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Guidelines

for Variable Message Signs

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Guidelines for Variable Message Signs

This document is authorised by the Executive Director Network Operations. Please submit all comments and requests to the Network Operations Planning Manager.

Authorisation

As Executive Director Network Operations I authorise the issue and use of this document *Smart Freeways Operation Efficiency Audit Guidelines.*

MEHDI LANGROUDI

Approved by Executive Director Network Operations

Date: 7 Aug 2025

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Preface

Main Roads policy and guidelines

Main Roads Western Australia's Smart Freeways policy and various guidelines influence overall planning, project development, delivery and ongoing operation of Smart Freeways and routes in Western Australia.

The Smart Freeways documents were originally developed as part of the Managed Freeways Policy Framework in 2012. At that time Main Roads used the term 'Managed Freeways', which was changed to 'Smart Freeways' during the first Smart Freeways project on Kwinana Freeway northbound. Major revisions to these documents were undertaken in 2020 and new versions of the Smart Freeways Guidelines were issued in March 2021. After subsequent years of Smart Freeways projects and operations in Western Australia, further revisions to these guidelines were undertaken in 2024. These new versions of the guidelines were then issued in 2025.

Historically, intelligent transport systems (ITS) on freeways were typically case-by-case. Our current approach is outlined in the Smart Freeways policy, which states that all freeways are considered for ITS provision at either Freeway Type F (Foundation) or Smart Freeway Type C, B or A standard according to these guidelines.

The Main Roads Smart Freeways policy and guidelines comprise of the documents listed in the table below. This document is shown highlighted.

Document	Description
Smart Freeways Policy	One-page high-level policy statement setting out Smart Freeways objectives and principles.
Smart Freeways Policy Framework Overview	Smart Freeways context, principles, corporate governance, processes and intended outcomes to achieve policy objectives.
Smart Freeways Provision Guidelines	Guidelines and warrants for application of Smart Freeways traffic management treatments and ITS devices.
Smart Freeways Operational Efficiency Audit Guidelines	Guidelines for formal examination of traffic analysis and design of all freeway projects.
Guidelines for Variable Message Signs	Guidelines for the design and use of variable message signs for traveller information for safe and efficient travel for road users.
Supplement to Victoria's Managed Motorway Design Guide, Volume 2: Design Practice, Parts 2 and 3	Main Roads supplement relating to: • network optimisation tools (benefits and operation of coordinated ramp signals) • planning and design for mainline, entry ramps (including ramp signals), exit ramps and interchanges.
Supplement to Victoria's Managed Freeways Handbook for Lane Use Management and Variable Speed Limits	Main Roads supplement relating to: • lane use management system (LUMS) • variable speed limits (VSL).

Smart freeways concept

Smart Freeways optimise the use of the existing freeway network, particularly during periods of high demand and traffic incidents. They employ ITS and operational strategies that support dynamic, real time network management. Smart Freeways traffic management initiatives, complemented by appropriate mainline and ramp geometric improvements, function as an integrated system to achieve and maintain optimal freeway conditions, minimising delay and congestion.

Guidelines for variable message signs

These guidelines apply to Smart Freeways and the wider freeway network (including high standard arterial routes being progressively upgraded to freeways) and to arterial roads. They also include a section on portable variable message signs (pVMS) for use at roadworks and events.

Using variable message signs (VMS) to provide up-to-date information for travellers optimises road network operations and safety performance. Travellers improve their transport choices using VMS details such as travel times, traffic conditions, congestion and incident information. The benefits include:

- influencing road user route choices (during an incident, roadworks, planned event or congestion)
- improving safety in changing road conditions (lane closures, reduced visibility or an incident, which may reduce the likelihood of crashes particularly rear-end crashes)
- providing road user journey information (travel time, delays, speed limit changes) and other relevant information, such as the reason for a speed limit reduction.

This guide provides an overview of the various types of VMS that can be used to display traveller information including:

- strategic VMS - used on the mainline for warnings, planned works, travel time information, awareness campaigns and traffic detours
- tactical VMS - used as part of a lane use management scheme (LUMS) to provide real-time warnings and instructions to road users
- arterial road VMS - used on arterial road approaches to the freeway interchanges to provide real-time traveller information and warning messages to road users
- portable VMS – used for roadworks and events.

This guide also includes information to guide the design and installation of other signs.

Abbreviations

ALR	All lane running
AS	Australian Standard
CCTV	Closed circuit television
DMS	Dynamic message signs
ETT	Estimated travel time
FCS	Freeway control system
ITS	Intelligent transport systems
LUMS	Lane use management system
LUS	Lane use sign
MOU	Memorandum of understanding
NTT	Nominal travel time
RC1	Ramp control sign 1
RC2	Ramp control sign 2
RC3	Ramp control sign 3
pVMS	Portable variable message sign
RNOC	Road Network Operations Centre
TCS	Trip condition sign
TIS	Trip information sign
TVMS	Tactical variable message signs
VMS	Variable message sign or signs. This generic term may include dynamic message signs (DMS)
VSL	Variable speed limit
WA	Western Australia

1 Introduction

1.1 Purpose

Variable message signs (VMS) are critical to providing traveller information, particularly in real-time, to road users during their journey. Real-time traveller information assists road users to make informed travel decisions and enables road operators to manage the road network efficiently.

Traveller information systems use traffic data and relevant inputs from the Main Roads Network Operations Centre to provide road users with information including current travel times, timely and relevant details about congestion, traffic incidents, roadworks, special events and severe weather conditions which may impact the road users' journeys.

The VMS guidelines have been developed to:

- guide designers and practitioners when developing detailed design and operational requirements
- recommend road user information to be displayed on VMS for Perth's wider freeway network and key arterial roads
- define travel time destinations on strategic VMS
- provide a guide for operating VMS, the types of signs and sign locations for the wider freeway network and key arterial roads in Perth, and for the design of detailed signing schemes and locations.

These guidelines provide a framework for future road user information needs that can be applied as freeways and arterial roads are upgraded. It provides an overview of the VMS that can be used to display traveller information including:

- strategic VMS - used on the mainline for warnings, planned works, travel time information, awareness campaigns and traffic detours
- tactical VMS - used as part of a lane use management system (LUMS) to provide real-time warnings and instructions to road users
- freeway-to-freeway strategic VMS – used to provide travel time and traffic condition information from the intersecting freeway
- arterial road VMS - used on arterial road approaches to the freeway interchanges to provide real-time traveller information and warning messages to road users
- portable VMS for roadworks or events.

In this guideline, strategic VMS specifically refers to the VMS located on freeway mainlines that provide high-level strategic information. In Victoria, these VMS are referred to as freeway VMS. While VMS installed on the arterial road network also display strategic information, they are referred to in this guideline as arterial road VMS (or their applicable AS type) to distinguish them from the strategic VMS on freeway mainlines.

VMS is a generic term for electronic signs and may include dynamic message signs (DMS).

1.2 Benefits of providing traveller information

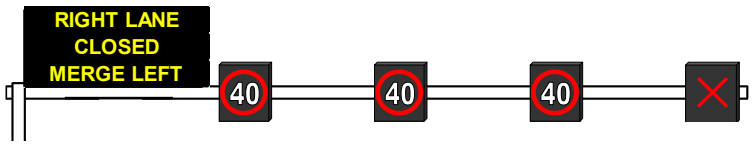
The provision of traveller information assists in optimising road network operations, efficiency and safety performance across the road network. This is achieved by providing travel times, congestion and incident information to enable road users to make informed travel choices. The benefits include:

- influencing road user route choices (during an incident, roadworks, planned event or congestion)
- improving safety in changing road conditions (lane closures, reduced visibility or an incident) which may reduce the likelihood of crashes, particularly rear-end crashes
- providing road users with travel time information to key destinations as well as expected delays
- providing road user journey information (travel time, delays, speed limit changes) and other relevant information, such as the reason for a speed limit reduction or road safety messages.

1.3 Typical traveller information signing

Traveller information for road users is typically disseminated via real-time information displayed on VMS at strategic locations on freeways and arterial roads. Examples of sign types referenced in these guidelines are shown in Table 1-1. Signs indicated for freeway use may also be used elsewhere on the road network where sign size or functionality is appropriate.

Table 1-1 VMS traveller information sign types and messages

Sign type	Example
Strategic VMS (refer Section 2)	 Incident management  Travel time (Kwinana Freeway mainline) **Note**: Due to system limitations and old VMS standards, interim use of strategic VMS may provide the travel times in the pictogram panel on the left side of a composite sign.
Tactical VMS (refer Section 3)	 Lane status and warning information used as part of a lane use management system

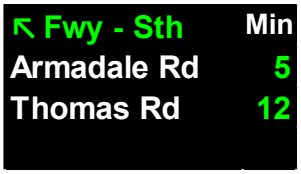
Sign type	Example
Freeway-to-freeway strategic VMS (RC3-C) (refer Section 4)	  VMS prior to a freeway exit for traveller information or incident management on the intersecting freeway, and warning if freeway ramp signals are operating on the ramp
Arterial road VMS (RC3-A and RC3-B) (refer Section 5)	  RC3 travel time and incident information on arterial roads entering the freeway
AS Type A and Type B VMS (refer Section 5.8.1)	 Other arterial road traffic management applications (non-freeway)
Portable VMS (refer Section7)	 Construction and event management

Table 1-2 Summary of typical VMS sign details

Type	Operating speeds (km/h) (see note 1)	Typical text size (mm)	Typical no. lines of text	Pictograms	Colours
Strategic VMS	80 to 100	400	3	Yes	Yellow, white, green, red
Tactical VMS	80 to 100	320 or 400	Up to 3	No	Yellow, white, green, red
Freeway-to-freeway strategic VMS (RC3-C)	80 to 100	320	Up to 4	No	Yellow, white, green, red
Arterial road VMS (RC3-A)	Up to 60	120	3	No	Yellow, white, green, red
Arterial road VMS (RC3-B)	70 and 80	200 to 250	3	No	Yellow, white, green, red
AS Type A *(see note 2)*	Up to 60	200	4	No	Yellow
AS Type B *(see note 2)*	Up to 90	320	3	No	Yellow
AS Type C *(see note 2)*	80 to 110	400	3	No	Yellow
Portable VMS	Various	Various	4	Yes	Yellow, white, green, red

Note 1: The speed environment needs to be considered when determining the sign text size.
Note 2: Type A, B and C Australian Standard VMS may also be used on the Main Roads arterial network.

1.4 General guidance

In applying these guidelines, consideration must also be given to broader signage selection matters. This includes site selection, sight distance and visibility factors (for example sign clutter, sun glare), legibility and reading distance, spacing between adjacent signs, overhead clearances, placement in relation to a driver's line of sight, use of signs on curves, maintenance access and use of overhead bridges or other structures for mounting signs. In general, good and consistent messages should:

- be appropriate to the location, time of day, road environment and prevailing road conditions
- be written in a directive tone
- use appropriate font cases, as outlined in these guidelines.
  (This includes fonts consistent with general static signing principles, such as destination information on freeway and arterial road VMS using the upper and lowercase fonts as used on direction signs. Lowercase fonts may also be considered for campaign or promotion (Priority 4) messages. Research suggests that lowercase fonts are more legible because they have more pronounced contours.)

- be as brief as possible and be considered 'glance appreciative' to promote quick comprehension by road users
- generally, use no more than eight words to match the processing capability of an average road user
- have words of no more than eight characters, except location names
- contain no single line with more than two pieces of information (symbols and words), and not allow a unit of information to be split across two lines, unless logical (see Figure 1-1)

Figure 1-1 Example of incorrect and correct combination of information to facilitate comprehension

- use the minimum number of words necessary (see Figure 1-2)

Figure 1-2 Example of minimising number of words

- avoid excessive use of full stops (see Figure 2-4), except where information needs to be separated to avoid confusion
- limit filler messages (campaigns or promotions) to no more than a single screen
- allow screen-timing of no less than three seconds per screen, where two-screen messages are to be used
- avoid the use of inappropriate language, which is likely to offend the public.

1.5 Australian standards

Australian Standard 4852.1-2019 defines fixed VMS in three sizes as Type A, B and C which relates 85th percentile speed to legibility and character height as shown in Table 1-3. The various types of VMS in these guidelines generally enhance the Australian Standard (AS) sign requirements or provide appropriate standards relative to the use and application. Reference needs to also be made to Main Roads Specification 707 for *Variable Message Signs (Fixed Type*).

Table 1-3 Australian Standard VMS types and display requirements

Size type	85th percentile approach speed (km/h)	Minimum sight distance (m)	Minimum equivalent character height (mm)
A	≥50 and ≤60	140	200
B	>60 and ≤90	224	320
C	>90	280	400

(Source: AS 4852.1-2019 Table 5.1 and Table B1)

1.6 Providing freeway traveller information

Valuable traveller information is provided on the freeway mainline and near freeway interchanges on the adjacent arterial or local road network to enable road users to make informed choices about their journey. These guidelines provide information regarding:

- types of information provided on VMS and typical messages
- estimated travel time to destinations
- freeway operating conditions (quality of traffic flow) compared to free-flow travel conditions (levels of congestion, including escalating messages related to the extent of congestion using colour coded displays in green, yellow or red)
- location and direction information related to incidents or roadworks and events (planned or unplanned) including road closures
- other information as applicable, such as community safety or promotion messages.

Real-time information allows road users to make informed travel choices and has the potential to reduce the impact of an incident or event by reducing the demand on the main traffic flow. Traveller information signage locations can include:

- on-freeway signs
- off-freeway signs to provide road users with information before entering the freeway, including signs at ramp entrances and the arterial road approaches to interchanges.

1.7 Context and detailed ITS specifications

This VMS guide, together with the *Smart Freeways Design Guidelines* and the *Policy Framework Overview*, has been developed to outline the requirements for the planning, design, and implementation of Smart Freeways across Western Australia's freeway network.

This guide should be read in conjunction with other Main Roads design guidelines, as well as the relevant functional and technical specifications for intelligent transport systems (ITS) elements.

Reference must also be made to the applicable Main Roads 700 Series Specifications regarding the supply and installation of ITS devices. These include:

- Main Roads Specification 707 – Variable Message Signs (Fixed Type)
- Main Roads Specification 714 - RC1 and RC2 Ramp Control Signs
- Main Roads Specification 715 – RC3 Real-Time Information Signs
- Main Roads Specification 716 – Ramp Signals

1.8 Other complementary documents

Other complementary documents include:

- *Smart Freeways Provision Guidelines*
- *Smart Freeways Operational Efficiency Audit Guidelines*
- *Main Roads Supplements to Victoria's Managed Motorway Design Guide*
- *Victoria's Managed Motorway Design Guide*
- *Victoria's Managed Motorway Design Guide Volume 2: Part 4 Lane Use Management, Variable Speed Limits, Traveller Information.*

Other guidelines and standards may also be relevant, including:

- Austroads *Guide to Traffic Management Part 10: Traffic Control and Communication Devices.* However, it is noted that trip condition signs (TCS) and trip information signs (TIS) are not used in Western Australia (refer Section 2.3.6).
- Main Roads *Supplement to the Austroads Guide to Traffic Management Part 10: Transport Control – Types of Devices*
- *Australian Standard AS 4852.1-2019: Variable Message Signs Part 1: Fixed signs.*

2 Strategic VMS

2.1 Overview

Strategic VMS provide real-time, integrated and consistent traffic condition information to road users. These VMS, sometimes referred to as dynamic message signs (DMS), are also used to support incident and event management, and lane use management where applicable.

In general VMS need to be multi-purpose rather than single-purpose, and the variety of VMS types need to be minimised to simplify system integration and maintenance. VMS need to display incident warnings as well as real-time traffic and travel time information.

Strategic VMS consist of a single full matrix display area as shown in Figure 2-1. A typical display includes:

- a message in an alphanumeric format with up to three lines of text (generally up to 18 characters per line), with a typical text height of 400 mm on 100 km/h roads and a minimum 320 mm on 80 or 90 km/h roads
  (The displays are generally consistent with AS 4852.1-2019.)
- a colour pictogram, symbol or travel time information as part of the display.

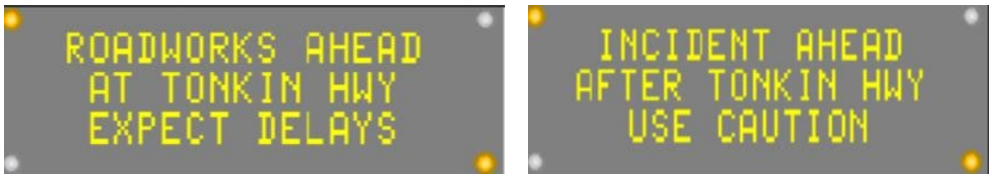


Figure 2-1 Strategic VMS example layouts

2.2 Message hierarchy and priority

The primary purpose of a strategic VMS is to display real-time travel information relevant to a road user's current trip. A secondary function is to display information relevant to trips for that freeway in the near future, for example future roadworks. Other relevant road safety messages (campaigns or promotions) may also be displayed when appropriate but are usually of a lower priority and must only be used when there are no other higher priority road user messages to display.

Various types of messages can be displayed on a VMS and a hierarchy of control is essential to ensure that the VMS is used for the most appropriate need at the time. The message priorities are outlined in Table 2-1.

The VMS default mode display is current traffic conditions and travel times. These messages are particularly useful to road users during peak periods or other times when freeway conditions may affect a road user's trip, for example during incidents. Traffic conditions and travel times need to be shown, unless a higher priority message needs to be displayed as outlined in Table 2-1. The following general principles also apply:

- The operational need will determine the priority of messages displayed on variable message signs (VMS), including the use of alternating frames (pages) when a higher-priority message needs to be shown.

- Generally, messages should be limited to a single frame; in rare cases a two-frame message is required (Priority 1 only). For example, when the message cannot fit within a single display frame, each frame must convey a complete, standalone message. Readers should not be required to view both frames to understand the content of each.
- In determining the priority of message displays, consideration may also need to be given to the incident severity as outlined in Section 2.4.4.

Table 2-1 Strategic VMS and arterial road VMS message hierarchy and purpose

Priority	Message type	Purpose / Description
Default display	Traffic condition and travel time	Dynamic information about real-time traffic conditions, including travel time information.
1	Incidents, current roadworks, current events	Incident messages provide details to road users about an incident, roadworks underway or an event (e.g. CITY TO SURF) underway, an unplanned event (e.g. BREAKDOWN or SPILLED LOAD) and other unplanned road or traffic conditions (e.g. OIL SPILL) requiring immediate unplanned maintenance, or severe congestion to warn road users of slow-moving traffic. Priorities for incident severity may also exist within this message type (refer Section 2.4.3) or for strategic messages (e.g. PORT CLOSED). Messages relating to changed speed limits or lane availability on Smart Freeways as part of LUMS are considered incident messages. Two frames may be needed for a Priority 1 incident message (refer Section 2.4.3) if additional information needs to be manually provided (not automated). Priority 1 main messages are not alternated with a default message or any other priority category. General unplanned events such as major storms, fires and floods are considered to be community safety messages (refer Priority 2), unless they are not related to the road users targeted by the VMS. In this case they need to be regarded as Priority 4 messages.
2	Community safety	Important information for road users about a significant event such as a major storm, fire, fog or flood affecting travel on that roadway. The impact of the event needs to be of significant importance for road users passing and reading the sign. 'TOTAL FIRE BAN TODAY' is also regarded as a Priority 2 message, aligned with the memorandum of understanding (MOU) with the Department of Fire and Emergency Services. Community safety messages may be displayed on every other VMS along a route with planned works or events messages on other VMS along the route, where this is likely to maximise message impact and therefore the expected outcome. Messages to change road user behaviour or improve road safety as well as general filler messages, unrelated to road conditions, are considered to be campaign or promotion messages (refer Priority 4).

Priority	Message type	Purpose / Description
3	Planned works or events	Messages about future road works or lane closures and events that will have a significant impact on traffic conditions. In some instances, the message could relate to a major intersecting road (e.g. at an interchange exit), where a significant proportion of road users may be exiting. Generally, mainline VMS signs are not a substitute for normal roadwork and traffic management signs, particularly long-term works, as the VMS may need to be used for other higher priority purposes (e.g. an incident). The traffic management plan for works or events will set out how the information will be communicated to road users, assuming that the permanent VMS is being used for default or other higher priority messages. The mainline VMS can be used to complement traffic management signing when not needed for a higher priority purpose, but planning must not rely on the use or availability of the mainline VMS. Messages must only relate to the impact of the event on traffic (e.g. a lane closure), not promote or raise awareness of an event or campaign. The consequence of the planned works or event would have a significant impact on road users passing and reading this sign. Planned works or events messages may be displayed from three days before the works or events. Depending on the event, some planned works or events messages may need to be displayed one week before to capture the target audience. For example, a major event on a Sunday may require planned event messages displayed on the previous Sunday to capture road users who may use the road only on the weekend. Planned works or events messages and travel times may be displayed on alternate signs along a route, where planned works or events messages need to be displayed during peak periods and where enough signs are available on the route. Planned works or events messages may transition into incident (Priority 1) messages when the works or event commence (e.g. ROAD CLOSURE may become ROAD CLOSED).
4	Campaigns or promotions	Messages that promote road safety as part of an approved safety campaign and other general filler type messages, unrelated to road conditions. Typical messages not related to the road users targeted by the VMS (refer Priority 2) – as shown in Appendix B - General community safety messages – would be regarded as Priority 4 messages. Messages need to be brief, preferably single frame, to facilitate road users receiving and comprehending the information. Such messages need to avoid the potential to distract road users from their primary driving tasks. Campaign and promotion messages must only be displayed outside peak periods and when there are no other higher priority messages. No commercial or advertising information, logos, or organisation names must be used.

2.3 Display messages

2.3.1 General

To ensure road users read and act on VMS messages, appropriate sign usage and message credibility is important to maintain. At Main Roads, VMS usage and messaging is approved using operational procedures at our Road Network Operations Centre (RNOC).

Using VMS messages that do not reflect appropriate purposes and priorities reduces the effectiveness of the information they display. Our incident message wording is generally an automated standard message within the control system, with operator confirmation and over-ride functions available as required.

2.3.2 Single and multiple frames

In general, message displays need to use a single frame. This typically shows a message over a maximum of three lines in the text section of the VMS.

Where necessary, as outlined in Table 2-1 and Section 2.4.3, a maximum of two frames may be selected for use by the automated system or by the operator. When using two frames, messages generally need to be a maximum of two lines per frame with the changes between frames blanking one display and simultaneously generating the next display. This means there is no blank time between frames.

2.3.3 Use of abbreviations

Abbreviations can be used for VMS for long road names and other terminology. Authorised standard abbreviations need to be used to ensure messages can be understood independently of their context, or when they are used combined with certain prompt words.

A standard list of abbreviations is provided in Appendix E. Further abbreviations may be identified and added to the list as specific messages are considered within the sign size capabilities. No scrolling of messages is permitted.

2.3.4 Use of conspicuity devices

The conspicuity devices in each corner of older VMS (refer Section 2.4.2 and Figure 5-9) may be activated for incident and community safety messages (Priority 1 and 2). They are not to be activated for traffic condition or travel time (default displays), planned works or events (Priority 3), or for campaigns and promotions messages (Priority 4). They must not be activated if no messages are being displayed.

2.3.5 Message displays for traffic conditions and travel times

Messages on VMS will be arranged from top to bottom, as read by road users. This approach will:

- align with other messages such as incident notifications
- display destinations in the order they appear on the route, prioritising the nearest
- match the sequence used on arterial road signs.

VMS will provide travel times and freeway conditions for various destinations (see Section 6). These messages will include:

- estimated travel time (in minutes)
- for Smart Freeways only - colour coding to show freeway conditions compared to normal times
- a format consistent with arterial road VMS standards (see Section 5), which road users encounter before entering the freeway.

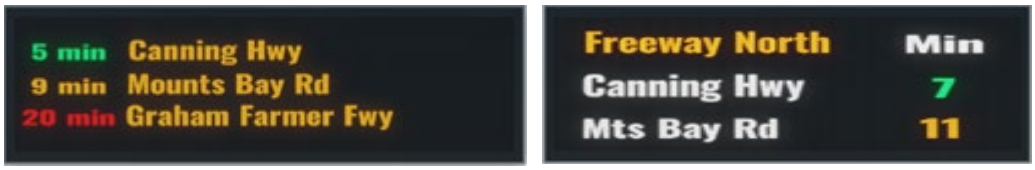


Figure 2-2 Strategic VMS travel time display

To maintain consistency with static directional signage principles, destination information displayed on freeway and arterial road VMS will use a combination of upper and lowercase lettering.

2.3.6 Existing VMS

As part of the early phases of a project (the assess, select, and develop phases) existing VMS should be evaluated, in collaboration with the Network Operations Directorate, to determine whether they are fit for purpose.

2.4 Message displays for incidents

2.4.1 Message structure

VMS incident messages generally need to be structured as shown in Table 2-2 using problem, location, effect and action statements as a guide.

Table 2-2 VMS incident message structure

Problem statement	Defines the situation or type of incident that will affect traffic operations, for example incident, roadworks, high winds.
Location statement	Describes the location of the incident, for example distance to incident, interchange name, exit name or number or a landmark.
Effect statement	Describes the state of the road or the effect the problem will have on traffic, for example, left lane closed, major delays, freeway closed.
Action statement	Provides guidance and describes what the road user is required to do, for example, proceed with caution, prepare to stop, consider alternate route.
Attention statement (special case)	Identifies specific road users the message is directed to, for example trucks, if the message does not apply to all traffic.

A message with a pictogram and text over three lines illustrates the display of four information elements as shown in Figure 2-3. The pictogram generally represents the problem statement, and the remaining information elements are displayed with text, on separate lines, arranged from the top to the bottom of the sign.

Figure 2-3 VMS pictogram and text displays – problem, location, effect, action

Examples of VMS messages and pictograms used within the freeway control system message library are shown in Appendix A. Perception testing conducted in other jurisdictions has confirmed road users generally understand the pictograms, both on their own and when paired with accompanying text. Pictograms alone were found to be well comprehended, and their combination with a text resulted in full understanding.

Generally, no pictogram is used for community safety (Priority 2), planned works and events (Priority 3), or campaign and promotion messages (Priority 4).

Different sequences may be appropriate for campaign and promotion messages where a lasting (take home) message is intended, for example the action 'Buckle Up' may be the top line of the message, as shown in Figure 2-4.

Figure 2-4 VMS text displays – campaign/promotion messages

2.4.2 Interim use of older VMS

Tactical incident messaging generally follows the problem, location, effect and action guide. However, in some situations, such as using older VMS with no pictogram display area, there may be strategic reasons for providing the location first, for example prior to an exit for an event or closure on another road. In this case, the strategic message guide may use location, effect and action only. Indicating the location first may be appropriate, as the problem is not immediate and impacts a smaller number of road users. For example, a VMS on Kwinana Freeway could be used to warn road users of a problem on Tonkin Highway as shown in Figure 2-5.

Figure 2-5 Example - VMS incident display

2.4.3 Main and supplementary messages during incidents

Initiating an incident response plan generates an automated VMS message, with a manual override available before and after implementation. The automated VMS generates one or two varied messages for display on different sections of the freeway. The nature of the incident will determine if an alternating main or supplementary message may be required, as indicated below or at Table 2-1. The placement and location of VMS are considered in Sections 2.5 and 4.3 of this guide.

Main message (first VMS upstream of the incident)

A main text message together with an appropriate pictogram will be displayed on the VMS upstream of the incident, or at the start of the LUMS. Tactical VMS may also be provided within the LUMS area (refer Section 3).

Figure 2-6 VMS example of a main message upstream of an incident

Supplementary message (other upstream VMS)

A supplementary message with a pictogram is displayed on the VMS in the freeway sections upstream of the incident within the default length of freeway, based on the incident severity (refer Section 2.4.4 and Table 2-3), if VMS exist within these upstream sections of freeway. The supplementary message is required for major, severe and freeway closure incidents.

Figure 2-7 VMS example of a supplementary message upstream of an incident

As outlined in Table 2-1, traffic condition and travel time is the default message for all capable strategic VMS. Other priority messages, as listed below, can be displayed as main or supplementary messages on strategic VMS, but the system cannot alternate between travel times and priority messages:

- Priority 1 - Incident message
- Priority 2 - Community safety messages
- Priority 3 - Planned works and events messages
- Priority 4 - Campaign / promotional messages.

2.4.4 Incident severity

The severity of a freeway incident as indicated in Table 2-3 determines the upstream length where messages are displayed on strategic VMS and arterial road VMS.

A high severity incident may have a significant impact on freeway flow. Therefore, the information needs to be displayed over a longer distance upstream of the incident to advise road users of the issue and provide opportunities for alternative route choices. Providing advanced information recognises the importance of managing large traffic volumes and facilitates choices to exit and to facilitate unloading of the freeway, for example traffic exiting over a large number of interchanges. Providing information upstream of the incident creates opportunities for traffic to divert and be distributed to a number of alternative routes, rather than creating a major impact on one exit or on the freeway network. Upstream incident advice may also be provided on intersecting downstream freeway routes using the strategic VMS or the freeway-to-freeway strategic VMS (see Section 4).

The incident severity criteria and the freeway distances over which traveller information is generally provided are shown in Table 2-3. The default distances are configurable, and an operator may adjust the distance for a specific incident, when necessary.

Table 2-3 Incident severity / upstream extent of message displays (the below is a guide only)

Incident severity	Criteria	Strategic VMS	Arterial road VMS
1 Minor	Emergency stopping lane affected, or other hazard without a reduction in lane usage, for example high winds, sun glare, surface debris (sand)	Warning message may be provided at the discretion of the operator	Generally no message
2 Major	One traffic lane affected	Upstream for 5 km	
3 Severe	Two or more traffic lanes affected	Upstream for 8 km	
4 Freeway closure	All lanes affected or the freeway needs to be closed	Upstream for 15 km or more	

2.5 Design principles for locating strategic VMS

2.5.1 General principles

Strategic VMS are to be placed where displayed messages for an incident or event are relevant to a significant proportion of road users on the freeway. The location of signs also needs to be consistent with incident management plans, for example, prior to nominated exits to the arterial road network that would have strategic importance for diverting traffic.

The positioning of all types of signs during design sequence needs to consider the hierarchy of various sign types, in the following order:

1. static directional signs
2. LUMS gantries and signs
3. VMS.

All VMS need to be placed with clear sight distance so that they are legible to road users, per Section 1.5 of this guideline. Every effort needs to be made to reduce competition between VMS and other traffic signs or roadside furniture and vegetation.

2.5.2 Strategic VMS spacing and location

The desirable spacing of successive VMS is between 3 and 5 km, subject to the spacing of significant interchanges and presence of a LUMS environment. The strategic VMS should be located at least two interchanges apart (except for use of freeway-to-freeway strategic VMS) and needs to be located clear of structures or other sight distance restrictions, as per Section 1.5 of this document.

The longitudinal placement of VMS signs is typically:

- 700 m to 1,500 m before major decision points to provide adequate time for road users to respond, including:
  - significant exit ramps (start of taper), for example likely to be used for trip diversion
  - freeway-to-freeway (system) interchanges (start of taper)
- before a LUMS environment to support and advise of lane closures or reduced speed limits.

When locating a strategic VMS prior to a freeway-to-freeway interchange, it is for the purpose of providing traveller information on the continuing route and should be positioned prior to the freeway-to-freeway strategic VMS (see section 4).

Detailed design needs to ensure VMS locations are separated from other signs and typically no closer than:

- 200 m to static direction signs or LUMS signs
- 300 m off an exit ramp (start of taper)
- 350 m beyond an entry ramp (nose), for example install beyond the merging area.

VMS are placed before major decision points to provide adequate time for motorists to respond. These decision points are determined based on road use data and other strategic considerations. They are selected to provide the best impact for road network management. Major decision points include:

- significant exit ramps (likely to be used for trip diversion)
- freeway to freeway (system) interchanges
- on approach to key locations (airport, tunnel).

2.5.3 Co-location of signs

Separation guidance provided in Section 2.5.2 is preferred for the positioning of strategic VMS, as it is undesirable to locate strategic VMS at the same location as direction signs, LUMS signs or other significant traffic management devices, such as speed limit signs.

The concept of operations, developed during the earlier phases of the project life cycle, defines co-location requirements and informs the detailed design.

Guidelines relating to the co-location of tactical VMS are provided in Section 3.

2.6 Sign installation

Overhead mounting of VMS on gantries provides optimum visibility on wide carriageways and is the most effective method for conveying important information to road users on a high-volume, high-speed freeways.

Where there are fewer than four lanes, VMS are generally mounted on cantilevered structures. However where a VMS is integrated with LUMS, gantry mounted is recommended.

3 Tactical VMS

3.1 Overview

Tactical VMS (TVMS) provide real-time warnings and instructions to road users as part of a LUMS.

TVMS are generally installed on the LUMS gantries, as shown in Figure 3-1, and are used to help road users understand the reasons for lane closures or lower speed limits.

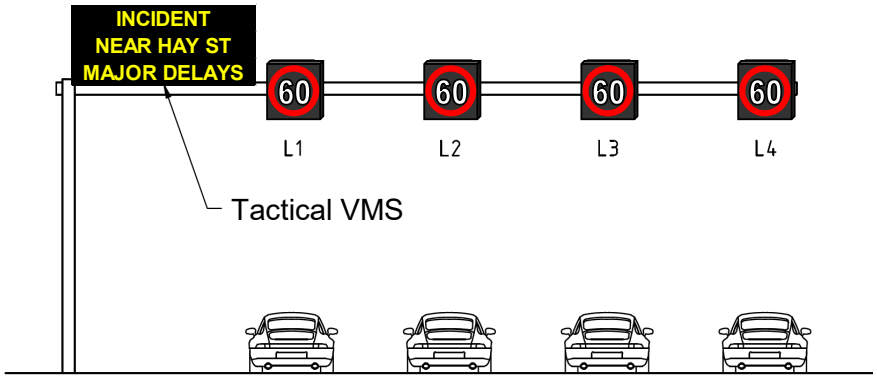


Figure 3-1 Tactical VMS used as part of a LUMS scheme

3.2 Sign size, location and displays

TVMS typically have yellow font (as a warning message) and can display messages in up to three lines of text. In association with a LUMS scheme they are generally installed on every second gantry, and in advance of emergency stopping bays in all lane running (ALR) sections. They are positioned to provide more frequent messages relevant to the traffic situation.

When combining TVMS and LUMS signs on the same gantry, consideration needs to be given to the amount of information displayed in one place. For example, there may be a lane closed (or merging), a reduced speed limit and an explanation. This may result in messages being missed or creating a safety issue, as road users take their focus off the road for longer than desirable to read and comprehend the displayed information. Therefore, it is preferred that the TVMS displays one screen of text only. The display of two alternating screens may be acceptable if the LUMS displays are in default mode, that shows no changes to lane use or speed limits.

Typically, TVMS are used for incident messages only (Priority 1 as defined in Table 2-1), for example for incident messages that complement a lane closure, to reinforce a reduced speed limit or advise of a specific downstream hazard.

When freeway operations do not require the use of Priority 1 or 2 messages, the TVMS default needs to be blank, as lower priority messages are not shown on these signs. This maximises the potential for road users to notice messages on TVMS when important real-time safety information is displayed.

4 Freeway-to-freeway strategic VMS

4.1 Purpose and use

Freeway-to-freeway strategic VMS (sign no. RC3-C) are provided for road users exiting at a freeway-to-freeway interchange. They provide road users with travel time and traffic condition information from the intersecting freeway, that is from destinations that are not on the route currently being travelled. In some instances, an RC3-C can also be installed on major arterial roads that interchange with a freeway and where a sign larger than RC3-B is warranted.

Freeway-to-freeway strategic VMS provide valuable information for road users intending to leave the freeway and facilitate route choice decisions, such as whether to use the intersecting freeway or other roads to reach their destinations. Where relevant, when entering exit ramps, the VMS can also indicate if entry ramp signals for the intersecting freeway are operating. A freeway-to-freeway strategic VMS installation is shown in Figure 4-1.

Figure 4-1 Example of freeway-to-freeway strategic VMS (RC3-C) on cantilever structure

For locations where an RC3-B sign is considered the preferred option, refer to Main Roads Specifications 714 and 715 to assess whether an RC3-A or an RC3-C sign may be a more suitable alternative for that location.

4.2 Sign displays

The freeway-to-freeway strategic VMS which provide information to road users in the left lane exiting the freeway, can display up to four lines of text with a character height of 320 mm. All full and abbreviated words should begin with an initial capital letter followed by lowercase letters (for example 'Signals' and 'Fwy'.) This format is effective in 100 km/h speed environment where lower speeds are generally observed in the left lane. The size, shape and position of the VMS needs to reinforce its specific purpose and help prevent confusion with strategic VMS used for traveller information on the continuing freeway.

Where appropriate, the freeway-to-freeway strategic VMS need to indicate colour coded travel time and traffic conditions for key destinations on the intersecting freeway that road users are entering. The VMS needs to also be capable of providing traveller information to assist with network optimisation and management, for example during incidents, lane or ramp closures and roadworks.

When ramp signals are off (or where there are no ramp signals on the ramp), the freeway-to-freeway strategic VMS default display is either blank or displays travel times and traffic conditions.

Example freeway-to-freeway strategic VMS messages are shown in Figure 4-2 and Figure 4-3. The sign header (first line) shows the intersecting freeway direction and is colour coded according to traffic conditions. These escalating messages provide general advice, as well as give information that could lead to road users choosing to divert to other routes, if feasible. When the sign is being used for a travel time message, the abbreviation 'Min' is shown on the first line above the travel times if sufficient space is available (abbreviate freeway name as appropriate – see Appendix E).

Lines two and three provide colour coded traffic condition and travel time information, if appropriate. In setting message options, care is needed to avoid information overload with complex messages, particularly if the VMS is co-located at an exit direction sign or LUMS gantry location (which is generally undesirable – see Section 4.3). A maximum of two destinations on the intersecting freeway are provided.

The bottom line will indicate 'Ramp Signals On', if appropriate, but may also be used for other warning messages if necessary.

The priority of freeway-to-freeway strategic VMS messages is determined in a similar way to that used for strategic VMS, as outlined in Section 2.2 and Table 2-1, but Priority 4 messages (campaigns and promotions) are generally not appropriate.

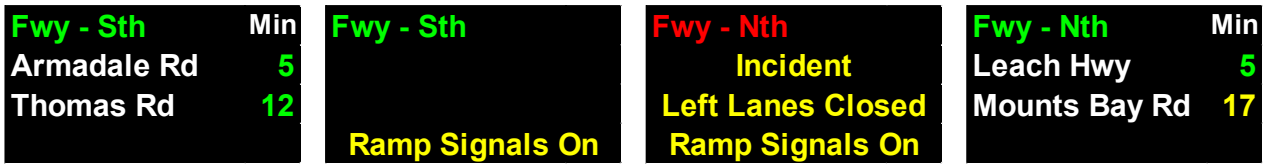


Figure 4-2 Examples of freeway-to-freeway strategic VMS messages for signs on Roe Highway east of Kwinana Freeway

4.3 Design locations and installation

The design of a freeway-to-freeway strategic VMS location before a freeway exit needs to consider the spacing requirements relative to other signs, particularly the exit direction signs, the exiting lane arrangements (one- or two-lane exit) and LUMS gantries, if provided.

The longitudinal position of the freeway-to-freeway strategic VMS before the ramp exit needs to be in accordance with the following general design principles:

- Installed on a dedicated support structure, separate from other signs as shown in Figure 4-3. This is preferred to minimise signing complexity. Typically, the sign should be installed mid-way between the 1 km and 500 m advance exit direction signs, with a minimum desirable separation distance from other signs of 200 m. This location links the sign information to the direction sign exit information and provides sufficient distance for road users to read the sign and make a decision whether to exit the freeway.

If a strategic VMS is also provided prior to a freeway-to-freeway interchange for traveller information on the continuing route, it should be positioned before the freeway-to-freeway strategic VMS (see Section 2).

- For a long exit lane arrangement (for example a two-lane exit), the freeway-to-freeway strategic VMS generally needs to be positioned after the initial advance exit direction sign and before the start of the exit lanes, with a maximum of 1200 m before the related freeway exit. This positioning may be subject to design constraints, such as curves or high lane changing manoeuvres where driver distraction must be avoided.
- For exits where design constraints prevent separate installation, the freeway-to-freeway strategic VMS may be co-located with:
  - LUMS signs on the same gantry if no tactical VMS are installed
  - a simple advance exit sign ('Exit 1km') or direction sign ('Exit left lane'). It would generally be undesirable to co-locate the freeway-to-freeway strategic VMS with complex signage, for example lane allocation signs or exit signs with more than one destination.
- As the sign is intended for exiting traffic, the freeway-to-freeway strategic VMS generally needs to be installed near the side of the carriageway in the direction the traffic is leaving (usually the left), over the emergency stopping lane, or over the left lane for a two-lane exit. This position reinforces the purpose of the message for exiting traffic.

Further guidance relating to design locations and use of freeway-to-freeway strategic VMS is available in the Main Roads *Supplement to Victoria's Managed Motorway Design Guide Volume 2*: Part 3.

Figure 4-3 Example of freeway-to-freeway strategic VMS installation

5 Arterial road VMS

5.1 Overview

Arterial road VMS (sign Nos. RC3-A and RC3-C) provide real-time traveller information and warning messages to road users on the arterial road network. The arterial road VMS for ramp control are generally provided as part of the ramp signal design. They may be installed in locations remote from a freeway interchange (see Section 5.7) or in other applications where a colour display or message flexibility offers advantages.

Arterial road VMS display real-time traveller information including traffic condition and travel time information to road users before they enter the freeway as shown in Figure 5-1. The arterial road VMS also support ramp management during ramp signal operation, incidents, roadworks or congestion.

Figure 5-1 Example of arterial road VMS with traffic condition and travel time information

Arterial road VMS are generally installed on arterial roads near a freeway interchange prior to the left and right-turn lanes. Separate signs are installed for each travel direction for road users entering the freeway.

Where LUMS or strategic VMS are provided, the signs also integrate with the Main Roads central control system to provide consistent messaging. Messages consistent with the guideline hierarchy may also be displayed by a network operations system operator, if required.

5.2 Sign sizes

Arterial road VMS used at arterial road freeway interchanges are available in two sizes that broadly align to Australian Standard (AS) Type A and B sign dimensions:

- RC3-A for lower speed arterial road environments (up to 60 km/h)
- RC3-B for higher speed arterial roads (70 and 80 km/h).

For freeway-to-freeway ramps, a larger RC3-C strategic VMS is available for placement on the freeway carriageway before the interchange (see Section 4). Use of the RC3-C may also be considered at arterial road interchanges with speed environments greater than 80 km/h, that is in higher-speed locations where similar functionality is needed but increased text size is required.

The appropriate VMS size for arterial roads that are not part of Smart Freeways should be determined based on the guidance provided in Australian Standard 4852.1-2019 (see Sections 1.5 and 6).

The use of the RC3-A sign on lower speed arterial roads takes into account that road users are decelerating when approaching a turning lane. The design process and sign size need to also consider the balance required between available space for sign mounting, installation cost, display impact relative to static signs, and legibility for the likely arterial road approach speeds.

Although the font size used is smaller than that specified in AS 4852.1, the sign remains legible for non-safety-critical messages by using mixed-case lettering and increased letter, word and line spacing beyond AS 4852.1 standard.

(Refer to Main Roads Specification 715 for RC3 *Real Time Information Signs and Specification 716 for Ramp Signals*.)

5.3 Display messages

The arterial road VMS displays travel time information as the default message for the freeway routes downstream from the interchange. VMS messages relating to events and incidents need to complement and be compatible with the strategic VMS operation. The types of messages include:

- traveller information relating to:
  - travel time (default)
  - freeway condition, such as level of congestion
  - incidents and events
- freeway closure information.

Examples of arterial road VMS incident and roadworks messages are shown in Figure 5-2.

Figure 5-2 Examples of arterial road VMS incident and roadwork messages

Abbreviations may need to be used to display some long freeway names, like Graham Farmer Freeway, and when freeway names are combined with other information in the header line, for example traffic condition and event details. Abbreviations may also be needed when using names on smaller signs. While considered, the use of larger signs to accommodate longer names would result in significant disadvantages for installation, as well as system and maintenance management. Omitting the word 'Min' in the top line is reasonable if the text being displayed is relatively long and cannot be abbreviated, for example for an incident message. In this case it is considered that road users will understand the travel times, as they are displayed in a consistent location on the sign and where the word 'Min' would be provided in all other situations.

A standard list of abbreviations for general terminology is provided in Appendix E.

5.4 Travel time messages

The arterial road VMS display travel time information for the freeway routes downstream from an interchange. The information provides estimated travel times to:

- two destinations at most sites in each travel direction on the freeway
- four key destinations (two destinations per route) for locations close to a downstream freeway fork, where the traffic entering the freeway at the interchange can travel in different downstream directions; separate signs are displayed on each pole to provide information for each of the downstream directions (also see Section 5.6).

Various freeway sections are used for advising road users about travel times and congestion as outlined in Section 6. The central freeway control system enables operators to display the destinations for which travel times are calculated on each VMS.

5.5 Message priorities

Travel time and freeway traffic condition information are the default messages usually displayed.

The priority of other messages is determined in a similar way to that used for strategic VMS, as outlined in Section 2.2. The hierarchy of message priorities are outlined in Table 2-1, with the following variations relating to arterial road VMS:

- Priority 2 messages (community safety) are generally not appropriate
- Priority 4 messages (campaigns and promotions) are not appropriate.

5.6 Design locations for arterial road VMS near interchanges

Arterial road VMS provide warning and other information to road users before they enter the freeway. The signs are installed on arterial roads near freeway interchanges prior to the left and right-turn lanes as shown in Figure 5-3. To minimise confusion, separate poles and signs are provided for each travel direction entering the freeway.

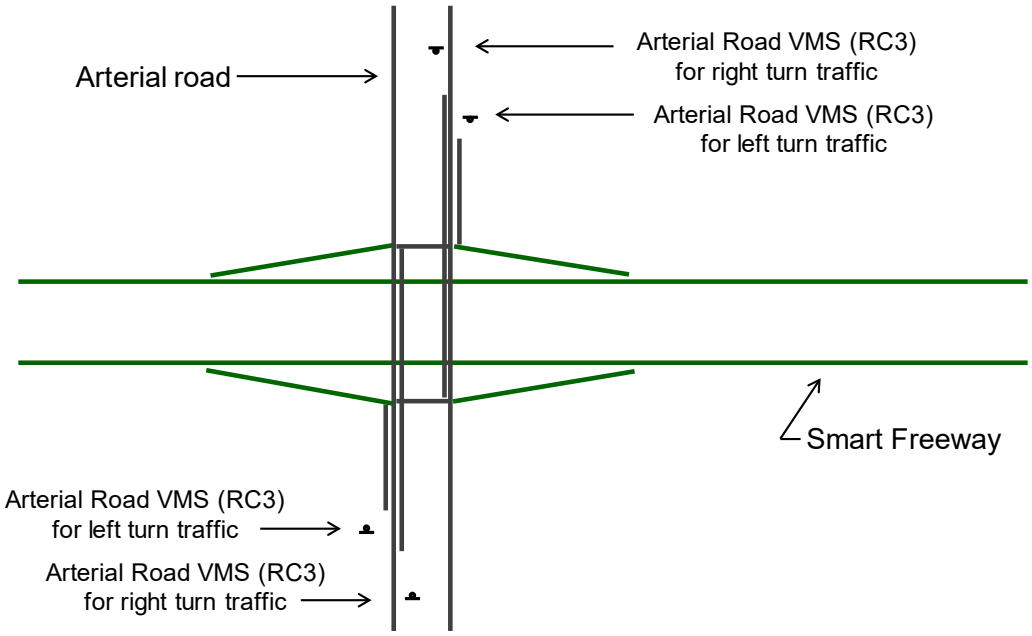


Figure 5-3 Typical locations for remote arterial road VMS

Guidelines for positioning RC3 signs, before the start of turning lanes and relative to other signs, are provided in Table 5-1. The following principles also apply:

- Provide separate signs for all turning movements onto the freeway at interchanges where ramp signals are provided. Provide signs in advance of the indented left and right-turn lanes (if divided carriageway or if turn lanes are provided).

- Where practicable, position the signs on the same side of the road as the movement that is being signed, such as on the left side of the road for left-turn movement and right side (in the median) for right-turn movement.

Where arterial road interchanges are close to a downstream freeway fork, where the freeway divides into different downstream routes to create a route choice, two separate arterial road VMS should be provided on the same pole on each arterial road approach. This enables separate travel information messages to be displayed for each downstream route (see Section 5.4). For example, when entering Roe Highway at Karel Avenue to travel west, two signs would be provided, one for Kwinana Freeway northbound and one for Kwinana Freeway southbound.

Arterial road VMS are generally installed on special poles designed to accommodate wind and sign loadings. When installed, the sign poles must not create a hazard and appropriate measures including offsets to the roadway or shielding with a safety barrier should be considered according to roadside design practice. In some instances, shielding may not be an option due to various factors related to sign location or barrier installation. Road safety risks may need to be assessed. However risks are generally similar to those associated with other poles on arterial roads.

The mounting height to the bottom of the sign is generally a minimum of 2.5 m to provide clearance over footpaths and minimise potential for vandalism.

The arterial road VMS need to be located at an adequate distance before the action point (where a road user makes a decision), so that road users have time to respond to the messages displayed.

The desirable minimum distances for sign installation before the action point are provided in Table 5-1. The desirable separation distance relative to other signs is also provided.

Table 5-1 Arterial road VMS location prior to action point and spacing relative to other signs

Installation	Speed environment (km/h)	
	60 and 70	80
Distance prior to action point	60 to 80 m	80 to 120 m
Spacing to other signs	50 m	60 m
	Minimum 0.6V m (where V is the 85th percentile speed in km/h)	

Note: Based on Appendix D of AS 1742.2-2022

5.7 Remote arterial road VMS

The principle for considering remote arterial road VMS is that they are used to provide freeway condition information at travel decision points before road users enter the freeway. This enables road users to choose whether to take an alternative route if they so desire. Typically, remote arterial road VMS are only installed where alternative parallel routes can provide travel to similar end-destinations, compared with travel on the freeway

Remote arterial road VMS are generally located some distance away from the freeway where route choices are available and before a major arterial road intersection, as shown in Figure 5-4. In this example, the arterial road VMS would be useful for city-bound travel for the morning peak period, but could also be beneficial at other times when the use of alternative routes may be desirable, for example during an incident.

An example of a remote arterial road VMS traveller information message with freeway travel times is in Figure 5-5. If arterial road travel time data is available, the preferred approach is to display comparative travel times via the freeway and the alternative route as shown in the example in Figure 5-6.

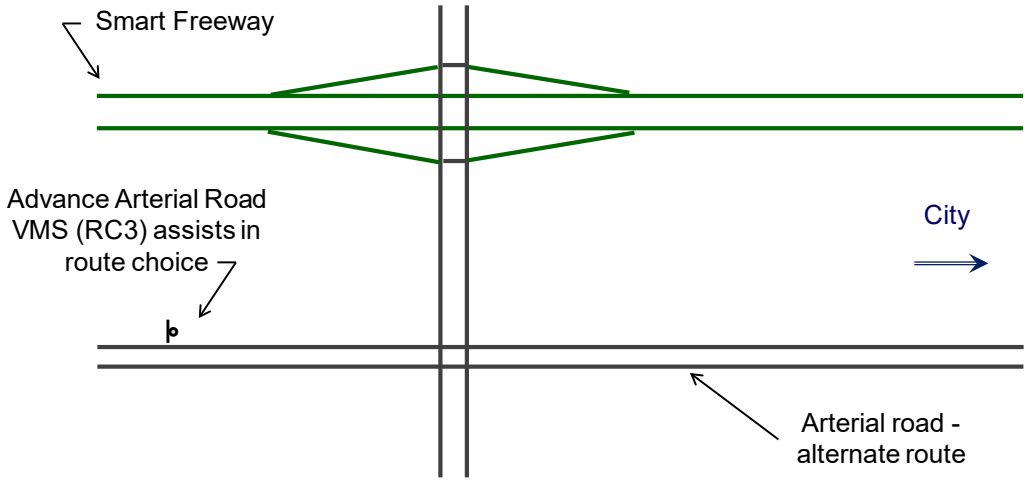


Figure 5-4 Typical remote location for an arterial road VMS

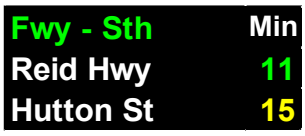


Figure 5-5 Example of remote arterial road VMS traveller information message

Figure 5-6 Example of remote arterial road VMS message if arterial road data is available

Due to the importance of the messages used, the typical speed environment and the legibility and time needed to read and understand the information, RC3-B size signs would generally be the minimum size considered for remote arterial road VMS.

Examples of a remote arterial road VMS include travel towards Perth from the north. Wanneroo Road and Marmion Avenue are both alternative southbound routes to Mitchell Freeway. Remote arterial road VMS could include the following locations (also see Figure 5-7):

- Wanneroo Road north of Hester Avenue and Burns Beach Road
- Burns Beach Road east of Wanneroo Road
- Marmion Avenue north of Hester Avenue and Burns Beach Road.

When approaching Perth from the south, an alternative to Kwinana Freeway northbound is Rockingham Road / Stock Road and then Stirling Highway via Leach Highway / High Street. Remote arterial road VMS could be installed at the following locations (also see Figure 5-8):

- Rockingham Road south of Thomas Road
- Stock Road south of South Street.

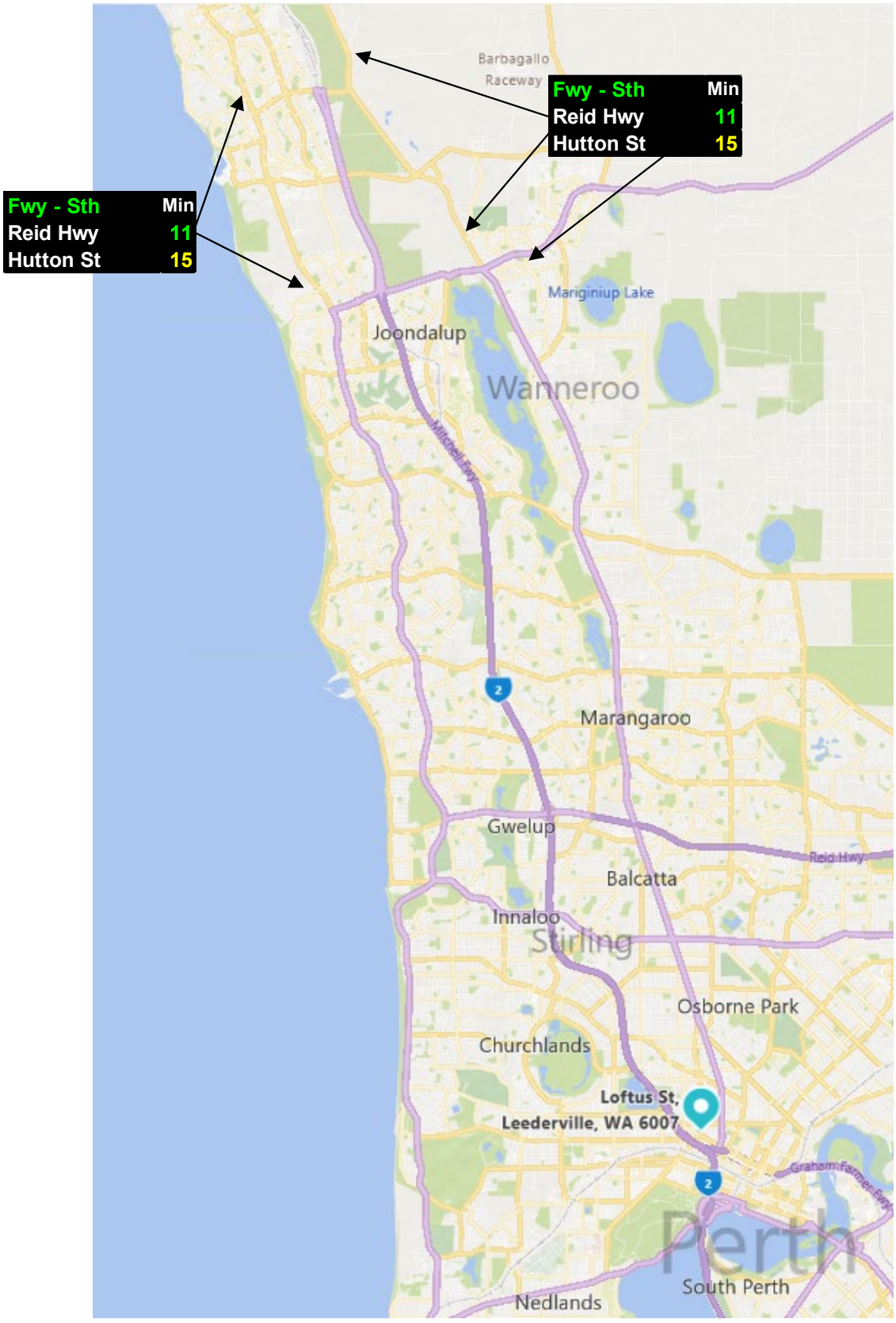


Figure 5-7 Options for remote arterial road VMS messages – southbound towards Perth

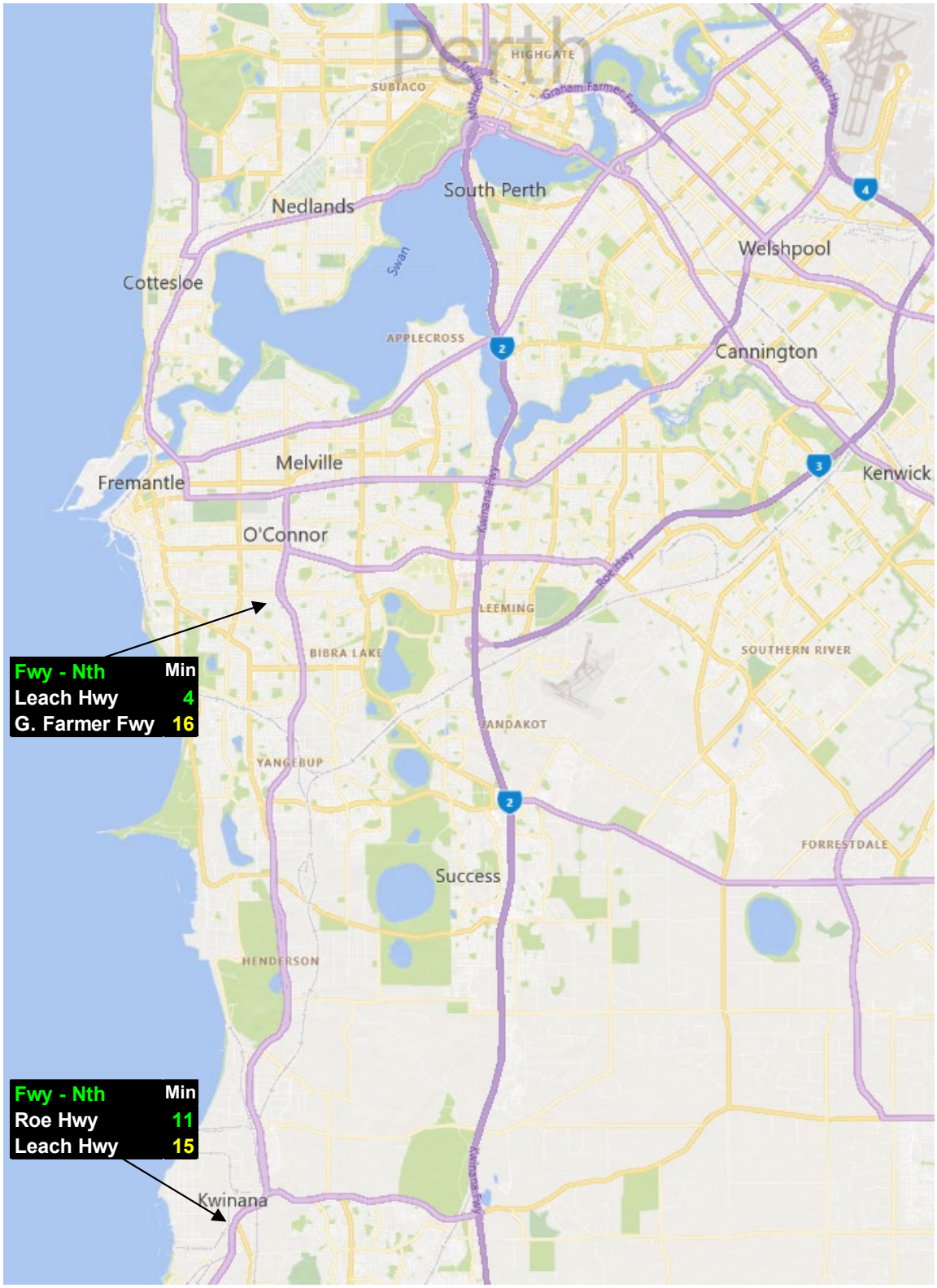


Figure 5-8 Options for remote arterial road VMS messages – northbound towards Perth

5.8 Other VMS on arterial roads

5.8.1 Australian Standard Type A, B and C VMS on arterial roads

Historically, Main Roads has used Australian Standard VMS on the road network, and an example is shown in Figure 5-9. Further information and guidance on sign size is provided in Section 1.5.

Type A, Type B and Type C VMS, as applicable, have been installed on the arterial road network as part of a network-wide traveller information system, or for specific purposes applicable to a particular road, for example operation of a part-time bus lane.

Figure 5-9 Example of Australian Standard arterial road VMS

6 Freeway sections for travel time

Travel time information provides a snapshot of travel time along the freeway based on the mainline speed data from each detector location. This traveller information can provide confidence to road users for their current trip. Alternatively, information on delays that may impact their journey time may enable them to plan accordingly, for example detour to another route or advise others that they are delayed.

6.1 Rationale for choosing destinations

Travel time information is most effective when provided for major arterial roads that are strategic intersecting routes within the road network, including system (freeway-to-freeway) interchanges.

Typically, it is not necessary to provide travel time information for all freeway exits. Instead, signage should focus on strategic interchanges that meet the following criteria:

- significant destinations associated with high volume traffic movements that benefit a large number of road users
- high-capacity routes that offer viable alternatives during periods of congestion or incidents
- routes that have strong connectivity within the broader road network.

Other less significant interchanges may need to be used on the outer limits of a Smart Freeway, where travel time data stations are available, for example Thomas Road on Kwinana Freeway.

Off-freeway destinations may also include significant locations that are close to the freeway but are reached after leaving the freeway, for example the airport, if travel time data is available for the calculations.

6.2 Destination signing principles

In most cases, it is not possible to display all downstream travel time destinations unless the sign or freeway entry is located near the end of the route. As a result, the destinations displayed at each location represent a subset of the full list of destinations input into the system for the freeway corridor.

The following principles generally apply to the use of destination signing:

- Travel time destinations are consistent with names on freeway directional signage to facilitate understanding and navigation by road users.
- The first displayed destination is typically two interchanges or more downstream from the mainline VMS location or the interchange entry ramp. This provides reasonable accuracy and credibility of travel time using the data available.
- The mainline VMS displays one frame with a maximum of three destinations.
- RC3 signs display the nearest key destination and second nearest key destination (close destinations are shown, rather than distant destinations). Further destinations would be shown on the mainline VMS that can display up to three destinations.

- When close to the end of the freeway or a freeway fork, where the freeway diverts into two routes of similar importance (for example Roe Highway approaching Kwinana Freeway):
  - Upstream strategic VMS will only display travel time to the freeway interchange (that is destinations on each continuing route will not be displayed to avoid alternating frames on the VMS; for example strategic VMS on Roe Highway for westbound traffic will only indicate travel time to the Kwinana Freeway interchange, but not travel time destinations to the north or south).
  - Upstream freeway-to-freeway strategic VMS (see Section 4), if provided, may display destinations on each of the downstream routes.
  - Two RC3 signs are desirable at each signing location on upstream arterial roads to provide separate signs and destinations for each route, including destinations downstream of the interchange, if applicable. Installation of two signs avoids the distraction of alternating frames in the default (travel time) situation. Destination names on the same frame need to be on the same route.
- When close to other system interchanges (generally a crossing freeway):
  - Upstream mainline VMS will only display on-freeway destinations on the continuing route.
  - Upstream mainline exit traffic condition VMS (if provided) will display off-freeway destinations on the intersecting routes.
  - RC3 VMS at upstream freeway interchanges may display destinations on the continuing route and an intersecting route (two signs required at each signing location).
- If a key destination name is longer than the available space on the sign (strategic VMS and arterial road VMS may differ), it needs to be abbreviated (see Appendix E). There is to be no scrolling of messages.

6.3 Travel time destinations

Destinations signed for travel time are locations on the freeway where road users would be leaving the network. They are typically:

- **On-freeway destinations -** these locations are on the freeway the road user is currently travelling on, or on the freeway being entered from an arterial or local road.
- **Off-freeway destinations** - these are locations that are reached from another downstream freeway, including after leaving the current freeway being used. Generally, these destinations are only signed when close to the freeway exit (refer Section 4).

The suggested on-freeway travel time destinations for the strategic transport routes (inbound towards the city) and outbound (away from the city) are shown in Table 6-1.

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Table 6-1 Travel time destinations

Freeway	Travel time destinations	
	Inbound	Outbound
Mitchell Freeway	Burns Beach Road Ocean Reef Road Reid Highway Karrinyup Road Graham Farmer Freeway Mounts Bay Road Canning Highway	Hay Street Powis Street Karrinyup Road Reid Highway Hepburn Avenue Ocean Reef Road Burns Beach Road Neerabup Road Hester Avenue
Graham Farmer Freeway	East Parade Loftus Street Mitchell Freeway	Great Eastern Highway
Reid Highway	Alexander Drive Tonkin Highway Great Northern Highway	Tonkin Highway Alexander Drive Mitchell Freeway
Tonkin Highway (north of Great Eastern Highway)	Reid Highway Great Eastern Highway Dunreath Drive (T3 T4) Airport Drive (T1 T2) Roe Highway	Morley Drive Reid Highway Wanneroo Road via Reid Highway Gnangara Road Great Northern Highway (Muchea)
Tonkin Highway (south of Great Eastern Highway)	Orrong Road via Leach Highway Albany Highway via Leach Highway Airport Drive (T1 T2) Dunreath Drive (T3 T4) Great Eastern Highway Guildford Road Morley Drive Reid Highway	Great Eastern Highway Dunreath Drive (T3 T4) Airport Drive (T1 T2) Roe Highway Welshpool Road East Kelvin Road Albany Highway Thomas Road
Kwinana Freeway	Armadale Road Roe Highway Leach Highway Canning Highway Mounts Bay Road Graham Farmer Freeway Karrinyup Road	Canning Highway Leach Highway Roe Highway Armadale Road Thomas Road Safety Bay Road Mandjoogoordap Drive Lakes Road Pinjarra Road Old Coast Road

Freeway	Travel time destinations	
	Inbound	Outbound
Roe Highway	Great Eastern Highway Great Eastern Highway Bypass Tonkin Highway Leach Highway via Tonkin Highway Orrong Road Albany Highway (via Kenwick Link) South Street Kwinana Freeway	South Street Albany Highway (via Kenwick Link) Tonkin Highway (Airport) Great Eastern Highway Great Northern Highway Tonkin Highway

Notes: On Tonkin Highway detailed signing is provided in the vicinity of the airport

The travel destinations are freeway or arterial road interchanges on the routes travelled. Where a freeway changes names but can be driven as a continuing route, for example Mitchell Freeway to or from Kwinana Freeway, travel time destinations on the downstream route are signed.

Key off-freeway destinations, such as Perth City and Perth Airport, have been considered for signing, given their use by a significant number of travellers. Rather than signing 'City' directly, off-freeway destinations are signed at the freeway interchanges that travellers would use to reach them. For example, on Mitchell Freeway and Kwinana Freeway travel times are displayed at the Graham Farmer Freeway and Mounts Bay Road interchanges, which serve the city. Signing to the airport, including terminal numbers, may also be appropriate, as it can be identified as a single-point destination, provided the tools are available to measure travel times to that specific location.

Travel times to destinations require review and updates following any key road network changes or upgrades and land use changes.

7 Portable VMS for roadworks or events

7.1 General

Portable VMS (pVMS) can be moved around and used across many types of applications, including road construction projects or events. They are appropriate for use at strategic locations to provide road and traffic condition information for road users, as they can be moved around on a road construction projects as work progresses. The portable signs may also be appropriate for significant events to provide traveller information as part of an overall traffic management plan. An example of a pVMS is shown in Figure 7-1.

Figure 7-1 An example of portable VMS displaying travel time on a construction project

On a road construction project, the pVMS will display messages relating to current roadworks, incidents affecting traffic and future roadworks. As pVMS can have multiple uses, the signs may also provide real-time travel-time and traffic information, or may be used to display roadwork-related messages, for example planned lane closures, detours and safety messages.

While pVMS are controlled locally as part of construction projects or events, it is also desirable that pVMS have communications with RNOC via the central control system in case of an emergency, particularly outside work hours, in consultation with the relevant project or event managers. The pVMS needs to comply with relevant requirements of Main Roads Specification 707.

Reference needs to also be made to the Main Roads *Traffic Management for Works on Roads: Code of Practice* (2024) to ensure consistency with requirements for managing traffic at work sites on roads, including relevant approvals that need to be obtained.

7.2 Traffic management plans and detours

Proposals for detouring traffic and use of pVMS and other traffic management signs and devices should be considered in the context of the development and approval of a traffic management plan (TMP) for proposed works.

Detours may involve significant volumes of traffic, so appropriate traffic analysis needs to be carried out for the chosen routes and their capacity, particularly if freeway traffic movements are involved (mainline and ramps). Traffic deviations may also need to be confined to off-peak travel times so that peak traffic movements are not impacted.

Where a TMP includes the proposed use of permanent freeway signs (strategic VMS, tactical VMS, arterial road VMS), this requires appropriate consideration and approval. Permanent freeway signs are operated within the message hierarchy and priorities outlined in Section 2.2. Therefore, the TMP for temporary traffic works needs to set out how information will be communicated to road users, if a permanent VMS is being used for other purposes. In this context (see description for Priority 3 operation in Table 2-1), strategic VMS signs are not substitute for normal roadwork and traffic management signs, particularly long-term works, as the VMS may need to be used for other higher priority purposes (for example an incident). If existing VMS are to be relocated or temporarily disconnected as part of a project, alternate arrangements need to be made during the works to ensure temporary VMS are provided to provide traveller information to road users.

7.3 Message hierarchy for construction sites

The order of priority for pVMS messages in a construction project is indicated in Table 7-1.

Table 7-1 Hierarchy of messages for pVMS

Priority	Message type	Description
1	Incidents	Incident messages take precedence over other messages. Details may include messages advising of any incidents impacting traffic such as a crash, stalled vehicle or spilled load. They may also include imminent major disruption such as lane or road closures or detours, and community safety messages on severe weather events such as a bushfire, storm or flooding affecting traffic. Example: **CRASH** **AHEAD** **SLOW DOWN**
2	Current roadworks	Most pVMS will be used for messages on current roadworks. This includes standard signs in AS 1742.3, where appropriate. Examples: **LEFT LANE CLOSED. MERGE RIGHT** **TRAFFIC CONTROL. PREPARE TO STOP**
3	Current traffic or road condition, or travel times	Dynamic traffic condition information including travel times. Example: **Min** **Leach Hwy 9** **H. Miller Dr 14** Note the use of mixed case (mix of upper and lower case font) for travel times. Guidance on the use of colours for travel times is provided in Section 7.10. Road condition information including changed road alignment, changed road surface and heavy machinery close to road. Example: **CHANGED ROAD ALIGNMENT DRIVE WITH EXTRA CAUTION**
4	Planned roadworks	Messages about future roadworks. Example: **NIGHT WORK LEACH TO KEWDALE FROM 24 APR**

Priority	Message type	Description
5	Individual vehicle speeds	These messages can be displayed when connected with a speed measuring device. They will advise if a vehicle is travelling over the speed limit. They could be useful if speeding is a problem at the site. Example: **Your Speed** **64 km/h** **Slow Down** ☹ **Your Speed** **59 km/h** **Thank You** ☺ The line 'Slow Down' will flash to provide additional warning if the speed is too high, say, 10 km/h above the posted speed limit (no need to flash the emoticon).
6	Safety messages (related to worksite safety only)	The pVMS may be used for safety messages (worksite related only) when they are not required for higher priority messages. They need to be limited to a single screen and only be displayed when the worksite is in operation and outside peak periods. Example: **Slow Down for** **Workers'** **Safety.** **They Work for U** Note the use of mixed-case letters for safety messages, and also the use of 'U' for 'You', which needs to only be used in safety messages (filler messages) .

At construction sites during work hours, the default display for pVMS is the current roadwork message (Priority 2), or the current traffic condition or travel-time message (Priority 3) when there are no relevant roadwork messages. For Priority 3 messages (current traffic condition and travel times) the message would generally include two or three destinations plus the header row. Incident messages (Priority 1) will always take priority.

When traffic conditions are normal, for example outside work hours, Priority 4 or lower messages may be displayed.

For all displayed messages, but particularly when using multi-frame messages, consideration needs to be given to the amount of information that road users can comprehend. This will ensure legibility and minimise unnecessary driver distraction.

7.4 Display colour and dimension requirements

The multifunction pVMS can display graphics using four colours (yellow, red, green and white) with up to four lines per frame and 14 characters per line.

The character height for Priority 1 and Priority 2 messages is generally 320 mm (which will limit the number of characters to 10 per line), with a legibility distance of 200 m. Priority 3 and Priority 6 messages need to have 200 mm high characters (to accommodate up to 14 characters per line), with a legibility distance of 100 m. The character height for Priority 3 messages can be either 320 mm or 200 mm if the number of characters per line is more than 10. For priority 5 messages, 200 mm high characters may be used.

The pVMS will also have flashing conspicuous lights at its four corners, which are only to be used for Priority 1 messages. If the message involves two frames, flashing conspicuous lights may not be used (assuming that the changing frames will be adequate to draw attention to the sign).

7.5 Using multi-frame and alternating messages

Due to the limited space available on pVMS, the use of multiple frames may be required for important messages. However, this is generally undesirable and needs to only be considered if other options are not available. The use of multiple frames is not recommended for Priority 3 and lower messages.

When multiple frames have to be used (for Priority 1 or Priority 2 messages), they need to be limited to two frames. Multi-frame messages may include a symbol and text combination or only text, as shown in Figure 7-2. Each of the two frames needs to comprise complete and meaningful information, forming a stand-alone message. The screen timing needs to be at least three seconds per screen (frame). Scrolling messages are not permitted.

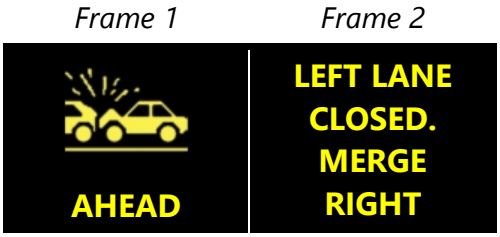


Figure 7-2 Multiple screens including a symbolic pictogram

Alternating two messages of the same type, for example a symbol or a text message or two symbols, is permitted only in Priority 2 messages, with a maximum of two frames as shown in Figure 7-3.

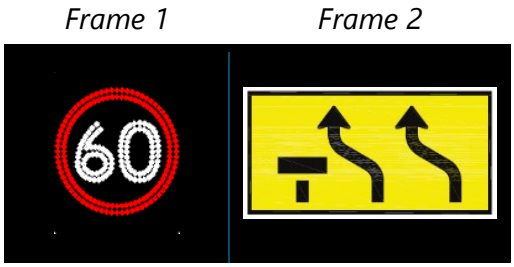


Figure 7-3 Alternating symbol Priority 2 (roadwork) signs

7.6 Message design

In general, the credibility and effectiveness of VMS messages depends on how the messages are designed and used. Messages that are poorly designed, irrelevant or displayed at the wrong time are less effective and may confuse road users.

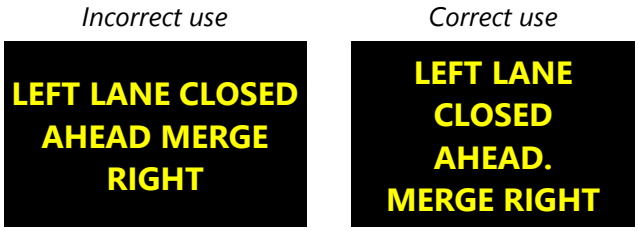
Designing pVMS incident messages follows the same guidelines as outlined in Section 2.4.1. As the pVMS does not have a separate pictogram panel, messages generally need to have a problem and action statement as a minimum. As space is limited on a pVMS, a message may take two frames.

Commercial or advertising messages must not be displayed on worksite pVMS.

Guidelines for the development of new messages are provided below, based on good signing practice:

- Where needed, only approved or standard abbreviations must be used. All pVMS may require the use of more abbreviations because of space limits. A list of approved abbreviations is provided in Appendix E.

- Messages need to be appropriate to the location, time of day, road environment and prevailing road conditions.
- Messages need to be clear, concise and unambiguous, and written in a directive tone.
- Messages need to be as brief as possible and be considered 'glance appreciative', to promote quick comprehension of the message by the road user.
- Generally, an eight-word message approaches the processing capability of an average road user.
- A single message must not contain more than seven pieces of information (words and symbols).
- No single line must contain more than two pieces of information (words and symbols).
- A single space needs to be left between a number and its unit.
- No information must be illogically split or combined. An example is shown in Figure 7-4.
- A full stop may be used to separate information where necessary to avoid confusion. However, excessive use of full stops need to be avoided (refer Figure 7-2 and Figure 7-5).



NOTE: For demonstration of the argument only. The above message may not be able to be displayed on a pVMS due to space limitations.

Figure 7-4 Example of incorrect and correct combination of information that facilitates comprehension

- Use the minimum number of words necessary to convey message. An example is shown in Figure 7-5.

Figure 7-5 Example of how surplus words on a message can be avoided

- Appropriate case needs to be used for the messages:
  - use upper case, except for travel times and safety (filler) messages
  - use mixed-case for travel times and safety messages, with the first letter of each word in upper case, except in words such as 'to', 'with' or 'for' - unless they are used as the first word in a line.
- Inappropriate language, which is likely to offend the public, must not be used.

To minimise confusion noted around messages using 'ROAD CLOSED' on the days before the proposed closure date, the following principle is applied. The advanced notice ('ROAD CLOSURE' message) leading up to the road closure needs to be a Priority 3 message (planned roadworks) with 200 mm characters, while the 'ROAD CLOSED' message on the days of closure is a Priority 2 message with 320 mm characters (refer Figure 7-6). This helps road user understand the message, particularly if they have not read the closure dates.

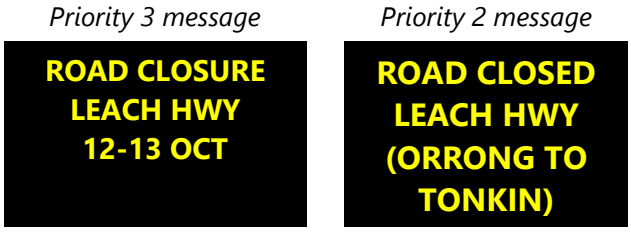


Figure 7-6 Message priorities and correct use of 'ROAD CLOSURE' and 'ROAD CLOSED' messages

7.7 Message approvals

An approved message library is attached at Appendix C , while approved pictograms and approved abbreviations are provided in Appendix D and Appendix E.

Any road sign in AS1742.3 is also deemed approved for use on pVMS as appropriate. Any new message, pictogram, abbreviation or road sign not in this guide needs to be approved by the Manager Real Time Traffic Operations.

7.8 pVMS placement

The longitudinal placement of pVMS needs to be as shown in Table 7-2.

Table 7-2 Portable VMS location prior to a problem and spacing relative to other signs, as based on table D1 of AS1742.2

Installation	Speed environment (km/h)	
	60 to 90	< 60
Distance prior to the subject of the message (no complex manoeuvres)	80 to 180 m	30 to 100 m
Distance prior to the subject of the message (complex manoeuvres)	400 to 500 m	300 – 400 m
Spacing to static signs	50 to 60 m	50 m

When being used to give advance warning of worksites, the pVMS needs to be placed 300 m in advance of the worksite.

The pVMS needs to aim at the middle of the lanes travelling towards the pVMS, at a point on the road that is:

- 65 m from the pVMS having a legibility distance of 100 m
- 140 m from the pVMS having a legibility distance of 200 m.

7.9 Construction site message posting and operator control

The pVMS should generally have remote and local control at a construction worksite.

In the event of a major incident, the local (site-based) operator needs to liaise with the RNOC regarding pVMS messages. If RNOC operators want to take over the control of project-based pVMS, they may do so after discussions with the local operator. This may mean either deploying messages decided by RNOC through the local operator, or in an extreme case, full direct control of pVMS by RNOC until the operation is handed back to the local operator.

All projects on state-controlled roads in the metropolitan area, with a duration greater than three weeks, are required to develop (in consultation with RNOC – Road Planned Interventions Section) a project specific remote access to pVMS Procedure. As a minimum, the procedure will address the requirements outlined in this section of the VMS guidelines. Contact RNOC (Road Planned Interventions Manager) for a sample Remote Access to pVMS Procedure.

Except for the travel-time displays (refer Section 7.10), all other pVMS messages are to be posted manually by an authorised operator. There must be at least one designated operator at all times with a backup operator also available. A list of authorised pVMS operators needs to be approved for each worksite.

Traffic management implementers at the work site must have a map of current pVMS locations and their unique identification numbers. They need to be aware of the status of all pVMS at the site and maintain an accurate record of changes to the messages at each pVMS, with the details of the new message, date and time of change (unless such details are logged in automatically by the control system associated with the pVMS).

7.10 Travel-time displays

The display of near real-time travel information on pVMS may also be implemented with the use of appropriate data.

An application needs to be available for the pVMS in consultation with the data supplier, so that the travel time data can be automatically uploaded to the relevant pVMS via an appropriate communication link. This data would generally be refreshed every five minutes. Travel times to the destination need to be provided to the nearest minute.

A pVMS with a travel time display is illustrated in Figure 7-1 and in Figure 7-7.

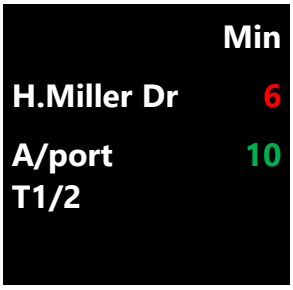


Figure 7-7 An example pVMS with real-time travel-time information

Colour coding will be used as in Table 7-3 to indicate the estimated or actual travel-time (ETT) relative to nominal travel time (NTT). NTT is based on posted speed prior to roadworks.

Table 7-3 Travel time (or speed) thresholds for travel-time colour display

Travel time colour	ETT / NTT ratio	Equivalent speed range (km/h)			
		100	90	80	70
Green	< 1.5	> 66	> 60	> 53	> 46
Yellow	1.5 to < 2.0	50 to 66	45 to 60	40 to 53	to 46
Red	> 2.0	< 50	< 45	< 40	< 35

Travel times can be overridden by an authorised operator with a higher priority message if needed.

Travel time destinations are usually the key intersections within the project area, unless key intersections and destinations, for example the airport, are outside the project area but are significant and within proximity.

Destinations need to be in top to bottom order with the closest destination at the top and the furthest last. A project destinations strategy needs to be developed. Focus group testing may be needed to confirm comprehension of sign messages.

When travel times are not available for a short duration, due to a breakdown in the communication link or other reasons, the screens can move to a default safety message.

7.11 Event management message posting and operator control

For the use of pVMS before or during significant events, the sign locations and proposed messages need to be determined as part of an overall traffic management plan for the event. The RNOC would generally manage and control the pVMS remotely as part of the event management.

8 References

Austroads 2019, Guide to Traffic Management Part 10: Traffic Control and Communication Devices, AGTM10-19, Austroads, Sydney, NSW. However, it is noted that Trip Condition Signs (TCS) and Trip Information Signs (TIS) are not used in Western Australia (refer Section 2.3.6).

Main Roads Western Australia 2023, Main Roads Supplement to the Austroads Guide to Traffic Management Part 10: Transport Control – Types of Devices.

Main Roads 2024, Traffic Management for Works on Roads: Code of Practice, July 2024.

Main Roads Western Australia 2020, Main Roads Specification 707 for Variable Message Signs (Fixed Type), Main Roads Western Australia, East Perth, WA.

Main Roads Western Australia 2020, Main Roads Specification 714 for RC1 and RC2 Ramp Control Signs, Main Roads Western Australia, East Perth, WA.

Main Roads Western Australia 2020, Main Roads Specification 715 for RC3 Real Time Information Signs, Main Roads Western Australia, East Perth, WA.

Main Roads Western Australia 2020, Main Roads Specification 716 for Ramp Signals, Main Roads Western Australia, East Perth, WA.

Standards Australia 2019, Variable message signs Part 1: Fixed signs, AS 4852.1—2019, Sydney, NSW.

Standards Australia 2019, Australian Standard AS 4852.2 – 2019 Variable message signs Part 2: Portable signs, Standards Australia, Sydney.

Standards Australia 2022, Manual of uniform traffic control devices, Part 2: Traffic control devices for general use, AS 1742.2-2022, Sydney, NSW.

Standards Australia 2022, Australian Standard AS 1742 Set – 2022 Manual of uniform traffic control devices Set, Standards Australia, Sydney.

VicRoads 2019, Managed Motorway Design Guide Volume 2: Part 3, Motorway Planning and Design, Ministry of Transport, Melbourne, Victoria.

VicRoads 2020, Managed Motorway Design Guide Volume 2: Part 4, Lane Use Management, Variable Speed Limits and Traveller Information, Ministry of Transport, Melbourne, Victoria.

Main Roads Smart Freeways Provision Guidelines.

Main Roads Smart Freeways Operational Efficiency Audit Guidelines.

Main Roads Supplements to Victoria's Managed Motorway Design Guide.

Victoria's Managed Motorway Design Guide.

Victoria's Managed Motorway Design Guide Volume 2: Part 4 Lane Use Management, Variable Speed Limits, Traveller Information.

Appendix A VMS Message Library – Incidents and Events

Table A1 VMS message library – incidents and events.

No.	Pictogram	Event type	Location	Effect	Action	Comment
1		HIGH WINDS	- ON ____		- CAUTION - REDUCE SPEED - DRIVE SAFELY	*This symbol is used to represent high winds. This will be used at bridges during winds greater than the prescribed threshold.*
				- _____CLOSED - FREEWAY CLOSED	- USE ALT ROUTE - USE EXIT "number" - USE "name" EXIT - USE NEXT EXIT	
2		CONGESTION QUEUES	- AHEAD - AT ___ - ___ TO ___ - IN TUNNEL - ON ____ - NEAR __ - AFTER ___	- EXPECT DELAYS	- PREPARE TO STOP - CAUTION - DRIVE SAFELY - USE ALT ROUTE	*This pictogram is used for congestion and queuing.* *The event type is to be displayed in the text message section of the sign or beneath the pictogram.*
3	**No symbol used for planned (future) event**	SPECIAL ROAD EVENT	- ___ TO ___ - IN TUNNEL - ON ____	- EXPECT DELAYS - **SEEK ALT ROUTE (NON ACTIVE)**	**SCHEDULED DAY/DATES** - "Day" – "Day" - "No." "Month" - "No." "Month" - "No." "Month" - "No." AM – "No." PM	*No pictogram is used when information for planned events is displayed (future roadworks or special road events etc.).* *The effects shown in bold red are only used in planned event messages.*
		PLANNED ROADWORK	- AT ___ - ___ TO ___ - IN TUNNEL - ON ____	- EXPECT DELAYS - **NIGHT WORKS** - **SEEK ALT ROUTE (NON ACTIVE)**	**SCHEDULED DAY/DATES** - "Day" – "Day" - "No." "Month" - "No." "Month" - "No." "Month" - "No." AM – "No." PM	

No.	Pictogram	Event type	Location	Effect	Action	Comment
4		BREAKDOWN	- AHEAD - AT ___ - IN TUNNEL - ON ____ - NEAR __ - ___ AHEAD - AFTER ____	- LEFT LANE(S) CLOSED	- MERGE RIGHT	*This pictogram is used to represent a broken-down vehicle.*
				- RIGHT LANE(S) CLOSED	- MERGE LEFT	
				- ON SHOULDER	- REDUCE SPEED	
				- _____CLOSED - FREEWAY CLOSED	- USE ALT ROUTE - USE EXIT "number" - USE "name" EXIT - USE NEXT EXIT	
				- EXPECT DELAYS	- PREPARE TO STOP - CAUTION - REDUCE SPEED - DRIVE SAFELY	
5		ROADWORKS	- AHEAD - AT ___ - ___ TO ___ - IN TUNNEL - ON ____ - NEXT ____ - ___ AHEAD - AFTER ____	- LEFT LANE(S) CLOSED	- MERGE RIGHT	*This pictogram is used for any active roadworks.*
				- LEFT LANE(S) CLOSED	- MERGE LEFT	
				- LEFT SHOULDER CLOSED - RIGHT SHOULDER CLOSED		
				- _____CLOSED - FREEWAY CLOSED	- USE ALT ROUTE - USE EXIT "number" - USE "name" EXIT - USE NEXT EXIT	
				- MAJOR DELAYS - MINOR DELAYS - EXPECT DELAYS	- PREPARE TO STOP - CAUTION - REDUCE SPEED - DRIVE SAFELY	

No.	Pictogram	Event type	Location	Effect	Action	Comment
6		TRAFFIC CONTROLLER	- AHEAD - AT ___ - ___ TO ___ - IN TUNNEL - ON _____ - NEXT _____ - ____ AHEAD - AFTER ____	- LEFT LANE(S) CLOSED	- MERGE RIGHT	*The traffic controller sign is used to give advance warning of a traffic controller.* *PREPARE TO STOP is used in conjunction with this sign if traffic is required to stop at the traffic controller position.*
				- RIGHT LANE(S) CLOSED	- MERGE LEFT	
				- LEFT SHOULDER CLOSED - RIGHT SHOULDER CLOSED		
				- MAJOR DELAYS - MINOR DELAYS - EXPECT DELAYS	- PREPARE TO STOP - CAUTION - REDUCE SPEED - DRIVE SAFELY	
7		FLOODING	- AHEAD - AT ___ - ON _____ - NEXT _____ - ____ AHEAD - AFTER _____	- _____CLOSED - FREEWAY CLOSED	- USE ALT ROUTE - USE EXIT “number” - USE “name” EXIT - USE NEXT EXIT	*This pictogram is used to represent water over road.* *The event type is to be displayed in the text message section of the sign or beneath the pictogram.*
				- MAJOR DELAYS - MINOR DELAYS - EXPECT DELAYS	- PREPARE TO STOP - CAUTION - REDUCE SPEED - DRIVE SAFELY	
8		EMERGENCY VEHICLE		- LEFT LANE CLOSED	- MERGE RIGHT	*This pictogram is used when a lane closure is implemented solely for use by an emergency vehicle.*
				- RIGHT LANE CLOSED	- MERGE LEFT	
					- CAUTION	

No.	Pictogram	Event type	Location	Effect	Action	Comment
9		CYCLING EVENT RUNNING EVENT	- ___ TO ___ - IN TUNNEL - ON _____	- LEFT LANE(S) CLOSED	- MERGE RIGHT	*This pictogram is used for an active cycling event.* *The type of cycling event is to be displayed in the text message section of the sign or beneath the pictogram.*
				- RIGHT LANE(S) CLOSED	- MERGE LEFT	
				- LEFT SHOULDER CLOSED - RIGHT SHOULDER CLOSED		
				- _____CLOSED - FREEWAY CLOSED	- USE ALT ROUTE - USE EXIT "number" - USE "name" EXIT - USE NEXT EXIT	*This pictogram is used for an active running event.* *The type of running event is to be displayed in the text message section of the sign or beneath the pictogram.*
				- MAJOR DELAYS - MINOR DELAYS - EXPECT DELAYS	- PREPARE TO STOP - CAUTION - REDUCE SPEED - DRIVE SAFELY	
10		OIL SPILL DEBRIS CHEMICAL SPILL FOG SMOKE ANIMAL	- AHEAD - AT ___ - IN TUNNEL - ON ___ - NEAR ___ - AFTER ____	- LEFT LANE(S) CLOSED	- MERGE RIGHT	*This pictogram is only used when there is not a more specific pictogram available.* *It is used individually or in conjunction with words indicating the event type.* *The event type is to be displayed in the text message section of the sign or beneath the pictogram.*
				- RIGHT LANE(S) CLOSED	- MERGE LEFT	
				- _____CLOSED - FREEWAY CLOSED	- USE ALT ROUTE - USE EXIT "number" - USE "name" EXIT - USE NEXT EXIT	
				- MAJOR DELAYS - MINOR DELAYS - EXPECT DELAYS	- PREPARE TO STOP - CAUTION - REDUCE SPEED - STAY IN VEHICLE - DRIVE SAFELY	

OFFICIAL

No.	Pictogram	Event type	Location	Effect	Action	Comment
11		INCIDENT	- AHEAD - AT ___ - IN TUNNEL - ON _____ - NEAR ___ - AFTER ____	- LEFT LANE(S) CLOSED	- MERGE RIGHT	*This pictogram is used to for an incident or a crash.*
				- RIGHT LANE(S) CLOSED	- MERGE LEFT	
				- _____CLOSED - FREEWAY CLOSED	- USE ALT ROUTE - USE EXIT "number" - USE "name" EXIT - USE NEXT EXIT	
				- LEFT SHOULDER CLOSED - RIGHT SHOULDER CLOSED		
				- MAJOR DELAYS - MINOR DELAYS - EXPECT DELAYS	- CAUTION - REDUCE SPEED - STAY IN VEHICLE - DRIVE SAFELY	
				- RIGHT LANE(S) CLOSED	- MERGE LEFT	
12		(Used as part of a LUMS response only)		- LEFT LANE(S) CLOSED	- MERGE RIGHT	*This pictogram is only used before the start of a LUMS environment to display advance warning of a reduced speed limit to 40 km/h and lane closure at the 1st LUMS gantry, i.e. when there is no other upstream gantry to indicate a lane change is required.*
				- RIGHT LANE(S) CLOSED	- MERGE LEFT	
13		EXIT		- FREEWAY CLOSED	- USE EXIT "number" - USE "name" EXIT - USE NEXT EXIT	*This pictogram is used only on the VMS upstream of a full freeway closure and upstream of an off ramp, informing road users that they must exit at the next exit.*

Appendix B VMS Message Library – Campaigns and Promotions

Table B.1 VMS Message Library – campaigns and promotions

No.	Message	Purpose
C1	Buckle Up. Seat Belts Save Lives	Safe road users
C2	Drink Driving is Never OK	Drink driving behaviour / road safety
C3	Stick to Speed Limit	Road safety
C4	Speed can Kill. Slow Down	Road safety
C5	Don't be Distracted By Mobile Phone	Safe road users
C6	Bike Week Date to Date Cycle Instead	Campaign
C7	Walk Safely To School Day Fri Date May	Campaign
C8	Spinal Injury Awareness Week Date to Date Nov	Campaign
C9	Double Demerits Date to Date Drive Safely	Campaign
C10	Keep Left Unless Overtaking	Driver behaviour
C11	Charity Ride Ahead Expect Delays	Awareness and warning
C12	Back to School 40 km/h In School Zones	Public awareness / road safety
C13	Total Fire Ban Today	Public awareness

Note: This VMS library is not an exhaustive list; rather it provides a sample of approved messages. Contact Manager Real Time Traffic Operations for use of messages not presented within this appendix.

Appendix C VMS Message Library – Portable VMS

Table C.1 Incident (Priority 1) pVMS messages

Sign ID	Message	Other combinations[1]				
		Problem	Location	Effect	Attention	Action
PV1-01a	CRASH AHEAD. RIGHT LANE CLOSED	CONGESTION DEBRIS EMERGENCY FLOOD FOG HAZARD INCIDENT OIL SPILL OVERSIZE LOAD OVERSIZE VEHICLE POLICE CONTROL POOR VISIBILITY QUEUES SMOKE SURFACE WATER TRAFFIC CONTROL VIP CONVOY WATER ON ROAD	LEFT LANE MID LANE NEXT (number) KM NEXT (number) M ON (name of road) RIGHT LANE	(name of road) CLOSED (number) MINS DELAY DELAYS LFT LANE CLOSED MAJOR DELAY(S) MID LANE CLOSED MINOR DELAY(S) NO SHOULDER (S) QUEUES ROAD CLOSED	(destination) TRAFFIC ALL TRAFFIC BUSES CARS EMERGENCY VEHICLE LOCAL TRAFFIC OVERSIZE VEHICLE THROUGH TRAFFIC TRANSIT VEHICLE TRUCKS	DRIVE SAFELY DRIVE WITH CARE DRIVE WITH CAUTION EXIT TO (name of road) MERGE RIGHT PREPARE TO STOP REDUCE SPEED SLOW DOWN STAY IN CAR STAY IN VEHICLE TURN LEFT TURN RIGHT USE ALT ROUTE USE DETOUR DO NOT OVERTAKE MERGE LEFT USE OTHER ROUTE USE (name of road) KEEP LEFT
PV1-01b	ALL TRAFFIC MERGE RIGHT					

[1] Some statements may need to be split into two lines and approved abbreviations may be required for some words due to space limitations.

Table C.2 Current roadwork (Priority 2) messages[2]

Sign ID	Message	Other combinations				
		Problem	Location	Effect	Attention	Action
PV2-01	**ROADWORKS AHEAD. REDUCE SPEED**	FLAGMAN TRAFFIC CONTROLLER	(same as in PV1-01)	(same as in PV1-01)	(same as in PV1-01)	(same as in PV1-01)

Table C.3 Current traffic or road condition, or travel time (Priority 3) messages

Sign ID	Message	Uses
PV3-01	**Changed Road Alignment. Drive with EXTRA CAUTION**	Road alignment is changed.
PV3-02	**Changed Road Surface. Drive with EXTRA CAUTION**	Road surface conditions have changed to a poorer condition than before.
PV3-02	**Heavy Machinery Close to Road. Drive with EXTRA CAUTION**	When heavy machinery works close to traffic, particularly for prolonged periods.

[2] Generally use AS1742.3 road signs

Table C.4 Planned roadwork (Priority 4) messages[3]

Sign ID	Message	Other combinations				
		Problem	Location	Effect	Attention	Action
PV4-01	**NIGHT WORK XXXX RD FROM XX**					

Table C.5 Safety (Priority 6) messages for pVMS (at roadworks sites)

Sign ID	Message	Uses
PV6-01	**Slow Down for Workers' Safety. They Work for U**	When workers work close to live traffic, and speeding through the worksite is an issue. Must not be used when the worksite is not in operation.
		Refer note 1
PV6-02	**Slow Down For Your & Others Safety**	When speeding through the worksite is an issue. Refer note 1
PV6-03	**Obey Road Signs For Your & Others Safety**	Road signs are ignored.
PV6-04	**Speed can Stop you Forever Slow Down**	Where a high proportion of drivers are exceeding the speed limit.

Note 1: Where appropriate or necessary, use directive tone and omit 'Please' or 'Pls'

[3] This table needs to be populated in consultation with roadworks traffic management team as construction proceeds

Appendix D Portable VMS Pictograms

Table D.1 Pictograms library (sample)

ID[4]	Pictogram	Uses
PVP-01		Congestion Queues
PVP-02		Incident (vehicle breakdown)
T1-5		Roadworks
T1-34		Traffic control
PVP-05		Flooding Water on road
PVP-06		Crash
PVP-07		Exit
T3-3		Slippery surface
T3-9		Loose material on road surface

Source: Adapted from VicRoads

[4] The sign IDs starting with T are Australian Standard sign numbers. Other IDs are temporary IDs assigned in this document. All signs need to conform to Australian Standards in size, colour and other parameters.

Appendix E VMS Abbreviations

The following abbreviations are acceptable on VMS signs:

Table E.1 Abbreviations – Road Names

Road Name	Abbreviation
Horrie-Miller Drive	H. Miller Dr
Graham Farmer Freeway	G. Farmer Fwy
Great Eastern Highway	Gt Eastern Hwy
Great Northern Highway	Gt Northern Hwy

Table E.2 Abbreviations – General Terminology

Word	Abbreviation
Alternate	ALT
Avenue	AVE
Boulevard	BVD
Corner	CNR
East bound	EAST-BND
Esplanade	ESP
Freeway	FWY
Highway	HWY
Hours	HRS
Information	INFO
Junction	JNC
Kilometre	KM
North bound	NTH-BND
Minutes	MIN
Road	RD
Shoulder	SHLDR
South bound	STH-BND
Street	ST
Vehicle	VEH
West bound	WEST-BND

OFFICIAL

Table E.3 Abbreviations – Times and dates

Word	Abbreviation
Time duration	'number' Min
	'number' HRS
	'number' DAYS
	'number' WEEKS
Time of day	'number' AM
	'number' PM
Time period	'number' AM – 'number' PM
Days of week	SUN
	MON
	TUE
	WED
	THU
	FRI
	SAT
Day period	MON - FRI
Months of year	JAN
	FEB
	MAR
	APR
	MAY
	JUN
	JUL
	AUG
	SEP
	OCT
	NOV
	DEC
Date	'number' JAN
Date period	'number' JAN – 'number' FEB

OFFICIAL

Table E.4 Other abbreviations for pVMS safety (filler) messages only

Word	Abbreviation
AND	& (or) n
FOR	4
TO	2
YOU	U

Note: These abbreviations must not be used in any other message type, except in filler messages in pVMS where they may be used only if necessary (for lack of space) and in appropriate context.