extended queue jump facility.

3.9.2. Integrated Speed and Lane Use Management System

Integrated Speed and Lane Use Management (LUMS) provides both speed and lane use control over a freeway carriageway through combination lane signals/speed signs. Speed signs above open lanes display the applicable speed limit for the carriageway; lane signals above closed lanes display a red cross. Merge signals are also displayed.

The Managed Freeways Handbook for Lane Use Management sets out placement requirements for LUMS. Note that it is not proposed to use Integrated Speed and Lane Use Management for arterial roads or reversible lane facilities that do not have rigid barriers separating traffic directions.

Figure 3.4: Integrated Speed and Lane Use Management (LUMS)
On urban freeways, LUMS should be considered when:
- the running lanes are signed at the normal operating speed applicable with emergency stopping lanes, but a continuous emergency stopping lane or continuous pull-off area such as a central median is not available, or
- there are more than three running lanes, and a continuous emergency stopping lane or continuous pull-off area such as a central median is not available, or
- lanes (including emergency stopping lanes) are opened or closed dynamically as part of normal operation, or
- speed limits are changed dynamically and there are three or more running lanes.

Real-time management of lane use (for incidents or unusual conditions) is most effective when a reduced speed limit is able to be applied to lanes remaining open. This provides a higher level of safety for persons on the road in a closed lane – such as road workers, incident responders and others directly involved in incidents. Integrated Speed and Lane Use Management (LUMS) provides this combined functionality.

3.9.3. Freeways without Emergency Stopping Lanes
Principles for the deployment of traffic and safety facilities on sections of freeway with no ESL available (either full-time or part-time) are outlined below.
- Minimise the chance of crashes and breakdowns occurring.

The lack of an ESL can increase the risk of crashes involving vehicles stopped or stopping due to a breakdown, and can increase the consequences of any crashes or breakdowns.
- Clear any incidents as quickly as possible.

If an incident occurs in a traffic lane, there will be considerable traffic congestion and a greater chance of secondary crashes.

Managing traffic around an incident
Where an ESL is not available, a broken-down vehicle will adversely impact traffic flows, due to the blockage of a traffic lane and the turbulence caused by drivers changing lanes to get around the obstruction. To avoid the greater chance of secondary crashes, approaching drivers need to be alerted and diverted away from the affected location as early as practicable.

Providing a transition process
Where an ESL operates on a part-time basis, a process must be implemented to ensure that there are no safety risks, such as a stopped vehicle, when the lane changes from an ESL to a traffic lane.

Combined treatments
For sections of freeway without Emergency Stopping Lanes, the following measures should be considered:
- provision of Integrated Speed and Lane Use Management (LUMS)
- emergency stopping bays with Help Phones, typically at 500m spacing,
- vehicle detection for all emergency stopping bays
- CCTV coverage including all emergency stopping bays and any areas under bridges or other structures
- automated incident detection with high sensitivity.

Figure 3.5: Part-time exit queue storage on Western Link exit to Flemington Road
3.9.4. Part-Time Facilities

Part-time facilities may include changed use of a lane (running lane or ESL) at particular times of the day. Extended lengths of part-time lane use by general traffic should normally be managed using LUMS. Specialised applications such as use of stopping lanes for exit queue storage (over short lengths) or by priority vehicles (buses using stopping lanes during peak periods) may be signed without LUMS, provided the conditions are invariant. Any part-time facilities continued across entry and exit points require careful design to ensure safe operation that is easily understood by drivers. See Figure 3.5.

Part-time use of the ESL for exit queue storage can improve safety and traffic flow by relocating stationary vehicles away from moving traffic. In some cases this will formalise arrangements that are current practice at the exit, improving safety by better managing the practice.

Part-time facilities are to be provided only on a needs basis. Exit queue storage treatments should be considered where queues from the exit frequently overflow the exit ramp and suitable arrangements can be implemented.

3.10. Incident Detection

Automated incident detection is recommended for all freeways which have Freeway Data Stations. For some critical lengths of freeway, more intensive applications of incident detection such as video image processing may also be appropriate.

3.11. Real Time Information Signs (RTIS)

Real Time Information Signs (RTIS) provide travel time and condition information for the freeway at the start of the entry ramp. This enables road users to make informed decisions about whether to use the freeway, particularly during incidents or congestion. This type of sign replaces the previous ramp control sign and provides additional capabilities. This sign is referred to as “RC3” on standard drawings for Freeway Ramp Signals.

RTIS are recommended to be placed at all entry ramps with ramp signals. They are also useful where real-time or variable information is communicated to road users but where a full-size VMS is not warranted or feasible.
3.12. Variable Message Signs (VMS)

Variable Message Signs (VMS) provide a range of information to motorists including advice on emergencies, delays, detours, travel times and traffic conditions.

Variable message signs greatly assist with the control of freeway traffic during incidents or emergencies. They provide motorists with the necessary information to allow them to choose alternative routes. The signs also facilitate safer conditions for personnel undertaking road works and maintenance activities.

Variable message signs should be located to advise the maximum number of motorists about general traffic conditions on the freeway and about alternative routes, and to divert traffic from incidents or congestion. The highest priority messages on VMS are those requiring immediate action by the motorist, for example, a diversion due to a crash ahead or merging due to a lane closure.

Signs must be sited far enough in advance of decision points (e.g. exits to other major routes) to allow drivers to read the message, come to a decision, and make any manoeuvres necessary to take advantage of the message. However, they must not be sited so far away that drivers either forget the message or fail to make the connection between the information on the sign and the point on the road to which the sign applies. Experience suggests that 30 seconds is sufficient time to perform all the necessary tasks in comfort in most circumstances, and that 45 seconds is too long.

The general placement requirements on freeway standard roads are:

- VMS should be placed 900-1200m before a major decision point (minimum 300 m)
- successive VMS should be no closer than 1000m
- the minimum distance between a VMS and lane control signs/signals should not be less than 200m.

VMS are recommended to cover all decision points related to interchanges between freeway standard roads. Additionally, where the average weekday peak direction traffic volume exceeds 1200 pcu/h/lane, VMS are recommended at a spacing of no more than 5km in each direction. VMS are also recommended at a spacing of no more than 10km where the average weekday peak direction traffic volume exceeds 600 pcu/hlane.

![Variable Message Sign](image)

Figure 3.7: Variable Message Sign
3.13. DriveTime Information

Historically, Trip Information and Trip Condition signs were installed to provide travel time signage as part of the Drive Time system, showing estimated travel times to various key freeway exits as well as colour-coded indicators to advise of downstream traffic conditions in real-time. Road users can use this information to plan their trips, including decisions about diversions and improved knowledge of likely arrival time. As the system is not predictive in nature, it is not recommended to show distant destinations due to likely changes in conditions while en-route.

On managed freeways VicRoads will deploy VMS which are able to display incident warnings as well as real time traffic information and travel time information. These will supersede Trip Condition Signs (TCS) and Trip Information Signs (TIS) for new or upgraded managed freeways and replace TCS and TIS in the long-term. Where VMS are used as a substitute for DriveTime signs, the display of travel time must incorporate both the number of minutes to that destination and the appropriate colour and wording (or symbolic arrow) for LIGHT, MEDIUM and HEAVY. The need for both types of information has been demonstrated through public comprehension testing.

DriveTime information should be placed to provide advice to the maximum number of motorists about traffic conditions on the freeway. On freeways with an average weekday peak direction traffic volume that exceeds 1200 pcu/h/lane, this information is recommended to be provided on approaches to key decision points and at spacings of no greater than 5km in each direction. However, where TCS and TIS are being replaced by multi-purpose VMS, the design and location principles should be in accordance with the previous section and VicRoads Handbook for Lane Use Management, Variable Speed Limits and Traveller Information.
3.14. Freeway Condition Signs

Freeway condition signs have been installed on major approaches to urban freeways to advise motorists of traffic conditions and closures on the freeway. Freeway condition signs consist of a variable electronic display within a static destination sign (see Figure 3.10). The variable display usually shows a single line message – LIGHT, MEDIUM, HEAVY, CLOSED. The static part of the signs provides guidance to alternative routes.

The freeway condition signs are being replaced by advance Real Time Information Signs (RTIS), allowing the display of more information (see Figure 3.6). Advance RTIS may display information similar to that which would be placed on Variable Message Signs, when appropriate. Advance RTIS may also be able to display information about traffic conditions on alternative routes.

Advance RTIS may also be used in new locations where it is desired to provide information about freeway traffic conditions. Advance RTIS signs are not required in locations where there is no alternative route prior to the freeway and there are RTIS signs at the freeway entry ramps.

Advance RTIS are mounted at the side of the road, and are not generally suitable for advising motorists of conditions that may apply only to the traffic lanes on the far side of the carriageway. In some locations, it may be suitable to provide advance RTIS on both sides of the carriageway, for instance, on divided arterials approaching a full diamond freeway interchange (see Figure 3.11). Advance RTIS should be installed approximately 50 to 100 metres in advance of associated destination signs, thereby separating the more detailed freeway / arterial condition information from the destination sign information.

4. Central Infrastructure and Systems for Managed Freeways

Central infrastructure and systems refers to the equipment and control systems located off-freeway, particularly in and around the Traffic Management Centre. This infrastructure and these systems are shared across all managed freeways and other ITS within VicRoads.

Where managed freeway projects create a requirement for improved capacity, functionality and/or performance of central infrastructure and systems, allowance for funding these improvements must be included within the project TEC.