Final National Variable Message Sign (VMS) Usage Policy

Prepared for: The South African National Roads Agency Limited


03 May, 2010

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ACRONYMS

FMS – Freeway Management System
NMC – Network Management Centre
SANRAL – South Africa National Roads Agency Limited
SOP – Standard Operating Procedure
VMS – Variable Message Sign
## REVISION HISTORY

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1. INTRODUCTION

1.1 Background

Variable Message Signs (VMS) are a core component of South African National Roads Agency Limited (SANRAL) Freeway Management System (FMS) and overall road user/traveller information programme. SANRAL currently operates a number of message signs on Gauteng freeways from the Network Management Centre (NMC), now Transportation Management Centre (TMC) in Gauteng. Additional facilities such as those in KwaZulu-Natal (KZN) and Cape Town also have or will control VMS on SANRAL and other routes. Some facilities also may partner with local agencies to operate VMS on regional and municipal routes, and in some cases, local partners are already operating VMS on freeways in those regions.

To promote consistent application of this National Policy, it is essential that SANRAL liaise with operational partners to obtain buy-in and agreement to implement the VMS message policy. This includes city partners, toll concessionaires, and operations contractors, as these role players all potentially have an operational responsibility for VMS operations.

It is the intent that this policy be extended to cover all road authorities in South Africa with VMS operations responsibility. This will require SANRAL to liaise with National Department of Transportation and the South Africa Development Community (SADC) to incorporate appropriate requirements into a future edition of the SADC Road Traffic Sign Manual (RTSM).

1.2 Need for Policy for VMS Usage and Operations

The VMS component of the road network is perhaps one of the most visible system technology elements to the road users. Ensuring consistent usage and message formats are imperative when building and maintaining the public’s confidence in a VMS system. A more formal policy and operating guidelines are required to ensure that VMS on SANRAL national routes as well as locally-managed routes are being used in a consistent manner, including how messages are displayed, under which conditions messages are provided to road users, and for consistency of message format and content. Establishing standardized policies, procedures, and guidelines between agencies can afford the driver with a consistent and meaningful message.

Currently, the only guidelines for operations of VMS is the Sanral NMC Operations Manual developed for the Gauteng NMC. However, NMC operators also have developed workbooks containing instruction related to the use of VMS. This has created an environment where different operators refer to workbooks with varying levels of information. The importance of all operators and managers working from a complete and consistent document is significant and will have positive effects on motorist safety, travel time, and overall driving experience.

As SANRAL seeks to implement a new FMS, there will be an updated Operations Manual prepared to serve as a resource to NMC/TMC operators in each of the regions where FMS is deployed. VMS will be one of the core components of this Operations Manual.

1.3 Document Scope

The intent of this document is to establish a National Policy for use by all Road Authorities to provide guidance for consistent use of permanent VMS on freeways and local roads. The most important goal of this document is to create an effective policy that will enable all agencies to consistently disseminate a precise and clear message to motorists. A well-established National
VMS Strategy will assist in attaining a seamless operation of monitoring traffic and weather conditions and notifying the travelling public in the most efficient manner.

This policy will be included within FMS Operations Manuals in each of the SANRAL regions and will also provide important input to operator training/skill set development.

Best practices and VMS Operations/Usage Guidelines and Policies were consulted and utilised when developing this policy for South Africa. These documents are identified in the References section at the end of this document.

It is important to note that there are several design requirements for VMS that will need to be aligned with the South African Development Community (SADC) Road Traffic Signs Manual (RTSM). The RTSM document contains important signage standards, addressing issues such as sign placement, letter size for optimum legibility, reading time and a reading time formula, among others. Section 3 presents initial guidance on recommended VMS placement and location requirements. It is recommended that SANRAL liaise with SADC for an amendment or update to the RTSM to incorporate VMS design requirements.
2. **CURRENT SYSTEMS AND CAPABILITIES**

2.1 **Existing and Planned VMS**

SANRAL currently operates approximately 50 VMS in the Gauteng region and there are approximately 50 VMS planned for Cape Town and approximately 20 in KZN. These signs are used primarily to support incident management and advisories of road works closures and restrictions. The VMS are an integral component of SANRAL’s FMS strategy; they are monitored and activated by operators at SANRAL’s traffic management centres.

SANRAL places permanent VMS on freeways in the urban areas to provide for adequate coverage, in advance of freeway exit ramps (for diversion), and in advance of freeway-to-freeway interchange and major decision points. This is consistent with international best practices for placement of VMS to maximise effectiveness of this traveller information technology.

In addition to permanent VMS, there are numerous mobile or portable VMS used to support location-specific road user information needs, including:

- Road works and road construction zones
- Extended closures and restrictions due to hazards or disasters
- Special event directional information
- Supplement permanent VMS locations

2.2 **Current VMS Operational Strategies**

The SANRAL Network Management Centre in Gauteng currently has an operator’s notebook with standard operating procedures for various communications protocols. Within this notebook, Standard Operating Procedure 6 (SOP6) covers VMS operations. Though this document is in the operator’s notebook, the extent to which it is used varies from operator to operator. These documents are not dated and therefore it is difficult to determine whether or not operators are working from a current or complete copy. There was an additional SOP6A issued, however that did not make it to all notebooks or operators, and it is not clear if that SOP6A was ever finalised or fully implemented. Additionally, there is an operator’s workbook that contains other guidance and instruction. Operators may have variations on this workbook. Having one complete document available to all operators and agencies will be essential in standardising a process that will be beneficial to all users of the system.

Currently, the NMC Operations Manual outlines a subset of message numbers specific to the type of message in the message table. However, closer evaluation has revealed that many of the messages repeat one another with slight variations. Inconsistent abbreviations and varying levels of detail also were common occurrences. In addition, many of the messages with the same meanings are comprised of different phrases or phrases in a different order. Establishing a standardised message table and written procedure for message phrase order are essential for effective VMS operations. The message table will need to be aligned with the FMS software development effort.

Mobile or portable VMS are typically operated by contractors, particularly for road works projects. These VMS are programmed locally (at the sign), and are not monitored, controlled or updated by SANRAL operators. Their smaller size requires additional attention to aspects such as message length, display time, height and visibility of the signs, and other parameters. Because they cannot be dynamically updated, messages are intended provide information on future impacts or closures, or safety messages as part of ongoing road works projects.
3. VMS PLACEMENT AND LOCATION GUIDELINES

Formal design specifications for VMS are to be established in accordance with additional requirements for visibility, right-of-way, clearance, and other design parameters in the SADC-RTSM. At present, VMS are not specifically addressed within the Manual’s requirements, although certain criteria for visibility, readability and other parameters apply.

It is recommended that SANRAL work with SADC to update and amend the RTSM with appropriate VMS design requirements.

3.1 Placement of Permanent VMS – Freeway

- VMS should be installed in advance of decision or diversion points (freeway off-ramps or interchanges) to allow road users sufficient time to make route decisions or diversions. Placement of a VMS 900-1200M in advance of a decision point provides sufficient time to motorists to respond to diversion messages.
- VMS should not be installed in close proximity to an on-ramp (merge point).
- Spacing between VMS on an urban area freeway corridor should consider the following:
  - Desirable Minimum spacing between VMS: 800-1000M
  - Desirable Maximum spacing between VMS: 4000-5000M
- Depending on the corridor characteristics or complexity of interchanges and merge points, other spacing options may be considered. In non-urban areas, spacing between VMS will likely exceed the 5000M maximum identified above. In rural areas, VMS should be placed a minimum of 1000M in advance of a decision point.
- Placement of other road signs in proximity to freeway VMS (standard directional or information signage) need to factor rate of information processing by motorists. This includes minimising information overload, information conflicts, and allowing enough time for road users to process information presented on multiple signs.

Section 5.7 of this document provides additional information on acceptable number of “units” of information that can be safely processed by road users at freeway speeds. Reading time and textual characteristics also influence road users’ ability to process and respond to information. Consult the SADC-RTSM Chapter 4.4 for established guidance.

3.2 Placement of Mobile VMS – Freeway

- Mobile VMS should be used as a supplement to freeway VMS for specific instances, including road works, incidents or special events.
- Placement of mobile VMS shall follow similar criteria to the permanent VMS, but the nature of mobile VMS requires additional precautions with proximity, sight distance, and units of information conveyed.
- Portable VMS shall be placed off the shoulder, where feasible and applicable. Where possible, a clear zone shall be provided.
- Placement of mobile VMS shall be on one side of the freeway at a specific location, not both sides. Placement shall consider other permanent signage so as not to obstruct motorists view of all applicable safety, guidance and regulatory signage.
- Mobile VMS need to be routinely monitored for position in regard to glare and horizontal sight distance.
- Placement guidelines apply to contractor-located portable VMS in addition to SANRAL VMS.
3.3 Placement of VMS – Arterial
- On arterial roads, overhead VMS may be easier to install but consideration should be given to their visual impact.
- The desirable horizontal clearance distance from the traveled way is 6M, with an absolute minimum of 5.6M.
- Sign placement should be checked so that horizontal or vertical curves do not result in the sign being outside of the range of 10 degrees to centre horizontally and 5 degrees vertically of a driver’s line of sight.
- VMS should be located sufficiently ahead of major decision points (major intersections) – between 400-700M.
- Where incidents occur between diversions are not required, the VMS should be located to provide adequate warning but not so distant from the incident that drivers revert to normal speeds between the sign and the incident.

3.4 Luminance Requirements

General requirements for the illumination of the VMS during daylight and nighttime conditions are provided in this section. There shall be a matte black background for the VMS so as to not disturb the readable message. All surfaces visible through the windows of the VMS shall match the matte black background of the message. Other illumination requirements are described below:

Contrast Ratio

Contrast ratios during the daytime between 8 and 12 provide optimum legibility (above 85% of drivers correctly read the message). The absolute minimum acceptable contrast ratio is 3 and the absolute maximum contrast ratio is 20. During the nighttime, sign illuminance levels should follow Table 3-1 shown below.

<table>
<thead>
<tr>
<th>Sign Illuminance Level (lx)</th>
<th>Minimum Luminance Ratio</th>
<th>Minimum Luminance</th>
<th>Maximum Luminance</th>
</tr>
</thead>
<tbody>
<tr>
<td>40,000</td>
<td>10</td>
<td>6,200</td>
<td>120,000</td>
</tr>
<tr>
<td>4,000</td>
<td>10</td>
<td>1,100</td>
<td>21,000</td>
</tr>
<tr>
<td>400</td>
<td>10</td>
<td>300</td>
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<td>40</td>
<td></td>
<td>200</td>
<td>2,000</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>60</td>
<td>300</td>
</tr>
</tbody>
</table>

External and Internal Illumination

The most common current VMS use LED internal illumination. Required luminance and luminance ratios are provided above in Table 3-1. It should be noted that luminance levels reduce with the age of the display components. At this stage, it is suggested that 90% of the above levels is acceptable.

The message display area should be designed to permit maximum exposure of copy to direct sunlight and ambient daylight for optimum daytime legibility without artificial illumination.
4. VMS USAGE POLICY

4.1 VMS Policy Principles

The following represents the overall parameters for the National VMS policy:

- It is understood and agreed that VMS are a highly visible component of SANRAL’s FMS, and are to be viewed as an integral part of SANRAL’s road user information programme.
- It is recognised that agencies or entities other than SANRAL may be posting messages to VMS on national routes. The VMS policy shall be reviewed and acknowledged in writing by all operating agencies or entities that will be posting messages on VMS on SANRAL national routes.
- A message hierarchy has been established within the VMS policy, and this shall be adhered to unless directed by SANRAL’s NMC/TMC Operations Manager. Overriding the message hierarchy shall be coordinated through the shift supervisor and operations manager.
- English shall be the language of all VMS messages to be consistent with the South Africa Development Community – Road Traffic Signs Manual (SADC-RTSM).
- VMS operations to support incident management shall be aligned with SANRAL’s Incident Management System (IMS) guidelines and protocols.
- Message set structures have been established to promote consistency of how information is displayed, abbreviations used, and to govern content.
- Complex messages on VMS may be displayed in two phases, but messages must be for the same incident or condition.
- It is agreed that VMS will be left blank unless there is an incident, event traffic guidance information, weather alert, emergency alert or travel time message being displayed. A “heartbeat” may be used while a VMS is blank to indicate its operational status. Safety or public service messages are discouraged.
- Operators will utilise standard message sets within the system to post messages to VMS; if there is an emergency situation requiring customised messages, proper protocol for involving the shift supervisor or operations manager will be followed.
- Operators will be provided paper copies of the VMS policy and standardised operating procedures will be incorporated into each operator manual. An electronic version shall also be made available via SANRAL’s intranet.
- Contractors for SANRAL projects that will be utilising portable VMS shall also receive a copy of this policy, and will be expected to adhere to the requirements and operational guidelines.

The VMS Policy discusses the following operational parameters in detail in this document:

- Define phrase requirement for message
- Standard and acceptable abbreviations to be used in VMS messages
- Operator use of pre-defined messages – one message or toggle between multiple messages
- Message hierarchy – to include need for blank signs
- Development and use requirements of customised messages
- Version control for message set library and notification procedure for new updates
- Shared operational control of VMS and permission levels
- Confirmation procedures for verifying selected message is being displayed correctly
4.2 VMS Message Hierarchy and Message Priorities

The following hierarchy is established in **Table 4-1** as part of the National VMS usage policy to aid operators in determining message priorities. In the event of multiple message requests (or needs) for a specific sign or corridor, the following shall govern the message priority for display:

**Table 4-1: VMS Message Priorities**

<table>
<thead>
<tr>
<th>Message Priority</th>
<th>Condition/Situation</th>
<th>Factors and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 1</td>
<td>Emergency/Disaster Alert and Warning</td>
<td>Affects wide area, multiple corridors</td>
</tr>
<tr>
<td></td>
<td>Evacuation</td>
<td>May require frequent updates based on changing conditions or emergency responses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road closures on major freeways within a 30-40 km radius of the sign</td>
</tr>
<tr>
<td>Priority 2</td>
<td>Traffic-Related Emergency Situations</td>
<td>Unplanned road conditions and incidents that block lanes for substantial periods of time</td>
</tr>
<tr>
<td></td>
<td>Incidents – Major</td>
<td>Road closures on major freeways or incidents causing congestion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not for incidents with minimum blockage and with short time duration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Messages should be placed on VMS in advance of multiple decision points upstream from the situation or incident</td>
</tr>
<tr>
<td>Priority 3</td>
<td>Adverse weather or environmental conditions</td>
<td>Messages should not project anticipated road conditions due to expected extreme weather more than 24 hours in advance</td>
</tr>
<tr>
<td>Priority 4</td>
<td>Current Roadworks/Restrictions</td>
<td>Planned but immediate road conditions</td>
</tr>
<tr>
<td></td>
<td>Planned Roadworks/Restrictions</td>
<td>Message should be displayed no more than 48 hours in advance of planned roadworks / restrictions lasting less than two business days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Message should be displayed no more than four days in advance of planned roadworks / restrictions for weekends</td>
</tr>
<tr>
<td>Priority 5</td>
<td>Planned Special Event</td>
<td>Initial message should be provided in advance of two decision points for travel to the event</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subsequent messages provided in advance of at least one decision point for travel to the event or parking at the event</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length of warnings are to be determined per event-specific traffic management plan</td>
</tr>
<tr>
<td>Priority 6</td>
<td>Travel Time</td>
<td>Automatically generated from system based on detection data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operator can preempt travel time if incident or other conditions warrant</td>
</tr>
<tr>
<td>Priority 7</td>
<td>Public Service/Safety Announcements</td>
<td>General advice about road safety and traffic management such as stand-by messages</td>
</tr>
<tr>
<td></td>
<td>Multi Modal Information</td>
<td>Requires approval by Operations Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anticipate low frequency of usage; these messages are not encouraged</td>
</tr>
<tr>
<td>Priority 8</td>
<td>Test Messages</td>
<td>Use only if testing sign during initial installation or maintenance is required</td>
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</table>
4.3 Operation of VMS by Other Personnel

If a management centre is not in operation 24/7, there may be benefit in allowing other personnel to operate one or more of the VMS. If unexpected traffic congestion or adverse weather conditions arise during off hours, and there is no message conveyed to motorists, there is a risk in jeopardising the public’s trust in the VMS system.

Additional authorized personnel from an agency should be able to operate VMS located in their respective jurisdiction during operation centres off hours for emergency situations. Additionally, partnerships among agencies (i.e., local authorities and regional or national authorities) can establish joint operations agreements that can provide for 24/7, shared operations. The emergency situation may include the following:

- Crashes
- Emergency roadwork
- Spilled loads
- Special events
- Severe weather or pavement conditions
- Heavy weekend/holiday traffic

The other authorized personnel should only display messages contained in a message table.

4.4 General Operations

Only information about current incidents, roadwork, pavement conditions, traffic (including travel times), roadway, or environmental conditions that could have an effect on driver safety and travel efficiency shall be displayed on the VMS. Exceptions may be made to display the following:

- Advance notification of roadwork requiring lane closures; and
- Advance notification of special events that will adversely affect travel either because of the forecasted increase in traffic or the requirement to close streets or highways.

4.5 Blank Signs

VMS shall be kept in blank mode during non-peak periods when there are no incidents, travel conditions, or future road works that warrant the display of a message. A “heartbeat” may be used while a VMS is blank to indicate its operational status. Stand-alone safety messages or public service announcements are not encouraged.

4.6 Messages During Peak Periods

During daily peak traffic periods, messages shall be used to advise motorists of unusual conditions (i.e. incidents, lane blockages, etc.). When normal traffic congestion is present during peak-hours, travel time messages may be used to give motorists an estimated time to defined points along the freeway (such as an exit, interchange or landmark). VMS shall not be used to inform drivers of something they already know (i.e. “CONGESTION AHEAD” when drivers are already stopped in traffic). VMS should only be used when a response or action is required by motorists.

4.7 Display of Upcoming Roadworks

Traffic related information that provides advance notice of upcoming roadworks may be displayed, but should be replaced by current information whenever applicable. The upcoming roadworks may be on the same freeway as the VMS, or on a downstream intersecting freeway. VMS shall not be
used to substitute roadwork signing; rather, VMS shall be used to supplement roadwork signs. Roadwork messages shall not be of the general nature (e.g., “Roadworks Next 10 KM”). They must be specific to the work being done and a general action can be provided to be used at the drivers’ discretion, such as “USE ALTERNATE ROUTE”, not “USE R102”.

If the work is to be performed within 48 hours, use day of week abbreviations (MON, TUES, WED, etc.). Messages that impact the safety and operation of the freeway shall have priority over messages for upcoming roadwork, in accordance with the message hierarchy shown previously in Table 4-1. If messages need to be displayed more than 48 hours in advance of scheduled roadworks, the provision for display of dates should include two-digit month, day and year (e.g. 12 August, 2010 = 12-08-10).

The following two figures display example roadworks messages. These are stand-alone messages and not two phases of a single message.

![Figure 4-1: Roadworks Example Messages](image)

4.8 Display of Upcoming Special Events That Adversely Affect Travel

Traffic-related information that provides advance notice of upcoming special events that will adversely affect travel (by generating major traffic or by requiring road closures) or provide guidance information (i.e., “Event Traffic Use Exit ____”) may be displayed. Use of specific actions such as exit numbers may be used only for event information purposes. There are typically a limited number of available routes to a specific event, and therefore directing event traffic to utilise specific routes works to provide efficiency in traffic ingress. Use day of week abbreviations (MON, TUES, WED, etc). Event messaging must be specific to guiding traffic; no sponsor or commercial information may be displayed on the VMS.

Messages on VMS in conjunction with a major event need to be pre-planned as part of a special event management plan. As applicable, strategies to coordinate messages among freeway and arterial VMS should be incorporated into the event traveller information guidance plan.

4.9 Display of Travel Times

Travel time information may be displayed if reliable, current travel time data is available on the route. The information must be displayed and updated on the VMS automatically by the central system computers; travel times are not to be manually entered or modified. Travel time information should be displayed during normal daily peak traffic conditions. Only permanent VMS should display travel times; travel times are not permitted on portable or mobile VMS.

SANRAL may consider expanding this display time if there are severe conditions outside of the typical peak travel periods, although such conditions would likely be prompt an incident-specific message on the VMS.
The following examples shown in Figure 4-2 display example travel time messages. SANRAL will need to determine the format for displaying travel times on VMS. Some agencies prefer to provide a range of times (typically two minutes) rather than a specific single time.

![Figure 4-2: Travel Time Example Messages](image)

### 4.10 Traffic Diversion (General)

VMS shall not be used to divert traffic to a specific route unless positive route guidance is available along the alternate route (such as in the case of event management plans), and unless conditions on the alternate route are known or confirmed. Both of the following requirements must be met:

- The VMS operator has accurate, current, and continuously updated knowledge of the traffic conditions on the alternate route.
- Use of the alternate route will result in time savings for the diverted traffic.

### 4.11 Traffic Diversion to Roadways Not Under the Jurisdiction of the Agency

VMS displaying specific alternate routes may be used only when the alternate route is a national route or municipal freeway operated by a partner agency located within the operations centre. Specific messages recommending diversion to a specific roadway or local street not within the same jurisdiction are not permitted unless:

- the appropriate agency has given permission; and
- road conditions on the alternate route are confirmed.

Generic diversion messages may be displayed when conditions warrant (i.e. “USE ALT ROUTE”).

### 4.12 Special Events

Permanent and portable/mobile VMS may be used to display traffic information related to special events in an effort to inform travellers of saturated road conditions or road closures, as well as to provide motorists with information to access the event. The VMS can direct motorists to the event and to warn non-attending motorists of unusual traffic conditions, as shown in the examples in Figure 4-3.

VMS may be used to advise thru-drivers on the freeway of adverse traffic conditions created as a result of the ingress and egress of special event traffic.

Messages on VMS in conjunction with a major event need to be pre-planned as part of a special event management plan. This is one instance where providing a specific exit or route is considered appropriate.
4.13 Adverse Weather, Environmental, and Roadway Conditions

VMS may be used to display adverse weather or roadway conditions that impact driver visibility and safety (such as fog, high winds, broken pavement, local flooding, etc.). VMS also may be used to advise motorists of specific restrictions due to weather or roadway conditions.

When these messages are used, they are restricted to a specific VMS. The adverse condition must be in the vicinity of the sign displaying the message (i.e., “High Wind Advisory, Next 10 KM”). General messages about the adverse conditions shall not be displayed.

4.14 Limits of VMS Influence for Incidents

VMS messages should be displayed for all verified major incidents (i.e. multiple vehicle crashes, several lanes affected or closed) that occur on the freeway. TMC operators shall assess traffic impacts, backups and queues when determining which VMS to use; this includes placing messages on VMS on other freeway networks that feed into the affected corridor. The message should be specific enough to indicate the location of the incident and the number of lanes affected. When multiple incidents occur simultaneously, the traffic conditions of the more major incident shall be displayed. The following shall be displayed as space allows:
- Condition of the road (lane closed)
- Distance to the incident or location defined by cross street or interchange
- Effect on the motorist (extent of delay)
- Suggested action (use alternate route)

VMS messages should be displayed up to 15km upstream from the VMS for all minor incidents that occur on the freeway. The message should be specific enough to indicate the location of the incident and number of lanes affected. When multiple incidents occur simultaneously, the traffic conditions of the more major incident shall be displayed.

VMS messages may be displayed concerning verified lane-blocking incidents that occur on an intersection freeway located downstream from the VMS depending on the location, severity and duration of the incident.
Figure 4-4 shows examples of incident messages.

![Incident Example Messages](image)

**Figure 4-4: Incident Example Messages**

### 4.15 Advertising

VMS messages advertising any commercial product, sponsor, service, campaign, or political party are prohibited. Messages for special events should be designed generally enough that advertising is not embedded in the messages. Messages on VMS for special events need to be coordinated as part of a special event management plan.

### 4.16 Public Service/Safety Announcements

Generally, public service announcements (ridesharing, telephone hotlines, etc.) on VMS are discouraged from use or require low frequency of use. Public service announcements must relate to the operations of the freeway system and be approved by the operations centre manager prior to being displayed on a VMS.

Public service announcements related to safety issues may be displayed only as a supplement to safety media campaigns. These messages shall have low priority and should not be displayed on any individual VMS for more than 10 days per month and two hours per day.

Figure 4-5 displays example public service announcement/safety messages.

![Public Service Announcement/Safety Example Messages](image)

**Figure 4-5: Public Service Announcement/Safety Example Messages**
4.17 Multi-modal and Inter-modal Information

VMS may be used to display messages to assist motorists with other aspects of travel, or to support notifications of Open Road Tolling (ORT advisories). VMS may display some variation of the following messages:

- Availability of parking at a Park-and-Ride facility
- Activation of variable tolling or toll restrictions (such as HOV lanes)
- Availability of parking at the airport, train station, bus station (only signs in close proximity to these facilities)

4.18 Test Messages

When testing a VMS either for validation or special studies purposes, the display must be a non-message test pattern (i.e. number sequence, alphabet, or lines). If text is preferred, the message should read “SIGN UNDER TEST”. Any other desired message must be approved by the operations centre manager prior to display on the sign.
5. **VMS MESSAGING OPERATIONAL GUIDELINES**

The operation of a VMS involves a comprehensive thought process covering multiple steps. *Figure 5-1* demonstrates a logical order of the considerations necessary in operating a VMS. The following paragraphs expand on each of these considerations.

![Diagram of VMS Operations Process](Changeable Message Sign Operation and Messaging Handbook)

**Figure 5-1: VMS Operations Process**

5.1 **Determine the Purpose for Using a VMS**

The purpose of using a VMS is to advise motorists in advance of changing road conditions and to provide motorists with traveller information to be able to make informed decisions about their travel route. Real-time information improves highway safety, operations, and use of facilities to allow the traveler to reach their destinations as safely as possible without undue delays. VMS are used to post information about incidents and delayed conditions as well as provide advisory information such as travel times, event information, and wide area alerts/warnings.

5.2 **Determine Which VMS is Appropriate to Use**

**Proximity of VMS**

VMS operators must determine which VMS within the overall system to use to address a particular situation based on the types of information the operator needs to display on the VMS. The operator should have knowledge of current VMS locations or be able to locate them quickly through automated software. It is important to make sure the VMS selected will reach the appropriate audience for the message to be displayed. Whether this is through regional advisories, event-driven messages, or incident information, the audience needs to be considered in choosing the...
correct VMS based on proximity criteria. The following reasonably measurable questions should be asked when determining which VMS to activate based on the purpose of displaying the message as categorized below:

**Regional Advisories:**
- Are there a significant number of motorists travelling past the VMS to alert a majority of the travelling public of a regional advisory or emergency/evacuation message?
- Is there more than one location for the regional message to be displayed will be required to cover a majority of the travelling public for a regional advisory or emergency/evacuation message?
- Is the VMS message being placed on a sign that is along a segment of the corridor that warrants reading potentially multiple lines of information rather than at a location near a decision point which will deflect attention from the sign?

**Incidents:**
- Is the incident close enough to the VMS so that the distance does not exceed the written VMS operations policy?
- Is the expected duration of the incident longer than the expected travel time from that VMS to the incident?
- Are there a significant number of motorists travelling past the VMS in which the message is intended to be displayed who are destined for the incident location?
- Is there an alternate path available between the VMS and the incident location that would allow travellers to make decisions on which route to take based on the incident information provided on the VMS? (This question would enhance the use of VMS messages for an incident but is not required to be met in order to place a message on a VMS.)

**Roadworks:**
- Are the VMS being used displaying information for the corridor on which the VMS is located or is in proximity or direct connection to?
- Is the location of the VMS along the same corridor as the location of the roadworks information being displayed on the VMS and/or within two decision points of the roadworks location such as a message displayed on one freeway near a freeway interchange that leads into the roadworks?

**Travel Times:**
- Are the VMS being used displaying information for the corridor on which the VMS is located or is in proximity or direct connection to?
- If there are other corridor travel times displayed on the VMS, is the VMS displaying the message in close proximity to the other corridor?
- If there are other corridor travel times displayed on the VMS, is the path from one corridor to the other a typical travel pattern?

**Events:**
- Is the location of a VMS being used to display event information in advance of at least two decision points along a corridor for the travelling public to decide an alternate route if needed?
- Is the location of a VMS being used to display event information on a different corridor at least within two kilometres of the corridor in which the event is taking place?
If the answer to any of the questions for the topic area that the message would be used for is “no,” the VMS may not be appropriate to activate for that situation and should be reviewed by the Operations Manager.

For advance warning of future lane closures and special events, the message displayed should be of a general warning nature and therefore can be displayed on VMS over a wide area.

**Characteristics of the VMS**

The maximum length of VMS message to be displayed will be dictated by the physical characteristics of the sign. Such characteristics include:

- the type of sign;
- the number of lines available (most permanent VMS have three available lines, most arterial VMS have two available lines); and
- the number of characters on each line.

This information also can be prescribed through the message library of some VMS software packages. VMS messages selected for particular VMS should be able to be viewed by the operating software prior to posting to verify that the message fits the characteristics of the VMS.

In locations where there are no permanent VMS or in situations where the information that needs to be presented exceeds the motorists’ processing capabilities from a single sign, it may be beneficial to deploy mobile or portable VMS to supplement the information on the VMS. The time it takes to deploy these devices must be considered in determining whether it will be effective for a given situation. These portable VMS should be deployed at a spacial distance and meeting reading time criteria based on the location of other VMS, existing static signing, and complex roadway geometrics areas per SADC-RTSM requirements. The agency must take care not to overload a motorist with information when choosing where to place the portable VMS.

While the lower speeds on an urban arterial road permit smaller VMS, the narrower corridors can make roadside mounted signs more difficult to accommodate. In urban residential areas, the visual intrusion of the VMS size should not be over-specified and should consider local amenity as well as road and driver issues.

The character size and number of characters and lines will dictate the overall dimensions of the VMS. VMS are large signs and consideration must be given to the visual impact on an area. This is particularly important in urban areas, although interference with views can also be a consideration in rural areas.

A summary of typical lines and characters for different types of VMS includes:

- A permanent VMS should be able of displaying a minimum of 3 lines in the display, and 15 characters per line, with each character having 5 horizontal by 7 vertical pixels. This results in an overall matrix of 103 pixels wide by 25 pixels high.
- An arterial VMS should be able to display a minimum of 2 lines with a display of 11 characters per line with an overall matrix of 85 pixels wide and 28 pixels high.
- A mobile VMS should be capable of displaying a minimum of 3 lines, each of 8 characters, at the appropriate character size for their deployment location.

Mobile or portable VMS present a different set of characteristics that must be factored in to their usage, including:

- Two or three available lines (compared to three standard for permanent VMS)
- Due to the smaller dimensions, characters per line are typically limited to eight.
Roadside placement on high-speed facilities (such as freeways) limits the number of phases that can be read and understood by motorists. It is recommended no more than two phases be used.

5.3 Determine What to Display on the VMS

Designing messages for VMS is of high importance. An understanding of what information a motorist needs to make a decision is key in providing effective information. The following should be considered prior to displaying a message to motorists.

- What is the problem I am trying to address? What is the type of notification that needs to be shared with the motorist?
- Is the purpose of the message related to a specific event/corridor/incident location?
- Where is an appropriate location or corridor for displaying traveler information?
- Is there an effect on travel that needs to be communicated?
- Who is the audience for the message and where are they located on the transportation network?
- Is there a response or action that is recommended by motorists?

Roadworks and Incident Diversion Routes

Motorists must not be diverted to prescribed routes. A message to “USE ALT ROUTE” should be used when an alternate route would likely provide a safer route that allows a motorist to save time versus remaining on the freeway. It is recommended that Road Authorities adopt a policy to not prescribe a specific alternate route in the event of roadworks or incident situations; the only exception being another corridor where the Road Authorities can visually confirm conditions on that route.

VMS Operator Message Options

There are a number of incidents that could be reported on a VMS using a standard message. Often times, roadworks or weather conditions often necessitate the use of repeated messages. However, there may also be instances when a unique message is needed in response to an incident. Given this range of possibilities, there are essentially three options available to an operator.

1 – Select a message from a message table – The agency would have a predefined scenario prepared for a given type of problem, location, severity, and response required from the motorist. If the problem fits the scenario, the operator can simply call up a message from the message table and display it on the appropriate VMS. Messages selected from a standard message table needs to be consistent with the message priority list defined in the VMS Message Hierarchy section. Occasionally, there is a need to display more than one message at a time (i.e. roadworks and a traffic incident). To avoid potential conflicts, it is important to have a prioritization of messages. This will remove the guesswork or interpretation of which message to display.

2 – Modify a message from a message table – This type of VMS message requires some modification by the operator to develop a more specific message. For example, there might be a message in the table with blanks for the operator to fill in information such as the location of the road condition or event, the lanes affected, distance to the event/roadworks/incident or action to be taken by the traveller. This type of message requires the operator to ensure the message is reviewed adequately before posting to the VMS. Review process includes:
   - The message does not exceed the character length or line limitations of the VMS being used.
The message uses standard abbreviations and standard language as defined in the message library.

The message does not contain information that is not pertinent to the purpose of message such as phone numbers or marketing information.

The message should include the fewest words possible to convey the message.

3 – Create a new message – For instances when there is no message in the table to properly address a situation a new message must be created. This type of message requires maximum attention from an operator to ensure the standard procedures for creating a message are followed. Proper review of the message by the Operations Manager (or Shift Supervisor) must be conducted prior to posting the message on the VMS. The review of the message should conform to existing policy, procedures and local guidelines which include:

- Confirming that the message is being used to answer one or more of the questions listed at the beginning of this section (4.3) for the travelling public.

- Roadworks messages should include:
  - Problem statement (e.g. road work, accident)
  - Location statement (e.g. ahead, left lane)
  - Action statement if needed (e.g. use alt route, prepare to stop)
  - Time period if needed (e.g. MON-FRI, 8PM)
  - And/or an attention statement if the message is being directed at a segment of drivers (e.g. through traffic, all trucks)

- The message does not exceed the character length or line limitations of the VMS being used.

- The message uses standard abbreviations and standard language where possible as defined in the message library.

- The message does not contain information that is not pertinent to the purpose of the message such as phone numbers or marketing information.

- The message type used is consistent with the priority listing.

- Messages should be appropriate to the location, time of day, road environment and prevailing road conditions.

- Unnecessary words (e.g. ‘a’, ‘an’, ‘the’) should be eliminated unless the intent of the message becomes unclear without them.

- The message should include the fewest words possible to convey the message.

- All messages must be reviewed and approved by the Operations Manager or Shift Supervisor.

5.4 Determine How Long to Display the Message

The read time, or actual time it takes a driver to read and process a message is based on the speed of the vehicle intending to read the message, the text sizing, and the distance at which the sign is intended to be read. These characteristics are quantified and provided in the SADC-RTSM Chapter 4.4 in Tables 4.2, 4.3 and 4.4. Based on freeway speeds and reading distances between 44-94 meters, the following are some examples of the number of “bits” of information that can be read on a VMS:

80km/hr = 8 words = 2.94 seconds

100km/hr = 7 words = 2.54 seconds
120km/hr = 6 words = 2.14 seconds

An arterial sign as well as a mobile sign should be legible for the same distance and time as a permanent VMS because mounting heights are likely to be lower which allows for traffic to be a common interference.

The display time of a message on a VMS contributes to the public’s perception of the VMS system. Encountering an incident or congestion when there has been no advance warning can be frustrating to motorists. Also, messages of incidents after they have been cleared will deplete the confidence in the accuracy of the VMS system.

There are numerous ways to manage the time a message is displayed on a VMS. The following apply to both permanent VMS and mobile or portable VMS:

- For planned roadworks involving a ramp closure or freeway closure, it is recommended that messages be displayed for at least 48 hours prior to the planned roadworks impact. This will provide drivers who routinely travel the route to plan for travel during the roadworks restriction or closure.

- For incidents, determining the appropriate duration to run the message is not as simple. If a message is set with a long duration, the operator must monitor the incident and deactivate the message when the incident clears. The FMS software shall include a feature to allow operators to set a message ‘end time’ and provide a ‘time out’ alarm to notify operators that a message is still active; operators can then extend the message if the incident is still active, or alert them to discontinue the message if the incident is cleared and they have not already removed the message. This removes the possibility of the operator forgetting the message after the incident has cleared, but still requires monitoring of the incident should the message display time need to be extended.

Mobile or portable VMS are often pre-programmed or programmed locally (at the sign), and messages are for conditions with an anticipated longer duration. The same principles apply for planned roadworks with 48-hour advanced notice of upcoming closures or restrictions.

Display durations should be set based on the purpose of the message and shall not be standardised based on the variety of circumstances that could warrant a specific usage.

5.5 Display and Verify VMS Message

Once an operator has fully investigated the need for disseminating a message to the public and the message is activated, a thorough review is necessary. If the message is not from a message table, the message should be reviewed by the operations centre manager prior to displaying on the sign. Once the message has been sent to the sign, electronic validation from the software/computer system should be obtained. Closed-circuit television cameras also provide a means of verification.

5.6 VMS Operational Modes

**Manual Signing**

Manual signing requires operators to type in and display messages on VMS. This method could present difficulty in ensuring messages are changed in a timely manner, and are better suited for longer-duration messages (such as roadworks notifications). Also, from agency to agency there is likely to be some inconsistency of messages displayed to motorists. A well defined review process of messages prior to activation should be established. This process would also eliminate the possibility of having the system update travel time information automatically.
Automated Signing

Automated signing can minimize potential issues related to manual signing by relying on pre-programmed message sets that might require some minor modification. It is important to confirm that the software produces efficient and accurate results.

5.7 Message Design Considerations

To effectively design messages for VMS, it is necessary to establish certain characteristics.

Message content – A VMS message should contain specific information about what is happening ahead, the “problem” (“MAJOR CRASH”, “ROADWORK”). The message should also give general action advice; “REDUCE SPEED”, “USE ALT ROUTE”. The advice should be brief and general at the end of the message.

Section 4 presented guidance on message structure for different types of messages (travel times, incidents, road works, etc.). Alert-oriented messages (incidents, road works, closures, or events) should generally contain three pieces of information:

- The problem or situation the driver will encounter
- The location or distance to the problem or situation
- Action/recommended action

Message Length – Due to the limited line capacity of a VMS, it is often necessary to count the characters in a message. Most permanent VMS have a maximum of 20 characters per line; most arterial or mobile/portable VMS have a maximum of 8 characters per line (these may vary depending on the sign manufacturer).

If a message needs to be condensed or shortened, look for repeated words that can be eliminated, acceptable abbreviations that could be used, or an acceptable break to segment the message into phases.

Message Load – This is the total amount of information conveyed in a message. Flashing, scrolling or otherwise dynamic elements are not recommended or encouraged.

Unit of Information – This is used to refer to each item in a message that gives a driver information to make a decision. For example, “ACCIDENT” is enough for a driver to know there will likely be congestion ahead, “USE ALT ROUTE” is enough for a driver to know there are adverse travel conditions ahead and another route would be better.

The following applies to units of information, as per the guidelines recommended in the SADC-RTSM:

- No more than 4 units of information for speeds greater than 60km/hr
- No more than 5 units of information for speeds less than 60km/hr
- No more than 3 units of information per phase
- No more than 2 units of information per line

It is most typical to have one unit of information per line.

Message Format – Because the wording sequence plays a role in how quickly a driver can read and process a message, the VMS must contain information in an order expected by the driver with consistent formatting. Refer to the SADC-RTSM, Chapter 4 for guidelines on message format based on reading time and text characteristics.
5.8 Specific Requirements for Portable or Mobile VMS

5.8.1 Limitations of Portable or Mobile VMS

Permanent VMS on overhead structures offer maximum visibility to motorists in travel lanes. Portable or mobile VMS, placed on the roadside or in a restricted lane (such as a roadworks zone), have limited viewing by all travel lanes. Also, the height at which portable or mobile VMS are stationed could significantly limit visibility by all motorists in all travel lanes. Their usage and application needs to consider these limitations.

The display size of the portable or mobile VMS also limits the amount of content that can be displayed. As a result, content can be severely limited and will likely require multiple phases. No more than two phases are permitted for portable or mobile VMS. Additional guidelines include:

- Each phase should convey a single thought.
- If the message can be displayed in one phase, the top line should present the problem, the center line should present the location or distance ahead, and the bottom line should present the recommended driver action.
- The message should be as brief as possible.
- When a message is longer than two phases, additional portable or mobile VMS should be used.
- When abbreviations are used, they should be easily understood.

5.8.2 Recommended Usage of Portable or Mobile VMS

Mobile VMS should only be used for incident or event related messages, including road works advisories. They should not be used for general road safety messages or public service announcements. Because they cannot be controlled or updated from an operations centre, messages for a specific event or incident will need to be pre-programmed or manually programmed at the sign. Due to the dynamic nature of incident conditions, use of portable or mobile VMS for incidents is not recommended; their primary application should be to support special event messages, road works restrictions, or other events that have a specific duration.

One exception would be for a hazard or extended incident impact, and only if there are no permanent VMS in the vicinity to support road user information strategies.
6. **GUIDELINES FOR MESSAGES ON VMS**

6.1 **General Message Format Guidelines**
- All messages shall be clear, precise, brief, and legible.
- Standard messages from the message library do not require supervisor approval for use.
- Messages posted by other personnel may only be selected from the message table.
- The Operations Manager or Shift Supervisor must approve any customised message.
- All letters shall be capital.

6.2 **General Operational Guidelines**
- VMS shall remain blank during non-peak periods when there are no incidents or travel conditions to display. A “heartbeat” may be used while a VMS is blank to indicate its operational status.
- A supervisor must approve all Priority 1 messages and customised or newly created messages prior to them being posted on the VMS.
- Messages shall be displayed in a constant read. They shall not flash, fade, scroll, or be animated in any other way.
- Travel time messages may be displayed during normal peak travel conditions.
- Travel time messages may only be displayed using automated processes; travel time are not to be manually entered or updated.
- Messages shall divert traffic to use prescribed exits only for special event-specific purposes.
- Messages shall not be used to divert traffic to use specific routes or exits during roadworks or incidents, unless the condition of the recommended route can be verified.

6.3 **Content Restrictions**
- Special event messages shall be general and traffic related. No event sponsor name shall be used.
- No advertising, commercial, political or personal messages shall be displayed on the signs at any time.
- No phone numbers greater than five digits shall be displayed.
- No web sites or SMS addresses shall be displayed.
- No graphics shall be displayed.
- Message may not divert traffic specifically to local streets.
- Messages shall not cause undue alarm or disregard for the signs. (i.e. CAUTION!! CAUTION!! Should not be used)
- Abbreviations shall be limited; when needed, recommended abbreviations are to be used. Avoid confusing abbreviations.

6.4 **VMS Phasing Guidelines and Requirements**
- A maximum of two pages (cycles) per message shall be used.
- Each page (cycle) shall provide a complete thought.
- Each page shall be displayed a minimum of three seconds. Reading time formulated as per SADC-RTSM Volume 1 Chapter 4 should be considered when determining message length.
- Each page of a two page message shall be legible at least twice by a motorist approaching at the posted speed.
6.5 Message Display Guidelines

- Day of week abbreviations (i.e. MON, TUES, WED, etc.) shall be used when work is to be performed within seven days of message being displayed.
- Day of week abbreviations (i.e. MON, TUES, WED, etc.) shall be used when work is to be performed less than 48 hours from message being displayed.
- When space permits, both day and date shall be used when work is to be performed within seven days of message being displayed.

6.6 Abbreviations

The table of abbreviations below as posted in the Changeable Message Sign Operation and Messaging Handbook, was developed from the Manual on Uniform Traffic Control Devices (United States equivalent of the RTSM). Studies showed that these abbreviations were understood by at least 85 percent of drivers tested. Standard abbreviations should be posted on SANRAL’s i-traffic website accessible by partner agencies to create broader awareness of usage. Table 6-2 provides a list of abbreviations that should be avoided, as they have multiple interpretations.

Table 6-1: Message Sign Abbreviations

<table>
<thead>
<tr>
<th>Word Message</th>
<th>Standard Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afternoon/Evening</td>
<td>PM</td>
</tr>
<tr>
<td>Alternate</td>
<td>ALT</td>
</tr>
<tr>
<td>Avenue</td>
<td>AVE</td>
</tr>
<tr>
<td>Average</td>
<td>AVG</td>
</tr>
<tr>
<td>Boulevard</td>
<td>BLVD</td>
</tr>
<tr>
<td>Centre</td>
<td>CNTR</td>
</tr>
<tr>
<td>Drive</td>
<td>DR</td>
</tr>
<tr>
<td>East</td>
<td>E</td>
</tr>
<tr>
<td>Emergency</td>
<td>EMER</td>
</tr>
<tr>
<td>Entrance, Enter</td>
<td>ENT</td>
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<tr>
<td>Expressway</td>
<td>EXPWY</td>
</tr>
<tr>
<td>FM Radio</td>
<td>FM</td>
</tr>
<tr>
<td>Freeway</td>
<td>FRWY, FWY</td>
</tr>
<tr>
<td>Friday</td>
<td>FRI</td>
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<tr>
<td>Hazardous Material</td>
<td>HAZMAT</td>
</tr>
<tr>
<td>Highway</td>
<td>HWY</td>
</tr>
<tr>
<td>Information</td>
<td>INFO</td>
</tr>
<tr>
<td>Junction/Intersection</td>
<td>JCT</td>
</tr>
<tr>
<td>Kilometre/hour</td>
<td>KM/H</td>
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<tr>
<td>Lane</td>
<td>LN</td>
</tr>
<tr>
<td>Left</td>
<td>LFT</td>
</tr>
<tr>
<td>Maintenance</td>
<td>MAINT</td>
</tr>
<tr>
<td>Minute(s)</td>
<td>MINS</td>
</tr>
<tr>
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<td>MON</td>
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<table>
<thead>
<tr>
<th>Word Message</th>
<th>Standard Abbreviation</th>
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<tr>
<td>Morning/Late Night</td>
<td>AM</td>
</tr>
<tr>
<td>Normal</td>
<td>NORM</td>
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<td>Parking</td>
<td>PKING</td>
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<td>PKWY</td>
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<td>Right</td>
<td>RT</td>
</tr>
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<td>Road</td>
<td>RD</td>
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<td>Saturday</td>
<td>SAT</td>
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<td>SERV</td>
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<td>Shoulder</td>
<td>SHLDR</td>
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<td>Slippery</td>
<td>SLIP</td>
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<td>TRAVLRS</td>
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Source: Changeable Message Sign Operation and Messaging Handbook
Table 6-2: Abbreviations with Multiple Interpretations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Intended Word</th>
<th>Common Misinterpretations</th>
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</thead>
<tbody>
<tr>
<td>ACC</td>
<td>Accident</td>
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Source: Changeable Message Sign Operation and Messaging Handbook
7. REFERENCES


