National Roads Authority

GUIDELINES FOR THE USE OF VARIABLE MESSAGE SIGNS ON NATIONAL ROADS

PART B – GUIDANCE AND REQUIREMENTS FOR THE USE OF VARIABLE MESSAGES SIGNS ON NATIONAL ROADS

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PREFACE

About this document

These guidelines are intended for use by anyone deploying or intending to deploy Variable Message Signs (VMS). They cover all prospective and existing VMS used on national roads in Ireland and should be read in conjunction with Chapter 3 of the Department of Transport's Traffic Signs Manual ("the TSM") and the relevant sections of the National Roads Authority's (NRA) Design Manual for Roads and Bridges ("the NRA DMRB").

Guideline updates

This document will be maintained and periodically updated as required by the NRA.

Guideline aims

A number of organisations in Ireland are developing Intelligent Transport Systems (ITS) that include or could potentially include VMS signs. Without clear guidance, the deployment and operation of VMS could lead to the inconsistent presentation of traffic information to the public. This in turn, could cause confusion and could reduce the public's confidence in and compliance with messages displayed on VMS.

In order to help avoid this situation, the NRA has prepared these guidelines. They are intended to assist anyone deploying or intending to deploy VMS to:

- Make best use of existing VMS infrastructure;
- Ensure effective introduction of new VMS infrastructure;
- Promote national and European harmonisation of VMS usage;
- Maximise the benefits that can be achieved from investment in VMS technology thus achieving more efficient use of the national road network.

The guidelines have been based on the operational experiences of the NRA and other network managers worldwide. They are also designed to reflect current best practice.

Local authorities and consultants are encouraged to use the notes and VMS approval criteria described within these guidelines. However, responsibility for the design, development, procurement, installation and operation of all VMS remains with the sponsoring authority. Application of the guidelines contained herein needs to be considered with due care and forethought. The guidelines contained herein also needs to be considered with due reference to applicable legislation, standards, advice and information.

These guidelines should not be considered to be the formal or only solutions capable of meeting a particular requirement for VMS.

Structure of the document

The following document is divided into two parts. Part A is intended to provide an overview of the various types of VMS along with a review of the relevant legislation and standards.

Part B provides detailed guidance for anyone deploying or intending to deploy VMS. This includes guidance on the design and approval of new VMS schemes and best practice in their deployment and operation.

Contact Details

Any enquiries or comments on these guidelines should be forwarded in writing to:

Network Operations
National Roads Authority
St Martin's House
Waterloo Road
Dublin 4

GUIDELINES FOR THE USE OF VARIABLE MESSAGE SIGNS ON NATIONAL ROADS

PART B:

GUIDANCE AND REQUIREMENTS FOR THE USE OF VARIABLE MESSAGE SIGNS ON NATIONAL ROADS

1 INTRODUCTION

This document provides detailed guidance for anyone deploying or intending to deploy VMS on national roads in Ireland. It includes guidance on the design and approval of new VMS schemes and best practice in their deployment and operation.

In particular, it covers the following aspects of VMS design, deployment and operation:

- The VMS approval process
- Statement of general requirements
- Requirements for VMS location
- Requirements for VMS type selection
- Requirements for VMS/LCS display functionality
- Requirements for VMS installation
- Requirements for VMS messages.
- Appendix A provides the Approval Form which needs to be completed and submitted to the NRA for approval of any new VMS scheme.

1.1 Related documents

The guidelines reference a number of related documents as follows:

- Department of Transport Traffic Signs Manual: Chapter 3 (Variable Message Signs) and Chapter 8 (Temporary Traffic Measures and Signs for Roadworks).

- The NRA Design Manual for Roads and Bridges (NRA.DMRB) Volume 8, and references to the UK.DMRB. Specific reference is made to document TD 33/05, 'The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads'; TA 60/90, 'The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads';-(NRA Comment – 'same name?' TD 27/07, 'Cross Sections and Headroom'; and European Standard EN 12966 – Variable Message Signs, Parts 1, 2 and 3.

- European "Framework for harmonised Implementation of Variable Message Signs in Europe', generally referred to as the "FIVE framework".

- NRA HD 19 Road Safety Audits (1994).

1.2 NRA Framework Agreement for the supply and installation of VMS

The NRA has a Framework Agreement for the supply and installation of VMS and lane control signs (LCS). This Agreement supports the NRA's ITS strategy and provides for a supply and installation of a variety of VMS/LCS and structure/mounting types based on the NRA's specifications.

The key objectives of the Agreement are to:

- Provide economies of scale, which can be realised by all relevant Irish Authorities;
- Promote standardisation in the design, deployment and usage of VMS/LCS; and
- Provide all local authorities with a defined and efficient approach for the procurement of VMS/LCS.

Local authorities are encouraged to procure any VMS through this Framework Agreement. This will ensure that any signs they procure reflect international standards and can be used to comply with recognised best practice. This will ensure consistency of sign type and layout as well as promoting consistency of operation. It should also streamline the procurement process for local authorities.

2 APPROVAL OF NEW VMS SCHEMES

2.1 Introduction

This section outlines the NRA's approval process. This process applies to all new VMS installations and should be used as a means by which the effectiveness of any proposed VMS scheme can be assessed prior to its procurement and deployment.

- Appendix A provides the Approval Form which needs to be completed and submitted to the NRA for approval of any new VMS scheme.

2.2 The NRA's formal VMS approval process

This section describes the NRA's formal process for approving all new VMS schemes. This is also shown graphically in Figure 2.

Step	Description
1	A Statement of General Requirements should be prepared (See Section 1 of this document).
2	Identify the preferred location of the proposed VMS using guidelines given in Sections 4.2, 4.3 and 4.4.
3	Assess the preferred VMS location using the guidance given in Sections 4.5, 4.6 and 4.7. If the location conforms to approval criteria, proceed to Section 5. If the location does not conform to approval criteria go back to Step 2.
4	Select the preferred VMS type using the guidelines given in Section 5.
5	Specify the preferred VMS type using the guidelines given in Section 5.
6	Using the approval process provided in Section 9 and the VMS Approval Form provided in Appendix A, assess the overall VMS specification. If the specification conforms to approval criteria go to Section 7; if not go back to Step 4.
7	Using the VMS message requirements outlined in Section 8, assess all proposed messages. If the message set conforms to approval criteria then go to step 9. Should any message in the message set not conform to the approval criteria then return to step 7 and amend those messages.
8	Assess the location, the specification and proposed message sets against the Statement of General Requirements developed in stage 1. If the criteria meet the Statement of General Requirements, go to step 10; if not then return to step 1 and re-assess.
9	Assess the approved criteria to identify any potential improvements that could be made. If potential improvements are identified then go to steps 3, 6 or 8 as appropriate and reassess against the approval criteria. If no potential improvements can be made then go to step 11.
10	Using the guidelines given in Section 7, specify the overall VMS installation detail.
11	Complete the VMS Approval Form as described in Section 9.
12	Submit a copy of the VMS Approval Form along with all relevant additional documentation defined in the VMS approval criteria to:

Step	Description
	VMS Approval Network Operations National Roads Authority St Martin's House Waterloo Road Dublin 4
13	The NRA will assess the VMS Approval Form and return a VMS Approval Certificate or VMS Approval Exception Report as appropriate

Figure 1 – Formal VMS Approval Process

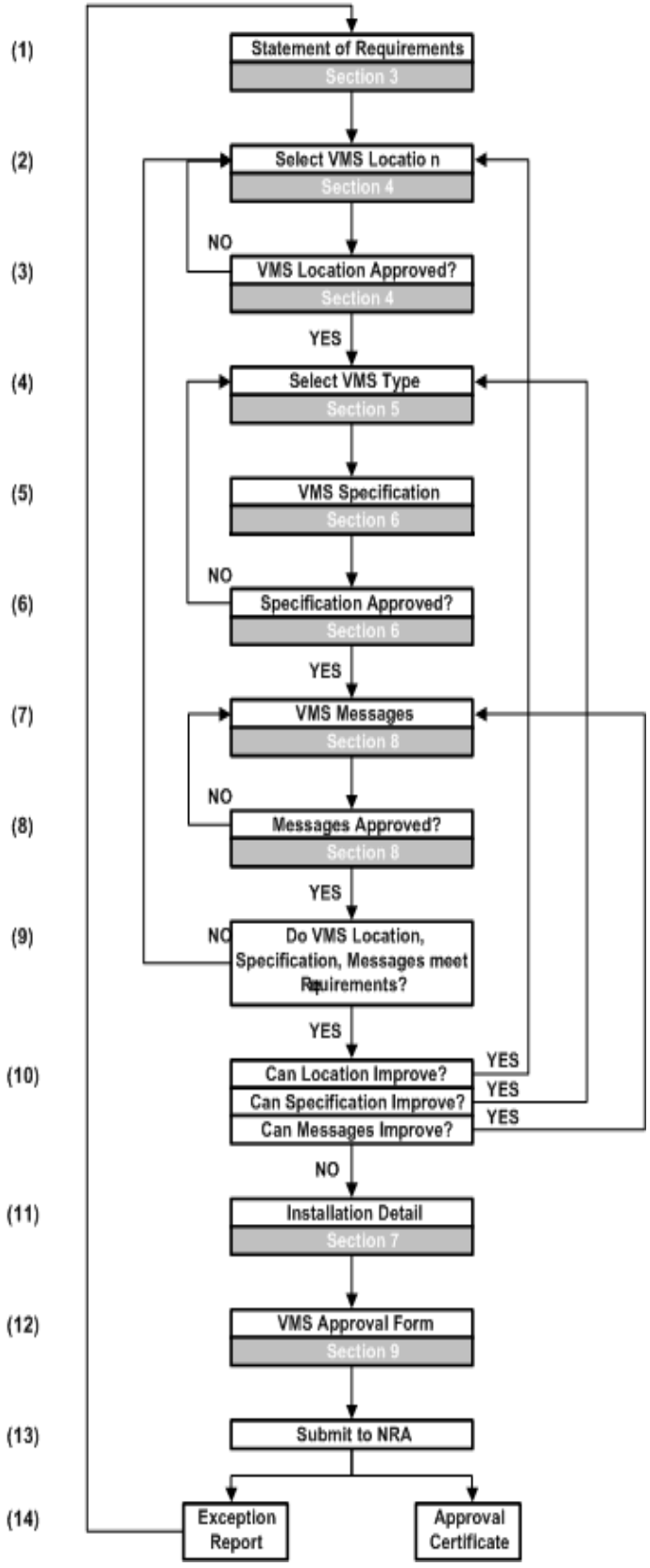

Figure 2 - NRA VMS Approval Process

3 STATEMENT OF GENERAL REQUIRMENTS

3.1 Introduction

This section describes what is required as part of preparing a Statement of General Requirements.

3.2 Content of a Statement of General Requirements

The first part of preparing any new VMS scheme for approval is to prepare a Statement of General Requirement. This should include the following information:

- **Project Overview** – this should provide an overview of new VMS scheme. If it is to be implemented as part of a wider ITS deployment, this should be described;
- **Project Location** – the proposed location of VMS scheme should be described including the route, the start and end points of the scheme as well as any notable features such as bridges, tunnels, junctions and major traffic generators for example:

- Problem Definition – the nature of the traffic management issues to be addressed via the new VMS scheme should be described;
- Operational Regime – a description of how the new VMS scheme will be operated including details of the organisation(s) that will be operating them should be provided;
- Strategic Plan and Intended Purpose – any specific strategic aims and the intended purpose of the new VMS scheme should be described;
- Scheme Sponsor – details of the scheme sponsor (including their contact details) should be provided.

4 VMS LOCATION

4.1 Introduction

This section highlights the criteria that need to be taken into account when establishing the location of new VMS. These criteria should be based in part, on the intended purpose of the VMS as defined in the Statement of General Requirements.

4.2 Stakeholder Consultation

All relevant stakeholders considered to have an interest in any new VMS scheme should be identified and consulted. As a minimum, this may include:

- The local roads authority;
- The Department of Transport;
- NRA;
- Garda Traffic Division;
- Other emergency services.

The nature of these consultations will vary according to the nature of the new scheme, its location, the intended purpose of the new VMS and the proposed operational regime. However, it is recommended that as a minimum, stakeholders are consulted on the following:

- Operational boundaries;
- Existing traffic management operational practice;
- Existing ITS infrastructure.
- Each of these is described in more detail below.

4.2.1 OPERATIONAL BOUNDARIES

The operational boundaries of the Traffic Control Centre (TCC) that will operate the VMS need to be established. Any existing interactions between the TCC and any other control centres with respect to traffic management operations should be identified and examined in order to determine:

- Any potential inter-TCC operational conflict;
- Any potential for dual operation;
- Any potential advantages to be gained from interaction with a neighbouring TCC(s).

4.2.2 EXISTING TRAFFIC MANAGEMENT PRACTICE

The current codes of practice and operational policies of the following parties should be reviewed and analysed:

- The local roads authority;
- The Department for Transport;
- NRA
- Garda Traffic Division;

This review should identify the following:

- Existing static signing policy with respect to the location and proximity of entry points to signed strategic diversion routes applicable to incident or planned event management operations;
- Existing operational policies with respect to their location and proximity to entry points of unsigned but agreed strategic diversion routes that are applicable to incident or planned event management operations;
- Any existing local operating agreements that could be extended or potential new agreements that could be implemented to maximise the efficiency of VMS operations.

4.2.3 EXISTING ITS INFRASTRUCTURE

The location of any existing ITS (and supporting) infrastructure in the immediate vicinity of the proposed VMS scheme should be identified and plotted on a suitable scale map. ITS

infrastructure of interest should include the following:

- Existing VMS/LCS;
- Power supplies;
- Communications infrastructure;
- CCTV;
- Traffic data collection infrastructure.
- The map should subsequently be analysed in order to identify any:
- Potential conflict with operations on existing VMS;
- Potential advantages to be gained from interaction with a neighbouring sign;
- Potential for connection to an existing power supply network;
- Potential for connection to existing communications infrastructure;
- Coverage of potential locations by CCTV that could be used to monitor traffic conditions and the VMS site;
- Potential for the operation of VMS in conjunction with real time or detailed historic traffic flow information.

4.3 Intended Uses of the VMS

The European FIVE Framework identified three broad categories of VMS use which relate to the content of messages as follows:

- Regulation;
- Warning;
- Information.

The planned use(s) of the new VMS scheme should be identified as appropriate within each of these categories.

4.3.1 REGULATION

This involves the use of VMS to present mandatory information about a regulatory condition (for example, a change in speed limit) to road users and is designed to elicit an immediate response from drivers.

VMS which may be used to present this kind of information should be located close to the start of the regulatory condition of interest or at an intermediate location within the envelope of the regulatory condition provided that driver's have already been alerted to it in advance by other means (for example static signs).

VMS locations within the envelope of the regulatory condition should be selected so as to either reinforce existing signing or to reinforce the mandatory information about the regulatory condition at a key location.

Where several VMS or a combination of VMS and static signing are used to convey mandatory information, signs should be located at regular distances apart to be most effective.

4.3.2 WARNING

VMS conveying warning information provide drivers with notification and/or guidance relating to a specific immediate hazard ahead. Locations where VMS are typically used to provide warning information include:

- Locations susceptible to weather conditions such as areas prone to:
- Fog;
- Ice;
- Strong winds; and
- Flooding;
- Locations where congestion occurs either regularly due to saturation traffic flows or periodically in relation to planned events where traffic queues may form.

The locations of VMS used to present warning information should be selected so that they are close enough to be clearly associated with the specific hazard but sufficiently far in advance of the hazard to ensure drivers have time to react to the warning message.

Where several VMS or a combination of VMS and static signing are used to convey warning

messages, signs should be located at regular distances apart to be most effective.

It is important to ensure that the use of VMS to present warning information does not distract drivers at critical points on the road network. In this respect, guidelines on the location of VMS used to present warning messages should also be considered in conjunction with the guidance provided in Section 4.3.3.

An example of a mobile VMS being used to display a warning message is shown below.

Figure 3 - Mobile VMS Message on M50

4.3.3 INFORMATION

This involves the use of VMS to provide drivers with useful information that may influence their travel behaviour, their route selection or keep them up-to-date with network conditions. This can include information on:

- Network conditions (for example, “congestion ahead”);
- Journey times;
- Advising on future events;
- Temporary changes in network conditions such as roadworks.

VMS conveying information should to be located such that drivers have the opportunity to adapt their journey if desired or advisable. In this respect, they may have to be located far in advance of the network condition they are providing information on depending on the characteristics of road network in question.

4.4 Geographic Relevance of the Information Presented on VMS

In addition to message content, the use of VMS can also be characterised by the geographic relevance of the messages conveyed. Typically, the geographic relevance can be characterised as:

- Tactical use
- Strategic use
- Diversion use

These are discussed in more detail below.

4.4.1 TACTICAL MESSAGES

Tactical messages relate solely to the section of the road network where the VMS is located. Network links which may benefit from the use of tactical VMS include those which:

- Have high traffic volume;
- Are regularly congested;
- Experience local problems that require frequent regulatory information to be provided for drivers as identified in Section 4.3.1;
- Experience regular weather problems as identified in Section 4.3.2.

The choice of which VMS to use to display tactical messages on any specific link needs to be such that drivers have sufficient time to interpret the context of messages being presented to them and to adapt their behaviour accordingly. Locations could include:

- In advance of queue tails;
- In advance of regulatory zones on the link;
- In advance of part of the link that experience periodic hazards;
- Where journey time generally begins to differ from that of free-flow conditions.

4.4.2 STRATEGIC MESSAGES

Strategic VMS messages differ from tactical VMS messages insofar as they relate to conditions on the entire network rather than to a specific link.

VMS used to convey strategic messages are often paired with tactical VMS. If VMS pairs are used, consideration needs to be given to VMS type and specification as detailed in Sections 1 and 1 of these Guidelines.

The criteria for choosing which VMS to use to display strategic messages are similar to those for tactical messages with the exception that strategic messages can apply to any link downstream of the sign. Additional location criteria can also include:

- The number, range and significance of strategic links in the network; and
- The number, range and significance of key tactical routes.

4.4.3 DIVERSION MESSAGES

VMS presenting diversion messages provide drivers with information relating to an alternative route(s) to a particular destination. This is typically in response to network conditions affecting the usual route to the destination in question.

The impact of any diversion message depends on the location of the VMS displaying the message relative to key routing decision points and the seriousness of the network conditions affecting the usual route as conveyed by the message.

The selection of VMS locations to display specific diversion messages should be based on an analysis of viable diversion routes for each link on the network. This analysis should be carried out in consultation with key stakeholders and should consider:

- The location of existing or planned static signs;
- Historical traffic conditions on possible diversion routes;
- The location of key decision points where a driver can act on diversion information;
- Reliable origin/destination data;
- The results of consultations with stakeholder that may impact:
- suitability of a diversion route for different classes of traffic (for example, is a particular route suitability for heavy goods vehicles?);
- restriction of diversion routes to the same category of roadway (for example, should traffic from motorways only be diverted to other motorways?);
- agreement with the Garda Traffic Division and consistency with existing Garda Traffic Division diversion plans;
- agreement with local roadway authorities.

On the basis of the diversion route analysis and stakeholder consultation, VMS locations should be selected taking into account the location of:

- Key routing decision points;
- Other VMS;
- Existing static signs;
- Other ITS infrastructure.

4.5 VMS Site Location Details

Having established the preferred location for a VMS in principle, there are a number of factors that should be considered in order to establish the sign's precise location. These need to be determined through a site survey which should, as a minimum, address the following:

- Installation footprint;
- Presence of underground services
- Projected sightlines;
- Lateral clearance;

- Location in relation to existing Advance Directional Signs (ADS);
- VMS height;
- Sign face alignment;
- Location relevant to structures;
- Location relevant to ITS equipment;
- Location relevant to lighting columns;
- Power supply;
- Geotechnical data;
- Safety barriers;
- Associated infrastructure.

BD 51, Design Criteria for Portal and Cantilever Sign/Signal Gantries, with NRA Addendum is the relevant standard intended for use in designing permanent and temporary structures which wholly span or are partially cantilevered over a carriageway, hard shoulder and/or hard strip for the purpose of supporting large signs and/or motorway type signals and/or message signs.

It should also be noted that the location criteria described below apply to all types of VMS with the exception of Mobile VMS.

4.5.1 INSTALLATION FOOTPRINT & UNDERGROUND SERVICES

The preferred location of the VMS needs to be surveyed to ensure that there are no underground services that could be affected and that there is sufficient physical space for the installation, civil engineering works and the subsequent safe operation and maintenance of the VMS.

4.5.2 PROJECTED SIGHTLINES

Best practice suggests that there should be a projected clear sightline for drivers sitting in the inside lane of a dual carriageway to each VMS of a minimum of 225 metres with 400 metres desirable[1].

The minimum distance between any two verge mounted signs or between a verge mounted sign and a cantilever column shall normally be 300 metres but not less than 200 metres. This ensures that drivers have sufficient time to read both signs. The minimum distance between two gantry columns shall normally be 300 metres but not more than 500 metres[2].

[1] DMRB (UK); Volume 9 Section 4, TA83/05 Guide to the Use of Variable Message Signs for Strategic Traffic Management on Trunk Roads and Trunk Road Motorways; A4.2/10 - Siting Criteria for Message Signs; November 2005

[2] NRA DMRB; Volume 8 Section 2; TD 33/05 The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads; Section 11.4 – Siting Requirements, November 2005

4.5.3 LATERAL CLEARANCE

The lateral clearance between the edge of the carriageway, hard shoulder or hardened verge and the nearest point of the sign infrastructure should be not less than the minimum clearance distances prescribed below[3]:

- < 50 kph – 0.8m;
- 50 – 80 kph – 1.0m;
- > 80 kph – 1.5m.

(Note that the speeds referred to above are the 85 percentile approach speed or the design speed of a new road).

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4.5.4 VMS HEIGHT

Where a VMS is verge mounted and all parts of the infrastructure are greater than the permissible lateral clearance from the edge of the carriageway (see Section 4.5.3), then the best practice is for the minimum installed height of VMS, from the verge surface to the lowest edge of the VMS infrastructure, shall be 2.3m or 2.5m if cyclists use the carriageway.

Where a VMS is verge mounted and any parts of the infrastructure are less than the permissible lateral clearance from the edge of the carriageway, or the VMS is installed above the carriageway, then the minimum installed height of a VMS from the carriageway surface to the lowest edge of the VMS infrastructure shall be 5.7m[4].
If a route has been defined as an abnormal load route, then minimum installed height of VMS from the carriageway surface to the lowest edge of the VMS infrastructure shall be 6.45m[5].

4.5.5 VMS SIGN FACE ALIGNMENT

The face of each VMS should be perpendicular to the upstream carriageway.

There should be some leeway in the optical alignment of the VMS/LCS to allow for adjustment. For best practice, the vertical plane of each VMS face shall typically be offset -4 degrees down towards the direction of approaching traffic and should allow for an adjustment of 2 degrees either side of this.

4.5.6 LOCATION RELEVANT TO STRUCTURES

- Where a VMS is to be installed upstream of a structure, it should be installed at a distance in advance of a structure of no less than twice the height of the proposed VMS6.

- Where a VMS is to be installed downstream of a structure, sightlines should be checked to ensure compliance with Section 4.5.2.

- A route confirmatory sign or a sign indicating the distance to the next Motorway Service Area that is within 200 metres in advance of a VMS should preferably be relocated to achieve a separation of at least 300 metres[7].

3 NRA DMRB; Volume 8 Section 2; TD 33/05 The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads; Table 4 – Lateral Clearances; Appendix A; November 2005

4 NRA DMRB; Volume 6 Section 1; TD 27/05 Cross Sections and Headroom; Table 6.1 – Standard Headroom at Structures; February 2005

5 NRA DMRB; Volume 6 Section 1; TD 27/05 Cross Sections and Headroom; Table 6.1 – Standard Headroom at Structures; February 2005

6 UK DMRB; Volume 9 Section 4 TA83/05 Guide to the Use of Variable Message Signs for Strategic Traffic Management on Trunk Roads and Trunk Road Motorways; B4.3 Siting Considerations for VMS; November 2005

7 NRA.DMRB; Volume 8 Section 2; TD 33/05 The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads; Section 11.6 – Siting Requirements; November 2005.

4.5.7 LOCATION RELEVANT TO OTHER ITS EQUIPMENT

The proposed location of a VMS should not affect the operation or the detection field of existing or planned ITS equipment. For the purposes of these guidelines, ITS equipment should be considered to include:

- Congestion monitoring systems including queue detection;
- Incident detection systems;
- Weather monitoring systems including fog detectors;
- The field of vision of CCTV cameras; and
- Traffic signals.

4.5.8 LOCATION RELEVANT TO LIGHTING COLUMNS

Where a VMS is to be located on a section of road that is lit, it should be located at least one column length away from the nearest lighting column. This is to prevent damage to the VMS in the event of the lighting column collapsing due to impact from a vehicle for example.

4.5.9 POWER SUPPLY

The availability of a mains power supply is a crucial factor in the siting of any VMS. The availability and procurement of a suitable power supply should be considered early in the development of any new VMS scheme.

Power may be taken from the local public lighting supply with the agreement of the local authority and the Electricity Supply Board where less then 2kVA is required[8]. If a power supply of greater than 2kW is required, this must come from a metered source. However, it should be noted that the procurement of an independent power supply is recommended.

In consultation with the local electricity supply company (ESB), early consideration should also given be to:

- The location of existing power supplies established as part of the ITS infrastructure survey (Section 4.2.3);
- Lead in times for installing a new power supply;
- The reliability of existing power supplies;
- The cost of providing a new power supply in relation to the business case and budget for the new VMS.

4.5.10 GEOTECHNICAL DATA

The availability of existing data relating to the condition of the ground at the proposed VMS location(s) should be established. Existing data should be analysed to determine if further geotechnical survey works are required as this may have a significant impact on the VMS installation programme.

4.5.11 SAFETY BARRIERS

Safety barriers should be provided at all sites to conform to requirements applicable to the classification of roadway and to NRA standards[9]. The design of the safety barrier will depend on whether the VMS structure has been designed for collision loading.

4.5.12 ASSOCIATED INFRASTRUCTURE

Associated infrastructure to be accommodated within the VMS site includes:

- Power supply and communications cabinets;

[8] Guidelines for Local Authorities to Connect Public Lighting, ESB Networks

[9] NRA DMRB; Volume 2 Section 2; TD19/06 – Requirements for Road Restraint Systems; 3.17 – Fixed objects; December 2007

- Hard standing areas or equivalent. Access for maintenance vehicles should be provided where possible in order to ensure that maintenance personal can safely access VMS and associated equipment; and
- Retaining walls, drainage channels, steps, walkways and any other infrastructure elements as required.

4.6 Tunnel VMS

- In tunnels with CCTV surveillance, VMS should be deployed in advance of the tunnel entrance to display messages relating to conditions within the tunnel itself. VMS deployed in this way are particularly useful to convey information to drivers in the event of an incident occurring within the tunnel.

- Consideration should also be given to the use of VMS in long tunnels. Where VMS are used within a tunnel, all messages and pictograms should be consistent with those used on VMS deployed on the road network local to the tunnel.

4.7 Environmental Impacts

An environmental impact assessment (EIA) report should only be necessary where new VMS schemes are, by their nature, extent or location, likely to have significant effects on the environment. An EIA is unlikely to be required for the erection of VMS structures[10].

Thoughtful planning at an early stage can help mitigate undesirable visual impacts associated with large signs.

Consideration should be given to:

- The visual impact of all the VMS infrastructure including cabinets, posts, gantries, foundations, hard standings, cabling, communications masts/antennae and steps;
- The visual impact of the VMS should be considered in both day-time and night-time conditions with special consideration given to the potential impact messages may have on adjacent properties at night;
- The local setting in terms of landscape, views, conservation areas, architecture and urban design;
- Nearby residential and commercial properties;
- Any potential requirements to remove or prune trees, shrubs or other foliage so as to ensure sight lines to the VMS; and
- Any light pollution produced by the VMS.

[10] The statutory Environmental Impact Assessment (EIA) process is the framework within which environmental considerations are effectively integrated into national road scheme planning. This is complemented by the NRA's *National Roads Project Management Guidelines (NRPMG)* which places an emphasis on the identification and avoidance of environmental impacts in the early stages of project planning and design. This process occurs prior to taking the project through the statutory procedures, including, where appropriate, the preparation of the Environmental Impact Statement see NRA - Environmental Impact Assessment of National Road Schemes – A Practical Guide http://www.nra.ie/Publications/DownloadableDocumentation/Environment/file,3488,en.pdf)

5 VMS TYPE SELECTION

5.1 Overview of VMS Type Options

VMS "type" refers to the choice of mounting structure, the overall capability of the VMS, its layout and geometry. It does not include sign functionality which is covered in Section 1.

The VMS mounting structures available for consideration are:

- Post mounted;
- Cantilever mounted;
- Portal gantry; and
- Mobile (mounted).

It is quite usual for a new VMS scheme to include a combination of these VMS mounting structures.

When considering VMS mounting structures, it should be noted that the costs of the civil engineering works required for the foundation installation and the mounting structure can be significant and in some cases, can be significantly higher than the cost of the VMS itself.

The types of VMS provided for by the NRA's Framework Agreement are summarised in Figure 4. This also provides a summary of sizes, functionality, typical locations and mounting arrangements.

5.1.1 VMS DISPLAY FUNCTIONALITY

The NRA's VMS/LCS specifications include a number of key technology considerations as follows:

- All signs will be free format full matrix (rather than character-based);
- All signs shall be high resolution with pixel pitch between 20 and 25mm;
- All signs must comply with EN 12966 (Parts 1, 2 and 3) including specified performance levels appropriate to Ireland;
- All signs shall employ LED technology providing both yellow and red colours;
- Messages shall include upper and lower case fonts, specified pictograms and shall include fail safe messages; and
- VMS shall include ambient light sensors such that the intensity of any message can be varied.

It is recognised that VMS technology and the NRA's requirements will both evolve over time. The current specifications will need to be modified to reflect any such changes.

Sign Type	Sign Usage	Character Size (mm)	Indicative Display Area	Typical Location	Mounting
Free Format Full Matrix VMS	Strategic VMS	(i) 400mm	(a) three lines of twenty-one characters (b) three lines of eighteen characters	(a) Motorway	(a) Gantry only (b) Gantry or cantilever
		(ii) 320mm	(a) three lines of eighteen characters (b) four lines of twelve characters (c) four lines of nine characters (d) five lines of twelve characters	(a) Motorway (b) Other National Roads (c) Motorway and National Roads (d) Motorway and National Roads	(a) Cantilever (b) Cantilever or post (c) Post (d) Gantry or post
		(iii) 240mm	(a) four lines of twelve characters	(a) Rural National Roads	(a) Post
	Local VMS	(i) 160mm (ii) 100mm	(a) four lines of twelve characters (b) four lines of twelve characters	(a/b) Regional / Local Roads	(a/b) Post
LCS (Lane Control Signs/Signals)	Display lane control characters and numeric characters	N/A	Display: - red roundel - red cross - wickets - Yellow diagonal arrow - three numeric characters with: – Option 1: plus the letters km/h – Option 2: without the letters km/h	(a) Motorway	(a) Gantry (b) Post
Free Format Full Matrix VMS	Mobile VMS	(i) 400mm	(a) three lines of seven characters	(a) Motorway (b) Other National Roads	Trailer mounted
		(ii) 240mm (iii) 160mm	(a) three lines of eight characters (b) four lines of twelve characters	(a) Regional / Local Roads	Trailer mounted
Contract Authority Specified	-	-	To be defined as required in any new signing scheme	-	-

Figure 4 - VMS/LCS types allowed for in the NRA's Framework Agreement

5.2 Post Mounted VMS

5.2.1 OVERVIEW

A number of post-mounted VMS have been installed on roads in Ireland.
Figure **5** shows an example this type of VMS.

Figure 5 - Post Mounted VMS

5.2.2 ADVANTAGES

The advantages of a post mounted VMS include:

- Economic to install; and
- Relative ease of installation and maintenance.

5.2.3 LIMITATIONS

Post mounted VMS can be obscured to traffic travelling in lane nearest the sign by high-sided vehicles. Where such obstructions are likely to occur alternative sign types should be considered.

5.3 Cantilever Mounted VMS

5.3.1 OVERVIEW

There are two types of full matrix, verge-mounted cantilever VMS that have been used in Ireland. Examples of these are illustrated Figure 6.

5.3.2 ADVANTAGES

The key advantages of cantilever mounting structures are:

- Suspending the VMS from a cantilevered structure above the running lane minimises obscuration of messages by large vehicles;
- The inclusion of access facilities within the structure makes it possible to perform routine maintenance operations without the requirement for lane closures;
- Cantilever structures are verge mounted reducing the likelihood of collision damage; and
- Cantilever structures and their foundations can be protected by the installation of suitable barriers.

Figure 6 - Existing cantilevered VMS on the M1

5.3.3 LIMITATIONS

The key limitations of cantilever-mounted structures are cost-related and include:

- The civil engineering works required to install the concrete foundation for the VMS can cost more than the VMS itself;
- The installation of the mounting structure and the VMS on the concrete foundation can require significant traffic management.

5.4 Portal Gantry

5.4.1 OVERVIEW

Portal gantries can be used to locate both VMS and LCS directly over each lane of the road. Additional ADS can be accommodated on the same gantry if required. Gantries can accommodate additional ITS infrastructure such as enforcement cameras, CCTV cameras and vehicle detection systems. Mounting 'boxes' or frames should be mounted to the back of the sign.

The use of portal gantries should be considered for the following scenarios:

- Where lane control is required for traffic/queue management purposes;
- Where lane control units are to be installed in conjunction with VMS and/or ADS to display traffic related messages; and
- Where there is a risk of strategic and tactical signs on other types of mounting arrangement being obscured by large vehicles.

This type of VMS mounting offers improved traffic management capability and legend visibility and provides the opportunity to use larger VMS displays if needed.

5.4.2 ADVANTAGES

The key advantages of portal gantry mounting structures are:

- The problems of the VMS or LCS message being obscured are removed;
- Larger sign lengths can be installed compared to other mounting structures. VMS up to 10,000mm wide by 3200mm high can be accommodated on portal gantries;
- It is the most effective way of mounting LCS as these need to be mounted over each lane; and
- In common with cantilevers, portal gantries can include secure access to allow routine maintenance.

5.4.3 LIMITATIONS

The key limitations of portal gantries are typically cost-related and include:

- Gantry installations often require additional design considerations and approvals based on the installation site and the different VMS to be mounted;
- The installation of the gantry structure and VMS require complex traffic management typically involving contra-flows or lane closures.

5.5 Mobile VMS

5.5.1 OVERVIEW

Mobile VMS (mVMS) should be deployed where there are no permanent signs or to provide temporary support for permanent signs. They are most commonly used for roadworks but may also be deployed for traffic management at large events or to assist in safety campaigns and traffic use. They should not be used for advertisements or promotions unrelated to road safety. mVMS are now being considered for use in place of

permanent VMS on motorways in advance of a permanent VMS being installed. Special considerations are required in these cases to locate the mVMS on a solid and protected platform.
Mobile VMS are available in many sizes and forms but essentially consist of:

- A trailer mount;
- VMS sign panel;
- VMS control panel;
- Power supply; and
- Communications infrastructure.

It is recommended that all mVMS:

- Shall be capable of displaying combinations of text or pictograms as defined in the Department of Transport Traffic Signs Manual; Chapter 3 – Variable Message Signs; January 2009;
- Shall be provided with four flashing amber lanterns, one at each corner of the mVMS. These flashing lanterns shall be outside the active matrix area and shall be used whenever there is a specified requirement to display flashers;
- Shall comply with the class designations for yellow light as defined in EN 12966-1[11]; and
- Shall incorporate default and fail-safe message functions.
- Shall be mounted and braked suitably to avoid it rolling on inclines or subject to being dislodged by strong winds.

Figure 7 – Example of a Mobile VMS Displaying Network Information Message

[11] EN 12966-1; Road Vertical Signs – Variable Message Traffic Signs – Part 1; Section 6.3 – Luminance; December 2004

5.5.2 ADVANTAGES

The key advantages of mVMS are:

- They can be deployed rapidly for use in multiple scenarios and multiple locations to meet different requirements;
- Their capabilities are continuing to improve and many can provide the same performance of permanent VMS; and
- mVMS are readily available for hire thereby reducing capital expenditures.

5.5.3 LIMITATIONS

The limitations of mVMS are generally related to the considerations required for siting and use. Some physical limitations are as follows:

- The optical performance of a mVMS should meet the minimum standards applied to permanent VMS which may be difficult when using temporary power supplies from generators, batteries, wind turbines or solar sources.
- mVMS are physically limited in the number of characters per line that can be displayed and message lengths need to be constrained;
- Careful siting is required and must be managed for each deployment;
- mVMS are susceptible to vandalism and tampering;
- Communications between the TCC and mVMS may not always be available or adequate; and
- When mVMS are used in a semi-permanent location to temporarily replace a permanent VMS, they should be sited on an approved mounting pad with appropriate safety and protective barriers.

6 VMS DISPLAY FUNCTIONALITY

6.1 VMS Specification

Once the location and type of VMS have been determined, a specification needs to be developed for the VMS display requirements. This should include:

- Character size;
- Character form;
- Pictograms;
- Sign layout and size;
- Optical performance;
- Power;
- Communications; and
- Control;

These requirements are discussed in the following sections.

6.1.1 CHARACTER SIZE

The minimum height of characters displayed on any light emitting matrix VMS in Ireland should be in accordance with the standards set out in the EN 12966[12].

Figure 8 presents typical values for character dimensions and associated tolerances to be used on VMS in order to obtain an acceptable legibility[13].
The choice of the size range is determined by the required legibility distance and approach speed to the sign on site. The legibility distance can be based on letter height times a factor. This factor is dependent on various environmental and human parameters and is typically given a value in the range 500 to 600[14].

Size Range	Minimum char height: h (mm)	Minim char width: w (mm)	Minimum char spacing: sc (mm)	Minimum word spacing: sw (mm)	Minimum line spacing: sl (mm)	Minimum backing board border distance: (mm)
A	100	71	28	71	57	100
B	160	114	46	114	91	160
C	240	171	68	171	137	240
D	320	228	91	228	182	320
E	400	285	114	285	228	400

Notes
1 The minimum character width is equal to 5/7 h.
2 The minimum character spacing is equal to 2/7 h.
3 The minimum word spacing is equal to 5/7 h.
4 The minimum line spacing is equal to 4/7 h.
5 The minimum backing board border distance is equal to h. This distance is measured from the border of text to the border of backing board.

Figure 8 - Dimensions and tolerances for text

Each character on a VMS is made up of elements. The minimum number of elements for an alphanumeric character is seven in vertical direction by five in horizontal direction.

6.1.2 PICTOGRAMS AND ASPECTS

A pictogram is a graphical representation of an event or instruction and can be used to support regulatory, warning and information messages. An aspect is defined as any display on a Lane Control Signal or Tunnel Lane Control Signal or a Periodic or Variable Speed Limit[15].

[12] EN 12966; Road Vertical Signs – Variable Message Signs – Part 1; December 2004
[13] EN1266-1; Road Vertical Signs – Variable Message Signs – Part 1; Annex D; Table D.2 – Dimensions and Tolerances for Text; December 2004
[14] EN1266-1; Road Vertical Signs – Variable Message Signs – Part 1; Annex D; D.1 – General; December 2004
[15] Department of Transport; Traffic Signs Manual Chapter 3 – Variable Message Signs; Appendix 3A – Glossary and Abbreviations; January 2009

The use of pictograms on VMS is encouraged as it helps to make messages more understandable to road users whose first language is not English.

The NRA must approve the use of all pictograms used on VMS on national roads in Ireland. Figure 9 shows the pictograms currently approved by the NRA.

	**Crosswind / Reported Strong Winds**	
	**Slippery Road Ahead**	
	**Tunnel Ahead**	
	**Roadworks**	
	**Warning or Alert**	
	**Congestion / Queues likely / Queues Ahead**	

Figure 9 – Pictograms approved by the NRA, (the right hand column shows the inverse of these signs which can be displayed also)

Proposals for new pictograms must be submitted to the NRA at the address given in the Preface to these guidelines.

In addition to the above pictograms it is also permissible to use any regulatory warning sign mentioned in Chapter 3 & 6 of the Traffic Signs Manual, for example a VMS near roadworks could display a chevron or left/right arrow sign.

6.1.3 SIGN LAYOUT AND SIZE

The overall size of the VMS display should be determined by considering:

- VMS face layout (for example, is it intended that the VMS should display pictograms as well as text);
- The size of the proposed message sets; and
- The size of any proposed pictograms.

Figure 4 gives an overview of the NRA's requirements for VMS sizes and configurations. Note that while all VMS defined in Figure 4 are free format full matrix, the display area has been expressed as lines and characters to provide an indicative size.

The standard message sets are listed in Section 8. The size of each message can be determined with reference to the minimum character spacing and minimum line spacing defined in Figure 8.

If pictograms are to be used in conjunction with the message sets, this will also need to be taken into consideration. (For guidance, at 20mm pixel pitch, the pictograms will be 1280 x 1280mm. At 25mm pixel pitch, the pictograms will be 1600 x 1600mm).

The display size needs to be considered in conjunction with the preferred sign type (see Section 1). If the two are not compatible with the requirements of Figure 4, further iterations of either the VMS type or the criteria dictating the display size need to be made until a satisfactory solution is reached.

6.1.4 OPTICAL DISPLAY STANDARDS AND ALIGNMENT

Optical display standards

The optical performance standards of VMS required by the NRA are as follows[16]:

- All light emitting VMS display equipment shall employ LED technology. Red and yellow emitters shall comply with the requirements of international standards[17]:
- Sequencing of VMS messages shall be possible, allowing the use of alternating messages to be displayed on all types of VMS;
- Flashing of all or any part of a VMS/LCS message shall be possible;
- Message displayed on the VMS shall be updated in a manner that appears instantaneous;
- In the case where no other default VMS message has been configured, a blank fail-safe message shall be displayed in the event of power failure, display module failure or the failure of any major equipment associated with the control of VMS;
- Default VMS messages are controlled by the designated TCC computer system. VMS design shall permit these messages to be configured and downloaded to VMS as required;

In the event of communications failure, VMS shall be configured to display a default message;

- The intensity of the VMS display shall vary in accordance with the ambient light level and may be overridden by the designated TCC computer system.
- Light sensors shall be incorporated into all VMS to measure the external illumination of the VMS from all directions. Adjustment of display intensity shall compensate for all ambient conditions including direct sunlight and darkness;
- The ability to determine and display the prevailing ambient level of illumination and corresponding VMS display intensity level at any time during operation of the VMS shall be provided.
- The VMS shall be provided with a 200mm diameter yellow flasher constructed from LED pixels at each corner of the sign. These flashers shall be outside the active matrix area. The area of LED pixels forming the flasher shall be capable of flashing depending on the text or pictogram displayed and shall be capable of operating in conjunction with a blank message.

For the purposes of consistency and good practice, it is advised that anyone intending to deploy VMS on non-NRA roads should also adopt these requirements as far as possible.

Similarly, anyone intending to deploy VMS not included on the NRA's Framework Agreement should contact the NRA for guidance in this area.

16 EN 12966; Road Vertical Signs – Variable Message Signs – Part 1; December 2004

17 EN 12966; Road Vertical Signs – Variable Message Signs – Part 1; Section 7 – Visual Performance; December 2004

Alignment

It is essential that the VMS light-emitting optics are correctly aligned with the road and provision is made in the VMS structure for fine adjustment in the field to assure optimum optical alignment.

Where a VMS message is visible from more than one carriageway, the use of louvers or a specification relating to the angle of light emissions should be considered to ensure that drivers cannot read messages which do not refer to their direction of travel.

Where a light emitting VMS is positioned so that sunlight shines directly onto the sign face, two issues need to be considered as follows:

- Wash out – the contrast between the light source and sign face can be lost rendering the message faint or even invisible to drivers; and
- Phantom messages – where characters or messages may appear to be visible to a driver even when the sign is switched off.

If the location cannot be refined to mitigate against these issues, shading may be required in the form of a canopy, hood or louvers.

Where the face of a VMS is enclosed behind a screen (for example to protect against debris), reflections can sometimes cause issues. In these cases, the following measures should be considered:

- Careful site orientation;
- Use of non-reflective materials; and
- Use of a specifically designed optically neutral screen.

6.2 SIGN Control and Communications

As part of any new scheme design, consideration needs to be given as to how VMS will be controlled and managed. It is recommended that purchasers' adopt a vendor independent solution for the TCC system used to control the VMS. This will provide purchasers with the flexibility to procure VMS from different vendors without the need for standalone proprietary control systems.

An essential requirement for any control system is to allow Operators to know what message is currently being displayed on each VMS and whether messages sent to each device are actually being displayed.

The NRA uses this approach and has implemented its own Advanced Traffic Management System (ATMS) which can control VMS from different vendors. In addition to this basic control functionality, the NRA's ATMS also provides the following additional functionality:

- Event management and response functionality allowing operators to declare traffic events such as incidents, roadworks, queues, and adverse weather conditions via the ATMS. The ATMS automatically proposes a Response Plan which identifies the specific VMS it suggests should be set as well as the proposed messages to be displayed;

- Scheduling messages which can be defined in advance and scheduled to be displayed appear on specific VMS at a specified time; and

- A message library which allows operators to select pre-defined, pre-approved messages for display.

6.2.1 INTERFACE PROTOCOLS

The interface protocol is the method by which the control system communicates with the VMS and by which diagnostic and operational status information is provided. There are a number of different interface protocols that can be used. While some of these are proprietary protocols, there are also a number of vendor-independent protocols available for use as follows:

National Transportation Communications for ITS Protocol (NTCIP)

NTCIP is a family of communications standards for transmitting primarily data and message between computer controlled devices used in ITS. NTCIP is being promoted and developed by the Federal Highway Administration (FHWA), the American Association of State and

Highway Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA) to allow interoperability between various traffic management devices. It has been used by many highways authorities worldwide and has been adopted by NRA as the standard to be used for VMS signs deployed on the national road network. More details on NTCIP can be found at: http://www.ntcip.org/

Urban Traffic Management and Control (UTMC)

UTMC is similar to NTCIP but is a suite of UK standards more suited to ITS in the urban environment. UTMC has been used in the UK and Ireland by a number of local authorities and UTMC-compliant systems are widely available from the major ITS equipment suppliers. Further information on UTMC systems can be found at: http://www.utmc.uk.com/

6.2.2 COMMUNICATIONS

The method of communicating with the VMS will be greatly influenced by its location. TCP/IP-based communications have been widely adopted by the ITS community and it is recommended that this used for VMS deployments.

Typical options for the transmission include but are not limited to:

- Ethernet over Fibre-optic cable or Copper;
- GPRS / 3G UTMS; and
- 802.11 Wireless Ethernet Standards (WiFi, WiMax, Mesh).

6.2.3 CONTROL PROCEDURES

The controlling authority must establish procedures which define access to and operation of the VMS control system. These procedures should include:

- Network security of the VMS control system and associated communications infrastructure;
- Operational access should be limited to trained personnel;
- Other than in exceptional circumstances, only prescribed and approved messages should be allowed; and
- Suitable arrangements need to be made for control system maintenance.

7 VMS INSTALLATION

7.1 Structural Specifications and Design Standards

All structural design, checking, certification, testing and installation work associated with the supply of VMS supporting structures, VMS enclosures and VMS walkway housings and access arrangements shall comply with the requirements of Figure 10, below.

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Amendments made to any of these specifications by the NRA must also be complied with. Note that in case of conflicting requirements, the NRA's amendments take precedence.

Any VMS designs that do not comply with the requirements of Figure 10 should be submitted for the NRA for approval.

Sign type	Support structure	Display configuration	Structure design specification	Enclosure and brackets design specification
Free Format Matrix VMS	Cantilever	3 x 18 @ 400mm 3 x 18 @ 320mm 4 x 12 @ 320mm	BD51 TR 2197C	BD51 TR2196C
	Post	5 x 12 @ 320mm 4 x 12 @ 320 mm 4 x 12 @ 240mm 4 x 12 @ 160mm 4 x 12 @ 100mm	BD51	BD51/98 TR2196C
	Portal	3 x 21 @ 400mm 3 x 18 @ 400mm 5 x 12 @ 320mm	BD51/98	BD51/98 TR2198B TR2196C
Lane Control Signs	Portal	Display specified lane control characters or numbers.	BD51/98	BD51/98
Contract Authority specified sign	Other	To be defined in a Call-Off Package	To be specified by Client/Designer	To be specified by Client/Designer

Figure 10 - VMS support structure requirements, standards and specifications[18]

[18] The NRA Design Manual for Roads and Bridges, including BD 51/98 and BD 37/01. The requirements of TR2196, TH2197 and TR2198 are published by the Traffic Control & Communications Division of the Highways Agency.

In addition to the requirements of Figure 10 the following additional elements should also be considered:

- VMS type (see Section 1);
- Access to VMS;
- Access ladder and walkway;
- Ducting for communications; and
- Internal cabling.

7.2 Health and Safety

The primary purpose of a Road Safety Audit is to identify potential safety hazards arising from the design of a VMS as they could affect road users. Anyone implementing a VMS scheme needs to carry out a road safety audit in accordance with NRA guidance[19].

Local authorities should also consider their obligations under the requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006.

7.2.1 STAGES OF THE AUDIT

Audits should be undertaken at four specific stages in the development of a VMS scheme[20] as follows:

- Stage F: Route selection stage;
- Stage 1: Completion of preliminary design prior to land acquisition procedures;
- Stage 2: Completion of detailed design, prior to tender of construction contract. In the case of design and build contracts, a Stage 2 Audit shall be carried out in accordance with the requirements of the contract; and
- Stage 3: Completion of construction : prior to opening of the scheme to traffic wherever possible.

The Road Safety Auditor will be responsible for identifying potential safety deficiencies by assessing a range of issues including:

- Whether the scheme design creates confusion or ambiguity for road users that could lead to potential road traffic accidents;
- The amount of information available to road users;
- Visibility and/or obstructions to road users' view; and
- Any hazards or obstacles to road users.

If any deficiencies in the scheme design are identified, remedial measures may be necessary.

7.3 Temporary Traffic Management

All reasonable steps should be taken to ensure the safety of road users and workers during the installation and maintenance of a VMS. This section provides guidance on the:

- The role of a traffic management plan;
- Specific traffic management and control issues; and
- Traffic management coordination meetings.

Any temporary traffic management used in conjunction with VMS installation or maintenance must be conducted in accordance with the Department of Transport guidance[21].

19 NRA Design Manual for Roads and Bridges, NRA HD 19/04 Road Safety Audits and NRA HA 42/04 Road Safety Audit Guidelines

20 NRA Design Manual for Roads and Bridges, NRA HD 19/04 Road Safety Audits

21 Department of Transport; Traffic Signs Manual; Chapter 8 - Temporary Traffic Measures and Signs for Roadworks; Section 10.3; November 2006.

7.3.1 TRAFFIC MANAGEMENT PLAN

Traffic management requirements that typically apply to the installation of each type of VMS are shown below.

VMS Mounting Types	Traffic Management Requirements		
	Motorway	Dual Carriageway	Other Roads
Post Mounted	Hard shoulder closure	Lane 1 closure	Varies according to site
Cantilever and Gantry Mounted	Carriageway to be closed – contra flow to operate	Carriageway to be closed – contra flow to operate	Varies according to site
Mobile	Hard shoulder closure	Lane 1 closure	Varies according to site

Figure 11 – Traffic management requirements

Traffic management proposals to meet the requirements of Figure 11 should be documented in a traffic management plan. This should, as a minimum, cover:

Phasing of the works at each location;
Drawings showing the traffic management layout including:
Geometric Design.
Width of Lanes.
Working Areas.
Safety Zones.
Crossovers.
Access and egress locations for construction.
Signing.
Road markings.
Temporary Lighting
Provision for emergency services
Timing of operations; and
Road lighting.

For works in the Dublin area, contractors should also take cognisant of the requirements of the Directions for the Control and Management of Roadworks in Dublin City, Dublin City Council, Office of the Director of Traffic, August 2001.

7.3.2 TRAFFIC MANAGEMENT CO-ORDINATION MEETINGS

Prior to the implementation of any traffic management scheme relating to a VMS installation or maintenance, meetings should be held to coordinate the safety measures. These should typically involve the following organisations:

- The relevant Local Authority / Operating Agency;
- NRA;
- The Garda Síochána; and
- The Engineer and all contractors for the works.

8 VMS MESSAGES

8.1 Message Structure

Any message that is displayed on a VMS on a national road must be either prescribed or pre-authorised.

Messages must only be displayed as text-only (in English) or as a combination of text and pictograms[22].

This section provides guidelines for the structure of VMS messages.

8.1.1 MESSAGE CONTENT

VMS should only be used to display information defined in Sections 4.3 and 4.4. Under no circumstances should any VMS on a national road be used to display information relating to any other subject including:

- Advertising;
- Political slogans; and
- Requests for information either related to accidents or public consultation exercises.

8.1.2 MESSAGE SEQUENCING

Sequencing of VMS messages shall be possible, allowing for the use of alternating messages to be displayed.

Flashing of all or any part of a VMS/LCS message shall be possible.

VMS messages shall be updated in a manner that appears instantaneous.

8.1.3 MESSAGE LENGTH

The maximum length of a VMS message should not exceed ten words. The definition of a single word includes:

- A place name even if it is formed from more than one word. For example, 'CARRICK-ON-SHANNON' would be counted as one word (applicable in the same way to bilingual translation of place names);
- Road names. For example, 'NAAS ROAD' instead of 'N7' would be counted as one word;
- Infrastructure names even if formed from more than one word. For example, 'DUBLIN PORT TUNNEL' or 'CAR FERRY' would each be counted as one word;
- Any directions, distances or route extensions. For example, DUBLIN (N), 20 KM or M50 (N2) would each be counted as one word;
- All other words irrespective of length. For example, 'M50 Road Closed From J5 to J6' would be counted as seven words;
- Arrows and symbols each count as one word each; and
- Any punctuation marks (for example, a dash '-') are not counted.

8.1.4 ROAD NUMBERS

Where possible, it is advisable to identify roads by their designated number rather than their name. For example, 'N7' should be used rather than 'NAAS ROAD.' If road names have to be used, truncated or abbreviated versions should be avoided.

Road numbers should be displayed without any gaps between the characters. For

22 Department of Transport; Traffic Signs Manual, Chapter 3 – Variable Message Signs, Section 3.4.4; January 2009

example, ‘M50’ and ‘N2’ should be used rather than ‘M 50’ and ‘N 2’.

8.1.5 JUNCTION NUMBERS

Where space is limited, junctions should be identified by junction number rather than the junction name. For example, ‘J2’ should be used rather than ‘AIRPORT’. However, as many drivers are unfamiliar with junction numbers on their own, where the VMS display permits, it is advisable to use both junction numbers and names together (for example, ‘J2 AIRPORT’).

Junction numbers should be displayed without any gaps between the characters. For example, ‘J1’ should be used, not ‘J 1’.

Truncated or abbreviated versions of junction names should not be used. If a junction name is too long to be displayed as part of a message, it is advisable to only use the junction number.

8.1.6 COMPASS DIRECTIONS

Where a route number or name is displayed, a compass direction (displayed in full or an abbreviated form) may be used as follows:

- Full form - NORTH, SOUTH, EAST, WEST; or
- Abbreviated form - N, S, E, W, NW, NE, SW, SE.

8.2 NRA Approved Messages

8.2.1 APPROVED MESSAGE ELEMENTS

The list of message elements approved by the NRA is shown in Figure 12 (over the next 3 pages). The approved message elements are defined in the following six columns:

- Column A – Incident
- Column B – Closure
- Column C – Location
- Column D – Information / Advice
- Column E – Notice (to all or specific traffic)
- Column F – Instruction

Column A Incident	Column B Closure
ACCIDENT ANIMALS CONGESTION DEBRIS DEBRIS ON ROAD DIVERSION FLOODING FLOODS FOG FOG PATCHES GRITTING IN PROGRESS HEAVY RAIN HIGH WINDS ICE INCIDENT LARGE LOAD M[x] ROADWORKS M[x] ROADWORKS START [date] MAJOR INCIDENT MERGING TRAFFIC MOBILE WORKS N[x] ROADWORKS N[x] ROADWORKS START [date] NO PHONES OBJECT ON ROAD OBSTRUCTION OIL SPILL ONCOMING VEHICLE PEDESTRIANS QUEUE ROAD WORKS ROADWORKS START [date] SETTING OUT ROAD WORKS SKID RISK SLIPPERY SURFACE SLOW MOVING LARGE LOAD SLOW TRAFFIC SMOKE SNOW SNOW PLOUGH SPILLAGE SPRAY STRANDED VEHICLE STRONG WINDS SURFACE WATER TELEPHONES OUT OF ORDER TRAFFIC SIGNALS OUT WEIGHT CHECK WINDS	[junction name] CLOSED [junction number] CLOSED [route name] CLOSED [route number] CLOSED [xxx] BRIDGE CLOSED [xxx] TUNNEL CLOSED BRIDGE CLOSED BUS LANE CLOSED EXIT CLOSED LANE [x] CLOSED LANE CLOSURE LANES [x] [x] CLOSED LEFT LANE CLOSED M[x] CLOSED MOTORWAY CLOSED N[x] CLOSED NEXT SERVICE AREA CLOSED OUTSIDE LANE CLOSED ROAD CLOSED SLIP ROAD CLOSED TUNNEL CLOSED

Column C Location	Column D Information / Advice
[bridge name]	[junction name] [travel time] MIN
[junction name]	[junction name] [travel time] MINUTES
[junction number]	[junction number] [travel ime] MIN
[junction number] TO [junction number]	[junction number] [travel ime] MINUTES
[number] KILOMETRES	[number] HOUR DELAYS
[number] KM	[number] HR DELAYS
[route name]	[number] MINUTE DELAYS
[route number]	[place name] [travel time] MINUTES
ABNORMAL LOAD AHEAD	[place name] [travel time] MINUTES
ACCIDENT AHEAD	ADVISORY SPEED LIMIT [xx]
AFTER [bridge name]	ALT. ROUTE FOLLOW [place name]
AFTER [junction name]	ALT. ROUTE FOLLOW [symbol]
AFTER [junction number]	ALT. ROUTE USE [route name]
AFTER [place name]	ALT. ROUTE USE [route number]
AFTER [tunnel name]	ALTERNATIVE ROUTE FOLLOW [place name]
AFTER NEXT JCT	ALTERNATIVE ROUTE FOLLOW [symbol]
AFTER NEXT JUNCTION	ALTERNATIVE ROUTE USE [route name]
AHEAD	ALTERNATIVE ROUTE USE [route number]
AT [bridge name]	AVOID LANE CHANGES
AT [junction name]	CONGESTION LIKELY
AT [junction number]	DELAYS
AT [place name]	DELAYS POSSIBLE
AT [tunnel name]	DO NOT USE HARD SHOULDER
AT EXIT	DRIVE WITH CAUTION
AT NEXT EXIT	FOR [place or event name] FOLLOW [place name]
AT NEXT JCT	FOR [place or event name] FOLLOW [symbol]
AT NEXT JUNCTION	FOR [place or event name] USE [junction name]
AT TOLL	FOR [place or event name] USE [junction number]
BEFORE [bridge name]	FOR [place or event name] USE [route name]
BEFORE [junction name]	FOR [place or event name] USE [route number]
BEFORE [junction number]	FOR [x] KM
BEFORE [place name]	LONG DELAYS
BEFORE [tunnel name]	M[x] [junction name] [travel time] MIN
BEFORE NEXT JCT	M[x] [junction name] [travel time] MINUTES
BEFORE NEXT JUNCTION	M[x] [junction number] [travel ime] MIN
CONGESTION AHEAD	M[x] [junction number] [travel ime] MINUTES
FOR [number] KILOMETRES	N[x] [junction name] [travel time] MIN
FOR [number] KM	N[x] [junction name] [travel time] MINUTES
IN [place name]	N[x] [junction number] [travel ime] MIN
IN ROAD	N[x] [junction number] [travel ime] MINUTES
ON [name of bridge] BRIDGE	NEXT JUNCTION [travel time] MIN
ON BRIDGE	NEXT JUNCTION [travel time] MINUTES
ON M[x]	ONE LANE OPEN
ON N[x]	REJOIN MAIN CARRIAGEWAY
ON SLIP ROAD	SLOW
QUEUE AHEAD	SLOW DOWN
ROAD CLOSED AHEAD	SLOW FOR [x] KM
TO [route name]	SLOW TRAFFIC
TO [route number]	SLOW TRAFFIC FOR [x] KM
	SORRY FOR ANY DELAY

Column E Notice	Column F Instruction
[vehicle category] AND [vehicle category] ALL TRAFFIC CARAVANS CARS HGV'S HIGH SIDED VEHICLES HIGH SIDED VEHS M'CYCLES MOTORCYCLES	EXIT AT [junction name] EXIT AT [junction number] EXIT AT NEXT JCT EXIT AT NEXT JUNCTION EXIT MOTORWAY FOLLOW [place name] FOLLOW [symbol] FOLLOW DIVERSION HIGH VEHICLES USE MIDDLE OF ROAD LEAVE AT [junction name] LEAVE AT [junction number] LEAVE AT NEXT JCT LEAVE AT NEXT JUNCTION LEAVE MOTORWAY USE [junction name] USE [junction number] USE [route name] USE [route number] USE BUS LANE USE HARD SHOULDER WAIT FOR POLICE

Figure 12 - Approved VMS Message Element

A message can be formed by adding together elements from the columns in Figure 12 in the combinations shown in Figure 13:

Message content	Message element composition (ref Fig12)
• Incident + Location	A + C
• Incident + Location + Advice	A + C + D
• Incident + Location + Notice + Instruction	A + C + E + F
• Incident + Location + Instruction	A + C + F
• Incident + Advice	A + D
• Incident + Notice + Instruction	A + E + F
• Incident + Instruction	A + F
• Closure	B
• Closure + Location	B + C
• Closure + Location + Advice	B + C + D
• Closure + Location + Notice + Instruction	B + C + E + F
• Closure + Location + Instruction	B + C + F
• Closure + Advice	B + D
• Closure + Notice + Instruction	B + E + F
• Closure + Instruction	B + F

Figure 13 - Message composition

Any message element in columns A or B can be preceded by:

- a road name or prefer ably number (see Section 8.1.4);
- a junction name and/or number (see Section 8.1.5); and
- a compass direction (see Section 8.1.6).

It is permissible to combine two journey time messages.

Where a message includes a vehicle classification (HGV for example), appropriate text may be replaced by appropriate symbol.

8.2.2 NEW MESSAGE ELEMENT APPROVAL

New message elements may be added to the approved lists with approval by the NRA. Requests for the approval of new message elements should be submitted to the NRA in writing. A formal response from the NRA must be received prior to the utilisation of any new message element.

Non-approved message elements may be used in emergency situations. In these cases, the use of such an emergency non-approved message element must be documented and a briefing note submitted to the NRA as soon as practicable.

8.3 Safety Messages

VMS may be used to support road safety campaigns. However, the following restrictions apply:

- The NRA must approve all safety campaign messages. Approved safety campaign messages may be temporarily added to the prescribed list of approved messages but only until a date specified by the NRA.

- Blanket implementation or indiscriminate area-wide display of a safety campaign message may be inappropriate. Messages must be appropriate to users of the road where the VMS are located.

- Safety campaign messages must be allocated a low priority and must be removed when operational use of a VMS is required.

An example of a safety message employed on a VMS is illustrated below.

Figure 14 - VMS Displaying Safety Message

9 VMS APPROVAL FORM

The NRA VMS approval procedure is applicable to all new VMS schemes on national roads in the Republic of Ireland and can be used to assess the effectiveness of existing VMS facilities and message sets.

The VMS Approval Form is provided as Appendix A. The form includes the following sections:

9.1.1 SECTION 1 – STATEMENT OF GENERAL REQUIREMENTS:

- Contact details of the local authority implementing the VMS scheme;
- A description of the local authority including its facilities, operational staff, etc;
- Project Location including the affected route, the start and end points and notable features included (for example, bridges, tunnels, junctions, major traffic generators, etc);
- Definition of the operational problem that is to be addressed by the introduction of a VMS scheme;
- An overview of the VMS scheme or project associated with the proposed VMS scheme;
- the specific strategic aims associated with proposed VMS scheme;

9.1.2 SECTION 2 – DETAILS FOR EACH VMS INSTALLATION:

- Proposed VMS location;
- Proposed VMS Type;
- Environmental Impact Assessment;
- VMS Functionality/Specification;
- Systems Details;
- New message elements for approval;
- New non-standard messages for approval;
- VMS Installation Details (Structural) indicating which party (for example, the owner or consultant) is responsible for the civil and structural works assessment and design;
- Maintenance access including vehicle parking, gantry access and vandalism prevention for example;
- Safety assessment including roadside clearances and safety barriers for example.

On completion, the form must be submitted to the NRA for approval along with all relevant additional documentation.

Appendix A - VMS Installation Approval Form

VARIABLE MESSAGE SIGNS

APPROVAL FORM APPLICATION

The NRA VMS approval procedure is applicable to all new VMS infrastructure schemes in the Republic of Ireland and can be used to assess the effectiveness of existing VMS facilities and message sets. Please use in conjunction with *NRA Guidelines for the Use of Variable Message Signs on National Roads*

Note:

Section 1 provides a general overview of the proposed scheme: please submit only one copy per scheme.

Section 2 provides a detailed description of the proposed scheme: please submit one copy for each proposed VMS installation.

Please submit this document along with all relevant additional documentation defined above to:

VMS Approval
Network Operations
National Roads Authority
St. Martin's House
Waterloo Road
DUBLIN 4

SECTION 1
STATEMENT OF GENERAL REQUIREMENTS

Contact details for implementing local authority	
Organisation name	
Address	
E-mail	
Telephone	
Fax	
Contact name	
Position	

Please provide details of the implementing local authority including its organisation/authority, facilities, operational staff, etc as well as any other pertinent details

Describe the affected route, including start and end points, along with notable physical features e.g. bridges, tunnels, junctions, major traffic generators, etc.

Describe the traffic operational problem that is to be addressed by the provision of a VMS sign

Provide an overview of the scheme or project associated with the proposed VMS implementation

Provide a definition of the specific strategic aims and intended purpose of the proposed VMS scheme

SECTION 2
DETAILED DESCRIPTION OF THE PROPOSED VMS SCHEME

(To be completed for each VMS)

2.1 Location of Proposed VMS

Provide details of the proposed location of the VMS with reference to the requirement of Section 4 of the NRA Guidelines for the Use of Variable Message Signs on National Roads.

Please describe the general location below and attach the VMS Site Survey Report along with this application form

2.2 Select VMS Mounting Arrangement

	Post mounted in the Verge
	Post mounted in the central reservation
	Verge mounted cantilever
	Cross carriageway Gantry
	Mobile sign

2.3 Environmental Impact Assessment

Please attach an EIA report as detailed in Section 4.7 of the NRA Guidelines for the Use of Variable Message Signs on National Roads.

2.4 VMS Functionality / Specification

VMS Characteristics	
Sign mounting arrangement	
Number of characters and number of rows	
Character size	
Character format	
Pictogram Provision	

VMS Characteristics	
Sign layout and size	
Optical performance	
Display options	
Associated lamps	
Power	
Communications	
Control	
Materials	

2.5 Systems Details

Indicate operational control requirements, system software, communications, integration with other systems

2.6 Specify a list of new message elements for approval

Provide details of any new message elements for approval. Proposed message elements should be based on the requirements of Section 8 of the NRA Guidelines for the Use of Variable Message Signs on National Roads.

2.7 Specify a list of messages that are not built from the elements, such as safety messages, for approval

Provide details of any new safety messages for approval. Proposed safety messages should be based on the requirements of Section 8 of the NRA Guidelines for the Use of Variable Message Signs on National Roads.

2.8 VMS Installation Details

Structural Work - Indicate which party (owner or consultant) is responsible for the civil and structural works assessment and design

2.9 Health and Safety

Please include details and attach any documents regarding the consideration given to safe maintenance access to the site (both vehicular and pedestrian, gantry access, vandalism prevention and safety assessment (roadside clearances, barriers)

---------- END ----------