



**An Roinn Iompair,
Turasóireachta agus Spóirt**
Department of Transport,
Tourism and Sport

VARIABLE MESSAGE SIGNS

CHAPTER 3
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Traffic Signs Manual

Chapter 3 – Variable Message Signs

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3.1 Introduction

- 3.1.1 This Chapter provides information and guidance on the various types of Variable Message Sign (VMS) that are available for use on roads in Ireland. It includes signs that consist wholly of variable message elements and those where the variable message forms only part of a larger sign. The chapter should be read in conjunction with other relevant chapters. Further information on the use of the Manual is given in Chapter 1.
- 3.1.2 For the purposes of this Manual:
- **Shall** or **must** indicates that a particular requirement is mandatory;
 - **Should** indicates a recommendation; and
 - **May** indicates an option.
- 3.1.3 This chapter should be read in conjunction with the National Roads Authority's Guidelines for the Use of Variable Message Signs on National Roads¹ (the NRA VMS Guidelines).
- 3.1.4 The NRA VMS Guidelines are updated on a regular basis to incorporate changes in VMS technologies and standards. They will also be changed when there are changes in approved messages or aspects. Rather than duplicate that information, this chapter refers to the NRA VMS Guidelines where applicable. The Guidelines cover the following topics:
- VMS Type selection;
 - Design criteria;
 - Functionality;
 - Communication protocols;
 - Control methods;
 - Installation;
 - Messaging; and
 - Approval.
- 3.1.5 The chapter contains terminology specific to this type of sign: Appendix 3A, which provides a glossary and list of abbreviations, is included for clarification.

¹ National Roads Authority. *Guidelines for the Use of Variable Message Signs on National Roads*. NRA, Dublin.

USES OF VMS

- 3.1.6 Variable Message Signs may be used to display regulatory signs, warning signs or information. Typical uses include:
- Messages providing driver information to assist with incident management, tactical control or strategic management;
 - Warning or traffic control at roadworks (mobile VMS);
 - Car park signs (directions and/or occupancy);
 - Lane control signals;
 - Periodic or variable speed limits; and
 - Diversion of over-height vehicles.
- 3.1.7 A decision to select a VMS should only be made when it can be shown that a normal fixed plate sign would be inadequate.

MESSAGE SIGNS

- 3.1.8 The most significant use of VMS is for message signs, either displaying text only or displaying text and/or pictograms (free format matrix signs). Such signs are generally confined to the more heavily trafficked routes.
- 3.1.9 The aim of using VMS as a driver information system is to inform drivers either in advance or in real time of events or incidents on the road network that may affect traffic conditions and journey times. The information may relate to the local network and extended network links such as ferry ports or airports. Events could include roadworks or major sporting events. Related applications could involve the provision of estimated journey time information or parking guidance.
- 3.1.10 The use of VMS for tactical control provides information to the driver in relation to an incident or event on the local network.
- 3.1.11 The use of VMS as part of a strategic or advanced traffic management system enables the network operator to provide drivers with a range of information and advice on traffic conditions. As an advanced tool, the system enables the maximisation of network capacity through the redistribution of traffic from congested areas to alternative routes with spare capacity.

3.2 Types of Variable Message Sign

- 3.2.1 The term Variable Message Sign (VMS) covers several types of sign that vary widely in terms of complexity, capability and cost. A VMS is a traffic sign whose message can be changed manually, electronically, mechanically, or electromechanically. The information is most often displayed in real-time and can be controlled either from a remote location or locally at the site.
- 3.2.2 Table 3.1 lists some of the main types of VMS in use. The more commonly used types are described in subsequent paragraphs.

Table 3.1: Main Types of Variable Message Signs

Broad Classification		Description
Mechanical/Manual or Electro-mechanical	Matrix	Electromagnetic – fibre optic with optical shutter
	Flexible Roller Blinds	Single blind – roller to roller
		Single blind – single roller
	Rigid Plate Display	Rotating plank or prism
		Flat type – hinged plates
		Sliding slat or plate
		Continuous belt
Wholly Electronic (Non-mechanical)	Matrix	Individual lamps
		Fibre-optic – single cell occupancy
		Fibre-optic – multiple cell occupancy
		Light Emitting Diode (LED)
	Other Types	Trans-illuminated display face
		Shaped tubing symbols and/or letters

Note: VMS types shown shaded are less commonly used.

Fibre Optic VMS

3.2.3 Fibre optic VMS technology utilises bundles of fibre optic strands strung between each pixel and a lamp source. A single lamp source will power several pixels. To control which pixels are displayed, shutters are placed in front of each pixel. When a message is displayed the magnetically controlled shutters open or remain closed to form a character or pattern.

Rotating Prism VMS

3.2.4 Rotating prism (or plank) signs normally consist of a series of planks or prisms that align to form a flat sign face. When required to show a different message the planks or prisms rotate to present a different sign face. Either the whole sign face can be changed in this way, or only those parts that need to be changed. In areas of intense cold or high chill factor, problems may be encountered with the actuating mechanisms of flexible roller blinds and rigid plate displays.

3.2.5 Rotating prism (or plank) signs can typically display up to three alternative fixed messages, which limits their flexibility. However, by comparison with the most common light emitting diode (LED) based VMS, prismatic signs offer the advantage of being able to replicate almost any variant of the fixed message signs described in Chapters 2, 4, 5, 6 or 8.

3.2.6 Rotating prism VMS can vary in size from small post mounted VMS up to large gantry mounted VMS. Figures 3.1 and 3.2 show typical examples of rotating prism VMS at the Jack Lynch Tunnel in Cork.

Flap or Hinged Plate VMS

3.2.7 Flap type signs, with a hinged plate, are the simplest form of VMS. Rigid upright signs are constructed with a hinged plate which can be rotated so that the sign can display one or other of two sign faces. Such signs are generally operated manually, with the flap being padlocked to display the desired information. A typical use is to direct traffic close to sports venues, where the signs need to be displayed only during major events. At other times, the hinged plate signs can display either the normal required traffic signs, or be folded down to display a grey backing.



Figure 3.1:
Typical Rotating Prism VMS

(Note: The design of this sign is not in accordance with the current requirements of Chapter 2.)



Figure 3.2:
Typical Rotating Prism VMS

3.2.8 Only rigid plate display type Variable Message Signs may be operated by purely mechanical means, without the need for a power supply. The provision of a power supply for these types of signs is unnecessary provided there is no need for night-time illumination, flashing amber lights or remote control.

Light Emitting Diode (LED) VMS

3.2.9 LED technology utilises clusters of solid-state diodes that form a single pixel. When voltage is applied, each diode glows. By turning voltage on or off, each pixel cluster is manipulated into forming the characters or pattern of the displayed message – see Figure 3.3. The majority of VMS are of this type.

3.2.10 Problems may be encountered if light emitting type Variable Message Signs are positioned so that the sun shines directly at the display. Contrast may be lost (wash-out) or messages may be visible to drivers when the sign is not switched on (phantom). Some means of shading using a hood or louvres may be necessary, depending on the type of sign, to help to reduce these effects.



Figure 3.3:
Typical LED VMS
(Continuous Matrix)

Hybrid VMS

3.2.11 A typical hybrid VMS uses both flip disk and either fibre optic or LED technology. Each flip disk has a hole in its centre for light to pass through. The light is generated by a fibre optic bundle or LED cluster. When the pixel is activated, the disk is flipped, allowing light to pass through the hole while displaying the reflective side of the disk to traffic. When the pixel is off, its reflective surface is rotated, or flipped, blocking the light source.

NOTATION

3.2.12 Discontinuous VMS are made up of discrete characters, where each character is made up by a varying number of pixels in width and height. For discontinuous VMS, VMS are normally defined by a type reference which defines the number of lines they contain, the number of characters per line and the character height of one character. An example for urban use would be 4 line 15 character VMS where each character is 160mm high.

3.2.13 Continuous matrix VMS are made up of continuous pixels across the entire display area, with display elements existing between characters. Continuous matrix VMS can be referenced either by pixel width by pixel height (e.g. '5 x 7 pixels'), see Section 3.7, or by unique reference name. The majority of large VMS in Ireland are the continuous matrix type.

3.3 Specific Applications of VMS

3.3.1 Variable Message Signs may be used for a wide variety of applications. For types of VMS currently available for use on national roads, refer to the NRA VMS Guidelines.

VMS FOR SPEED LIMITS

3.3.2 Three types of VMS are available to denote speed limits which vary from time to time: Periodic Speed Limit signs, Road Tunnel Speed Limit signs and Variable Speed Limit signs.

3.3.3 Advice on the use of Special Speed Limits and the procedure for making the necessary bye-laws is given in the Department of Transport's Guidelines for the Application of Special Speed Limits².

Periodic Speed Limits

3.3.4 County and City Councils have powers under the Road Traffic Act 2004 to make bye-laws to introduce special speed limits which are imposed for a specified period or periods during any day or during specified days. The Periodic Speed Limit sign (RUS 045) is available for this purpose. The sign is similar to the normal Speed Limit signs except the numerals and text are white on a black background. A typical use for the Periodic Speed Limit sign is to slow traffic outside a school during periods when the children are arriving or leaving: Figure 3.4 shows such an installation.

3.3.5 The speed shown on the sign is normally one of the following regulatory speed limits: 30, 50, 60 or 80km/h.

3.3.6 Advice on the use of Periodic Speed Limits and the procedure for making the necessary bye-laws is given in the Department of Transport's Guidelines for Setting and Managing Speed Limits in Ireland.

3.3.7 Sign RUS 045 shall be internally illuminated and the red roundel shall be 600mm or 750mm in diameter. At periods when the speed limit is not in operation, the sign shall show a blank black disc. A manual or automatic device is required to light and turn off the sign at the appropriate times.



Required Variant:	Speed displayed shall be 30, 50, 60, 80, 100 or 120.
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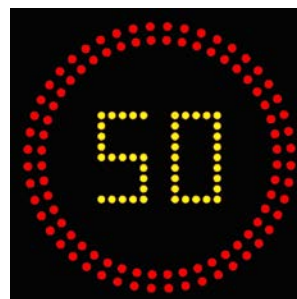


**Figure 3.4:
Periodic Speed Limit Sign
in Combination with Other Signs**

² Department of Transport, Tourism and Sport. *Guidelines for Setting and Managing Speed Limits in Ireland* DTTAS, Dublin.

3.3.8 The sign may be mounted on its own, or on a grey backing board as part of an assembly in combination with appropriate warning or information signs. For example, the sign may be erected on a grey backing board with Sign W 141, School Ahead, and Signal S 102, Flashing Amber Signals, as illustrated in Figure 3.4. See also Chapters 5, 6 and 9.

3.3.9 This sign or combination of signs may be provided on one or both sides of the road at the entry point of the section of road defined in the relevant bye-law. At the end of the defined section of road, permanent signs shall be provided indicating the relevant speed limit beyond the Periodic Speed Limit (see Chapter 5). These can normally be mounted on the rear of the Periodic Speed Limit signs.



**RVMS 100:
Road Tunnel Speed Limit**

Required Variant:	Speed displayed shall be 30, 50, 60 or 80.
Requirement	Supplementary Plate P 054 shall be added.

Road Tunnel Speed Limits

3.3.10 In certain circumstances, such as in tunnels or on very congested motorways, it may be advantageous to apply a Special Speed Limit which can be varied from time to time to suit traffic conditions. Two signs are available to display variable speed limits: one (RVMS 100) for use in tunnels where space is restricted and the other (RVMS 102) for use elsewhere.

3.3.11 The Road Tunnel Speed Limit Sign, RVMS 100, shall only be erected in tunnels and on the approaches to and exits from tunnels. This sign consists of a black square which, when illuminated, displays a red roundel containing a number in yellow or white on a black background to indicate the speed limit applying. The standard size of the sign is for the outer diameter of the roundel to be 500mm, but diameters of 476mm, 600mm or 750mm may be used.



**Supplementary Plate P 054:
km/h**

3.3.12 Signs RVMS 100 shall be provided with a Supplementary Plate P 054, to denote that the speed is in km/h. The plate may be positioned above or below the sign.



**RVMS 102:
Variable Speed Limit**

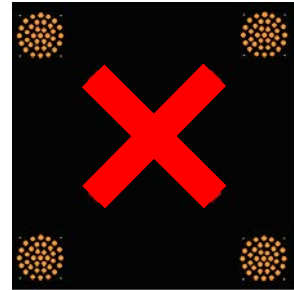
Required Variant:	Speed displayed shall be 30, 50, 60, 80, 100 or 120.
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Variable Speed Limits

3.3.13 Variable Speed Limit signs (RVMS 102) are identical in appearance to Periodic Speed Limit signs (RUS 045), but are used in a different way. Whereas a Periodic Speed Limit sign is used to denote when a particular specified speed limit applies, Variable Speed Limit signs are used to control traffic by imposing different speed limits at different times, depending on the traffic conditions. At times of heavy flow, a lower speed limit may be imposed to help reduce congestion.

3.3.14 Signs RVMS 102 may be 600mm, 750mm, 900mm or 1200mm in diameter. As for RUS 045, the speed shown on the sign shall be one of the regulatory speed limits: 30, 50, 60, 80, 100 or 120km/h. When not in use, the sign shall display a blank black disc.

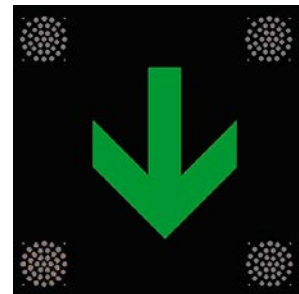
3.3.15 Signs RVMS 102 may be mounted on posts in the verge and central reserve. However, on multi-lane roads, they may, with advantage, be mounted on gantries, with a sign centred over each lane. Using gantries, it is possible to impose different speed limits in the different lanes.



RVMS 101X: Lane Closed

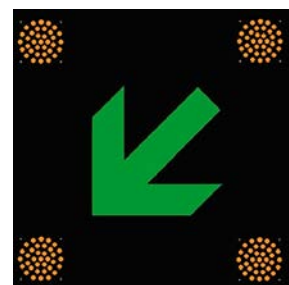
OVERHEAD LANE CONTROL SIGNALS

3.3.16 Overhead Lane Control Signals, RVMS 101, are single aspect signals which may display as required any one of the following: red cross, RVMS 101X, and green arrows, RVMS 101A, RVMS 101L and RVMS 101R. Lane Control Signals may be used to advise drivers of lanes that are closed and open respectively. Flashing amber lights are mounted in the corners of the signal. The top and bottom amber lights flash alternately whenever Signals RVMS 101X, RVMS 101L or RVMS 101R are displayed, but are not lit when RVMS 101A is displayed. The separate designations RVMS 101X, 101A, 101L and 101R are for convenience only: the different displays are all referred to as RVMS 101 in the Road Traffic (Signs) Regulations.



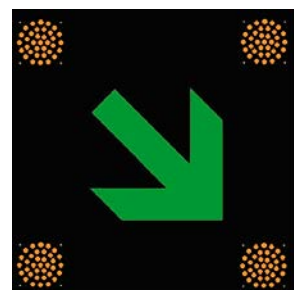
RVMS 101A: Lane Open

3.3.17 Lane Control Signals are mounted centrally over each lane, normally on gantries or from the tunnel soffit. These signals shall only be used where there is a particular need: for example, where emergency lane closures may be required, such as in tunnels or on the approach roads to tunnels. They may also be used to control traffic flow on very heavily trafficked routes, such as urban motorways. They should be repeated at regular intervals along the required length of road.



RVMS 101L: Move Into Lane on Left

3.3.18 Signals RVMS 101 may be 700mm or 1200mm square. The red cross on RVMS 101X shall fit within a square with sides of 345mm for the smaller signal and 637mm for the larger. The arrows on the other three signals shall be 325mm long for the smaller signal and 637mm long for the larger.



RVMS 101R: Move Into Lane on Right

- 3.3.19 The signal RVMS 101A indicates that a lane is open to traffic. RVMS 101X indicates that it is closed, and traffic shall not proceed beyond the signal in that lane. RVMS 101L and RVMS 101R indicate that the lane is closed further ahead and that all traffic shall move out of the lane, crossing into the lane to the left or right respectively. The last two signals are normally displayed on one or two gantries before the Lane Closed signal, RVMS 101X.
- 3.3.20 Overhead Lane Control Signals are normally displayed only when required. However, in some instances, such as tunnels, the Lane Open arrow, RVMS 101A, is displayed whenever the lane is open.
- 3.3.21 When an Overhead Lane Control Signal is not required, the signal shall display a black square.



Figure 3.5:
Urban Information VMS (UK)

URBAN INFORMATION SIGNS

Urban Information Signs

- 3.3.22 Urban Information Signs can be used to enhance overall traffic control and inform drivers of diversions as necessary at strategic locations prior to entering town and city centres. They can also be used as an information sign as shown in Figure 3.5.
- 3.3.23 Urban information signs are physically smaller than most text VMS, to suit the local environment. They can be designed as single post (as shown) or double post designs. Character sizes are chosen to suit the local speed limits. Typical character heights are 100mm, 160mm and 240mm compared with 320mm and 400mm character heights used on the national roads network. The single post design reduces pedestrian restriction and may be considered to have a better appearance.

Parking Guidance Information

- 3.3.24 Car park information signs are a particular form of urban information sign. They usually consist of LED inserts in fixed signs providing details of the number of spaces available or noting that the car park is full. The fixed parts of the sign shall be designed in accordance with the requirements for car park signs (see Chapter 4). Use of this information can enable drivers to choose the best available car park, thereby avoiding unnecessary travel. The signs need to be located strategically as part of the overall parking and signing strategy.

TEXT MESSAGE VMS

3.3.25 The types of VMS used for displaying text messages (and/or pictograms) on roads in Ireland are described below.

Travel Time VMS

3.3.26 Figure 3.6 shows a single colour full matrix (continuous) Variable Message Sign. This has single colour amber display 52 pixels wide by 32 pixels high, mounted in a cantilever arrangement.

Dual Colour Full Matrix VMS

3.3.27 Figure 3.7 shows a small Dual Colour Full Matrix Variable Message Sign mounted on a single pole.

GANTRY MOUNTED VMS

3.3.28 Mounting VMS on gantries provides superior visibility and larger display capabilities. Gantries may be of the cantilever type erected in the verge, such as the Travel Time VMS and the Dual Colour Full Matrix VMS illustrated, or full portal gantries spanning the carriageway. Gantries can also be used to mount additional Intelligent Transport System infrastructure such as enforcement cameras and vehicle detection systems. Suspending a VMS from a cantilevered gantry over a vehicle lane minimises issues of obstruction by large vehicles. As an alternative lightweight space frame or monotube structures can offer minimal visual intrusion.

3.3.29 VMS may have a ladder access for inspection and maintenance. However, the VMS in Figure 3.6 has no ladder access: access is obtained via a mobile access platform. The implications of using mobile access platforms for inspection and maintenance, with associated lane closures, needs to be considered when the VMS is being designed. Similarly, the likelihood of vandalism needs to be considered.

3.3.30 In considering larger VMS types, it should be noted that the costs of the civil engineering works required for the sign base and supporting structure are significant and can be higher than the cost of the sign itself.



Figure 3.6:
Single Colour Full Matrix VMS



Figure 3.7:
Dual Colour Full Matrix VMS

MOBILE VMS

3.3.31 Mobile VMS may be deployed where there are no immediate permanent signs, or in conjunction with permanent signs. They are most commonly used for roadworks but may also be deployed for traffic management purposes.

3.3.32 Mobile VMS are available in many sizes and forms but essentially consist of:

- Trailer mount;
- VMS;
- VMS control panel;
- Power supply; and
- Communications infrastructure.

3.3.33 The temporary power supply should ensure that any interruption or decrease in power shall not reduce the legibility of the message.

3.3.34 Typically, mobile VMS are very limited in the number of characters per line and hence are constrained in the message length they are able to display (see Figure 3.8). They may be used at roadworks (in addition to the fixed signs) to display chevrons or arrows, to help emphasise a required change in direction (see Figure 3.9 and also Chapter 8). Figure 3.13 contains details of approved chevron and arrow displays.

3.3.35 Mobile VMS shall conform to the NRA VMS Guidelines with respect to character size and message format.

3.3.36 Mobile VMS should be positioned carefully, to ensure that they do not form an unacceptable hazard to traffic.



**Figure 3.8:
Mobile VMS
(Displaying Text Message)**



**Figure 3.9:
Mobile VMS
(Displaying Chevrons)**

3.4 Messages

GENERAL PRINCIPLES

- 3.4.1 Where possible, VMS messages should be displayed in a static (non-cyclic) mode.
- 3.4.2 The VMS is a means of presentation of information where it is deemed that a fixed sign would be inadequate. The basic principles applicable to the equivalent fixed signs – size, positioning and legibility – should also be applicable to equivalents displayed using VMS technology. These principles and the standards applicable to them are set out and explained in Chapters 1, 2, 4, 5, 6 and 8.

TEXT

- 3.4.3 The text forms and messages which may be displayed on VMS are governed generally in terms of the following;
- character form and height;
 - words and combinations of words used;
 - number of elements in the message;
 - updating and phasing of multi-element messages; and
 - location of the VMS in relation to traffic flow.
- 3.4.4 Due to the restrictions in the amount of text which can safely and effectively be displayed, the use of bilingual Irish/English messages cannot always be accommodated on matrix type VMS signs. In Gaeltacht areas Irish text shall always be provided.
- 3.4.5 No message should contain more than 10 words.
- 3.4.6 The messages displayed on a VMS should fall into one of the following categories:
- Regulatory;
 - Warning;
 - General information;
 - Tactical information
 - Network information; or
 - Diversion information.
- 3.4.7 VMS (permanent or mobile) either on or near a road must not, under any circumstances be used to display information relating to anything other than the road network. Thus VMS shall not be used for:
- Advertising or promotion;
 - Political slogans; or
 - Requests for information related to accidents or public consultation exercises

National Roads

3.4.8 The permitted text and message sets are defined in the NRA VMS Guidelines. The messages are made up of a standard set of 'message elements' which can be assembled to form the required information.

Regional and Local Roads

3.4.9 Where VMS are installed on regional or local roads, the text and message sets should, wherever practicable, be in accordance with the NRA VMS Guidelines.

3.4.10 Urban VMS displaying text information will have a local emphasis and have message sets that must be approved by the Local Authority. The recommended minimum character heights specified in the NRA VMS Guidelines should be used to ensure consistency of VMS text throughout the country.

PICTOGRAMS

3.4.11 As an alternative to text, pictograms should be displayed on VMS to convey the required message. Appropriate pictograms have the advantage that they are universally recognised and can generally be understood more quickly than text. Pictograms should be representations of standard static signs – either regulatory, warning or roadworks signs from Chapters 5, 6 or 8 respectively. Colours displayed on VMS should generally reproduce those of the equivalent static signs. However, to increase driver legibility during hours of darkness, pictograms may be the inverse of the static sign equivalents. This is preferable for yellow diamond warning signs in particular.



Figure 3.10:
Example Pictogram

3.4.12 Pictograms displayed on VMS must reproduce the proportions of the static equivalent signs. An example is shown in Figure 3.10. Although pixilation of pictograms always occurs on VMS, the minimum size of pictogram displayed on a VMS should be of an acceptable quality and easily recognised as the equivalent of a static sign. The minimum dimensions of static equivalent signs are governed principally by the speed of approach towards the sign. This information can be found in Chapters 5 and 6.

3.4.13 The NRA VMS Guidelines define the range of approved pictograms. The use of pictograms not defined in the Guidelines must be approved by the National Roads Authority.

3.5 Design Considerations

SIGN FACE

- 3.5.1 The display area of a text message VMS shall exhibit a black or grey area, normally rectangular, to approaching drivers when a message is not being displayed.
- 3.5.2 The appearance of a text message VMS when displaying a message shall be in accordance with the requirements of Sections 3.4 and 3.7.
- 3.5.3 Light dimming circuitry shall be included in the design of light-emitting type matrix displays and brought into operation to ensure that the legibility of legends is maintained for each of the different operating conditions in which the sign operates
- 3.5.4 The appearance of roller blind, rotating prism and flap or hinged plate VMS shall be similar to the equivalent fixed sign in accordance with Chapters 2, 4, 5, 6 or 8 as appropriate. Areas or faces of such signs which do not display information should normally be coloured grey.
- 3.5.5 Any sign legends, symbols, or character forms that do not conform with the Road Traffic (Signs) Regulations or the Traffic Signs Manual, or any flashing amber lamps used with a VMS, must be authorised by the Department of Transport before being used on any road.

LOCATION

- 3.5.6 The requirement to install Variable Message Signs will depend on the type of road and the type of message under consideration. The need for Periodic Speed Limit signs will be determined on a site-specific basis. For most other VMS, a strategy covering a route or area will need to be prepared to determine what types of sign are required and where they should be located.
- 3.5.7 VMS generally form signs of a substantial size, mounted on posts or on cantilever or portal gantries. They should be constructed in accordance with the general principles and standards set out in Chapter 1.
- 3.5.8 A sign positioned on the near-side verge of a carriageway can suffer from heavy vehicles obscuring the legend from those drivers in the outer lanes. It may be possible to overcome such difficulties by providing an identical repeater sign, mounting the signs on a gantry, or by duplicating the message on a sign installed in the central reserve.

- 3.5.9 The mounting of a second sign in the central reserve of a dual carriageway or motorway can be difficult due to the need to widen the reserve to provide sufficient width for the sign and the required clearances. The problems of access for maintenance may also be unacceptable.
- 3.5.10 As a minimum, the following issues should be considered when choosing a location for VMS:
- Access for maintenance;
 - Speed limit;
 - Verge width;
 - Verge grade;
 - Visibility;
 - Ease of construction;
 - Services present;
 - Safety barrier present (if required);
 - Availability of power source;
 - Communications present;
 - VMS height and lateral clearance;
 - Traffic management during construction and installation;
 - Vegetation in front of and behind sign;
 - Visual impact;
 - Geotechnical conditions;
 - Land ownership;
 - Network operator;
 - Position with regards to other traffic signs and VMS;
 - Position with regards to sources of illumination, e.g. street lights; and
 - Sustainability requirements (e.g. materials used and recycling).

Conspicuousness

- 3.5.11 The sign must attract attention in the environment in which it is placed. This is a function of sign technology and design as well as the physical environment.

Legibility

- 3.5.12 The observer must be able to read all text, aspects or pictograms displayed. This requires consideration of the distance at which the sign first becomes legible and the duration for which it remains legible. Observers must have sufficient time to read and understand the entire message without unduly diverting their attention from the driving task.

3.5.13 Where flashing amber lights are to be used with a sign there shall be four in number. Normally two shall be positioned above the displayed message and two below it. Alternatively, where through constraints of sign dimensions or siting difficulties this is not practical, these lamps may be positioned on either side of the displayed message. In either case they shall be positioned at or near each corner of the sign and within the surround to the message display area. The lamps shall be switched in pairs alternately top to bottom in such a manner that the lights of one of the horizontal pairs are always shown when the lights of the other horizontal pair are not shown.

Comprehensibility

3.5.14 The observer must understand the message. Message information clarity and consistency is required, particularly in relation to geographic descriptions, the use of abbreviations and the amount of information or instructions to be assimilated by the observer in the time available.

Response

3.5.15 The observer must have adequate time (distance) to respond safely and appropriately to the message. This will depend on the location of the VMS relative to routing decision points.

Credibility

3.5.16 The observer must be able to rely on the information displayed. This will depend on how the source information is obtained, the timeliness of information updates and how well the system is managed and operated. Experience has shown that, where out-of-date information has been displayed, drivers soon learn to disregard the signs, thus negating the value of the VMS.

Alignment

3.5.17 VMS display elements shall be aligned correctly with the road. Provision shall be made for fine adjustment in the field to ensure optimum optical alignment.

EUROPEAN LEGISLATION

3.5.18 VMS shall comply with IS EN 12966³. This standard covers the performance requirements for VMS used for the instruction and guidance of road users on public and private land, including tunnels. Although IS EN 12966 is often considered as an optical specification, it also contains electromagnetic compatibility, safety and environmental (physical) requirements.

3.5.19 Annex D of IS EN 12966 provides guidance for dimensions and tolerances of symbols and characters while Annex F provides guidance on the design of VMS Messages.

APPROVAL

3.5.20 Any sign legends, symbols, or character forms that do not conform with the Road Traffic (Signs) Regulations or the Traffic Signs Manual, or any flashing amber lamps used with a VMS, must be authorised by the Department of Transport before being used on any road.

³ National Standards Authority of Ireland. *IS EN 12966: Road Vertical Signs – Variable Message Traffic Signs*. NSAI, Dublin.

3.6 Maintenance

- 3.6.1 All VMS require regular inspection and maintenance to maintain their effectiveness and general condition. The following examples illustrate the possible results of poor maintenance;
- VMS partially obscured by foliage, dirt or graffiti;
 - VMS message difficult to read; and
 - VMS display partially or fully inoperable.
- 3.6.2 Chapter 1 provides general guidance on inspection and maintenance of traffic signs. These considerations are equally applicable to VMS.
- 3.6.3 Inspection and maintenance, especially of large message VMS on cantilever or portal gantries over the carriageway, are important factors which need to be taken into account when designing the sign. The provision of ladder access and/or walkways can substantially increase the size of the supporting structure. Conversely, the use of mobile access platforms will generally require lane closures, which will impinge on traffic flows.
- 3.6.4 Where regular cutting of vegetation is not anticipated, consideration should be given to the provision of a paved area in front of the sign for such a distance as to ensure the VMS is not obscured.

3.7 Character Sets

3.7.1 The font (text character format) for fixed VMS shall be capable of displaying the standard, special and test character formats depicted in Figures 3.10 to 3.12.

3.7.2 In addition to the characters shown in Figures 3.10 to 3.12, mobile VMS are also permitted to display the selection of aspects illustrated in Figure 3.13. These allow animated arrows or chevrons to emphasise the change of direction.

3.7.3 The example character set shown in Figures 3.10 to 3.12 are 5 pixels wide by 7 pixels high. Other character ratios in use on discontinuous VMS are:

- 6 pixels wide by 9 pixels high;
- 7 pixels wide by 9 pixels high; and
- 16 pixels wide by 22 pixels high.

In accordance with IS EN 12966 (Annex D.2), the minimum character width should be equal to $5/7h$ where 'h' is the character height. IS EN 12966 (Annex F) provides definition of character height and character width. Other character sets are available from the National Roads Authority.

CENTRING OF MESSAGES

3.7.4 To enhance readability all messages displayed on VMS must be centred on the sign. In the event that an odd number of characters is required to be displayed in any line the text in that line will be biased to the left by one character position, thus:

- If spaces to the right of the text = 'X'
- Then spaces to the left of text = 'X-1'.



Figure 3.10:
Text Character Formats (5 x 7 Pixels)

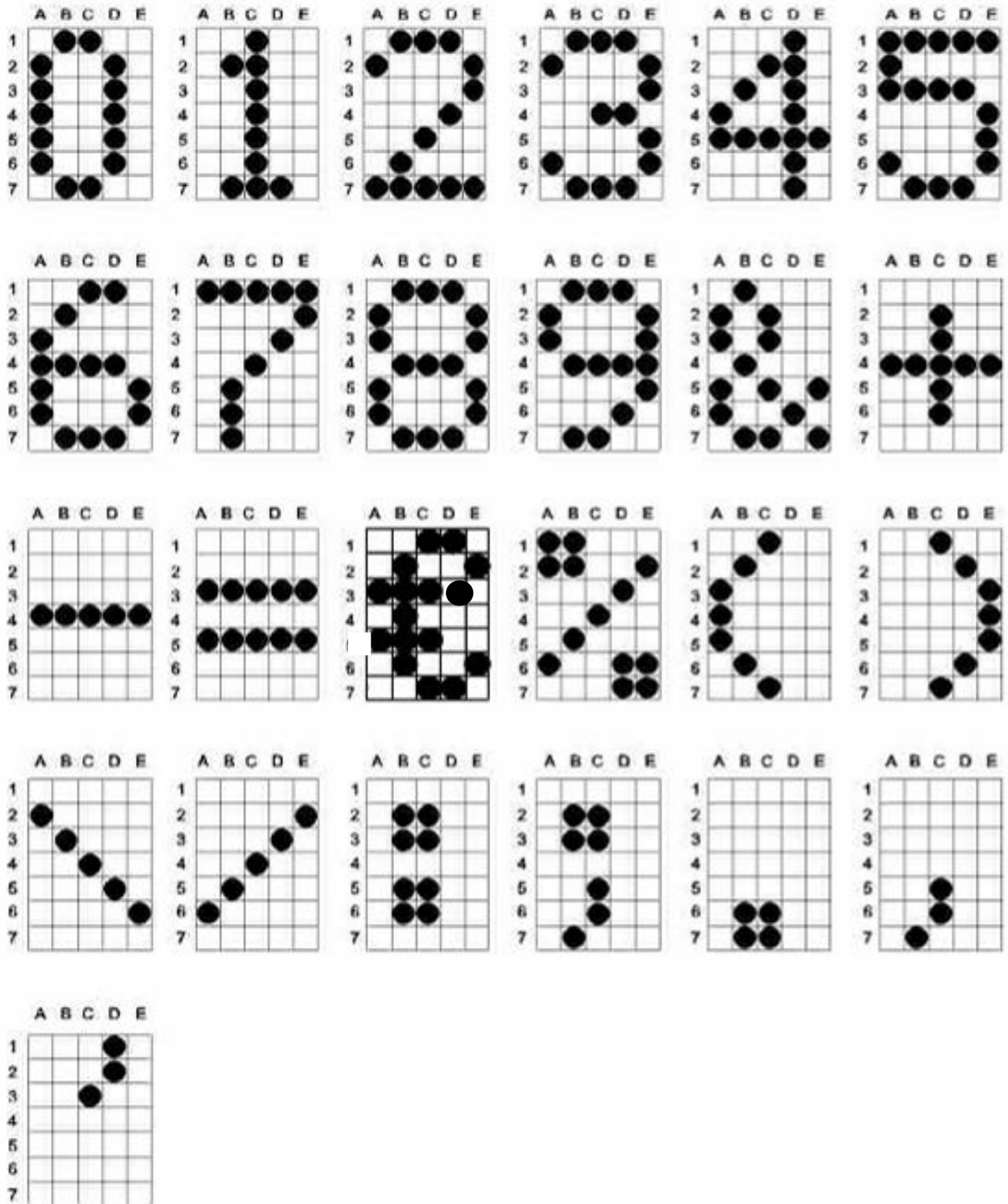
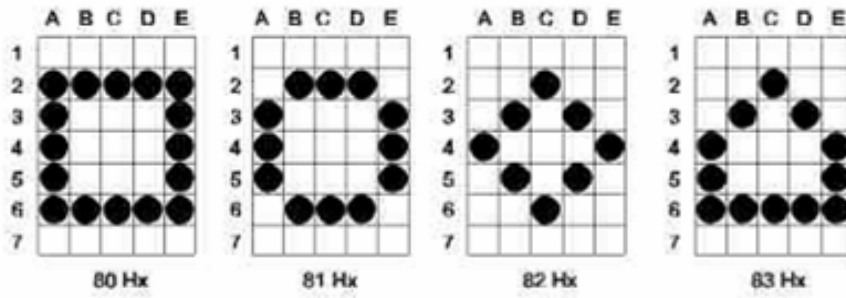


Figure 3.11:
Text Character Formats (5 x 7 Pixels) (Continued)

SPECIAL CHARACTERS



TEST CHARACTERS

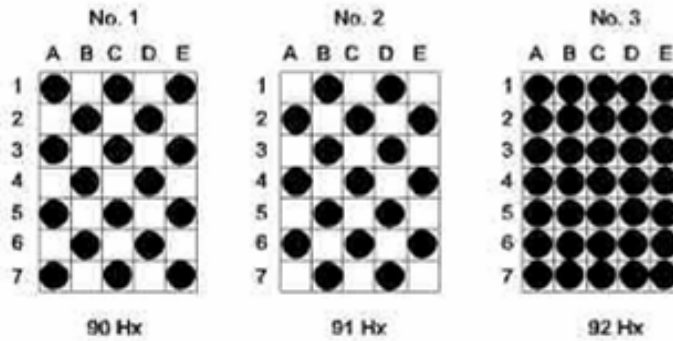
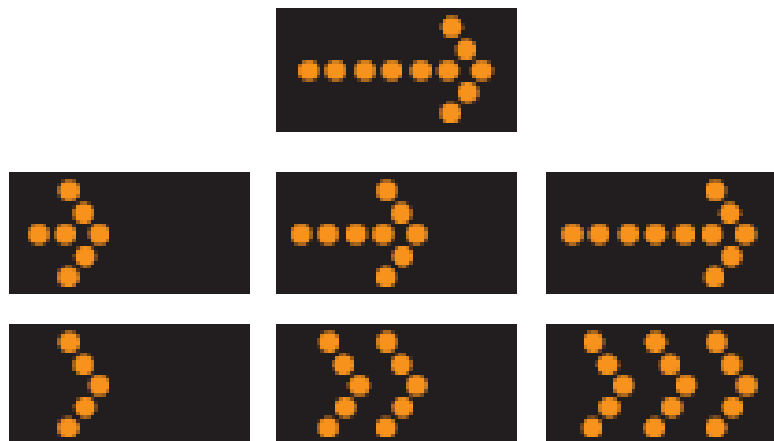


Figure 3.12:
Text Character Formats (5 x 7 Pixels) (Continued)



MOVE / MERGE RIGHT
(Arrows or chevrons may point to left)

Figure 3.13:
Arrow Formats for Mobile VMS

3.8 Vehicle Activated Signs

- 3.8.1 There is an established relationship between speed and road accidents. On rural roads driving too fast for the conditions is more likely to be factor in accidents than exceeding the speed limit. Encouraging drivers to adjust their speed to suit the conditions is, therefore, important.
- 3.8.2 Vehicle Activated Signing is one measure which has been developed to encourage drivers to approach hazards such as bends and junctions at a safe speed and also to encourage them to comply with the speed limit. Drivers exceeding a set threshold speed trigger a sign indicating the specific hazard or actual travel speed.
- 3.8.3 Vehicle Activated Signs may also be used to warn over-height vehicles that they are approaching a low bridge.

SIGN FACES

- 3.8.4 Vehicle Activated Signs will normally display a message (pictogram or text) delineated by either fibre-optic cables or LEDs. Different parts may be in different colours. The sign face should be provided with an automatic dimmer to reduce the intensity during night-time operation. When not activated, the sign should remain blank (blacked out).
- 3.8.5 On the approach to a hazard, a Vehicle Activated Sign may display a pictogram depicting the relevant warning sign from Chapter 6. Where considered necessary, the pictogram may be accompanied by the text “Go Mall SLOW”: see Figure 3.14.
- 3.8.6 On the approach to a low bridge, the Restricted Headroom pictogram, based on Sign W 110, may be used on a Vehicle Activated Sign, accompanied by the text “Cas ar Ais TURN BACK”. Flashing Amber Signals, S 102 (see Chapter 9), should be mounted above or below the sign: see Figure 3.15. This whole sign would be activated by vehicle height detectors.
- 3.8.7 Similarly Sign F 903, Turn Back, may be used on a Vehicle Activated Sign (see Figure 3.16). Such a sign would be used to prevent traffic travelling the wrong way along a slip road onto a major road (see Chapter 4). The sign could be mounted with Flashing Amber Signals, S 102, or the whole sign could be made to flash.



Figure 3.14:
Vehicle Activated Sign for Sharp Bend
(Sign W 050L with SLOW)

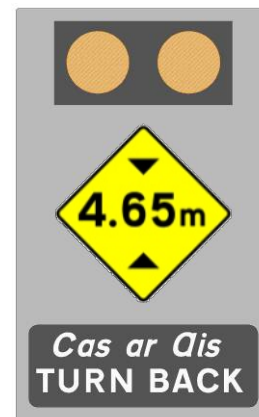


Figure 3.15:
Vehicle Activated Sign for Low Bridge
(Sign W 110 with Signals S 102 and TURN BACK)



Figure 3.16:
Sign F 903, Turn Back, as Vehicle Activated Sign

3.8.8 Where a Vehicle Activated Sign is to be used to encourage drivers to comply with the speed limit, the sign shall not depict a Periodic Speed Limit (RUS 045) or a Variable Speed Limit (RVMS 102). Instead, the sign may depict either:

- The speed numeral and the legend “km/h” in white characters within a white roundel, all on a black background (see Figure 3.17); or
- The actual speed of the approaching vehicle, as shown in Figure 3.18. However, when actual speeds are used, the speed displayed should top out at a pre-selected maximum level.



Figure 3.17:
**Vehicle Activated Sign Depicting
Speed Limit**

3.8.9 Other than the use of No Straight Ahead, Sign RUS 011, in Sign F 903 as described above, Vehicle Activated Signs shall not depict Regulatory Signs.

INSTALLATION GUIDELINES

3.8.10 Vehicle Activated Signs are not a substitute for standard fixed signs, nor are they to be used as speed limit repeater signs. They should be considered only when there is an accident problem associated with inappropriate speed or over-height vehicles that has not been remedied by standard signing and where safety cameras and related signs would not be an appropriate solution.

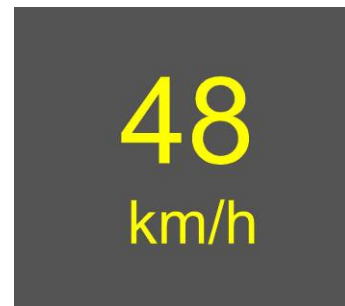


Figure 3.18:
**Vehicle Activated Sign Depicting
Actual Speed**

3.8.11 Before the decision to install Vehicle Activated Signs is taken, it is important to undertake an audit of existing road furniture, fixed signs, road markings and road condition. It is not recommended that Vehicle Activated Signs be deployed unless it is clear that the problem cannot be remedied by improving the fixed signs. Vehicle Activated Signs should be used only sparingly.

3.8.12 A detailed accident investigation should be undertaken to identify the dominant accident patterns and confirm that Vehicle Activated Signs are an appropriate remedial measure. Monitoring of traffic speeds should be undertaken to establish that a problem with inappropriate speeds exists.

3.8.13 For warning of a hazard, the Vehicle Activated Sign should be positioned after the fixed warning sign but not so close to the hazard as to leave insufficient response time. Distances of 50m to 100m in advance of the hazard may be suitable.

3.8.14 For reinforcing a speed limit, both the Vehicle Activated Sign and the speed monitoring detectors should be positioned within the length of road with that speed limit. Thus, the sign should not activate until after a vehicle has passed the fixed sign at the start of the speed limit zone.

3.8.15 Vehicle Activated Signs can operate via an external trigger such as above ground microwave detectors or inductive loops. In addition, Vehicle Activated Signs can be restricted to operate during pre-set hours; for example, to coincide with school opening and closing times.

Appendix 3A Glossary and Abbreviations

A number of acronyms and abbreviations are used in the field of Variable Message Signs. The following table provides a quick reference to the most common terms used in this chapter.

Abbreviation/Term	Meaning
Aspect	In general, Aspect refers to any display on a Lane Control Signal or Tunnel Lane Control Signal or a Periodic or Variable Speed Limit. In conjunction with some Aspects, two pairs of amber Lanterns may be required.
Aspect Format	The particular combination of Display Cells which, when active, form an Aspect.
Character	Letter, numeral or punctuation mark. This normally consists of a five Pixel wide by seven Pixel high matrix of 35 Display Cells from which a Character may be formed. Other Pixel ratios are permitted.
Character Format	The particular combination of Display Cells which, when active, form a Character.
Character Height	The height of an UPPER-CASE Character expressed in millimetres. See also IS EN 12966 Annex F2.
Character Width	The width of an UPPER-CASE Character expressed in millimetres. See also IS EN 12966 Annex F2. VMS are commonly expressed by their character height <u>not</u> character width.
Character Spacing	The horizontal spacing between individual Characters on the same line of a Variable Message Sign.
Continuous Sign	Continuous Signs are similar in appearance to fixed signs, the only difference being that they can show various Messages by some electrical or mechanical means. Examples include rotating prism signs, roller blinds and continuous matrix signs.
Discontinuous Sign	Discontinuous Signs create messages using individual Elements that can be in one of two states (or more) and can thereby create various Messages on the same sign face.
Display Area	That area of a Variable Message Sign which can be used for displaying messages. It excludes the backing board but includes a protective front screen for each Character.
Display Cell	That part of a Character or Display Area enclosing the Element. When active in conjunction with other active Display Cells forms a Character or Aspect.
Electro-mechanical Sign	A matrix sign in which a disc or bar is turned electro-mechanically to display either of its two faces. One face is coloured to blend into the background and the other is coloured to contrast with the background.
Element	That part of a Display Cell forming the light emitting area.
Font	The style of lettering used in a sign.
Format	The arrangement of active Display Cells which defines an Aspect or Symbol.
Illuminated Sign	A sign that emits light from an internal light source, or which is lit by external lamps.

Abbreviation/Term	Meaning
Internally Illuminated Sign	A power illuminated sign in which the light source is located behind the sign face.
Lantern	A flashing light source incorporated into a Variable Message Sign which is designed to draw attention to the sign or signal. Required to accompany certain defined Aspects.
LED	Light Emitting Diode.
Legibility	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. See also IS EN 12966 part 1.
Legend	Any Message appearing on a VMS.
Line	A row of Characters, the top row being Line 1.
Message	Any Message appearing on a Variable Message Sign.
NRA	National Roads Authority.
Pictogram	VMS representation of a static equivalent sign. Pictograms may be the inverse of the static sign equivalents.
Pixel	The individual light emitting device which can be turned on or off to form part of a Character.
Stroke Width	The Stroke Width is the width of the solid stroke of a character or, if the stroke of a character consists of more than one line of cells or elements adjacent to one another, the Stroke Width shall be taken as being the overall width of all the lines of cells or elements which make up a stroke of a character. See also IS EN 12966 Annex F2.
Symbol	An arrangement of active Display Cells designed to convey information using a graphical display. A pictorial representation used in a sign.
TII	Transport Infrastructure Ireland
VAS	Vehicle Activated Sign. A generic term for a type of Variable Message Sign which displays a message conditional upon the presence, or speed, of a road vehicle.
VMS	Variable Message Sign
x-height	The height of the lower-case letters of a typeface that do not have ascenders or descenders.